GUIDELINES ON TECHNICAL REQUIREMENTS FOR REGISTRATION OF VETERINARY PHARMACEUTICAL PRODUCTS IN THE SOUTHERN AFRICAN DEVELOPMENT COMMUNITY (SADC)

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ABBREVIATIONS AND GLOSSARY OF TERMS

API	-	Active Pharmaceutical Ingredient
ATC	-	Anatomic Therapeutic Chemical Classification
AUC	-	Area Under the Plasma Concentration Time Curve
BAN	-	British Approved Name
BoMRA	-	Botswana Medicines Regulatory Authority
BP	-	British Pharmacopoeia
BSE	-	Bovine Spongiform Encephalopathy
CAS	-	Chemical Abstract Service
CEP	-	European Certificate of Suitability
C_{max}	-	Maximum plasma concentration
CoA	-	Certificate of Analysis
CPP	-	Certificate of Pharmaceutical Product
DMF	-	Drug Master File
EAC	-	East African Community
EU	-	European Union
FDC	-	Fixed Dose Combination
FPP	-	Finished Pharmaceutical Products
GMP	-	Good Manufacturing Practice
ICH	-	International Council on Harmonisation of Technic Requirements for Registration of Pharmaceuticals for Human Use
INN	-	International Non-proprietary Name
JAN	-	Japanese Accepted Name
JP	-	Japanese Pharmacopoeia
LOD	-	Loss on Drying
MCAZ	-	Medicines Control Authority of Zimbabwe
MedDRA	-	Medical Dictionary for Drug Regulatory Authorities
M.R	-	Modified Release
Mg	-	Milligramme
Ml	-	Millilitre
MRA	-	Medicines Regulatory Authority
NMRC	-	Namibia Medicines Regulatory Council
NCE	-	New Chemical Entity

NMT	**-**	Not More Than
PhEur	**-**	European Pharmacopoeia
PMRA	**-**	Pharmacy Medicines Regulatory Authority
PICs	**-**	Pharmaceutical Inspection Co-operation Scheme
QA	**-**	Quality Assurance
RH	**-**	Relative Humidity
SADC	**-**	Southern Africa Development Community
SAHPRA	**-**	South Africa Health Products Regulatory Authority
SMACS	**-**	Starting Materials Certification Scheme
SMF	**-**	Site Master File
TMDA	**-**	Tanzania Medicines and Medical Devices Authority
TSE	**-**	Transmissible Spongiform Encephalopathy
VICH	**-**	International Conference on Harmonization of Technical Requirement for Registration of Veterinary Medicinal Products
VMP	**-**	Veterinary Medicinal Product
ZAMRA	**-**	Zambia Medicines Regulatory Authority
Veterinary Medicines Zazibona	**-**	SADC VMP registration collaborative initiative/ countries involved in the SADC VMP registration collaborative initiative

ACKNOWLEDGEMENTS

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FOREWORD

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INTRODUCTION

1.1 Background

This guideline provides guidance for applicants while preparing a Common Technical Document (CTD) for the Registration of Veterinary Medicinal Products (VMP) for submission to the SADC Member States (MS) harmonisation initiative. The document describes how to compile applications based on the technical format based on the International Council for Harmonisation of Technical Requirements for Pharmaceuticals for Human Use (ICH) guidelines M4 (R4) on the CTD.

According to the CTD format, each application is a collection of documents, grouped into 5 modules. Module 1 prescribes Administrative Information and Prescribing Information requirements which is region specific. The Summaries, Quality, Non-clinical, and Clinical modules have been described in Modules 2 to 5, respectively. Applicants should not modify the overall organization of the CTD.

If not contained in the bulk of the documentation, any additional data should be included as addenda to the relevant part, together with additional expert comment that may be provided as a supplement to, or incorporated into, the relevant summary, or overview.

Information in these Modules should be present in relevant sections.

For application procedures refer to process flow on Procedural Aspects for Application for Market Authorization for Veterinary Medicinal Products.

1.2 Scope

These guidelines will assist applicants to prepare applications to register veterinary medicinal products for SADC Member States. The format for applications is the Common Technical Document (CTD). These guidelines apply to MA applications for medicinal products containing APIs of synthetic or semi-synthetic origin. Biologicals, biotechnological, and herbal products are not covered by these guidelines

DEFINITIONS

For the purposes of these guidelines, the following phrases are defined as follows:

Active pharmaceutical ingredient (API)	An active ingredient is any component that provides pharmacological activity or other direct effect in the diagnosis, cure, mitigation, treatment, or prevention of disease, or to affect the structure or any function of the body of man or animals. (USFDA Glossary of terms, it can be found online at Drugs@FDA Glossary of Terms).
Active Pharmaceutical Ingredient (API) starting material	A raw material, intermediate, or an API that is used in the production of an API and that is incorporated as a significant structural fragment into the structure of the API.
Applicant	Means a person who owns a formula or trademark of a veterinary medicinal product, who may be a manufacturer or a person to whose order and specifications the product is manufactured and who shall be the registration holder and have the primary responsibility of the product on the MS.
Commitment batches	Production batches of an API or FPP for which the stability studies are initiated or completed post-approval through a commitment made in a regulatory application.
Bioavailability	Means the rate and extent to which the active ingredient reaches the systemic circulation and becomes available to the site of action.
Composition	In relation to a veterinary medicinal product means the ingredients of which it consists, proportions, degree of strength, quality and purity in which those ingredients are contained.
Container	Means a bottle, jar, box, packet, sachet or other receptacle which contains or is to contain in it, not being a capsule or other article in which the veterinary product is or is to be administered or consumed, and where any such receptacle is or is to be contained in another receptacle, includes the former but does not include the latter receptacle.

Container labelling	Means all information that appears on any part of a container, including that on any outer packaging of such as a carton.
Drug, medicine, or veterinary pharmaceutical product or veterinary medicinal product (VMP)	Means any substance or mixture of substances manufactured sold or represented for use in: (a) The diagnosis, treatment, mitigation or prevention of a disease, disorder, abnormal physical or mental state, or the symptoms thereof, in animals; (b) Restoring, correcting or beneficial modification of organic or mental functions in animals; (c) Disinfection in premises in which veterinary medicines are manufactured, prepared or kept, ambulatory services, veterinary clinics, veterinary facilities and equipment; Articles intended for use as a component of any article specified in clause (a), (b) or (c); but does not include veterinary medical devices or their components, parts or accessories.
Drug Master File	Means a master file that provides a full set of data on an API. In some countries, the term may also comprise data on an excipient or a component of a veterinary product such as a container.
Established active pharmaceutical ingredient	Means APIs which are subject of the current veterinary pharmacopoeias or those well documented in the literature and generally recognized as safe and effective for use as a veterinary medicine.
Excipient	Means any component of a finished dosage form which has no therapeutic value.
Expert report	Means a summary and interpretation of data, with conclusions, prepared by an independent expert on the subject by the applicant.
Finished product	Means a veterinary medicinal product that has undergone all stages of production, including packaging in its final container and labelling.

Formulation	Means the composition of a dosage form, including the characteristics of its raw materials and the operations required to process it.
Generic (multisource) products	Means veterinary medicinal products that are pharmaceutical equivalents or alternatives to innovator or reference products and which are intended to be therapeutically equivalent and can therefore be used interchangeably with the innovator or reference product.
Immediate release dosage form	Means a dosage form that is intended to release the entire active ingredient on administration with no enhanced, delayed or extended-release effect.
Innovator pharmaceutical product	Means a veterinary medicinal product which was first authorized for marketing (normally as a patented product) on the basis of documentation of efficacy, safety and quality (according to the requirements at the time of authorization).
Interchangeability	An interchangeable pharmaceutical product means one that is therapeutically equivalent to an innovator (reference) product.
Label	Means any tag, brand, mark, pictorial, or other descriptive matter, written, printed, stencilled, marked, embossed, or impressed on or attached to a container of any veterinary medicine.
Manufacture (manufacturing)	Means all operations of purchase of materials and products, production, quality control, release, storage, shipment of finished veterinary products and the related controls.
Manufacturer	Means a person or firm that is engaged in the manufacture of veterinary medicinal product (s).
Marketing authorization (registration)	Means an official authorization or registration of a veterinary product by BoMRA, MCAZ, NMRC, PMRA, SAHPRA, TMDA, ZAMRA or any medicines regulatory authority for the purpose of marketing or free distribution in the SADC region after evaluation for quality, safety and efficacy.

New active pharmaceutical ingredient	Means a veterinary medicine product (active ingredient), including its salts, esters, derivatives, etc. or biological agent, which is not a subject of current pharmacopoeias.
New combination	Means a product containing medicines in combination (qualitative content and/or proportions) different from those veterinary medicinal products that are subject of current pharmacopoeias.
New pharmaceutical product	Means a pharmaceutical product that contain a new API, a new combination of marketed APIs or a new multisource (generic) veterinary medicinal product.
Pharmacopoeia	Means a current edition of the British Pharmacopoeia, European Pharmacopoeia, United States Pharmacopoeia, International Pharmacopoeia, and Japanese Pharmacopoeia.
Specifications – expiry or shelf life	Means the combination of physical, chemical, biological and microbiological test requirements that an active ingredient must meet up to its retest date or a veterinary medicinal product must meet during its shelf life.
Specification – release	Means the combination of physical, chemical, biological and microbiological test requirements that determine whether a veterinary medicinal product is suitable for release at the time of its manufacture.
Variation	Means a change to any aspect of a veterinary pharmaceutical product, including but not limited to a change to formulation, method and site of manufacture, specifications for the finished product and ingredients, container and container labelling and professional product information.
Well-established veterinary medicinal products	Means pharmaceutical products which contain well established medicines and which: • Have been marketed for at least five years in countries that undertake active post- marketing monitoring; • Have been widely used in a sufficiently large number of patients to permit the assumption that safety and efficacy are well known; and • Have the same route of administration and strength, and the same or similar indications as in those countries.

WHO-type certificate	Means a certificate of veterinary pharmaceutical product of the type defined in the WHO Certification Scheme on the Quality of Pharmaceutical Products Moving in International Commerce.

MODULE 1: ADMINISTRATIVE AND PRESCRIBING INFORMATION

Module 1 should contain all administrative documents (for example, application forms and certifications), labelling, general correspondence, and annexes (environmental impact assessments, antibiotic resistance and overseas evaluation reports), as needed. Documents should be organized in the order listed below. Generally, all the documents in Module 1, other than the annexes, can be provided in a single volume. The annexes to the module should be submitted in separate volumes. Official language is English as a mandatory language for all veterinary medicines.

Products shall be evaluated on a First in First out (FIFO) basis and the timeline for review and approval should be within 12 months.

Comprehensive Table of Contents for all Modules

Table of contents shall indicate the sections, subsection and corresponding page numbers for the entire application.

Motivation letter

Motivation letter of not more than 500 words should be submitted with the product dossier indicating why the product should be registered in MS. The letter should be signed by Marketing Authorization Holder.

Manufacturing and Marketing Authorization

Certificate of Pharmaceutical Product (CPP) or an equivalent certificate issued by competent authority of the country of origin as per WHO format, should be submitted.

Application Information

Language

All applications and supporting documents shall be in English.

Application form

An application to register a medicinal product for veterinary use must be accompanied by a completed Application Form (Annex I – Common Application Form)

The application form should be dully filled with relevant information and attachments, dated signed and stamped appropriately.

Data Presentation

Generally data to be presented in the application for registration of Veterinary Medicinal Product should be compiled in accordance with the specified summarised table below:

Table 1: Parts required for each type of veterinary medicinal product

	Product type	Modules required				
		1	**2**	**3**	**4**	**5**
		Regional Administrative Information	Summaries	Quality	Non Clinical Study Reports, Residue Depletion Studies, where applicable	Clinical Study Reports
1.	Innovator	✓	✓	✓	✓	✓
2.	Innovator: fixed dose combination	✓	✓	✓	✓	✓
3.	Innovator variants: either as single or composite variation in dosage level, form, route of administration, or indication	✓	✓	✓	Bridging studies data	Bridging studies data
4.	Generic: single active ingredient or fixed dose combination	✓	✓	✓	**X**	TE (BE)

Key: TE: Therapeutic Equivalence (Bioequivalence, BE) Data
✓: Required
X: Not required

For generic medicines data on quality and therapeutic equivalence in target animals shall be presented in separate files.

Product Information and Labelling
Provide copies of all package inserts, labels and any information intended for distribution with the product to the patient.

Prescribing Information (Summary of Product Characteristics)
All prescription medicines should be accompanied by SPC. The Prescribing information is not a promotional document. Statements of a promotional nature such as “x is the safest drug’’ are not acceptable.

An applicant shall prepare and present prescribing information in the contents and format as provided in **Annex II – Summary of Product Characteristics.**.

Container labelling
Product should be labelled as prescribed in local requirements for each MS where the VMP will be marketed.

Information Leaflet
Every container of a veterinary medicinal product shall be accompanied with information leaflet.

Provide two copies of information on A4 paper and also specimens as they will appear with the commercial product.

The contents and format of the container labelling and leaflet should comply with local requirements for each MS where the VMP will be marketed.

Good Manufacturing Practice (GMP)
For all veterinary medicines, irrespective of the country of origin, all key manufacturing and/or processing steps in the production of active pharmaceutical ingredient ingredients and finished veterinary medicinal products must be performed in plants that comply with SADC GMP and or Pharmaceutical Inspection Co-operation Scheme (PIC/S) GMP guidelines. Attach a WHO type certificate of GMP. For more information on GMP requirements and application for GMP inspection, refer SADC Guidelines on Good Manufacturing Practice for more guidance.

Product sample
Product samples should be submitted as stipulated by the local requirements in which the applicant intends to market the VMP. For example five samples of the smallest commercial pack(s) from one batch with the total amount not less than 200 capsules/tablets, 400ml for liquid preparations and 250 g for cream and ointments should submitted, otherwise additional samples shall be submitted to meet the total minimum required for the dosage form.

MODULE 2: OVERVIEW & SUMMARIES

Table of contents of Module 2

A table of content of module 2 should be provided

CTD Introduction

Quality overall summary (QOS)

The Quality Overall Summary (QOS) is a summary that follows the scope and the outline of the Body of Data in Module 3. The QOS should not include information, data or justification that was not already included in Module 3 or in other parts of the CTD.

The QOS template is available as a separate template to this guideline. The QOS must be provided in both word and PDF version.

Non-clinical Assessment template

The template for assessment of non-clinical studies should be provided in word, where applicable. Information from module 4 study reports should be used to populate this template.

Residue Depletion Studies Templates

The residue depletion studies templates should be completed in word, where applicable.

Environmental Impact Assessment Form

For new chemical entities, the EIA Form should be completed and submitted in word, where applicable.

Efficacy and Safety Assessment Template

The Efficacy and Safety reports should be submitted, where applicable. The information used to populate the Efficacy and Safety Assessment Template by the applicant should be obtained from module 5 or other relevant parts of the CTD.

Bioequivalence Trial Information (BTIF)

The BTIF should be completed and submitted in word, where applicable.

MODULE 3: QUALITY INFORMATION

Table of Contents of the Quality part

A table of content of the filed product dossier should be provided

Body of Data

ACTIVE SUBSTANCE(s)

The active substance information can be submitted to the SADC VMP registration collaborative initiative in one of the following three options:

- Option 1: Certificate of suitability of the European Pharmacopoeia (CEP); or
- Option 2: Drug master file (DMF); or
- Option 3: Full details as prescribed in module 3 of this guideline.

The applicant should clearly indicate at the beginning of the active substance section (in the PD and in the QOS-PD) how the information on the active substance for each active substance manufacturer is being submitted. The active substance information submitted by the applicant/VMP manufacturer should include the following for each of the options used.

Option 1: Certificates of Suitability of the European Pharmacopoeia (CEP)
A complete copy of the CEP (including any annexes) should be provided in Module.

1. The declaration of access for the CEP should be duly filled out by the CEP holder on behalf of the VMP manufacturer or applicant to the SADC VMP registration collaborative initiative who refers to the CEP.

In addition, a written commitment should be included that the applicant will inform the SADC VMP registration collaborative initiative in the event that the CEP is withdrawn. It should also be acknowledged by the applicant that withdrawal of the CEP will require additional consideration of the active substance data requirements to support the PD. The written commitment should accompany the copy of the CEP in Module 1.

Along with the CEP, the applicant should supply the following information in the dossier, with data summarized in the QOS.

- 3.2. S.1.3 General Properties - discussions on any additional applicable physicochemical and other relevant active substance properties that are not controlled by the CEP and Ph.Eur. monograph, e.g. solubilities and polymorphs as per guidance in this section.
- 3.2. S.3.1 Elucidation of structure and other characteristics - studies to identify polymorphs (exception: where the CEP specifies a polymorphic form) and particle size distribution, where applicable, as per guidance in this section.
- 3.2. S.4.1 Specification - the specifications of the VMP manufacturer including all tests and limits of the CEP and Ph.Eur. monograph and any additional tests and acceptance criteria that are not controlled in the CEP and Ph.Eur. monograph, such as polymorphs and/or particle size distribution.
- 3.2. S.1.2 / 3.1.S.4.3 Analytical procedures and validation – for any tests in addition to those in the CEP and Ph.Eur. monograph.
- 3.2. S.4.4 Batch analysis - results from three batches of at least pilot scale, demonstrating compliance with the VMP manufacturer’s active substance specifications.

- 3.2. S.6 Container closure system - specifications including descriptions and identification of primary packaging components. Exception: where the CEP specifies a re-test period.
- 3.2. S.7 Stability - exception: where the CEP specifies a re-test period that is the same as or of longer duration than the re-test period proposed by the applicant. In the case of sterile active substances, data on the sterilization process of the active substance, including validation data, should be included in the PD.

Option 2: Drug Master File (DMF)
Full details of the chemistry, manufacturing process, quality controls during manufacturing and process validation for the active substance may be submitted as a DMF by the active substance manufacturer.

In such cases, the Open part (non-proprietary information) needs to be included in its entirety in the PD as an annex to 3.S.1. In addition, the applicant/VMP manufacturer should complete the following sections in the PD and QOS-PD in full according to the guidance provided unless otherwise indicated in the respective sections:

a) General information S.1.1 through S.1.3
b) Manufacture S.2
c) Manufacturer(s) S.2.1
d) Description of manufacturing process and process controls S.2.2
e) Controls of critical steps and intermediates S.2.4
f) Elucidation of structure and other characteristics S.3.1
g) Impurities S.3.1
h) Control of the active substance S.4.1 through S.4.5
i) Reference standards or materials S.5
j) Container closure system S.6
k) Stability S.7.1 through S.7.3

It is the responsibility of the applicant to ensure that the complete DMF (i.e., both the applicant's Open part and the restricted part, where necessary) is supplied to SADC VMP registration collaborative initiative or the respective SADC MS directly by the active substance manufacturer.

A copy of the letter of access should be provided in the Module 1.

DMF holders can use the guidance provided for the option "Full details in the PD" for preparation of the relevant sections of the Open and Restricted parts of their DMFs.

Option 3: Full Details in the Product Dossier
Information on the 3.2.S Active substance sections, including full details of chemistry, manufacturing process, quality controls during manufacturing and process validation for the active substance, should be submitted in the PD as outlined in the subsequent sections of this guideline. The QOS should be completed as per Section 3.2.S of this guidelines.

3.2.S Drug Substance (or active pharmaceutical ingredient (API)

3.2. S.1 General Information

3.2. S.1.1 Nomenclature
Information on the nomenclature of the active substance should be provided. For example:

- (Recommended) International Non-proprietary Name (INN).
- Compendial name, if relevant.
- Chemical name(s).

- Company or laboratory code.
- Other non-proprietary name(s) (e.g., national name, United States Adopted Name (USAN), British Approved Name (BAN)); and
- Chemical Abstracts Service (CAS) registry number.

The listed chemical names should be consistent with those appearing in scientific literature and those appearing on the product labelling information (e.g., Prescribing information leaflet and user information leaflet), labelling).

3.2. S.1.2 Structure

The structural formula, including relative and absolute stereochemistry, the molecular formula, and the relative molecular mass should be provided. This information should be consistent with that provided in Section 3.2.S.1.1. For active substances existing as salts, the molecular mass of the free base or acid should also be provided.

3.2. S.1.3 General properties

A list should be provided of physicochemical and other relevant properties of the active substance. This information can be used in developing the specifications, in formulating VMPs and in the testing for release and stability purposes.

The physical and chemical properties of the active substance should be discussed including the physical description, solubilities in common solvents (e.g., water, alcohols, dichloromethane, acetone), quantitative aqueous pH solubility profile to target animals (e.g polymorphism, pH and pKa values, UV absorption maxima and molar absorptivity, melting point, refractive index (for a liquid), hygroscopicity, partition coefficient, etc (see table in the QOS). This list is not intended to be exhaustive but provides an indication as to the type of information that could be included.

Some of the more relevant properties to be considered for active substances are discussed below in greater detail.

Physical description

The description should include appearance, colour and physical state. Solid forms should be identified as being crystalline or amorphous (see 3.2.S.3.1 for further information on active substance solid forms).

Solubilities/quantitative aqueous pH solubility profile

The following should be provided for all options for the submission of active substance data.

The solubilities in a number of common solvents should be provided (e.g., water, alcohols, dichloromethane, and acetone).

The solubilities over the physiological pH ranges of the target animals in several buffered media should be provided in mg/ml. If this information is not readily available (e.g. literature references), it should be generated in-house.

Polymorphism

The following refers to where specific data should be located in the PD:

- The polymorphic form(s) present in the proposed active substance should be listed in Section 3.2.S.1.1.3;
- The description of manufacturing process and process controls (3.2.S.1.2.2) should indicate which polymorphic form is manufactured, where relevant.
- The literature references or studies performed to identify the potential polymorphic forms of the active substance, including the study results, should be provided in Section 3.2.S.1.3.2;

Additional information is included in the referenced sections of this guideline.

Particle size distribution
The studies performed to identify the particle size distribution of the active substance should be provided in Section 3.2.S.1.3.2 (refer to this section of this guideline for additional information).

Information from literature
Supportive data and results from specific studies or published literature can be included within or attached to this section.

Reference:

- VICH GL39 Test procedures and acceptance criteria for new veterinary drug substances and new medicinal products: chemical substances

3.2. S.2 Manufacture (name, manufacturer)

3.2. S.2.1 Manufacturer(s) (name, manufacturer)

The name, address, and responsibility of each manufacturer, including contractors, and each proposed production site or facility involved in manufacturing and testing should be provided.

The facilities involved in the manufacturing, packaging, labelling, testing and storage of the active substance should be listed. If certain companies are responsible only for specific steps (e.g., milling of the active substance), this should be clearly indicated.

The list of manufacturers/companies should specify the actual addresses of production or manufacturing site(s) involved (including block(s) and units(s)), rather than the administrative offices. Telephone number(s), fax number(s) and e-mail address (es) should be provided.

A valid manufacturing authorization should be provided for the production of active substances. If available, a certificate of GMP compliance should be provided in the PD in Module 1.

3.2. S.2.2 Description of manufacturing process and process controls

The description of the active substance manufacturing process represents the applicant's commitment for the manufacture of the active substance. Information should be provided to adequately describe the manufacturing process and process controls. For example:

A flow diagram of the synthetic process(es) should be provided that includes molecular formulae, weights, yield ranges, chemical structures of starting materials, intermediates, reagents and active substance reflecting stereochemistry, and identifies operating conditions and solvents.

A sequential procedural narrative of the manufacturing process should be submitted. The narrative should include, for example, quantities of raw materials, solvents, catalysts and reagents reflecting the representative batch scale for commercial manufacture, identification of critical steps, process controls, equipment and operating conditions (e.g., temperature, pressure, pH, time).

Alternate processes should be explained and described with the same level of detail as the primary process. Reprocessing steps should be identified and justified. Any data to support this justification should be either referenced or filed in 3.2. S.2.5.

Where the DMF procedure is used, a cross-reference to the restricted part of the DMF may be indicated for confidential information. In this case, if detailed information is presented in the restricted part, the information to be provided for this section of the PD includes a flow chart (including molecular structures and all reagents and solvents) and a brief outline of the manufacturing process, with special emphasis on the final steps including purification procedures. However, for sterile active substances full validation data on the sterilization process should be provided in the Open part (in cases where there is no further sterilization of the final product). The

following requirements apply to the third option for submission of active substance information, where full details are provided in the dossier.

As discussed in ICH Q7, the point at which the active substance starting material is introduced into the manufacturing process is the starting point of the application of GMP requirements, according to the above guideline. The active substance starting material itself needs to be proposed and justified by the manufacturer and accepted as such by assessors. This justification should be documented and be available for review by SADC GMP inspectors.

The active substance starting material should be fully characterized with respect to identity and purity. The starting material for synthesis defines the starting point in the manufacturing process for an active substance to be described in an application. The applicant should propose and justify which substances should be considered as starting materials for synthesis. See section 3.2.S.2.3 for further guidance.

In addition to the detailed description of the manufacturing process as per ICH M4Q, the recovery of materials, if any, should be described in detail with the step in which they are introduced into the process. Recovery operations should be adequately controlled such that impurity levels do not increase over time. For recovery of solvents, any processing to improve the quality of the recovered solvent should be described. Regarding recycling of filtrates (mother liquors) to obtain second crops, information should be available on maximum holding times of mother liquors and maximum number of times the material can be recycled. Data on impurity levels should be provided to justify recycling of filtrates.

Where there are multiple manufacturing sites for one active substance manufacturer, a comprehensive list in tabular form should be provided comparing the processes at each site and highlighting any differences.

All solvents used in the manufacture (including purification and/or crystallization step(s)) should be clearly identified. Solvents used in the final steps should be of high purity. Use of recovered solvents in the final steps of purification and/or crystallization is not recommended.

Where polymorphic/amorphous forms have been identified, the form resulting from the synthesis should be stated.

Where particle size is considered a critical attribute (see 3.2.S.3.1 for details), the particle size reduction method(s) (milling, micronization) should be described.

Justification should be provided for alternate manufacturing processes. Alternate processes should be explained with the same level of detail as the primary process. It should be demonstrated that batches obtained by the alternate processes have the same impurity profile as the principal process. If the obtained impurity profile is different, it should be demonstrated to be acceptable according to the requirements described under 3.2.S.3.2.

It is acceptable to provide information on pilot scale manufacture, provided it is representative of production scale and scale-up is reported immediately to the SADC VMP collaborative platform according to the requirements of the SADC VMP registration collaborative procedures.

3.2. S.2.3 Control of materials

Materials used in the manufacture of the active substance (e.g., raw materials, starting materials, solvents, reagents, catalysts) should be listed identifying where each material is used in the process. Information on the quality and control of these materials should be provided. Information demonstrating that materials meet standards appropriate for their intended use should be provided, as appropriate.

Where the DMF procedure is used, a cross-reference to the restricted part of the DMF is considered sufficient for this section.

The following requirements apply to the third option for submission of active substance information, where full details are provided in the dossier.

In general, the starting material for synthesis described in the PD should:

- Be a synthetic precursor of one or more synthesis steps prior to the final active substance intermediate. acids, bases, salts, esters and similar derivatives of the active substance, as well as the racemate of a single enantiomer active substance, are not considered final intermediates.
- Be a well characterized, isolated and purified substance with its structure fully elucidated including its stereochemistry (when applicable).
- Have well defined specifications that include among others one or more specific identity tests and tests and limits for assay and specified, unspecified and total impurities.
- Be incorporated as a significant structural fragment into the structure of the active substance.

For each starting material, the name and manufacturing site address of the manufacturer should be indicated. If there are several manufacturers, it should be clarified whether the starting material obtained from different sources is prepared by the same route of synthesis or if different routes are used. Specifications proposed for the starting material should apply to the material from each source.

Copies of the specifications for the materials used in the synthesis, extraction, and isolation and purification steps should be provided in the PD, including starting materials, reagents, solvents, catalysts and recovered materials. Confirmation should be provided that the specifications apply to materials used at each manufacturing site. A certificate of analysis of the starting material for synthesis should be provided. A summary of the information on starting materials should be provided in the QOS- PD.

The carry-over of impurities of the starting materials for synthesis into the final active substance should be considered and discussed.

A letter of attestation should be provided confirming that the active substance, the starting materials and reagents used to manufacture the active substance are without risk of transmitting agents of animal spongiform encephalopathies.

When available, a CEP demonstrating TSE-compliance should be provided. A complete copy of the CEP (including any annexes) should be provided in Module1.

Reference:

- VICH GL39 Test procedures and acceptance criteria for new veterinary drug substances and new medicinal products: chemical substances

3.2. S.2.4 Controls of critical steps and intermediates

Critical Steps: Tests and acceptance criteria (with justification including experimental data) performed at critical steps identified in 3.2.S.2.2 of the manufacturing process to ensure that the process is controlled should be provided.

Intermediates: Information on the quality and control of intermediates isolated during the process should be provided.

Where the DMF procedure is used a cross-reference to the restricted part of the DMF is considered sufficient for this section of the PD, with the exception of information that is also relevant for the applicant

3.2. S.2.5 Process validation and/or assessment

Process validation and/or assessment studies for aseptic processing and sterilization should be included.

Where the DMF procedure is used, a cross-reference to the restricted part of the DMF is considered sufficient for this section of the PD.

The following requirements apply to the third option for submission of active substance information, where full details are provided in the dossier.

It is expected that the manufacturing processes for all active substances are properly controlled. If the active substance is prepared as sterile, a complete description should be provided for aseptic processing and/or sterilization methods. The controls used to maintain the sterility of the active substance during storage and transportation should also be provided. Alternate processes should be justified and described (see guidance in 3.2.S.2.2 for the level of detail expected).

3.2. S.2.6 Manufacturing process development

A description and discussion should be provided of the significant changes made to the manufacturing process and/or manufacturing site of the active substance used in producing comparative bioavailability or biowaiver, scale-up, pilot, and, if available, production scale batches.

Reference should be made to the active substance data provided in section 3.2.S.4.4.

Where the DMF procedure is used, a cross-reference to the Restricted part of the DMF is considered sufficient for this section of the PD.

3.2. S.3 Characterization

3.2. S.3.1 Elucidation of structure and other characteristics

Confirmation of structure based on e.g., synthetic route and spectral analyses should be provided. Information such as the potential for isomerism, the identification of stereochemistry, or the potential for forming polymorphs should also be included.

Elucidation of structure

The PD should include quality assurance (QA) certified copies of the spectra, peak assignments and a detailed interpretation of the data of the studies performed to elucidate and/or confirm the structure of the active substance. The QOS-PD should include a list of the studies performed and a conclusion from the studies (e.g. if the results support the proposed structure).

For active substances that are not described in an officially recognized pharmacopoeia, the studies carried out to elucidate and/or confirm the chemical structure normally include elemental analysis, infrared (IR), ultraviolet (UV), nuclear magnetic resonance (NMR) and mass spectra (MS) studies. Other tests could include X-ray powder diffraction (XRPD) and differential scanning calorimetry (DSC).

For active substances that are described in an officially recognized pharmacopoeia, it is generally sufficient to provide copies of the IR spectrum of the active substance from each of the proposed manufacturer(s) run concomitantly with a pharmacopoeial reference standard. See Section 3.S.5 for details on acceptable reference standards or materials.

Isomerism/Stereochemistry

When an active substance is chiral, it should be specified whether specific stereoisomers or a mixture of stereoisomers have been used in the comparative biostudies, and information should be given as to the stereoisomer of the active substance that is to be used in the VMP.

Where the potential for stereoisomerism exists, a discussion should be included of the possible isomers that can result from the manufacturing process and the steps where chirality was introduced. The identicality of the isomeric composition of the active substance to that of the active substance in the comparator product should be established. Information on the physical and

chemical properties of the isomeric mixture or single enantiomer should be provided, as appropriate. The active substance specification should include a test to ensure isomeric identity and purity.

The potential for interconversion of the isomers in the isomeric mixture, or racemisation of the single enantiomer should be discussed.

When a single enantiomer of the active substance is claimed for non-pharmacopoeial active substances, unequivocal proof of absolute configuration of asymmetric centers should be provided such as determined by X-ray of a single crystal.If, based on the structure of the active substance, there is not a potential for stereoisomerism, it is sufficient to include a statement to this effect.

Polymorphism

Many active substances can exist in different physical forms in the solid state. Polymorphism is characterized as the ability of an active substance to exist as two or more crystalline phases that have different arrangements and/or conformations of the molecules in the crystal lattice. Amorphous solids consist of disordered arrangements of molecules and do not possess a distinguishable crystal lattice. Solvates are crystal forms containing either stoichiometric or nonstoichiometric amounts of a solvent. If the incorporated solvent is water, the solvates are also commonly known as hydrates.

Polymorphic forms of the same chemical compound differ in internal solid-state structure and, therefore, may possess different chemical and physical properties, including packing, thermodynamic, spectroscopic, kinetic, interfacial and mechanical properties. These properties can have a direct impact on active substance processability, pharmaceutical product manufacturability and product quality/performance, including stability, dissolution and bioavailability. Unexpected appearance or disappearance of a polymorphic form may lead to serious pharmaceutical consequences.

Applicants and active substance manufacturers are expected to have adequate knowledge about the polymorphism of the active substances used and/or produced. Information on polymorphism can come from the scientific literature, patents, compendia or other references to determine if polymorphism is a concern. Polymorphic screening is generally accomplished via crystallization studies using different solvents and conditions.

There are a number of methods that can be used to characterize the polymorphic forms of an active substance. Demonstration of a nonequivalent structure by single crystal X-ray diffraction is currently regarded as the definitive evidence of polymorphism. XRPD can also be used to provide unequivocal proof of polymorphism. Other methods, including microscopy, thermal analysis (e.g. DSC, thermal gravimetric analysis and hot-stage microscopy) and spectroscopy (e.g. IR, Raman, solid-state nuclear magnetic resonance [ssNMR]) are helpful to further characterize polymorphic forms. Where polymorphism is a concern, the applicants/manufacturers of active substances should demonstrate that a suitable method, capable of distinguishing different polymorphs, is available to them.

Decision tree 4(1) of ICH Q6A can be used where screening is necessary and 4(2) can be used to investigate if different polymorphic forms have different properties that may affect performance, bioavailability and stability of the VMP and to decide whether a preferred polymorph should be monitored at release and on storage of the active substance. Where there is a preferred polymorph, acceptance criteria should be incorporated into the active substance specification to ensure polymorphic equivalence of the commercial material and that of the active substance batches used in the comparative bioavailability or biowaiver studies. The polymorphic characterization of the active substance batches used in comparative bioavailability or biowaiver studies by the above-mentioned methods should be provided. The method used to control polymorphic form should be demonstrated to be specific for the preferred form.

Polymorphism can also include solvation or hydration products (also known as pseudopolymorphs). If the active substance is used in a solvated form, the following information should be provided:

- Specifications for the solvent-free active substance in 3.2.S.2.4, if that compound is a synthetic precursor.
- specifications for the solvated active substance including appropriate limits on the weight ratio of active substance to solvent (with data to support the proposed limits);
- A description of the method used to prepare the solvate in 3.2.S.2.2.

Particle size distribution

For active substances that are not highly soluble contained in solid VMPs, or liquid VMPs containing undissolved active substance, the particle size distribution of the material can have an effect on the in vitro and/or in vivo behaviour of the VMP. Particle size distribution can also be important in dosage form performance (e.g. delivery of inhalation products), achieving uniformity of content in low-dose tablets (e.g. 2 mg or less), desired smoothness in ophthalmic preparations and stability of suspensions.

If particle size distribution is an important parameter (e.g. as in the above cases), results from an investigation of several batches of the active substance should be provided, including characterization of the batch (es) used in the comparative bioavailability or biowaiver studies. active substance specifications should include controls on the particle size distribution to ensure consistency with the material in the batch(es) used in the comparative bioavailability and biowaiver studies (e.g. limits for d10, d50 and d90). The criteria should be established statistically based on the standard deviation of the test results from the previously mentioned studies. The following is provided for illustrative purposes as possible acceptance criteria for particle size distribution limits:

- d10 not more than (NMT) 10% of total volume less than X µm
- d50 XX µm - XXX µm
- d90 not less than (NLT) 90% of total volume less than XXXX µm.

Other controls on particle size distribution can be considered acceptable, if scientifically justified.

Reference:

- VICH GL39 Test procedures and acceptance criteria for new veterinary drug substances and new medicinal products: chemical substances

3.2. S.3.2 Impurities

Information on impurities should be provided.

Details on the principles for the control of impurities (e.g. reporting, identification and qualification) are outlined in the VICH impurity guidelines. Additional information to provide further guidance on some of the elements discussed in the VICH guidelines is outlined below.

Regardless of whether a pharmacopoeial standard is claimed, a discussion should be provided of the potential and actual impurities arising from the synthesis, manufacture, or degradation of the active substance. This should cover starting materials, by-products, intermediates, chiral impurities and degradation products and should include the chemical names, structures and origins. The discussion of pharmacopoeial active substances should not be limited to the impurities specified in the active substance monograph.

The tables in the QOS-PD template should be used to summarize the information on the active substance-related and process-related impurities. In the QOS-PD, the term origin refers to how

and where the impurity was introduced (e.g. “Synthetic intermediate from Step 4 of the synthesis”, “Potential by-product due to rearrangement from Step 6 of the synthesis”). It should also be indicated if the impurity is a metabolite of the active substance.

The VICH thresholds for reporting, identification (used to set the limit for individual unknown impurities) and qualification are determined on the basis of potential exposure to the impurity, e.g. by the maximum daily dose (MDD) of the active substance. For active substances available in multiple dosage forms and strengths having different MDD values, it is imperative that the thresholds and corresponding controls for each of the presentations be considered to ensure that the risks posed by impurities have been addressed. This is normally achieved by using the highest potential daily MDD, rather than the maintenance dose. For parenteral products, the maximum hourly dose of the active substance should also be included.

It is acknowledged that active substances of semi-synthetic origin do not fall within the scope of the VICH impurity guidelines. However, depending on the nature of the active substance and the extent of the chemical modification steps, the principles on the control of impurities (e.g. reporting, identification and qualification) could also be extended to active substances of semi-synthetic origin. As an illustrative example, an active substance whose precursor molecule was derived from a fermentation process, or a natural product of plant or animal origin that has subsequently undergone several chemical modification reactions generally would fall within this scope, whereas an active substance whose sole chemical step was the formation of a salt from a fermentation product generally would not fall within this scope. It is understood that there is some latitude for these types of active substances.

Identification of impurities

It is recognized by the pharmacopoeias that active substances can be obtained from various sources and thus can contain impurities not considered during the development of the monograph. Furthermore, a change in the production or source may give rise to additional impurities that are not adequately controlled by the official compendial monograph. As a result, each PD is assessed independently to consider the potential impurities that may arise from the proposed route(s) of synthesis. For these reasons, the ICH limits for unspecified impurities (e.g. NMT 0.10% or 1.0 mg per day intake (whichever is lower) for active substances having a maximum daily dose ≤2 g/day) are generally recommended, rather than the general limits for unspecified impurities that may appear in the official compendial monograph that could potentially be higher than the applicable VICH limit.

Qualification of impurities

The VICH impurity guidelines should be consulted for options on the qualification of impurities. The limit specified for an identified impurity in an officially recognized pharmacopoeia is generally considered to be qualified. The following is an additional option for qualification of impurities in existing active substances:

The limit for an impurity present in an existing active substance can be accepted by comparing the impurity results found in the existing active substance with those observed in an innovator product using the same validated, stability-indicating analytical procedure (e.g. comparative HPLC studies). If samples of the innovator product are not available, the impurity profile may also be compared to a different prequalified VMP with the same route of administration and similar characteristics (e.g. tablet versus capsule). It is recommended that the studies be conducted on comparable samples (e.g. age of samples) to obtain a meaningful comparison of the impurity profiles.

Levels of impurities generated from studies under accelerated or stressed storage conditions of the innovator or prequalified VMP are not considered acceptable/qualified.

A specified impurity present in the existing active substance is considered qualified if the amount of the impurity in the existing active substance reflects the levels observed in the innovator or prequalified VMP.

Basis for setting the acceptance criteria
The basis for setting the acceptance criteria for the impurities should be provided. This is established by considering the identification and qualification thresholds for active substance-related impurities (e.g. starting materials, by-products, intermediates, chiral impurities or degradation products) and the concentration limits for process-related impurities (e.g. residual solvents) as per the applicable ICH guidelines (e.g. Q3A, Q3C).

The qualified level should be considered as the maximum allowable limit. However, limits which are considerably wider than the actual manufacturing process capability are generally discouraged. For this reason, the acceptance criteria are also set taking into consideration the actual levels of impurities found in several batches of the active substance from each manufacturer, including the levels found in the batches used for the comparative bioavailability or biowaiver studies. When reporting the results of quantitative tests, the actual numerical results should be provided rather than vague statements such as “within limits” or “conforms”. In the cases where a large number of batches have been tested it is acceptable to summarize the results of the total number of batches tested with a range of analytical results.

If there are identified impurities specified in an official compendial monograph that are not controlled by the proposed routine in-house analytical procedure, a justification for their exclusion from routine analyses should be provided. If acceptable justification cannot be provided it should be demonstrated that the routine in-house method is capable of separating and detecting the impurities specified in the official compendial monograph at an acceptable level (e.g. 0.10%). If such a demonstration cannot be performed, a one-time study should be conducted applying the pharmacopoeial method to several recent batches to demonstrate the absence of the pharmacopoeial listed impurities.

For guidance on acceptable residual solvent limits, refer to VICH GL18(R).

The absence of known established highly toxic impurities (genotoxic) used in the process or formed as a by-product should be discussed and suitable limits should be proposed. The limits should be justified by appropriate reference to available guidance or by providing experimental safety data or published data in peer- reviewed journals.

Residues of metal catalysts used in the manufacturing process and determined to be present in batches of active substance are to be controlled in specifications. This requirement does not apply to metals that are deliberate components of the pharmaceutical substance (such as a counter ion of a salt) or metals that are used as a pharmaceutical excipient in the VMP (e.g. an iron oxide pigment). The guideline on the specification limits for residues of metal catalysts or metal reagents or any equivalent approaches can be used to address this issue. The requirement normally does not apply to extraneous metal contaminants that are more appropriately addressed by GMP, GDP or any other relevant quality provision such as the heavy metal test in monographs of recognized pharmacopoeias that cover metal contamination originating from manufacturing equipment and the environment.

Reference:

- VICH GL10(R) Impurities in New Drug Veterinary Substances
- VICH GL18(R) Impurities: Residual Solvents in a New Veterinary Medicinal product, Active ingredients, excipients

3.2. S.4 Control of the Active substance

3.2. S.4.1 Specification
The specification for the active substance should be provided. As defined in VICH GL 39 and or ICH’s Q6A guideline, a specification is:

“A list of tests, references to analytical procedures and appropriate acceptance criteria, which are numerical limits, ranges, or other criteria for the tests described. It establishes the set of criteria to which an active substance or VMP should conform to be considered acceptable for its intended use. “Conformance to specifications” means that the active substance and / or VMP, when tested according to the listed analytical procedures, will meet the listed acceptance criteria. Specifications are critical quality standards that are proposed and justified by the manufacturer and approved by regulatory authorities.”

Copies of the active substance specifications, dated and signed by authorized personnel (e.g. the person in charge of the quality control or quality assurance department) should be provided in the PD, including specifications from each active substance manufacturer as well as those of the VMP manufacturer.

The VMP manufacturer’s active substance specification should be summarized according to the table in the QOS-PD template under the headings tests, acceptance criteria and analytical procedures (including types, sources and versions for the methods).

- The standard declared by the applicant could be an officially recognized compendial standard (e.g. BP, or In House (manufacturer’s) standard.
- The specification reference number and version (e.g. revision number and/or date) should be provided for version control purposes.
- For the analytical procedures, the type should indicate the kind of analytical procedure used (e.g. visual, IR, UV, HPLC, laser diffraction), the source refers to the origin of the analytical procedure (e.g. BP, in-house) and the version (e.g. code number/version/date) should be provided for version control purposes.

In cases where there is more than one active substance manufacturer, the VMP manufacturer’s active substance specifications should be one single compiled set of specifications that is identical for each manufacturer. It is acceptable to lay down in the specification more than one acceptance criterion and/or analytical method for a single parameter with the statement “for active substance from manufacturer A” (e.g. in the case of residual solvents).

Any non-routine testing should be clearly identified as such and justified along with the proposal on the frequency of non-routine testing.

The ICH Q6A guideline outlines recommendations for a number of universal and specific tests and criteria for active substances.

Reference:

- ICH, Q6A, officially recognized pharmacopoeia
- VICH GL39 — Specifications: Test Procedures and Acceptance Criteria for New Veterinary Drug Substances and New Medicinal Products:

3.2. S.4.2 Analytical procedures

The analytical procedures used for testing the active substance should be provided.

Copies of the in-house analytical procedures used to generate testing results provided in the PD, as well as those proposed for routine testing of the active substance by the VMP manufacturer should be provided. Provide copies of compendial analytical procedures used.

Tables for summarizing a number of the different analytical procedures and validation information (e.g. HPLC assay/impurity methods, GC methods) can be found in the 2.3.R Regional information section of the QOS-PD (i.e. 2.3.R.2). These tables should be used to summarize the in-house analytical procedures of the VMP manufacturer for determination of the residual solvents, assay and purity of the active substance, in section 2.3.S.4.2 of the QOS-PD. Other methods used to generate assay and purity data in the PD can be summarized in 2.3.S.4.4 (c) or 2.3.S.7.3 (b) of the QOS-PD. Officially recognized compendial methods need not be summarized unless modifications have been made.

Although HPLC is normally considered the method of choice for determining active substance-related impurities, other chromatographic methods such as GC and TLC can also be used, if appropriately validated. For determination of related substances, reference standards should normally be available for each of the identified impurities, particularly those known to be toxic and the concentration of the impurities should be quantified against their own reference standards. Impurity standards may be obtained from pharmacopoeias (individual impurities or resolution mixtures), from commercial sources or prepared in-house. It is considered acceptable to use the active substance as an external standard to estimate the levels of impurities, provided the response factors of those impurities are sufficiently close to that of the active substance, i.e. between 80 and 120%. In cases where the response factor is outside this range, it may still be acceptable to use the active substance, provided a correction factor is applied. Data to support calculation of the correction factor should be provided for an in-house method. Unspecified impurities may be quantified using a solution of the active substance as the reference standard at a concentration corresponding to the limit established for individual unspecified impurities (e.g. 0.10%).

The system suitability tests (SSTs) represent an integral part of the method and are used to ensure the adequate performance of the chosen chromatographic system. As a minimum, HPLC and GC purity methods should include SSTs for resolution and repeatability. For HPLC methods to control active substance-related impurities, this is typically done using a solution of the active substance with a concentration corresponding to the limit for unspecified impurities. Resolution of the two closest eluting peaks is generally recommended. However, the choice of alternate peaks can be used if justified (e.g. choice of a toxic impurity)

3.2. S.4.3 Validation of analytical procedures

Analytical validation information, including experimental data for the analytical procedures used for testing the active substance, should be provided.

Copies of the validation reports for the analytical procedures used to generate testing results provided in the PD, as well as those proposed for routine testing of the active substance by the VMP manufacturer, should be provided.

Tables for summarizing a number of the different analytical procedures and validation information (e.g. HPLC assay/impurity methods, GC methods) can be found in the 2.3.R Regional information section of the QOS (i.e. 2.3.R.2). These tables should be used to summarize the validation information of the analytical procedures of the VMP manufacturer for determination of residual solvents, assay and purity of the active substance, in section 2.3.S.4.3 of the QOS. The validation data for other methods used to generate assay and purity data in the PD can be summarized in 2.3.S.4.4 (c) or 2.3.S.7.3 (b) of the QOS.

As recognized by regulatory authorities and pharmacopoeias themselves, verification of compendial methods can be necessary. The compendial methods as published are typically validated based on an active substance or an VMP originating from a specific manufacturer. Different sources of the same active substance or VMP can contain impurities and/or degradation products that were not considered during the development of the monograph. Therefore, the monograph and compendial method should be demonstrated suitable to control the impurity profile of the active substance from the intended source(s).

In general verification is not necessary for compendial active substance assay methods. However, specificity of a specific compendial assay method should be demonstrated if there are any potential impurities that are not specified in the compendial monograph. If an officially recognized compendial method is used to control active substance-related impurities that are not specified in the monograph, full validation of the method is expected with respect to those impurities.

If an officially recognized compendial standard is claimed and an in-house method is used in lieu of the compendial method (e.g. for assay or for specified impurities), equivalency of the in-house and compendial methods should be demonstrated. This could be accomplished by performing duplicate analyses of one sample by both methods and providing the results from the study. For impurity methods, the sample analyzed should be the active substance spiked with impurities at concentrations equivalent to their specification limits.

References:

- VICH GL1 Validation of Analytical Procedures
- VICH GL2 Validation of Analytical Procedures: Methodology

3.2. S.4.4 Batch analyses

Description of batches and results of batch analyses should be provided.

The information provided should include batch number, batch size, date and production site of relevant active substance batches used in comparative bioavailability or biowaiver studies, preclinical and clinical data (if relevant), stability, pilot, scale-up and, if available, production-scale batches. This data is used to establish the specifications and evaluate consistency in active substance quality.

Analytical results should be provided from at least two batches of at least pilot scale from each proposed manufacturing site of the active substance and should include the batch(es) used in the comparative bioavailability or biowaiver studies. A pilot- scale batch should be manufactured by a procedure fully representative of and simulating that to be applied to a full production-scale batch.

Copies of the certificates of analysis, both from the active substance manufacturer(s) and the VMP manufacturer, should be provided for the profiled batches and any company responsible for generating the test results should be identified. The VMP manufacturer’s test results should be summarized in the QOS-PD.

The discussion of results should focus on observations noted for the various tests, rather than reporting comments such as “all tests meet specifications”. For quantitative tests (e.g. individual and total impurity tests and assay tests), it should be ensured that actual numerical results are provided rather than vague statements such as “within limits” or “conforms”.

A discussion and justification should be provided for any incomplete analyses (e.g. results not tested according to the proposed specification).

3.2. S.4.5 Justification of specification

Justification for the active substance specification should be provided.

A discussion should be provided on the inclusion of certain tests, evolution of tests, analytical procedures and acceptance criteria, differences from the officially recognized compendial standard(s), etc. If the officially recognized compendial methods have been modified or replaced, a discussion should be included.

The justification for certain tests, analytical procedures and acceptance criteria may have been discussed in other sections of the PD (e.g. impurities, particle size distribution) and does not need to be repeated here, although a cross-reference to their location should be provided.

3.2. S.5 Reference standards or materials

Information on the reference standards or reference materials used for testing of the active substance should be provided.

Information should be provided on the reference standard(s) used to generate data in the PD, as well as those to be used by the VMP manufacturer in routine active substance and VMP testing.

The source(s) of the reference standards or materials used in the testing of the active substance should be provided (e.g. those used for the identification, purity, assay tests). These could be classified as primary or secondary reference standards.

A suitable primary reference standard should be obtained from an officially recognized pharmacopoeial source (e.g. Ph.Eur., BP,) where one exists and the lot number should be provided. Where a pharmacopoeial standard is claimed for the active substance and/or the VMP, the primary reference standard should be obtained from that pharmacopoeia when available. Primary reference standards from officially recognized pharmacopoeial sources do not need further structural elucidation.

Otherwise, a primary standard may be a batch of the active substance that has been fully characterized (e.g. by IR, UV, NMR, MS analyses). Further purification techniques may be needed to render the material acceptable for use as a chemical reference standard. The purity requirements for a chemical reference substance depend upon its intended use. A chemical reference substance proposed for an identification test does not require meticulous purification, since the presence of a small percentage of impurities in the substance often has no noticeable effect on the test. On the other hand, chemical reference substances that are to be used in assays should possess a high degree of purity (such as 99.5% on the dried or water/solvent free basis). Absolute content of the primary reference standard must be declared and should follow the scheme: 100% minus organic impurities (quantitated by an assay procedure, e.g. HPLC, DSC, etc.) minus inorganic impurities minus volatile impurities by loss on drying (or water content minus residual solvents).

A secondary (or in-house) reference standard can be used by establishing it against a suitable primary reference standard, e.g. by providing legible copies of the IR of the primary and secondary reference standards run concomitantly and by providing its certificate of analysis, including assay determined against the primary reference standard. A secondary reference standard is often characterized and evaluated for its intended purpose with additional procedures other than those used in routine testing (e.g. if additional solvents are used during the additional purification process that are not used for routine purposes).

Reference standards should normally be established for specified impurities. Refer to section 3.2.S.4.2 for additional guidance

Reference:

- VICH GL39 Test procedures and acceptance criteria for new veterinary drug substances and new medicinal products: chemical substances

3.2. S.6 Container closure system

A description of the container closure system(s) should be provided, including the identity of materials of construction of each primary packaging component, and their specifications. The specifications should include description and identification (and critical dimensions with drawings, where appropriate). Non-Compendial methods (with validation) should be included, where appropriate.

For non-functional secondary packaging components (e.g., those that do not provide additional protection), only a brief description should be provided. For functional secondary packaging components, additional information should be provided.

The suitability should be discussed with respect to, for example, choice of materials, protection from moisture and light, compatibility of the materials of construction with the active substance, including sorption to container and leaching, and/or safety of materials of construction.

Primary packaging components are those that are in direct contact with the active substance or VMP. The specifications for the primary packaging components should be provided and should include a specific test for identification (e.g. IR).

Copies of the labels applied on the secondary packaging of the active substance should be provided and should include the conditions of storage. In addition, the name and address of the manufacturer of the active substance should be stated on the container, regardless of whether relabeling is conducted at any stage during the active substance distribution process.

3.2. S.7 Stability

3.2. S.7.1 Stability summary and conclusions

The types of studies conducted, protocols used, and the results of the studies should be summarised. The summary should include results, for example, from forced degradation studies and stress conditions, as well as conclusions with respect to storage conditions and re-test date or shelf-life, as appropriate.

The purpose of stability testing is to:

> "Provide evidence of how the quality of an active substance or VMP varies with time under the influence of a variety of environmental factors such as temperature, humidity and light."

The tables in the QOS-PD template should be used to summarize the results from the stability studies and related information (e.g. conditions, testing parameters, conclusions, commitments).

Stress testing

Publications from peer-reviewed literature could be submitted to support/replace experimental data

Stress testing of the active substance can help to identify the likely degradation products, which can in turn help establish the degradation pathways and the intrinsic stability of the molecule and validate the stability indicating power of the analytical procedures used. The nature of the stress testing will depend on the individual active substance and the type of VMP involved.

Degradation paths for pharmaceutical compounds are typically reactions of hydrolysis, oxidation, photolysis, and/or acid-base chemistry. To force these reactions, the active substance or VMP is placed in solution expediently, for example, under the conditions shown in the following table.

Stress factor	Conditions
Heat	60°C
Humidity	75% RH or greater
Acid	0.1N HCl
Base	0.1N NaOH
Oxidative	3% H_2O_2
Photolytic	Metal halide, Hg Xe lamp, or UV-B/fluorescent
Metal ions (optional)	0.05 M Fe2+ or Cu2+

The objective is not to completely degrade the active compound but to generate degradation to a small extent, typically 10-30% loss of active by assay when compared with non-degraded compound. This target is chosen so that some degradation occurs, but it is not so severe that secondary products are generated. (Secondary degradation products are degradation products of degradation products and in most cases are not observed during stability studies.) In the total absence of degradation products after 10 days, the active substance is considered stable. If degradation is detectable but its extent is less than 10%, then the stress factors or the stress conditions, or both, should be increased.

Stress testing is to be carried out on a single batch of the active substance. Photostability testing should be an integral part of stress testing. The standard conditions for photostability testing are described in VICH GL5.

Solid-state degradation can also be considered. For active substances, placing a solid sample at elevated temperatures —e.g., 60-120 °C, or 5-10 °C below the melting point— can generate some degradation compounds. Because of the harsher conditions, these compounds may not be observed under the accelerated stress studies. However, this approach serves to generate degradation products that can be used as a worst case to assess the analytical method performance.

Examining degradation products under stress conditions is also useful in developing and validating suitable analytical procedures. However, it may not be necessary to examine specifically for certain degradation products if it has been demonstrated that they are not formed under accelerated or long-term storage conditions. Results from these studies form an integral part of the information provided to the SADC VMP registration collaborative platform.

For active substances not described in an official pharmacopoeial monograph, there are two options:

- When available, it is acceptable to provide the relevant data published in the “peer review” literature to support the proposed degradation pathways.
- When no data are available in the scientific literature, including official pharmacopoeias, stress testing should be performed. Results from these studies will form an integral part of the information provided to the SADC VMP registration collaborative platform.

Reference:

- VICH GL5 Photostability Testing of New Veterinary Drug Substances and Medicinal Products

Accelerated and long-term testing

Summarize the stability testing program and report the results of stability testing of not less than three (minimum one production scale and two pilot scale) batches of the active substance. The

data for each attribute should be discussed, trends analyzed, and a re-test date should be proposed. Information on the analytical procedures used to generate the data and validation of these procedures should be included.

Describe the methodology used during stability studies; if this is identical to methodology described elsewhere in the dossier, a cross-reference will suffice. If different methodology was used, provide validation of tests for impurities including degradants and assay and for other tests as necessary.

At the time of submitting the dossier, the general requirements are:

Storage temperature (°C)	Relative humidity (%)	Minimum period covered by data at submission (months)
Accelerated: 40±2	75±5	6
Long term: 30±2	75±5	12

Note: Unless otherwise justified, 30 ± 2ºC and 75 ± 5% RH is the long-term stability condition for products to be marketed in SADC.

A storage statement should be proposed for the labeling (if applicable), which should be based on the stability assessment of the active substance.

A re-test period should be derived from the stability information, and the approved re-test date should be displayed on the container label and CoA.

Unless otherwise justified, the long-term stability studies should be conducted at 30°C ± 2°C/75± 5%RH conditions.

Reference:

- VICH GL8: Stability Testing for Medicated Premixes.
- VICH GL45: Bracketing and matrixing designs for Stability Testing of New Veterinary Drug Substances and Medicinal Products.
- VICH GL58: Stability Testing of New Veterinary Drug Substances and Medicinal Products in Climatic Zones III and IV.

Stability Data

Results of the stability studies (e.g., forced degradation studies and stress conditions) should be presented in an appropriate format such as tabular, graphical, or narrative. Information on the analytical procedures used to generate the data and validation of these procedures should be included.

The actual stability results used to support the proposed re-test period should be included in the dossier. For quantitative tests (e.g. individual and total degradation product tests and assay tests), it should be ensured that actual numerical results are provided rather than vague statements such as “within limits” or “conforms”.

References:

- VICH GL3 (R) –Stability testing of the new veterinary substances and medicinal products,

3.2. P VETERINARY MEDICINAL PRODUCT(s) [VMP(s)]

3.2. P.1 Description and Composition of the VMP

Information provided should include:

Description of the dosage form
The description of the VMP should include the physical description, available strengths, release mechanism (e.g. immediate, long acting injection), as well as any other distinguishable characteristics, e.g.

"The proposed X 100mg bolus is available as white, oval, film-coated tablets, debossed with '100' on one side and a break-line on the other side.

Composition
List of all components of the dosage form, and their amount on a per unit basis (including overages, if any), the function of the components, and a reference to their quality standards (e.g., compendial monographs or manufacturer's specifications)

The tables in the QOS template should be used to summarize the composition of the VMP and express the quantity of each component on a per unit basis (e.g. mg per tablet, mg per ml, mg per vial) and percentage basis, including a statement of the total weight or measure of the dosage unit. The individual components for mixtures prepared in-house (e.g. coatings) should be included in the tables, where applicable.

All components used in the manufacturing process should be included, including those that may not be added to every batch (e.g. acid and alkali), those that may be removed during processing (e.g. solvents) and any others (e.g. nitrogen, silicon for stoppers). If the VMP is formulated using an active moiety, then the composition for the active ingredient should be clearly indicated. All overages should be clearly indicated (e.g. "contains 2% overage of the active substance to compensate for manufacturing losses").

The components should be declared by their proper or common names, quality standards (e.g. BP, House) and, if applicable, their grades (e.g. "Microcrystalline Cellulose NF (PH 102)") and special technical characteristics (e.g. lyophilized, micronized, solubilised, emulsified).

The function of each component (e.g. diluent/filler, binder, disintegrant, lubricant, glidant, granulating solvent, coating agent, antimicrobial preservative) should be stated. If an excipient performs multiple functions, the predominant function should be indicated.

The qualitative composition, including solvents, should be provided for all proprietary components or blends (e.g. capsule shells, colouring blends, imprinting inks). This information (excluding the solvents) is to be listed in the product information (e.g. prescribing information leaflet, User information leaflet and labelling).

Description of accompanying reconstitution diluent(s)
For VMPs supplied with reconstitution diluent(s) that are commercially available or have been assessed and considered acceptable in connection with another Product Dossier (PD) with the Veterinary Medicines Zazibona region, a brief description of the reconstitution diluents(s) should be provided.

For VMPs supplied with reconstitution diluent(s) that are not commercially available or have not been assessed and considered acceptable in connection with another PD with the Veterinary Medicines Zazibona, information on the diluent(s) should be provided in a separate VMP portion ("3.2.P"), as appropriate.

Type of container and closure used for the dosage form and accompanying reconstitution diluents, if applicable

The container closure used for the VMP (and accompanying reconstitution diluents, if applicable) should be briefly described, with further details provided under 3.2.P.7 Container closure system, e.g.

“The product is available in HDPE bottles with polypropylene caps (in sizes of, 50’s and 100’s) and in PVC/Aluminum foil unit dose blisters (in packages of 2’s (blister of 2 x1, 10 blisters per package).”

Reference:

- ICH Q6A Specifications: Test Procedures and Acceptance Criteria for New Drug Substances and New Drug Products: Chemical Substances

3.2. P.2 Pharmaceutical development

The Pharmaceutical Development section should contain information on the development studies conducted to establish that the dosage form, the formulation, manufacturing process, container closure system, microbiological attributes and usage instructions are appropriate for the purpose specified in the application. The studies described here are distinguished from routine control tests conducted according to specifications. Additionally, this section should identify and describe the formulation and process attributes (critical parameters) that can influence batch reproducibility, product performance and VMP quality. Supportive data and results from specific studies or published literature can be included within or attached to the Pharmaceutical Development section. Additional supportive data can be referenced to the relevant nonclinical or clinical sections of the product dossier.

Pharmaceutical development information should include, at a minimum:

- The definition of the quality target product profile (QTPP) as it relates to quality, safety and efficacy, considering for example the route of administration, dosage form, bioavailability, strength and stability;
- Identification of the potential critical quality attributes (CQAs) of the VMP so as to adequately control the product characteristics that could have an impact on quality;
- Discussion of the potential CQAs of the active substance(s), excipients and container closure system(s) including the selection of the type, grade and amount to deliver drug product of the desired quality;

Discussion of the selection criteria for the manufacturing process and the control strategy required to manufacture commercial lots meeting the QTPP in a consistent manner. These features should be discussed as part of the product development using the principles of risk management over the entire lifecycle of the product (ref: ICH Q8).

For a discussion of additional pharmaceutical development issues specific to the development of VMPs https://www.ema.europa.eu/documents/scientific-guideline/note-guidance-development-pharmaceutics-veterinary-medicinal-products_en.pdf and FDCs, reference should be made to Doc. Ref.EMEA/CVMP/83804/2005,Guideline on pharmaceutical fixed combination product.

References:

- ICH Q6A: Specifications: Test procedures and acceptance criteria for new drug substances and new drug products: Chemical substances
- ICH Q8: Pharmaceutical Development
- ICH Q9: Quality Risk Management
- ICH Q10: Pharmaceutical Quality System

3.2. P.2.1 Components of the VMP
3.2.P.2.1.1 Active substance

The compatibility of the active substance with excipients listed in 3.2.P.1 should be discussed. Additionally, key physicochemical characteristics (e.g., water content, solubility, and particle size distribution, polymorphic or solid state form) of the active substance that can influence the performance of the VMP should be discussed. For fixed-dose combinations, the compatibility of active substances with each other should be discussed.

Physicochemical characteristics of the active substance may influence both the manufacturing capability and the performance of the VMP.

In addition to visual examination, chromatographic results (assay, purity) are required to demonstrate active substance-active substance and active substance- excipient compatibility. In general, active substance-excipient compatibility is not required to be established for specific excipients when evidence is provided (e.g. Prescribing information leaflet) that the excipients are present in the comparator product.

3.2. P.2.1.2 Excipients

The choice of excipients listed in 3.2.P.1, their concentration, and their characteristics that can influence the VMP performance should be discussed relative to their respective functions.

Ranges or alternates for excipients are normally not accepted, unless supported by appropriate process validation data. Where relevant, compatibility study results (e.g. compatibility of a primary or secondary amine active substance with lactose) should be included to justify the choice of excipients. Specific details should be provided where necessary (e.g. use of potato or corn starch).

Where antioxidants are included in the formulation, the effectiveness of the proposed concentration of the antioxidant should be justified and verified by appropriate studies.

Antimicrobial preservatives are discussed in 3.2.P.2.5.

3.2. P.2.2 Finished pharmaceutical product
3.2. P.2.2.1 Formulation development

A brief summary describing the development of the VMP should be provided, taking into consideration the proposed route of administration and usage. The differences between the comparative bioavailability or biowaiver formulations and the formulation (i.e., composition) described in 3.2.P.1 should be discussed. Results from comparative in vitro studies (e.g., dissolution) or comparative in vivo studies (e.g., bioequivalence) should be discussed, when appropriate.

An established generic product as one that has been marketed by the applicant or manufacturer associated with the dossier for at least five years and for which at least 10 production batches were produced over the previous year, or, if less than 10 batches were produced in the previous year, not less than 25 batches were produced in the previous three years. For products that meet the criteria of an established generic product, all sections of 3.2.P.2.1 of the dossier and QOS-PD should be completed with the exception of 3.2.P.2.1 (a). In addition, a product quality review should be provided as outlined in Annex VI – Quality Overall Summary (QOS) template.

If the proposed VMP is a scored tablet, the results of a study should be provided of the uniformity of dosage units of the tablet halves. The data provided in the PD should include a description of the test method, individual values, mean and relative standard deviation (RSD) of the results. Uniformity testing (i.e. content uniformity or weight variation, depending on the requirement for the whole tablet) should be performed on each split portion from a minimum of 10 randomly

selected whole tablets. As an illustrative example, the number of units (i.e. the splits) would be 10 halves for bisected tablets (one half of each tablet is retained for the test) or 10 quarters for quadrisect tablets (one quarter of each tablet is retained for the test). At least one batch of each strength should be tested. Ideally, the study should cover a range of the hardness values. The splitting of the tablets should be performed in a manner that would be representative of that used by the consumer (e.g. manually split by hand). The uniformity test on split portions can be demonstrated on a one- time basis and does not need to be added to the VMP specification(s). The tablet description in the VMP specification and in the product information (e.g. prescribing information leaflet and user information leaflet, and labeling,) should reflect the presence of a score.

In vitro dissolution or drug release
A discussion should be included as to how the development of the formulation relates to development of the dissolution method(s) and the generation of the dissolution profile.

The results of studies justifying the choice of in vitro dissolution or drug release conditions (e.g. apparatus, rotation speed, medium) should be provided. Data should also be submitted to demonstrate whether the method is sensitive to changes in manufacturing processes and/or changes in grades and/or amounts of critical excipients and particle size where relevant. The dissolution method should be sensitive to any changes in the product that would result in a change in one or more of the pharmacokinetic parameters. Use of a single point test or a dissolution range should be justified based on the solubility of the active substance.

For slower dissolving immediate-release products (e.g. Q=80% in 90 minutes), a second time point may be warranted (e.g. Q=60% in 45 minutes).

Modified-release VMPs should have a meaningful in vitro release rate (dissolution) test that is used for routine quality control. Preferably this test should possess in vitro-in vivo correlation. Results demonstrating the effect of pH on the dissolution profile should be submitted if appropriate for the type of dosage form.

For extended-release VMPs, the testing conditions should be set to cover the entire time period of expected release (e.g. at least three test intervals chosen for a 12-hour release and additional test intervals for longer duration of release). One of the test points should be at the early stage of drug release (e.g. within the first hour) to demonstrate absence of dose dumping. At each test period, upper and lower limits should be set for individual units. Generally, the acceptance range at each intermediate test point should not exceed 25% or ±12.5% of the targeted value. Dissolution results should be submitted for several lots, including those lots used for pharmacokinetic and bioavailability or biowaiver studies.

Recommendations for conducting and assessing comparative dissolution profiles can be found in annex II of this module.

3.2. P.2.2.2 Overages
Any overages in the formulation(s) described in 3.2.P.1 should be justified. Justification of an overage to compensate for loss during manufacture should be provided, including the step(s) where the loss occurs, the reasons for the loss and batch analysis release data (assay results).

Overages for the sole purpose of extending the shelf-life of the VMP are generally not acceptable.

3.2. P.2.2.3 Physicochemical and Biological Properties
Parameters relevant to the performance of the VMP, such as pH, ionic strength, dissolution, redispersion, reconstitution, particle size distribution, aggregation, polymorphism, rheological properties, biological activity or potency, and/or immunological activity, should be addressed. In addition to the above considerations, refractive index may be a relevant parameter for some VMPs.

3.2. P.2.3 Manufacturing Process Development

The selection and optimization of the manufacturing process described in 3.2.P.3.3, in particular its critical aspects, should be explained. Where relevant, the method of sterilization should be explained and justified.

Where relevant, justification for the selection of aseptic processing or other sterilization methods over terminal sterilization should be provided.

Differences between the manufacturing process (es) used to produce comparative bioavailability or biowaiver batches and the process described in 3.2.P.3.3 that can influence the performance of the product should be discussed.

For products that meet the criteria of an established generic product, in order to fulfill the requirements of section P.2.3 section P.2.3 (b) of the dossier and QOS-PD should be completed and a product quality review should be submitted as outlined in Appendix III. The guidance that follows applies to all other products, for which section P.2.3 should be completed in its entirety.

The rationale for choosing the particular pharmaceutical product (e.g. dosage form, delivery system) should be provided. The scientific rationale for the choice of the manufacturing, filling and packaging processes that can influence VMP quality and performance should be explained (e.g. wet granulation using high shear granulator). Active substance stress study results may be included in the rationale. Any developmental work undertaken to protect the VMP from deterioration should also be included (e.g. protection from light or moisture).

The scientific rationale for the selection, optimization and scale-up of the manufacturing process described in 3.2.P.3.3 should be explained, in particular the critical aspects (e.g. rate of addition of granulating fluid, massing time, granulation end-point). A discussion of the critical process parameters (CPP), controls and robustness with respect to the QTPP and CQA of the product should be included (ref: ICH Q8).

3.2. P.2.4 Container Closure System

The suitability of the container closure system (described in 3.2.P.7) used for the storage, transportation (shipping) and use of the VMP should be discussed. This discussion should consider, e.g., choice of materials, protection from moisture and light, compatibility of the materials of construction with the dosage form (including sorption to container and leaching) safety of materials of construction, and performance (such as reproducibility of the dose delivery from the device when presented as part of the VMP).

The suitability of the container closure system used for the storage, transportation (shipping) and use of any intermediate/in-process products (e.g. premixes, bulk VMP) should also be discussed.

3.2. P.2.5 Microbiological Attributes

Where appropriate, the microbiological attributes of the dosage form should be discussed, including, for example, the rationale for not performing microbial limits testing for non-sterile products and the selection and effectiveness of preservative systems in products containing antimicrobial preservatives. For sterile products, the integrity of the container closure system to prevent microbial contamination should be addressed.

Where an antimicrobial preservative is included in the formulation, the amount used should be justified by submission of results of the product formulated with different concentrations of the preservative(s) to demonstrate the least necessary but still effective concentration. The effectiveness of the agent should be justified and verified by appropriate studies (e.g. Ph.Eur. general chapters on antimicrobial preservatives) using a batch of the VMP. If the lower bound for the proposed acceptance criteria for the assay of the preservative is less than 90.0%, the effectiveness of the agent should be established with a batch of the VMP containing a concentration of the antimicrobial preservative corresponding to the lower proposed acceptance criteria. A single primary stability batch of the VMP should be tested for effectiveness of the antimicrobial preservative (in addition to preservative content) at the proposed shelf- life for

verification purposes, regardless of whether there is a difference between the release and shelf-life acceptance criteria for preservative content.

3.2. P.2.6 Compatibility

The compatibility of the VMP with reconstitution diluent(s) or dosage devices (e.g., precipitation of active substance in solution, sorption on injection vessels, stability) should be addressed to provide appropriate and supportive information for the labeling.

Where sterile, reconstituted products are to be further diluted, compatibility should be demonstrated with all diluents over the range of dilution proposed in the labeling. These studies should preferably be conducted on aged samples. Where the labeling does not specify the type of containers, compatibility (with respect to parameters such as appearance, pH, assay, levels of individual and total degradation products, sub visible particulate matter and extractable from the packaging components) should be demonstrated in glass, PVC and polyolefin containers. However, if one or more containers are identified in the labeling, compatibility of admixtures needs to be demonstrated only in the specified containers.

Studies should cover the duration of storage reported in the labeling (e.g. 24 hours under controlled room temperature and 72 hours under refrigeration). Where the labeling specifies co-administration with other VMPs, compatibility should be demonstrated with respect to the principal VMP as well as the co-administered VMP (i.e. in addition to other aforementioned parameters for the mixture, the assay and degradation levels of each co-administered VMP should be reported).

3.2. P.3 Manufacture

3.2. P.3.1 Manufacturer(s)

The name, address, and responsibility of each manufacturer, including contractors, and each proposed production site or facility involved in manufacturing and testing should be provided.

The facilities involved in the manufacturing, packaging, labeling and testing should be listed. If certain companies are responsible only for specific steps (e.g. manufacturing of an intermediate), this should be clearly indicated.

The list of manufacturers/companies should specify the actual addresses of production or manufacturing site(s) involved (including block(s) and unit(s)), rather than the administrative offices.

For a mixture of an active substance with an excipient, the blending of the active substance with the excipient is considered to be the first step in the manufacture of the final product and therefore the mixture does not fall under the definition of an active substance. The only exceptions are in the cases where the active substance cannot exist on its own. Similarly, for a mixture of active substances, the blending of the active substances is considered to be the first step in the manufacture of the final product. Sites for such manufacturing steps should be included in this section.

A valid Certificate of Pharmaceutical Product, should be submitted to demonstrate that the product is registered or licensed in accordance with national requirements (Module 1,).

For each site where the major production step(s) are carried out, when applicable, attach a WHO-type certificate of GMP issued by the competent authority in terms of the WHO Certification Scheme on the Quality of Pharmaceutical Products Moving in International Commerce (Module 1,).

Justification for any differences to the product in the country or countries issuing the WHO-type certificate(s)

When there are differences between the product for which this application is submitted and that marketed in the country/countries which provided the WHO- type certificate(s), provide data to support the applicability of the certificate(s) despite the differences. Depending on the case, it may be necessary to provide validation data for differences in site of manufacture, specifications, formulation, etc. Note that only minor differences are likely to be acceptable. Differences in container labeling need not normally be justified.

Regulatory situation in other countries
The countries should be listed in which this product has been granted a marketing authorization, this product has been withdrawn from the market and/or this application for marketing has been rejected, deferred or withdrawn (Module 1,).

3.2. P.3.2 Batch formula
A batch formula should be provided that includes a list of all components of the dosage form to be used in the manufacturing process, their amounts on a per batch basis, including overages, and a reference to their quality standards.

The tables in the QOS-PD template should be used to summarize the batch formula of the VMP for each proposed commercial batch size and express the quantity of each component on a per batch basis, including a statement of the total weight or measure of the batch.

All components used in the manufacturing process should be included, including those that may not be added to every batch (e.g. acid and alkali), those that may be removed during processing (e.g. solvents) and any others (e.g. nitrogen, silicon for stoppers). If the VMP is formulated using an active moiety, then the composition for the active ingredient should be clearly indicated (e.g. “1 kg of active ingredient base = 1.065 kg active ingredient hydrochloride”). All overages should be clearly indicated (e.g. “Contains 7 kg (corresponding to 2%) overage of the active substance to compensate for manufacturing losses”).

The components should be declared by their proper or common names, quality standards (e.g. BP, In-House) and, if applicable, their grades (e.g. “Microcrystalline Cellulose NF (PH 102)”) and special technical characteristics (e.g. lyophilized, micronized, solubilised, emulsified).

3.2. P.3.3 Description of manufacturing process and process controls
A flow diagram should be presented giving the steps of the process and showing where materials enter the process. The critical steps and points at which process controls, intermediate tests or final product controls are conducted should be identified.

A narrative description of the manufacturing process, including packaging that represents the sequence of steps undertaken and the scale of production should also be provided. Novel processes or technologies and packaging operations that directly affect product quality should be described with a greater level of detail. Equipment should, at least, be identified by type (e.g., tumble blender, in-line homogenizer) and working capacity, where relevant.

Steps in the process should have the appropriate process parameters identified, such as time, temperature, or pH. Associated numeric values can be presented as an expected range. Numeric ranges for critical steps should be justified in Section 3. P.2.3.4. In certain cases, environmental conditions (e.g., low humidity for an effervescent product) should be stated.

The maximum holding time for bulk VMP prior to final packaging should be stated. The holding time should be supported by the submission of stability data, if longer than 30 days.

Proposals for the reprocessing of materials should be justified. Any data to support this justification should be either referenced or filed in this section (3.P.2.3.3).

The information above should be summarized in the QOS-PD template and should reflect the production of the proposed commercial batches.

For the manufacture of sterile products, the class (e.g. A, B, C etc.) of the areas should be stated for each activity (e.g. compounding, filling, sealing etc), as well as the sterilization parameters for equipment, container/closure, terminal sterilization etc. Reference documents: ICH Q8, Q9, Q10

3.2. P.3.4 Controls of Critical Steps and Intermediates

Critical Steps: Tests and acceptance criteria should be provided (with justification, including experimental data) performed at the critical steps identified in 3.2.P.3.3 of the manufacturing process, to ensure that the process is controlled.

Intermediates: Information on the quality and control of intermediates isolated during the process should be provided.

Examples of applicable in-process controls include:

- Granulations: moisture (limits expressed as a range), blend uniformity (e.g. low dose tablets), bulk and tapped densities, particle size distribution;
- Solid oral products: average weight, weight variation, hardness, thickness, friability, and disintegration checked periodically throughout compression, weight gain during coating;
- Liquids: pH, specific gravity, clarity of solutions; and
- Parenterals: appearance, clarity, fill volume/weight, pH, filter integrity tests, particulate matter, leak testing of ampoules.

Reference:

- VICH GL1 - Validation of analytical procedures: Definition and Terminology
- VICH GL2 - Validation of analytical procedures: Methodology
- ICH Q6A - Specifications: Test Procedures and Acceptance Criteria for New Drug Substances and New Drug Products: Chemical Substances
- ICH Q8 – Pharmaceutical development
- ICH Q9 – Quality risk management
- ICH Q10 - Pharmaceutical quality system

3.2. P.3.5 Process validation and/or assessment

Description, documentation, and results of the validation and/or assessment studies should be provided for critical steps or critical assays used in the manufacturing process (e.g., validation of the sterilization process or aseptic processing or filling).

For products that meet the criteria of an established generic product, a product quality review as outlined in Annex III of this module may be submitted in lieu of the information below.

The following information should be provided for all other products:

a) a copy of the process validation protocol, specific to this VMP, that identifies the critical equipment and process parameters that can affect the quality of the VMP and defines testing parameters, sampling plans, analytical procedures and acceptance criteria;

b) a commitment that three consecutive, production-scale batches of this VMP will be subjected to prospective validation in accordance with the above protocol; The applicant should submit a written commitment that information from these studies will be available for verification by the Veterinary Medicines Zazibona inspection team; and

c) If the process validation studies have already been conducted (e.g. for sterile products), a copy of the process validation report should be provided in the PD in lieu of (a) and (b) above.

One of the most practical forms of process validation, mainly for non-sterile products, is the final testing of the product to an extent greater than that required in routine quality control. It may involve extensive sampling, far beyond that called for in routine quality control and testing to normal quality control specifications and often for certain parameters only. Thus, for instance, several hundred tablets per batch may be weighed to determine unit dose uniformity. The results are then treated statistically to verify the "normality" of the distribution and to determine the standard deviation from the average weight. Confidence limits for individual results and for batch homogeneity are also estimated. Strong assurance is provided that samples taken at random will meet regulatory requirements if the confidence limits are well within compendial specifications.

Similarly, extensive sampling and testing may be performed with regard to any quality requirements. In addition, intermediate stages may be validated in the same way, e.g. dozens of samples may be assayed individually to validate mixing or granulation stages of low-dose tablet production by using the content uniformity test. Products (intermediate or final) may occasionally be tested for non-routine characteristics. Thus, sub visual particulate matter in parenteral preparations may be determined by means of electronic devices, or tablets/capsules tested for dissolution profile if such tests are not performed on every batch.

Where ranges of batch sizes are proposed, it should be shown that variations in batch size would not adversely alter the characteristics of the finished product. It is envisaged that those parameters listed in the following validation scheme will need to be re-validated once further scale-up is proposed after the product given Veterinary Medicines Zazibona approval.

The process validation protocol should include inter alia the following:

- a reference to the current master production document;
- a discussion of the critical equipment;
- The process parameters that can affect the quality of the VMP (critical process parameters (CPPs)) including challenge experiments and failure mode operation;
- details of the sampling: sampling points, stages of sampling, methods of sampling and the sampling plans (including schematics of blender/storage bins for uniformity testing of the final blend);
- the testing parameters/acceptance criteria including in-process and release specifications and including comparative dissolution profiles of validation batches against the batch(es) used in the bioavailability or biowaiver studies;
- The analytical procedures or a reference to appropriate section(s) of the dossier;
- the methods for recording/evaluating results; and
- The proposed timeframe for completion of the protocol.

The manufacture of sterile VMPs needs a well-controlled manufacturing area (e.g. a strictly controlled environment, highly reliable procedures and appropriate in- process controls). A detailed description of these conditions, procedures and controls should be provided, together with actual copies of the following standard operating procedures:

- Washing, treatment, sterilizing and depyrogenating of containers, closures and equipment;
- Filtration of solutions;
- Lyophilization process;
- Leaker test of filled and sealed ampoules;

- Final inspection of the product; and
- Sterilization cycle.

The sterilization process used to destroy or remove microorganisms is probably the single most important process in the manufacture of parenteral VMPs. The process can make use of moist heat (e.g. steam), dry heat, filtration, gaseous sterilization (e.g. ethylene oxide), or radiation. It should be noted that terminal steam sterilization, when practical, is considered to be the method of choice to ensure sterility of the final VMP. Therefore, scientific justification for selecting any other method of sterilization should be provided.

The sterilization process should be described in detail and evidence should be provided to confirm that it will produce a sterile product with a high degree of reliability and that the physical and chemical properties as well as the safety of the VMP will not be affected. Details such as Fo range, temperature range and peak dwell time for an VMP and the container closure should be provided. Although standard autoclaving cycles of 121°C for 15 minutes or more would not need a detailed rationale, such justifications should be provided for reduced temperature cycles or elevated temperature cycles with shortened exposure times. If ethylene oxide is used, studies and acceptance criteria should control the levels of residual ethylene oxide and related compounds.

Filters used should be validated with respect to pore size, compatibility with the product, absence of extractable and lack of adsorption of the active substance or any of the components.

For the validation of aseptic filling of parenteral products that cannot be terminally sterilized, simulation process trials should be conducted. This involves filling ampoules with culture media under normal conditions, followed by incubation and control of microbial growth. A level of contamination of less than 0.1% is considered to be acceptable.

Reference:

- ICH Q8 – Pharmaceutical development
- ICH Q9 – Quality risk management
- ICH Q10 - Pharmaceutical quality system

3.2. P.4 Control of excipients

3.2. P.4.1 Specifications

The specifications from the applicant or the VMP manufacturer should be provided for all excipients, including those that may not be added to every batch (e.g. acid and alkali), those that do not appear in the final VMP (e.g. solvents) and any others used in the manufacturing process (e.g. nitrogen, silicon for stoppers).

If the standard claimed for an excipient is an officially recognized compendial standard, it is sufficient to state that the excipient is tested according to the requirements of that standard, rather than reproducing the specifications found in the officially recognized compendial monograph. A copy of the monograph used should be provided.

If the standard claimed for an excipient is a non-compendial standard (e.g. In House standard) or includes tests that are supplementary to those appearing in the officially recognized compendial monograph, a copy of the specification for the excipient should be provided.

For excipients of natural origin, microbial limit testing should be included in the specifications. Skip testing is acceptable if justified (submission of acceptable results of five production batches).

For oils of plant origin (e.g. soy bean oil, peanut oil) the absence of aflatoxins or biocides should be demonstrated.

The colours permitted for use are limited to those listed in the “Japanese pharmaceutical excipients”, the EU “List of permitted food colours”, and the FDA “Inactive ingredient guide”. For proprietary mixtures, the supplier’s product sheet with the qualitative formulation should be submitted, in addition to the VMP manufacturer’s specifications for the product including identification testing.

For flavours the qualitative composition should be submitted, as well as a declaration that the excipients comply with foodstuff regulations (e.g. USA or EU).

If additional purification is undertaken on commercially available excipients details of the process of purification and modified specifications should be submitted.

Reference:

- VICH GL39 Test procedures and acceptance criteria for new veterinary drug substances and new medicinal products: chemical substances
- List of permitted food colours, Official journal of the European Communities, 1994. L237. (European Commission Directive 94/36/EC).
- Inactive ingredient guide. Rockville, MD, United States Food and Drug Administration, Division of Drug Information and Research, 1996.
- Japanese pharmaceutical excipients. Tokyo, Pharmaceutical and Cosmetics Division, Pharmaceutical Affairs Bureau, Ministry of Health and Welfare (updated annually or biennially).

3.2. P.4.2 Analytical procedures

The analytical procedures used for testing the excipients should be provided. Copies of analytical procedures from officially recognized compendial monographs used should be submitted. Provide certificate of analysis of one batch of each excipient.

3.2. P.4.3 Validation of analytical procedures

Analytical validation information, including experimental data, for the analytical procedures used for testing the excipients should be provided, where appropriate.

Copies of analytical validation information are generally not submitted for the testing of excipients, with the exception of the validation of in-house methods where appropriate.

References:

- VICH GL1 - Validation of Analytical Procedures: Definition and Terminology
- VICH GL2 - Validation of Analytical Procedures: Methodology

3.2. P.4.4 Justification of specifications

Justification for the proposed excipient specifications should be provided, where appropriate. A discussion of the tests that are supplementary to those appearing in the officially recognized compendial monograph should be provided.

3.2. P.4.5 Excipients of human or animal origin

For excipients of human or animal origin, information should be provided regarding adventitious agents (e.g., sources, specifications, description of the testing performed, viral safety data).

The following excipients should be addressed in this section: gelatin, phosphates, stearic acid, magnesium stearate and other stearates. If from plant origin a declaration to this effect will suffice.

For these excipients from animal origin, evidence or proof confirming that the excipients used to manufacture the VMP are without risk of transmitting agents of animal spongiform encephalopathies.

Materials of animal origin should be avoided whenever possible.

When available, a CEP demonstrating TSE-compliance should be provided. A complete copy of the CEP (including any annexes) should be provided in Module1.

Reference:

- ICH Q5A - Quality of biotechnological products: viral safety evaluation of biotechnology products derived from cell lines of human or animal origin
- ICH Q5D - Derivation and characterisation of cell substrates used for production of biotechnological/biological products
- ICH Q6B - Specifications: Test Procedures and Acceptance Criteria for Biotechnological/Biological Products

3.2. P.4.6 Novel excipients

For excipient(s) used for the first time in an VMP or by a new route of administration, full details of manufacture, characterisation, and controls, with cross references to supporting safety data should be provided according to the active substance and/or VMP format.

3.2. P.5 Control of VMP

3.2. P.5.1 Specification(s)

The specification(s) for the VMP should be provided. As defined in VICH GL39 and in ICH's Q6A guideline, a specification is:

> "a list of tests, references to analytical procedures and appropriate acceptance criteria, which are numerical limits, ranges, or other criteria for the tests described. It establishes the set of criteria to which an active substance or VMP should conform to be considered acceptable for its intended use. "Conformance to specifications" means that the active substance and / or VMP, when tested according to the listed analytical procedures, will meet the listed acceptance criteria. Specifications are critical quality standards that are proposed and justified by the manufacturer and approved by regulatory authorities."

A copy of the VMP specification(s) from the applicant (as well as the company responsible for the batch release of the VMP, if different from the applicant), dated and signed by authorized personnel (i.e. the person in charge of the quality control or quality assurance department) should be provided in the PD. Two separate sets of specifications may be set out: after packaging of the VMP (release) and at the end of shelf-life.

The specifications should be summarized according to the tables in the QOS template including the tests, acceptance criteria and analytical procedures (including types, sources and versions for the methods):

- The standard declared by the applicant could be an officially recognized compendial standard (e.g. PhEur,) or in House (manufacturer's) standard;

- Specification reference number and version (e.g. revision number and/or date) should be provided for version control purposes;
- For the analytical procedures, the type should indicate the kind of analytical procedure used (e.g. visual, IR, UV, HPLC), the source refers to the origin of the analytical procedure (e.g. Ph.Eu , BP, in-house) and the version (e.g. code number/version/date) should be provided for version control purposes.

ICH's Q6A guideline outlines recommendations for a number of universal and specific tests and criteria for VMPs. Specifications should include, at minimum, tests for appearance, identification, assay, purity, pharmaceutical tests (e.g. dissolution), physical tests (e.g. loss on drying, hardness, friability, particle size, apparent density), uniformity of dosage units, identification of colouring materials, identification and assay of antimicrobial or chemical preservatives (e.g. antioxidants) and microbial limit tests.

The following information provides guidance for specific tests that are not addressed by ICH's Q6A guideline:

a) Fixed-dose combination VMPs (FDC-VMPs):
   - analytical methods that can distinguish each active substance in the presence of the other active substance(s) should be developed and validated,
   - Acceptance criteria for degradation products should be established with reference to the active substance they are derived from. If an impurity results from a chemical reaction between two or more active substances, its acceptance limits should be calculated with reference to the worst case (the active substance with the smaller area under the curve). Alternatively, the content of such impurities could be calculated in relation to their reference standards,
   - when any one active substance is present at less than 25 mg or less than 25% of the weight of the dosage unit, a test and limit for content uniformity is required for each active substance in the VMP,
   - when all active substances are present at equal or greater than 25 mg and equal or greater than 25% of the weight of the dosage unit, a test and limit for weight variation may be established for each active substance in the VMP, in lieu of content uniformity testing;

b) Modified-release products: a meaningful active substance release method;

c) Suppositories: uniformity of dosage units, melting point;

Unless there is appropriate justification, the acceptable limit for the active substance content of the VMP in the release specifications is ± 5% of the label claim (i.e. 95.0- 105.0%).

Any differences between release and shelf-life tests and acceptance criteria should be clearly indicated and justified. Note that such differences for parameters such as dissolution are normally not accepted.

Reference:

- VICH GL39 - Specifications: Test Procedures and Acceptance Criteria for New Drug Substances and New Medicinal Products: Chemical Substances + Decision trees.
- ICH Q3B - Impurities in new drug products
- ICH Q3C - Residual solvents

- ICH Q6A - Specifications: Test Procedures and Acceptance Criteria for New Drug Substances and New Drug Products: Chemical Substances

3.2.P.5.2 Analytical Procedures

The analytical procedures used for testing the VMP should be provided.

Copies of the in-house analytical procedures used during pharmaceutical development (if used to generate testing results provided in the PD) as well as those proposed for routine testing should be provided. Provide copies of compendial analytical procedures used.

Tables for summarizing a number of the different analytical procedures and validation information (e.g. HPLC assay/impurity methods) can be found in the 2.3.R Regional information section of the QOS (i.e. 2.3.R.2). These tables should be used to summarize the analytical procedures used for determination of the assay, related substances and dissolution of the VMP.

Refer to section 3.2.S.4.2 of this guideline for additional guidance on analytical procedures.

3.2. P.5.3 Validation of analytical procedures

Analytical validation information, including experimental data, for the analytical procedures used for testing the VMP, should be provided.

Copies of the validation reports for the in-house analytical procedures used during pharmaceutical development (if used to support testing results provided in the PD) as well as those proposed for routine testing should be provided.

Tables for summarizing a number of the different analytical procedures and validation information (e.g. HPLC assay/impurity methods, GC methods) can be found in the 2.3.R Regional information section of the QOS-PD (i.e. 2.3.R.2). These tables should be used to summarize the validation information of the analytical procedures used for determination of the assay, related substances and dissolution of the VMP.

As recognized by regulatory authorities and pharmacopoeias themselves, verification of compendial methods can be necessary. The compendial methods, as published, are typically validated based on an active substance or a VMP originating from a specific manufacturer. Different sources of the same active substance or VMP can contain impurities and/or degradation products or excipients that were not considered during the development of the monograph. Therefore the monograph and compendial method(s) should be demonstrated suitable for the control of the proposed VMP.

For officially recognized compendial VMP assay methods, verification should include a demonstration of specificity, accuracy and repeatability (method precision). If an officially recognized compendial method is used to control related substances that are not specified in the monograph, full validation of the method is expected with respect to those related substances.

If an officially recognized compendial standard is claimed and an in-house method is used in lieu of the compendial method (e.g. for assay or for related compounds), equivalency of the in-house and compendial methods should be demonstrated. This could be accomplished by performing duplicate analyses of one sample by both methods and providing the results from the study. For related compound methods, the sample analyzed should be the placebo spiked with related compounds at concentrations equivalent to their specification limits.

Reference:

- VICH GL1 Validation of Analytical Procedures: Definition and Terminology
- VICH GL2 Validation of Analytical Procedures: Methodology

- ICH Q2 - Validation of analytical procedures: text and methodology
- WHO Guideline: Validation of analytical procedures used in the examination of pharmaceutical materials

3.2. P.5.4 Batch analyses

A description of batches and results of batch analyses should be provided. Information should include strength and batch number, batch size, date and site of production and use (e.g. used in comparative bioavailability or biowaiver studies, preclinical and clinical studies (if relevant), stability, pilot, scale-up and, if available, production-scale batches) on relevant VMP batches used to establish the specification(s) and evaluate consistency in manufacturing.

Analytical results tested by the company responsible for the batch release of the VMP (generally, the applicant or the VMP manufacturer, if different from the applicant) should be provided for not less than three analyses.

The testing results should include the batch (es) used in the comparative bioavailability or biowaiver studies. Copies of the certificates of analysis for these batches should be provided in the PD and the company responsible for generating the testing results should be identified.

The discussion of results should focus on observations noted for the various tests, rather than reporting comments such as “all tests meet specifications”. This should include ranges of analytical results, where relevant. For quantitative tests (e.g. individual and total impurity tests and assay tests), it should be ensured that actual numerical results are provided rather than vague statements such as “within limits” or “conforms” (e.g. “levels of degradation product A ranged from 0.2 to 0.4%”). Dissolution results should be expressed at minimum as both the average and range of individual results. Recommendations for conducting and assessing comparative dissolution profiles can be found in Annex II of the module 3.

A discussion and justification should be provided for any incomplete analyses (e.g. results not tested according to the proposed specification).

Reference:

- ICH Q3B - Impurities in new drug products
- ICH Q3C - Residual solvents
- ICH Q6A - Specifications: Test Procedures and Acceptance Criteria for New Drug Substances and New Drug Products: Chemical Substances

3.2. P.5.5 Characterization of impurities

Information on the characterisation of impurities should be provided, if not previously provided in “3.2.S.3.2 Impurities”.

A discussion should be provided of all impurities that are potential degradation products (including those among the impurities identified in 3.2.S.3.2 as well as potential degradation products resulting from interaction of the active substance with other active substances (FDCs), excipients or the container closure system) and VMP process-related impurities (e.g. residual solvents in the manufacturing process for the VMP).

Reference:

- VICH GL(R)11 - Impurities in New Veterinary Medicinal Products

- VICH GL18 - Impurities: Residual Solvents in new veterinary medicinal products, active substances and excipients
- ICH Q3B - Impurities in new drug products
- ICH Q3C - Residual solvents
- ICH Q6A - Specifications: Test Procedures and Acceptance Criteria for New Drug Substances and New Drug Products: Chemical Substances

3.2. P.5.6 Justification of specification(s)

Justification for the proposed VMP specification(s) should be provided.

A discussion should be provided on the omission or inclusion of certain tests, evolution of tests, analytical procedures and acceptance criteria, differences from the officially recognized compendial standard(s), etc. If the officially recognized compendial methods have been modified or replaced, a discussion should be included.

The justification for certain tests, analytical procedures and acceptance criteria (e.g. degradation products, dissolution method development) may have been discussed in other sections of the PD and does not need to be repeated here, although a cross- reference to their location should be provided.

ICH Q6A should be consulted for the development of specifications for VMPs.

3.2. P.6 Reference standards or materials

Information on the reference standards or reference materials used for testing of the VMP should be provided, if not previously provided in “3.2.S.5 Reference Standards or Materials”.

See Section 3.2.S.5 for information that should be provided on reference standards or materials. Information should be provided on reference materials of VMP degradation products, where not included in 3.2.S.5.

Reference:

- ICH Q6A - Specifications: Test Procedures and Acceptance Criteria for New Drug Substances and New Drug Products: Chemical Substances

3.2. P.7 Container closure system

A description of the container closure systems should be provided, including the identity of materials of construction of each primary packaging component and its specification. The specifications should include description and identification (and critical dimensions, with drawings where appropriate). Non-compendial methods (with validation) should be included, where appropriate.

For non-functional secondary packaging components (e.g., those that neither provide additional protection nor serve to deliver the product), only a brief description should be provided. For functional secondary packaging components, additional information should be provided.

Suitability information should be located in 3.2.P.2.

Descriptions, materials of construction and specifications (of the company responsible for packaging the VMP, generally the VMP manufacturer) should be provided for the packaging components that are:

- In direct contact with the dosage form (e.g. container, closure, liner, desiccant, filler);
- Used for drug delivery (including the device(s) for multi-dose solutions, emulsions, suspensions and powders/granules for such);
- Used as a protective barrier to help ensure stability or sterility; and
- Necessary to ensure VMP quality during storage and shipping.

Primary packaging components are those that are in direct contact with the active substance or VMP.

The specifications for the primary packaging components should include a specific test for identification (e.g. IR). Specifications for film and foil materials should include limits for thickness or area weight.

Information to establish the suitability (e.g. qualification) of the container closure system should be discussed in Section 3.2.P.2. Comparative studies may be warranted for certain changes in packaging components (e.g. comparative delivery study (droplet size) for a change in manufacturer of dropper tips).

3.2. P.8 Stability

3.2. P.8.1 Stability summary and conclusions

The types of studies conducted, protocols used, and the results of the studies should be summarized. The summary should include, for example, conclusions with respect to storage conditions and shelf-life, and, if applicable, in-use storage conditions and shelf-life

The design of the formal stability studies for the finished product should be based on knowledge of the behaviour and properties of the active substance and the dosage form.

Describe the methodology used during stability studies; if this is identical to methodology described elsewhere in the data set, a cross-reference will suffice. If different methodology was used, the test procedures applied to the stability tests on the finished product should be validated or verified, and the accuracy as well as the precision (standard deviations) should be recorded. Characterize the possible degradants identified by stress stability testing (see 3.7.1 Stress testing (forced degradation) for details) during development pharmaceutics (compatibilities of the active substances with each other and with the excipients as well as the effect of temperature on the rate of degradation reactions). The tests for degradants should be validated to demonstrate that they are specific to the VMP being examined and are of adequate sensitivity.

Stability studies should be performed on each individual strength and container size of the finished product unless bracketing or matrixing is applied.

Other supporting data can be provided.

Stability-indicating quality parameters

Stability studies should include testing of those attributes of the VMP that are susceptible to change during storage and are likely to influence quality, safety and/or efficacy. Analytical procedures should be fully validated and stability indicating. Whether and to what extent replication should be performed will depend on the results of validation studies.

Characteristics studied should be those in the finished product specification that are likely to be affected by storage and/or not monitored routinely at the time of manufacture, but which may be indicative of the stability/instability of the particular dosage form. These include:

- Physical characteristics (such as organoleptic properties, physical properties characteristic to the dosage form, important quality parameters, e.g., in vitro dissolution,

moisture content and change of polymorphs, if relevant). As regards tablets and capsules packed with semi-permeable blister films, loss or uptake of water must be tested during stability studies.

- Efficacy of additives, such as antimicrobial agents, to determine whether such additives remain effective and within the accepted validated range throughout the projected shelf life.
- Chemical characteristics (assay of the active substance, content of degradation products, content of other ingredients such as preservatives, antioxidants, as well as enantiomeric purity, if relevant).
- Study of the container and closure interaction with the contents, when applicable.
- Where the product is to be diluted or reconstituted before being administered to the patient (e.g. a powder for injection or a concentrate for oral suspension) “in use” stability data must be submitted to support the recommended in-use storage time and conditions for those storage forms.

It may be appropriate to have justifiable differences between the shelf life and release acceptance criteria based on the stability assessment and the changes observed on storage. Any differences between the release and shelf life acceptance criteria for antimicrobial preservative content should be supported by a validated correlation of chemical content and preservative effectiveness demonstrated during drug development on the product in its final formulation (except for preservative concentration intended for marketing. A single primary stability batch of the finished product should be tested for antimicrobial preservative effectiveness (in addition to preservative content) at the proposed shelf life for verification purposes, regardless of whether there is a difference between the release and shelf life acceptance criteria for preservative content.

Report and discuss the results of stability testing. Organize data for all attributes separately and evaluate each attribute in the report. No statistical analysis is required, if the stability data do not show variability or a trend over the time.

Shelf life acceptance criteria should be derived from consideration of all available stability information. The proposed storage conditions should be achievable in practice in SADC.

The summary should include conclusions with respect to in-use storage conditions and shelf life, when applicable.

Long-term studies should cover the whole shelf life. When available long-term stability data on primary batches do not cover the proposed shelf-life period granted at the time of approval, a commitment should be made in writing to continue the stability studies post approval in order to firmly establish the shelf-life period. The post-approval stability protocol should also be provided and should be the same as that for the primary batches, unless otherwise scientifically justified.

Repackaging of bulk finished product will require stability studies in the bulk container and the final container closure system. Expiration dating is linked to the manufacturing date of the dosage form.

Photostability Testing

Photostability testing should be conducted on at least one primary batch of the VMP, if not included in the stress stability tests.

Reference:

- VICH GL5 - Photostability Testing of New Veterinary Drug Substances and Medicinal Products

Selection of Batches
At the time of submission data from stability studies should be provided for batches of the same formulation and dosage form in the container closure system proposed for marketing.

Stability data on three primary batches are to be provided. One of the three batches should be of production scale, the remaining two batches at least pilot scale. The composition, batch size, batch number and manufacturing date of each of the stability batches should be documented and the certificate of analysis at batch release should be attached.

The manufacturing process used for primary batches should simulate that to be applied to production batches and should provide product of the same quality and meeting the same specification as that intended for marketing. Where possible, batches of the finished product should be manufactured by using different batches of the active substance.

Container Closure System
Stability testing should be conducted on the dosage form packaged in the container closure system proposed for marketing (including, as appropriate, any secondary packaging and container label). Any available studies carried out on the product outside its immediate container or in other packaging materials can form a useful part of the stress testing of the dosage form or can be considered as supporting information, respectively.

Testing Frequency
At the accelerated storage condition, a minimum of three points, including the initial and final time points (e.g., 0, 3, and 6 months), from a 6-month study is recommended. Where an expectation (based on development experience) exists that results from accelerated testing are likely to approach significant change criteria, increased testing should be conducted either by adding samples at the final time point or by including a fourth time point in the study design.

At long term storage condition, sampling should be done at initial, 3, 6, 9, 12, 18, 24, 36 etc. months to establish the stability characteristics of the VMP.

Reduced designs, i.e., Matrixing or bracketing, where the testing frequency is reduced or certain factor combinations are not tested at all, can be applied, if justified.

Reference:

- VICH GL45: Bracketing and Matrixing Designs for Stability Testing of New Veterinary Drug Substances and Medicinal product

Storage Conditions
In general, a VMP should be evaluated under storage conditions (with appropriate tolerances) that test its thermal stability and, if applicable, its sensitivity to moisture or potential for solvent loss. The storage conditions and the lengths of studies chosen should be sufficient to cover storage, shipment, and subsequent use.

Stability testing of the finished product after constitution or dilution, if applicable, should be conducted to provide information for the labelling on the preparation, storage condition, and in-use period of the constituted or diluted product. This testing should be performed on the constituted or diluted product through the proposed in-use period on primary batches as part of the formal stability studies at initial and final time points and, if full shelf life long term data will not be available before submission, at six months or the last time point for which data will be available. In general, this testing need not be repeated on commitment batches.

Note: in-use stability testing should be performed on at least two different batches one of which should be investigated close to the end of shelf life.

The long-term testing should cover a minimum of **12 months duration** at the time of submission and should be continued for a period of time sufficient to cover the proposed shelf life. Additional data accumulated during the assessment period of the registration application should be submitted through the SADC VMP collaborative procedure if requested.

Data from the accelerated storage condition can be used to evaluate the effect of short-term excursions outside the label storage conditions (such as might occur during shipping).

General case

Storage temperature (°C)	Relative humidity (%)	Minimum time period covered by data at submission
Accelerated: 40±2	75±5	6
Long term: 30±2	75±5	12

Note. Unless otherwise justified, 30°C ± 2°C/75% RH ± 5% RH is the long term stability condition for products to be marketed in SADC.

When a “significant change" occurs at any time during 6 months' testing at the accelerated storage condition, these should be evaluated during long term stability testing.

In general, “significant change” for a finished product is defined as:

- A 5% change in assay from its initial value; or failure to meet the acceptance criteria for potency when using biological or immunological procedures.
- Any degradation product exceeding its acceptance criterion.
- Failure to meet the acceptance criteria for appearance, physical attributes, and functionality test (e.g., colour, phase separation, hardness).
- And, as appropriate for the dosage form:
- Failure to meet the acceptance criterion for pH; or
- Failure to meet the acceptance criteria for dissolution for 12 dosage units.

Finished products packaged in impermeable containers

Sensitivity to moisture or potential for solvent loss is not a concern for finished products packaged in impermeable containers that provide a permanent barrier to passage of moisture or solvent. Thus, stability studies for products stored in impermeable containers can be conducted under any controlled or ambient humidity condition.

Finished products packaged in semi-permeable containers

Aqueous-based products packaged in semi-permeable containers should be evaluated for potential water loss in addition to physical, chemical, biological, and microbiological stability. This assessment can be carried out under conditions of low relative humidity, as defined below.

Study	Storage condition	Minimum time period covered by data at submission (months)
Long term	30±2°C/75±5% RH	12
Accelerated	40±2°C/NMT 25±5% RH	6

Note. Unless otherwise justified, 30 ± 2°C and 75 ± 5% RH is the long term stability condition for products to be marketed in SADC.

Ultimately, it should be demonstrated that aqueous-based finished products stored in semi-permeable containers could withstand low relative humidity environments. Other comparable approaches can be developed and reported for non-aqueous, solvent-based products.

A 5% loss in water from its initial value is considered a significant change for a VMP packaged in a semi-permeable container after three (3) months storage at 40 ± 2oC and NMT 25 ± 5% RH.

Assessment

A systematic approach should be adopted in the presentation and assessment of the stability information, which should include, as appropriate, results from the physical, chemical, biological and microbiological tests, including particular attributes of the dosage form (for example, dissolution rate for solid oral dosage forms, hardness, LOD, etc.)

The purpose of the stability study is to establish, based on testing a minimum of three batches of the finished product, a shelf life and label storage instructions applicable to all future batches of the finished product manufactured and packaged under similar circumstances. The degree of variability of individual batches affects the confidence that a future production batch will remain within specification throughout its shelf life.

Where the data show so little degradation and so little variability that it is apparent from looking at the data that the requested shelf life will be granted, it is normally unnecessary to go through the formal statistical analysis; providing a justification for the omission should be sufficient

An approach for analyzing data on a quantitative attribute that is expected to change with time is to determine the time at which the 95% one-sided confidence limit for the mean curve intersects the acceptance criterion. If analysis shows that the batch- to-batch variability is small, it is advantageous to combine the data into one overall estimate. This can be done by first applying appropriate statistical tests (e.g., p values for level of significance of rejection of more than 0.25) to the slopes of the regression lines and zero time intercepts for the individual batches. If it is inappropriate to combine data from several batches, the overall shelf life should be based on the minimum time a batch can be expected to remain within acceptance criteria.

The nature of any degradation relationship will determine whether the data should be transformed for linear regression analysis. Usually the relationship can be represented by a linear, quadratic, or cubic function on an arithmetic or logarithmic scale. Statistical methods should be employed to test the goodness of fit of the data on all batches and combined batches (where appropriate) to the assumed degradation line or curve.

Reference:

- VICH GL3 (R) –Stability testing of the new veterinary substances and medicinal products

Extrapolation of data

An active substance is considered as stable if it is within the defined specifications when stored at 30 ± 2^{o}C/75 ± 5 % RH (2 years) and 40 ± 2^{o}C/75 ± 5 % RH (6 months).

If long term data are supported by results from accelerated studies the re-test period/shelf life may be extended beyond the end of long-term studies. The proposed retest period or shelf life can be up to twice, but should not be more than 12 months beyond, the period covered by long-term data.

Reference:

- VICH GL3 (R) –Stability testing of the new veterinary substances and medicinal products.

Core Storage Statements

Testing conditions where stability has been shown	Required labelling statement	Additional labelling statement*, where relevant
30ºC/75% RH (long term) 40ºC/75% RH (accelerated)	Do not store above 30ºC, or Store below 30ºC	Do not refrigerate or freeze

* Depending on the pharmaceutical form and the properties of the product, there may be a risk of deterioration due to physical changes if subjected to low temperatures. Low temperatures may also have an effect on the packaging in certain cases. An additional statement may be necessary to take account of this possibility.

Reference:

- VICH GL8: Stability Testing for Medicated Premixes.
- VICH GL58: Stability Testing of New Veterinary Drug Substances and Medicinal Products in Climatic Zones III and IV.

3.2. R Regional information

3.2. R.1 Production documentation

3.2. R.1.1 Executed production documents

(a) List of batches (including strengths) for which executed production documents have been provided (e.g. comparative bioavailability or biowaiver batches):

A minimum of two batches of at least pilot scale, or in the case of an uncomplicated VMP (e.g. immediate-release solid VMPs (with noted exceptions), non-sterile solutions), not less than one batch of at least pilot scale (the batch used in comparative bioavailability or biowaiver studies) and a second batch which may be smaller (e.g. for solid oral dosage forms, 25 000 or 50 000 tablets or capsules), should be manufactured for each strength. These batches should be manufactured by a procedure fully representative of and simulating that to be applied to a full production-scale batch.

For solid oral dosage forms, pilot scale is generally, at a minimum, one-tenth that of full production scale or 100 000 tablets or capsules, whichever is the larger.

Copies of the executed production documents should be provided for the batches used in the comparative bioavailability or biowaiver studies. Any notations made by operators on the executed production documents should be clearly legible.

If not included in the executed batch records through sufficient in-process testing, data should be provided for the batch used in comparative bioavailability or biowaiver studies that demonstrates the uniformity of this batch. The data to establish the uniformity of the biobatch should involve testing to an extent greater than that required in routine quality control. English translations of executed records should be provided, where relevant. Alternatively in cases where BMR cannot be submitted i.e. for innovator products, the following should be submitted:

- A formal communication (written correspondence) from the applicant of the innovator company seeking exemption from submission of batch records giving reasons thereof
- A WHO-type Certificate of Pharmaceutical product (CPP) issued by one of the regulatory authorities of the ICH region or associated countries
- A summary of product characteristics (SmPC) approved by the respective regulatory authority

- A copy of the quality assessment report issued by a competent regulatory authority. This may be send directly from the drug regulatory authority in the country of origin of the product to the NMRA or Veterinary Medicines Zazibona
- A WHO-type batch certificate from the manufacturer
- An undertaking that the packaging of the product is the same as that approved by the drug regulatory authorities of the ICH region and associated countries
- The product information to be the same as on the WHO-type CPP for at least unit and batch composition, strength and specifications

3.2. R.1.2 Master production documents

Copies of the VMP master production documents should be provided for each proposed strength, commercial batch size and manufacturing site.

The details in the master production documents should include, but not be limited to, the

following:

a) master formula;

b) dispensing, processing and packaging sections with relevant material and operational details;

c) relevant calculations (e.g. if the amount of API is adjusted based on the assay results or on the anhydrous basis);

d) identification of all equipment by, at minimum, type and working capacity (including make, model and equipment number, where possible);

e) process parameters (e.g. mixing time, mixing speed, milling screen size, processing temperature range, granulation end-point, tablet machine speed (expressed as target and range));

f) list of in-process tests (e.g. appearance, pH, assay, blend uniformity, viscosity, particle size distribution, LOD, weight variation, hardness, disintegration time, weight gain during coating, leaker test, minimum fill, clarity, filter integrity checks) and specifications;

g) sampling plan with regard to the:

   i. steps where sampling should be done (e.g. drying, lubrication, compression),

   ii. number of samples that should be tested (e.g. for blend uniformity testing of low dose VMPs, blend drawn using a sampling thief from x positions in the blender),

   iii. frequency of testing (e.g. weight variation every x minutes during compression or capsule filling);

h) precautions necessary to ensure product quality (e.g. temperature and humidity control, maximum holding times);

i) for sterile products, reference to SOPs in appropriate sections and a list of all relevant SOPs at the end of the document;

j) theoretical and actual yield;

k) compliance with the GMP requirements.

Reference:

- WHO Technical Report Series, Nos. 902 and No. 908

3.2. R.2 Analytical procedures and validation information

ANALYTICAL PROCEDURES AND VALIDATION INFORMATION SUMMARIES			
ATTACHMENT NUMBER:			
HPLC Method Summary		**Volume/Page:**	
Method name:			
Method code:		**Version and/or Date:**	
Column(s) / temperature (if other than ambient):			
Mobile phase (specify gradient program, if applicable):			
Detector (and wavelength, if applicable):			
Flow rate:			
Injection volume:			
Sample solution concentration (expressed as mg/ml, let this be termed “A”):			
Reference solution concentration (expressed as mg/ml and as % of “A”):			
System suitability solution concentration (expressed as mg/ml and as % of “A”):			
System suitability tests (tests and acceptance criteria):			
Method of quantification (e.g. against ACTIVE SUBSTANCE or impurity reference standard(s)):			
Other information (specify):			

ATTACHMENT NUMBER:				
Validation Summary	**Volume/Page:**			
Analytes				
Typical retention times (RT)				

ATTACHMENT NUMBER:					
Relative retention times ($RT_{Imp.}/_{RTACTIVE\ SUBSTANCE\ or\ Int.\ Std.}$):					
Relative response factor ($RF_{Imp.}/RF_{ACTIVE\ SUBSTANCE}$):					
Specificity:					
Linearity / Range:	Number of concentrations: Range (expressed as % "A"): Slope: Y-intercept: Correlation coefficient (r^2):				
Accuracy:	Conc.(s) (expressed as % "A"): Number of replicates: Percent recovery (avg/RSD):				
Precision / Repeatability: (intra-assay precision)	Conc.(s) (expressed as % "A"): Number of replicates: Result (avg/RSD):				
Precision / Intermediate Precision: (days/analysts/equipment)	Parameter(s) altered: Result (avg/RSD):				
Limit of Detection (LOD): (expressed as % "A")					
Limit of Quantitation (LOQ): (expressed as % "A")					
Robustness:	Stability of solutions: Other variables/effects:				
Typical chromatograms or spectra may be found in:					
Company(s) responsible for method validation:					
Other information (specify):					

MODULE 4: NON-CLINICAL STUDY REPORTS

Table of contents of module

Body data

Information on this part is required for all products containing new active substances. However for products containing well established ingredients pre- clinical data is not required; instead provide literature review as prescribed. For generic products, pre- clinical data is also not required but data demonstrating therapeutic equivalence (bioequivalence) is required and this can be presented in Module 5.

The objective of non-clinical studies is to define the pharmacological actions (Pharmacodynamic and pharmacokinetics) and toxicological effects of the active substance in test animals and target species, users, consumers and the environments. This normally involves initial studies in laboratory animals and later on pre-clinical studies in the target species, which should take into consideration the following:

a) Selection of the relevant animal species.

b) Age of the animals.

c) Physiological state of the animals.

d) The manner of delivery, including dose, route of administration and treatment regimen and the effect on the animals.

e) Stability of the test material or drug under the condition of use.

f) Safety of personnel.

g) Environmental safety.

The safety documentation of the dossier shall show:

a) The potential toxicity of the veterinary medicine and any dangerous effects which may occur under the proposed conditions of use in animals. These should be evaluated in relation to the severity of the pathological condition concerned;

b) The potential harmful effects to man of residues of the veterinary medicine or substance in foodstuffs obtained from treated animals and what difficulties these residues may create in the industrial processing of foodstuff;

c) The potential risks which may result from the exposure of human beings to the medicinal product;

d) The potential risks to the environment resulting from the use of the medicinal product

Pre-clinical data should be presented in the following sequence:

a) Objectives

b) Experimental protocol including methodology and materials

c) Summarized results and related statistical analysis

d) Discussions and conclusions

e) In case of toxicity studies proposed measures to minimize potential toxicity during use of the product

Pharmacological studies

Pharmacodynamics
Provide a full description of tests performed to establish the pharmacological actions that are relevant to the proposed indication(s) of the active substance and mechanisms of action. Where possible it will be helpful to relate the pharmacodynamics of the drug to available data (in terms of selectivity, safety, potency etc.) on other drugs in the same class.

Other actions (desired/undesired)
Give assessment summary of action(s) other than those of therapeutic use. The results of two or three dosage levels studied should be submitted, with the lowest level representing the ED50 for the active substance's primary action on the animal species being investigated.

For effects, which may be expected to have significant adverse reactions, attempts should be made to estimate the threshold levels.

Pharmacodynamic interactions
The applicant shall submit data either to establish that such interactions do not occur or that they are clearly recognized and defined.

Discuss the pharmacodynamic interactions and mechanisms of interactions of the active substance with other compounds (drug or other substances), which are relevant to proposed therapeutic use. Where there is evidence of antagonism or additive/synergistic effects, these should be well elucidated.

In case of fixed dose combination or combination packs appropriate data to justify the benefit of combination against single active substance should be given.

Pharmacokinetics
Pharmacokinetics studies should be made with single dose by various routes. Repeated dose studies should also be performed when relevant, to establish the pharmacokinetics of chronic drug administration.

Metabolic studies should be conducted on species used in toxicological and reproduction studies using the proposed clinical routes of administration.

Where radioactive labelled materials are used in studies, position of label stability and specificity of material should be stated.

Where the product contains a combination of drugs, the effect of use of two or more drugs on the pharmacokinetics of one or the other drugs should be established.

Provide studies done to establish the pattern and time course of absorption, distribution, biotransformation, pharmacokinetic interactions and excretion of the active substance and/or its metabolites as described below.

Absorption
Provide summary of mechanism of absorption, factors affecting absorption, rate and extent of absorption, plasma levels of the active substance and metabolites (peak levels, half-life, etc.). This information should be discussed for different routes. Correlation between plasma drug concentrations and pharmacological effects should be discussed.

Distribution of active substance and metabolites
Provide a summary and time course of distribution of the active substance and metabolites in body fluids, tissues, and organs.

Accumulation, retention of the drug/metabolites in tissues, organs, penetration of blood-brain and placental barriers, plasma binding all these parameters should be reported in quantitative form.

Biotransformation
Give the pattern and time-course of biotransformation of the drug, i.e. sites of metabolism and their importance, metabolic pathway(s), nature and quantities of metabolites, rate of metabolism, pre-systemic metabolites enzyme inhibition or induction, activity of metabolites, if any.

Pharmacokinetic interactions
Discuss the pharmacokinetic interactions and mechanisms of interactions of the active substance with other compounds (drug or other substances), which are relevant to proposed therapeutic use. Where there is evidence of antagonism or additive/synergistic effects, these should be well elucidated.

Excretion
Summarize the routes and extent of excretion of the drug and its metabolites. State also its excretion in milk in case of lactating animals. Discuss the rate of elimination and factors influencing elimination.

Toxicological studies

The scope of toxicological assessment should be described in relation to the proposed clinical use. Information obtained from experimental and biological studies of all aspects of toxicology (general toxicity, acute toxicity studies, sub-acute toxicity and long term toxicity studies including teratology, reproduction effects, carcinogenicity, genotoxicity, immunogenicity, microbial affects (e.g. development of resistance), local tolerance (potential for adverse effects at site of administration, etc) is required to establish the safe use of the drug and must be submitted for all new drug applications.

The investigation should, if possible, include experiments conducted with the drug in the vehicle intended for therapeutic application or its final pharmaceutical formulation (product).

General Toxicity Studies
In general toxicity studies, at least three or more routes of administration should be used including one for therapeutic use and at least one other which ensures systemic absorption, i.e. intravenous, intramuscular or subcutaneous.

Different dose levels spaced logarithmically should be used. The maximum tolerated dose should be indicated.

All animals dying during the experiment should be autopsied and cause of death determined where possible.

Full post-mortem should be carried out on all animals and histopathological studies undertaken on control and dosed groups.

Results should be tabulated. Full data for all parameters measured, with mean, range for groups, should be included.

If it is expected that the product will be used in young animals, studies should be conducted on both adult and young animals.

Acute toxicity studies
Principles governing general toxicity studies shall be applicable to acute, sub-acute and long term toxicity studies and local tolerability studies, LD_{50}

Single-dose toxicity studies can be used to:

a) Predict the possible effects of acute overdosing in the target species;

b) Predict the possible effects of accidental administration to veterinaries;

c) Predict the doses which may usefully be employed in the repeat dose studies

d) Assess the relative toxicity of the compound.

Single dose toxicity studies should reveal the acute toxic effects of the substances and the time course for their onset and remission. These studies should normally be carried out in both sexes of at least two mammalian species. One species may be replaced, if appropriate, by an animal species for which the medicinal product is intended. Preferably two different routes of administration should be studied. The route selected should be the same as that proposed for the target species. If substantial exposure of the user of the medicinal product is anticipated, for example for inhalation or dermal contact, these routes should be studied.

Sub acute toxicity studies
Repeat-dose toxicity tests are intended to reveal any physiological and/or pathological changes induced by repeated administration of the active substance or combination of active substances under examination, and to determine how these changes are related to dosage.

In the case of substances or medicinal products intended solely for use in animals which do not produce food for human consumption, a repeat-dose toxicity study in one species of experimental animal will normally be sufficient. This study may be replaced by a study conducted in the target species. The frequency and route of administration, and the duration of the study should be chosen having regard to the proposed conditions of clinical use. The investigator shall give reasons for the extent and duration of the trials and the dosages chosen.

In the case of substances or medicinal products intended for use in food producing animals, the studies should be conducted in at least two species, one of which should be a non-rodent. The investigator shall give reasons for the choice of species, having regard to the available knowledge of the metabolism of the product in animals and man. The test substance shall be administered orally. The duration of some of the studies shall be at least 90 days. The investigator shall clearly state and give reasons for the method and frequency of administration and the length of the trials.

The maximum dose should normally be selected so as to bring harmful effects to light. The lowest dose level should not produce any evidence of toxicity.

Assessment of the toxic effects shall be based on observation of behaviour, growth, haematology and physiological tests, especially those relating to the excretory organs, and also autopsy reports and accompanying histological data. The choice and range of each group of tests depends on the species of animal used and the state of scientific knowledge at the time.

References:

- VICH GL31 (Safety Repeat dose); Studies to evaluate the safety of residues of veterinary drugs in human food: Repeat dose toxicity testing
- VICH GL37 (Safety: Repeat-dose chronic toxicity) Studies to evaluate the safety of residues of veterinary drugs in human food: Repeat-dose (chronic) toxicity testing

Long term toxicity studies
Where applicable long-term toxicity determinations i.e. one year chronic study in dogs or a lifetime chronic study in rats, may be required.

Long-term animal carcinogenicity studies will usually be required for substances to:

a) Which veterinary beings will be exposed,

b) Which have a close chemical analogy with known carcinogens,

c) Which during mutagenicity testing produced results indicate a possibility of carcinogenic effects

d) Which gave rise to suspect signs during toxicity testing

The state of scientific knowledge at the time the application is submitted shall be taken into account when designing carcinogenicity studies and evaluating their results.

Reference:

- VICH GL23 (Safety Genotoxicity) ;Studies to evaluate the safety of veterinary drug residues in human food: Genotoxicity testing

Mutagenicity/Clastogenicity

Mutagenicity tests are intended to assess the potential of substances to cause transmissible changes in the genetic material of cells. If there is any indication of mutagenicity, carcinogenicity studies will be required.

Any new substances intended for use in veterinary medicinal products must be assessed for mutagenic properties.

The number and types of tests and the criteria for the assessment of the results shall depend on the state of scientific knowledge when the application is submitted.

Reference;

- VICH GL28 (Safety Carcinogenicity); Studies to evaluate the safety of veterinary drug residues in human food: carcinogenicity testing

Reproductive toxicity studies

Reproductive studies will be required if there is any indication of adverse effects on potential reproduction in the preceding preclinical studies.

The purpose of such studies is to identify possible impairment of male or female reproductive function or harmful effects on progeny resulting from the administration of the medicinal products or substance under investigation.

In the case of substances or medicinal products intended for use in food-producing animals, the study of the effects on reproduction shall be carried out in the form of a two-generation study on at least one species, usually a rodent. The substances or product under investigation shall be administered to males and females from an appropriate time prior to mating. Administration should continue until the weaning of the F2 generation. At least three dose levels shall be used. The maximum dose should be selected so as to bring harmful effects to light. The lowest dose level should not produce any evidence of toxicity.

Assessment of the effects on reproduction shall be based upon fertility, pregnancy and maternal behaviour; suckling growth and development of the F1 offspring from conception to maturity and the development of the F2 offspring to weaning.

Study of embryotoxic/foetotoxic effects including teratogenicity

Embryotoxic/foetotoxic, including teratogenicity studies will be required:

In the case of substances or medicinal products intended for use in food-producing animals, studies of embryotoxic/foetotoxic effects, including teratogenicity, shall be carried out. These studies shall be carried out in at least two mammalian species, usually a rodent and the rabbit. The details of the test (number of animals, doses, time at which administered and criteria for the

assessment of results) shall depend on the state of scientific knowledge at the time the application is lodged and the level of statistical significance which the results should attain. The rodent study may be combined with the study of effects on reproductive function.

In the case of substances or medicinal products which are not intended for use in food-producing animals, to animals which might be used for breeding, a study of embryotoxic/fetotoxic effects, including teratogenicity, shall be required in at least one species, which may be the target species

Neurotoxicity
Neurotoxicity studies will be required if there is any indication of such effects in the preceding preclinical studies or if the product is chemically related to a group with such potential

Immunotoxicity
Where the effects observed during repeated dose studies in animals reveal specific changes in lymphoid organ weights and/or histology and/or changes in the cellularity of lymphoid tissues, bone marrow or peripheral leukocytes, the investigator shall consider the need for additional studies of the effects of the product on the immune system.

The state of scientific knowledge at the time the application to be is submitted shall be taken into account when designing such studies and evaluating their results.

Reference:

- VICH GL22 (Reproduction testing) Studies to evaluate the safety of veterinary drug residues in human food:
- VICH GL32 (Safety Developmental toxicity); Studies to evaluate the safety of residues of veterinary drugs in human food: Developmental toxicity testing

Safety to users

Studies on potential harmful effects to exposure by various routes, e.g. inhalation, topical contact, oral ingestion, performed on laboratory animals, shall be presented. The implications to human handling the product should be described and, where appropriate, precautions during preparation and use of the product should be proposed.

Reference:

EMA Guideline on user safety for pharmaceutical veterinary medicinal products (https://www.ema.europa.eu/en/documents/scientific-guideline/guideline-user-safety-pharmaceutical-veterinary-medicinal-products_en.pdf)

Risk assessment of veterinary drugs residues in food of animal origin

Residue study data from pharmacokinetic/tissue residue depletion studies should be provided to justify withdrawal periods for milk, meat, eggs for each species for which the product is indicated.

Safety assessment of veterinary drugs residues in food of animal origin should be performed for all new drugs. A study to confirm the withdrawal period(s) may also be required for some generic products where there is a risk of higher local residues at the site of administration. . Reference to the relevant Maximum residue limits (MRLs) in food producing animals should be provided. Reference could be made to Codex or EU MRLs. These should be accompanied by appropriate residue depletion studies, which are conducted in accordance with international standards, and withdrawal period(s) proposed. The analytical methods used should also be provided together with validation data. Relevant guidelines are listed below.

Pre and post antimicrobial resistance surveillance should be performed on indicator pathogens e.g. E.coli, Salmonella spp.

Reference:

- VICH GL46 Studies to evaluate the metabolism and residue kinetics of veterinary drugs in food-producing animals: Metabolism study to determine the quantity and identify the nature of residues
- VICH GL47 Studies to evaluate the metabolism and residue kinetics of veterinary drugs in food-producing animals: Comparative metabolism studies in laboratory animals
- VICH GL48(R) Studies to evaluate the metabolism and residue kinetics of veterinary drugs in food-producing animals: Marker residue depletion studies to establish product withdrawal periods
- VICH GL49(R) Studies to evaluate the metabolism and residue kinetics of veterinary drugs in food-producing animals: Validation of analytical methods used in residue depletion studies
- VICH GL56 Studies to evaluate the Metabolism and Residue Kinetics of veterinary drugs in food-producing species: study design recommendations for residue studies in honey for establishing MRLs and withdrawal period
- VICH GL57 Studies to evaluate the Metabolism and Residue Kinetics of veterinary drugs in food-producing species: Marker Residue Depletion studies to establish product withdrawal periods in aquatic species

Toxicity to the environment

Requirements for safety are important to avoid persistent damage to the environment. An assessment of the potential of exposure of the drug and its active metabolites to the environment shall be made taking into account:

a) The target species and likelihood of and method of excretion of the product and its active metabolites into the environment.

b) Pattern of use and therefore quantity drug to be used (herd/flock medication or individual medication)

c) The method of administration and whether it may lead to direct entry of the product into the environment, e.g. sprays

d) The method of disposal of the unused, used products and containers

Studies on potential harmful effect of the product to the environment shall be provided. The environment shall include soil, water and air such studies shall include:

a) Fate and behaviour in the soil

b) Effects on soil organisms

c) Fate and behaviour in water

d) Effect on aquatic organisms

e) Effects of other non-target organisms

Proposed measures to minimize the above potential risks during use of the product shall be described.

Data on environmental safety assessment shall be given for the following products:

a) Antibiotics in poultry, pig and fish feeds

b) Antihelmintics in large animals e.g. ivermectins

c) External preparations

Reference:

- VICH GL6: Environmental Impact Assessment (EIAs) for veterinary medicinal products (VMPs) - Phase 1
- VICH GL38 - Environmental Impact Assessment (EIAs) for Veterinary Medicinal Products (VMPs) - Phase II
- VICH GL43: (TAS Pharmaceuticals) Target Animal Safety for Pharmaceuticals.

MODULE 5: CLINICAL STUDY REPORTS

Innovator products

For innovator products clinical trials using the proposed product is required. The purpose of clinical trials is to demonstrate or substantiate the effect of the veterinary medicinal product after administration at the proposed dosage regimen via the proposed route of administration and to specify its indications and contra-indications according to species, age, breed and sex, its directions for use as well as any adverse reactions which it may have.

Experimental data shall be confirmed by data obtained under normal field conditions. Unless justified, clinical trials shall be carried out with control animals (controlled clinical trials). The efficacy results obtained should be compared with those from the target animal species that have received a veterinary medicinal product authorised in the Community for the same indications for use in the same target animal species, or a placebo or no treatment. All the results obtained, whether positive or negative, shall be reported. Established statistical principles shall be used in protocol design, analysis and evaluation of clinical trials, unless justified.

All veterinary clinical trials shall be conducted in accordance with a detailed trial protocol. Clinical field trials shall be conducted in accordance with established principles of good clinical practice, unless otherwise justified. Before the commencement of any field trial, the informed consent of the owner of the animals to be used in the trial shall be obtained and documented. In particular, the animal owner shall be informed in writing of the consequences of participation in the trial for the subsequent disposal of treated animals or for the taking of foodstuffs from treated animals. A copy of this notification, countersigned and dated by the animal owner, shall be included in the trial documentation.

The dossier on efficacy shall include all pre-clinical and clinical documentation and/or results of trials, whether favourable or unfavourable to the veterinary medicinal products, in order to enable an objective overall assessment of the risk/benefit balance of the product.

Reference

- VICH GL9 Good Clinical Practices (GCP)
- VICH GL7 Efficacy of Anthelmintics: General Requirements
- VICH GL12 Efficacy of Anthelmintics: Specific Recommendations for Bovines
- VICH GL13 Efficacy of Anthelmintics: Specific Recommendations for Ovines
- VICH GL14 Efficacy of Anthelmintics: Specific Recommendations for Caprines
- VICH GL15 Efficacy of Anthelmintics: Specific Recommendations for Equine
- VICH GL16 Efficacy of Anthelmintics: Specific Recommendations for Swine
- VICH GL19 Efficacy of Anthelmintics: Specific Recommendations for Canine
- VICH GL20 Efficacy of Anthelmintics: Specific Recommendations for Feline
- VICH GL21 Efficacy of Anthelmintics: Specific Recommendations for Poultry

Generics

5.1 Interchangeability

Applicants for registration of generic drugs must submit evidence showing that the generic drug is therapeutically equivalent to its innovator or reference product in the relevant animals by either submitting comparative pharmacodynamic studies or comparative clinical trials.

a) Comparative pharmacodynamic studies

Describe the study protocol including the study design, pharmacological or biochemical response measured, measuring instruments used results, statistical methods used and their justification. Tabulation and graphical illustration of results and conclusion. This study is also called bioequivalence study.

i. A cross-over design is preferred and where it is not appropriate a parallel design is acceptable. The study design must consider the pathology and natural history of the condition.

ii. Studies should be done in healthy subjects or in patient if the disease affects the actions/responses studied.

iii. Inclusion/exclusion criteria must be stated, and non-responders should be identified and excluded prior to begin the study.

iv. Measured pharmacological response should be relevant to the claimed therapeutic uses where there are more than one therapeutic use studies should be done to demonstrate the therapeutic equivalence for each use.

v. Measurement of responses should as far as possible be quantitative, measured under double blind conditions and be recorded in an instrument producer/instrument recorded fashion. The methodology must be validated for precision, accuracy, reproducibility and specificity.

vi. The principles of Good Clinical Practice (GCP) and Good Laboratory Practice (GLP) should be adhered to during the study.

vii. Where possible the effect can be graphically illustrated using the area under the effect time curve, maximum effect and time of maximum effect.

In using pharmacodynamic methods, the following requirements must be satisfied:

- The response can be measured precisely over a reasonable range
- The response can be measured repeatedly to obtain time-course from the beginning to end of the response
- It should be possible to derive the common parameters of comparison.
- It should be possible to derive the common parameters of comparison like C_{max}, T_{max} and AUC

The test and reference product should not produce a maximal response during the course of study. A reference product is a VMP granted an authorisation on the basis of a complete product dossier, i.e., with submission of all quality, safety and efficacy data. The products that are eligible to be considered as reference products are those innovator products approved by SRA[1] countries.

Reference

[1] SRA countries in this context are the VICH founding members.

- VICH GL52 Bioequivalence: Blood Level Bioequivalence Study
- VICH GL52 The supplement explanatory document to VICH GL52
- VICH GL9 (GCP) – Good Clinical Practice

b) Comparative clinical data

Describe in detail the study protocol, which should, include the title of the study investigator(s), location, justification and objective, dates, time, duration, observation periods and justification thereof, study design (randomization methods description of design e.g. cross-over or parallel etc), inclusion, exclusion, criteria, methods and treatments, specification of comparator and placebo, results (definition of ethical endpoints measured, methods, measured and recording clinical response (scoring system for endpoints). Statistical methods used and their justification.

i. Comparative clinical studies is required in cases where pharmacodynamic studies cannot be done i.e. when plasma concentration time profile data is not suitable to assess therapeutic equivalence or lack of meaningful pharmacodynamic parameters which, are measured (quantified).

ii. The number of animal chosen and acceptance limits should be justified

ANNEX I: APPLICATION FORM FOR REGISTRATION OF VETERINARY MEDICINAL PRODUCTS

General Instructions:

Provide as much detailed, accurate and final information as possible. A properly filled out and signed original copy of the form (including a copy in MS Word on a CD-ROM) must be submitted together with other application documents. The entire Common Technical Document should be submitted both as hard-copy and on CD-ROM. Statutory applications forms specific to a MS should also be completed.

The application should be sent to the following address:

Director General

MS Medicines Authority

P.O. Box

Annex 1 – Common Application Form

Common Application Form

APPLICATION FOR A NEW MARKETING AUTHORISATION FOR PHARMACEUTICAL AND BIOLOGICAL/IMMUNOLOGICAL PRODUCTS

A separate application form is required for each strength and/or pharmaceutical dosage form. Different pack sizes of the same product can be included on the same form.

SECTION 1 - PRODUCT NAME(s)

1.1. Proposed trade name of product

1.2. International Non-Proprietary Name (Generic Name)

SECTION 2 – APPLICATION DETAILS

2.1 Product Type

Please select either pharmaceutical OR Biological/Immunological

☐ Pharmaceutical

☐ Biological/Immunological - A VMP sourced from a biological source or a vaccine.

2.2 Type of Drug Substance

Please select only one

☐ Newly marketed Product with New Drug Substance

☐ Newly marketed Product with New Combination of Drugs Substances

☐ Newly marketed Product with Existing Drug Substance

☐ Re-evaluation of an Existing Product

SECTION 3 – PRODUCT DETAILS

3.1 Formulation *(provide the full formulation details)*

	Name of the substance	**Concentration in the final product**	**Description of Function** *(example, active substance, attenuated virus, adjuvant, excipient)*
1			
2			

Please add extra rows, if required.

3.2 Therapeutic Subgroup Classification (example, inactivated viral vaccine, diuretic drug)

3.3 Dosage Form (example, solution for injection)

3.4 Visual appearance including colour (example, clear, light yellow oily solution)

3.5 Target Species and Route(s) of Administration

	Target Species	**Route of Administration**	**Food-producing?** *(tick as appropriate)*
1			Yes ☐ No ☐
2			Yes ☐ No ☐

Please add extra rows, if required.

3.6 Do all active substances have the appropriate MRLs set in the species and for the route of administration(s) for which they are indicated? For example, from Codex, EU or other.

YES ☐ NO ☐

If no, please tell us what you are doing to obtain the appropriate MRL(s):

3.7 Pack type details

Please provide information of all pack types including their container and closures.

	Pack Size *(example, 100 ml)*	**Container** *(example HDPE bottle)*	**Closure** *(example, polyethylene screw-cap)*
1			
2			

Please add extra rows, if required.

3.8 Proposed shelf-life

SECTION 4 – CONTACT INFORMATION

4.1 Details of the proposed Marketing Authorisation Holder (MAH) contact:

Company Name:	
Company Address:	
Telephone No.	

4.2 Name, address and contact details of the proposed finished product manufacturer(s):

If the proposed named manufacturer is the same as the proposed MAH, simply enter 'same as MAH' in the field below.

	Name, address and telephone number	**Brief description of functions performed** *(e.g. bulk manufacturing, batch release, primary or secondary packaging)*
1		
2		

Please add extra rows, if required.

SECTION 5 – REGULATORY STATUS

5.1 Regulatory Status in Country of Origin

Provide the regulatory status in the country of manufacture and the authorisation number/reference.

5.2 Regulatory Status in Other Territories

Regulatory status of the proposed product in other countries globally, including successful or pending, rejected, withdrawn, suspended or revoked applications.

Country/Region with successful authorisations

Please add extra rows, if required.

Country/Region where applications are pending

Please add extra rows, if required.

Country/Region where applications/authorisations have been rejected, withdrawn, suspended or revoked

Please add extra rows, if required.

SECTION 6 - DECLARATION

Contact details of the person responsible for the application:

A legal representative of the applying company to take full responsibility for the application on behalf of the MAH and is answerable to the authority.

Name:	
Address (including country):	
Telephone No.	
Email Address:	
Position and Affiliation:	

I confirm that the information provided in support of this application is correct at time of submission.

I understand that if any information provided in this application is later found to be false or incorrect, the authorisation may be suspended or revoked

SIGNATURE:	
DATE:	

Note – not signing this box will lead to your application being rejected at validation.

ANNEX 1: Country Specific Information

If applications are being made to a number of countries, please provide the following details for each country (please replicate this annex for each country)

A.1 Contact details of in-country Local Technical Representative:

An in-country legal representative of the company holding the original authorisation to take full responsibility for the product on behalf of the MAH and is answerable to the authority.

Name:	
Address (including country):	
Telephone No.	
Email Address:	

A.2 Name and contact details of person responsible for pharmacovigilance: *(non-mandatory field)*

Name:	
Telephone No.	
Email Address:	

A.3 Proposed Distribution Category in country *(example, controlled drug, drug requiring prescription by veterinarian etc.)*

ANNEX II: SUMMARY OF PRODUCT CHARACTERISTICS

1. NAME OF THE VETERINARY MEDICINAL PRODUCT

{(Invented) name of veterinary medicinal product <strength> pharmaceutical form <target species>}

2. QUALITATIVE AND QUANTITATIVE COMPOSITION

Active substance<s>:

<Excipient<s>:>

For the full list of excipients, see section 6.1.

3. PHARMACEUTICAL FORM

4. CLINICAL PARTICULARS

4.1 Target species

4.2 Indications for use, specifying the target species

4.3 Contraindications

<None.>

<Do not use in ….>

<Do not use in cases of hypersensitivity to the active substance(s)<, or to any of the excipient(s).>

4.4 Special warnings for each target species

<None.>

<Vaccinate healthy animals only.>

4.5 Special precautions for use

i) Special precautions for use in animals

<Not applicable.>

ii) Special precautions to be taken by the person administering the veterinary medicinal product to animals

<Not applicable.>

<In case of accidental <self-administration><self-injection><ingestion><spillage onto skin>, seek medical advice immediately and show the package leaflet or the label to the physician.>

<People with known hypersensitivity to {INN} should <avoid contact with the veterinary medicinal product.><administer the veterinary medicinal product with caution.>>

<Personal protective equipment consisting of {specify} should be worn when handling the veterinary medicinal product.>

<The veterinary medicinal product should not be administered by pregnant women.>

<To the user:

This veterinary medicinal product contains mineral oil. Accidental injection/self-injection may result in severe pain and swelling, particularly if injected into a joint or finger, and in rare cases could result in the loss of the affected finger if prompt medical attention is not given. If you are accidentally injected with this veterinary medicinal product, seek prompt medical advice even if only a very small amount is injected and take the package leaflet with you. If pain persists for more than 12 hours after medical examination, seek medical advice again.

To the physician:

This veterinary medicinal product contains mineral oil. Even if small amounts have been injected, accidental injection with this product can cause intense swelling, which may, for example, result in ischaemic necrosis and even the loss of a digit. Expert, PROMPT, surgical attention is required and may necessitate early incision and irrigation of the injected area, especially where there is involvement of finger pulp or tendon.>

<The long-term effects of the veterinary medicinal product on the population dynamics of dung beetles have not been investigated. Therefore, it is advisable not to treat animals on the same pasture every season.>

4.6 Adverse reactions (frequency and seriousness)

4.7 Use during pregnancy, lactation or lay

<The safety of the veterinary medicinal product has not been established during <pregnancy><lactation><lay>.>

<Pregnancy:>

<Can be used during pregnancy.>

<The use is not recommended (during the whole or part of the pregnancy).>

<Do not use (during the whole or part of the pregnancy).>

<The use is not recommended during <pregnancy><lactation>.>

<Use only accordingly to the benefit-risk assessment by the responsible veterinarian.>

<Laboratory studies in {species} have not produced any evidence of <teratogenic>, <foetotoxic>, <maternotoxic> effects.>

<Laboratory studies in {species} have shown evidence of <teratogenic>, <foetotoxic>, <maternotoxic> effects.>

<Lactation:>

<Not applicable.>

<Laying birds:>

<Do not use in <birds in lay><breeding birds> <and within 4 weeks before the start of the laying period>.>

<Fertility:>

<Do not use in breeding animals.>

4.8 Interaction with other medicinal products and other forms of interaction

<None known.>

<No data available.>

4.9 Amounts to be administered and administration route

< Dosage to be given per each specified species and rout of administration should be stated.>

4.10 Overdose (symptoms, emergency procedures, antidotes), if necessary

4.11 Withdrawal period(s)

<Not applicable.>

<Zero days.>

<<Meat and offal><Eggs><Milk> <Honey>: {X} <days><hours>.>

<{X} degree days.>

<Not authorised for use in animals producing milk for human consumption.>

<Do not use in pregnant animals which are intended to produce milk for human consumption within {X} months of expected parturition.>

<Not for use in birds producing or intended to produce eggs for human consumption.>

<Do not use within {X} weeks of the start of the laying period.>

5. PHARMACOLOGICAL PROPERTIES

Pharmacotherapeutic group: {group}.

ATC vet code: {lowest available level (e.g. subgroup for chemical substance)}.

<5.1 Pharmacodynamic properties>

<5.2 Pharmacokinetic particulars>

<Environmental properties>

6. PHARMACEUTICAL PARTICULARS

6.1 List of excipients

6.2 Major incompatibilities

<Not applicable.>

<In the absence of compatibility studies, this veterinary medicinal product must not be mixed with other veterinary medicinal products.>

<Do not mix with any other veterinary medicinal product<, except <solvent or other component> <recommended><supplied> <for use with the veterinary medicinal product>.>

<None known.>

6.3 Shelf life

<Shelf life of the veterinary medicinal product as packaged for sale: >

<Shelf life after first opening the immediate packaging: >

<Shelf life after <dilution><reconstitution> according to directions: >

<Shelf life after incorporation into meal or pelleted feed: >

<6 months.><…><1 year.><18 months.><2 years.><30 months.><3 years.><use immediately.>

6.4. Special precautions for storage

<Do not store above <25º C><30º C>.>

<Store below <25 º C><30 º C>.>

<Store in a refrigerator (2 º C – 8 º C).>

<Store and transport refrigerated (2 º C – 8 º C).>*

<Store in a freezer {temperature range}.>

<Store and transport frozen {temperature range}.>**

<Do not <refrigerate> <or> <freeze>.>

<Protect from light.>

** This statement should be used only when critical.

6.5 Nature and composition of immediate packaging

<Not all pack sizes may be marketed.>

6.6 Special precautions for the disposal of unused veterinary medicinal product or waste materials derived from the use of such products

<Not applicable.>

<Any unused veterinary medicinal product or waste materials derived from such veterinary medicinal product should be disposed of in accordance with local requirements.>

<Dispose of waste material by boiling, incineration or immersion in an appropriate disinfectant approved for use by the competent authorities.>

<{Invented name} should not enter water courses as this may be dangerous for fish and other aquatic organisms.>

7. MARKETING AUTHORISATION HOLDER

{Name and Address}

<{Tel.}>

<{Fax}>

<{E-mail}>

8. MARKETING AUTHORISATION NUMBER(S)

9. DATE OF FIRST AUTHORISATION/RENEWAL OF THE AUTHORISATION

<{DD/MM/YYYY}><{DD month YYYY}.>

10 DATE OF REVISION OF THE TEXT

{MM/YYYY} or {month YYYY}

PROHIBITION OF SALE, SUPPLY AND/OR USE

<Not applicable.>

<Consideration should be given to official guidance on the incorporation of medicated premixes in final feeds.>