Report of the WOAH Scientific Commission for Animal Diseases

Original: English (EN)

11 to 15 September 2023
Paris

World Organisation for Animal Health
Founded as OIE

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Table of Contents

List of Annexes

A meeting of the WOAH Scientific Commission for Animal Diseases (the Commission) was held from 11 to 15 September 2023 at the WOAH Headquarters in Paris, France.

1. Welcome

Dr Montserrat Arroyo, WOAH Deputy Director General, International Standards and Science, welcomed members of the Scientific Commission and thanked them for their ongoing contributions to the work of WOAH. Dr Arroyo also extended these thanks to the members' employing institutions and national governments.

Dr Arroyo informed the Commission that the Organisation is currently dedicating efforts to various IT projects with the aim of creating tools that will facilitate access to WOAH services and practices as detailed in the organisation's Basic Texts. Among these tools are the evolution of the system for collecting annual reports from Reference Centres, a digitised system for navigating the Code and Manuals, an improved system for self-declaration of disease status, and a repository of PVS reports, all with the goal of improving and simplifying access to these tools, ensuring transparency, and enhancing the traceability of WOAH's work, while also interconnecting all the tools.

Dr Arroyo also expressed her satisfaction with the past General Session and highlighted that the Organisation will celebrate its 100th anniversary in the coming year. She congratulated the Commission on its interactions with the other Specialist Commissions, emphasising the importance of harmonising and adopting a consistent approach to common work themes.

The members of the Commission thanked Dr Arroyo for the excellent support provided by the WOAH Secretariat.

2. Meeting with the Director General

The WOAH Director General, Dr Monique Eloit, met with the Commission on 14 September and thanked the Commission for their continued commitment to working with the WOAH to meet its objectives.

Dr Eloit remarked on the positive outcomes of the 90th General Session, highlighting the favourable response to the change in the Session's format, which included an Animal Health Forum on Avian Influenza. Dr Eloit emphasised that the forum facilitated interactive discussions and encouraged exchanges from both an administrative and technical perspective.

Dr Eloit informed the Commission that WOAH is currently undergoing a consultancy to evaluate the Organisation's *Basic Texts* from both a technical and legal viewpoint. The importance of this consultancy is to introduce a more robust and transparent approach to the organisation's procedures, supported by a solid legal basis. Dr Eloit pointed out the need to determine which fundamental documents or standard operating procedures necessitate revision and subsequent endorsement by the Assembly. The revision of the *Basic Texts* is essential to maintaining WOAH's credibility among stakeholders, and Members. This assessment will be completed in time for the celebrations of WOAH's 100th anniversary in May 2024.

In addition, Dr Eloit provided an update of the status of the call for nomination to establish a list of experts for the WOAH Specialist Commissions, which closed on 8 September 2023.

The members of the Commission thanked Dr Eloit for taking the time to meet, and appreciated the opportunity to be kept up-to-date on various developments of WOAH.

3. Adoption of the agenda

The draft agenda was adopted by the Commission. The meeting was chaired by Dr Cristóbal Zepeda and the WOAH Secretariat acted as rapporteur. The agenda and list of participants are attached as **Annexes 1** and **2**, respectively.

4. Terrestrial Animal Health Code

4.1. Member comments received for Commission consideration

4.1.1. Chapter 1.6. Procedures for official recognition of animal health status, endorsement of an official control programme, and publication of a self- declaration of animal health status, by WOAH

At its September 2022 meeting, the Code Commission considered a request from a Member to amend Chapter 5.8. International transfer and laboratory containment of animal pathogenic agents, and to improve clarity as to whether Members can hold pathogenic agents in laboratories without affecting their animal health status. The Code Commission noted that in addition to Chapter 5.8., references relevant to recommendations for laboratories were also included in Chapter 3.2., Chapter 3.4. (Article 3.4.7.), and Chapters 1.7. to 1.12. in the *Terrestrial Code* and in Chapters 1.1.3. and 1.1.4. of the *Terrestrial Manual*. The Code Commission agreed

that this specific request should be addressed in the context of official status recognition by WOAH by amending Chapter 1.6.

At its February 2023 meeting, the Code Commission proposed to develop a new Article 1.6.4. to clarify that the presence of a pathogenic agent in an approved laboratory with an appropriate level of containment and biosecurity in accordance with the *Terrestrial Manual* will not impact the animal health status of a country or zone. The Code Commission also agreed to cover in the same article other similar provisions currently included in other horizontal chapters.

This draft revised Chapter 1.6. including the draft new Article 1.6.4. was submitted to the Scientific Commission for its consideration.

At its September 2023 meeting, the Scientific Commission agreed to improve the text further, also to clarify that Members may work with pathogenic agents in approved animal experimental facilities with the appropriate level of biosecurity, without affecting their animal health status.

While suggesting using the Glossary definition of 'laboratory', the Commission noted that it only includes veterinary diagnostic testing and proposed to review the definition, in consultation with the Biological Standards Commission, to also consider approved facilities for other purposes, such as experiments.

The opinion of the Commission was forwarded to the Code Commission.

4.1.2. Chapter 8.8. Infection with foot and mouth disease virus

The Commission addressed selected comments, forwarded by the Code Commission, which were received from Members during and after the 2023 General Session on the revised draft chapter proposed for adoption.

General comments

In response to a Member's comment suggesting to elucidate the carrier status durations, the Commission clarified that the objective of the general provisions was to explain the epidemiological significance of the carrier state in different species and to emphasise that the only species for which transmission of FMDV has been proven for carrier individuals is the African buffalo. Considering that the duration of carrier state in ruminants is largely strain and species dependent and variable within species, the Commission considered that describing all the different carrier time periods was of much less importance. Nevertheless, the Commission acknowledged that the terminology 'persistently infected individuals' could give the wrong impression of existence of lifelong carriers and agreed to replace it with 'carriers'.

Article 8.8.3. Country or zone free from FMD where vaccination is practised

The Commission clarified the description of the target population for compulsory systematic vaccination according to the provisions under Chapter 4.18. of the *Terrestrial Code*.

Article 8.8.5bis. Establishment of a protection zone within a country or zone free from FMD

For the implementation of a 'protection zone,' the Commission was of the opinion that the increased/enhanced surveillance in the rest of the country/zone might be overly demanding as long as there is an effective early warning system in place, and agreed that 'enhanced awareness' in the rest of the country or zone would be sufficient.

The Commission considered a question regarding the fate of a protection zone after the period of 24 months from the date of its approval by WOAH. The Commission clarified that a protection zone should not last more than 24 months and that, during this period, the Member should either inform WOAH of the lifting of the protection zone or apply for its official recognition as a free zone in accordance with either Article 8.8.2. or 8.8.3.

Article 8.8.6. Establishment of a containment zone within a country or zone previously free from FMD

The Commission discussed the practicalities of the implementation of containment zones and noted for future discussion the need for maintaining both options (a and b) for the containment zones in Article 4.4.7.

The Commission clarified that if recovery of the free status of the containment zone is not achieved within 24 months, the 'free status' of the rest of the country/zone would be suspended.

Articles 8.8.10. Recommendations for importation of susceptible animals from countries, zones or compartments free from FMD where vaccination is not practised

With regard to the testing of vaccinated animals (point 4 of Articles 8.8.10. and 8.8.11.), the Commission was of the opinion that, regardless of the vaccination status of the FMD-free country/zone where the animals are originating from, the objective would be to demonstrate that vaccinated animals had not been exposed to FMDV, both past infection (NSP serological testing) and recent infection (virological testing).

Article 8.8.11. Recommendations for importation of domestic ruminants and pigs from countries, zones or compartments free from FMD where vaccination is practised

In response to a question on why Article 8.8.11. refers to domestic ruminants and pigs and not to susceptible animals, as Article 8.8.10., the Commission explained that the validation of FMD serological tests is generally proven for domestic ruminants and pigs but not for other species.

Regarding a question of the need for both virological and serological testing of unvaccinated animals, the Commission explained that both serological and virological testing would be necessary to detect both past and recent infections, and considering the detection of disease through passive surveillance is less sensitive in unvaccinated animals existing within a vaccinated population.

Article 8.8.40. General principles of surveillance

The Commission reiterated its disagreement with comments that importing vaccinated animals from 'FMD-free country/zones/compartments with vaccination' entails an increased risk. The Commission acknowledged that the importation of vaccinated animals might require adjusting the surveillance strategy of the importing country. Nevertheless, the Commission maintained its position stated in its last February 2023 meeting that the mitigation measures, including testing, described in Articles 8.8.11. and 8.8.11bis. result in a negligible risk.

The opinion of the Commission was forwarded to the Code Commission and addressed at its September 2023 meeting.

4.1.3. Chapter 12.1. Infection with African horse sickness virus

Article 12.1.2. Country or zone free from AHS

At its February 2023 meeting, the Code Commission proposed amendments to points (c) and (d) related to the occurrence of infection and surveillance for freedom for clarity and requested the Secretariat to seek the opinion of the Scientific Commission on the proposed amendments at the same time they were circulated to Members.

The Commission clarified that adjacency to an infected country does not entail loss of free status but requires surveillance according to Articles 12.1.11. to 12.1.13.

The Commission agreed with the amendments to points (c) and (d) proposed by the Code Commission in response to Members' comments, except for point d) iii). The Commission proposed deleting this point, as reference to Chapter 1.5. had already been included under Articles 12.1.11. to 12.1.13. The Commission also discussed that climate change is likely to change the distribution of *Culicoides.* The Commission considered that there are few, if any, countries that could be considered free of all species of *Culicoides.*

The opinion of the Commission was forwarded to the Code Commission and addressed at its September 2023 meeting.

4.2. Other considerations

4.2.1. Chapter 1.11. Application for official recognition by WOAH of free status for foot and mouth disease

At its February 2023 meeting, the Commission had considered a comment proposing the revision and parallel adoption of Chapter 1.11. Application for official recognition by WOAH of free status for FMD with the adoption of the revised Chapter 8.8. In response to this comment, the Commission revised the questionnaire of Chapter 1.11. and proposed amendments to Article 1.11.3. The revised article was forwarded to the Code Commission and addressed at its September 2023 meeting.

4.2.2. Chapter 14.8. Scrapie

The Commission was informed by the Secretariat that scrapie has been raised to priority '2' of the work programme of the Code Commission, based on requests by Members to update the recommendations for live animal testing and testing for genetic resistance; the Secretariat invited the Scientific Commission to consider whether an update of Chapter 14.8. may be included in its work programme.

Prior to incorporating this work into its work programme, the Commission requested the Secretariat to obtain more information on the specific requests from Members, and to seek the opinion of the Biological Standards Commission on testing of live animals and testing for genetic resistance. The Commission will consider this information at its February 2024 meeting and agree on the next steps with the Code Commission.

5. *Ad hoc* and Working Groups

5.1. Meeting reports for consideration

5.1.1. *Ad hoc* Group on surra and dourine

The Commission was informed that an *ad hoc* Group meeting on surra and dourine was convened in-person in July 2023 to continue the work on updating *Terrestrial Code* Chapter 12.3. Dourine and to recommend amendments to draft Chapter 8.Z. Infection with *Trypanosoma evansi* (surra) to address some concerns raised by Members. The Commission noted Code Commission would address the proposed amendments to Chapter 8.Z. in response to Member comments, and therefore focused its review on the updates to Chapter 12.3., which the *ad hoc* Group developed based on the draft chapter on surra.

The Commission agreed with the recommendation of the *ad hoc* Group to limit the scope of animal hosts to be covered in the case definition for infection with *Trypanosoma equiperdum* (dourine) to domestic and captive wild equids. The Commission considered that the risk of wild equids transmitting the infection to domestic and captive wild equids is not a significant transmission pathway, as dourine is primarily spread by coitus and wild equid populations are normally segregated from the domestic population. In view of the mode of transmission, the Commission also agreed with the recommendation of the *ad hoc* Group to include meat as a safe commodity as peroral spread is not a natural exposure pathway. However, the Commission noted that in the case of surra where peroral transmission is a significant pathway for spread, meat should not be considered a safe commodity, and therefore agreed with the *ad hoc* Group's recommendation to include draft Article 8.Z.11bis. 'Recommendations for importation of fresh meat from susceptible animals from countries or zones infected with *T.evansi*'. In addition, the Commission was uncertain that standard slaughter practices would satisfy the waiting period of 48 hours and supported the Group's proposal to specify recommendations for maturation in Article 8.Z.11bis.

In draft Article 12.3.7. 'Recommendations for importation of equids from countries, zones or compartments not free from dourine', the Commission noted the *ad hoc* Group's use of the term 'isolation' with the rationale that equids are not necessarily held in quarantine stations. However, as the Commission was unclear as to how 'isolation' would be interpreted by Members given it is not a defined term, it proposed to replace 'isolation' with clear measures on what this 'isolation' should entail, i.e. separation from any source of infection. Therefore, it proposed to describe the measures that the *ad hoc* Group had originally proposed under draft Article 12.3.8. 'Recommendations for the temporary importation of horses', namely that the equids were not used for any breeding and did not have sexual contact with other horses and were not subjected to any practice that could represent a risk of transmission of infection. To avoid repetition of text, the Commission amended point 2) of Article 12.3.8. to refer to this point in Article 12.3.7.

With regard to the recommendation by the *ad hoc* Group for a waiting period of 45 days in Article 12.3.7., the Commission noted that this was to align with the changes proposed by the *ad hoc* Group to Article 8.Z.7. on recommendations for importation of susceptible animals from countries or zones infected with *T.evansi*, in response to a Member comment to shorten the quarantine period. The Commission was informed that the rationale for this is based on a peer-reviewed paper which had established that seroconversion takes place between 10 – 20 days of infection, and 'non-infected status' can be established if negative results were obtained in a quarantine context, tested twice at a one-month interval[1]. However, the Commission also noted that a member of the *ad hoc* Group had raised that this did not apply to camels, and requested the Secretariat to seek the opinion of camel experts.

[1] Desquesnes M, Sazmand A, Gonzatti M, et al. Diagnosis of animal trypanosomoses: proper use of current tools and future prospects. Parasit Vectors. 2022;15:235. doi:10.1186/s13071-022-05352-1

In draft Article 12.3.8. on the temporary importation of horses, the Commission proposed to require both that the horses be accompanied by a passport in accordance with the model contained in Chapter 5.12., and be individually identified as belonging to a high health status subpopulation as defined in Chapter 4.17. The Commission noted that Chapter 5.12. is a template for competition horses, which includes a range of populations, including those that do not qualify as high health population, and these should be moved according to the provisions in Article 12.3.7. The Commission noted that this would also concur with point 3.7. of the report of the *ad hoc* Group which stressed that temporarily imported horses are under the supervision of the Veterinary Authority, and therefore it was important for the horse to be part of the high health status subpopulation; having a model passport alone would not be sufficient.

In draft Article 12.3.9. 'Recommendations for importation of semen from countries, zones or compartments free from dourine', the Commission did not agree with the *ad hoc* Group's recommendation to require that the donor males were kept for six months prior to semen collection in an establishment in which surveillance demonstrates that no case had occurred during the period. The Commission highlighted that this article refers to countries, zones or compartments that are free from dourine and this recommendation to attest establishment freedom would be excessive. For consistency with equivalent articles in other disease-specific chapters, the Commission proposed to replace this with an attestation that the donor males were kept for the six month period in a free country, zone or compartment.

In draft Article 12.3.10. on the importation of semen from countries, zones and compartments not free from dourine, the Commission proposed to delete 'compartment' from the title as by default, a compartment should be free of infection. As this article refers to establishment-level surveillance, the Commission recommended that further elaboration be provided in draft Article 12.3.14. 'Surveillance for demonstrating freedom from dourine' on what this surveillance should entail. It therefore proposed supplementary text to draft Article 12.3.14.

The opinion of the Commission was forwarded to the Code Commission. The endorsed report of the *ad hoc* Group is available on the WOAH website.

5.1.2. *Ad hoc* Group on biosecurity

The Commission received an update of the progress made by the *ad hoc* Group on biosecurity for terrestrial animals, which met for the second time in May 2023. The Commission was presented with the initial draft of the chapter, which took into account their previous comments. The Commission acknowledged the efforts of the *ad hoc* Group and commented positively that the chapter is taking a risk-based approach.

The Commission provided comments related to the proposed glossary definition for 'swill' to include the intention for feeding to animals, and additional comments related to the draft chapter.

The opinion of the Commission was forwarded to the Code Commission.

5.2. Planned *ad hoc* Groups and confirmation of proposed agendas

With regard to the *ad hoc* Groups on the evaluation of animal health status and official control programmes for WOAH endorsement, the Commission was briefed on the proposed agendas including information on the applications submitted to the WOAH so far. With the exception of the meeting of the *ad hoc* Group on the evaluation of FMD status which will occur in a physical format, the rest of the *ad hoc* Group meetings (not cancelled) are planned to take place virtually.

5.2.1. *Ad hoc* Group on the evaluation of AHS status: 28–29 September, 5 October 2023

5.2.2. *Ad hoc* Group on the evaluation of BSE risk status: 3–5 October 2023 (cancelled)

5.2.3. *Ad hoc* Group on the evaluation of official control programmes for dog-mediated rabies: 4 and 6 October 2023

5.2.4. *Ad hoc* Group on the evaluation of PPR status: 17–19 October 2023

5.2.5. *Ad hoc* Group on the evaluation of FMD status: 23–26 October 2023

5.2.6. *Ad hoc* Group on the evaluation of CSF status: 7–9 November 2023 (cancelled)

5.2.7. *Ad hoc* Group on the evaluation of CBPP status: 5–7 December 2023 (to be confirmed)

5.3. Meeting reports for information

5.3.1. WOAH Working Group on wildlife

The Commission was provided an update of the December 2022 and June 2023 meetings of the Working Group on Wildlife (WGW) by the WGW Secretariat.

The Commission noted that the WGW had provided feedback on the definition of 'emerging disease' in its December 2022 report, and requested the WGW Secretariat to provide more details on the specific recommendations of the WGW. The Commission also noted the importance of sharing this feedback with the Code and Aquatic Commissions.

The Commission was also informed of an article by the WGW on 'Early warning and early action – the coming El Niño Southern Oscillation phenomenon and health impacts', and that its previous suggestion on the paper on the vaccination of animals of high conservation value had been incorporated.

6. Official animal health status

6.1. Annual reconfirmations for maintenance of status

6.1.1. Selection of status for comprehensive review of 2023 annual reconfirmations

The Commission selected the list of Members' 2023 annual reconfirmations for comprehensive review during its forthcoming meeting in February 2024. The selection was based on a set of criteria described in the SOPs. The Commission will comprehensively review a total of 48 annual reconfirmations during its February 2024 meeting. The Members selected for comprehensive review of their annual reconfirmations will be notified officially by letter from WOAH in October 2023.

6.2. Specific update on official animal health status

6.2.1. Update on situation of countries/zone with suspended status

6.2.1.1. Thailand AHS status recovery

Thailand was officially recognised as free from AHS in May 2014 but following an outbreak, Thailand's "AHS-free country" status was suspended on 27 March 2020. In March 2023, the Commission reviewed Thailand's application for recovery of its AHS status and recommended the reinstatement of Thailand's AHS-free status.

6.2.1.2. Malaysia AHS status recovery

Malaysia was officially recognised as free from AHS in May 2013 but following an outbreak, Malaysia's "AHS-free country" status was suspended on 6 August 2020. The Commission reviewed Malaysia's application for recovery of its AHS status and recommended the reinstatement of Malaysia's AHS-free status.

6.2.1.3. Botswana FMD status recovery with the establishment of a containment zone

Zone 6b consisting of part of Francistown of Botswana was officially recognised as having an "FMD-free where vaccination is not practised" status, but following an outbreak, this status was suspended on 18 August 2022. The Commission reviewed Botswana's application for the establishment of a containment zone within Zone 6b, located in Bisoli North and concluded that the containment zone was compliant with Articles 4.4.7. and 8.8.6. of the *Terrestrial Code*. Subsequently, the "FMD-free zone where vaccination is not practised" status of the territory outside of the containment zone of Zone 6b was re-instated with effect from 03 March 2023.

6.2.2. Update on FMD status application of Republic of Korea (2022-2023 evaluation cycle)

The Commission was informed that following the notification of an outbreak of FMD in Cheongwon-gu, Cheongju-si in May 2023, the recommended recognition of the Republic of Korea's 'FMD-free country where vaccination is practised' (cf February 2023 report of the Commission) was no longer included in the relevant resolution for adoption at the last General Session.

6.3. State of play and prioritisation of expert mission to Members requested by the Commission

6.3.1. Follow-up of field missions

6.3.1.1. Malaysia FMD

Based on the review of the past annual reconfirmations and the recent change in FMD epidemiology (i.e., outbreak in Indonesia), the Commission had recommended a field mission to assess Malaysia's compliance with the relevant requirements of Chapter 8.8. of the *Terrestrial Code* for the maintenance of the FMD-free zonal status.

The Commission considered the detailed report of the FMD mission conducted in July 2023 and recommended the maintenance of Malaysia's FMD-free zonal status. The Commission commended the mission team for the thorough assessment undertaken in the limited time of the mission. The Commission also commended Malaysia for their continuous collaboration in WOAH activities and agreed with the recommendations provided in the report.

6.3.1.2. Türkiye FMD

Following a mission in Türkiye in June 2022 and the annual reconfirmation in November 2022, the Commission agreed with the maintenance of Türkiye's 'FMD-free zone where vaccination is practised'. Considering the recent change in FMD epidemiology in Türkiye (i.e., introduction of a new FMDV serotype SAT2 in Anatolia, FMD-infected zone), the Commission reviewed a list of questions proposed by the Secretariat to be sent to Türkiye for providing information during the upcoming annual reconfirmation campaign.

6.3.1.3. Other missions

The Commission considered and endorsed the detailed reports of another mission (Kazakhstan FMD and CSF) conducted in April 2023 to assess compliance by the country with the relevant provisions of the WOAH *Terrestrial Code* for reinstate of its official status. The Commission commended the mission team for the thorough assessment undertaken in the limited time of the mission, as well as the country for their continuous collaboration in WOAH activities. The Commission did not recommend the reinstatement of the status and the final reports accompanied by the Commission's recommendations were referred to the Member concerned.

6.3.2. State of play and prioritisation

The Commission reviewed and prioritised the missions for the maintenance of disease status and the endorsement of official control programmes to be undertaken, considering the priority issues identified by the Commission when reviewing the annual reconfirmations submitted in November 2022 as well as recent changes in the epidemiological situation in certain regions. The prioritised list of missions will be confirmed following consultation with the Director General of the WOAH.

6.4. Standards and procedures related to official status recognition

6.4.1. Update on the progress of activities subsequent to the adoption of Chapters 11.4. and 1.8. on BSE

The Commission was informed of the activities implemented by WOAH following the adoption of Chapters 1.8. and 11.4. of the *Terrestrial Code* at the General Session in May 2023:

- Publication of the years of recognition (at the bottom of the Official Disease Status webpage) of BSE risk status after Members' agreement on the year and status to be published.
- Publication of BSE surveillance guidelines on the General Information webpage, and their advertisement in the WOAH Bulletin (September issue).
- Update of the Official Disease Status and General Information webpages.
- Update of the Standard Operating Procedure for suspension/recovery of official status.

The Commission trusts that the aforementioned updates and developments will be useful to Members.

6.4.2. Form for the annual reconfirmation of the BSE risk status of Members

Further to the adoption of Chapters 1.8 and 11.4 of the *Terrestrial Code,* and the publication of the BSE surveillance guidelines, a draft BSE annual reconfirmation form prepared in consultation with BSE *ad hoc* Group experts was reviewed and endorsed by the Commission and is attached as **Annex 3** of this report. According to Resolution No. 20 adopted during the last General Session, Member's having an official BSE-risk status by WOAH should use this new form from November 2024 to reconfirm their status.

6.4.3. Non-compliance of Members having an official animal health status by WOAH with provisions of the *Terrestrial Code* for imports of commodities from countries not officially recognised as free by WOAH

At its February 2022 and 2023 meetings, the Commission discussed the issue of certain Members with an official animal health status (mainly for PPR and CSF and in some cases for AHS, CBPP and FMD) importing commodities from countries not officially recognised as free by WOAH for the respective disease without fully complying with the relevant provisions of the *Terrestrial Code* for importation from infected countries or zones.

The Commission took note that the rationale provided by Members in some cases was that legislation/regulation of regional economic or political unions was followed especially to facilitate movements of commodities between countries of the same region.

The Commission reiterated its recommendations from its previous meetings that all Members having an official animal health status should comply with the relevant requirements of the *Terrestrial Code* for importation from countries or zones with undetermined animal health status. In case alternative measures to the ones stipulated in the *Terrestrial Code* were followed, the Commission requested Members to provide scientific evidence that these measures achieve an equivalent level of risk mitigation in accordance with Chapter 5.3. which defines the principle of "equivalence of sanitary measures".

The Commission stressed that, considering that the procedure for the official recognition of animal health status by WOAH is voluntary, the responsibility lies with all Members benefiting from this procedure to either comply with WOAH standards or demonstrate that alternative measures in place provide a level of protection that is equivalent. The Commission encouraged Members to seek support from their regional bodies in this regard, if needed.

6.4.4. Development of the Official Status Management Platform

The Commission received an update on the development of the online platform dedicated to disease status management that is aimed to serve as a secure centralised system to archive, track, search, and submit all relevant dossiers related to the official recognition and maintenance of animal health status, and self-declarations of disease freedom. The Commission took note that the component of the platform dedicated to annual reconfirmations for maintenance of status was close to being finalised and expected to be launched for the annual reconfirmation campaign of 2023.

7. Global control and eradication strategies

7.1. Update on the FMD global situation and activities of the Reference Laboratory Network

Dr Donald King (WOAH FMD Reference Laboratory, Pirbright Institute, United Kingdom) updated the Commission on the activities of the WOAH/FAO FMD Reference Laboratory Network and on significant FMD-related events that occurred globally in recent years, with emphasis on the past 12 months.

Dr King noted that FMD continues to be endemic in much of Asia and Africa and due to the continuing long-distance movement of FMDV. One of the recent key events was the new FMD outbreaks due to serotype SAT2 in Middle East and North Africa and that this may be the first time that serotype SAT 2 has been detected in Iraq, Jordan and Türkiye. Whilst vaccine matching results (in vitro) are quite positive, he noted the uncertainty regarding the performance of the vaccine in the field; some in vivo studies were planned to take place before the end of 2023. Furthermore, as vaccination against serotype SAT2 is rare, there is potential for rapid spread.

Serotype O remains the dominant serotype. O/ME-SA/Ind-2001 continues to represent a potential source for future spread as the source of multiple escapes from Pool 2 with many events involving long distance spread.

Dr King highlighted that gathering information on the distribution of the FMD virus lineage in each of the seven pools of virus circulation is fundamental for vaccine matching in these regions and stressed the key role of the WOAH/FAO FMD Reference Laboratory Network in sharing field samples, sequences and information. He also mentioned about ongoing studies on vaccine selection for endemic pools, FMD vaccine testing to identify indicative responses on performance, and on the correlation between vaccine-induced antibodies and protection.

The Commission commended the FMD Reference Laboratory Network for their efforts.

7.2. Peste des Petits Ruminants. Global Control and Eradication Strategy

The Commission was informed on the recent activities of the PPR Global Control and Eradication Strategy (GCES).

The Commission was reminded that, with the first phase (2017-2021) of the PPR Global Eradication Programme (GEP I) having come to an end, the joint WOAH/FAO PPR Core Expert Team undertook to review and formulate the second phase of the PPR Global Eradication Programme (GEP II) having received feedback from all regions globally in the period 2021-2022. The draft was subjected to review by PPR experts, as well as social economic and gender experts, the PPR Advisory Committee, key donors and other stakeholders. The finalised draft was validated by the joint management of WOAH and FAO. The short version of the document **"Overview of the Plan of Action: Peste des Petits Ruminants Global Eradication Programme II & III - Blueprint"** was launched on 4 November 2022 in Rome and the longer one is under preparation for publishing.

On the sidelines of the launch of the PPR GEP II & III Blueprint, the 5th Advisory Committee meeting was held in Rome on 2–3 November 2022 and made several recommendations touching GEP Blueprint and episystem approach, as well as Advisory Committee leadership and terms of reference.

Following the launch of the PPR GEP II and III Blueprint, the joint FAO/WOAH PPR Secretariat organised PPR Blueprint and roadmap consultation meetings for the countries of the Economic Cooperation Organisation/Eurasia (25-27 April 2023, Baku, Azerbaijan), Intergovernmental Authority on Development (IGAD)/Eastern Africa (3-5 May 2023, Kampala, Uganda) and South Asia (7-13 May 2023, Paro Bhutan). Prior to these meetings, the PPR Regional Advisory Group of each region was trained on its roles and responsibilities with regard to the new PPR Monitoring and Assessment Tool and its guidelines through webinars.

In addition, the following PPR related meetings were organised by WOAH or jointly with FAO:

- The fifth PPR Global Research and Expertise Network (GREN) meeting was held from 7 to 9 December 2022 in Montpellier, France;
- A Workshop for the technical enrichment and alignment of the phase II document of the national plan for the control and eradication of PPR in Cameroon was held from 19 to 23 December 2022, in Edea, Cameroon;
- A meeting was held on 8 March 2023 for the finalisation of the WOAH Twinning Project on PPR between the national laboratory of Senegal (ISRA/LNERV) and CIRAD;
- The Fifth PPR Vaccine Producers Workshop was held from 27 to 30 April 2023 in Ahmedabad, India;
- A meeting to discuss the North Africa PPR strategy was held on 21 June 2023 in Ioannina, Greece. This is the first regional strategy being revised with the aim to be aligned to the PPR GEP II and III Blueprint;
- The PPR and Lumpy Skin Disease meeting for East Asia was organised by WOAH from 24 to 26 July, in Qingdao, China. An item on Standing Group of Experts on ASF was also included in the agenda of the meeting.

The Commission was further informed that, following the finalisation of the revised PMAT in December 2022, the tool is in the process of being edited for publishing. The development of a digitised version of the tool and of PMAT training e-modules has also been initiated.

Finally, the Commission was informed that the EC Directorate General for International Partnerships (DG INTPA) has pledged to support the Panafrican PPR eradication Programme. In this regard, an Action Document was jointly developed by AU-IBAR, WOAH and FAO for the first phase of funding and submitted to the EC for its approval.

The Commission noted that, despite the numerous meetings organised, little progress has been achieved to date by Members with some having moved from stage 1 of the stepwise approach to stage 2 but none having managed to eradicate the disease. For the next update, the Commission requested the Secretariat a presentation of measurable indicators on the progress achieved. The Commission noted that the need for improving the management and monitoring of the implementation of the programme, to enhance its effectiveness, was identified during the development of the PPR GEP II & III Blueprint, which envisages the establishment of an updated Monitoring and Evaluation Framework with revised indicators to improve accountability and reporting of the impact of the programme.

7.3. Avian Influenza. Global Control Strategy. Animal health forum. OFFLU

In light of the ongoing global avian influenza crisis, WOAH hosted its first Animal Health Forum (AHF), fully dedicated to the disease during WOAH's recent 90th General Session. The Technical Item titled 'Strategic Challenges in the Global Control of High Pathogenicity Avian Influenza' presented at the event set the stage for the AHF, and WOAH Members adopted the Resolution N.28 which will serve as a basis for shaping future avian influenza control activities. The Resolution underscores the importance of Members respecting and implementing WOAH international standards to effectively combat avian influenza.

The Commission was updated on the WOAH avian influenza framework that was being developed to implement the Resolution. The framework defines the activities, outputs and expected outcomes for the next two years to address the strategic challenges in the global control of HPAI that were discussed during the 90th WOAH General Session. This framework was been developed in consultation with the WOAH scientific network, the technical departments at headquarters and regional and Sub-regional offices.

The Commission was updated on OFFLU (Joint WOAH-FAO Network of Expertise on Animal Influenza) activities. OFFLU experts participated in multiple technical meetings, conducted risk shared important data with the scientific community and policy makers. The network released scientific statements to address emerging animal influenza threats which include statement on high pathogenicity avian influenza caused by viruses of the H5N1 subtype, avian influenza events in mammals and cats. The Commission was briefed on OFFLU's contribution to the February 2023 WHO Consultation on the Genetic and antigenic characteristics of zoonotic influenza A viruses and development of candidate vaccine viruses for pandemic preparedness. The network provided sequence data gathered from laboratories in Europe, Asia, Africa, Oceania, and the Americas. For the avian influenza report, the network collected 795 avian influenza virus sequences of H5, 34 of H7, and 305 of H9 subtypes. Additionally, for the swine influenza report it gathered 69 swine influenza virus sequences of H1 and 7 of H3 from WOAH Reference Centres, national veterinary laboratories, and research networks via the OFFLU network.

An OFFLU avian influenza matching (AIM) initiative is underway to provide information on the real time antigenic characteristics of contemporary avian influenza viruses is underway. This information will facilitate selection of appropriate vaccines for poultry and updating of poultry vaccine antigens in places where vaccines are being used. A report presenting the results of the pilot project will be made available to stakeholders in October 2023 and networking and expanding the geographical reach of this project with select partners is ongoing. The OFFLU wildlife technical activity have been sharing data and offering support to countries and working close with their local public health counterparts to track and monitor risk in response to the H5 mammalian spill overs experienced throughout 2022 and 2023. OFFLU experts released statements to update the H5N1 events in wild birds in the Americas and the Europe and also contributed to the Scientific task force on avian influenza and wild birds statement.

Finally, the Commission was updated on the progress of updating the GF-TADS avian influenza global strategy. The strategy is expected to be a short high-level document presenting the background, objectives, theory of change and the governance that rely on strong involvement at regional level. The strategy's purpose is to guide and create a global coordination framework to support regional and country action plans dedicated to the prevention and control of HPAI. The final version of the strategy is expected to be available by the end of the year.

The Commission commended the various activities presented to address the current global avian influenza crisis. The Commission supported the idea of developing guidance for surveillance in vaccinated populations and the implementation of vaccination, zoning and compartmentalisation. The Commission mentioned the importance of providing guidance to Members in the selection of vaccines. The Commission believed that the outcomes of the animal health forum and the adopted resolution will pave the way forward for shaping future avian influenza control activities and Members respect and implement WOAH international standards to effectively combat the disease.

7.4. African swine fever. Global Control Initiative

The Commission was updated on the activities conducted under the Global Initiative (GI) for the Control of African swine fever (ASF), noting that the GI is managed by the FAO and WOAH under the GF-TADs. The responsibility for chairing the GF-TADs ASF Working Group alternates annually between FAO and WOAH, with FAO holding this position for the upcoming year (July 2023 to June 2024).

At the level of the ASF Working Group, a significant activity was the launch of the Global Coordination Committee for ASF (GCC ASF), aimed at strengthening inter-regional cooperation and dialogue on ASF prevention and control and strengthen relevance of the GI through sharing of good practices and lessons learnt, discussion on key developments and provide advice to the ASF Working Group. The inaugural meeting was held on 23 May 2023 at the sidelines of the 90th WOAH General Session. Priority areas identified in common across the regions were: biosecurity on smallholder farms, the impact of wild pigs on disease epidemiology, issues around the use of illegal vaccines and provision of information on quality and safety of vaccines and transparency of the ASF situation and exchange of information. The Chairs of the GF-TADs Regional Steering Committees had agreed that the meeting was a useful

mechanism to exchange information and expertise, and committed to continuing meeting yearly at the margins of the WOAH General Session, with the option for virtual meetings where necessary.

The Commission was informed that under a Cooperative Agreement between the WOAH and the Agricultural Research Service of the United States Department of Agriculture (USDA-ARS), the engaged consultant has concluded his work in the drafting of guidelines for the manufacture and development of safe and efficacious ASF vaccines. The first product, a review of current approaches in ASF vaccine development may be found here. The second product, a set of guidelines on the manufacture of safe and efficacious ASF vaccines have been developed after a series of surveys, in-person exchanges with subject matter experts, five technical workshops, including one with key vaccine regulatory bodies. This set of guidelines have been drafted in the form of standards for *Terrestrial Manual* Chapter 3.9.1. African swine fever, and have been shared with the ASF Reference Laboratory Network for comments. The guidelines were presented to the Biological Standards Commission at its September 2023 meeting for its consideration. See the September 2023 report of the Biological Standards Commission for more information.

The Commission was also informed that the WOAH had piloted a methodology for WOAH PVS Evaluation with ASF specific content mission to allow Members the option of submitting to a specific evaluation on the strengths and weaknesses in the prevention and control of ASF whilst undergoing a PVS Evaluation.

At the regional level, the Commission noted that regional Standing Groups of Experts (SGE) continue to be organised in the Africa, Asia-Pacific and Europe regions, and an upcoming meeting is planned for the Americas region.

7.5. Bovine tuberculosis. Global Strategy for zoonotic tuberculosis. Guidelines for alternative strategies for the control of *Mycobacterium tuberculosis* complex infection in livestock

The Commission was updated about the recommendations of the WOAH *ad hoc* Group on Alternative Strategies for the Control and Elimination of Mycobacterium tuberculosis complex infection in livestock on identifying actionable strategies to control tuberculosis (TB) in livestock other than by test and slaughter.

Based on the *ad hoc* Group recommendations, the Commission was informed about the WOAH consultancy project to develop guidelines for alternative control strategies. These guidelines would be generated after eliciting science-based opinions from experts and community members through literature reviews, surveys, and focus group discussions. This project would also contribute towards the priority areas identified by the *ad hoc* Group.

The Commission supported the initiative and recommended WOAH to assess the burden of bovine tuberculosis in the mycobacterium tuberculosis complex (MTBC). The Commission also suggested adding information about new tools used to diagnose MTBC in these guidelines.

The Commission nominated a member to follow the work on TB and to participate as an observer at the next WOAH *ad hoc* Group meeting on Alternative Strategies for the Control and Elimination of mycobacterium tuberculosis complex infection.

8. Liaison with other Commissions and Departments

8.1. Terrestrial Animal Health Standards Commission (Code Commission)

The Commission was updated on relevant ongoing activities of the Code Commission, including the development of a framework for Terrestrial Code standards to serve as reference for those revising or developing a new chapter. In terms of prioritising *Terrestrial Code* chapters for revision, the Commission highlighted that sheep and goat pox is an emerging issue that requires expert opinion and regional engagement to assess whether existing Chapter 14.9. is still fit-for-purpose, noting that the chapter has not been revised since adoption in 1986.

8.2. Biological Standards Commission

The Commission and the Biological Standards Commission both have responsibilities in the ongoing work on develop of case definitions, and in the assessment of pathogenic agents against the criteria for listing in Chapter 1.2. of the *Terrestrial Code*. At this meeting, the Commission considered the Biological Standards Commission's opinion on two proposed case definitions (see items 9.3.2.1. and 9.3.2.3.).

9. Disease control: specific issues

9.1. Emerging diseases

9.1.1. Annual re-assessment of emerging disease: infection with SARS-CoV-2

The Commission noted that infection with SARS-CoV-2 was considered an emerging disease for the purpose of notification to WOAH since 2020. In accordance with point 5.1 of the Standard Operating Procedure for determining whether a disease should be considered as emerging, the Commission was asked to recommend if, based on new evidence, the disease should be assessed against the listing criteria of WOAH *Terrestrial Code* Chapter 1.2., or (if not) confirm that the disease should be maintained as emerging for the purpose of notification to WOAH.

The Commission noted since the onset of the pandemic, multiple animal species including cats, dogs, ferrets, fruit bats, mink, pigs, rabbits and white-tailed deer were reported to be naturally infected with SARS-CoV-2. With the exception of transmission observed in farmed minks and white-tailed deer, there have been no evidence of animal-human or animal-animal transmission in the other species of animals. However, so far in 2023, the number of reports of infections in animals, including farmed mink has been less than in the previous years.

The Commission noted that the primary purpose of listing is to assist Members in implementing effective measures to prevent the transboundary spread of diseases. The Commission also noted that animals do not seem to play a significant role in the global transmission of SARS-CoV-2. In addition, the Commission did not consider there was a need to recommend specific risk mitigation measures beyond basic hygiene measures and farm biosecurity when handling susceptible animals to mitigate any potential risk of transboundary spread. Thus, subjecting SARS-CoV-2 to the listing criteria may not be appropriate with the current knowledge, as it would not meet this overall objective of listing.

Nonetheless, taking into account the massive consequences arising from the SARS-CoV-2 pandemic, the potential for virus mutations and the recommendations of the World Health Organization to continue with surveillance in animals, the Commission advised that SARS-CoV-2 should remain an emerging disease of animals at this current time and to continue to monitor the situation and evidence that may arise in the next 12 months. The Commission would include this point for discussion at its September 2024 agenda.

9.2. Evaluation of pathogenic agent against the listing criteria of *Terrestrial Code* Chapter 1.2.

9.2.1. Equine encephalitides

At the September 2022 and February 2023 meetings, both the Commission and the Code Commission agreed to assess the following four equine encephalitides against the listing criteria before discussing the approach to reviewing the corresponding chapters in the *Terrestrial Code:* Chapter 8.10. Japanese encephalitis, Chapter 12.4. Equine encephalomyelitis (Eastern and Western) and Chapter 12.11. Venezuelan equine encephalomyelitis.

At this meeting, the Commission reviewed the assessments by subject-matter experts.

Japanese encephalitis (JE)

The Commission agreed with the experts that international spread of the pathogenic agent has been proven and that criterion 1 has been met. Japanese encephalitis is an arbovirus with a natural life cycle involving birds as reservoir hosts, with humans and horses as dead-end hosts and pigs as amplifying hosts. The Commission agreed with the assessment that criterion 2 has been met, as cases of JE are localised to the Asia-Pacific region and there are countries with official programmes in place to control and prevent the spread of the agent. The Commission further agreed that criteria 3 and 4 (4a and 4b) have been met. The Commission also took note of experts' recommendation that horses are dead-end hosts, and as such should not be subject to trade restrictions in Chapter 8.10. of the *Terrestrial Code*, although surveillance in horse populations should be maintained. The Commission also noted that recommendations should cover the movement of live pigs, given that they act as amplifying hosts.

The Commission therefore, agreed with the experts that JE should remain listed. The report of the experts may be found in **Annex 4** (English report only)**.**

Eastern (EEE) and Western equine encephalitis (WEE)

The Commission noted that one expert did not agree that criteria 1 and 2 have been met, with the rationale that there has not been any historical precedent confirming global spread as the disease is limited to Western Hemisphere (criterion 1), and he was unaware of any country, zone or compartment in the Western Hemisphere with a history of endemicity for EEE or WEE that has recovered and demonstrated freedom (criterion 2). The Commission also noted the opinion of the same expert that natural spread mechanisms involve the movement of migratory birds and mosquitoes, and management of such transmission pathways is outside the realm of what could be considered logistically feasible by Veterinary Authorities.

The Commission agreed with the other two experts that criteria 1 and 2 have been met and clarified that criterion 1 would be satisfied if vectors and live animals, in this case mosquitoes and birds respectively, are involved in the international spread of the virus, even if the movement of mosquitoes and wild birds was outside the control of Veterinary Authorities. The Commission considered that wild birds are a natural reservoir and play a direct role in the maintenance of enzootic cycles and are a source of virus for mosquitoes. The Commission also considered that criterion 2 has been met as countries outside the Western hemisphere were free, and control programmes are in place within countries in the Western hemisphere, both infected and free, for control and prevention.

The Commission further agreed with the experts that criteria 3 and 4 have been met, and supported the continued listing of EEE and WEE. The report of the experts may be found in **Annex 5** and **Annex 6**.

Venezuelan equine encephalomyelitis

The Commission agreed with all the experts the VEE should continue to be listed. The Commission agreed that criteria 1 and 2 have been met, as the virus has been shown to spread to other countries, which is postulated to be through wind-borne carriage of infected mosquitoes and infected equids, and the virus is largely confined to the Western hemisphere, and control programmes are in place in several countries for prevention and control.

The Commission considered the opinion of experts that only the epizootic subtypes 1AB and 1C should be listed, and requested this to be explored further by the *ad hoc* Group which would be convened to develop and review these chapters. The Commission noted that it would be important to clarify whether the epizootic feature of these subtypes is a function of the host status or a natural feature of the virus.

The Commission further agreed that criteria 3 and 4 have been met, and supported the continued listing of VEE.

The report of the experts may be found in **Annex 7**.

The opinion of the Scientific Commission on the listing of the above encephalitides was forwarded to the Code Commission.

9.2.2. Theileria orientalis (Ikeda and Chitose)

At its February 2023 meeting, the Commission had requested the Secretariat to refer comments raised by a Member regarding the continued listing of *T. orientalis* (Ikeda and Chitose) to the experts who conducted the listing assessment. This was in response to a comment made by the Member at the time of adoption of Chapter 11.10. Infection with *Theileria annulate*, *T.orientalis* and *T.parva* during the 89th General Session in May 2022 that *T.orientalis* should be delisted.

Regarding the Member comment that *T. orientalis* (Ikeda and Chitose) have a worldwide distribution and therefore would not meet point 2 of Article 1.2.2. of the *Terrestrial Code,* the Scientific Commission agreed with the experts that the geographic distribution of these genotypes were limited to Asia-Pacific and Southern Asia. The experts had also noted that the papers cited by the Member do not report a worldwide distribution for these genotypes.

In response to the Member comment that *T. orientalis* (Ikeda and Chitose) do not have the ability to transform leukocytes of host animals to allow infected cells to proliferate indefinitely and therefore was not of the same pathogenicity as the other listed genotypes *T. annulata* and *T. parva*, the experts considered that even if these genotypes were not 'transforming', they were nevertheless still pathogenic and have been described to cause outbreaks in cattle. The experts did not agree with the Member that there is limited information on outbreaks from *T. orientalis*, or that *T. orientalis* (Chitose) has a variant subpopulation with questionable pathogenicity, noting evidence of studies that suggest the Chitose genotype may directly cause clinical disease and reiterated papers from its previous assessment demonstrating the impact from *T. orientalis* (Ikeda and Chitose).

The Commission agreed with the experts that there is significant evidence of clinical signs, pathogenicity and economic losses associated with *T. orientalis* (Ikeda and Chitose) infection, and therefore supported the continued listing of *T. orientalis* (Ikeda and Chitose).

The report of the experts and supporting literature may be found in **Annex 8** (English report only).

The opinion of the Scientific Commission on the listing of *Theileria orientalis* (Ikeda and Chitose) was forwarded to the Code Commission.

9.3. Development of case definitions

9.3.1. Case definition process and progress update

The Commission received an update on the status of case definitions under development and noted the efforts by the Secretariat to also seek feedback from the Biological Standards Commission on the proposed case definitions and extended its appreciation to the Biological Standards Commission for its feedback.

9.3.2. Case definitions

9.3.2.1. Infestation with Old World and New World Screwworms

The Commission reviewed the draft case definition prepared by the experts, along with the accompanying technical report and the Biological Standards Commission opinion on the case definition.

The Commissions noted the suggestion from one expert on using the term 'myiasis' and was of the opinion that 'myiasis' or 'infestation' could be applicable, however the existing WOAH convention was to use the term 'infestation'. The Commission agreed with the recommendation of the Biological Standards Commission to refer to the name of the pathogenic agent instead of 'New World Screwworm' and 'Old World Screwworm' and therefore proposed modifications to the draft case definition.

The Commission did not agree with the recommendation of the experts to exclude birds from the proposed case definition. The Commission considered that even though the frequency of reports of infestation in birds was low, birds, like mammals, host stages of the life cycle of screwworms, from which the larvae fall off and subsequently develop to adult flies, thereby perpetuating the life cycle of the parasite. In addition, screwworm myiasis in birds reflects the existence of fertile *Cochliomyia hominivorax* and *Chrysomya bezziana* flies in the locality which is important information in order that Members may take action to apply measures. Therefore, Members should notify the occurrence of screwworms in domestic and wild birds.

The Commission agreed with the diagnostic criteria proposed by the experts and noted that this was in line with the *Terrestrial Manual*. Due to the potential for conflict between the endorsed case definition and the *Terrestrial Code* Chapter 8.13. in terms of animal hosts, the case definition will be forwarded to the Code Commission and the Biological Standards Commission to inform their revisions as appropriate, to Chapter 8.13. of the *Terrestrial Code* and Chapter 3.1.14. of the *Terrestrial Manual*. The case definition will not be made available to Members on the WOAH website. However, the experts' report is annexed to this report as **Annex 9**.

9.3.2.2. Infection with Nairobi sheep disease virus (Nairobi sheep disease)

The Commission was informed that in the process of case definition development for Nairobi sheep disease virus (NSDV), the Secretariat had consulted an expert who queried the continued listing of NSDV, as it has limited impacts to animal health. The expert noted that the virus has been present in some localities without causing disease. The Commission was also informed that in the past ten years, no Member had reported the occurrence of NSD and there was a paucity of literature on NSD outbreaks in the last few decades.

The Commission discussed that although no significant outbreaks have been reported in the recent years, there is the potential for NSDV to cause outbreaks in naïve populations, through animal movements and ecological changes that could drive the expansion of the range of competent tick species.

Before making a decision on whether to proceed with case definition development for NSDV or to propose NSDV for an assessment against the listing criteria, the Commission requested the Secretariat to obtain more information from other experts in the field, namely where the virus is known to circulate.

9.3.2.3. Infection with Crimean-Congo haemorrhagic fever virus (CCHFV)

The Commission reviewed the draft case definition for infection Crimean-Congo haemorrhagic fever virus (CCHFV), which had been further refined by the lead expert and the Biological Standards Commission at this September 2023 meeting.

The Commission noted the clarification from the lead expert on the diagnostic protocols for serological evidence of active infection (option 3), including using two different serological tests each based on a different antigen for the detection of IgM antibodies given the potential for cross-reactivity, or by seroconversion based on a rise in total or IgG antibody titres on samples taken at two to four weeks apart. The Scientific Commission also noted that 'seroconversion' is defined in the Glossary of terms of the *Terrestrial Manual*.

The revised case definition was endorsed by the Commission and it advised to upload the case definition onto the WOAH website. The Commission advised Biological Standard Commission to clarify the test protocol for option 3 in the *Terrestrial Manual* Chapter.

The experts' report is provided as **Annex 10**. The opinion of the Commission was forwarded to the Code Commission.

The Commission was also requested to provide its opinion on the scope of a disease-specific chapter for CCHF and considered the report of the *ad hoc* Group on Crimean Congo haemorrhagic fever which met in February 2010. The Commission noted that whilst CCHF is not a priority disease for Veterinary Services given that animals do not develop clinical signs, it is a priority disease for the human health sector where infections of humans can result in the development of severe disease.

After reviewing the information in the report of the *ad hoc* Group, the Commission recommended that for the time being, the *Terrestrial Code* chapter should include an article with the case definition and a full chapter could be considered when there is further data on animal-human transmission. The Commission noted that Chapters 1.4 and 1.5. of the *Terrestrial Code* are relevant for Members conducting surveillance on CCHF, and advised the WOAH to include guidance on the surveillance for CCHF when developing surveillance guidelines for zoonotic haemorrhagic fevers.

9.3.2.4. Infection with Avian metapneumovirus (Turkey rhinotracheitis)

The Commission was informed that the Code Commission, at its February 2023 meeting, had requested for its clarification on some points in the case definition. At this meeting, whilst reviewing the comments from the Code Commission, the Commission noted that some information on the recommended diagnostic criteria was missing in the *Terrestrial Manual* chapter on avian metapneumovirus, and requested the Secretariat to seek clarification from the lead expert and the Biological Standards Commission.

The Scientific Commission will discuss the case definition at its next meeting in February 2024.

10. For Commission information

10.1. Update on the STAR-IDAZ International Research Consortium

The Commission was informed about the activities of the Global Strategic Alliances for the Coordination of Research of Major Infections Diseases of Animals and Zoonosis (STAR-IDAZ) International Research Consortium (IRC) and its Secretariat (SIRCAH2), co-hosted by WOAH.

The last IRC Executive and Scientific Committee (SC) met at ILRI, Nairobi, Kenya on 13 - 15 June 2023. Members shared information on their research activities and discussed how the IRC can improve its impact in advocating for STAR-IDAZ IRC and enlarge the network. Advocacy activities focused on increasing partners in underrepresented Regions had its start and 2 new partners joined recently the IRC. To facilitate engagement with industry and scale up from idea to product, it was agreed that STAR-IDAZ, trough SIRCAH 2 funding, could support participation of two selected applicants for the innovation spotlight sessions Discovery to Innovation in Animal Health (DIAH) Conference.

Updates on the following working groups activities were provided: Influenza, One Health, AMR and the Alternative to Antibiotics, ASF, Coronavirus, bovine tuberculosis , diagnostics, mycoplasmas, vaccinology, vector biology and disease transmission were discussed. Current identified priority topics remain important working areas for STAR-IDAZ IRC, moreover it was agreed to establish a WG on aquaculture. The focus of this WG should be determined by consultation within SC, funders and experts of this field. Further engagement has also been agreed with the Global Foot-and-Mouth Research Alliance (GFRA) and the Global African Swine Fever Research Alliance (GARA).

STAR-IDAZ Regional Networks (for Africa & the Middle East, the Americas, Asia & Australasia, and Europe) periodically facilitate regional cooperation and coordination among more than 50 countries around the globe, by identifying common research priorities in the Regions, opportunities for sharing resources including access to samples, specialised facilities, and expertise, and international or regional funding opportunities. The Africa and Middle East Regional Network met virtually on 1 August 2023, the next in person meeting is alongside the 13th International Veterinary Immunology Symposium (IVIS 2023) in Kruger, South Africa on 16 November 2023. The Americas Regional Network met on 17 March 2023 virtually and in person in Quito, Ecuador on 22 August 2023 with a focus on AMR and alternatives to antimicrobials. The Asia and Australasia Regional Network met virtually on 4 April 2023 and the next meeting will also be virtually in October 2023. The European Regional Network (operated through the SCAR CWG-AHW) met in Vienna, Austria on 4–5 May 2023. The next meeting will be held virtually in Autumn 2023.

The Commission acknowledged the challenges in maintaining and growing a global international consortium for animal health and highlighted the importance to reinforce Regional Networks to bring forward solutions for regional research priorities. Moreover, the Commission suggested engaging more with less active partners and find strategies to monitor impacts of the Consortium.

10.2. Update on the WOAH antiparasitic resistance activities

The Commission was updated on the work of the Electronic Expert Group (EEG) on Antiparasitic Resistance, which led to the publication of the document on 'Responsible and prudent use of anthelmintic chemicals to help control anthelmintic resistance in grazing livestock species'. The last meeting of EEG took place on 17 April 2023.

The implementation of the recommendations of the publication started in 2023. The publication was presented with a call for implementation to WOAH Members during the Focal Points Seminar for English-speaking countries in the African region from 5 to 7 September 2023, in Lilongwe, Malawi to identify Members that could participate in the pilot implementation phase.

The Commission was also informed of the work initiated by FAO on acaricide resistance management, which also involves WOAH and its Collaborating Centres for Veterinary Drug Regulatory Programmes (Food and Drug Administration, USA) and Veterinary Medicinal Products (ANMV, within the Agence Nationale Sécurité Sanitaire Alimentaire Nationale, France), with the objective to publish guidelines based on Community of Practice in 2025.

Noting that the work on antiparasitic activities largely applied to terrestrial animals, the Commission suggested including aquatic animals considering WOAH's focus on improving aquatic animal health and building more sustainable aquatic animal health systems under the WOAH Aquatic Animal Health Strategy. The Commission provided the Secretariat with a paper by Buchmann, K. (2022)[2], which could be useful reference.

10.3. Update on the Global Burden of Animal Diseases programme and the WOAH Collaborating Centre for the Economics of Animal Health

The Commission was updated on the progress of the Global Burden of Animal Diseases programme (GBADs). The objective of GBADs is to systematically assess the economic burden of animal diseases including net loss of production, expenditure, and trade impacts to improve investment decisions in the livestock and aquatic sectors as a result of the incorporation of standardised economic analysis and publication of data, analysis, and reports. Activities since February 2023 include (i) the submission of publications on the GBADs methods to peer-review journals; (ii) the second evaluation of the GBADs programme by an external independent reference group; (iii) the GBADs case studies in Ethiopia (proof-of-concept study), Indonesia (initial stages), Senegal (launched in September 2023); (iv) the establishment of the Collaborating Centre for the Economics of Animal Health (CCEAH) for the Americas; and (v) WOAH's expanded activities on the economics of animal health to include a project on the Economics of Antimicrobial resistance. The Commission encouraged GBADs to ensure that the approach designed is inclusive of the differences in economic realities and livestock systems in different countries.

10.4. Composition of the WOAH Editorial Board

WOAH Head of the Publications Unit explained the need to establish a new Editorial Board for WOAH's peer reviewed journal, the *Scientific and Technical Review*. Although the content is of high quality and robust editorial and reviewing processes are in place, the publication lacks governance to maintain its scientific credibility.

The Editorial Board will monitor and foster the quality and impact of the *Scientific and Technical Review* and will also advise on WOAH's overall publications strategy on request. The role of the Board will be mainly advisory but it will also participate in reviewing content occasionally and will attend two meetings per year.

[2] Buchmann, K. (2022). Control of parasitic diseases in aquaculture. *Parasitology*. 149 (14), 1985 - 1997

The Commission was asked to nominate a candidate for the Editorial Board who could commit to the role. Given that the mandate of the current Commission will end in May 2024, the term of the first nominated candidate will run until September 2024.

The Commission agreed that the creation of a new Editorial Board would be a positive step forward for WOAH's publications and agreed to nominate a member to be part of the board.

10.5. WOAH Standards Online Navigation Tool Project

The Commission was informed by the WOAH Standards Department of a project to develop a new WOAH Standards Online Navigation Tool. This project is an initiative to change how WOAH Standards are displayed and made available to Members and other users. The project will enhance the display of the *Aquatic Code*, *Terrestrial Code*, *Aquatic Manual*, and *Terrestrial Manual* on the WOAH website. The project will also comprise a specific tool aiming at providing specific search functions for the visualisation of sanitary measures recommended for the international trade of commodities for terrestrial animals. In addition, the new tool is expected to simplify the annual updating process of the content of the Standards.

The project is aligned with the goals of the 7th Strategic Plan (7SP) and will provide significant benefits for WOAH and its Members, including enhanced accessibility to WOAH Standards, efficiency in information retrieval, supporting lastly the implementation of WOAH Standards. The project will also bring gains to the organisation itself, by improving the efficiency of internal processes and the interoperability across various datasets related to WOAH Standards.

The Commission expressed interest and support for the project and recognised the importance of facilitating Members' access to achieve better understanding and use of WOAH Standards.

11. Programme and priorities

11.1. Update and prioritisation of the work plan

The Commission updated its work programme, identified the priorities, and scheduled the dates for the various *ad hoc* Group meetings, which will be accessible to Members through the WOAH website. The updated work programme is attached as **Annex 11**.

12. Adoption of the meeting report

The Commission adopted the report that was circulated electronically after the meeting

13. Date of the next meeting

The next meeting of the Commission is scheduled to take place between 12 and 16 February 2024.

14. Meeting Review

A meeting review was conducted in accordance with the Commission Performance Management Framework.

…/Annexes

Annex 1. Adopted Agenda

MEETING OF THE WOAH SCIENTIFIC COMMISSION FOR ANIMAL DISEASES

Paris, 11 to 15 September 2023

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1. Welcome

2. Meeting with the Director General

3. Adoption of the agenda

4. Terrestrial Animal Health Code

4.1. Member comments received for Commission consideration

4.1.1. Chapter 1.6. Procedures for official recognition of animal health status, endorsement of an official control programme, and publication of a self- declaration of animal health status, by WOAH

4.1.2. Chapter 8.8. Infection with foot and mouth disease virus

4.1.3. Chapter 12.1. Infection with African horse sickness virus

4.2. Other considerations

4.2.1. Chapter 1.11. Application for official recognition by WOAH of free status for foot and mouth disease

4.2.2. Chapter 14.8. Scrapie

5. *Ad hoc* and Working Groups

5.1. Meeting reports for consideration

5.1.1. *Ad hoc* Group on surra and dourine

5.1.2. *Ad hoc* Group on biosecurity

5.2. Planned *ad hoc* Groups and confirmation of proposed agendas

5.2.1. *Ad hoc* Group on the evaluation of AHS status: 28–29 September, 5 October 2023

5.2.2. *Ad hoc* Group on the evaluation of BSE risk status: 3–5 October 2023 (cancelled)

5.2.3. *Ad hoc* Group on the evaluation of official control programmes for dog-mediated rabies: 4 and 6 October 2023

5.2.4. *Ad hoc* Group on the evaluation of PPR status: 17–19 October 2023

5.2.5. *Ad hoc* Group on the evaluation of FMD status: 23–26 October 2023

5.2.6. *Ad hoc* Group on the evaluation of CSF status: 7–9 November 2023 (cancelled)

5.2.7. *Ad hoc* Group on the evaluation of CBPP status: 5–7 December 2023 (to be confirmed)

5.3. Meeting reports for information

5.3.1. WOAH Working Group on wildlife

6. Official animal health status

6.1. Annual reconfirmations for maintenance of status

6.1.1. Selection of status for comprehensive review of 2023 annual reconfirmations

6.2. Specific update on official animal health status

6.2.1. Update on situation of countries/zone with suspended status

6.2.2. Update on FMD status application of Republic of Korea (2022-2023 evaluation cycle)

6.3. State of play and prioritisation of expert mission to Members requested by the Commission

6.3.1. Follow-up of field missions

6.3.2. State of play and prioritisation

6.4. Standards and procedures related to official status recognition

6.4.1. Update on the progress of activities subsequent to the adoption of Chapters 11.4. and 1.8. on BSE

6.4.2. Form for the annual reconfirmation of the BSE risk status of Members

6.4.3. Non-compliance of Members having an official animal health status by WOAH with provisions of the *Terrestrial Code* for imports of commodities from countries not officially recognised as free by WOAH

6.4.4. Development of the Official Status Management Platform

7. Global control and eradication strategies

7.1. Update on the FMD global situation and activities of the Reference Laboratory Network

7.2. Peste des Petits Ruminants. Global Control and Eradication Strategy

7.3. Avian Influenza. Global Control Strategy. Animal health forum. OFFLU

7.4. African swine fever. Global Control Initiative

7.5. Bovine tuberculosis. Global Strategy for zoonotic tuberculosis. Guidelines for alternative strategies for the control of Mycobacterium tuberculosis complex infection in livestock

8. Liaison with other Commissions and Departments

8.1. Terrestrial Animal Health Standards Commission (Code Commission)

8.2. Biological Standards Commission

9. Disease control: specific issues

9.1. Emerging diseases

9.1.1. Annual re-assessment of emerging disease: infection with SARS-CoV-2

9.2. Evaluation of pathogenic agent against the listing criteria of *Terrestrial Code* Chapter 1.2.

9.2.1. Equine encephalitides

9.2.2. Theileria orientalis (Ikeda and Chitose)

9.3. Development of case definitions

9.3.1. Case definition process and progress update

9.3.2. Case definitions

10. For Commission information

10.1. Update on the STAR-IDAZ International Research Consortium

10.2. Update on the WOAH antiparasitic resistance activities

10.3. Update on the Global Burden of Animal Diseases programme and the WOAH Collaborating Centre for the Economics of Animal Health

10.4. Composition of the WOAH Editorial Board

10.5. WOAH Standards Online Navigation Tool Project

11. Programme and priorities

11.1. Update and prioritisation of the work plan

12. Adoption of the meeting report

13. Date of the next meeting

14. Meeting Review

Annex 2. List of Participants

MEETING OF THE WOAH SCIENTIFIC COMMISSION FOR ANIMAL DISEASES

Paris, 11 to 15 September 2023

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MEMBERS OF THE COMMISSION

Dr Cristóbal Zepeda
(President)
Regional Manager - Director
North America Region
USDA-APHIS-International Services
U.S. Embassy, Mexico City
MEXICO

Dr Trevor Drew
(Vice-President)
CSIRO Australian Centre for Disease Preparedness
AUSTRALIA

Dr Misheck Mulumba
(member)
Senior Manager Research
Agricultural Research Council
SOUTH AFRICA

Dr Kris De Clercq
(Vice-President)
Department of Infectious Diseases in Animals
Exotic and Vector-borne Diseases Unit
Sciensano
BELGIUM

Dr Silvia Bellini (Remote participation)
(member)
Staff Director
Istituto Zooprofilattico Sperimentale della Lombardia e dell'Emilia Romagna
ITALY

Dr Baptiste Dungu
(member)
Veterinary Specialist
Afrivet Business Management
SOUTH AFRICA

WOAH HEADQUARTERS

Dr Gregorio Torres
Head
Science Department

Dr Min Kyung Park
Head
Status Department

Dr Anna-Maria Baka
Disease Status Officer
Status Department

Dr Charmaine Chng
Deputy Head
Science Department

Dr Monal Daptardar
Scientific Coordinator
Science Department

Dr Natalie Moyen
Disease Status Officer
Status Department

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Annex 3. 6.4.2. Form for the annual reconfirmation of the BSE risk status of Members

MEETING OF THE WOAH SCIENTIFIC COMMISSION FOR ANIMAL DISEASES

Paris, 11 to 15 September 2023

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Specific period (cover a period of 12 months) *:

***** *Please make sure that the current "specific period" is directly consecutive with the previous reporting period (i.e., that there are no gaps, nor overlaps between this "specific period" and the one from last year's annual reconfirmation).*

	QUESTION	YES	NO
1.	Has the risk assessment for BSE in accordance with Article 11.4.3 been reviewed by the Competent Authority of the country/zone, through incorporation of documented evidence, in the past 12 months?	Please provide the conclusions of the review and any subsequent actions/updates that may have been taken.	Please explain why and provide the tentative date of completion of the review.
2.	a) Have there been any changes in the livestock industry practices during the specific period, as described under Point 1.b.i of Article 11.4.3., including any changes in auditing practices or any increase in non-compliances detected?	Please provide an updated description of the industry practices preventing bovines from being fed ruminant-derived protein meal, as per Point 1.b.i of Article 11.4.3. Please provide the rationale for the changes in auditing practices.	
	b) Have there been any changes to the BSE-specific risk mitigation measures (other than import requirements addressed under question 4b) during the specific period, as described under Point 1.b.ii of Article 11.4.3., including any changes in auditing practices or any increase in non-compliances detected?	Please provide an updated description of specific risk mitigation measures preventing bovines from being fed ruminant-derived protein meal. Please provide the rationale for the change in measures.	
3.	Have any modifications in the legislation regarding BSE (except for import requirements addressed in question 4b) been made during the specific period?	Please summarise the modification(s) made, highlighting their potential impact on BSE risk mitigation measures, including surveillance. Please explain how the updated legislation still aligns with Articles 11.4.4 and 11.4.5. Please provide the rationale for the change in legislation.	

QUESTION			YES	NO
4.	a) Have the following commodities been imported during the specific period? If yes, please indicate the quantities imported during that period by commodity and origins in Table 1.	i. Bovines		
		ii. Ruminant-derived protein meal		
		iii. Feed (not intended for pets) that contains ruminant-derived protein meal		
		iv. Fertilizers that contain ruminant-derived protein meal		
		v. Any other commodity that either is, includes, or could be contaminated by commodities listed in Article 11.4.15.		
	b) Have there been any changes to the import requirements of the following commodities during the specific period?	i. Bovines	Please summarise the modifications, the rationale for the changes, and highlight their potential impact on BSE risk mitigation measures. Please describe how the updated legislation is still aligned with Articles 11.4.3. and 11.4.4.	
		ii. Ruminant-derived protein meal		
		iii. Feed (not intended for pets) that contains ruminant-derived protein meal		
		iv. Fertilisers that contain ruminant-derived *protein meal*		
		v. Any other commodity that either is, includes or could be contaminated by commodities listed in Article 11.4.15.		
5.	a) Has the surveillance programme continued to report and test all animals that show signs on the clinical spectrum of BSE during the specific period, as described under Points 1 & 2 of Article 11.4.20.?		Please provide supportive information by completing Table 2.	Please describe why the system has not continued to report and/or test all bovines that show signs on the clinical spectrum of BSE during the specific period. In addition, please provide the corrective measures implemented/to be implemented and the timeline for implementation.
	b) Have the awareness and training programmes for the different stakeholder groups been implemented during the specific period as described under Point 3a of Article 11.4.20.?		Please provide a summary of the activities conducted, including the target audience.	Please describe why and provide the corrective measures and the timeline for implementation.
	c) Has BSE continued to be notifiable throughout the whole territory during the specific period (Point 3b of Article 11.4.20)?			Please describe why and provide the corrective measures implemented/to be implemented and the timeline for implementation.

	QUESTION	YES	NO
	d) Have all tests for BSE been conducted in accordance with the *Terrestrial Manual*? (Point 3c of Article 11.4.20)		Please describe why and provide the corrective measures implemented/to be implemented and the timeline for implementation.
	e) Is the surveillance system still supported by robust, documented evaluation procedures as listed in Point 3d of Article 11.4.20?	Please provide a summary of these procedures and, if applicable, non-compliances and subsequent corrective measures.	Please describe why and provide the corrective measures implemented/to be implemented and the timeline for implementation.
6.	a) Have any cases of atypical BSE occurred during the specific period?	Please include the number of cases and how the cases were identified. Please also provide documented evidence that the case was atypical and assurance that it wasn't recycled (i.e. that measures were taken to ensure that all detected cases have been completely destroyed or disposed of to ensure they did not enter the feed or food chain, as per point 4 of Article 11.4.4.)	
	b) Have any cases of classical BSE occurred during the specific period?	Please attach the final epidemiological investigation report that was provided to WOAH further to the notification. Please describe any measures that may have been taken to avoid reoccurrence. Please describe the measures taken to ensure that all detected cases have been completely destroyed or disposed of to ensure they did not enter the feed or food chain, as per point 4 of Article 11.4.4.	
7.	Have any changes in the epidemiological situation or other significant events occurred during the specific period?	Please describe the "significant event(s)" and any significant changes in the epidemiological situation and the actions taken in response to such events/changes.	

Table 1. Record of imports since your last submission (cover a period of 12 months). Specific period (check one of the boxes below):

☐ same as period at the top of the form

☐ different, if so, please specify:

***** *Please make sure that the current "specific period" is directly consecutive with the previous reporting period (i.e. that there are no gaps, nor overlaps between this "specific period" and the one from last year's annual reconfirmation).*

Describe bovines, ruminant-derived protein meal and other commodities imports from all countries in this table.

Country of origin of import	Commodity and quantity									
	Bovines		Ruminant-derived protein meal		Feed (not intended for pets) that contains ruminant-derived protein meal		Fertilizers that contain ruminant-derived protein meal		Any other commodity that either is, includes, or could be contaminated by commodities listed in Article 11.4.15.	
	Number of animals	Intended use	Amount	Type of commodity (+)	Amount	Type of commodity (+)	Amount	Type of commodity (+)	Amount	Type of commodity (+)

(+) Specify the type and intended use of feedstuff or species composition of ingredients

Table 2. Record surveillance conducted since your last submission (cover a period of 12 months).
Summary of all bovines with clinical signs suggestive of BSE that were reported and evaluated by the Veterinary Services.

Specific period (check one of the boxes below):

☐ same as period at the top of the form

☐ different, if so, please specify:

Provide the adult bovine population size (24 months and older):

Clinical presentation (See Point 2 of Article 11.4.20)	Number reported	Number tested for BSE
Bovines displaying progressive clinical signs suggestive of BSE that are refractory to treatment and where the presentation cannot be attributed to other common causes of behavioural or neurological signs		
Bovines showing behavioural or neurological signs at antemortem inspection at slaughterhouses/abattoirs		
Bovines presented as downers (non-ambulatory) with an appropriate supporting clinical history (i.e., the presentation cannot be attributed to other common causes of recumbency)		
Bovines found dead (fallen stock) with an appropriate supporting clinical history (i.e., the presentation cannot be attributed to other common causes of death)		

Annex 4. 9.2.1. Listing Assessment for Equine Encephalitides (JEE)

MEETING OF THE WOAH SCIENTIFIC COMMISSION FOR ANIMAL DISEASES

Paris, 11 to 15 September 2023

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SUMMARY OF THE EXPERT ASSESSMENT OF JAPANESE ENCEPHALITIS AGAINST THE LISTING CRITERIA OF *TERRESTRIAL CODE* CHAPTER 1.2.

Three experts participated in this consultation:

- **Peter Timoney** (IHSC Consultant, Gluck Equine Research Center, USA)
- **Ann Cullinane** (Irish Equine Center, Ireland)
- **Alf Fussel** (IHSC Consultant, retired from European Commission, Belgium)

Criterion	1	2	3
Criterion 1: International spread of the pathogenic agent (via live animals or their products, vectors or fomites) has been proven.	YES	YES	YES
Criterion 2: At least one country has demonstrated freedom or impending freedom from the disease, infection or infestation in populations of susceptible animals, based on the provisions of Chapter 1.4.	YES	YES	YES
Criterion 3: Reliable means of detection and diagnosis exist, and a precise case definition is available to clearly identify cases and allow them to be distinguished from other diseases, infections or infestations.	YES	YES	YES
Criterion 4a: Natural transmission to humans has been proven, and human infection is associated with severe consequences.	YES	YES	YES
Criterion 4b: The disease has been shown to have a significant impact on the health of domestic animals at the level of a country or a zone taking into account the occurrence and severity of the clinical signs, including direct production losses and mortality.	YES	YES	NO
Criterion 4c: The disease has been shown to, or scientific evidence indicates that it would, have a significant impact on the health of wildlife taking into account the occurrence and severity of the clinical signs, including direct economic losses and mortality, and any threat to the viability of a wildlife population.	YES	NO	NO
CONCLUSION: Does infection with Japanese encephalitis virus match the listing criteria that are described in the Terrestrial Animal Health Code Chapter 1.2?	YES	YES	YES

Assessment for Japanese Encephalitis: Peter Timoney

The criteria for the inclusion of a disease, infection or infestation in the WOAH list are as follows:

1) International spread of the pathogenic agent (via live animals or their products, vectors or fomites) has been proven.

Yes ☒ **No** ☐

Scientific rationale:

First described in Japan in 1871, Japanese encephalitis (JE) occurs across a wide swath of countries in East, South and Southeastern Asia and the Western Pacific (World Health Organization, 2015; NHS-UK, 2019). A source of increased concern has been the expanding geographic distribution of the disease that has taken place over the past several decades. The causal virus has spread westward into Nepal and Pakistan, and eastward into Papua New Guinea and islands to the north of Australia (Mackenzie, 1998; Mackenzie et al., 2002).

JE is an arboviral disease of humans, equids and pigs and certain other domestic species. The natural life cycle of JE virus involves wading and water birds especially Ardeid species such as herons and egrets as reservoir hosts. Unlike pigs, humans and equids are dead-end or tangential hosts that fail to develop viremias of sufficient magnitude to infect mosquitoes competent to transmit the infection. Pigs on the other hand, develop significant viremias and act as important amplification hosts of the virus (Scherer et al., 1959).

In countries in which JE is endemic, outbreaks of encephalitis in equids due to this virus tend to coincide with seasonal occurrences of the disease in humans. Frequency of the disease in equids has been reduced very significantly in countries practicing annual vaccination.

There can be no doubt from the ever-widening global distribution of JE within the past 30-40 years, that international spread of the causal virus has taken place between countries in Asia and the Western Pacific on various occasions. The likelihood is that such incursions have arisen following wind-borne carriage of the disease agent via infected mosquitoes from an endemic country or countries (Ellis et al., 2000; Ritchie and Rochester, 2001). Changes in climate, destruction of natural habitats and other factors can bring about changes in vector distribution and relocation to new regions or countries (Connor and Bunn, 2017). There is no documented evidence in support of an alternative explanation associating these events with the movement of animals, animal products, or the transfer of fomites or people. The most recent instance exemplifying international spread of JE virus was a report of an increased incidence of reproductive problems on commercial breeding pig farms in the states of Queensland, New South Wales, and Victoria, Australia in February 2022. Investigation of cases of stillbirths, weak piglets and neonatal deaths led to confirmation of a diagnosis of JE infection (Australian Government Department of National Pest & Disease Outbreaks, March 2022). South Australia was added to the number of known affected states in early March 2022. This was the latest but not the first incursion of JE virus either onto some of the islands of the Torres Strait in 1995 (Hanna et al., 1996) or Cape York Peninsula on the Australian mainland in 1998 (Hanna et al., 1999). Subsequent surveillance studies provided serologic evidence that JE virus had been circulating in the feral and domestic pig and cattle populations in Northern Australia.

By April 2022, JE virus had been detected in 73 pig farms across the four afore-mentioned states (WHO Outbreak News, 2022). In light of the known distribution of the disease in the affected states and the fact that it is very probable that the virus continues to circulate in the feral pig population in Northern Australia, the Veterinary Authorities are now considering JE as an endemic disease and at least for the time being, no longer a transboundary disease in the affected states.

In summary, in the author's opinion, international spread of JE virus has taken place on at least several occasions since the 1990s, either to islands in the Torres Strait in 1995 or to the Australian mainland as identified on the Cape York Peninsula in 1998 and most recently in early 2022. Such incursions likely arose following wind-borne carriage of the virus via infected mosquitoes from an endemic country, possibly Papua New Guinea. This provides the proof needed to meet Criterion 1 required for listing in the *Terrestrial Code*.

AND

2) At least one country has demonstrated freedom or impending freedom from the disease, infection or infestation in populations of susceptible animals, based on the provisions of Chapter 1.4.

Yes ☒ **No** ☐

Scientific rationale:

Regarded as an emerging disease of international concern because of its expanding encroachment into previously non-endemic regions, JE is considered a very significant human and equine pathogen. Countries long affected by the disease

have resorted to vaccination as an effective strategy for reducing the incidence of clinical disease and losses attributable to the virus. Official programs to control and prevent the spread of JE have been implemented by various countries including but not necessarily exclusive of: Japan (Nakamura, 1972); Singapore (Loke, 1981; Ismail, 1989); China (Huang, 1982); Malaysia and Hong Kong (Ellis et al., 2000). While the majority of programs have emphasized vaccination of at-risk susceptible human and equine populations, some have been expanded to include additional strategies aimed at vector control, limiting exposure of equids to infected mosquitoes, and very importantly, limiting amplification of JE virus in pigs. Because of JE's zoonotic significance, Public Health and Veterinary Authorities need to work in concert at all levels in striving to prevent this disease in human populations. Although the focus of these programs has been on prevention and control of JE, to the author's knowledge, none of the countries concerned have as yet been in a position to eliminate this virus and declare country freedom from the disease. The challenge is especially daunting for countries in which the sylvan cycle of the virus has become established or where there is a significant risk of periodic reintroduction of virus from neighboring countries where the disease is also endemic.

Prior to the latest discovery of JE in southeastern Australia in early March 2022, the Veterinary Authorities had formulated a plan many years earlier detailing measures that ought to be taken in the event of an incursion of JE into the country (Agriculture and Resources Management Council of Australia and New Zealand, 1998). In light of the current situation, the Australian government has declared the multistate outbreaks of JE a Communicable Disease Incident of National Significance (Australian Government Department of Health, May 2022). JE is a notifiable disease in both humans and animals in Australia. Of primary importance in controlling future spread of the disease is to develop and implement a national surveillance plan to determine the area(s) and extent to which JE virus is circulating in the country. Emphasis is being placed on piggeries and mosquitoes because of their significance in amplification and transmission of the virus. This will likely present a major logistical challenge considering the very extensive land area involved. While JE vaccine(s) is/are available for immunization of human at-risk groups, no vaccines for animals are currently registered for general use in Australia (WHO Outbreak News, April 2022). A vaccine for use in horses being exported to a JE endemic country will hopefully be approved for use domestically by horse owners to protect their animals. Furthermore, there is an urgent need to develop a vaccine for use in pigs because of their major role in amplification and spread of the virus. An Achilles heel in implementation of the surveillance program is the feral pig population in northern Australia. While this population can be logistically difficult to trace and sample, it is important to monitor since it can play a contributory role in the spread of JE virus.

Additional to targeted surveillance, such a plan should also emphasize strategies for reducing vector populations, especially in proximity to piggeries; restricting the movement and congregation of pigs and the potential for transfer of virus by viremic animals; limiting exposure of horses to the virus by accommodating them in screened barns from dusk to dawn; and more widespread use of insect repellents on at-risk horses (Ellis et al., 2000).

The National Plan that the Australian government has launched in response to the current JE situation in four southeastern states Queensland, New South Wales, Victoria, and South Australia, represents a highly comprehensive, well integrated approach to bringing this disease under control not only in the affected states, but also in the longer term on a national scale. It remains to be seen how effective these collective efforts will turn out and whether it will be possible to permanently eliminate the virus from the states in question. It would be very encouraging if it did. Success even at a state level would hopefully augur well for accomplishing disease freedom on a much wider scale, even perhaps at a national level. As it currently stands, given time, Australia has the potential to comply with the requirements to be considered free from JE, in accordance with the surveillance principles outlined in Chapter 1.4 of the *Terrestrial Code*. Only time will tell what the eventual outcome will turn out to be at the state and national level.

In summary, the author considers that Australia, among a number of other countries, measures up to the basis for Criterion 2 with respect to listing in the *Terrestrial Code*. Australia has the potential to comply with requirements to be considered free from JE, in accordance with the surveillance principles outlined in Chapter 1.4 of *Terrestrial Code*.

AND

3) Reliable means of detection and diagnosis exist and a precise case definition is available to clearly identify cases and allow them to be distinguished from other diseases, infections or infestations.

Yes ☒ **No** ☐

Scientific rationale:

A variety of diseases, infectious and non-infectious, can be associated with the development of neurologic signs in horses and other equid species. Among viral diseases, there are an increasing number caused by different arboviruses, all of which can give rise to neurologic disease that is very similar in nature, range of clinical signs, and course of the disease to JE. A provisional clinical diagnosis must always be substantiated by laboratory confirmation of the responsible etiological agent (Ellis et al., 2000), in this case JE virus. This can only be arrived at following testing of appropriate clinical/post-mortem specimens by a laboratory having the capability, expertise and experience in conducting the tests needed to establish a diagnosis.

A range of virus detection and identification tests as well as antibody determination tests are available for the diagnosis of JE infection. JE virus can be isolated from serum, cerebrospinal fluid or the brain of a horse with neurologic disease or a case of subclinical infection. Isolation of virus can be attempted in a susceptible strain of mice inoculated intracerebrally, or in certain cell lines. Identification of viral isolates as JE virus is best accomplished using the plaque-reduction neutralization test or a molecular, nucleic acid based assay viz. polymerase chain reaction assay (Ellis et al., 2000). Most recently, JE virus infection has been confirmed by RNA-based metagenomic next-generation sequencing (Maamary et al., 2023), as yet not available in most testing labs. Virus-specific antigen has been demonstrated immunohistochemically in the brain of some cases of the disease. Several serological tests can be used in investigating suspect cases of JE virus infection, of which the JE specific enzyme-linked immunosorbent assay (ELISA) and the plaque-reduction neutralization test offer the most definitive results. Other serological tests lack specificity due to serologic cross-reactions with related flaviviruses (Ellis et al., 2000).

In summary, a range of lab tests are available for the detection and identification of cases of JE infection. These enable confirmation of a diagnosis of the disease and its differentiation from cases of infection caused by other viral or microbial agents. As such, JE meets Criterion 3 for listing in the *Terrestrial Code* with respect to the availability of lab tests capable of confirming a diagnosis of the disease.

AND

4a) Natural transmission to humans has been proven, and human infection is associated with severe consequences.

Yes ☒ **No** ☐

Scientific rationale:

The zoonotic significance of JE virus has been recognized for well over 100 years. Prior to the availability of a vaccine with which to protect against the disease, epidemics of encephalitis in the human population were frequently recorded in the various countries in South and Southeastern Asia in which the disease was endemic. JE has been estimated to be responsible for 100,000 cases annually worldwide (Maamary et al., 2023). Two types of transmission patterns have been described: 1) seasonal epidemic transmission in temperate regions; and 2) low endemic transmission in tropical regions throughout the year (Mehta et al., 2021). The clinical features associated with JE virus infection range from asymptomatic infection to a fulminant encephalitic syndrome with a case fatality rate of between 20-30%. Upwards of 50% of survivors are left with neurological sequelae. Most human infections with JE virus are asymptomatic. Symptomatic cases are uncommon, occurring in an estimated one in 250 cases of infection. They are more common in children. In fact, JE is regarded as a disease of children (Mehta et al., 2021). Even to this day, JE is a highly significant cause of serious illness and death in humans, despite the availability of vaccines known to be effective in protecting against this very important disease.

In summary, JE meets Criterion 4a for listing in the *Terrestrial Code* by virtue of its proven ability to cause human disease of very major clinical significance.

OR

4b) The disease has been shown to have a significant impact on the health of domestic animals at the level of a country or a zone taking into account the occurrence and severity of the clinical signs, including direct production losses and mortality.

Yes ☒ **No** ☐

Scientific rationale:

Analogous to the situation in humans, JE has been proven to have a significant impact on the health of two species of domestic animals, horses including other equid species and pigs, specifically pregnant sows. The outcome of JE infection in horses parallels that in humans, (Burns et al., 1949; Nakamura, 1972). Horses and donkeys are susceptible to infection with the virus (Huang, 1982). Horses are most likely to develop inapparent infections than observable signs of disease (Burns et al., 1949). That notwithstanding, periodic epidemics of encephalitis in horses in summer have been documented, the majority during the 20th century. Case fatality rates in such events have varied from 5-15% to as high as 30-40% (Nakamura, 1972).

The frequency of epidemics in endemic countries has diminished in more recent times with greater widespread use of vaccine against the disease. Three clinical syndromes have been described in horses infected with JE virus, transient, lethargic, and hyperexcitable. Horses exhibiting the transient or lethargic forms of the disease usually recover in a matter of several days. Individuals afflicted with the hyperexcitable manifestation of JE may recover but more commonly succumb to the disease. Residual neurologic sequelae may supervene in horses that survive the encephalitic form of JE.

Except for pregnant sows, JE virus infection in pigs is asymptomatic. Infection of pregnant sows can frequently result in abortion, or the birth of mummified weak piglets (Burns, 1950). Affected piglets can develop neurologic disease and frequently die. Losses at piggeries can be very high in the face of peak virus transmission, with up to 1/3 of infected sows losing their litters (Takashima et al., 1988).

In summary, historical and current experience has shown that JE virus can have a significant impact on the health of equids and pigs. The series of outbreaks of JE infection in breeding sows on multiple piggeries in four states in Australia exemplifies the direct economic and production losses that can occur, given the circumstances that the at-risk pig population was fully susceptible to the effects of the virus. In the author's opinion, these data support the listing of JE in the *Terrestrial Code*.

OR

4c) The disease has been shown to, or scientific evidence indicates that it would, have a significant impact on the health of wildlife taking into account the occurrence and severity of the clinical signs, including direct economic losses and mortality, and any threat to the viability of a wildlife population.

Yes ☒ **No** ☐

Scientific rationale:

There is a dearth of published information on the impact of JE virus infection on the health of wildlife. Beyond infecting various species of wading and water birds in nature, and chickens, ducks and pigeons under experimental conditions, all of which can develop high viremias similar to pigs, infection is not associated with development of clinical signs of disease. It is presumed that JE infection in feral pregnant pigs will produce the same pathologic response as characterized in the domestic pig, namely reproductive losses from abortion, stillbirths, mummified fetuses and neonatal deaths. Under such circumstances, JE virus will have the potential to impact the health of feral pig populations. That being so, it will match with Criterion 4c for listing in the *Terrestrial Code*.

Conclusion regarding [pathogenic agent name]:

Does **[pathogenic agent name]** match the listing criteria that are described in the *Terrestrial Animal Health Code* Chapter 1.2.?

Yes ☒ **No** ☐

Summary Conclusion:

Japanese encephalitis virus is exceptional among the group of equine encephalitic viruses in that its known global distribution has expanded significantly over the past 30-40 years. It has spread westward into Nepal and Pakistan and eastward into Papua New Guinea and islands to the north of Australia. Aside from humans and horses that are dead-end hosts of the virus, pigs are highly susceptible to infection, developing very high viremias and acting as efficient amplification hosts of the virus. Spread of JE virus in East, South and Southern Asia and the Western Pacific has likely been associated with wind-borne carriage of the disease agent via infected mosquitoes from an endemic country. This is the most logical explanation to account for the incursion of JE into offshore islands in the Torres Strait in 1995, Cape York Peninsula on the Australian mainland in 1998, and most recently, discovery of the virus in pigs associated with reproductive losses in three southeastern states, Queensland, New South Wales and Victoria in March 2022. A fourth state, South Australia, was added a month later. The Australian Veterinary Authorities are now considering JE as an endemic disease in the four affected states. The most recent series of events is confirmation of the incursion of JE into Australia most probably by infected vectors (mosquitoes) perhaps from Papua New Guinea. This matches Criterion 1 with respect to proven international spread of a disease agent. Australia has a highly comprehensive and well integrated official plan in place to combat and prevent further spread of JE virus. An integral component of this plan is in-depth targeted surveillance of the mosquito and pig populations initially in the four affected states and on a wider scale later, to determine the extent of distribution of the virus in the respective populations. The surveillance plan is structured so that it is in accordance with the surveillance principles outlined in Chapter 1.4 of the *Terrestrial Code*. Whereas the plan is conditional at this point in time, it is in keeping with the terms of Criterion 2 with reference to listing in the *Terrestrial Code*. A range of laboratory tests are available that enable the diagnosis of JE virus infection. Some are directed at detection and identification of the causal agent, whereas others, for example certain serologic tests, can be used to investigate suspect cases of this infection. It needs to be borne in mind that some serologic assays lack specificity due to cross reactions with related flaviviruses. The availability, sensitivity and specificity of laboratory tests for confirmation of a diagnosis of JE matches Criterion 3 in the *Terrestrial Code*. The zoonotic importance of JE for human populations in countries in which this disease is endemic is widely accepted. Epidemics of disease continue in susceptible populations notwithstanding the availability of safe, effective vaccines against the disease. JE is more common in children in which it can be a serious if not infrequently fatal illness. The disease continues to be of major clinical significance and matches with Criterion 4a for listing in the *Terrestrial Code*. Analogous to the JE in humans, JE has been proven to have an important impact on the health of horses and other equid species, and pigs. JE virus has the potential to cause encephalitis in horses, with fatality rates in some outbreaks as high

as 30-40%. Residual neurologic sequelae may supervene in horses that survive the encephalitic form of JE. With the exception of pregnant sows, JE infection is asymptomatic in pigs. Infection in pregnant sows can frequently result in abortion, stillbirths, and mummified piglets. Losses in affected piggeries can be very significant. The impact of JE virus on the health of horses and pigs matches Criterion 4b for listing in the *Terrestrial Code*. There is very little published information on the impact of JE virus infection on the health of wildlife with one exception, namely that of the pregnant feral pig population. It is reasonable to assume that this population will suffer the same reproductive losses as encountered in the domestic pig. Under such circumstances, JE virus will have the potential to impact the reproductive health of feral pig populations and match with Criterion 4c for listing in the *Terrestrial Code*. JE virus matches important Criteria 1 and 2 (conditional) and also Criteria 3, 4a, 4b and 4c. The conditional match under Criterion 2 is based upon the following: 1) Australia has a National Surveillance Plan in place to control and prevent the further spread of JE virus; and 2) the country has the potential to comply with the requirements to be considered free from the disease or infection in accordance with the surveillance principles outlined in Chapter 1.4 of the *Terrestrial Code*.

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Assessment for Japanese Encephalitis: Ann Cullinane

The criteria for the inclusion of a disease, infection or infestation in the WOAH list are as follows:

1) International spread of the pathogenic agent (via live animals or their products, vectors or fomites) has been proven.

Yes ☒ **No** ☐

Scientific rationale:

Japanese Encephalitis (JE) is primarily prevalent in Asia but recent cases in Pakistan, Papua New Guinea and Australia suggest that its geographic range is expanding (Pierson and Diamond, 2020). In 2022, Japanese Encephalitis virus (JEV) was detected in Australia on a hitherto unprecedented scale, with local transmission by indigenous mosquitoes, disease outbreaks in piggeries and fatalities in humans https://www.who.int/emergencies/disease-outbreak-news/item/2022-DON365 and https://www.health.gov.au/health-alerts/japanese-encephalitis-virus-jev/japanese-encephalitis-virus-jev. The virus was identified as of the G4 genotype, the least common genotype worldwide. Until 2017 G4 was found only in Indonesia and Papua New Guinea. The method of international spread was not proven but introduction by migratory birds or mosquitoes was suggested (Pham et al., 2022).

AND

2) At least one country has demonstrated freedom or impending freedom from the disease, infection or infestation in populations of susceptible animals, based on the provisions of Chapter 1.4.

Yes ☒ **No** ☐

Scientific rationale:

There have been no documented cases of JE in Europe https://www.ecdc.europa.eu/en/japanese-encephalitis/facts or the Americas https://www.cdc.gov/japaneseencephalitis/maps/index.html (Mulvey and Duong, 2021).

AND

3) Reliable means of detection and diagnosis exist and a precise case definition is available to clearly identify cases and allow them to be distinguished from other diseases, infections or infestations.

Yes ☒ **No** ☐

Scientific rationale:

Currently available methods for JEV diagnosis including serology, nucleic acid amplification testing, virus isolation, sequencing and metagenomics (Pham et al., 2022). A highly sensitive JEV specific RT-qPCR assay has been developed (Bharucha et al., 2018). Serology tests cross reactivity with other flaviviruses but the plaque reduction neutralisation test is considered specific. Reliable means of diagnosis are described in the Terrestrial Manual https://www.woah.org/fileadmin/Home/eng/Health_standards/tahm/3.01.10_JEV.pdf . There is no precise case definition in the WOAH *Terrestrial Code*.

AND

4a) Natural transmission to humans has been proven, and human infection is associated with severe consequences.

Yes ☒ **No** ☐

Scientific rationale:

Natural transmission to humans is through the bite of infected Culex species mosquitoes (Solomon, 2006). JE is considered the most important viral encephalitis of humans particularly in children up to 14 years of age in South Eastern Asia and the Western Pacific (Erlanger et al., 2009), https://www.cdc.gov/japaneseencephalitis/transmission/index.html. The disease is most prevalent where there are rice fields (breeding sites for mosquitoes), and pigs (natural virus reservoirs) (Erlanger et al., 2009, van den Hurk et al., 2009). There are over 67 thousand new cases each year with 20-30% fatalities (Erlanger et al., 2009, Pierson and Diamond, 2020). Over 30% of survivors suffer neurological deficits (Erlanger et al., 2009, Solomon et al., 2000).

OR

4b) The disease has been shown to have a significant impact on the health of domestic animals at the level of a country or a zone taking into account the occurrence and severity of the clinical signs, including direct production losses and mortality.

Yes ☒ **No** ☐

Scientific rationale:

In horses symptoms include fever, profuse sweating, muscle tremors, hyperexcitability, loss of vision and coma (Kumar et al., 2018). Mortality rates can reach 30%. Vaccination against JEV is mandatory for designated horse populations in Hong Kong (China), Malaysia, Japan, and Singapore. In pigs the virus primarily affects reproductive performance. Sows may abort or give birth to mummified and stillborn or weak piglets, some with neurological signs (Mansfield et al., 2017).

OR

4c) The disease has been shown to, or scientific evidence indicates that it would, have a significant impact on the health of wildlife taking into account the occurrence and severity of the clinical signs, including direct economic losses and mortality, and any threat to the viability of a wildlife population.

Yes ☐ **No** ☒

Scientific rationale:

There is no evidence that the disease represents a threat to the viability of a wildlife population although wild mammals, reptiles and amphibians may be sub-clinically infected and feral pigs serve as a reservoir (Impoinvil et al., 2013, Mackenzie et al., 2022).

Conclusion regarding [pathogenic agent name]:

Does **[pathogenic agent name]** match the listing criteria that are described in the *Terrestrial Animal Health Code* Chapter 1.2.?

Yes ☒ **No** ☐

Summary Conclusion:

JE satisfies the WOAH criteria for listing but unlike pigs which are reservoir hosts, horses do not amplify the virus efficiently and are considered 'dead-end' hosts. Thus, the international movement or trade of horses should not be restricted due to JE.

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Assessment for Japanese Encephalitis: Alf Fussel

The criteria for the inclusion of a disease, infection or infestation in the WOAH list are as follows:

1) International spread of the pathogenic agent (via live animals or their products, vectors or fomites) has been proven.

Yes ☒ **No** ☐

Scientific rationale:

Both humans and horses are thought to be dead-end hosts.

References:

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AND

2) At least one country has demonstrated freedom or impending freedom from the disease, infection or infestation in populations of susceptible animals, based on the provisions of Chapter 1.4.

Yes ☒ **No** ☐

Scientific rationale:

WOAH WAHIS 2015-2022: disease only present in South and South-east Asia.

AND

3) Reliable means of detection and diagnosis exist and a precise case definition is available to clearly identify cases and allow them to be distinguished from other diseases, infections or infestations.

Yes ☒ **No** ☐

Scientific rationale:

https://www.woah.org/fileadmin/Home/fr/Health_standards/tahm/3.06.05_EEE_WEE_VEE.pdf
https://sitesv2.anses.fr/en/minisite/equine-diseases/sop

AND

4a) Natural transmission to humans has been proven, and human infection is associated with severe consequences.

Yes ☒ **No** ☐

Scientific rationale:

https://www.who.int/news-room/fact-sheets/detail/japanese-encephalitis
https://www.cdc.gov/japaneseencephalitis/index.html
https://www.ecdc.europa.eu/en/japanese-encephalitis/facts

OR

4b) The disease has been shown to have a significant impact on the health of domestic animals at the level of a country or a zone taking into account the occurrence and severity of the clinical signs, including direct production losses and mortality.

Yes ☐ **No** ☒

Scientific rationale:

References:

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OR

4c) The disease has been shown to, or scientific evidence indicates that it would, have a significant impact on the health of wildlife taking into account the occurrence and severity of the clinical signs, including direct economic losses and mortality, and any threat to the viability of a wildlife population.

Yes ☐ **No** ☒

Scientific rationale:

Reports about JE do not indicate any threat to the viability of a wildlife population.

Conclusion regarding [pathogenic agent name]:

Does **[pathogenic agent name]** match the listing criteria that are described in the *Terrestrial Animal Health Code* Chapter 1.2.?

Yes ☒ **No** ☐

Summary Conclusion:

Infection with the Japanese Encephalitis Virus meets the listing requirements set out in Chapter 1.2. of the *Terrestrial Code*.

This conclusion concourse with the outcome of the respective EFSA report (doi: 10.2903/j.efsa.2017.4948) and the conclusion of the European Union as set out in Annex II to Regulation (EU) 2016/429. (OJ L 84, 31.3.2016, p. 1.).

However, any possible measures to prevent the spread of the virus through international trade in certain captive birds and porcine animals should be set out in Section 8 "Multiple Species".

The requirements in Chapter 8.10. in respect of trade in equines should be removed, since equine animals are considered to be dead-end hosts due to the low level and short duration of viremia following the accidental infection from vector insects.

Since individual equine animals may be affected by the infection and because of the zoonotic nature of the infection, it is advised to maintain surveillance, not least to allow the vaccination of equines resident in, or intended to be moved to, endemic areas.

Annex 5. 9.2.1 Listing Assessment for Equine Encephalitides (EEE)

MEETING OF THE WOAH SCIENTIFIC COMMISSION FOR ANIMAL DISEASES

Paris, 11 to 15 September 2023

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SUMMARY OF THE EXPERT ASSESSMENT OF EASTERN EQUINE ENCEPHALOMYELITIS AGAINST THE LISTING CRITERIA OF *TERRESTRIAL CODE* CHAPTER 1.2.

Three experts participated in this consultation:

- **Peter Timoney** (IHSC Consultant, Gluck Equine Research Center, USA)
- **Ann Cullinane** (Irish Equine Center, Ireland)
- **Alf Fussel** (IHSC Consultant, retired from European Commission, Belgium)

Criterion	1	2	3
Criterion 1: International spread of the pathogenic agent (via live animals or their products, vectors or fomites) has been proven.	YES	YES	YES
Criterion 2: At least one country has demonstrated freedom or impending freedom from the disease, infection or infestation in populations of susceptible animals, based on the provisions of Chapter 1.4.	YES	YES	YES
Criterion 3: Reliable means of detection and diagnosis exist, and a precise case definition is available to clearly identify cases and allow them to be distinguished from other diseases, infections or infestations.	YES	YES	YES
Criterion 4a: Natural transmission to humans has been proven, and human infection is associated with severe consequences.	YES	YES	YES
Criterion 4b: The disease has been shown to have a significant impact on the health of domestic animals at the level of a country or a zone taking into account the occurrence and severity of the clinical signs, including direct production losses and mortality.	YES	YES	NO
Criterion 4c: The disease has been shown to, or scientific evidence indicates that it would, have a significant impact on the health of wildlife taking into account the occurrence and severity of the clinical signs, including direct economic losses and mortality, and any threat to the viability of a wildlife population.	YES	NO	NO
CONCLUSION: Does infection with Japanese encephalitis virus match the listing criteria that are described in the Terrestrial Animal Health Code Chapter 1.2?	YES	YES	YES

Assessment for Eastern Equine Encephalomyelitis: Peter Timoney

The criteria for the inclusion of a disease, infection or infestation in the WOAH list are as follows:

1) International spread of the pathogenic agent (via live animals or their products, vectors or fomites) has been proven.

Yes ☐ No ☒

Scientific rationale:

Eastern equine encephalitis (EEE), which was first clinically characterized and etiologically determined to be caused by a virus in the early 1930s, has a geographic range extending from Argentina in South America through countries in Central America, the Caribbean, Mexico, the USA and Canada (Hanson, 1973; CDC retrieved 30 April 2017). Historically, no proven instances have been reported of the international spread of the disease outside of the Western Hemisphere. It has been postulated that because of its complex biological cycle, it is unlikely that EEE could become established in other parts of the world (Hanson, 1973). Aside from the effectiveness of commodity-based preventive measures implemented under the mandate of Veterinary Authorities, a critical factor in greatly reducing the risk of transboundary spread of EEE, is that infected equids are considered “dead-end hosts” of the virus. They do not develop viremias of sufficient magnitude or duration to transmit the virus to mosquito species capable of spreading the disease (Spickler, 2017). An alternative and less significant pathway to the movement of live equids, with potential to spread EEE between countries in the Western Hemisphere, is via migratory birds infected with the virus (Calisher, et al. 1971; Hanson, 1973). The extent to which this occurs in nature is difficult to determine and likely outside the realm of what could be considered logistically feasible by the appropriate Veterinary Authorities.

A final point that warrants consideration with respect to spread of EEE concerns the role that wind-blown carriage of infected vectors, viz. mosquitoes might play in dissemination of the virus over variable distances (Calisher et al., 1971). This could be over land or water within states, from state to state, and even from country to adjacent country in the Western Hemisphere, depending on prevailing weather conditions. While this undoubtedly can occur, it is outside the realm of possibility regarding the transport of virus over very large expanses of water that separate the Americas from the nearest European or Asian countries.

In summary, since there has been no historical precedent confirming global spread of EEE, it is the opinion of the author that there is minimal risk of the likelihood of it occurring in the foreseeable future. Based on available scientific knowledge and history of EEE, international spread of the causal virus via live animals, their products, vectors or fomites has not been proven and accordingly, EEE does not therefore meet Criterion 1 for listing in the *Terrestrial Code*.

AND

2) At least one country has demonstrated freedom or impending freedom from the disease, infection or infestation in populations of susceptible animals, based on the provisions of Chapter 1.4.

Yes ☐ No ☒

Scientific rationale:

The author is unaware of any country that has demonstrated freedom or impending freedom from EEE, the disease or the infection, in a population of susceptible equids, based on the provisions of Chapter 1.4, in the *Terrestrial Code*. While cases of EEE in equids and certain species of birds are reportable to the Veterinary Authorities in some countries, for example North America (USA and Canada), there are no known official programs in place in other countries to control or prevent spread of the causal virus (Spickler, 2017). Although not mandated, veterinarians, equine owners, breeders and other stakeholders in the USA and Canada are strongly encouraged to report details of any case of EEE to the Equine Disease Communication Center at the national headquarters of the American Association of Equine Practitioners (AAEP), Lexington, Kentucky, USA (www.AAEP.org). EEE is one of a short list of “core diseases” that the AAEP considers are a priority for veterinarians, horse owners and equine stakeholders to vaccinate their horses or other equids with on a regular basis in accordance with vaccine manufacturer’s guidelines (AAEP, 2022). Voluntary-based supportive control measures against EEE include mosquito abatement, housing of horses in screened barns from dusk to dawn, and use of mosquito repellents.

On the matter of demonstrated freedom or impending freedom of a country from EEE, the author is unaware of any country zone or compartment in the Western Hemisphere with a history of disease endemicity where the Veterinary Authorities can claim to have achieved disease/infection freedom from EEE virus. Furthermore, the author has been unable to identify any country zone or compartment that purports to have a control program in place and is at a point of impending freedom from the disease/infection in accordance with established surveillance principles outlined in Chapter 1.4 of the *Terrestrial Code*.

In summary, based on available scientific knowledge and history of EEE, the latter does not meet Criteria 2 for listing in the *Terrestrial Code* with regard to demonstrated freedom of at least one country from the disease or infection or providing evidence of impending freedom from the disease/infection.

AND

3) Reliable means of detection and diagnosis exist and a precise case definition is available to clearly identify cases and allow them to be distinguished from other diseases, infections or infestations.

Yes ☒ **No** ☐

Scientific rationale:

Neurologic syndromes in equids can be symptomatic of a variety of diseases, some infectious, and others non-infectious. The clinical picture caused by a range of arboviruses is symptomatically similar and cannot be defined as caused by any one particular virus on clinical grounds alone. Determination of which specific etiological agent is responsible can only be arrived at following testing of appropriate clinical/postmortem specimens by a laboratory that has the capability, expertise and experience in conducting the tests needed to provide a diagnosis.

A range of agent detection and identification tests as well as antibody determination tests are available for the diagnosis of EEE infection (WOAH, 2022). These provide the ability to differentially distinguish cases of EEE from other neurological diseases both arboviral and non-arboviral. EEE can be isolated from the brains of horses that exhibited antemortem clinical signs of neurological disease, in certain cell culture systems, newborn mice, or less successfully, in chick embryos. Rapid detection and identification of the virus is most frequently accomplished using molecular, nucleic acid based assays (polymerase chain reaction) and less often by immunological techniques (Monroy et al., 1996; Patterson et al., 1996). A range of serological tests (complement fixation, enzyme-linked immunosorbent assays [ELISA], hemagglutination-inhibition and plaque reduction neutralization) can be used in investigating suspect clinical cases of EEE infection. The IgM capture ELISA test is widely used for this purpose and the most popular differential diagnostic assay to confirm a case of EEE virus infection (Sahu et al., 1994).

In summary, EEE meets Criterion 3 for listing in the *Terrestrial Code* insofar as reliable means of detection and identification are available that allow diagnosis of the disease and its differentiation from other diseases or infections.

AND

4a) Natural transmission to humans has been proven, and human infection is associated with severe consequences.

Yes ☒ **No** ☐

Scientific rationale:

Ever since its discovery in the late 1930s, natural transmission of EEE to humans has been proven year-in year-out in those countries in the Western Hemisphere in which the disease is endemic (Calisher, 1994; Morens et al., 2019). Whereas EEE tends to occur as isolated cases in humans, clusters of cases have infrequently been recorded in areas in which there are high levels of virus in circulation in the mosquito population. Infection with EEE virus can be potentially life-threatening. Two forms of the disease have been described: systemic and encephalitic. Whereas the systemic form is generally the less severe of the two, giving rise to influenza-type symptoms in affected individuals, the encephalic form is very frequently fatal. The mortality rate in human cases of EEE can be as high as 75% or even greater (Calisher, 1994). Those that survive suffer from significant neurologic sequelae that are usually long-term.

In summary, EEE meets Criterion 4a for listing in the *Terrestrial Code* in terms of a proven cause of human disease of major clinical significance.

OR

4b) The disease has been shown to have a significant impact on the health of domestic animals at the level of a country or a zone taking into account the occurrence and severity of the clinical signs, including direct production losses and mortality.

Yes ☒ **No** ☐

Scientific rationale:

Analogous to the consequences of infection in humans, EEE virus has a proven history of significantly impacting the health of horses and other equids in countries or zones in which the virus is endemic (Hanson, 1973). Clinical disease has also been reported infrequently in other domestic species inclusive of swine, cattle, sheep, camelids and dogs (Spickler, 2017). Historically and to the present day, EEE takes the greatest toll on susceptible horse populations. Even in countries such as the USA and Canada, in which vaccines are available to protect against this disease, illness and death in horses continues to be reported every year. The incidence of the disease can vary from year to year depending on the seasonally

prevailing climatic conditions. The vast majority of cases are fatal and are in unvaccinated individuals or those with incomplete vaccination histories. Apart from the economic losses involved, this is especially regrettable since EEE vaccines are included among the “core vaccines” that the AAEP very strongly recommends that horses need to be vaccinated with on a regular basis (AAEP, 2022).

In summary, EEE fully satisfies Criterion 4b concerning impact on the health of domestic species as defined for listing in the *Terrestrial Code*.

OR

4c) The disease has been shown to, or scientific evidence indicates that it would, have a significant impact on the health of wildlife taking into account the occurrence and severity of the clinical signs, including direct economic losses and mortality, and any threat to the viability of a wildlife population.

Yes ☒ **No** ☐

Scientific rationale:

Aside from its importance as a human pathogen and a cause of illness and death in a number of domestic animal species, EEE can also impact a not insignificant number of species of wildlife (Spickler, 2017). Clinical disease associated with infection with the virus has been recorded in deer, a harbor seal, certain non-human primates, Chukar partridges, pheasants, turkeys, ratites (emus and ostriches), pigeons, egrets, ibises, whooping cranes and African penguins. Direct economic loss has on occasion been documented in some species such as pheasants, partridges and ratites based on the mortality rates in affected flocks of birds. The author does not consider that the frequency and extent of the outbreaks of EEE that have been recorded in certain wildlife species have been sufficiently impactful to have posed a threat to the viability of the population(s) concerned.

In summary, EEE can be considered to meet Criterion 4c of impacting susceptible wildlife populations as defined for listing in the *Terrestrial Code*.

Conclusion regarding [pathogenic agent name]:

Does **[pathogenic agent name]** match the listing criteria that are described in the *Terrestrial Animal Health Code* Chapter 1.2.?

Yes ☐ **No** ☒

Summary Conclusion:

In summary, since there has been no historical precedent confirming global spread of EEE, it is the opinion of the author that there is minimal risk of the likelihood of it occurring in the foreseeable future. Based on available scientific knowledge and history of EEE, international spread of the causal virus via live animals, their products, vectors or fomites has not been proven and accordingly, EEE does not therefore meet Criterion 1 for listing in the *Terrestrial Code*.

Based on available scientific knowledge and history of EEE, the latter does not meet Criteria 2 for listing in the *Terrestrial Code* with regard to demonstrated freedom of at least one country from the disease or infection or providing evidence of impending freedom from the disease/infection.

EEE meets Criterion 3 for listing in the *Terrestrial Code* insofar as reliable means of detection and identification are available that allow diagnosis of the disease and its differentiation from other diseases or infections.

EEE meets Criterion 4a for listing in the *Terrestrial Code* in terms of a proven cause of human disease of major clinical significance.

EEE fully satisfies Criterion 4b concerning impact on the health of domestic species as defined for listing in the *Terrestrial Code*.

EEE can be considered to meet Criterion 4c of impacting susceptible wildlife populations as defined for listing in the *Terrestrial Code*.

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Assessment for Eastern Equine Encephalomyelitis: Ann Cullinane

The criteria for the inclusion of a disease, infection or infestation in the WOAH list are as follows:

1) International spread of the pathogenic agent (via live animals or their products, vectors or fomites) has been proven.

Yes ☒ **No** ☐

Scientific rationale:

Eastern equine encephalomyelitis virus (EEEV) has been identified in at least 35 species of mosquitoes and over 200 species of birds, various domestic animals, wild mammals, reptiles, and amphibians. Eastern equine encephalomyelitis (EEE) is endemic in parts of North and South America and the Caribbean. With climate change it is considered an emerging disease. In the USA there was increased incidence in 2019 and over the past decade the virus has spread to areas where its circulation was previously unknown or rare (Lindsey et al., 2020), https://www.cdc.gov/easternequineencephalitis/index.html.

Re international spread there is some circumstantial evidence to support that outbreaks in Canada were the result of spread from the USA but the method of spread (infected birds or mosquitoes) was not proven (Chénier et al., 2010). Similarly genetic studies suggest that the temporary introduction of North American strains of EEEV were responsible for outbreaks in Jamaica and the Dominican Republic (Weaver et al., 2012). It is believed that as a vector borne disease, EEE is likely to expand in range due to global warming and emerge more broadly in human and animal populations but there is a knowledge gap relating to the dynamics of EEEV spread (Corrin et al., 2021).

AND

2) At least one country has demonstrated freedom or impending freedom from the disease, infection or infestation in populations of susceptible animals, based on the provisions of Chapter 1.4.

Yes ☒ **No** ☐

Scientific rationale:

To-date EEEV transmission is limited to North and South America and the Caribbean. Other areas such as Europe are historically free.

AND

3) Reliable means of detection and diagnosis exist and a precise case definition is available to clearly identify cases and allow them to be distinguished from other diseases, infections or infestations. **Yes** ☒ **No** ☐

Scientific rationale:

Reliable means of detection and diagnosis exist as documented in the WOAH Manual. Virus detection methods include virus isolation on a variety of vertebrate cells and RT-PCR. Serological confirmation is based on the detection of IgM during the acute phase, or the seroconversion between acute and convalescent phases (Weaver et al., 2012). However, vaccination history must be taken into account when interpreting results of any serological tests.

There is no precise case definition in the WOAH *Terrestrial Code* (Chapter 12.4). The WOAH Manual states that the definitive method for diagnosis of EEE is virus isolation followed by typing. EEEV can usually be isolated from the brains of horses, unless more than five days have elapsed between the appearance of clinical signs and the death of the horse. Specific and highly sensitive RT-PCR assays have been developed. The plaque reduction neutralisation test is also very specific and can be used to differentiate between EEE, WEE and VEE virus infections.

AND

4a) Natural transmission to humans has been proven, and human infection is associated with severe consequences.

Yes ☒ **No** ☐

Scientific rationale:

EEEV is classified as a Category B agent by the Centers for Disease Control and Prevention, Atlanta (https://emergency.cdc.gov/agent/agentlist-category.asp). EEE has a fatality rate 33% to 50% in humans and recovered individuals frequently suffer neurological deficits often necessitating institutionalised care (Weaver et al., 2012, Corrin et al., 2021). Natural transmission to humans occurs by mosquito bite and human risk has been shown to correlate with equine infection rates as equine cases often precede human cases (Tang et al., 2021).

OR

4b) The disease has been shown to have a significant impact on the health of domestic animals at the level of a country or a zone taking into account the occurrence and severity of the clinical signs, including direct production losses and mortality.

Yes ☒ **No** ☐

Scientific rationale:

EEE is an important cause of disease in equids with fatality rates of up to 75% (Mackay,2009). High mortality rates also occur in swine (Elvinger et al., 1994). Many domesticated birds develop clinical disease including pheasants, partridges, emus, chickens and quail (Corrin et al., 2021). Viscerotropic disease after EEEV infection is associated with decreased egg production (Williams et al., 2000). Fatalities are common in turkeys (Ficken et al., 1993), pheasants (Weinack et al., 1978), ostriches (Brown et al., 1993) and emus (Tully et al., 1992). Camelids and swine are also susceptible (Corrin et al., 2021).

OR

4c) The disease has been shown to, or scientific evidence indicates that it would, have a significant impact on the health of wildlife taking into account the occurrence and severity of the clinical signs, including direct economic losses and mortality, and any threat to the viability of a wildlife population.

Yes ☒ **No** ☐

Scientific rationale:

High attack and mortality rates occur in cranes (Dein et al., 1986). Clinical signs have been described in white tailed deer and in camelids (Corrin et al., 2021). During the 2019 Eastern equine encephalitis virus (EEEV) outbreak in the USA two 2-month old Mexican wolf pups experienced neurologic signs and sudden death in a zoo in Michigan (Thompson et al., 2021).

Conclusion regarding [pathogenic agent name]:

Does **[pathogenic agent name]** match the listing criteria that are described in the *Terrestrial Animal Health Code* Chapter 1.2.?

Yes ☒ **No** ☐

Summary Conclusion:

EEE is an important neurotropic disease that satisfies the criteria for listing and notification, but care needs to be exercised that international movement of “dead-end hosts” such as horses that do not normally develop viremia sufficient to enable transmission by mosquitoes, is not unnecessarily restricted.

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Assessment for Eastern Equine Encephalomyelitis: Alf Fussel

The criteria for the inclusion of a disease, infection or infestation in the WOAH list are as follows:

1) International spread of the pathogenic agent (via live animals or their products, vectors or fomites) has been proven.

Yes ☒ **No** ☐

Scientific rationale:

Transport of the EEEV by migratory birds from North to South America.

References:

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AND

2) At least one country has demonstrated freedom or impending freedom from the disease, infection or infestation in populations of susceptible animals, based on the provisions of Chapter 1.4.

Yes ☒ **No** ☐

Scientific rationale:

WOAH WAHIS 2015-2022: disease not present in Eastern Hemisphere

AND

3) Reliable means of detection and diagnosis exist and a precise case definition is available to clearly identify cases and allow them to be distinguished from other diseases, infections or infestations.

Yes ☒ **No** ☐

Scientific rationale:

WOAH *Terrestrial Manual* 2021

https://www.woah.org/fileadmin/Home/fr/Health_standards/tahm/3.06.05_EEE_WEE_VEE.pdf
https://sitesv2.anses.fr/en/minisite/equine-diseases/sop

AND

4a) Natural transmission to humans has been proven, and human infection is associated with severe consequences.

Yes ☒ **No** ☐

Scientific rationale:

https://www.cdc.gov/easternequineencephalitis/index.html

OR

4b) The disease has been shown to have a significant impact on the health of domestic animals at the level of a country or a zone taking into account the occurrence and severity of the clinical signs, including direct production losses and mortality.

Yes ☐ **No** ☒

Scientific rationale:

A/APHIS reports 111 equine cases in 2022 (equine population about 7 mi) references: https://www.aphis.usda.gov/animal_health/downloads/animal_diseases/2022-eee-report-monthly.pdf https://horsesonly.com/horseindustry/#:~:text=3.,million%20horses%20in%20the%20U.S.&text=This%20is%20because%20there%20are,organization%20counts%20the%20numbers%20differently.

OR

4c) The disease has been shown to, or scientific evidence indicates that it would, have a significant impact on the health of wildlife taking into account the occurrence and severity of the clinical signs, including direct economic losses and mortality, and any threat to the viability of a wildlife population.

Yes ☐ **No** ☒

Scientific rationale:

Reports about EEE in Pheasants and Emus do not indicate any threat to the viability of a susceptible wildlife population.

Conclusion regarding [pathogenic agent name]:

Does **[pathogenic agent name]** match the listing criteria that are described in the *Terrestrial Animal Health Code* Chapter 1.2.?

Yes ☒ **No** ☐

Summary Conclusion:

Infection with the Eastern Equine Encephalomyelitis Virus meets the listing requirements set out in Chapter 1.2. of the *Terrestrial Code*.

This conclusion concourse with the outcome of the respective EFSA report (doi: 10.2903/j.efsa.2017.4946) and the conclusion of the European Union as set out in Annex II to Regulation (EU) 2016/429 (OJ L 84, 31.3.2016, p. 1.)

Any possible measures to prevent the spread of the virus through international trade in certain captive birds, reptiles or rodents should be set out in Section 8 "Multiple Species".

The requirements in Chapter 12.4. should be removed, since equine animals are considered to be dead-end hosts due to the low level and short duration of viremia following the accidental infection from vector insects.

Because of the zoonotic nature of the infection and since individual equine animals may be affected by the infection, it is advised to maintain surveillance, not least to allow the vaccination of equines resident in, or intended to be moved to, endemic areas.

Annex 6. 9.2.1. Listing Assessment for Equine Encephalitides (WEE)

MEETING OF THE WOAH SCIENTIFIC COMMISSION FOR ANIMAL DISEASES

Paris, 11 to 15 September 2023

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SUMMARY OF THE EXPERT ASSESSMENT OF WESTERN EQUINE ENCEPHALITIS AGAINST THE LISTING CRITERIA OF *TERRESTRIAL CODE* CHAPTER 1.2.

Three experts participated in this consultation:

- **Peter Timoney** (IHSC Consultant, Gluck Equine Research Center, USA)
- **Ann Cullinane** (Irish Equine Center, Ireland)
- **Alf Fussel** (IHSC Consultant, retired from European Commission, Belgium)

Criterion	1	2	3
Criterion 1: International spread of the pathogenic agent (via live animals or their products, vectors or fomites) has been proven.	NO	YES	YES
Criterion 2: At least one country has demonstrated freedom or impending freedom from the disease, infection or infestation in populations of susceptible animals, based on the provisions of Chapter 1.4.	NO	YES	YES
Criterion 3: Reliable means of detection and diagnosis exist, and a precise case definition is available to clearly identify cases and allow them to be distinguished from other diseases, infections or infestations.	YES	YES	YES
Criterion 4a: Natural transmission to humans has been proven, and human infection is associated with severe consequences.	YES	YES	YES
Criterion 4b: The disease has been shown to have a significant impact on the health of domestic animals at the level of a country or a zone taking into account the occurrence and severity of the clinical signs, including direct production losses and mortality.	YES	YES	NO
Criterion 4c: The disease has been shown to, or scientific evidence indicates that it would, have a significant impact on the health of wildlife taking into account the occurrence and severity of the clinical signs, including direct economic losses and mortality, and any threat to the viability of a wildlife population.	NO	YES	NO
CONCLUSION: Does infection with Western equine encephalitis virus match the listing criteria that are described in the Terrestrial Animal Health Code Chapter 1.2?	NO	YES	YES

Assessment for Western Equine Encephalomyelitis: Peter Timoney

The criteria for the inclusion of a disease, infection or infestation in the WOAH list are as follows:

1) International spread of the pathogenic agent (via live animals or their products, vectors or fomites) has been proven.

Yes ☐ No ☒

Scientific rationale:

In the early 1930s, Western equine encephalitis (WEE) was identified as one of the two arboviral diseases responsible for extensive outbreaks of equine encephalitis in the USA at the time, the other being EEE (Meyer et al., 1931; Meyer, 1933; TenBroeck and Merrill, 1933). WEE virus is the most important member of a complex of closely related disease agents that can be found from Argentina to North America in the Western Hemisphere. In North America, WEE has occurred primarily in U.S. states and Canadian provinces west of the Mississippi River. Similar to EEE, there have been no proven instances where cases/outbreaks of WEE have taken place outside the USA and Canada nor elsewhere in the Western Hemisphere as documented in the scientific literature (Byrne and Robbins, 1961; Hanson, 1973; Calisher, 1994). Akin to its ancestral relative EEE, horses and other equids infected with WEE virus do not develop viremias of sufficient magnitude and duration to transmit the agent to mosquito species potentially capable of spreading the disease. As such, they are deemed to be “dead-end hosts” in terms of virus transmission. They are not considered to play an active role in the maintenance of WEE in nature nor in global spread of the virus. Although incidents of WEE were relatively common in the USA and Canada for many years, the frequency of such events has declined significantly in more recent decades (Spickler, 2017). While an explanation for this change in virus behavior has not yet been determined, it does not appear to have resulted from a reduction in viral virulence.

Analogous to EEE, there is a plausible alternative pathway with the potential to spread WEE between countries in the Americas, that involves migratory birds infected with the virus (Calisher et al., 1971; Hanson, 1973). How significant this pathway may be in the case of WEE is a matter for speculation. Aside from the current commodity-based measures mandated by Veterinary Authorities to prevent the global spread of WEE, it is highly improbable that measures can be formulated that could curtail/eliminate the risk of virus spread through migratory birds.

In summary, there has not been any historical precedent that attests to the international spread of WEE from the Western Hemisphere. Accordingly, the disease cannot be considered to meet Criterion 1 regarding its international spread as required for listing in the *Terrestrial Code*.

AND

2) At least one country has demonstrated freedom or impending freedom from the disease, infection or infestation in populations of susceptible animals, based on the provisions of Chapter 1.4.

Yes ☐ No ☒

Scientific rationale:

Very few countries in the Western Hemisphere have an official program in place to control or prevent the spread of WEE virus. The USA and Canada are two countries in which cases of the disease in equids are reportable to the Veterinary Authorities. Veterinarians, equine owners, breeders and other stakeholders are strongly encouraged to report details of any case of WEE to the Equine Disease Communication Center at the national headquarters of the American Association of Equine Practitioners (AAEP), Lexington, Kentucky, USA (www.aaep.org). WEE is one of the short list of “core diseases” that the AAEP considers are a priority for veterinarians, horse owners and equine stakeholders to vaccinate their horses or other equids with on a regular basis in accordance with vaccine manufacture’s guidelines (AAEP, 2022). Voluntary based supportive control measures against WEE include mosquito abatement, housing of horses in screened barns from dusk to dawn, and use of mosquito repellents. On the matter of demonstrated freedom or impending freedom of a country from WEE, the author is unaware of any country, zone or compartment in the Western Hemisphere having a history of disease endemicity, where the Veterinary Authorities can claim country freedom from the disease or the infection.

As already noted, certain countries have reported a progressive decline in the number of reported clinical cases of WEE in equids and humans in recent decades (Spickler, 2017). This is supported by data from human studies that have shown the seropositivity rate in healthy humans has also decreased from 34% in 1960 to less than 3% in the 1990s. Because of the range of variables that can influence the circulation of WEE virus in nature, it is questionable if this trend will continue in the future. Were it to do so however, it might convince a country to declare that its WEE status had reached the point of impending freedom from the disease.

In summary, based on available scientific knowledge and history of WEE, the disease does not currently meet Criterion 2 for listing in the *Terrestrial Code* in terms of demonstration of freedom of at least one country from the disease or infection, or of providing evidence of impending freedom from WEE or infection with the virus.

AND

3) Reliable means of detection and diagnosis exist and a precise case definition is available to clearly identify cases and allow them to be distinguished from other diseases, infections or infestations.

Yes ☒ **No** ☐

Scientific rationale:

WEE is analogous to EEE in that there is no means of differentiating each disease from one other on clinical grounds alone. This also applies to a range of other neurological diseases with special reference to those caused by different arboviruses. Confirmation of the etiology of a case of neurological disease can only be determined by resorting to laboratory testing of appropriate clinical/postmortem specimens by a laboratory with the capability, expertise and experience in carrying out the tests needed to confirm a diagnosis of a disease.

Diagnosis of a case of WEE or virus infection is based on agent detection and identification or antibody determination depending on whether the test subject is dead or alive (WOAH, 2022). Currently available tests for this purpose are both highly sensitive and specific and those in greatest demand, timely in providing a test result. Unlike cases of EEE, WEE virus is rarely isolated from the brain or other tissues of infected horses (Spickler, 2017). WEE virus can be isolated in certain cell culture systems, newborn mice, and less successfully, in chick embryos. Rapid detection and identification of the virus is most frequently accomplished using molecular or nucleic acid based assays (polymerase chain reaction) and less often by immunological techniques (Lambert et al., 2003). Antibody determination is indicated when dealing with suspect cases of WEE infection with or without clinical signs. A range of serological tests (complement fixation, enzyme-linked immunosorbent assays [ELISA], hemagglutination-inhibition, and plaque reduction neutralization) are available diagnostic tests for confirming WEE infection. The IgM capture ELISA is widely used for this purpose and enables differentiation of cases of WEE from EEE infection.

In summary, a wide range of laboratory tests are available for the detection and identification of cases of WEE infection based either on agent detection or antibody determination. These enable confirmation of a diagnosis of the disease and its differentiation from cases of neurologic disease caused by other viral or microbial agents. As such, WEE meets Criterion 3 for listing in the *Terrestrial Code* with respect to the availability of laboratory tests capable of confirming a diagnosis of the disease.

AND

4a) Natural transmission to humans has been proven, and human infection is associated with severe consequences.

Yes ☒ **No** ☐

Scientific rationale:

WEE, like its arboviral counterpart EEE, was recognized as a human pathogen in the early 1930s when the disease was associated with epidemics in birds and horses (Meyer et al., 1931; Calisher, 1994). Unlike EEE, cases or outbreaks of WEE in humans or equids do not occur with regularity every year, even in regions or countries in which the disease is endemic. Reports of WEE in humans have been limited and sporadic. The virus has been associated with isolated cases, and very infrequently large numbers of cases in at-risk susceptible human populations in areas where there are high levels of WEE virus in circulation in the mosquito population. In contrast to EEE, the clinical response to WEE virus infection is generally less severe in most age groups. An exception is infants and young children who are more likely to develop neurologic disease. The latter is uncommon in healthy humans who very often experience a subclinical infection or a flu-like illness. Mortality in human cases of WEE is low, approximately 3-4%, and most frequently associated with disease in the elderly. Children that survive the disease are likely to experience serious sequelae that may be lifelong.

In summary, WEE meets Criterion 4a for listing in the *Terrestrial Code* in being a proven cause of human disease that can be of major clinical significance.

OR

4b) The disease has been shown to have a significant impact on the health of domestic animals at the level of a country or a zone taking into account the occurrence and severity of the clinical signs, including direct production losses and mortality.

Yes ☒ **No** ☐

Scientific rationale:

Since the late 1920s, WEE was a life-threatening disease responsible for widespread losses in susceptible populations of horses and other equid species in San Joaquin Valley in Southern California (Meyer et al., 1931). In the years that followed its discovery and before the development and availability of vaccines to protect against the disease, WEE exacted a significant toll on the horse populations along the coastal states in the USA and the prairie provinces of Saskatchewan, Alberta and Manitoba in Canada (Hanson, 1973). Epizootics of WEE have been recorded in Mexico, Central and South America, especially Argentina. Aside from equids, WEE causes disease in certain domesticated species of birds including emus, turkeys, pheasants and Chukar partridges (Spickler, 2017). Historically WEE has had the most significant impact on susceptible horse populations causing mortality rates of 15-20%. (Minnesota Department of Health, 2018). Incidents of the disease can vary significantly over time with zero confirmed cases reported in some years. Most of the deaths attributable to WEE are in unvaccinated individuals or those with incomplete vaccination histories. WEE vaccines are included in the group of "core vaccines" that the AAEP very strongly recommends that horses need to be vaccinated with on a regular basis (AAEP, 2022).

In summary, WEE satisfies Criterion 4b regarding its impact on the health of domestic species, in particular equids for listing in the *Terrestrial Code*.

OR

4c) The disease has been shown to, or scientific evidence indicates that it would, have a significant impact on the health of wildlife taking into account the occurrence and severity of the clinical signs, including direct economic losses and mortality, and any threat to the viability of a wildlife population.

Yes ☐ No ☒

Scientific rationale:

WEE is principally a pathogen of humans and equids with very little impact on the health of wildlife. The virus can cause disease of variable clinical severity in emus and turkeys, that in the former species can result in hemorrhagic enteritis, neurologic disease and death. Drop in egg production is the sole outcome of infection in turkeys (Spickler, 2017). Based on the very limited host range of wildlife species affected by WEE virus, there is little indication that the disease agent has a significant impact on the health of wildlife, nor that it poses a threat to the viability of any wildlife population.

In the opinion of the author and with reference to Criterion 4c, there are insufficient grounds for supporting the listing of WEE in the *Terrestrial Code*.

Conclusion regarding [pathogenic agent name]:

Does **[pathogenic agent name]** match the listing criteria that are described in the *Terrestrial Animal Health Code* Chapter 1.2.?

Yes ☐ No ☒

Summary Conclusion:

In summary, there has not been any historical precedent that attests to the international spread of WEE from the Western Hemisphere. Accordingly, the disease cannot be considered to meet Criterion 1 regarding its international spread as required for listing in the *Terrestrial Code*.

Based on available scientific knowledge and history of WEE, the disease does not currently meet Criterion 2 for listing in the *Terrestrial Code* in terms of demonstration of freedom of at least one country from the disease or infection, or of providing evidence of impending freedom from WEE or infection with the virus.

A wide range of laboratory tests are available for the detection and identification of cases of WEE infection based either on agent detection or antibody determination. These enable confirmation of a diagnosis of the disease and its differentiation from cases of neurologic disease caused by other viral or microbial agents. As such, WEE meets Criterion 3 for listing in the *Terrestrial Code* with respect to the availability of laboratory tests capable of confirming a diagnosis of the disease.

WEE meets Criterion 4a for listing in the *Terrestrial Code* in being a proven cause of human disease that can be of major clinical significance.

WEE satisfies Criterion 4b regarding its impact on the health of domestic species, in particular equids for listing in the *Terrestrial Code*.

In the opinion of the author and with reference to Criterion 4c, there are insufficient grounds for supporting the listing of WEE in the *Terrestrial Code*.

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Assessment for Western Equine Encephalomyelitis: Ann Cullinane

The criteria for the inclusion of a disease, infection or infestation in the WOAH list are as follows:

1) International spread of the pathogenic agent (via live animals or their products, vectors or fomites) has been proven.

Yes ☒ **No** ☐

Scientific rationale:

Western Equine Encephalitis (WEE) was historically detected primarily in the western USA with extension to Canada, Mexico and South America (Aréchiga-Ceballos and Aguilar-Setién, 2015; Kumar et al., 2018; Morris, 1989; Reisen & Monath, 1989; Walton, 1981). WEE virus is maintained between passerine birds and its primary mosquito vector *Culex tarsalis.* The mode of introduction of virus into new areas is unproven but international spread may potentially occur by infected vectors or reservoir species. Horses are considered dead end hosts and do not play a role in virus circulation.

Note that in recent years there has been a dramatic decline in WEE virus enzootic circulation and spillover into humans and horses. Since 2005 there have been no cases reported in the USA although positive mosquito pools have been identified (Robb et al., 2019). A fatal human case was reported in Uruguay in 2011 (Delfraro et al., 2011). This was an

isolated case but the report stated that the etiology of many viral encephalitides in Uruguay remains unknown. This is also true of many other countries in the region.

AND

2) At least one country has demonstrated freedom or impending freedom from the disease, infection or infestation in populations of susceptible animals, based on the provisions of Chapter 1.4.

Yes ☒ **No** ☐

Scientific rationale:

To-date WEEV transmission is limited to the Americas. Other areas such as Europe are historically free (Durand et al., 2013).

AND

3) Reliable means of detection and diagnosis exist and a precise case definition is available to clearly identify cases and allow them to be distinguished from other diseases, infections or infestations.

Yes ☒ **No** ☐

Scientific rationale:

Reliable means of detection and diagnosis of WEE exist as documented in the WOAH Manual. Virus isolation and RT-PCR are recommended for confirmation of clinical cases. Virus isolates can be identified by specific RT-PCR or neutralisation tests.

There is no precise case definition in the WOAH *Terrestrial Code* (Chapter 12.4).

AND

4a) Natural transmission to humans has been proven, and human infection is associated with severe consequences.

Yes ☒ **No** ☐

Scientific rationale:

WEEV is classified as a Category B agent by the Centers for Disease Control and Prevention, Atlanta (https://emergency.cdc.gov/agent/agentlist-category.asp). Humans are infected by mosquito vectors and the majority of cases are asymptomatic or similar to influenza. The very young and the aged are most susceptible to encephalitis and approximately 5-15% of encephalitis cases are fatal. Approximately 50% of surviving infants suffer permanent brain damage (Weaver et al., 1997). Fatalities have been recorded in laboratory workers.

OR

4b) The disease has been shown to have a significant impact on the health of domestic animals at the level of a country or a zone taking into account the occurrence and severity of the clinical signs, including direct production losses and mortality.

Yes ☒ **No** ☐

Scientific rationale:

Horses are more susceptible to WEE than people with a mortality rate of 20-50% in clinical cases. Clinical signs include fever, inappetence and lethargy, followed by excitability and then drowsiness, paresis, seizures and coma (CFSPH, 2015). WEE has also been reported to cause fatal disease in ratites (Tengelsen et al., 2001).

The largest epidemic was recorded in 1938 in USA and Canada when an estimated 264,000 equids were infected with a morbidity of 21.4% (Cameron, 1942).

OR

4c) The disease has been shown to, or scientific evidence indicates that it would, have a significant impact on the health of wildlife taking into account the occurrence and severity of the clinical signs, including direct economic losses and mortality, and any threat to the viability of a wildlife population.

Yes ☒ **No** ☐

Scientific rationale:

Spillover into wild mammals has been recorded and a secondary transmission cycle involves Aedes malanimon and the Black-tailed Jackrabbit (Hardy et al., 1977). Several amphibian and reptile species are suspected overwintering hosts (Thomas and Eklund, 1962) and it is likely that additional hosts remain unidentified.

There is a lack of evidence that WEE represents a threat to a wildlife population.

Conclusion regarding [pathogenic agent name]:

Does **[pathogenic agent name]** match the listing criteria that are described in the *Terrestrial Animal Health Code* Chapter 1.2.?

Yes ☒ **No** ☐

Summary Conclusion:

WEE satisfies the criteria for WOAH listing but the evidence from surveillance in North America suggests that the virus may have ceased circulating enzootically. The reason for this decline is unknown. WEE remains a notifiable disease in many parts of the world as it has the potential to re-emerge either naturally or as a result of bioterrorism. Thus on balance, WEE should be included in the WOAH list as a significant zoonotic neurotropic pathogen with the historical potential to cause disease outbreaks in horses and possibly,birds. However, at present such listing should have minimal impact on animal trade policy.

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Assessment for Western Equine Encephalomyelitis: Alf Fussel

The criteria for the inclusion of a disease, infection or infestation in the WOAH list are as follows:

1) International spread of the pathogenic agent (via live animals or their products, vectors or fomites) has been proven.

Yes ☒ **No** ☐

Scientific rationale:

References:

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AND

2) At least one country has demonstrated freedom or impending freedom from the disease, infection or infestation in populations of susceptible animals, based on the provisions of Chapter 1.4.

Yes ☒ **No** ☐

Scientific rationale:

The WEE virus is found in the western United States, western Canada, and as far south as Argentina.

WOAH WAHIS 2015-2022: disease not present in Eastern Hemisphere

AND

3) Reliable means of detection and diagnosis exist and a precise case definition is available to clearly identify cases and allow them to be distinguished from other diseases, infections or infestations.

Yes ☒ **No** ☐

Scientific rationale:

There are reliable means of detection and diagnosis:

https://www.woah.org/fileadmin/Home/fr/Health_standards/tahm/3.06.05_EEE_WEE_VEE.pdf
https://sitesv2.anses.fr/en/minisite/equine-diseases/sop

However, the case definition used in USA does not allow a clear differential diagnosis from EEE, unless laboratory investigations identify the WEEV.

https://www.aphis.usda.gov/vs/nahss/equine/ee/case_definition_western_equine_encephalitis_01_18_11.pdf

AND

4a) Natural transmission to humans has been proven, and human infection is associated with severe consequences.

Yes ☒ **No** ☐

Scientific rationale:

In the United States, the virus is transmitted by *Culex tarsalis* in an enzootic cycle with passerine birds. There have been 639 human cases of WEEV in the United States since 1964, but none since 1994. (www.cdc.gov)

"CDC has received reports of 37 western equine encephalitis (WEE) cases among humans and 132 cases among horses in the Plains and Rocky Mountain states thus far this year [i.e. in 1987]. This outbreak is the largest in the United States since 1977, when 41 cases among humans were reported. Active, hospital-based surveillance in Colorado has identified 29 cases, including one fatality. Passive surveillance has revealed three cases in Nebraska, two in Texas, two in North Dakota, and one in Montana. Colorado, Iowa, Nebraska, and North Dakota also reported sporadically occurring cases of St. Louis encephalitis (SLE), concurrently with the WEE epidemic. The diffuse character of the outbreak has made it difficult to assign a denominator to the human population at risk. However, the crude attack rate in Colorado, where there is evidence of statewide virus transmission, is 1.0/100,000."

https://www.cdc.gov/mmwr/preview/mmwrhtml/00000983.htm

OR

4b) The disease has been shown to have a significant impact on the health of domestic animals at the level of a country or a zone taking into account the occurrence and severity of the clinical signs, including direct production losses and mortality.

Yes ☐ **No** ☒

Scientific rationale:

There is an equine population of about 7 million animals in the US.

https://horsesonly.com/horse-industry/#:~:text=3.,million%20horses%20in%20the%20U.S.&text=This%20is%20because%20there%20are,organization%20counts%20the%20numbers%20differently

USDA/APHIS reports 111 equine arboviral encephalomyelitis cases in 2022, predominantly EEE.

https://www.aphis.usda.gov/animal_health/downloads/animal_diseases/2022-eee-report-monthly.pdf

OR

4c) The disease has been shown to, or scientific evidence indicates that it would, have a significant impact on the health of wildlife taking into account the occurrence and severity of the clinical signs, including direct economic losses and mortality, and any threat to the viability of a wildlife population.

Yes ☐ **No** ☒

Scientific rationale:

Reports about WEE do not indicate any threat to the viability of a wildlife population.

WEE virus is maintained in an enzootic cycle involving passerine birds and Culex tarsalis, a mosquito particularly adapted to irrigated agricultural areas. The feeding pattern for Culex tarsalis changes from birds in spring and early summer to increasingly include mammals in late summer when mosquito populations peak, depending on climatic factors and irrigation practices.

Other secondary mosquito vectors include Aedes melanimon and Ae. dorsalis, which can facilitate a secondary cycle of infection among lagomorphs and, with *Culex tarsalis*, transmit virus to horses and humans.

Serosurveys have confirmed WEEV infection in various rodents, rabbits, bats, squirrels, ungulates, tortoises, and snakes, suggesting that non-avian species may be important reservoir hosts.

Emus are susceptible to WEEV infection, but with considerably lower mortality rates than those associated with EEEV infection.

Conclusion regarding [pathogenic agent name]:

Does **[pathogenic agent name]** match the listing criteria that are described in the *Terrestrial Animal Health Code* Chapter 1.2.?

Yes ☒ **No** ☐

Summary Conclusion:

Infection with the Western Equine Encephalomyelitis Virus meets the listing requirements set out in Chapter 1.2. of the *Terrestrial Code*.

This conclusion would concur with the outcome of the respective EFSA report and the conclusion of the European Union as set out in Annex II to Regulation (EU) 2016/429. (doi: 10.2903/j.efsa.2017.4946)

However, any possible measures to prevent the spread of the virus through international trade in certain captive birds, reptiles or rodents should be set out in Section 8 "Multiple Species".

The requirements in Chapter 12.4. should be removed, since equine animals are considered to be dead-end hosts due to the generally low level and short duration of viremia following the accidental infection from vector insects.

Since individual equine animals may be affected by the infection and because of the zoonotic nature of the infection, it is advised to maintain surveillance, not least to allow the vaccination of equines resident in, or intended to be moved to, endemic areas.

Annex 7. 9.2.1. Listing Assessment for Equine Encephalitides (VEE)

MEETING OF THE WOAH SCIENTIFIC COMMISSION FOR ANIMAL DISEASES

Paris, 11 to 15 September 2023

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SUMMARY OF THE EXPERT ASSESSMENT OF VENEZUELAN EQUINE ENCEPHALOMYELITIS AGAINST THE LISTING CRITERIA OF *TERRESTRIAL CODE* CHAPTER 1.2.

Four experts participated in this consultation:

- **Peter Timoney** (IHSC Consultant, Gluck Equine Research Center, USA)
- **Ann Cullinane** (Irish Equine Center, Ireland)
- **Alf Fussel** (IHSC Consultant, retired from European Commission, Belgium)
- **Roberto Navarro Lopez** (US-Mexico Commission for the Prevention of FMD and other exotic animal diseases (SENASICA), Mexico)

Criterion	1	2	3	4
Criterion 1: International spread of the pathogenic agent (via live animals or their products, vectors or fomites) has been proven.	YES	YES	YES	YES
Criterion 2: At least one country has demonstrated freedom or impending freedom from the disease, infection or infestation in populations of susceptible animals, based on the provisions of Chapter 1.4.	YES	YES	YES	YES
Criterion 3: Reliable means of detection and diagnosis exist, and a precise case definition is available to clearly identify cases and allow them to be distinguished from other diseases, infections or infestations.	YES	YES	YES	YES
Criterion 4a: Natural transmission to humans has been proven, and human infection is associated with severe consequences.	YES	YES	YES	YES
Criterion 4b: The disease has been shown to have a significant impact on the health of domestic animals at the level of a country or a zone taking into account the occurrence and severity of the clinical signs, including direct production losses and mortality.	YES	YES	YES	YES
Criterion 4c: The disease has been shown to, or scientific evidence indicates that it would, have a significant impact on the health of wildlife taking into account the occurrence and severity of the clinical signs, including direct economic losses and mortality, and any threat to the viability of a wildlife population.	NO	YES	NO	NO
CONCLUSION: Does infection with Venezuelan equine encephalitis virus match the listing criteria that are described in the Terrestrial Animal Health Code Chapter 1.2?	YES	YES	YES	YES

Assessment for Venezuelan Equine Encephalomyelitis: Peter Timoney

The criteria for the inclusion of a disease, infection or infestation in the WOAH list are as follows:

1) International spread of the pathogenic agent (via live animals or their products, vectors or fomites) has been proven.

Yes ☒ **No** ☐

Scientific rationale:

Venezuelan equine encephalitis (VEE) first discovered in 1938, has a wide geographic distribution range throughout the Western Hemisphere with the exception of the USA and Canada (Kubes and Rios, 1939). Outbreaks of disease in humans and equids due to this virus have been reported in at least 12 countries extending from Argentina to numerous other countries in South and Central America, Trinidad, Mexico and the USA (Osorio and Yuill, 2017; Weaver et al, 2004).

Epidemics or epizootics of VEE occur periodically, not annually nor on a regular basis but rather following the emergence of one of the two subtypes 1AB or 1C that evolve from genetic modification of circulating enzootic subtype 1D strains, (Powers et al., 1997; Brault et al., 2002). To date, there has been one incursion of VEE into the USA. Late in 1969, epizootics of VEE spread northwards from El Salvador and Guatemala into most of Central America and Mexico (Forrester et al., 2017). The disease extended into 17 Mexican states before it crossed the border into southern Texas in 1971 (Zarate, 1978; Morilla-Gonzales, 1976). The virus spread along the Rio Grande and up the Gulf Coast between June and August of that year, infecting close to 2000 horses including 1426 associated deaths. Some 110 human cases were confirmed during the epidemic (Aguilar et al., 2011). Since its discovery in 1938, VEE has not been confirmed outside the Western Hemisphere.

VEE comprises a complex of viruses that include six antigenic subtypes, with antigenic variants in each subtype (Spickler, 2017). Each of these subtypes exhibits unique characteristics with respect to ecology, epidemiology and virulence for humans and equids (Aguilar et al., 2011). Two, 1AB and 1C, are designated epidemic or epizootic subtypes, historically identified with causing large scale outbreaks of disease in susceptible populations of horses and humans that may last for several years. Both subtypes are highly pathogenic and can spread quickly through equine populations. The remaining subtypes 1D to 1F and II to VI, are categorized as enzootic or endemic (Spickler, 2017). They generally circulate among rodents in forests and swampy habitats and are typically avirulent for equids but can cause disease and even death in humans similar to that seen in cases of infection with either of the epidemic/epizootic subtypes. In sharp contrast to both EEE and WEE viruses, equids infected with the 1AB or 1C subtypes of VEE virus develop high levels of viremia that can last up to seven days (Rico-Hesse, 2000; Walton et al., 1973). Equids are considered the key reservoir species and amplification hosts for both epidemic subtypes of the virus. Viremic horses can also shed VEE virus in body fluids and could be a potential source of infection for humans through direct contact or inhalation of aerosolized material (Johnson and Martin, 1974). Counter to typical behavior of endemic/enzootic subtypes of the virus, subtype 1E strains responsible for extensive outbreaks of disease in equids in Mexico in 1993 and 1996, were equine neurovirulent although not shown to develop high titered viremias (Gonzalez-Salazar et al., 2003). Under this circumstance, it is questionable whether equids infected with this particular variant of subtype 1E can act as efficient amplification hosts for virus transmission to appropriate mosquito vectors (Sahu et al., 2003).

To date, there has been only one historical precedent since original discovery of the virus of VEE occurring outside of the countries in South and Central America and Mexico in which the disease is endemic. This took place in the USA in 1971. In the opinion of the author, this unique event constituted a proven instance of the international or transboundary spread of VEE into a country that up to that point, enjoyed historical freedom from the disease. The mode of introduction of the virus is highly likely to have been via wind-borne carriage of infected vectors (mosquitoes) from the Gulf Coast of Mexico where VEE had been progressing northwards towards the border with the USA at an estimated rate of 4-5 miles/day (Zarate, 1978; Morilla-Gonzales, 1976). It is also possible that there might have been illegal movement of infected equids across the border into the USA that could also have been contributory sources of the virus. The incursion of VEE into the USA for the first and only time in 1971, is proof of the international spread of this disease. As such, it meets Criterion 1 for listing in the Terrestrial Code.

AND

2) At least one country has demonstrated freedom or impending freedom from the disease, infection or infestation in populations of susceptible animals, based on the provisions of Chapter 1.4.

Yes ☒ **No** ☐

Scientific rationale:

The Veterinary Authorities in the USA and Canada have always designated VEE a highly important transboundary disease insofar as its major significance as a human and equine pathogen. Were it to be introduced into either country, the economic consequences would be disastrous for the respective equine industries in terms of losses of animals that succumb from the disease and disruption of international trade. It is mandated in both countries that any suspect case of VEE must be reported immediately to federal and state authorities and an investigation undertaken to confirm/refute a diagnosis of the disease. The Veterinary Authorities, members of the veterinary profession, and equine industry stakeholders in the USA were alerted to the very real risk of the introduction of VEE into the country in the months leading up to the event in 1971. At the time, the disease was continuing to spread northwards from El Salvador and Guatemala through Mexico, and sooner rather than later, measures needed to be taken to prevent and control spread of the virus were it to be introduced into the country.

Those fears were realized when the first case of VEE was confirmed in a horse in Texas in late June 1971. A three-pronged approach was taken to minimize the extent of the epidemic or epizootic. This included: 1) enforced restriction of movement of equids out of the affected state; 2) mandated vaccination of at-risk equids with the modified live TC-83 vaccine against VEE; and 3) implementation of aerial and ground vector control measures to reduce mosquito populations in the region. In total, over 8 million doses of vaccine were administered to equids during the epizootic. Vaccination was used to establish a “cordon sanitaire” around the area affected with the disease. These collective efforts were successful in confining the epizootic and in restoring the USA's disease free status for VEE.

In the opinion of the author, the USA successfully eliminated VEE following its incursion into southern Texas in 1971 and has since demonstrated continued freedom from the disease, thereby meeting the second criterion for listing in the Terrestrial Code.

AND

3) Reliable means of detection and diagnosis exist and a precise case definition is available to clearly identify cases and allow them to be distinguished from other diseases, infections or infestations.

Yes ☒ **No** ☐

Scientific rationale:

VEE virus can cause a spectrum of clinical signs ranging from a mild flu-like illness to severe and not infrequently neurologic disease. It can be symptomatic of a variety of diseases, some infectious, others non-infectious. Differentiation of neurologic disease caused by VEE virus as opposed to other arboviral infections is not possible on clinical grounds alone. Confirmation of a provisional clinical diagnosis of VEE must be based on laboratory detection and identification of the virus or by demonstration of antibody conversion in serum or cerebrospinal fluid. Testing of appropriate clinical or post-mortem specimens from a suspect case of VEE virus infection requires a laboratory with the capability, expertise and experience in conducting the tests needed to furnish a diagnosis.

Epidemic strains of VEE can be isolated from blood in the early febrile phase of the disease but seldom once the affected individual has developed neurologic disease, at which point viremia has ceased (Spickler, 2017). Frequently, VEE viruses cannot be isolated from the brains of infected equids but may be found in other tissues such as the pancreas. Systems for the isolation of VEE virus include: 1-3 day old mice, hamsters or Guinea pigs; certain cell culture systems, or chick embryos. Rapid detection and identification of the virus is most frequently accomplished by using molecular nucleic acid based assays (polymerase chain reaction assays), and less often, by immunological techniques (Pisano et al., 2012). A range of serological tests (complement fixation, enzyme-linked immunosorbent [ELISA] assays, hemagglutination-inhibition and plaque reduction neutralization) can be used in investigating suspect clinical cases of VEE virus infection. The IgM capture ELISA is widely used for this purpose and the most popular differential diagnostic test to confirm a case of this infection. Vaccination histories must be taken into consideration when interpreting any of the VEE serological test results.

In summary, a range of laboratory tests are available for the detection and identification of cases of VEE virus infection. These enable diagnosis of the disease and its differentiation from cases of neurologic disease caused by other disease agents. Therefore in the author's opinion, VEE meets Criterion 3 listed for inclusion in the Terrestrial Code.

AND

4a) Natural transmission to humans has been proven, and human infection is associated with severe consequences.

Yes ☒ **No** ☐

Scientific rationale:

Ever since its discovery in 1938, VEE virus has been recognized as a highly important pathogen of humans and equids. Extensive occurrences of this disease caused by the epidemic subtypes 1AB or 1C have on occasion been associated with tens and even hundreds of thousands of cases of human infection (Osorio and Yuill, 2017; Weaver et al., 2004). In addition epizootic strains belonging to subtype 1 variants D-F and subtype II-VI, while typically non-pathogenic for equids, can cause clinical disease and even death in humans that is indistinguishable from that caused by the epidemic strains (Calisher, 1994). VEE virus infection in healthy humans usually results in a mild systemic flu-like illness that resolves in one to two weeks (Public Health Agency of Canada, 2011). Neurologic disease of variable severity can develop in a small percentage of individuals, especially in young children and in elderly adults (Spickler, 2017). Fatality rates in humans are less than 1% of symptomatic cases. VEE virus can affect the fetus in pregnant women and give rise to teratological abnormalities, abortion, pre-term deliveries or stillbirths. Vertical transmission of the virus from mother to fetus has been documented.

In summary, natural transmission of VEE virus to humans has been proven many times and the resultant human infection can be serious and even fatal. Accordingly, VEE virus meets Criterion 4a for listing in the Terrestrial Code with respect to its ability to cause human disease with severe consequences.

OR

4b) The disease has been shown to have a significant impact on the health of domestic animals at the level of a country or a zone taking into account the occurrence and severity of the clinical signs, including direct production losses and mortality.

Yes ☒ No ☐

Scientific rationale:

VEE virus is a highly significant pathogen of equids as well as humans (Walton, 2008). For over 100 years, the virus has been identified with periodic occurrences of disease in susceptible populations of horses and other equid species in South and Central America and also, Mexico. These have been associated with infection with one or other of the two epizootic subtypes of the virus 1AB and 1C. Some of these epizootics have been very extensive, involving up to hundreds of thousands of equids as well as humans (Weaver et al., 2004). The duration of these events can be variable; some have been known to last several years. The morbidity rate in at-risk equid populations can range from 10-40% in some locations to 50-100% in others. Case fatality rates in horses have been estimated at 30-90% (Spickler, 2017). Whereas most enzootic subtypes of VEE virus do not cause clinical disease or death nor are amplified in equids, certain strains of subtype IE virus emerged in Mexico in 1993 and 1996 that caused outbreaks of neurologic disease in affected individuals. The mortality rate associated with these occurrences was 30-50%.

In summary, there is undeniable proof that over many years, VEE has had a highly significant impact on the health of equid populations in regions/countries affected by epizootics of the disease. The impact includes production losses and mortality losses from the disease. Accordingly, VEE fully qualifies for listing in the Terrestrial Code.

OR

4c) The disease has been shown to, or scientific evidence indicates that it would, have a significant impact on the health of wildlife taking into account the occurrence and severity of the clinical signs, including direct economic losses and mortality, and any threat to the viability of a wildlife population.

Yes ☐ No ☒

Scientific rationale:

Besides humans and equids, the host spectrum of VEE virus is very limited (Spickler, 2017). The epizootic subtypes 1AB and 1C can infect and cause disease in rodents, especially hamsters and Guinea pigs. Subclinical infection has been demonstrated in rabbits and some bird species. Enzootic subtypes of the virus can infect wild rodents, opossums and bats but are not known to cause clinical disease in any of the aforementioned. Based on these limited data, VEE virus cannot be considered to have a significant impact on the health of wildlife nor does the virus appear to pose a threat to the viability of any wildlife population. In summary, there are insufficient grounds to support the listing of VEE in the Terrestrial Code with respect to Criterion 4c.

Conclusion regarding [pathogenic agent name]:

Does **[pathogenic agent name]** match the listing criteria that are described in the *Terrestrial Animal Health Code* Chapter 1.2.?

Yes ☒ **No** ☐

Summary Conclusion:

To date, the author is only aware of one historical event of VEE reported outside the countries of South and Central America and Mexico in which the disease is endemic. It took place in the USA in 1971. In the author's opinion, this event constituted a proven instance of the transboundary spread of VEE into a country that had been previously free of the disease. The source of the virus for this epidemic was almost certain to have been wind-borne carriage of infected mosquitoes northwards from Mexico into southern Texas. This very significant event confirmed the international spread of VEE and matched Criterion 1 described in the Terrestrial Code. The collective measures that were implemented by the US Veterinary Authorities at the time comprised: mandatory vaccination with TC-83 VEE vaccine within and ahead of the affected zone along the Rio Grande River and up the Gulf Coast; enforced restriction of movement of equids out of the state; and aerial and ground vector control measures. Collectively, these measures were successful in confining the epizootic and in restoring the disease free status of the USA for VEE that has remained ever since. This event and its outcome, namely elimination of VEE from the USA, matches Criterion 2 for listing in the Terrestrial Code. A range of laboratory tests are available for the detection and identification of cases of VEE virus infection. They enable diagnosis of the disease and its differentiation from cases of neurologic disease caused by other disease agents (Criterion 3). VEE virus has been proven on numerous occasions to be a highly significant human pathogen and a source of very high morbidity though limited mortality caused by infection with strains of subtypes 1AB or 1C. Enzootic subtypes of the virus can also cause sporadic cases of fatal infection in humans. Additionally, VEE virus can give rise to abortion, stillbirths and teratological abnormalities in the fetus of women exposed to the virus during pregnancy. VEE virus certainly matches Criterion 4a in terms of its significance as a human pathogen. For over 100 years, VEE has given rise to periodic epizootics of major magnitude in susceptible equid populations, the vast majority of which were caused by subtypes 1AB or 1C of the virus. While enzootic subtypes of VEE do not normally cause disease nor death in horses, there is confirmed evidence of the existence of neurovirulent strains of subtype 1E that have the ability to cause neurologic disease in infected horses and an associated 30-50% mortality rate. Based on its importance as an equine pathogen, VEE certainly matches Criterion 4b with respect to it being listed in the Terrestrial Code. The range of wildlife species susceptible to developing clinical disease upon infection with VEE virus, epizootic subtypes, is very limited. Accordingly, there are insufficient grounds to support the listing of VEE virus in terms of it impacting the health and viability of wildlife as per Criterion 4c. With the exception of Criterion 4c, VEE virus matches Criteria 1 and 2, also Criteria 3, 4a and 4b. There are insufficient grounds for supporting matching with respect to Criterion 4c.

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Assessment for Venezuelan Equine Encephalomyelitis: Roberto Navarro Lopez

The criteria for the inclusion of a disease, infection or infestation in the WOAH list are as follows:

1) International spread of the pathogenic agent (via live animals or their products, vectors or fomites) has been proven.

Yes ☒ **No** ☐

Scientific rationale:

Venezuelan equine encephalomyelitis viruses (VEEV) are taxonomically classified within the genus Alphavirus of the family Togaviridae. The EEV virus complex includes six antigenic subtypes (I-VI) divided by antigenic variants. They are divided into enzootic (endemic) and epizootic (epidemic). The purpose of this evaluation is to present inclusion criteria, so only the epizootic variants corresponding to viral genotypes I-AB and I-C, which are the only ones that have a biological behavior associated to equine-arthropod-equine epizootic activity, are considered in the Terrestrial Animal Health Code. It has been demonstrated that these viral genotypes are not found in natural reservoirs, and that their presence is due to punctual mutations that occur in the IE enzootic variants in some South American countries and south of Panama. These mutant viruses (genotypes IAB and C), when reaching an amplifying host, such as equines, causes epizootics and epidemics by allowing multiple arthropod vectors to become infected, therefore affecting other equines and people.

On the other hand, the genotypes called enzootic, have a rodent-arthropod-rodent transmission cycle and their presence does not represent a possibility of generating epizootic disease, since they can sicken an equine or a person, but are considered terminal hosts, as is the case with other arboviruses such as VON, EEE and EEO.

AND

2) At least one country has demonstrated freedom or impending freedom from the disease, infection or infestation in populations of susceptible animals, based on the provisions of Chapter 1.4.

Yes ☒ **No** ☐

Scientific rationale:

Venezuelan equine encephalomyelitis virus (EEV) caused by genotype IAB has caused periodic epidemics among humans and horses in Latin America from 1920s to early 1970s. The IAB and C genotypes have arisen from specific mutations of the IE genotype, present in Venezuela, Colombia, Ecuador, Peru, Trinidad and Panama. The first and only major epizootic outbreak from this South American region documented by the IAB genotype spread from these countries to Central America, Mexico and the USA in the late 1960s and early 1970s. The first major outbreak since 1973 occurred in Venezuela and Colombia during 1995 and affected some 75 000 to 100 000 people, this epidemic-epizootic caused by the IC genotype arose in Guajira, which is a region shared by Venezuela and Colombia.

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AND

3) Reliable means of detection and diagnosis exist and a precise case definition is available to clearly identify cases and allow them to be distinguished from other diseases, infections or infestations.

Yes ☒ **No** ☐

Scientific rationale:

A presumptive diagnosis of VEEV can be made when susceptible horses show the characteristic somnolence and other signs of neurological disease in areas where hematophagous insects are active. Confirmatory diagnosis of VEEV is based on virus isolation and identification or demonstration of seroconversion, but VEEV viruses are rarely isolated. Viruses can be isolated from field samples by inoculating embryonated chicken eggs or cell cultures. The virus can be identified by reverse transcription polymerase chain reaction (RT-PCR), complement fixation (CF), immunofluorescence or plaque reduction neutralization tests (PRN).

Specific identification of epizootic variants of VEEV can be performed by indirect fluorescent antibody testing, or a differential PRN test using subtype- or variant-specific monoclonal antibodies, or by nucleic acid sequencing.Virological diagnosis: Viral isolation or RT-PCR in tissues, blood or cerebrospinal fluid (CSF).Serological diagnosis: Determination of IgM or IgG during the acute phase (1 to 7 days after the onset of symptoms) and in the convalescent phase (14 days after the onset of signs), using ELISA, hemagglutination inhibition technique, neutralization or similar.

References:

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AND

4a) Natural transmission to humans has been proven, and human infection is associated with severe consequences.

Yes ☒ **No** ☐

Scientific rationale:

The epizootic subtypes IAB and IC can cause significant disease in both humans and equines. VEE can occur in all age groups and there is usually no sex bias during outbreaks. However, infected children are more likely than adults to develop long-lasting neurological sequelae and fatal encephalitis. Pregnant women infected with VEEV are at risk of congenital disabilities, miscarriages, premature births and stillbirths.

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OR

4b) The disease has been shown to have a significant impact on the health of domestic animals at the level of a country or a zone taking into account the occurrence and severity of the clinical signs, including direct production losses and mortality.

Yes ☒ **No** ☐

Scientific rationale:

In equines, generalized signs usually appear about 2–5 days after infection with epizootic VEEV, including fever, tachycardia, depression, and anorexia. Some or most animals go on to develop encephalitis 5–10 days after infection, with signs of circling, ataxia, and hyperexcitability. Death usually occurs about one week after experimental infection. Encephalitis and death are correlative with the magnitude of equine viremia, but even equine-avirulent enzootic strains produce lethal encephalitis when inoculated intracerebrally. This suggests that virulence is related to the ability of VEEV to replicate extracerebrally and spread to the brain rather than to innate neurovirulence.

The first well-documented outbreak of VEE involving equids occurred in the central river valleys of Colombia in 1935 and spread to Venezuela the following year. By 1943, the outbreak had spread to Trinidad. Additional epizootics were reported on the coast of Peru from 1942 to 1946.

One of the largest outbreaks of VEE began in La Guajira, Colombia, in 1962. It initially involved approximately 3000 human cases, of which 20 were fatal. This outbreak then spread to Venezuela, where it caused 23,283 human cases, including 960 neurological cases and 156 deaths, reported during a 26-month period. Data on the number of equine cases in this outbreak are scarce. During 1967 and 1968, epizootics were observed in Colombia, but exact numbers of human and equine cases were not documented. In early 1969, a large outbreak was reported in Ecuador involving approximately 31,000 human cases with 310 deaths and approximately 20,000 equine deaths. In late 1969, epizootics were reported in El Salvador and Guatemala; these outbreaks eventually spread to throughout Central America and Mexico [15 ,16]. During this outbreak, approximately 50 000 horses died, in addition to approximately 52 000 human cases, of which 93 were fatal in Mexico only. IIn the summer of 1969, equine deaths were initially reported in the state of Chiapas, Mexico near the border with Guatemala. By 1970, approximately 10,000 equine deaths were reported in the Pacific region of Chiapas and Oaxaca. This outbreak spread to northern Mexico, affecting 17 states, the Gulf Coast and eventually south to Texas. The last Mexican equine case was recorded in September 1972 in Islas Marias, Nayarit. In Texas, between June and August 1971, almost 2000 infected horses were reported, with 1426 deaths. During the same period of time, 110 human cases were confirmed.

In 1992, an initial outbreak was reported in Venezuela. In 1995, both Venezuela and Colombia reported outbreaks involving approximately 100,000 human cases, 3000 of which experienced neurological complications, with 300 associated deaths. There were also at least 4000 equine deaths associated with this outbreak.

Aguilar PV, Estrada-Franco JG, Navarro-Lopez R, Ferro C, Haddow AD, Weaver SC. Endemic Venezuelan equine encephalitis in the Americas: hidden under the dengue umbrella. Future Virol. 2011;6(6):721-740. doi: 10.2217/FVL.11.5. PMID: 21765860; PMCID: PMC3134406. n equines, generalized signs usually appear about 2–5 days after infection with epizootic VEEV, including fever, tachycardia, depression, and anorexia. Some or most animals go on to develop encephalitis 5–10 days after infection, with signs of circling, ataxia, and hyperexcitability. Death usually occurs about one week after experimental infection. Encephalitis and death are correlative with the magnitude of equine viremia, but even equine-avirulent enzootic strains produce lethal encephalitis when inoculated intracerebrally. This suggests that virulence is related to the ability of VEEV to replicate extracerebrally and spread to the brain rather than to innate neurovirulence.

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OR

4c) The disease has been shown to, or scientific evidence indicates that it would, have a significant impact on the health of wildlife taking into account the occurrence and severity of the clinical signs, including direct economic losses and mortality, and any threat to the viability of a wildlife population.

Yes ☐ No ☒

Scientific rationale:

There is no evidence of serious effects of these viruses on wildlife.

Conclusion regarding [pathogenic agent name]:

Does **[pathogenic agent name]** match the listing criteria that are described in the *Terrestrial Animal Health Code* Chapter 1.2.?

Yes ☒ No ☐

Summary Conclusion:

The Terrestrial Animal Code of the WOAH in its chapter 12.11. about Venezuelan equine encephalomyelitis, establishes the zoosanitary measures that countries must apply for the international trade of equines. So the countries that declare activity of any VEEV, are required among other measures, to quarantine the equines at the border, without discriminating if the VEEV are epizootic or enzootic. Even though this situation is well established epidemiologically in the Manual of Terrestrial Animals of the WOAH, but it is not taken up by the Code.

According to WOAH's guidelines for listing criteria for terrestrial animal diseases, it is recognized that some pathogens have different subspecies, lineages, or strains that may have different hosts, as well as different impacts on domestic or wild animals or humans. Therefore, it is possible that the criteria for listing a disease may specify only those subspecies that meet the criteria for listing.

Such is the case of epidemic VEE, in which only genotypes of subtypes I-AB and I-C have a biological behavior associated with epidemic activity in equids and humans; and that meet the criteria of having the potential for transboundary dissemination by vectors; according to their distribution, there are countries free of this epidemic subtype I-AB and I-C; There is a specific diagnostic test; Natural transmission to humans has been proven and the disease in humans can have severe consequences such as death.

Therefore, the epidemic VEE caused by strains I-AB and I-C are the ones that should be listed, differentiating the strains of the enzootic cycle that do not represent any risk of epizootic diseases that endanger people or other countries.

Assessment for Venezuelan Equine Encephalomyelitis: Ann Cullinane

The criteria for the inclusion of a disease, infection or infestation in the WOAH list are as follows:

1) International spread of the pathogenic agent (via live animals or their products, vectors or fomites) has been proven.

Yes ☒ **No** ☐

Scientific rationale:

Epizootic Venezuelan Equine Encephalitis (VEE) was initially limited to northern and western South America but spread to other regions and to Central America, Mexico, and the southern USA. The mechanism of international spread is poorly understood. Phylogenetic studies suggest that VEEV is maintained primarily in situ, with only occasional spread to neighbouring countries for example from Mexico into Southern USA, probably reflecting the limited mobility of rodent hosts and mosquito vectors. However, this mobility may increase due to habitat disturbance resulting from continued deforestation in areas such as the Amazon basin. Virus evolution also plays a role in spread as some strains of Venezuelan Equine Encephalitis (VEEV) have acquired infectivity for mosquito species with increased dispersal and a preference for large mammals. Furthermore, climate change has resulted in the spread of mosquito species to new areas. The recent appearance for the first time of Culex (Melanoconion) species in southern Florida increases the potential for other VEEV subtypes to spread northwards and establish enzootic transmission cycles (Forrester et al., 2017, Guzmán-Terán et al., 2020).

AND

2) At least one country has demonstrated freedom or impending freedom from the disease, infection or infestation in populations of susceptible animals, based on the provisions of Chapter 1.4.

Yes ☒ **No** ☐

Scientific rationale:

VEE is confined to South, Central and North America. Historically other regions are free.

AND

3) Reliable means of detection and diagnosis exist and a precise case definition is available to clearly identify cases and allow them to be distinguished from other diseases, infections or infestations.

Yes ☒ **No** ☐

Scientific rationale:

Reliable means of detection are described in the WOAH Manual, Chapter 3.6.5 https://www.woah.org/fileadmin/Home/eng/Health_standards/tahm/3.06.05_EEE_WEE_VEE.pdf .

Specific identification of epizootic VEE virus variants can be made by the indirect fluorescent antibody test, or a differential plaque reduction neutralisation (PRN) test using subtype- or variant-specific monoclonal antibody, or by nucleic acid sequencing.

There is no precise case definition in the WOAH Terrestrial Code.

AND

4a) Natural transmission to humans has been proven, and human infection is associated with severe consequences.

Yes ☒ **No** ☐

Scientific rationale:

VEEV is categorised as Category B agent by the Centers for Disease Control and Prevention, Atlanta (https://emergency.cdc.gov/agent/agentlist-category.asp). Equines are the key reservoir species for the epizootic strains of VEEV that cause fatal clinical disease in horses and humans. Transmission is by haematophagous insects but aerosol transmission has been reported in laboratory workers. Epidemics involving thousands of people have been reported with 4-14% mortality associated with neurological disease. Children are most susceptible to encephalitic disease in contrast to adults who tend to experience a mild febrile disease or influenza like symptoms (Kumar et al., 2018). Children are also more likely to suffer permanent neurological damage such as mental incapacity, epilepsy, learning difficulties, hydrocephalus, personality changes, and paralysis than adult survivors. A 1995 outbreak of VEE in Colombia and Venezuela affected an estimated 75,000 humans; 3000 people developed neurologic complications, and 300 fatalities occurred (Rivas et al., 1997).

OR

4b) The disease has been shown to have a significant impact on the health of domestic animals at the level of a country or a zone taking into account the occurrence and severity of the clinical signs, including direct production losses and mortality.

Yes ☒ **No** ☐

Scientific rationale:

Epizootic subtypes of VEEV are highly pathogenic to Equidae and a fatality rate of 19-83% has been recorded during epidemics (Weaver et al., 2004). The disease in horses is characterized by fever, loss of appetite, somnolence and disorders of the central nervous system, such as muscle deterioration, blindness, and seizures. In acute cases death may occur without neurological signs. One outbreak in Colombia was associated with 100,000 equid deaths.

Fatalities have also been recorded in other domestic animals for example sheep, goats, rabbits and dogs (Kumar et al., 2018).

OR

4c) The disease has been shown to, or scientific evidence indicates that it would, have a significant impact on the health of wildlife taking into account the occurrence and severity of the clinical signs, including direct economic losses and mortality, and any threat to the viability of a wildlife population.

Yes ☒ **No** ☐

Scientific rationale:

VEEV reservoirs include rodents, birds and possibly bats (Guzmán-Terán et al., 2020). Virus has been isolated from wild mammals such as foxes and opossums during epizootics. However, the impact on the health of wildlife requires further investigation.

Conclusion regarding [pathogenic agent name]:

Does **[pathogenic agent name]** match the listing criteria that are described in the *Terrestrial Animal Health Code* Chapter 1.2.?

Yes ☒ **No** ☐

Summary Conclusion:

VEE satisfies the criteria for WOAH listing. Equines are the key reservoir species for the epizootic strains of VEEV that cause fatal clinical disease in horses and humans.

Reference:

1. Forrester N.L., Wertheim J.O., Dugan V.G., Auguste A.J., Lin D., Adams A.P., Chen R., Gorchakov R., Leal G., Estrada-Franco J.G., Pandya J., Halpin R.A., Hari K., Jain R., Stockwell T.B., Das S.R., Wentworth D.E., Smith M.D., Kosakovsky Pond S.L. & Weaver S.C. 2017. Evolution and spread of Venezuelan equine encephalitis complex alphavirus in the Americas. *PLoS Negl. Trop. Dis.*, 11, e0005693.

2. Guzman-Teran C., Calderon-Rangel A., Rodriguez-Morales A. & Mattar S. 2020. Venezuelan equine encephalitis virus: the problem is not over for tropical America. *Ann. Clin. Microbiol. Antimicrob.*, 19, 19.

3. Kumar B., Manuja A., Gulati B.R., Virmani N. & Tripathi B.N. 2018. Zoonotic Viral Diseases of Equines and Their Impact on Human and Animal Health. *Open Virol. J.*, 12, 80-98.

4. Rivas F., Diaz L.A., Cardenas V.M., Daza E., Bruzon L., Alcala A., De La Hoz O., Caceres F.M., Aristizabal G., Martinez J.W., Revelo D., De La Hoz F., Boshell J., Camacho T., Calderon L., Olano V.A., Villareal L.I., Roselli D., Alvarez G., Ludwig G. & Tsai T. 1997. Epidemic Venezuelan equine encephalitis in La Guajira, Colombia, 1995. *J. Infect. Dis.*, 175, 828-32.

5. Weaver S.C., Ferro C., Barrera R., Boshell J. & Navarro J.C. 2004. Venezuelan equine encephalitis. *Annu. Rev. Entomol.*, 49, 141-74.

Assessment for Venezuelan Equine Encephalomyelitis: Alf Fussel

The criteria for the inclusion of a disease, infection or infestation in the WOAH list are as follows:

1) International spread of the pathogenic agent (via live animals or their products, vectors or fomites) has been proven.

Yes ☒ **No** ☐

Scientific rationale:

Infection with the VEEV can cause very high morbidity in humans and equines with a case-fatality rate of 50–70% in horses and less than 1% in humans. Domestic rabbits, goats, dogs and sheep are also potentially susceptible animals. While the main route of transmission is by infected mosquitoes, VEEV is highly infectious as an aerosol. Mechanical transmission of epizootic VEEV has been demonstrated for blackflies (*Simulium spp.*) (Homan et al., 1985). Horse to human and human to human transmission has not been recorded. No contact transmission experiments have been found and transplacental infection has not been reported.

References:

1. Durand B., Lecollinet S., Beck C., Martinez-Lopez B., Balenghien T. & Chevalier V. 2013. Identification of hotspots in the European union for the introduction of four zoonotic arboviroses by live animal trade. *PLoS ONE*, 8, 16.

2. Estrada-Franco J.G., Navarro-Lopez R., Freier J.E., Cordova D., Clements T., Moncayo A., Kang W., Gomez-Hernandez C., Rodriguez-Dominguez G., Ludwig G.V. & Weaver S.C. 2004. Venezuelan equine encephalitis virus, southern Mexico. *Emerg. Infect. Dis.* 2004 Dec; 10(12):2113-21. doi: 10.3201/eid1012.040393. PMID: 15663847; PMCID: PMC3323369. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3323369/pdf/04-0393.pdf

3. Adams A.P., Navarro-Lopez R., Ramirez-Aguilar F.J., Lopez-Gonzalez I., Leal G., Flores-Mayorga J.M. et al. 2012. Venezuelan Equine Encephalitis Virus Activity in the Gulf Coast Region of Mexico, 2003–2010. *PLoS Negl. Trop. Dis.* 6(11): e1875. https://doi.org/10.1371/journal.pntd.0001875

AND

2) At least one country has demonstrated freedom or impending freedom from the disease, infection or infestation in populations of susceptible animals, based on the provisions of Chapter 1.4.

Yes ☒ **No** ☐

Scientific rationale:

VEE is a zoonotic disease first discovered in horses in 1930s in South America and is considered to be native to the Americas, including North and South Americas.

WOAH WAHIS 2015-2022: disease not present in Eastern Hemisphere

AND

3) Reliable means of detection and diagnosis exist and a precise case definition is available to clearly identify cases and allow them to be distinguished from other diseases, infections or infestations.

Yes ☒ **No** ☐

Scientific rationale:

There are at least 14 subtypes and varieties within the VEE complex but only subtype I, varieties AB and C have been associated with major equine epizootics and epidemics (Aguilar et al., 2011). The IA and IB strains are considered genetically indistinguishable and are thus classified as IAB. Epizootic strains from subtypes IAB and IC are highly pathogenic for horses, with reported case-fatality rates of between 20% and 80%.

References:

1. Enzootic strains are not known to cause illness in equids, other domesticated livestock, dogs or cats, with the exception of one Mexican I-E variant, which is pathogenic for equids (BRAULT A.C., POWERS A.M., ORTIZ D., ESTRADA-FRANCO J.G., NAVARRO-LOPEZ R., WEAVER S.C.. Venezuelan equine encephalitis emergence: enhanced vector infection from a single amino acid substitution in the envelope glycoprotein. Proc Natl Acad Sci U S A. 2004 Aug 3;101(31):11344-9. doi: 10.1073/pnas.0402905101. Epub 2004 Jul 26. PMID: 15277679; PMCID: PMC509205.)

2. https://www.woah.org/fileadmin/Home/fr/Health_standards/tahm/3.06.05_EEE_WEE_VEE.pdf
https://sitesv2.anses.fr/en/minisite/equine-diseases/sop

AND

4a) Natural transmission to humans has been proven, and human infection is associated with severe consequences.

Yes ☒ **No** ☐

Scientific rationale:

References:

1. AGUILAR P., ESTRADA-FRANCO J. & NAVARRO-LOPEZ R., FERRO C., HADDOW A. & WEAVER S. (2011). Endemic Venezuelan equine encephalitis in the Americas: Hidden under the dengue umbrella. *Future virology*. 6. 721-740. 10.2217/fvl.11.50.

2. LORD, R.D. 1974. History and geographic distribution of Venezuelan equine encephalitis. *PAHO Bulletin*, Vol. VIII, No. 2.

OR

4b) The disease has been shown to have a significant impact on the health of domestic animals at the level of a country or a zone taking into account the occurrence and severity of the clinical signs, including direct production losses and mortality.

Yes ☒ **No** ☐

Scientific rationale:

"In early 1969, a large outbreak was reported in Ecuador involving approximately 31,000 human cases with 310 fatalities and approximately 20,000 equine deaths. Late in 1969, epizootics were reported in El Salvador and Guatemala; these outbreaks eventually spread to most of Central America and Mexico [15,16]. During this outbreak, an estimated 50,000 horses died, in addition to an estimated 52,000 human cases, of which 93 were fatal in Mexico alone [13,17,18]. Initially, equine deaths in Mexico were reported in Chiapas state near the Guatemalan border in the summer of 1969, but by 1970, approximately 10,000 equine deaths had occurred in the Pacific states of Chiapas and Oaxaca. This outbreak then spread

northward into 17 Mexican states, following the path of the susceptible equids, to the Gulf coast and eventually into southern Texas [18,19]. The outbreak was finally contained when more than 8 million doses of TC-83 vaccine were administered to equids and vector control was implemented [19]. The last Mexican equine cases were recorded in September 1972 on the Islas Marias, Nayarit [19]. In Texas, between June and August of 1971, almost 2000 infected horses were reported, including 1426 associated deaths. During the same time period, 110 human cases were confirmed."

Reference:

AGUILAR P.V., ESTRADA-FRANCO J.G., NAVARRO-LOPEZ R., FERRO C., HADDOW A.D. & WEAVER S.C. 2011. Endemic Venezuelan equine encephalitis in the Americas: hidden under the dengue umbrella. *Future Virology*, 6, 721–740.

OR

4c) The disease has been shown to, or scientific evidence indicates that it would, have a significant impact on the health of wildlife taking into account the occurrence and severity of the clinical signs, including direct economic losses and mortality, and any threat to the viability of a wildlife population.

Yes ☐ **No** ☒

Scientific rationale:

There are no reports indicating any significant impact on the viability of a wildlife population.

Reference:

Recent surveys demonstrated that cattle, swine, chickens and dogs have been shown to seroconvert after epizootics; and mortality has been observed in domesticated rabbits, dogs, goats and sheep (WEAVER et al., 2004; MESA et al., 2005; ZACKS and PAESSLER, 2010; FAD-PReP/USDA, 2013; CFSPH, 2015; WOAH, 2013b)**.**

Conclusion regarding [pathogenic agent name]:

Does **[pathogenic agent name]** match the listing criteria that are described in the *Terrestrial Animal Health Code* Chapter 1.2.?

Yes ☒ **No** ☐

Summary Conclusion:

This conclusion concourse with the outcome of the respective EFSA report (doi: 10.2903/j.efsa.2017.4950) and the conclusion of the European Union as set out in Annex II to Regulation (EU) 2016/429 (OJ L 84, 31.3.2016, p. 1.). Any possible measures to prevent the spread of the virus through international trade primarily in equine animals should be set out in Chapter 12.4. of the Terrestrial Code and should provide for the possibility to be adapted to the circulating serotypes identified through surveillance. Since individual equine animals may be affected by the infection and because of the zoonotic nature of the infection, it is advised to maintain surveillance, not least to allow the vaccination of equines resident in, or intended to be moved to, endemic areas.

Annex 8. 9.2.2 Listing Assessment for *Theileria orientalis* (Ikeda and Chitose)

MEETING OF THE WOAH SCIENTIFIC COMMISSION FOR ANIMAL DISEASES

Paris, 11 to 15 September 2023

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Expert opinion on the listing of *T. orientalis*:

- Dr Frans Van Gool (Member of the AHG on theileriosis)
- Dr Andrew MacFadden (Veterinary epidemiologist/ principal advisor, New Zealand)
- Dr Philip Toye (Member of the AHG on theileriosis) – agreed with all the comments provided by the other two experts,

Experts provided their opinion on the following points raised by the Member:

Several papers report a worldwide distribution (Khukhuu et al. 2010, Bogema et al. 2015). This would mean that the pathogen does not meet criterion in Article 1.2.2.2.
(Dr Frans Van Gool) *Theileria orientalis* genotype chitose and *Theileria orientalis* genotype Ikeda do not have a worldwide distribution, as indicated in the papers mentioned here above, they have both a geographic distribution limited to Asia-Pacific and Southern Asia. Also, many other papers are indicating the same geographic distribution. (Dr Andrew MacFadden) Yes agree. The recent outbreak of disease spread in America, after the importation of the HL tick, shows that significant naïve populations exist and how effectively it can spread. It is now in about 10 -12 states and spreading very efficiently. In addition, significant parts of the Pacific are free of *theileria orientalis* (anecdotal evidence from a small survey in Fiji). Myself and my team are conducting surveys in other Pacific nations; however, we have no indication that there has been clinical Theileria and cattle populations in these countries are assumed at this stage to be free and naïve. Surveys and testing is underway in a number of nations and we will have more data over the next 12 months.
The much greater pathogenicity of *T. annulata* and *T. parva* may be due to these species having different disease mechanisms to *T. orientalis*. For example, *T. annulata* and *T.parva* are considered 'transforming' as they have the ability to transform leukocytes of host animals to allow infected cells (and thus infecting parasites) to proliferate indefinitely. *T orientalis* does not have this ability and is termed 'non-transforming'. Transforming Theileria have undergone drastic genetic evolution, with greater genetic variation that is often linked to increased virulence and evasion of host immune defences (Sivakumar et al. 2014).
(Dr Frans Van Gool) I agree with this. But even if *T.orientalis* genotype Chitose and *T. orientalis* genotype Ikeda are not considered "transforming" they are pathogenic (but have lower pathogenicity than *T. annulate* and *T. parva*) and can also cause disease outbreaks in cattle, as described in the paper of C. Jenkins (Jenkins et al. 2015) (Dr Andrew MacFadden) The impacts from ikeda and chitose as a result of their pathogenicity are alluded to in the previous assessment and below.
Kim et al (2017) states 'There is limited information on disease outbreaks related to the genotypes of *T. orientalis* and the clinical relevance of the various MPSP types has not been clearly elucidated' (Kim et al. 2017).
(Dr Frans Van Gool) In the paper of C. Jenkins (Jenkins *et al.*, 2015) it is clearly indicated that *T. orientalis* genotype Ikeda caused clinical outbreaks of Theileriosis in Australia, as a sole infection, but more commonly as a mixture of genotypes, with as prevalent genotype, Chitose. "[...]Recent outbreaks of clinical theileriosis in Australasia have been linked to infection with the Ikeda genotype. In one study, this genotype was found to be present in clinical cases as a sole or mixed infection (Eamens *et al.*, 2013), but most commonly co-occurred with the Chitose genotype. In contrast to the Ikeda genotype, the Chitose genotype was rarely found to be associated with disease when present as a sole infection (Eamens *et al.*, 2013); however other studies have suggested that the Chitose genotype may directly cause clinical disease (McFadden *et al.*, 2011)." (Dr Andrew MacFadden) Yes agree. There are number of papers that myself and others have published on the clinical effects of Theileria in NZ. It is very clear that there was significant impact from ikeda. Thus, from this and other reports (e.g. Japan and Australia) it is inappropriate to suggest that there is limited information on disease outbreaks.

In Australia, *T. orientalis* genotype Chitose has two variant subpopulations, with one being strongly associated with clinical disease and almost always occurring as a coinfection with the Ikeda genotype, and the other appearing to have questionable pathogenicity (Jenkins et al. 2015). Despite expert assessment identifying anaemia as a significant impact of *T. orientalis* Ikeda and Chitose, the report fails to quantify the direct production losses that result from the anaemia. Thus with current scientific literature showing limited understanding of the different genotypes of *T. orientalis,* and their ability to cause disease, inclusion into the WOAH disease list is overly premature at this point in time.

(Dr Frans Van Gool) There are papers (Aparna *et al.*, 2011; McFadden *et al.*, 2011; Eamens *et al.*, 2013) indicating that disease outbreaks and economic losses related to farm animals with *T. orientalis* genotype Ikeda was found to be present in clinical cases as a sole or mixed infection (Eamens *et al.*, 2013), but most commonly co-occurred with the Chitose genotype. In contrast to the Ikeda genotype, the Chitose genotype was rarely found to be associated with disease when present as a sole infection (Eamens *et al.*, 2013); however other studies have suggested that the Chitose genotype may directly cause clinical disease (McFadden et al., 2011. So, in my opinion, inclusion of *T. orientalis* genotype Ikeda and *T.orientalis* genotype Chitose into the WOAH disease list are justified.

(Dr Andrew MacFadden) Yes agree. The coinfection of chitose and ikeda represents different periods of introduction e.g. chitose introduced some time ago enabling general and widespread exposure (vs the recent introduction of ikeda). Given that Ikeda introduction is a recent phenomenon in both NZ and Australia, coinfection is often detected during clinical events. However, anaemia/clinical impacts were directly associated with the detection of ikeda. The study in 2011 (McFadden *et al.*, 2011) showed that chitose can have a clinical effect in its own right. Our observations from the clinical impacts in naïve herds was that the impacts from ikeda were more dramatic and severe.

Mortality as a direct effect from anaemia (associated with ikeda) was observed in NZ outbreaks. Death is clearly a production effect. Outside of the impacts from mortality, varying levels of anaemia occur; however, in surveys we have published this can reach very high levels and the majority of animals within an affected herd. Some attempts have been made to quantify the effects of anaemia; however, as you know this is incredibly difficult to do, although some have attempted to do this on a small scale (McDougall, S. *et al.*, 2014; Perera *et al.*, 2014).

References :

1. APARNA M. *et al.* (2011). 'Molecular characterization of Theileria orientalis causing fatal infection in crossbred adult bovines of South India', *Parasitology International*, 60(4), pp. 524–529. Available at: https://doi.org/10.1016/j.parint.2011.08.002.

2. EAMENS G.J. *et al.* (2013) '*Theileria orientalis* MPSP types in Australian cattle herds associated with outbreaks of clinical disease and their association with clinical pathology findings', *Veterinary Parasitology*, 191(3), pp. 209–217. Available at: https://doi.org/10.1016/j.vetpar.2012.09.007.

3. JENKINS C. *et al.* (2015) 'Temporal dynamics and subpopulation analysis of *Theileria orientalis* genotypes in cattle', *Infection, Genetics and Evolution*, 32, pp. 199–207. Available at: https://doi.org/10.1016/j.meegid.2015.03.017.

4. MCDOUGALL S. *et al.* (2014). 'Effect of *Theileria orientalis* Ikeda on reproductive performance of a dairy herd', In *Proceedings of the Society of Dairy Cattle Veterinarians of the New Zealand Veterinary Association Annual Conference*. Hamilton, New Zealand, pp. 103–118.

5. MCFADDEN A.M.J. *et al.* (2011). 'An outbreak of haemolytic anaemia associated with infection of *Theileria orientalis* in naive cattle', *New Zealand Veterinary Journal*, 59(2), pp. 79–85. Available at: https://doi.org/10.1080/00480169.2011.552857.

6. PERERA P.K. *et al.* (2014) 'Oriental theileriosis in dairy cows causes a significant milk production loss', *Parasites & Vectors*, 7, p. 73. Available at: https://doi.org/10.1186/1756-3305-7-73.

Annex 9. 9.3.2.1 Report of the Development of the Case Definition for New World Screwworms and Old World Screwworms, 11 April to 22 August 2023

MEETING OF THE WOAH SCIENTIFIC COMMISSION FOR ANIMAL DISEASES

Paris, 11 to 15 September 2023

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The objective of this report is to provide the rationale and scientific justification for elements of the case definition for infestation with (a) New World screwworm and (b) Old World screwworm which was developed via videoconference with the lead expert and email exchanges with the other experts between 11th of April 2023 and 22nd August 2023.

The purpose of the case definition is to support notification to the World Organisation for Animal Health (WOAH, founded as OIE) as described in the WOAH *Terrestrial Animal Health Code* (the *Terrestrial Code)* Chapter 1.1.

Details of the external experts and WOAH staff who contributed to the drafting process are provided in *Appendix* 1.

1. Process

The Official 2021-1 provides a synopsis of this initiative: 'Developing case definitions for OIE-listed diseases for terrestrial animals'[3].

This report and the draft case definition will be presented for consideration first to the Biological Standards Commission (BSC) and then to the Scientific Commission for Animal Diseases (SCAD) at their next meetings. After endorsement by SCAD, and provided there is no conflict with either the WOAH *Terrestrial Code* or the WOAH *Manual of Diagnostic Tests and Vaccines for Terrestrial Animals* (the *Terrestrial Manual)*, the finalised case definition will be published on the WOAH website and, following the standard-setting process, eventually will be included in the *Terrestrial Code*.

2. Background

New World screwworm (*Cochliomyia hominivorax*) and Old World screwworm (*Chrysomya bezziana*) are listed in the *Terrestrial Code* Chapter 1.3. 'Diseases, infections, and infestations listed by the OIE' in Article 1.3.7. in the category of 'multiple species'.

There is a disease-specific chapter in the *Terrestrial Code* Chapter 8.13., 'New World screwworm (*Cochliomyia hominivorax*) and Old World screwworm (*Chrysomya bezziana*)' with the most recent update adopted in 1998. There is no case definition for the infestation although the provisions for importation from infested countries referred to 'domestic and wild mammals'. The *Terrestrial Manual* contains Chapter 3.1.14. 'New World screwworm (*Cochliomyia hominivorax*) and Old World screwworm (*Chrysomya bezziana*)' (version adopted on May 2019).

WAHIS was consulted on 4th of May 2023 for summary information[4] on 'New World screwworm' and 'Old World screwworm' developed from data contained in official reports (six-monthly reports, immediate notification, and follow-up reports). Figure 1 and Figure 2 summarise the total number of new outbreaks reported to WOAH between January 2005 and December 2022 for New World screwworm and Old World screwworm respectively.

[3] https://oiebulletin.fr/?officiel=10-3-2-2021-1_case-definitions
[4] https://wahis.oie.int/#/dashboards/qd-dashboard

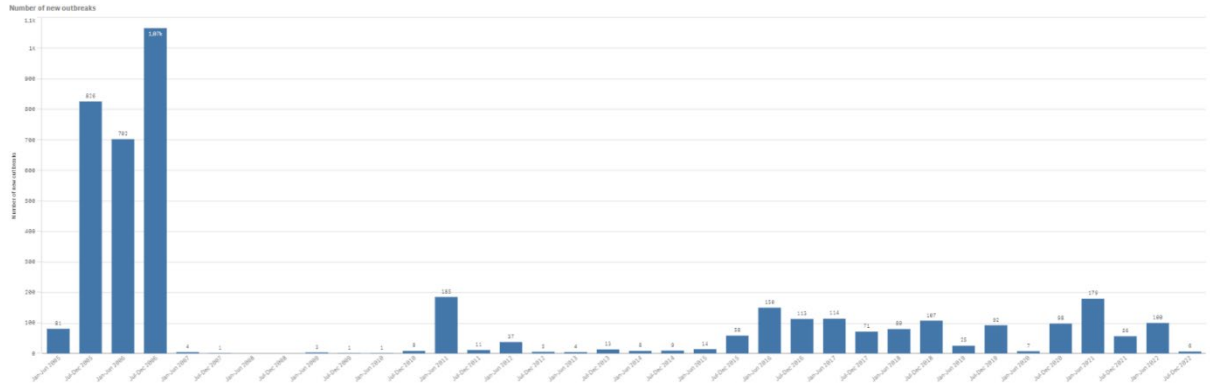

Figure 1 New outbreaks of 'New World screwworm' notified to WOAH-WAHIS by Members between January 2005 and December 2022.

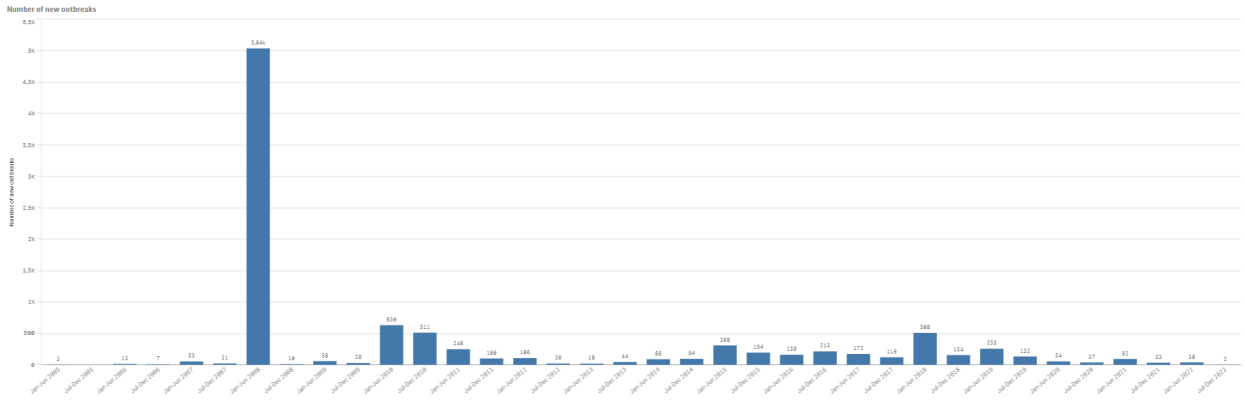

Figure 2 New outbreaks of 'Old World screwworm' notified to WOAH-WAHIS by Members between January 2005 and December 2022.

3. Discussion

Given the similar biology between New World screwworm and Old World screwworm, in consultation with the lead expert, it was agreed to embark on the case definition development for both screwworms in parallel by the same pool of experts.

3.1. Disease name

The experts agreed on the use of the name "New World screwworm" for the infestation caused by Cochliomyia hominivorax and "Old World screwworm" for the infestation caused by Chrysomya bezziana. An expert proposed to consider the use of 'myiasis' that would more accurately describe the clinical syndrome caused by screwworms, i.e. myiasis caused by [parasite].

3.2. Pathogenic agent

The experts agreed that the pathogenic agent for "New World screwworm" is *Cochliomyia hominivorax*, and the pathogenic agent for "Old World screwworm" is *Chrysomya bezziana,* which are species of two genera of the subfamily Chrysomyinae of the family Calliphoridae.

3.3. Hosts

Humans and a wide range of domestic and wild warm-blooded animals, are susceptible to infestation with *Cochliomyia hominivorax* and *Chrysomya bezziana.* Both are obligate parasites during their larvae stages in these hosts [1–6], feeding on living tissues and causing myiasis [7].

Among various wild species, cases of New World screwworm have been found in Asiatic water buffalo, *Bubalus bubalis* [7] ; feral swine, *Sus scrofa* [8]; beaver, *Castor canadensis* [9]; camel, *Camelus dromedarius* [3]; giant otter, *Pteronura brasiliensis* [10]; white-tailed deer, *Odocoileus virginianus texanus* [11,12]; Amazonian porcupine, *Coendou prehensilis*

prehensilis [13]; Texas cottontail rabbits, *Sylvilagus floridanus chapmani* [14]; mantled howler monkey, Alouatta palliata [15].

Cases of Old World screwworm have been found in the following wild animals: Buck, *Kobus ellipsiprymnus*; impala, *Aepyceros melampus*; rhinos, *Rhinocerus spp.* Linnaeus; elephants, *Loxodonta spp.*; Eland (*Taurotragus oryx*) [16] and numerous zoo species [17]. It is also discovered in livestock such as buffaloes, cattle, horses, sheep, pigs and goats, including cats, dogs, deer and humans.

In relation to wild mammals and screwworm myiasis, the interpretation of the literature and the lead expert's personal experience is that the risk of transmission or transport of screw worms into a new area by an infested wild animal is low, as wounded wild animals tend to lay down in a safe and quiet area to heal and avoid predators. However, wild animals serve as a reservoir for screwworms because untreated wounds will allow the life cycle of screwworms to continue in nature.

The transport by humans, of infested animals, is an important pathway for the spread of screwworms [18–22].

With regard to the involvement of birds, the only literature of screwworm myiasis in birds was from Lindquist, 1937 [12], which reported infestation in domestic turkeys. The demonstrated risk of wild birds being infested with but also transporting screwworms is very low. According to the personal experience of one expert, in New World screwworm-endemic countries, presentation in birds occurs but is rare, compared to the occurrence in cattle, horses, and pigs. It is not reported because it is considered to have a lesser impact and the existence of effective treatment. It generally affects large chickens, turkeys, ducks, and geese. Commonly the parasitized anatomical region is the breast muscles, which makes it difficult for the bird to fly and thereby reduces the risk of spreading the parasitosis [23]. Therefore, the experts considered that the role of birds in the epidemiology of screwworms is limited, and advised to limit the case definition to domestic and wild mammals.

3.4. Epidemiologic and diagnostic criteria

The experts identified **ONE option** for confirming a case of infestation with New World or Old World screwworm for the purposes of notification to WOAH. Other options commonly incorporated in other WOAH case definitions (detection of nucleic acid, antigen or antibodies) were not used by the experts for defining infestation as screwworms are parasites which require direct morphological observation and identification of the parasite. There is at present time no applicable serological tests [24] for the diagnosis of screwworms.

3.4.1. Option 1

The observation and identification of Cochliomyia hominivorax and Chrysomya bezziana as per the standards described in the Chapter 3.1.14. of the WOAH Terrestrial Manual is sufficient to confirm a case of infestation with screwworm (New World or Old World).

References:

1. CUSHING E.C. & PATTON W.S. (1935). Studies on the higher Diptera of medical and veterinary importance. *Annals of Tropical Medicine and Parasitology*, **29**, 19–32.

2. GINGRICH R.E. (1964). Nutritional studies on screw-worm larvae with chemically defined media. *Annals of the Entomological Society of America*, **Volume 57** (Issue 3), Pages 351-360. doi:https://doi.org/10.1093/aesa/57.3.351.

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…/Appendix

Appendix 1

9.3.2.1 Report of the Development of the Case Definition for New World Screwworms and Old World Screwworms

11 April to 22 August 2023

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Annex 10. 11.3.2.3 Report of the Development of the Case Definition for Infection with Crimean-Congo Haemorrhagic Fever Virus (CCHFV)

MEETING OF THE WOAH SCIENTIFIC COMMISSION FOR ANIMAL DISEASES

Paris, 11 to 15 September 2023

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The objective of this report is to provide the rationale and scientific justification for elements of the case definition for infection with Crimean-Congo haemorrhagic fever virus (Crimean Congo haemorrhagic fever) which was developed via videoconference and email exchange between 21 April and 30 January 2023.

The purpose of the case definition is to support notification to the World Organisation for Animal Health (WOAH, founded as OIE) as described in the WOAH *Terrestrial Animal Health Code* (the *Terrestrial Code)* Chapter 1.1.

Details of the external experts and WOAH staff who contributed to the drafting process are provided in Appendix 1.

1. Process

The Official 2021-1 provides a synopsis of this initiative: 'Developing case definitions for OIE-listed diseases for terrestrial animals' [1].

This report and the draft case definition will be presented for consideration first to the Biological Standards Commission (BSC) and then to the Scientific Commission for Animal Diseases (SCAD) at their next meetings. After endorsement by SCAD and provided there is no conflict with either the *Terrestrial Code* or the WOAH *Manual of Diagnostic Tests and Vaccines for Terrestrial Animals* (the *Terrestrial Manual)*, the finalised case definition will be published on the WOAH website and, following the standard-setting process, eventually will be included in the *Terrestrial Code*.

2. Background

'Crimean Congo haemorrhagic fever' is listed in the *Terrestrial Code* Chapter 1.3 'Diseases, infectious and infestations listed by the OIE' in Article 1.3.1. in the category of 'multiple species'. There is no disease-specific chapter or case definition in the *Terrestrial Code*. The *Terrestrial Manual* contains Chapter 3.1.5 'Crimean-Congo haemorrhagic fever' (version adopted in May 2014) [2].

WAHIS was consulted on 21 July 2022 for summary information[5] on 'Crimean Congo haemorrhagic fever' (CCHF) developed from data contained in official reports (six-monthly reports, immediate notification, and follow-up reports).

Figure 1 summarises the total number of countries reporting CCHF as present or suspected in domestic and wild animals to WOAH between 2006 and 2021.

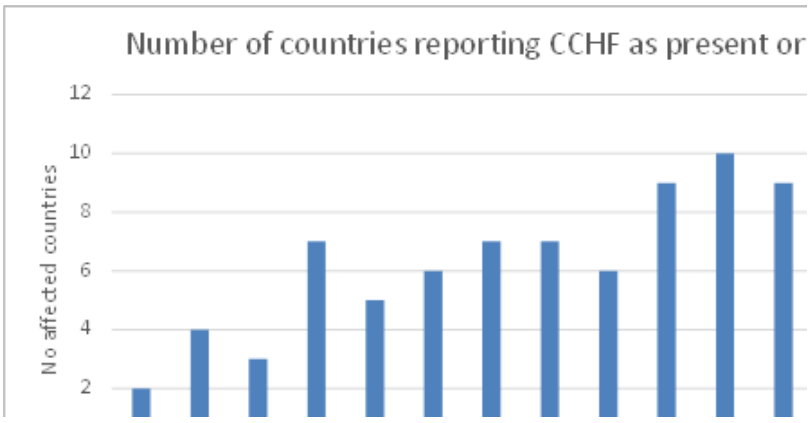

Figure 2. Total number of countries reporting 'Crimean Congo haemorrhagic fever' to WAHIS by Members between 2006 and 2021.

[5] https://wahis.oie.int/#/dashboards/qd-dashboard

3. Discussion

Transmission of CCHFV to humans occurs primarily through bites from an infected tick, or by contact with the blood or bodily fluids of an infected person or animal.

3.1. Disease name

As disease-specific chapters in the *Terrestrial* Code are created or updated, the convention is to refer to the disease or infection as 'infection with [pathogenic agent]' and to reflect this in the corresponding listed entry in Chapter 1.3 or in any disease-specific chapter that may be developed in the future. In consequence, the experts recommend that the entry for Crimean Congo haemorrhagic fever in Chapter 1.3 be updated to the hyphenated version of 'infection with Crimean-Congo haemorrhagic fever virus (Crimean-Congo haemorrhagic fever)' for consistency with the *Terrestrial Manual*, the International Committee on Taxonomy of Viruses (ICTV) and with the World Health Organisation (WHO).

3.2. Pathogenic agent

The experts agreed that the pathogenic agent for this disease is the Crimean-Congo haemorrhagic fever virus (CCHFV) which belongs to the genus *Orthonairovirus* of the family *Nairoviridae* of the order *Bunyavirales* [3].

3.3. Hosts

Hyalomma spp. ticks have been identified as the natural vector and reservoir for infection with CCHF, and the distribution of human cases of CCHF closely matches that of the vector [4]. The epidemiology of CCHF is complex where the role of ticks in transmitting the disease and that of wildlife in maintaining the disease through tick infestation are important. A wide range of domestic and wild species are susceptible to infection with CCHFV [5–8], although viraemia tends to be transient and infection usually is asymptomatic. Many species (particularly larger vertebrates) can serve as amplification hosts for CCHFV, and domestic animal species often are implicated when human cases are detected [4,9,10]. High seroprevalences frequently are found in cattle, sheep, goats, and camels, indicating high levels of exposure on a population basis [6]. Noting the potential for wild ruminants to similarly act as amplification hosts, the experts considered that host animals for the purposes of notification of infection with CCHFV to WOAH should consist of domestic and wild animals of the suborder Ruminantia, and dromedary camels (*Camelus dromedarius)* [4,6,11].

3.4. Epidemiologic and diagnostic criteria

The experts identified **four options** (any one of which is sufficient) for confirming a case of infection with Crimean Congo haemorrhagic fever virus for the purposes of notification to WOAH.

3.4.1. Option 1

The experts agreed that isolating CCHFV in samples from the host species listed above would be sufficient to confirm a case of infection with CCHFV. They elected to omit 'excluding vaccine strains' as there is currently no approved vaccine available [16].

3.4.2. Option 2

The experts agreed that detection of nucleic acid specific to CCHFV is suitable for confirmation of a case, provided this is accompanied by either an epidemiological link to a suspected or confirmed case of CCHF, or the animal is suspected to have been bitten by a tick positive on an antigen test or nucleic acid test specific to CCHFV.

The experts elected to not include 'antigen specific to CCHFV' in the option for the case definition at this time; this technique is not one of the methods recommended for identification of the agent in Table 1 of the *Terrestrial Manual*.

The experts elected to omit the text 'the [animal] host is showing clinical signs or pathological lesions consistent with infection with pathogen' as in livestock, the infection is usually asymptomatic or may occasionally result in mild fever [6]

3.4.3. Option 3

The experts agreed that seroconversion would be sufficient to confirm a case of infection with CCHFV, and noted that currently a few in-house systems have been published. Most commercial test systems for IgM or IgG by ELISA or immunofluorescence are designed for human diagnostics, but it is possible to adapt them for serological testing in animals.

3.4.4. Option 4

The experts agreed that the presence of antibodies in an animal host that is epidemiologically linked to a suspected or confirmed human or animal case of CCHF or that is suspected to have been bitten by a tick positive on an antigen test or nucleic acid test specific to CCHFV would constitute a confirmed case of CCHF.

The experts elected to omit 'that are not the consequence of vaccination' as there is currently no approved vaccine available [16].

The experts also elected to omit the text 'the [animal] host is showing clinical signs or pathological lesions consistent with infection with pathogen' as the infection in animals is usually asymptomatic or may occasionally result in mild fever [6].

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…/Appendix

Appendix 1

Report of the development of the case definition for infection with Crimean-Congo haemorrhagic fever virus (Crimean Congo haemorrhagic fever)

21 April – 30 January 2023

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Annex 11. Work programme

MEETING OF THE WOAH SCIENTIFIC COMMISSION FOR ANIMAL DISEASES

Paris, 11 to 15 September 2023

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Abbreviations: BSC: Biological Standards Commission; SCAD: Scientific Commission for Animal Diseases; TAHSC: Terrestrial Animal Health Standards Commission (Code Commission).

		September 2023	Next steps	Timeline
Update of WOAH Standards				
	Glossary	Not on agenda		
1	Ch. 1.2. Criteria for the inclusion of diseases, infections or infestations in the WOAH list	Not on agenda; at its February 2023 meeting, revisions had been proposed to the guidance document aimed at improving experts' interpretation of the listing criteria and the revised guidance was applied to the listing assessment for equine encephalitides. At this time, no specific revisions to Chapter 1.2. are recommended but SCAD welcomes the opportunity to be involved in discussions when the chapter is opened for revision.	Continue to review experts' interpretation of listing criteria and ensure consistency in application.	N.A.
1	Ch. 1.3. Diseases, infections and infestations listed by the WOAH	Not on agenda.	N.A.	N.A.
	Ch. 1.6. Procedures for official recognition	Revised draft Article 1.6.4 proposed by TAHSC regarding the holding of pathogenic agents without affecting the animal health status.	SCAD opinion forwarded to TAHSC.	
1	Ch 4.X. New chapter on biosecurity	Provided comments on chapter structure and glossary definitions that were proposed by the *ad hoc* Group on biosecurity.	SCAD opinion forwarded to TAHSC and addressed at its September 2023 meeting.	SCAD to consider relevant comments in February 2024.
1	Ch.8.8. Infection with foot and mouth disease virus	Considered selected comments forwarded by TAHSC received from Members during and after the 2023 General Session on the revised draft chapter.	SCAD opinion forwarded to TAHSC and addressed at its September 2023 meeting.	
1	Chapter 8.X. Infection with *Trypansoma evansi* (surra)	Provided some comments on proposed amendments by the *ad hoc* Group on surra and dourine. Opinion	The draft chapter will be circulated by TAHSC after its	SCAD to consider relevant comments and

		September 2023	Next steps	Timeline
		was forwarded to the TAHSC. Requested Secretariat to consult experts on infection dynamics in camels.	September 2023 meeting.	expert opinion in February 2024.
1	Ch. 12.1. Infection with African horse sickness virus	Reviewed and provided comments on amendments proposed by TAHSC.	SCAD opinion was forwarded to TAHSC and addressed at its September 2023 meeting.	
1	Ch. 12.3. Dourine	Reviewed draft revised Ch.12.3. prepared by the *ad hoc* Group on surra and dourine.	Forward opinion and revised draft chapter to TAHSC. The draft chapter will be reviewed by the TAHSC at its February 2024 meeting.	SCAD to consider relevant comments in September 2024.
	Ch. 1.11 FMD Questionnaire	In response to a comment considered at its February 2023 meeting, proposing the revision and parallel adoption of Chapter 1.11. with the adoption of the revised Chapter 8.8., SCAD revised Chapter 1.11. and proposed amendments.	The revised article was forwarded to TAHSC and addressed at its September 2023 meeting.	
Official animal health status recognition				
1	Evaluation of Member dossiers	Not applicable. SCAD was updated on the state of play of applications submitted by Members for evaluation and potential recognition at the GS in May 2024.		
2	Expert missions to Members	SCAD considered the reports of two missions that took place after its February 2023 meeting and followed up on a past mission after some epidemiological changes in the country and region.	Follow-up of actions taken by the respective Members in response to the recommendations from the missions during the review of 2023 annual reconfirmations in Feb 2024. Review in February 2024 the priority list of missions to be conducted taking into account the recommendations of the *ad hoc* Groups on applications.	
2	Follow up of Members with official animal health status or with suspended status	SCAD reviewed Malaysia's application for recovery of its AHS status and recommended the reinstatement of Malaysia's AHS-free status.		

		September 2023	Next steps	Timeline
	Non-compliance of Members having an official animal health status by WOAH with provisions of the Terrestrial Code for imports of commodities from countries not officially recognised as free by WOAH	SCAD discussed different scenarios and options and possible next steps.	A discussion paper will be produced by the Secretariat for SCAD and TAHSC to further discuss this issue in February 2024.	
1	Review of annual reconfirmations	SCAD identified 49 annual reconfirmations for comprehensive review at its February 2024 meeting.		
1	Harmonisation of the requirements in the *Terrestrial Code* Chapters for recognition and maintenance of official animal health status	Not on agenda	Continue follow-up on the progress of the remaining chapters (AHS, CBPP and FMD) before proposed for adoption.	
2	BSE Annual Reconfirmation form	SCAD reviewed and endorsed the draft form based on the newly adopted BSE standards in May 2023.	The form will be annexed to SCAD's September 2023 report and published on the website. No further action required from SCAD.	
Disease control issues				
2	Advise on global strategies and initiatives (FMD, PPR, rabies, ASF, AI, zTB)	Updates were provided on the global strategies/initiatives for FMD, PPR, ASF, AI and zTB.		
1	Consider non-disease-Status and non-standard-setting *ad hoc* Groups reports falling into the SCAD remit	Not on agenda		
2	Assess recent developments in control and eradication of infectious diseases	Addressed under the respective updates on global strategies and initiatives (PPR, ASF, AI, zTB)		
1	Evaluation of emerging diseases	Assessed and recommended the continued maintenance of SARS-CoV-2 as an emerging disease.		
1	Evaluation of pathogenic agents against the listing criteria of Chapter 1.2.	***Theileria orientalis***: SCAD considered expert opinion, which was sought in response to Member comments querying continued listing of *T.orientalis* Ikeda and Chitose. **Japanese encephalitis, eastern and western equine encephalitis,**	Forward opinion to TAHSC.	

		September 2023	Next steps	Timeline
		Venezuelan equine encephalomyelitis: SCAD considered expert opinion on listing of the equine encephalitides.		
1	Development of case definitions	SCAD commended the work on the internal processes for case definition development and noted progress made. **Avian metapneumovirus (turkey rhinotracheitis)**: SCAD discussed comments from the TAHSC, and requested Secretariat to seek clarification from lead expert and BSC. **Crimean-Congo haemorrhagic fever**: case definition discussed with BSC and revised with expert. SCAD endorsed case definition. SCAD also provided opinion on coverage of disease-specific chapter for CCHF in the *Terrestrial Code.* **New World and Old World screwworms**: case definition discussed with BSC, SCAD made refinements. **Nairobi sheep disease**: SCAD noted paucity of reports and literature on NSD outbreaks and requested Secretariat to obtain more information from experts in the field.	Secretariat to follow-up with lead expert and BSC to clarify information in *Terrestrial Manual*. Secretariat to upload case definition for Crimean-Congo haemorrhagic fever onto WOAH website. Forward opinion and revised case definition to TAHSC. Secretariat to consult experts in the field for occurrence and impact of NSD.	SCAD to consider expert and BSC opinion at its February 2024 meeting. SCAD to consider expert opinion at its February 2024 meeting.
3	Insects	None at this meeting.		
Liaison with other Specialist Commissions				
1	Terrestrial Animal Health Commission	None at this meeting.		
1	Biological Standards Commission	No liaison meeting, but through coordination by Secretariat, discussed case definition for Old World and New World screwworms and CCHF.		
Working Groups				
2	Antimicrobial Resistance Working Group	Not on agenda.		
2	Wildlife Working Group	Noted discussion of the Working Group as	WGW Secretariat to provide more details on	SCAD to consider specific

		September 2023	Next steps	Timeline
		captured in the December 2022 and June 2023 reports and requested for more details on the WGW discussion and recommendation on definition of 'emerging disease'.	the specific recommendations of the WGW.	recommendations of the WGW, if provided, at its February 2024 meeting.
Other activities that could impact SCAD work programme				
1	Evaluation of applications for WOAH Collaborating Centre status	None at this meeting		
3	Update on the main conclusion/ recommendations of meetings relevant for the work of the Commission	None at this meeting		
3	Updates provided for SCAD information	SCAD was updated on: STAR-IDAZ International Research Consortium; Global Burden of Animal Diseases (GBAD) programme and the WOAH Collaborating Centre for the Economics of Animal Health; composition of the WOAH Editorial Board and project on WOAH Standards Online Navigation Tool.		
	Any other business	None at this meeting		

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