OIE/FAO FMD Reference Laboratory Network

Annual Report 2011

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Editors comment; This report is the result of continued cooperation between a number of OIE/FAO reference laboratory staff and would not be possible without the support of a number of International agencies including the OIE, FAO, EU, EuFMD and Defra. I would like to extend my personal thanks to those who have contributed information and comment to the network meetings and to this report, and would especially thank those members of WRLFMD who have supported me in the preparation of this document. Jef Hammond March 2012.

OIE/FAO
Foot-and-Mouth Disease
Reference Laboratories
Network

OIE/FAO FMD Reference Laboratory Network Annual Report

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Comprising input from;

- **FAO World Reference Laboratory and OIE Reference Laboratory for FMD (WRLFMD), Institute for Animal Health, Pirbright, UK.**
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- **Federal Governmental Institute, Centre for Animal Health (FGI ARRIAH) and OIE Reference Laboratory for FMD, Vladimir, Russia.**
- **OIE Regional Reference Laboratory for Sub-Saharan Africa (RRLSSA), Gabarone, Botswana.**
- **OIE Reference Laboratory for Foot and Mouth Disease, Dirección de Laboratorio Animal, SENASA, Argentina.**
- **FAO/OIE FMD Reference Laboratory, Transboundary Animal Diseases Programme, ARC-Onderstepoort Veterinary Institute (ARC-OVI), South Africa.**
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- **National FMD Laboratory, Lanzhou Veterinary Research Institute (LVRI), CAAS, Gansu, P. R. China.**
- **Project Directorate on FMD (PDFMD), Indian Council for Agricultural Research, Mukteswar, Nainital (Uttarakhand), India.**

Introduction to the OIE/FAO FMD Reference Laboratory Network Report

The Network of OIE/FAO FMD Reference Laboratories has been established with two principal goals:

(1) To understand global virus distribution and patterns and provide vaccine recommendations

and

(2) To Improve the quality of laboratory testing carried out by international and national reference laboratories.

This requires sharing and joint evaluation of surveillance information from laboratory diagnosis, serotyping, genetic characterisation and vaccine matching tests and harmonisation of standards for diagnostic procedures.

This report is divided into two parts providing an update on progress towards each of these goals.

Additional information about the Network can be found at: http://www.foot-and-mouth.org/

PART 1

Genetic and antigenic diversity and global distribution of foot-and-mouth disease viruses. Information gaps, threats and vaccine recommendations

1.1 Executive Summary:

Foot-and-mouth disease (FMD) is highly contagious, infects a wide variety of domestic and wildlife hosts and occurs as multiple non-cross-protective virus serotypes. Its presence restricts trade opportunities for endemic countries and poses a constant threat to those countries free of the disease. FMD viruses are not randomly dispersed throughout the world but are associated with particular ecological niches. The distribution is affected by cyclical upsurges in the prevalence of particular strains that may be associated with viral evolution, waning population immunity and/or opportunities presented by the increasing and more frequent movements of animals and their products. This can give rise to pandemic spread affecting new regions. Global surveillance for FMD aims to identify the current hazards and to predict heightened risk so that appropriate diagnostics and vaccines are available for their detection and control. This requires sustained effort directed towards the monitoring of FMD outbreaks and ideally also of FMDV circulation and persistence, along with collection and characterisation of FMD viruses and integration of findings with associated epidemiological intelligence. This also then anticipates that decisions and actions enabling FMD control will be made by those with the power and influence to do so. Such an extensive effort requires a team approach encompassing national and international disease control services and their laboratories along with commercial vaccine and diagnostic providers. The OIE/FAO FMD Reference Laboratory Network is a vital contributor to the global control of FMD and provides opportunities and expertise for developing and sustaining laboratory capacity and capability, exchange of materials and technologies, harmonising approaches to diagnosis and supporting complementary research. Laboratories within the network regularly receive samples for FMD diagnosis from many parts of the world. The *in-vitro* antigenic properties of selected isolates are assessed for vaccine matching and nucleotide sequencing allows precise characterisation of new isolates and tracing of their origin by comparison with viruses held in virus collections. This analysis assists the monitoring of the 'real time' emergence and spread of FMD virus globally. The clustering of FMD viruses into 7 virus pools, with 3 pools covering Europe, the Middle-East and Asia, 3 pools covering Africa and 1 pool covering the Americas, is now enabling a targeted approach to progressive FMD control through the combined activities of OIE and FAO and the regional authorities. The worldwide distribution of the different serotypes and variants of FMD virus as compiled in 2011 and the associated activities of the network laboratories are presented in this document.

1.2 Introduction

Global surveillance for foot-and-mouth disease (FMD) aims to identify the current hazards and to predict heightened risk so that appropriate diagnostic tests and vaccines are available for their detection and control. This requires sustained effort directed towards the monitoring of FMD outbreaks and ideally also of FMD virus (FMDV) circulation and persistence, along with collection and characterisation of FMD viruses and integration of findings with associated epidemiological intelligence. Such extensive efforts require a sustained team approach encompassing national and international disease control services and their laboratories along with commercial vaccine and diagnostic providers.

The work of international FMD reference laboratories in collecting and characterising FMDV isolates has been reviewed (Ferris and Donaldson, 1992; Kitching 2000) and more recently with emphasis on the requirements and methodologies for vaccine selection (Paton et al., 2005). FMDV is unevenly distributed throughout the world reflecting factors such as livestock density and species mix, patterns of husbandry, animal movement and trade, wildlife reservoirs and incentives and capacities for disease control. The virus exists as multiple serotypes and subtypes with absent or incomplete cross-immunity, likely differences in species predilections and modes of persistence and transmission, and with distributions that are partly based on historical and chance events. The situation is dynamic and affected by viral evolution, waxing and waning host immunity and changing ecosystems and trading patterns. Despite the propensity and opportunities for spread of FMDV into new regions, comparisons of VP1 gene sequences of viruses submitted over many years do show a tendency for similar viruses to recur in the same parts of the world (Knowles and Samuel, 2003; Rweyemamu et al., 2008) and this presumably reflects some degree of either ecological isolation or adaptation. On this basis, the global pool of FMD viruses can be subdivided into seven 'regional pools' in which genetically and antigenically distinctive virus strains tend to occur within a defined region.

The seven 'Regional Pools' referred to throughout this report are shown in Figure 3 and represent:

Pool 1 – Eastern Asia
Pool 2 – Southern Asia
Pool 3 – Eur-Asia
Pool 4 – Eastern Africa
Pool 5 – Western Africa
Pool 6 –Southern Africa
Pool 7 – South America

Virus circulation and evolution within regional virus pools results in changing priorities for appropriately adapted vaccines. Periodically, viruses spread between pools and to free regions.

Ferris NP, Donaldson AI. (1992) Rev Sci Tech.11(3):657-84.
Kitching RP. (2000) Ann N Y Acad Sci. 916:139-46.
Paton DJ, Valarcher JF, Bergmann I, Matlho OG, Zakharov VM, Palma EL, Thomson GR. (2005) Rev Sci Tech. 24(3):981-93.
Knowles NJ, Samuel AR. (2003) Virus Res.91(1):65-80.
Rweyemamu M, Roeder P, Mackay D, Sumption K, Brownlie J, Leforban Y, Valarcher JF, Knowles NJ, Saraiva V. (2008) Transbound Emerg Dis. 55(1):57-72.

1.3 Overview of the Global FMD situation in 2011

In January 2011 Bulgaria lost its OIE status as FMD free without vaccination following the identification of FMDV type O in a wild boar shot in the Burgas region on 30/12/2010. Nine outbreaks in cattle, sheep, goats and pigs were identified between 04/01/2011 and 25/03/2011. In September 2011 Turkish Thrace also lost its status as FMD free with vaccination.

In 2010 both Japan and Republic of Korea reported FMD outbreaks and lost their status as countries listed by OIE as FMD-free without vaccination. In 2011 Japan regained its OIE status as FMD-free without vaccination whereas republic of Korea embarked on a national vaccination campaign which is ongoing.

Within endemically and sporadically infected parts of the world there have been upsurges of cases, sometimes leading to the submission of samples to reference laboratories and indicating an enhanced risk of collateral spread. The majority of viruses have been isolated from samples submitted from pools 1 and 3 which remain the major reservoirs for the FMD virus. In Southern America, FMDV circulation has been reported from Paraguay and Ecuador.

Figure 1. FMD situation by country according to OIE, Jan-Jun 2011[1]

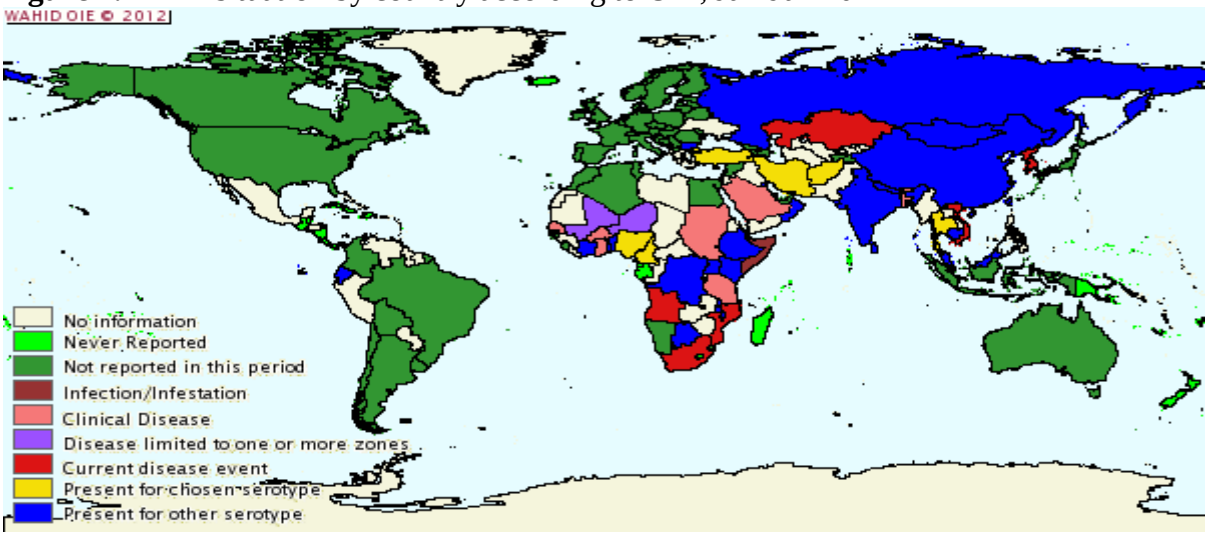
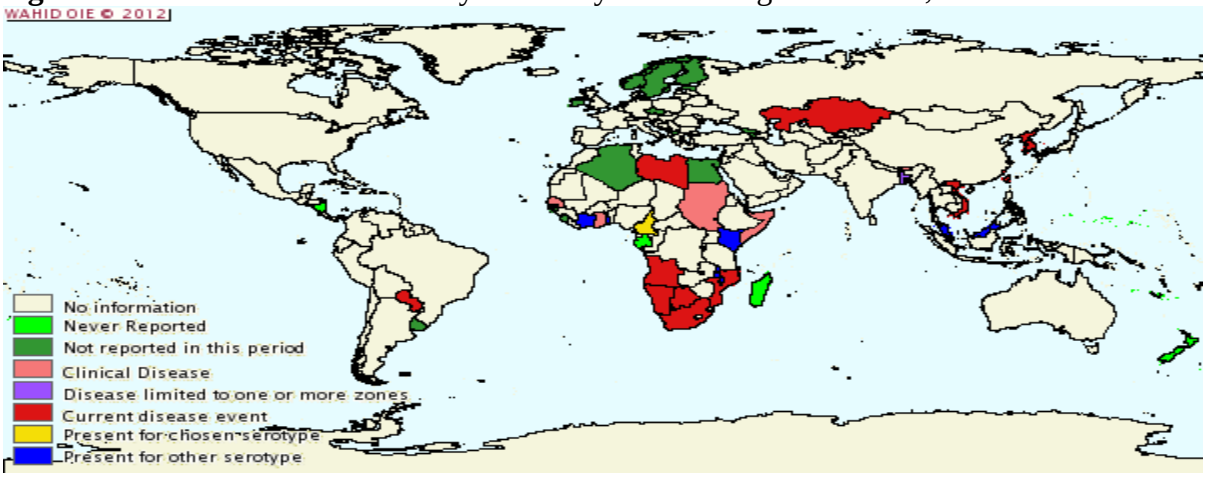
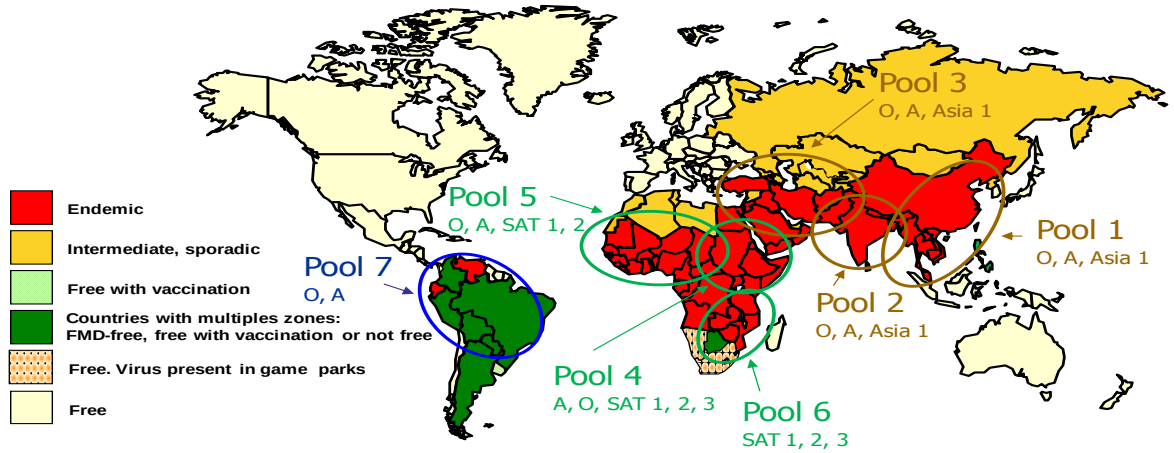


Figure 2. FMD situation by country according to OIE, Jul-Dec 2011



1 The WAHID Interface provides access to all data held within OIE's new World Animal Health Information System (WAHIS): http://www.oie.int/wahis/public.php?page=disease_status_map&disease_type=Terrestrial&disease_id=1&empty=999999&sta_method=semesterly&selected_start_year=2008&selected_report_period=1&selected_start_month=1&page=disease_status_map

Figure 3. The conjectured status of FMD in 2011 showing approximate distribution of regional virus pools.



Pool positions are approximate and colours indicate that there are three principal pools, two of which can be subdivided into overlapping areas

Note on Pools 4-6: In Africa there are currently three FMD virus pools loosely defined as covering East Africa (pool 4), West Africa (pool 5) and Southern Africa (pool 6). There is some overlap between pools 4 and 5. It has been suggested to extend pool 4 southwards to include Tanzania and to contract pool 6 to exclude that country.

1.3.1 Summary Information from the WRLFMD Quarterly Reports for 2011

EUROPE

Bulgaria

Following the identification of FMDV type O in a wild boar shot in the Burgas region on 30/12/2010, nine outbreaks in cattle, sheep, goats and pigs were identified between 04/01/2011 and 25/03/2011. All viruses so far examined belonged to the ME-SA/PanAsia-2^{ANT-10} lineage and were most closely related to viruses from Turkey. On the 3rd April, three new outbreaks (involving cattle, buffalo, sheep, goats and pigs) were reported and confirmed only by serology. Two outbreaks occurred at Bliznak, (Malko Turnovo Municipality, Burgas) and one at Dolno Yabalkovo (Sredets, Burgas).

Pools 1-3: Pool 1 – Eastern Asia, Pool 2 – Southern Asia, Pool 3 – Eur-Asia

Afghanistan, Iran, Pakistan and Turkey: The O/ME-SA/PanAsia-2^{ANT-10} and more recently identified A-Iran-05^{HER-10} and A-Iran-05 $^{SIS-10}$ lineages continue to dominate in these countries.

Pakistan, Iran and Bahrain: FMD type Asia 1. The recent appearance of Asia 1 in Bahrain and Iran in 2011 has been linked to viruses from Pakistan.

Dzauskom region, South Ossetia / Tskhinvali Region Georgia (disputed): An outbreak of FMD type O occurred in cattle on 05/08/2011. Laboratory diagnosis took place at the FGI-ARRIAH and the VP1 sequence was provided to the WRLFMD. The virus belonged to the ME-SA topotype, PanAsia-2^{ANT-10} lineage.

Israel: On 01/03/2011 an outbreak of FMD type O occurred in cattle at Bet Zera, Kineret, Hazafon. The VP1 sequences of two virus isolates showed them to be ME-

SA/PanAsia-2^{ANT-10} and closely related to viruses from Turkey and Bulgaria. Between 17/04/2001 and 16/06/2011, 12 outbreaks due to FMDV type O were reported in the Hazafon and Haifa areas in the north of the country and one outbreak in Hadarom in the south, close to the Gaza Strip. Viruses isolated at the WRLFMD all belonged to the ME-SA/PanAsia-2^{ANT-10} sub-lineage. Following these 12 outbreaks of FMD type O in the Hazafon/Haifa and Hadarom areas between April and June 2011, six further outbreaks were reported in the Hazafon area at Shamir, Tsefat (24/06/2011), Shirion Junction, Golan (30/06/2011), Orcha Junction, Golan (18/07/2011), Devora, Yizreel (10/07/2011), Dalton, Tsefat (10/07/2011) and Mi'elya, Acco (26/07/2011). All outbreaks involved only cattle. Viruses isolated at the WRLFMD all belonged to the ME-SA topotype, PanAsia-2^{ANT-10} lineage. An outbreak of FMD type O occurred on 15/10/2011 in cattle at Tarshiha, Acco, Hazafon District (RT-PCR and virus isolation positive).

Kazakhstan: Two outbreaks of FMDV type O were reported on 21/05/2011 (Tinali, Akzholskiy, Akzhaik, Ural'sk) and on 20/06/2011 (Lbishchenskoye, Akzholskiy, Akzhaik, Ural'sk). An outbreak of FMD O occurred in cattle on the 11/08/2011 at Karashilik, Kurchumskiy, East Kazakhstan. A sample was submitted to the FGI-ARRIAH and the VP1 sequence provided to the WRLFMD. Phylogenetic analysis showed the sequence to belong to the ME-SA topotype, PanAsia lineage and was closely related to sequences obtained from viruses occurring in Vietnam and P.R. China (Guizhou province).

P.R. China: Three outbreaks due to type O were reported in pigs in Xinjiang Autonomous Region (19/02/2011 and 19/03/2011) and Guizhou province (29/03/2011). A new FMDV type O outbreak was reported to have occurred on 29/03/2011 in Jing Xiang Village, Tianzhu, Qian Dongnan, Guizhou. VP1 sequence data provided by the Lanzhou Veterinary Research Institute (and submitted to GenBank – accession number JF837375) showed the virus to belong to the ME-SA/PanAsia lineage and to be closely related to recent viruses from Vietnam. Three further outbreaks of FMD type O were reported: on 13/07/2011 at Longfeng Village, Pudi, Bijie, Guizhou in cattle/sheep/goats/pigs; on 31/08/2011 at Liebugou, Lengda Village, Jiacha, Shannan, Tibet in cattle; and on 30/09/2011 at Duixu Village, Zhongda Town, Lang, Linzhi, Tibet in cattle. Two new outbreaks were reported on 16/10/2011 in cattle at Shuangjing village, Haiyuan, Zhongwei, Ningxia and on 27/12/2011 in pigs at Badong, Badong, Enshi, Hubei.

Republic of Korea (South Korea): Between 23/12/2010 and 05/01/2011, 36 outbreaks were identified in cattle and pigs in the following provinces: Chungcheongbuk-do, Chungcheongnam-do, Gangwon-do, Gyeonggi-do and Gyeongsangbuk-do. These belonged to the SEA/Mya-98 lineage. Three more outbreaks of FMD type O were reported on 16/04/2011 (Hwangjeong-ri, Geumho-eup, Yeongcheon-city, Gyeongsangbuk-do), 19/04/2011 (Samho-ri, Geumho-eup, Yeongcheon-city, Gyeongsangbuk-do) and 21/04/2011 (Donam-dong, Yeongcheon-city, Gyeongsangbuk-do).

Russian Federation: On the 13/03/2011FMD was reported in cattle and pigs in Us't-Imalka village, Ononsky, Zabajkal'Skij Kray. ARRIAH reported the outbreak was due to type O, SEA topotype.

Taiwan POC (Chinese Taipei): Two outbreaks of FMD type O were reported in pigs in Makung City, P'eng-Hu (22/03/2011); 30 pigs, which had been transported to a slaughterhouse from a pig farm on P'eng-Hu Island, were found with vesicular lesions.

Clinical investigation found that 110 pigs in the farm of origin also had vesicular lesions. Serotype O was shown to be the causative agent, but no phylogenetic results were reported. A third FMD outbreak, also in pigs, occurred in Siaying District, T'ai-Nan (21/03/2011). Routine inspection found abnormal lesions on 15 pigs' feet while the animals were still on the transportation vehicle before they entered into the auction market of Tainan City. Trace-back back to the farm of origin showed that 15 pigs on farm had the same clinical lesions. Laboratory investigations found antibody to FMDV O but no virus or virus RNA was detected. Three new outbreaks were detected by serology on 06/05/2011 (Xinpu Township, Hsin-chu), 16/05/2011 (Yongjing Township, Chang-hua) and 23/05/2011 (Tianwei Township, Chang-hua) all in pigs. No viruses were isolated. Two further outbreaks of FMD type O were detected by serology on 11/07/2011 (Yingge District, T'ai-pei) and 26/07/2011 (Shigang District, T'ai-nan); both were in pigs. No viruses were detected. Four new outbreaks of FMD type O were reported in pigs on 19/10/2011 in Erlun Township, Yun-Lin (sub-clinical infection, no virus isolated), on 30/10/2011 in Makung City, P'eng-Hu (RT-PCR and virus isolation positive), on 07/12/2011 in Luchu township, T'ao-Yuan (RT-PCR and virus isolation positive); and on 19/12/2011 in Beimen District, T'ai-Nan (RT-PCR and sequencing performed). No phylogenetic analyses have yet been reported.

Tajikistan: An outbreak of FMD due to type Asia 1 was reported to have occurred on 10/11/2011 in cattle, sheep and goats at Shurobod district, Khatlon. FMD was previously reported in Tajikistan in 2003-04.

The Democratic People's Republic of Korea (North Korea): Between 25/12/2010 and 17/03/2011, 139 outbreaks of FMD type O were reported in cattle, goats and pigs in North Korea (provinces of P'yongyang-Si, Hwanghae-Bukto, Kangwon-Do, P'yongan-Namdo, P'yongan-Bukto and Chagang-Do). Four further outbreaks of FMDV type O were reported during March (on 02/03/2011 in Kangwon-Do province) and on 06/03/2011, 17/03/2011 and 25/03/2011 in Hwanghae-Bukto province). One virus was isolated by the WRLFMD from the earlier outbreaks and shown to be O/SEA/Mya-98.

Pools 4-6: Pool 4 – Eastern Africa, Pool 5 – Western Africa, Pool 6 – Southern Africa

Botswana: On 04/02/2011 an outbreak of FMD was reported in cattle at Kaepe crush, Okavango, Ngamiland, Maun. The causal virus was type SAT 2. No phylogenetic analyses have been reported. A second focus of infection in cattle, also due to SAT 2, was reported on 29/04/2011 at Butale Syndicate Crush, Francistown, North East, close to the border with Zimbabwe. The previous outbreak of FMD in this area was in 2003. Subsequently, two further outbreaks were report in the region (on 22/05/2011 at Mabethe Crush, Francistown and on 27/05/2011 at Ramokgwebana, Selibe-phikwe, Central, Selibe Phikwe). Collaboration between the Botswana Vaccine Institute (BVI) and the WRLFMD has shown that the viruses isolated from the two foci belong to two different SAT 2 topotypes. The viruses from the Maun area belong to topotype III and are closely related to viruses present in that area during 2008 and 2009. While the viruses from the Francistown/ Selibe Phikwe outbreaks belong to topotype I and are closely related to viruses from Mozambique in 2010. A new outbreak of FMD was reported in cattle at Itoto, Okavango, Ngamiland, Maun (17/09/2011).

Libya: On 22/12/2010, two outbreaks of FMD were reported in cattle in Tripoli. Viruses from this and a subsequent outbreak belonged to the ME-SA/PanAsia-2^{ANT-10} lineage and were closely related to viruses from Pakistan and Iran.

Mozambique: An outbreak of FMDV type SAT 2 was reported from the Gaza area (20/05/2011 at Lumane, Chicumbane, Xai-xai). No sequence data was reported.

Namibia: Two outbreaks of FMD SAT 1 have occurred in cattle on 26/11/2011 (Masikili Village, Caprivi) and 19/12/2011 (Ihaha Crushpen, Caprivi). Contact with wild African buffalo (*Syncerus caffer*) was reported. No phylogenetic analysis was available.

South Africa: Between 01/02/2011 and 17/03/2011 FMDV non-structural antibodies were discovered in cattle, goats and sheep at 44 locations in KwaZulu-Natal. No virus could be isolated, nor FMDV genome detected. The causal virus remains untyped. Although some NSP ELISA tests were positive, most NSP ELISA test results were inconclusive. However, SAT 1 virus was isolated from cattle samples from the outbreak area and SAT 3 virus was isolated from buffalo samples from a nature reserve in the outbreak area.

Zimbabwe: Collaboration between the Botswana Vaccine Institute (BVI) and the WRLFMD showed that viruses isolated from Plumtree (close to the border with Botswana) in 2010 belong to SAT 2 topotype I and were most closely related to virus occurring in Zimbabwe in 2002 and 2003. Although belonging to the same topotype as the most recent outbreaks in eastern Botswana, they were not closely related to the Zimbabwe 2010 viruses. On 22/04/2011, an outbreak of FMD SAT 2 was reported in cattle at Ingwizi Ranch, Mangwe, Matabeleland South. The farm is adjacent to previously infected communal areas. Suspected cases were reported from 6 dip tanks in the area. No sequence data was available.

Pool 7: South America

Paraguay: FMD type O was found in cattle on 17/09/2011 at Sargento Loma, San Pedro department. FMD previous occurred in July 2003. A sample was received and characterised at WRLFMD with VP1 sequencing showing that the virus belonged to the EURO-SA topotypes and was most closely related to O/Corrientes/ARG/06 (4.85% nt difference). It was distinct from the vaccine strain, O_1/Campos/BRA/58 (16% nt difference). A second outbreak occurred in cattle on 30/12/2011 in the Aguaray Amistad district, San Pedro.

1.3.2 Information gaps

Submission of samples from endemic regions has continued to be mainly in response to perceptions of increased number or severity of outbreaks, although in some cases there are proactive projects promoting sample submission. Reactive sampling provides an incomplete survey of the global virus pool and often lacks context in the form of information on the history accompanying the samples. Nevertheless, the bias towards things that are out of the ordinary may be helpful in providing early warning for new epidemics. It is hoped that there will be growing uptake of regional FMD control schemes following the continuation of the OIE/FAO Progressive Control Pathway FMD initiative under the Global Framework for eradication of transboundary animal diseases. The starting point for countries that are currently endemically infected with FMDV will be surveillance to identify the types of virus present and the weight of infection.

The main gaps in knowledge about the global distribution of FMDV come from countries without control schemes, especially in sub-Saharan Africa and in southern and central Asia.

1.3.3 Threats

The greatest diversity of FMD viruses are in Africa and there are relatively few vaccines available that have been developed to protect against current African strains. Vaccines used in Africa may also lack stability and potency contributing to poor protection and increasing the threat of spread of outbreaks in the region and beyond. Historically, FMD viruses have rarely spread out of Africa, apart from sporadic incursions into the Middle East. However, changing patterns of global travel may alter this risk.

Despite growing efforts to control FMD in India and China and the attendant prospect of a reducing incidence of infection within their very large livestock populations, FMD viruses continue to circulate both in these countries and regionally. Therefore, Asia remains an important reservoir for serotypes O, A and Asia 1. FMD viruses have traditionally spread from Southern Asia, threatening FMD-free regions to the north and west in Central Asia and Europe. In fact, Asia has been the main source of outbreaks affecting the Middle East and Europe in the last twenty years (Valarcher et al., 2008; Knowles et al., 2012). There is also a continued possibility of spread of FMDV through countries of the former Soviet Union into Europe and China and from Indo-China into northern and eastern neighbours. Vaccine strains developed locally to control FMD within Asia are not maintained within European vaccine banks.

The incursions into the Middle East and North Africa of the O PanAsia 2 and A Iran 05 strains has continued and these still present a significant threat for further spread including to the west into Europe, and northwards into countries of the former Soviet Union.

In spite of a lack of reports in 2010, serotype Asia 1 has appeared in the Middle East and parts of Asia in 2011. Asia 1 was reported in Bahrain, Iran and Turkey as well as Pakistan and Afghanistan.

Therefore, the risk of Asia 1 spreading further westward should be borne in mind. Importantly, a consistent pattern of poor matching of current isolates with Asia 1 Shamir and other commercial vaccines is appearing. A close watch is being maintained on laboratory testing and use of Asia 1 vaccines in the field to determine any apparent failures of vaccination against the current circulating strain.

In South America, Ecuador and Venezuela are the two countries which remain endemic, representing a threat to the cattle population in the areas free with or without vaccination in South America. Virus O_1 is still circulating in Ecuador and Venezuela as well as virus A_{24} in Venezuela.
In Paraguay 2 outbreaks of FMD type O were reported in 2011. FMD was previously reported in July 2003.

The identification towards the end of 2010 and in 2011, of a variant type O virus in Ecuador, has necessitated the development of a revised strategy for FMD control. FMD Virus serotype C has not be reported since 2004 in the Amazon region from Brazil. In the early 2000, reintroduction of virus O occurred in the common border regions of Paraguay, Bolivia, Argentina and Brazil. As a consequence, a High Surveillance Zone was defined in the area and extensive serosampling for viral activity studies are being implemented in a joint programme between the four countries. The generally improving situation in South America may give rise to a reassessment of strain priorities for vaccine banks held by FMD-free countries elsewhere.

1.4 Vaccine recommendations

These take two forms. Regional recommendations are given in section 1.5, whilst the WRLFMD recommendations for FMD free countries are given in section 1.7.

Continuous molecular and antigenic characterisation of field viruses remains of utmost importance to generate intelligence and to inform rapid development of new vaccines that will provide coverage for specific regions. Regional vaccine selection does not always investigate whether vaccines produced elsewhere would be suitable, or conversely whether locally produced vaccines would have a wider application. This underscores the need for greater cooperation between the work of different regional reference laboratories. Commercial and national restrictions can prevent exchange of vaccine strains between reference laboratories and this lessens opportunities to evaluate the applicability of different vaccines to different regions. Harmonisation of local vaccine selection procedures is a priority so that results obtained in one laboratory can be extrapolated to other situations. Different manufacturing and licensing standards for vaccines also hinders the possibility for sharing of vaccines between regions.

Matching tests to check the antigenic suitability of vaccines to protect against circulating strains continue to reveal gaps in cover against SAT 2, and particularly important progressively towards the end of 2010 and through 2011 against serotype O PanAsia 2 isolates. There is still an urgent need for the development of new SAT vaccine strains with good immunogenicity, adaptation to suspension cultures of BHK-21 cells and post-inactivation stability. Following the introduction of the new O PanAsia 2 vaccine from Intervet in late 2010, the ability of this vaccine to match with field isolates has been carefully monitored throughout 2011. Laboratory vaccine matching test results clearly show that this new vaccine shows a good match with more than 90% of field samples tested at WRLFMD in 2011 and it has now been added to the high priority section of the vaccine recommendations from WRLFMD (see vaccine section).

As well as improving the efficacy, stability and safety of production, research on FMD vaccines is still urgently required to establish a better understanding of the vaccine coverage required for protection under different livestock systems and to improve alternatives for potency testing of vaccine batches. Further research is also needed to improve vaccine selection methods. Importantly there is still an urgent need to monitor existing vaccination programmes carefully to ensure pre vaccination quality and potency and then downstream effective delivery and post vaccination monitoring of vaccinated stock. This is still woefully inadequate in many regions.

1.5 Regional situation

1.5.1 Pool 1: EASTERN ASIA

Network labs receiving samples in 2011

Laboratory	Sample Nos.	Countries of origin
WRLFMD	183	Cambodia, DPR Korea (North), Hong Kong, Lao PDR, Malaysia, South Korea, Thailand, Vietnam
RRLSEA	161	Cambodia, Lao PDR, Sri Lanka, Vietnam, Thailand
LVRI	55	China

Indonesia, Singapore, Brunei and the island states of **Malaysia** remained FMD-free without vaccination.

No outbreaks of FMD have been reported from the **Philippines** since 2005 and the country was recognised as officially free of FMD in May 2011at the OIE general session.
Japan also regained its status as free without vaccination in May 2011at the OIE general session.

China: In **China**, 7 outbreaks have been reported in 2011 by LVRI (Figure 4 and Table1). No outbreaks of A or Asia 1 serotype were reported this year. All outbreaks were of serotype O, 2 were SEA topotype Mya 98 lineage and 5 were ME-SA topotype PanAsia lineage. VP1 sequencing showed that these viruses were closely related to other viruses circulating in the SEA region.
–Hainan province is being established as an FMD free zone with vaccination and is monitored 4 times a year by NFMDRL.

For serotype O, a Cathay-like virus vaccine (Os99) is also used in pigs.
–In 2010 an O- Myanmar 98 vaccine strain was selected and developed as a vaccine by LVRI. The new vaccine (O-Mya98) is used at a PD50 of 10.81 in pigs and 7.08 in cattle. In addition, a new synthetic peptide vaccine against O-Mya98 has been developed and animal protection experiments with this vaccine are ongoing. Very little efficacy data is available on the use of these vaccines although 1.5 billion doses of vaccine are used in a twice a year vaccination strategy in china.

– **Field isolates of Mya-98(O/CHA/31/2010) matching with Inactive vaccine(Type O) produced in China**

Vaccine 4 (O/MYA98/BY/2010 strain)	**10.81~13.59(PD_{50} value with pigs)**

– **For Serotype O, PanAsia strain collected from Guizhou Province in 2011(O/CHA/7/2011) matching with vaccine strains by VNT**

Isolates name	lineage	vaccine strains	
		O/Mya98/BY/2010	O/China99
O/CHA31/2010	Mya-98	>1	ND
O/CHA/7/2011	PanAsia	0.62	>1

–Vaccination occurs 2 times a year in spring and autumn. More than 700 million doses are used at each time implying up to 1.5 billion doses are produced and administered in China per year.

Details associated with the cases confirmed by LVRI are shown in Figure 4 and Table 1 below: This information has been submitted directly by LVRI.

Figure 4. Map of China showing regions with reported outbreaks of FMD.

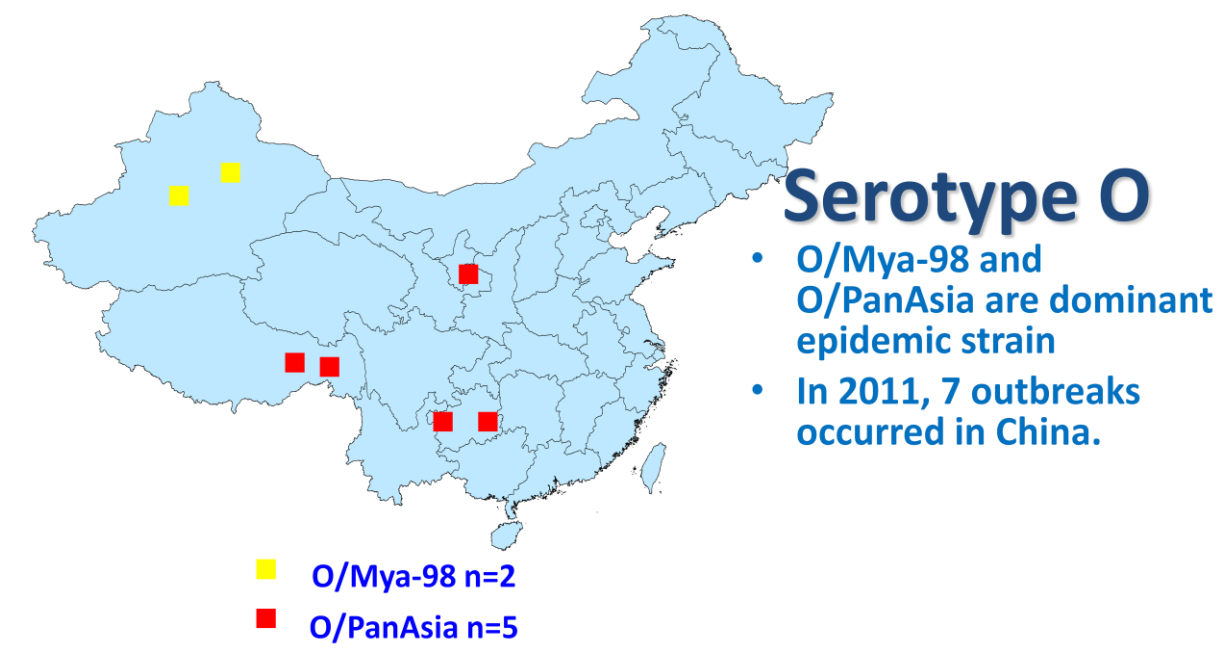


Table 1. FMD Information from LVRI, China

Outbreak date	Location	Report date	Serotype	Confirmation date	Species	Number susceptible	Number of cases	Number of deaths
19/02/2011	Qia'erbagexiang, Kuerle, Bazhou, XINJIANG	28/02/2011	O /mya-98	28/02/2010	Swine	3941	275	0
19/03/2011	Xinjiang Production and Construction Corps, XINJIANG	28/03/2011	O /mya-98	28/03/2010	Swine	205	58	25
29/03/2011	Jing Xiang village, Tianzhu, Qian dongnan , GUIZHOU	07/04/2011	O /PanAsia	07/04/2011	Cattle Sheep / goats Swine	252 7 421	87 0 4	12 0 2
13/07/2011	Longfeng village, Pudi, Bijie, GUIZHOU	21/07/2011	O /PanAsia	21/07/2011	Cattle Swine Sheep / goats	73 124 197	46 78 9	0 0 0
31/08/2011	Liebugou, Lengda village, Jiacha, Shannan, TIBET	05/09/2011	O /PanAsia	05/09/2011	Cattle	1744	6	6
30/09/2011	Duixu village, Zhongda town, Lang, Linzhi, TIBET	10/10/2011	O /PanAsia	10/10/2011	Cattle Sheep / goats Swine	108 2 22	7 0 0	0
16/10/2011	Shuangjing village, Haiyuan, Zhongwei, NINGXIA	17/10/2011	O /PanAsia	17/10/2011	Cattle Sheep / goats	389 293	26 0	

Taiwan (Chinese Taipei) A number of outbreaks of type O were reported in 2011 but no samples were received by a network reference laboratory

In 2011, 161 samples were submitted to the RRLSEA in Pakchong from **Cambodia, Lao PDR, Sri Lanka, Vietnam** and **Thailand.** Serotyping revealed types O and A.

WRLFMD received 183 samples from **Cambodia, DPR Korea (North), Hong Kong, Lao PDR, Malaysia, South Korea, Thailand** and **Vietnam**

The type O viruses from South East Asia that were tested for vaccine matching at WRLFMD again showed a generally poor to moderate match to O Manisa and in many cases a better match with O PanAsia 2, O 3039 and O 4625 vaccine strains (see vaccine matching section).

Republic of Korea (South Korea): Between 23/12/2010 and 05/01/2011, 36 outbreaks were identified in cattle and pigs in the following provinces: Chungcheongbuk-do, Chungcheongnam-do, Gangwon-do, Gyeonggi-do and Gyeongsangbuk-do. These belonged to the SEA/Mya-98 lineage. Three more outbreaks of FMD type O were reported on 16/04/2011 (Hwangjeong-ri, Geumho-eup, Yeongcheon-city, Gyeongsangbuk-do), 19/04/2011 (Samho-ri, Geumho-eup, Yeongcheon-city, Gyeongsangbuk-do) and 21/04/2011 (Donam-dong, Yeongcheon-city, Gyeongsangbuk-do).

The Democratic People's Republic of Korea (North Korea): Between 25/12/2010 and 17/03/2011, 139 outbreaks of FMD type O were reported in cattle, goats and pigs in North Korea (provinces of P'yongyang-Si, Hwanghae-Bukto, Kangwon-Do, P'yongan-Namdo, P'yongan-Bukto and Chagang-Do). Four further outbreaks of FMDV type O were reported during March (on 02/03/2011 in Kangwon-Do province) and on 06/03/2011, 17/03/2011 and 25/03/2011 in Hwanghae-Bukto province). One virus was isolated by the WRLFMD from the earlier outbreaks and shown to be O/SEA/Mya-98.

Vaccine strains that may be suitable for use in the region include:

Serotype	Internationally available	Locally produced
O	O_1 Manisa, O 3039, O Tur 5/09 (O PanAsia 2)	China 1999, Thailand 189/87, O-Mya 98(*China)
A	Malaysia 97	China 1972, Thailand 118/87, AF72, A/sakol/97
Asia 1	Shamir	China 2005, Thailand /85, Asia 1/JSL/06

Serotype O Cathay-like virus vaccines (e.g. O Taiwan 97, O Philippine 97, or O 1685 Russia 95) could also be useful where viruses of this topotype affect pigs.
* recent development for use in China

1.5.2 Pool 2: SOUTHERN ASIA.

Network labs receiving samples in 2011:

Laboratory	Sample Nos.	Countries of origin
WRLFMD	428	Afghanistan, Pakistan and Sri Lanka,
PDFMD	409	India

India, Pakistan, Sri Lanka, Bangladesh, Bhutan and Nepal remain endemically infected with FMDV.

Samples received at WRLFMD from **Afghanistan** (292), **Sri Lanka** (2) and **Pakistan** (130): Samples from Afghanistan (292) and Pakistan (130) comprised serotypes O, A and notably Asia 1. The O/ME-SA/PanAsia-2^{ANT-10} and A-Iran-05^{AFG-07} lineages continue to dominate in these countries.
Both samples from Sri Lanka were serotype O ME-SA topotype.

Serological tests on serotype O viruses from Afghanistan showed the best match against the O 4625, O Taw98 and O Tur 5/09 (O PanAsia 2) and did not show particularly good match with O_1 Manisa.
Serological tests on serotype A viruses from Afghanistan showed some poor matching but the best match against the A Iran 05 strain vaccines.
Serological tests on serotype Asia 1 viruses from Afghanistan showed poor to no matching with Asia 1 vaccines.

Serological tests on serotype O viruses from Pakistan showed the best match against the O Manisa, O 4625, O 3039, O Taw98 and O Tur 5/09 (O PanAsia 2) vaccine strains.
For serotype A viruses from Pakistan, the best match was against the A Iran 05 strain vaccines.
Serological tests on serotype Asia 1 viruses from Pakistan showed poor to no matching with Asia 1 vaccine strains.

India: PDFMD report that serotypes O, A and Asia 1 are endemic in India. Below is a table provided by PDFMD detailing the findings from 2011.

Table 2. FMD Information from PDFMD, India.

Outbreaks In India 2011				
Month	**States**	**No of Outbreaks**	**Serotypes detected**	**Remarks**
January	Tamil Nadu Kerala Assam Meghalaya Karnataka Bihar	3 3 2 2 10 1	O - 20 Asia 1 - 1	Asia 1 in Assam
February	Tamil Nadu Kerala Assam Meghalaya Karnataka Himachal Pradesh Punjab Gujarat Maharashtra Madhya Pradesh Nagaland Mizoram	4 1 1 2 1 1 4 2 6 2 1 1	O-22 Asia 1-4	Asia 1 in Meghalaya and Maharashtra
March	Tamil Nadu Kerala Bihar Arunachal Pradesh Karnataka Andhra Pradesh	1 1 1 1 2 1		

	Punjab	3		
	Gujarat	1	O-28	
	Maharashtra	2		
	Madhya Pradesh	9		
	Nagaland	1		
	Haryana	1		
	Uttar Pradesh	1		
	West Bengal	3		
April	Gujarat	1		
	Karnataka	3	O-8	
	West Bengal	4		
May	West Bengal	4		
	Kerala	3	O-10	
	Assam	2		
	Uttar Pradesh	1		
June	Assam	4		
	Tripura	1	O-6	
	West Bengal	1		
JULY	West Bengal	2	O - 2	
	Assam	12	O-2, A-3, Asia1- 7	Total – 28
	Orissa	2	O - 2	O – 14
	Nagaland	3	A – 3	A – 6
	Karnataka	1	O -1	Asia 1 - 8
	Mizoram	1	O – 1	
	Gujarat	1	Asia1 – 1	
	Kerala	3	O – 3	
	Bihar	3	O - 3	
AUGUST	West Bengal	3	O -2, Asia 1 -1	Total – 12
	Kerala	3	O -3	O – 9
	Chatisgarah	3	O 1, A - 2	A – 2
	Assam	2	O- 2	Asia 1 - 1
	Orissa	1	O - 1	
SEPTEMBER	West Bengal	2		Total – 11
	Assam	1		O – 11
	Orissa	3	O - 11	
	Andhra Pradesh	1		
	Karnataka	2		
	Kerala	2		
OCTOBER	Madhya Pradesh	4		Total – 14
	Kerala	2	O- 14	O – 14
	Karnataka	8		
NOVEMBER	West Bengal	2	Asia1 -2	Total – 21
	Assam	3	O – 3	O – 18
	Kerala	1	O -1	Asia 1 - 3
	Tamilnadu	2	O -2	
	Andhra Pradesh	2	O -2	
	Tripura	1	O -1	
	Karnataka	3	O – 3	
	Maharashtra	2	O -1, Asia1 – 1	
	Nagaland	1	O- 1	
	Bihar	4	O -4	
DECEMBER	West Bengal	1	O -1	Total – 29
	Assam	5	O -1, Asia1- 4	O – 21
	Kerala	5	O - 4, Asia1 – 1	A – 3
	Tamilnadu	2	O -2	Asia 1 - 5
	Madhya Pradesh	9	O -6, A -3	
	Karnataka	4	O -4	
	Bihar	3	O-3	
TOTAL		**Total: 214 (O –181, A – 11 and Asia 1 - 22)**		

Vaccine strains that may be suitable for use in the region include:

Serotype	Internationally available	Locally produced
O	O_1 Manisa, O 3039, O 4625, O Tur 5/09 (O PanAsia 2)	IND R2/75*
A	A Iran 05, A_{22} Iraq, A Tur/4/06	IND 40/2000*, Turkey 1/2006 (A Iran 05 lineage)
Asia 1	Shamir	IND 63/72*

* Trivalent vaccine comprising these three strains is nationally mandated in India

1.5.3 Pool 3: EUR-ASIA

Network labs receiving samples in 2011:

Laboratory	Sample Nos.	Countries of origin
WRLFMD	332	Bahrain, Bulgaria, Estonia, Iran, Israel, Kuwait, Libya, Turkey, United Kingdom
FGI-ARRIAH	41	Kazakhstan, Kyrgyzstan, Mongolia, Russia, South Ossetia

FMD viruses continue to circulate in many Middle-Eastern countries, the prevailing serotypes in 2011, being as in 2010, O (PanAsia-2 lineage) and A (Iran 05 lineage). There were a number of Asia 1 outbreaks reported in 2011.

Fewer countries reported outbreaks in the Middle East in 2011, however there was continued high level activity in **Turkey** and **Iran** with both countries reporting very high numbers of outbreaks throughout the year of 3 serotypes O (PanAsia-2), A (Iran 05) and Asia 1.

Turkey recorded more than 1500 outbreaks in 2011 and began producing and distributing a new variant O vaccine based on a local field strain for use this year. No details are available on its efficacy however.
Turkey also reported the development of a new Asia 1 vaccine which is still in its early stages of development and use.

The priority vaccines still remain O Manisa (and similar strains), A Iran 05 strain and Asia 1 Shamir (or similar strains). The introduction of the new O PanAsia 2 vaccine and the availability of supplementary strains such as O 4625 and O 3O39 from Merial should increase confidence that there are vaccines to cover the majority of known circulating O viruses.

The laboratory matching of Asia 1 Shamir and related vaccines with current circulating field isolates has been poor in 2011 and is a cause for concern regarding the expected protection that these vaccines can offer in the field. Further laboratory analysis will be carried out during 2012 to monitor the matching of new field isolates and a challenge study using Asia 1 Shamir vaccine followed by a current Asia 1 isolate challenge will be carried out At Pirbright to assess the ability of high potency emergency vaccine to protect against these recent strains. results will be published in 2nd quarter of 2012.

The major gaps in submissions continue to be from some central Asian Republics, the Caucasus and some Middle East countries concerned about the impact of transparency on

trade. The main problems for vaccine selection are an inability to compare vaccine matching results between centres due to the use of different vaccine strains, non-standardised methods and field isolates that are not shared. There is still a lack of information on the cross-reactivity of the new A Iran-05vaccine strains against other circulating A viruses.

As advised last year, an Asia 1 epidemic is building in EurAsia, with cases in Pakistan, Afghanistan, Bahrain, Turkey and Iran in 2011 where population immunity is low. Increased imports and movements of live cattle and small ruminants into and through the Middle East from Africa and through new trade routes may also increase the risk of African strains being introduced.

Vaccine strains that may be suitable for use in the region include:

Serotype	Internationally available	Locally produced*
O	O_1 Manisa, O4625, O Panasia 2	Russian O_1 PanAsia and O PanAsia 2
A	A Iran 05, A_{22} Iraq	Turkey 1/2006 (A Iran 05 lineage)
Asia 1	Shamir	Georgia 2000, Russia/2005

* Vaccines are also produced locally in Iran, Turkey, Egypt and Jordan

The main differences between vaccine requirements of pools 1-3 relate to serotype A.

1.5.4 Pool 4: EASTERN AFRICA

Network labs receiving samples in 2011:

Laboratory	Sample Nos.	Countries of origin
WRLFMD	70	DR Congo, Ethiopia, Kenya,

FMD vaccination is applied only at a limited scale in 6 countries in the region:

- Kenya (KEVEVAPI vaccine, Kenya)
- Ethiopia (NVI Ethiopia and Indian Immunologicals)
- Uganda (KEVEVAPI vaccine, Kenya)
- Somalia (pre-export at Berbera port, KEVEVAPI vaccine Kenya)
- Burundi (KEVEVAPI vaccine, Kenya)
- Sudan (KEVEVAPI vaccine, Kenya) Quadri-valent Vaccine

Vaccine strains that may be suitable for use in the region include:

Serotype	Internationally available	Locally produced in 2009/2010
O	O_1 Manisa	Kenya 77/78, Egypt 2/72, Ethiopia O 281
A	Eritrea 98	Kenya 5/80, Egypt 06, Ethiopia A110
SAT 1	See pool 6	Kenya T155/71
SAT 2	Saudi 2000, Eritrea 98, see pool 6	Kenya 52/84

1.5.5 Pool 5: WESTERN AFRICA

Network labs receiving samples in 2011:

Laboratory	Sample Nos.	Countries of origin

0	0	0

No samples were submitted from this region to OIE/FAO Reference Laboratories for investigation of FMD outbreaks, although the disease is known to be present.

FMD is endemic in the whole region and epizootic outbreaks are regularly observed, but rarely investigated. In West and Central Africa collection and testing for FMD identification are rare.

Regional lab networking:

Under the regional lab network for West and Central Africa (RESOLAB), a specific network on FMD is being built. Labs will be encouraged to collaborate in the area of sample collection, analysis and shipment. In addition laboratories capacities for FMD diagnosis will be enhanced through training focusing on FMDV detection and identification, and serology studies. The information relevant to the region and to the international community will be shared for discussion.
Nigeria, Mali and Senegal proposed to assist the other members countries by performing diagnosis and further assistance by shipping their samples and strains to the WRLFMD for confirmation and genotyping.

Vaccine strains that may be suitable for use in the region include:

Serotype	Internationally available	Locally produced
O	O_1 Manisa	
A	Eritrea 98, A_{22} Iraq	
SAT 1	Rhodesia 12/78, Botswana 1/68,	Botswana 1/77, KNP 196/91, Kenya T155/71, SAR 9/81
SAT 2	Saudi 2000, Eritrea 98, see pool 6	Nigeria 6/81*

* Current availability of this vaccine is not known

1.5.6 Pool 6: SOUTHERN AFRICA

Network labs receiving samples in 2011:

Laboratory	Sample Nos.*	Countries of origin
WRLFMD	33	Botswana, South Africa, Zambia and Zimbabwe
ARC-OVI	568 (21473)	South Africa (other country details not available)
	20	Namibia

* clinical samples except for those in parenthesis that represent serology samples.

Thirty three samples were sent to WRLFMD from Botswana, **South Africa, Zambia** and **Zimbabwe** in 2011 for characterisation and analysis.

Botswana: Collaboration between the Botswana Vaccine Institute (BVI) and the WRLFMD has shown that the viruses isolated from two SAT 2 outbreaks belong to two different SAT 2 topotypes. The viruses from the Maun area belong to topotype III and are closely related to viruses present in that area during 2008 and 2009. While the viruses from the Francistown/ Selibe Phikwe outbreaks belong to topotype I and are closely related to viruses from Mozambique in 2010.

South Africa: Between 01/02/2011 and 17/03/2011 FMDV non-structural protein antibodies were detected in serum from cattle, goats and sheep at 44 locations in KwaZulu-Natal. No virus could be isolated, nor FMDV genome detected. The causal virus remains untyped. Although some NSP ELISA tests were positive, most NSP ELISA test results were inconclusive. However, SAT 1 virus was isolated from cattle samples from the outbreak area and SAT 3 virus was isolated from buffalo samples from a nature reserve in the outbreak area.

Zimbabwe: Collaboration between the Botswana Vaccine Institute (BVI) and the WRLFMD showed that viruses isolated from Plumtree (close to the border with Botswana) in 2010 belong to SAT 2 topotype I and were most closely related to virus occurring in Zimbabwe in 2002 and 2003. Although belonging to the same topotype as the most recent outbreaks in eastern Botswana, they were not closely related to the Zimbabwe 2010 viruses. On 22/04/2011, an outbreak of FMD SAT 2 was reported in cattle at Ingwizi Ranch, Mangwe, Matabeleland South. The farm is adjacent to previously infected communal areas. Suspected cases were reported from 6 dip tanks in the area. No sequence data was available.

The priority vaccines are SAT 2 and SAT 1, but there is insufficient information to be more precise about the strains that should be included. For SAT 1, past vaccine matching results have indicated that vaccine strains are relevant. For SAT 2, there is now more concern over vaccine matching which will require much more analysis of field strains by laboratories in the network.

Vaccine strains that may be suitable for use in the region include:

Serotype	Internationally available	Locally produced
O	O_1 Manisa	Kenya 77/78, Egypt 2/72
A	Eritrea 98	Kenya 5/80, Egypt 06
SAT 1	Rhodesia 12/78, Botswana 1/68,	Botswana 1/77, KNP 196/91, Kenya T155/71, SAR 9/81
SAT 2	Zimbabwe 7/83, Eritrea 98, Saudi 2000	Zimbabwe 11/89, Zimbabwe 5/81, Zambia 3/81, KNP 19/89, Kenya 52/84, Kenya 65/82
SAT 3	Zimbabwe 9/81, Zimbabwe 2/83	KNP 10/90

Not all of the above-mentioned vaccine strains are in production and there are major problems in finding new strains suitable for vaccine production. This is not only due to the lack of availability of field isolates and sera for use in vaccine matching tests, but also the fact that prospective vaccine strain adaptation for production purposes is a cumbersome process and that commercial returns are uncertain on investment to generate new vaccine strains.

1.5.7 Pool 7: SOUTH AMERICA

Network labs receiving samples in 2011:

Laboratory	Sample Nos.	Countries of origin
WRLFMD	1	Paraguay
PANAFTOSA	4	Ecuador. Paraguay
SENASA	4	Ecuador, Paraguay

Paraguay: FMD type O was found in cattle on 17/09/2011 at Sargento Loma, San Pedro department. FMD previous occurred in July 2003. A sample was received and characterised at WRLFMD with VP1 sequencing showing that the virus belonged to the EURO-SA topotypes and was most closely related to O/Corrientes/ARG/06 (4.85% nt difference). It was distinct from the vaccine strain, O_1/Campos/BRA/58 (16% nt difference). A second outbreak occurred in cattle on 30/12/2011 in the Aguaray Amistad district, San Pedro.

Ecuador: In 2010 WRLFMD isolated 9 FMD type O viruses from samples sent from various locations in Ecuador. These were the first samples WRLFMD had received from this region. They all belonged to the EURO-SA topotype.

Vaccine matching studies carried out at WRLFMD demonstrated no match with current vaccine strain for the region O1 Campos by VNT. Other laboratories including SENASA and PIADC-FADDL reported the same results. SENASA also reported that the current O1 Campos vaccine also failed to protect vaccinated animals in a challenge study using a recent field isolate from Ecuador. In contrast PANAFTOSA reported that the results from their studies using complement fixation test together with Lp-ELISA and VNT test to determine the expectancy of protection (EPP) indicated that a systematic revaccination campaign would be effective in protecting the national herd against the field strains

Based upon the discrepancy in these findings a technical meeting of interested parties and reference laboratories was organised for these results to be discussed at an OIE expert meeting on FMD vaccine matching in Ecuador 17–18 November 2011, OIE Headquarters, Paris, France. Recommendations from this meeting included;

- To maintain the vaccine strain O1 Campos 1958 in the formula of the bivalent vaccine used in Ecuador.
- OIE Reference Laboratories for FMD should prepare a panel of harmonised cattle sera against vaccine strains currently used in South America, in particular against O1 Campos, to be used as a standard by all OIE Reference Laboratories in vaccine assessment testing.
- Further details of this meeting can be obtained from the OIE reference laboratories in South America and WRLFMD.

The vaccines used in the region are all single oil emulsions. O1 Campos and A24 Cruzeiro are used throughout the region, whilst C3 Indaial is included in Bolivia, Brazil and Paraguay. The justification has been the Amazonas outbreak in 2004. In Argentina, a tetravalent vaccine is used incorporating A ARG 2001 in addition to O Campos and A24 Cruzeiro and C3 Indaial. The role of the OIE reference Laboratories in advising on methodology and standards for vaccine control is considered extremely important. Cattle up to 2 years old are vaccinated every 6 months and thereafter annually, aiming for 100% coverage.
Considering the importance of vaccine potency, expectancy of protection (EPP) is also used to gauge antigenic match rather than relying on r_1 values alone.

Apart from the O virus circulating in Ecuador, vaccine matching studies suggest that vaccines that are currently in use shown below should still protect against clinical disease when applied under systematic vaccination and revaccination schemes. However, this will now need very careful monitoring.

Vaccine strains recommended for use in the region*:

Serotype	Internationally available	Locally produced
O	O_1 Campos,	O_1 Campos
A	A_{24} Cruzeiro, Argentina 2001	A_{24} Cruzeiro, Argentina 2001
C	C_3 Indaial	C_3 Indaial

* PANAFTOSA recommendation is as High Priority: O_1 Campos, A_{24} Cruzeiro, C_3 Indaial, and as medium priority: A Argentina 2001

NB: at the beginning of 2011 SENASA finished their O Ecuador 2010 vaccine production, which was used for *in vivo* challenged tests.

1.6 Clinical samples and FMDV isolates submitted to reference laboratories of the FMD network during 2011.

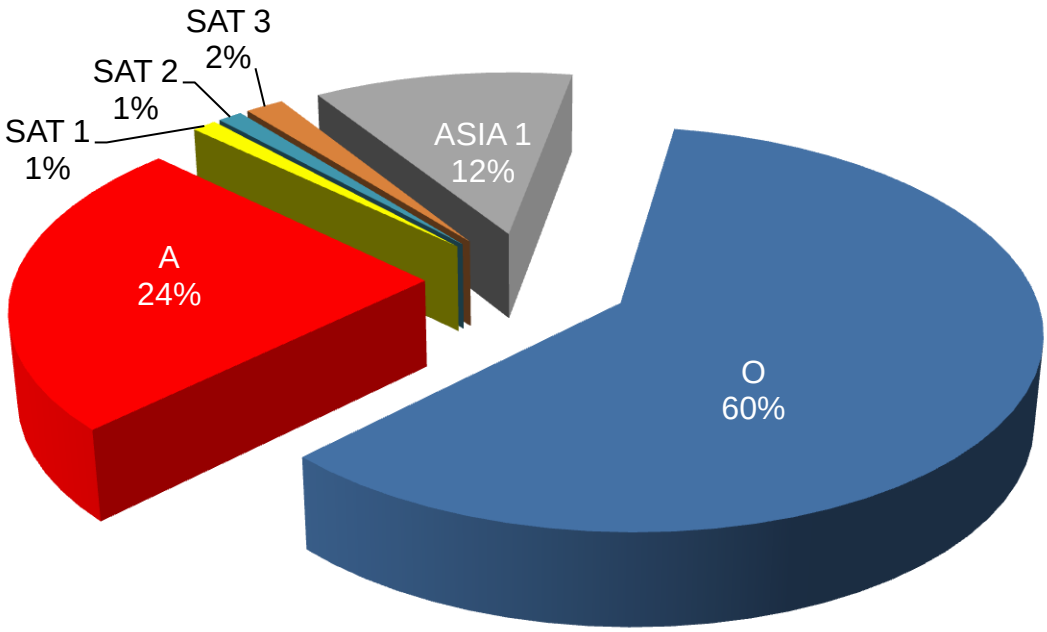
1.6.1 Overview of samples received and serotyping results

The network laboratories received and characterised more than 2,400 samples in 2011 from 34 countries, of which approximately 590 had been collected in 2010 or before.

The proportion of the different serotypes detected in 2011 is shown below demonstrating that 60% of the samples characterised in 2011 were of the O serotype.

Note that serotype C was not detected and SAT 3 was only detected in buffalo and cattle probang samples from South Africa and Namibia.

Figure 5. Serotypes detected in 2011



The approximate number of samples and number of virus isolates made by region is shown below for samples collected in 2011:

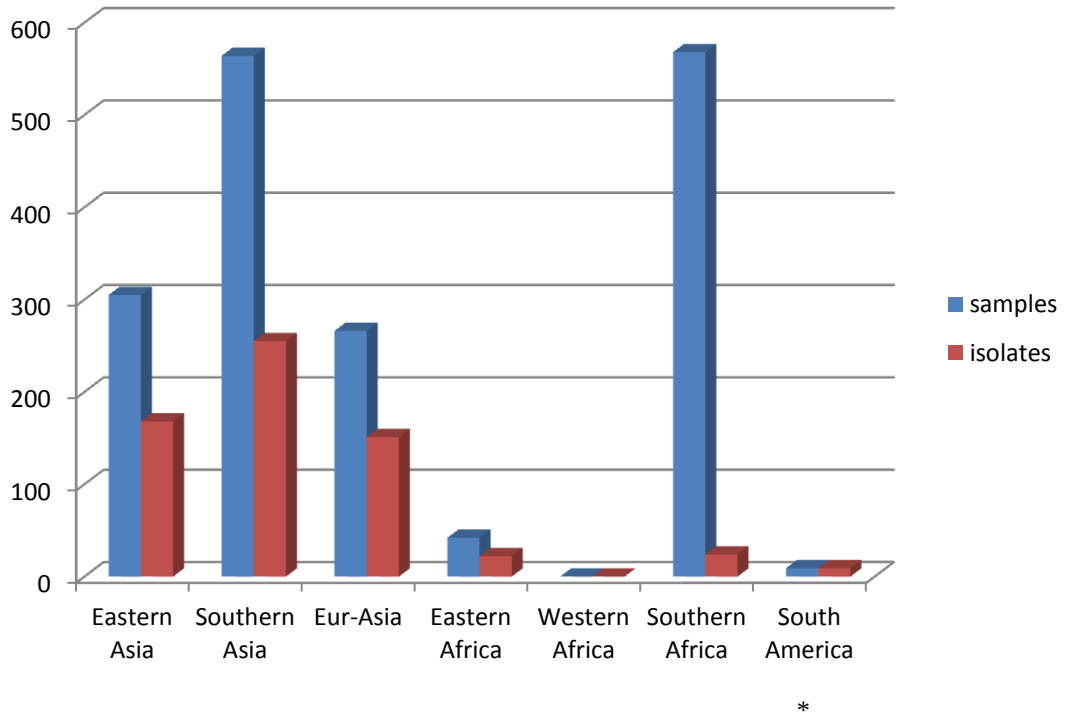


Figure 6. Samples and virus isolates made by region. * information on isolates not complete

The approximate numbers of samples received for FMDV detection and characterised in 2011 by the different network laboratories is tabulated below: In total 34 different countries submitted 2,400 samples in 2011 to the network laboratories with 54% being sent to WRLFMD.

Characterisation and analysis of samples sent to Network laboratories revealed that in 2011, 630 virus isolates were obtained with WRLFMD recording almost 60% of those isolations.

Table 3. Samples received for FMDV detection

	Collected in 2011		Collected earlier	
Laboratory	**Samples**	**Countries**	**Samples**	**Countries**
WRLFMD	574	26	467*	19
PANAFTOSA	4	2		
FGI-ARRIAH	36	4		
ARC-OVI	568	12	54	1
LVRI	55	3		
PDFMD	409	1		
RRLSEA	160	4	28*	2
SENASA	4	2	41	1
Total	**1,810**	**54#**	**590**	**23#**

* samples collected in 2010 and before; # Some countries submitted samples to more than one laboratory

A searchable on-line database of samples is available via the Reference Laboratories Information System (ReLaIS) for the OIE/FAO FMD Reference Laboratories Network http://www.foot-and-mouth.org/.

Characterisation results obtained on samples received by WRLFMD and PANAFTOSA can be found respectively at: http://www.wrlfmd.org/ and at: http://www.panaftosa.org.br.

1.6.2. Details of serotyping and molecular detection results of samples collected and received in 2011

Country	No. of samples	Virus isolation in cell culture/ELISA FMD virus serotypes							SVD virus	NVD	NT	RT-PCR for FMD (or SVD) virus (where appropriate)			Laboratory
		O	A	C	SAT 1	SAT 2	SAT 3	Asia 1				Positive	Negative	NT	
Pool 1: EASTERN ASIA															
CAMBODIA[b]	1	-	-	-	-	-	-	-	-	-	1	1	-	-	WRLFMD
CAMBODIA	31	16	-	-	-	-	-	-	-	15	-	22	9	-	RRLSEA
CHINA	53	7	-	-	-	-	-	-	-	-	-	7	46	-	LVRI
DEMOCRATIC REPUBLIC OF KOREA	31	1	-	-	-	-	-	-	-	30	-	1	30	-	WRLFMD
DEMOCRATIC REPUBLIC OF KOREA	1	1	-	-	-	-	-	-	-	-	-	1	-	-	LVRI
HONG KONG	9	9	-	-	-	-	-	-	-	-	-	9	-	-	WRLFMD
LAOS	2	2	-	-	-	-	-	-	-	-	-	2	-	-	WRLFMD
LAOS	20	16	-	-	-	-	-	-	-	4	-	17	3	-	RRLSEA
MALAYSIA[c]	20	1	6	-	-	-	-	-	-	-	13	12	8	-	WRLFMD
SOUTH KOREA	8	3	-	-	-	-	-	-	-	5	-	6	2	-	WRLFMD
THAILAND	13	4	9	-	-	-	-	-	-	-	-	13	-	-	WRLFMD
THAILAND	78	16	44	-	-	-	-	-	-	18	-	68	10	-	RRLSEA
VIETNAM	37	32	-	-	-	-	-	-	-	5	-	36	-	1	WRLFMD
VIETNAM	1	1	-	-	-	-	-	-	-	-	-	1	-	-	LVRI
Pool 2: SOUTHERN ASIA															
AFGHANISTAN[a]	60	20	17	-	-	-	-	7	-	18	-	53	7	-	WRLFMD
INDIA	409	132	3	-	-	-	-	11	-	Nr	Nr	Nr	Nr	Nr	PDFMD
PAKISTAN	90	19	1	-	-	-	-	42	-	28	-	85	5	-	WRLFMD
SRI LANKA	1	1	-	-	-	-	-	-	-	-	-	1	-	-	WRLFMD
SRI LANKA	4	2	-	-	-	-	-	-	-	2	-	4	-	-	RRLSEA
Pool 3: EUR-ASIA															
BAHRAIN	19	2	1	-	-	-	-	4	-	12	-	9	7	3	WRLFMD
BULGARIA	44	16	-	-	-	-	-	-	-	28	-	29	15	-	WRLFMD

ESTONIA	1	-	-	-	-	-	-	-	-	1	-	-	1	-	WRLFMD
IRAN	53	13	24	-	-	-	-	7	-	9	-	47	6	-	WRLFMD
ISRAEL	26	21	-	-	-	-	-	-	-	5	-	24	2	-	WRLFMD
KAZAKHSTAN	22	1	-	-	-	-	-	-	-	-	-	16*	6	-	ARRIAH
KYRGYZSTAN	8	1	7	-	-	-	-	-	-	-	-	8	-	-	ARRIAH
KUWAIT	2	2	-	-	-	-	-	-	-	-	-	2	-	-	WRLFMD
LIBYA	16	-	-	-	-	-	-	-	-	16	-	1	15	-	WRLFMD
RUSSIA	4	3	-	-	-	-	-	-	-	-	-	4	-	-	ARRIAH
SOUTH OSSETIA	2	1	-	-	-	-	-	-	-	1	-	2	-	-	ARRIAH
TURKEY[d]	64	10	35	-	-	-	-	3	-	17	-	63	1	-	WRLFMD
UNITED KINGDOM	5	-	-	-	-	-	-	-	-	5	-	-	5	-	WRLFMD
Pool 4: EASTERN AFRICA															
DEMOCRATIC REPUBLIC CONGO	13	-	7	-	-	-	-	-	-	6	-	13	-	-	WRLFMD
ETHIOPIA	28	14	-	-	-	-	-	-	-	14	-	15	13	-	WRLFMD
KENYA	1	1	-	-	-	-	-	-	-	-	-	1	-	-	WRLFMD
Pool 5: WESTERN AFRICA															
Pool 6: SOUTHERN AFRICA															
BOTSWANA	5	-	-	-	-	5	-	-	-	-	-	5	-	-	WRLFMD
SOUTH AFRICA	24	-	-	-	-	-	-	-	-	24	-	-	24	-	WRLFMD
SOUTH AFRICA	30	-	-	-	5	-	4	-	-	-	-	9	21	-	ARC-OVI
NAMIBIA	20	-	-	-	2	2	7	-	-	-	-	11	9	-	ARC-OVI
Pool 7: SOUTH AMERICA															
ECUADOR	3	3	-	-	-	-	-	-	-	-	-	3	-	-	PANAFTOSA
ECUADOR	3	3	-	-	-	-	-	-	-	-	-	3	-	-	SENASA
PARAGUAY	1	1	-	-	-	-	-	-	-	-	-	1	-	-	WRLFMD
PARAGUAY	1	1	-	-	-	-	-	-	-	-	-	1	-	-	PANAFTOSA
PARAGUAY	1	1	-	-	-	-	-	-	-	-	-	1	-	-	SENASA
Totals	**1,265**	**377**	**154**	**0**	**7**	**7**	**11**	**74**	**0**	**263**	**14**	**591**	**245**	**4**	

VI/ELISA	FMD (or SVD) virus serotype identified following virus isolation in cell culture and antigen detection ELISA
FMD	foot-and-mouth disease
SVD	swine vesicular disease
NVD	no FMD, SVD or vesicular stomatitis virus detected
RT-PCR	reverse transcription polymerase chain reaction for FMD (or SVD) viral genome
NT	not tested
Nr	Not reported
[a]	1 sample from Afghanistan contained a mixture of FMDV types O and A and another of a A and Asia 1
[b]	1 sample from Cambodia was RNA for PCR analysis
[c]	13 samples from Malaysia were received in Trizol for PCR analysis
[d]	1 sample from Turkey contained a mixture of FMDVs of types O and A

1.6.3. Details of serotyping and molecular detection results of samples collected prior to 2011 and received in 2011

Country	Year of samples	No. of samples	Virus isolation in cell culture/ELISA FMD virus serotypes							SVD virus	NVD	NT	RT-PCR for FMD (or SVD) virus (where appropriate)			Laboratory
			O	A	C	SAT 1	SAT 2	SAT 3	Asia 1				Positive	Negative	NT	
Pool 1: EASTERN ASIA																
CAMBODIA[b]	2010	3	2	-	-	-	-	-	-	-	-	1	3	-	-	WRLFMD
LAOS	2010	2	2	-	-	-	-	-	-	-	-	-	2	-	-	WRLFMD
MALAYSIA[c]	2009	9	-	-	-	-	-	-	-	-	-	9	9	-	-	WRLFMD
MALAYSIA[c]	2010	23	1	-	-	-	-	-	-	-	6	16	23	-	-	WRLFMD
SOUTH KOREA	2010	9	6	-	-	-	-	-	-	-	3	-	9	-	-	WRLFMD
THAILAND	2010	4	2	2	-	-	-	-	-	-	-	-	4	-	-	WRLFMD
VIETNAM	2010	10	9	1	-	-	-	-	-	-	-	-	10	-	-	WRLFMD
VIETNAM	2010	27	26	1	-	-	-	-	-	-	-	-	27	-	-	RRLSEA

Pool 2: SOUTHERN ASIA																
AFGHANISTAN[a]	2010	232	89	5	-	-	-	-	-	-	74	64	128	40	64	WRLFMD
PAKISTAN	2010	40	31	-	-	-	-	-	6	-	5	-	39	1	-	WRLFMD
SRI LANKA	2010	1	1	-	-	-	-	-	-	-	-	-	1	-	-	WRLFMD
SRI LANKA	2010	1	1	-	-	-	-	-	-	-	-	-	1	-	-	RRLSEA
Pool 3: EUR-ASIA																
BULGARIA	2010	3	1	-	-	-	-	-	-	-	2	-	3	-	-	WRLFMD
IRAN	2010	38	-	-	-	-	-	-	-	-	-	38	-	-	38	WRLFMD
IRAQ	2010	17	6	1	-	-	-	-	-	-	10	-	14	3	-	WRLFMD
LIBYA	2010	36	2	-	-	-	-	-	-	-	34	-	13	14	9	WRLFMD
MONGOLIA	2002	2	1	-	-	-	-	-	-	-	1	-	2	-	-	WRLFMD
MONGOLIA	2010	2	-	-	-	-	-	-	-	-	2	-	-	2	-	WRLFMD
TURKEY[d]	2010	4	1	2	-	-	-	-	-	-	1	-	4	-	-	WRLFMD
Pool 4: EASTERN AFRICA																
KENYA	2010	21	8	-	-	4	-	-	-	-	9	-	19	2	-	WRLFMD
ZAMBIA	2008	2	-	-	-	-	-	-	-	-	2	-	2	-	-	WRLFMD
ZIMBABWE	2010	2	-	-	-	-	2	-	-	-	-	-	2	-	-	WRLFMD
Pool 6: SOUTHERN AFRICA																
SOUTH AFRICA KNP	2008	28	-	-	-	12	4	7	-	-	-	-	23	5	-	ARC-OVI
SOUTH AFRICA TCA	2010	26	-	-	-	-	3	3	-	-	-	-	6	20	-	ARC-OVI
Pool 7: SOUTH AMERICA																
	2005	1	1	-	-	-	-	-	-	-	-	-	1	-	-	SENASA
	2006	2	1	-	-	-	-	-	-	-	-	-	2	-	-	SENASA
	2008	1	1	-	-	-	-	-	-	-	-	-	1	-	-	SENASA
Totals		**546**	**192**	**12**	**0**	**16**	**9**	**10**	**6**	**0**	**149**	**128**	**348**	**87**	**111**	

VI/ELISA	FMD (or SVD) virus serotype identified following virus isolation in cell culture and antigen detection ELISA
FMD	foot-and-mouth disease

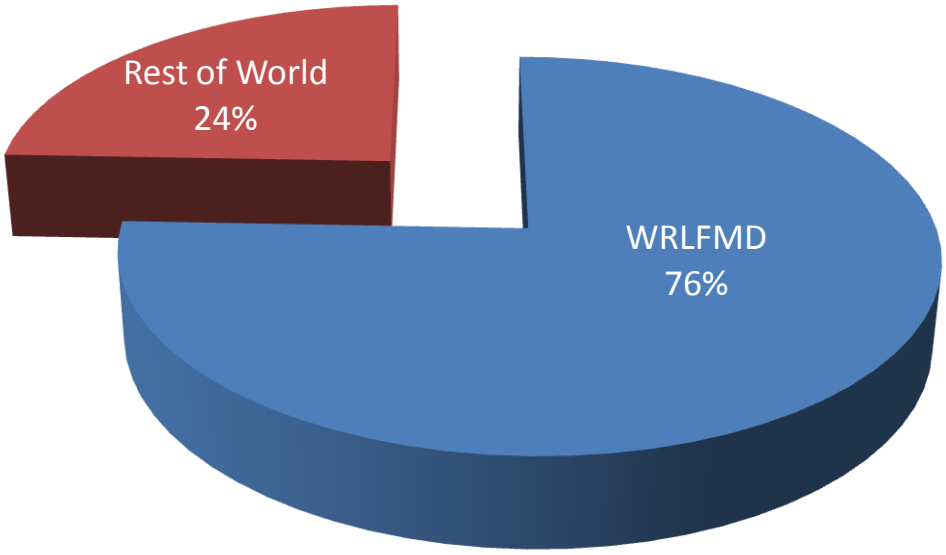
SVD	swine vesicular disease
NVD	no foot-and-mouth disease, swine vesicular disease or vesicular stomatitis virus detected
RT-PCR	reverse transcription polymerase chain reaction for FMD (or SVD) viral genome
NT	not tested
[a]	1 sample from Cambodia was RNA for PCR analysis
[b]	25 samples received from Malaysia were supplied in Trizol for PCR analysis
[c]	2 samples from Pakistan contained a mixture of FMDVs of types O and Asia 1

1.7. Genetic and antigenic typing of FMD virus isolates submitted to the Reference Laboratories

1.7.1 FMDV isolates for which VP1 gene sequences (639 nucleotides) have been obtained by Network Laboratories during 2011.

In total 721VP1 sequences were characterised for this report in 2011: 545 **(76%)** came from WRLFMD while the remaining 176 **(24%)** came from other laboratories as listed below. Phylogenetic trees and observations on them can be found at http://www.wrlfmd.org/ for all of the viruses that were analysed at WRLFMD. The VP1 gene sequences of a selection of virus isolates representative of all of the topotypes of FMDV can also be found at this website.

Figure 7. VP1 gene sequences obtained by Network Laboratories during 2011



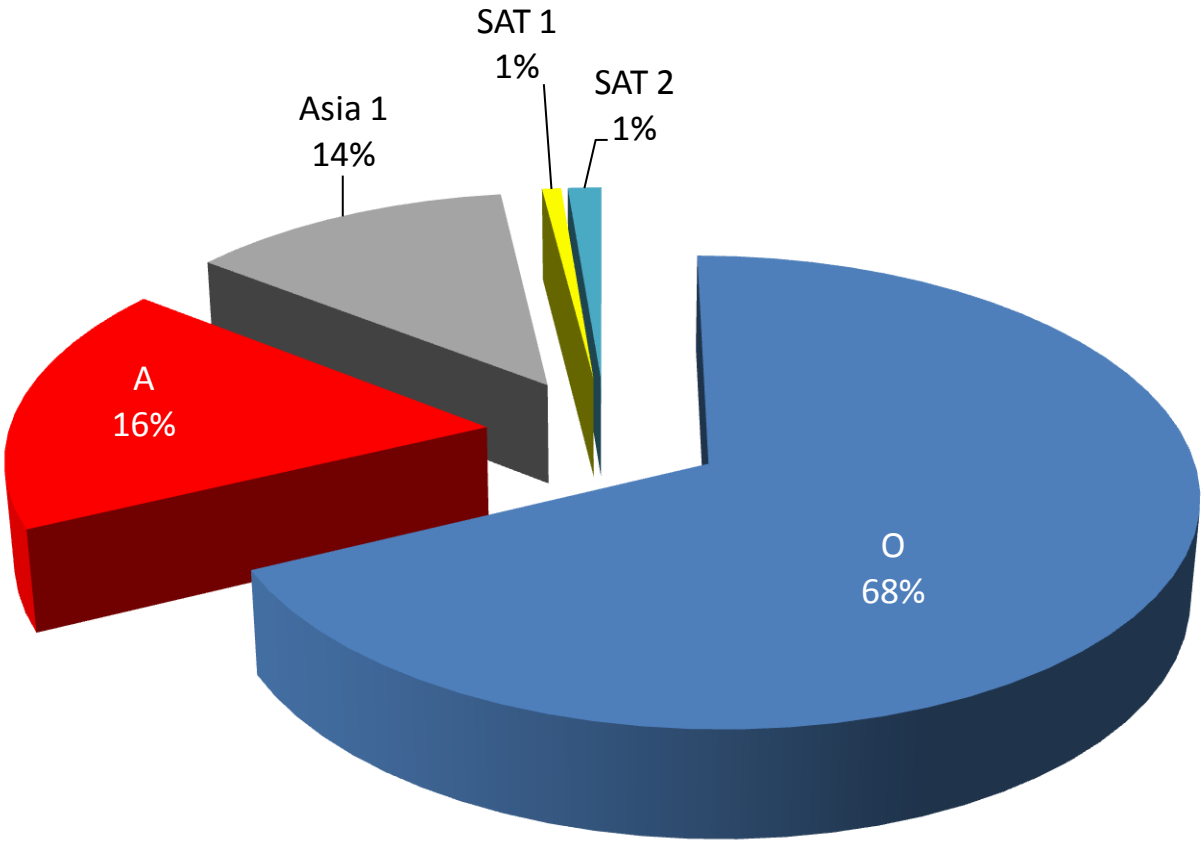


Figure 8. Serotype distribution of VP1 sequences obtained by Network Laboratories during 2011

Data from WRLFMD 2011

FMDV ID	Country of origin	Serotype	Topotype	Lineage/strain	Sub-lineage	Laboratory	Date received
Serotype A							
AFG/163/2010	Afghanistan	A	ASIA	Iran-05	AFG-07	WRLFMD	18/01/2011
AFG/232/2010	Afghanistan	A	ASIA	Iran-05	AFG-07	WRLFMD	18/01/2011
AFG/12/2011	Afghanistan	A	ASIA	Iran-05	-	WRLFMD	31/03/2011
AFG/13/2011	Afghanistan	A	ASIA	Iran-05	AFG-07	WRLFMD	31/03/2011
AFG/15/2011	Afghanistan	A	ASIA	Iran-05	AFG-07	WRLFMD	31/03/2011
AFG/20/2011	Afghanistan	A	ASIA	Iran-05	AFG-07	WRLFMD	31/03/2011
AFG/22/2011	Afghanistan	A	ASIA	Iran-05	AFG-07	WRLFMD	31/03/2011
AFG/24/2011	Afghanistan	A	ASIA	Iran-05	AFG-07	WRLFMD	31/03/2011
AFG/25/2011	Afghanistan	A	ASIA	Iran-05	AFG-07	WRLFMD	31/03/2011
AFG/26/2011	Afghanistan	A	ASIA	Iran-05	AFG-07	WRLFMD	31/03/2011
AFG/27/2011	Afghanistan	A	ASIA	Iran-05	AFG-07	WRLFMD	31/03/2011
AFG/29/2011	Afghanistan	A	ASIA	Iran-05	AFG-07	WRLFMD	31/03/2011
AFG/31/2011	Afghanistan	A	ASIA	Iran-05	AFG-07	WRLFMD	31/03/2011
AFG/34/2011	Afghanistan	A	ASIA	Iran-05	AFG-07	WRLFMD	31/03/2011
AFG/38/2011	Afghanistan	A	ASIA	Iran-05	-	WRLFMD	31/03/2011
AFG/42/2011	Afghanistan	A	ASIA	Iran-05	-	WRLFMD	31/03/2011
AFG/43/2011	Afghanistan	A	ASIA	Iran-05	AFG-07	WRLFMD	31/03/2011
AFG/56/2011	Afghanistan	A	ASIA	Iran-05	-	WRLFMD	31/03/2011
AFG/57/2011	Afghanistan	A	ASIA	Iran-05	AFG-07	WRLFMD	31/03/2011
BAR/18/2011	Bahrain	A	ASIA	Iran-05	HER-10	WRLFMD	03/11/2011
COD/2/2011	Democratic Rep. Congo	A	AFRICA	G-I	-	WRLFMD	29/09/2011
COD/3/2011	Democratic Rep. Congo	A	AFRICA	G-I	-	WRLFMD	29/09/2011
COD/8/2011	Democratic Rep. Congo	A	AFRICA	G-I	-	WRLFMD	29/09/2011
COD/9/2011	Democratic Rep. Congo	A	AFRICA	G-I	-	WRLFMD	29/09/2011
COD/10/2011	Democratic Rep. Congo	A	AFRICA	G-I	-	WRLFMD	29/09/2011
COD/11/2011	Democratic Rep. Congo	A	AFRICA	G-I	-	WRLFMD	29/09/2011
COD/12/2011	Democratic Rep. Congo	A	AFRICA	G-I	-	WRLFMD	29/09/2011

IRN/1/2011	Iran	A	ASIA	Iran-05	AFG-07	WRLFMD	26/01/2011
IRN/4/2011	Iran	A	ASIA	Iran-05	AFG-07	WRLFMD	26/01/2011
IRN/5/2011	Iran	A	ASIA	Iran-05	AFG-07	WRLFMD	26/01/2011
IRN/7/2011	Iran	A	ASIA	Iran-05	AFG-07	WRLFMD	26/01/2011
IRN/8/2011	Iran	A	ASIA	Iran-05	AFG-07	WRLFMD	26/01/2011
IRN/9/2011	Iran	A	ASIA	Iran-05	QAZ-11	WRLFMD	26/01/2011
IRN/12/2011	Iran	A	ASIA	Iran-05	AFG-07	WRLFMD	26/01/2011
IRN/17/2011	Iran	A	ASIA	Iran-05	QAZ-11	WRLFMD	26/01/2011
IRN/18/2011	Iran	A	ASIA	Iran-05	AFG-07	WRLFMD	26/01/2011
IRN/20/2011	Iran	A	ASIA	Iran-05	AFG-07	WRLFMD	26/01/2011
IRN/23/2011	Iran	A	ASIA	Iran-05	AFG-07	WRLFMD	10/03/2011
IRN/24/2011	Iran	A	ASIA	Iran-05	AFG-07	WRLFMD	10/03/2011
IRN/27/2011	Iran	A	ASIA	Iran-05	ESF-10	WRLFMD	10/03/2011
IRN/30/2011	Iran	A	ASIA	Iran-05	AFG-07	WRLFMD	10/03/2011
IRN/31/2011	Iran	A	ASIA	Iran-05	QAZ-11	WRLFMD	10/03/2011
IRN/32/2011	Iran	A	ASIA	Iran-05	AFG-07	WRLFMD	10/03/2011
IRN/36/2011	Iran	A	ASIA	Iran-05	AFG-07	WRLFMD	10/03/2011
IRN/37/2011	Iran	A	ASIA	Iran-05	AFG-07	WRLFMD	10/03/2011
IRN/40/2011	Iran	A	ASIA	Iran-05	QAZ-11	WRLFMD	10/03/2011
IRN/41/2011	Iran	A	ASIA	Iran-05	AFG-07	WRLFMD	10/03/2011
IRN/45/2011	Iran	A	ASIA	Iran-05	QAZ-11	WRLFMD	10/03/2011
IRN/51/2011	Iran	A	ASIA	Iran-05	QAZ-11	WRLFMD	10/03/2011
IRN/52/2011	Iran	A	ASIA	Iran-05	AFG-07	WRLFMD	10/03/2011
IRN/53/2011	Iran	A	ASIA	Iran-05	AFG-07	WRLFMD	10/03/2011
IRQ/5/2010	Iraq	A	ASIA	Iran-05	AFG-07	WRLFMD	06/04/2011
MAY/2/2011	Malaysia	A	ASIA	Sea-97	-	WRLFMD	09/12/2011
MAY/4/2011	Malaysia	A	ASIA	Sea-97	-	WRLFMD	09/12/2011
MAY/15/2011	Malaysia	A	ASIA	Sea-97	-	WRLFMD	09/12/2011
MAY/17/2011	Malaysia	A	ASIA	Sea-97	-	WRLFMD	09/12/2011
MAY/19/2011	Malaysia	A	ASIA	Sea-97	-	WRLFMD	09/12/2011
MAY/20/2011	Malaysia	A	ASIA	Sea-97	-	WRLFMD	09/12/2011
PAK/86/2011	Pakistan	A	ASIA	Iran-05	AFG-07	WRLFMD	31/03/2011
TAI/7/2010	Thailand	A	ASIA	Sea-97	-	WRLFMD	28/07/2011
TAI/8/2010	Thailand	A	ASIA	Sea-97	-	WRLFMD	28/07/2011
TAI/1/2011	Thailand	A	ASIA	Sea-97	-	WRLFMD	28/07/2011
TAI/3/2011	Thailand	A	ASIA	Sea-97	-	WRLFMD	28/07/2011

TAI/6/2011	Thailand	A	ASIA	Sea-97	-	WRLFMD	28/07/2011
TAI/8/2011	Thailand	A	ASIA	Sea-97	-	WRLFMD	28/07/2011
TAI/9/2011	Thailand	A	ASIA	Sea-97	-	WRLFMD	28/07/2011
TAI/10/2011	Thailand	A	ASIA	Sea-97	-	WRLFMD	28/07/2011
TAI/11/2011	Thailand	A	ASIA	Sea-97	-	WRLFMD	28/07/2011
TAI/12/2011	Thailand	A	ASIA	Sea-97	-	WRLFMD	28/07/2011
TAI/13/2011	Thailand	A	ASIA	Sea-97	-	WRLFMD	28/07/2011
TUR/40/2010	Turkey	A	ASIA	Iran-05	AFG-07	WRLFMD	25/02/2011
TUR/43/2010	Turkey	A	ASIA	Iran-05	AFG-07	WRLFMD	25/02/2011
TUR/2/2011	Turkey	A	ASIA	Iran-05	AFG-07	WRLFMD	25/02/2011
TUR/3/2011	Turkey	A	ASIA	Iran-05	AFG-07	WRLFMD	25/02/2011
TUR/5/2011	Turkey	A	ASIA	Iran-05	AFG-07	WRLFMD	25/02/2011
TUR/6/2011	Turkey	A	ASIA	Iran-05	AFG-07	WRLFMD	25/02/2011
TUR/7/2011	Turkey	A	ASIA	Iran-05	AFG-07	WRLFMD	25/02/2011
TUR/10/2011	Turkey	A	ASIA	Iran-05	AFG-07	WRLFMD	25/02/2011
TUR/11/2011	Turkey	A	ASIA	Iran-05	AFG-07	WRLFMD	25/02/2011
TUR/13/2011	Turkey	A	ASIA	Iran-05	AFG-07	WRLFMD	25/02/2011
TUR/14/2011	Turkey	A	ASIA	Iran-05	AFG-07	WRLFMD	25/02/2011
TUR/15/2011	Turkey	A	ASIA	Iran-05	AFG-07	WRLFMD	25/02/2011
TUR/16/2011	Turkey	A	ASIA	Iran-05	AFG-07	WRLFMD	25/02/2011
TUR/18/2011	Turkey	A	ASIA	Iran-05	AFG-07	WRLFMD	25/02/2011
TUR/21/2011	Turkey	A	ASIA	Iran-05	AFG-07	WRLFMD	25/02/2011
TUR/22/2011	Turkey	A	ASIA	Iran-05	AFG-07	WRLFMD	25/02/2011
TUR/23/2011	Turkey	A	ASIA	Iran-05	AFG-07	WRLFMD	25/02/2011
TUR/24/2011	Turkey	A	ASIA	Iran-05	AFG-07	WRLFMD	25/02/2011
TUR/26/2011	Turkey	A	ASIA	Iran-05	AFG-07	WRLFMD	25/02/2011
TUR/29/2011	Turkey	A	ASIA	Iran-05	SIS-10	WRLFMD	29/09/2011
TUR/30/2011	Turkey	A	ASIA	Iran-05	SIS-10	WRLFMD	29/09/2011
TUR/34/2011	Turkey	A	ASIA	Iran-05	SIS-10	WRLFMD	29/09/2011
TUR/35/2011	Turkey	A	ASIA	Iran-05	SIS-10	WRLFMD	29/09/2011
TUR/36/2011	Turkey	A	ASIA	Iran-05	SIS-10	WRLFMD	29/09/2011
TUR/37/2011	Turkey	A	ASIA	Iran-05	SIS-10	WRLFMD	29/09/2011
TUR/41/2011	Turkey	A	ASIA	Iran-05	SIS-10	WRLFMD	29/09/2011
TUR/42/2011	Turkey	A	ASIA	Iran-05	SIS-10	WRLFMD	29/09/2011
TUR/43/2011	Turkey	A	ASIA	Iran-05	SIS-10	WRLFMD	29/09/2011
TUR/44/2011	Turkey	A	ASIA	Iran-05	HER-10	WRLFMD	29/09/2011

TUR/46/2011	Turkey	A	ASIA	Iran-05	SIS-10	WRLFMD	29/09/2011
TUR/47/2011	Turkey	A	ASIA	Iran-05	SIS-10	WRLFMD	29/09/2011
TUR/48/2011	Turkey	A	ASIA	Iran-05	SIS-10	WRLFMD	29/09/2011
TUR/59/2011	Turkey	A	ASIA	Iran-05	SIS-10	WRLFMD	29/09/2011
TUR/60/2011	Turkey	A	ASIA	Iran-05	SIS-10	WRLFMD	29/09/2011
TUR/61/2011	Turkey	A	ASIA	Iran-05	SIS-10	WRLFMD	29/09/2011
TUR/63/2011	Turkey	A	ASIA	Iran-05	SIS-10	WRLFMD	29/09/2011
TUR/64/2011	Turkey	A	ASIA	Iran-05	SIS-10	WRLFMD	29/09/2011
VIT/17/2010	Vietnam	A	ASIA	Sea-97	-	WRLFMD	28/07/2011
Serotype Asia 1							
AFG/39/2011	Afghanistan	Asia 1	ASIA	unnamed	-	WRLFMD	31/03/2011
AFG/40/2011	Afghanistan	Asia 1	ASIA	unnamed	-	WRLFMD	31/03/2011
AFG/45/2011	Afghanistan	Asia 1	ASIA	unnamed	-	WRLFMD	31/03/2011
AFG/48/2011	Afghanistan	Asia 1	ASIA	unnamed	-	WRLFMD	31/03/2011
AFG/51/2011	Afghanistan	Asia 1	ASIA	unnamed	-	WRLFMD	31/03/2011
AFG/55/2011	Afghanistan	Asia 1	ASIA	unnamed	-	WRLFMD	31/03/2011
AFG/56/2011	Afghanistan	Asia 1	ASIA	unnamed	-	WRLFMD	31/03/2011
BAR/1/2011	Bahrain	Asia 1	ASIA	unnamed	-	WRLFMD	07/03/2011
BAR/2/2011	Bahrain	Asia 1	ASIA	unnamed	-	WRLFMD	07/03/2011
BAR/3/2011	Bahrain	Asia 1	ASIA	unnamed	-	WRLFMD	07/03/2011
BAR/4/2011	Bahrain	Asia 1	ASIA	unnamed	-	WRLFMD	07/03/2011
IRN/33/2011	Iran	Asia 1	ASIA	unnamed	-	WRLFMD	10/03/2011
IRN/38/2011	Iran	Asia 1	ASIA	unnamed	-	WRLFMD	10/03/2011
IRN/39/2011	Iran	Asia 1	ASIA	unnamed	-	WRLFMD	10/03/2011
IRN/43/2011	Iran	Asia 1	ASIA	unnamed	-	WRLFMD	10/03/2011
IRN/46/2011	Iran	Asia 1	ASIA	unnamed	-	WRLFMD	10/03/2011
IRN/47/2011	Iran	Asia 1	ASIA	unnamed	-	WRLFMD	10/03/2011
IRN/49/2011	Iran	Asia 1	ASIA	unnamed	-	WRLFMD	10/03/2011
PAK/106/2010	Pakistan	Asia 1	ASIA	unnamed	-	WRLFMD	18/01/2011
PAK/108/2010	Pakistan	Asia 1	ASIA	unnamed	-	WRLFMD	18/01/2011
PAK/109/2010	Pakistan	Asia 1	ASIA	unnamed	-	WRLFMD	18/01/2011
PAK/110/2010	Pakistan	Asia 1	ASIA	unnamed	-	WRLFMD	18/01/2011
PAK/111/2010	Pakistan	Asia 1	ASIA	unnamed	-	WRLFMD	18/01/2011
PAK/6/2011	Pakistan	Asia 1	ASIA	unnamed	-	WRLFMD	18/01/2011

PAK/7/2011	Pakistan	Asia 1	ASIA	unnamed	-	WRLFMD	18/01/2011
PAK/8/2011	Pakistan	Asia 1	ASIA	unnamed	-	WRLFMD	18/01/2011
PAK/11/2011	Pakistan	Asia 1	ASIA	unnamed	-	WRLFMD	18/01/2011
PAK/12/2011	Pakistan	Asia 1	ASIA	unnamed	-	WRLFMD	18/01/2011
PAK/13/2011	Pakistan	Asia 1	ASIA	unnamed	-	WRLFMD	18/01/2011
PAK/14/2011	Pakistan	Asia 1	ASIA	unnamed	-	WRLFMD	18/01/2011
PAK/15/2011	Pakistan	Asia 1	ASIA	unnamed	-	WRLFMD	18/01/2011
PAK/16/2011	Pakistan	Asia 1	ASIA	unnamed	-	WRLFMD	18/01/2011
PAK/17/2011	Pakistan	Asia 1	ASIA	unnamed	-	WRLFMD	18/01/2011
PAK/32/2011	Pakistan	Asia 1	ASIA	unnamed	-	WRLFMD	18/01/2011
PAK/33/2011	Pakistan	Asia 1	ASIA	unnamed	-	WRLFMD	18/01/2011
PAK/34/2011	Pakistan	Asia 1	ASIA	unnamed	-	WRLFMD	18/01/2011
PAK/35/2011	Pakistan	Asia 1	ASIA	unnamed	-	WRLFMD	18/01/2011
PAK/36/2011	Pakistan	Asia 1	ASIA	unnamed	-	WRLFMD	18/01/2011
PAK/37/2011	Pakistan	Asia 1	ASIA	unnamed	-	WRLFMD	18/01/2011
PAK/38/2011	Pakistan	Asia 1	ASIA	unnamed	-	WRLFMD	18/01/2011
PAK/39/2011	Pakistan	Asia 1	ASIA	unnamed	-	WRLFMD	18/01/2011
PAK/47/2011	Pakistan	Asia 1	ASIA	unnamed	-	WRLFMD	18/01/2011
PAK/48/2011	Pakistan	Asia 1	ASIA	unnamed	-	WRLFMD	18/01/2011
PAK/49/2011	Pakistan	Asia 1	ASIA	unnamed	-	WRLFMD	18/01/2011
PAK/50/2011	Pakistan	Asia 1	ASIA	unnamed	-	WRLFMD	18/01/2011
PAK/51/2011	Pakistan	Asia 1	ASIA	unnamed	-	WRLFMD	31/03/2011
PAK/52/2011	Pakistan	Asia 1	ASIA	unnamed	-	WRLFMD	31/03/2011
PAK/53/2011	Pakistan	Asia 1	ASIA	unnamed	-	WRLFMD	31/03/2011
PAK/54/2011	Pakistan	Asia 1	ASIA	unnamed	-	WRLFMD	31/03/2011
PAK/55/2011	Pakistan	Asia 1	ASIA	unnamed	-	WRLFMD	31/03/2011
PAK/56/2011	Pakistan	Asia 1	ASIA	unnamed	-	WRLFMD	31/03/2011
PAK/57/2011	Pakistan	Asia 1	ASIA	unnamed	-	WRLFMD	31/03/2011
PAK/58/2011	Pakistan	Asia 1	ASIA	unnamed	-	WRLFMD	31/03/2011
PAK/60/2011	Pakistan	Asia 1	ASIA	unnamed	-	WRLFMD	31/03/2011
PAK/61/2011	Pakistan	Asia 1	ASIA	unnamed	-	WRLFMD	31/03/2011
PAK/64/2011	Pakistan	Asia 1	ASIA	unnamed	-	WRLFMD	31/03/2011
PAK/66/2011	Pakistan	Asia 1	ASIA	unnamed	-	WRLFMD	31/03/2011
PAK/67/2011	Pakistan	Asia 1	ASIA	unnamed	-	WRLFMD	31/03/2011
PAK/68/2011	Pakistan	Asia 1	ASIA	unnamed	-	WRLFMD	31/03/2011
PAK/69/2011	Pakistan	Asia 1	ASIA	unnamed	-	WRLFMD	31/03/2011

PAK/81/2011	Pakistan	Asia 1	ASIA	unnamed	-	WRLFMD	31/03/2011
PAK/82/2011	Pakistan	Asia 1	ASIA	unnamed	-	WRLFMD	31/03/2011
PAK/83/2011	Pakistan	Asia 1	ASIA	unnamed	-	WRLFMD	31/03/2011
PAK/89/2011	Pakistan	Asia 1	ASIA	unnamed	-	WRLFMD	31/03/2011
PAK/90/2011	Pakistan	Asia 1	ASIA	unnamed	-	WRLFMD	31/03/2011
TUR/49/2011	Turkey	Asia 1	ASIA	unnamed	-	WRLFMD	29/09/2011
TUR/50/2011	Turkey	Asia 1	ASIA	unnamed	-	WRLFMD	29/09/2011
TUR/51/2011	Turkey	Asia 1	ASIA	unnamed	-	WRLFMD	29/09/2011
Serotype O							
AFG/110/2010	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
AFG/111/2010	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
AFG/119/2010	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
AFG/120/2010	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
AFG/121/2010	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
AFG/126/2010	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
AFG/131/2010	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
AFG/133/2010	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
AFG/135/2010	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
AFG/141/2010	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
AFG/142/2010	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
AFG/145/2010	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
AFG/148/2010	Afghanistan	O	ME-SA	unnamed	-	WRLFMD	18/01/2011
AFG/150/2010	Afghanistan	O	ME-SA	unnamed	-	WRLFMD	18/01/2011
AFG/151/2010	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
AFG/152/2010	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
AFG/153/2010	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
AFG/158/2010	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
AFG/160/2010	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
AFG/160/2010	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
AFG/164/2010	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
AFG/166/2010	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
AFG/170/2010	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
AFG/171/2010	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
AFG/174/2010	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
AFG/177/2010	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011

AFG/178/2010	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
AFG/180/2010	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
AFG/181/2010	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
AFG/182/2010	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
AFG/183/2010	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
AFG/190/2010	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
AFG/192/2010	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
AFG/192/2010	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
AFG/193/2010	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
AFG/193/2010	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
AFG/195/2010	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
AFG/196/2010	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
AFG/197/2010	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
AFG/199/2010	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
AFG/200/2010	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
AFG/201/2010	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
AFG/202/2010	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
AFG/204/2010	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
AFG/205/2010	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
AFG/207/2010	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
AFG/208/2010	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
AFG/209/2010	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
AFG/210/2010	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
AFG/211/2010	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
AFG/212/2010	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
AFG/213/2010	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
AFG/214/2010	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
AFG/217/2010	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
AFG/219/2010	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
AFG/220/2010	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
AFG/221/2010	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
AFG/223/2010	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
AFG/224/2010	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
AFG/225/2010	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
AFG/226/2010	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
AFG/227/2010	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011

AFG/229/2010	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
AFG/235/2010	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
AFG/236/2010	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
AFG/237/2010	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
AFG/238/2010	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
AFG/239/2010	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
AFG/240/2010	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
AFG/241/2010	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
AFG/242/2010	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
AFG/243/2010	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
AFG/244/2010	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
AFG/245/2010	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
AFG/246/2010	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
AFG/247/2010	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
AFG/248/2010	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
AFG/249/2010	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
AFG/250/2010	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
AFG/251/2010	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
AFG/252/2010	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
AFG/253/2010	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
AFG/256/2010	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
AFG/259/2010	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
AFG/261/2010	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
AFG/262/2010	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
AFG/263/2010	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
AFG/264/2010	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
AFG/265/2010	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
AFG/266/2010	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
AFG/267/2010	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
AFG/268/2010	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
AFG/1/2011	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	31/03/2011
AFG/2/2011	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	31/03/2011
AFG/3/2011	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	31/03/2011
AFG/4/2011	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	31/03/2011
AFG/5/2011	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	31/03/2011
AFG/6/2011	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	31/03/2011

AFG/7/2011	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	31/03/2011
AFG/8/2011	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	31/03/2011
AFG/9/2011	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	31/03/2011
AFG/10/2011	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	31/03/2011
AFG/11/2011	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	31/03/2011
AFG/18/2011	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	31/03/2011
AFG/19/2011	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	31/03/2011
AFG/32/2011	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	31/03/2011
AFG/33/2011	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	31/03/2011
AFG/35/2011	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	31/03/2011
AFG/36/2011	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	31/03/2011
AFG/38/2011	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	31/03/2011
AFG/41/2011	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	31/03/2011
AFG/44/2011	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	31/03/2011
BAR/17/2011	Bahrain	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	03/11/2011
BAR/19/2011	Bahrain	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	03/11/2011
BUL/1/2010	Bulgaria	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	07/01/2011
BUL/2/2010	Bulgaria	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	07/01/2011
BUL/3/2010	Bulgaria	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	07/01/2011
BUL/3/2011	Bulgaria	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	16/02/2011
BUL/4/2011	Bulgaria	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	16/02/2011
BUL/5/2011	Bulgaria	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	16/02/2011
BUL/6/2011	Bulgaria	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	16/02/2011
BUL/7/2011	Bulgaria	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	16/02/2011
BUL/10/2011	Bulgaria	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	23/03/2011
BUL/11/2011	Bulgaria	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	23/03/2011
BUL/13/2011	Bulgaria	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	23/03/2011
BUL/14/2011	Bulgaria	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	23/03/2011
BUL/15/2011	Bulgaria	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	23/03/2011
BUL/19/2011	Bulgaria	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	05/04/2011
BUL/20/2011	Bulgaria	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	05/04/2011
BUL/23/2011	Bulgaria	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	05/04/2011
BUL/25/2011	Bulgaria	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	05/04/2011
BUL/26/2011	Bulgaria	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	05/04/2011
BUL/27/2011	Bulgaria	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	05/04/2011
CAM/6/2010	Cambodia	O	ME-SA	PanAsia	-	WRLFMD	28/07/2011

CAM/8/2010	Cambodia	O	ME-SA	PanAsia	-	WRLFMD	28/07/2011
DRK/31/2011	Dem. People's Rep. of Korea	O	SEA	Mya-98	-	WRLFMD	01/06/2011
COD/1/2010	Democratic Rep. Congo	O	EA-2	unnamed	-	WRLFMD	29/09/2011
COD/2/2010	Democratic Rep. Congo	O	EA-2	unnamed	-	WRLFMD	29/09/2011
COD/3/2010	Democratic Rep. Congo	O	EA-2	unnamed	-	WRLFMD	29/09/2011
COD/4/2010	Democratic Rep. Congo	O	EA-2	unnamed	-	WRLFMD	29/09/2011
ETH/1/2011	Ethiopia	O	EA-3	unnamed	-	WRLFMD	02/11/2011
ETH/2/2011	Ethiopia	O	EA-3	unnamed	-	WRLFMD	02/11/2011
ETH/3/2011	Ethiopia	O	EA-3	unnamed	-	WRLFMD	02/11/2011
ETH/4/2011	Ethiopia	O	EA-3	unnamed	-	WRLFMD	02/11/2011
ETH/5/2011	Ethiopia	O	EA-3	unnamed	-	WRLFMD	02/11/2011
ETH/7/2011	Ethiopia	O	EA-3	unnamed	-	WRLFMD	02/11/2011
ETH/9/2011	Ethiopia	O	EA-3	unnamed	-	WRLFMD	02/11/2011
ETH/10/2011	Ethiopia	O	EA-3	unnamed	-	WRLFMD	02/11/2011
ETH/11/2011	Ethiopia	O	EA-3	unnamed	-	WRLFMD	02/11/2011
ETH/12/2011	Ethiopia	O	EA-3	unnamed	-	WRLFMD	02/11/2011
ETH/13/2011	Ethiopia	O	EA-3	unnamed	-	WRLFMD	15/12/2011
ETH/18/2011	Ethiopia	O	EA-3	unnamed	-	WRLFMD	15/12/2011
ETH/26/2011	Ethiopia	O	EA-3	unnamed	-	WRLFMD	15/12/2011
ETH/28/2011	Ethiopia	O	EA-3	unnamed	-	WRLFMD	15/12/2011
HKN/1/2011	Hong Kong SAR, PRC	O	SEA	Mya-98	-	WRLFMD	20/04/2011
HKN/2/2011	Hong Kong SAR, PRC	O	SEA	Mya-98	-	WRLFMD	20/04/2011
HKN/3/2011	Hong Kong SAR, PRC	O	CATHAY	unnamed	-	WRLFMD	15/09/2011
HKN/4/2011	Hong Kong SAR, PRC	O	CATHAY	unnamed	-	WRLFMD	15/09/2011
HKN/5/2011	Hong Kong SAR, PRC	O	CATHAY	unnamed	-	WRLFMD	15/09/2011
HKN/6/2011	Hong Kong SAR, PRC	O	CATHAY	unnamed	-	WRLFMD	15/09/2011
HKN/7/2011	Hong Kong SAR, PRC	O	CATHAY	unnamed	-	WRLFMD	15/09/2011
HKN/8/2011	Hong Kong SAR, PRC	O	CATHAY	unnamed	-	WRLFMD	07/12/2011
HKN/9/2011	Hong Kong SAR, PRC	O	CATHAY	unnamed	-	WRLFMD	07/12/2011
IRN/2/2011	Iran	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	26/01/2011
IRN/6/2011	Iran	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	26/01/2011
IRN/10/2011	Iran	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	26/01/2011
IRN/13/2011	Iran	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	26/01/2011
IRN/14/2011	Iran	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	26/01/2011
IRN/15/2011	Iran	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	26/01/2011
IRN/25/2011	Iran	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	10/03/2011

IRN/28/2011	Iran	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	10/03/2011
IRN/29/2011	Iran	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	10/03/2011
IRN/34/2011	Iran	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	10/03/2011
IRN/35/2011	Iran	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	10/03/2011
IRN/44/2011	Iran	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	10/03/2011
IRN/50/2011	Iran	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	10/03/2011
IRQ/4/2010	Iraq	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	06/04/2011
IRQ/6/2010	Iraq	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	06/04/2011
IRQ/7/2010	Iraq	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	06/04/2011
IRQ/8/2010	Iraq	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	06/04/2011
IRQ/12/2010	Iraq	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	06/04/2011
IRQ/13/2010	Iraq	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	06/04/2011
ISR/1/2011	Israel	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	23/03/2011
ISR/2/2011	Israel	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	23/03/2011
ISR/4/2011	Israel	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	08/06/2011
ISR/5/2011	Israel	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	08/06/2011
ISR/6/2011	Israel	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	08/06/2011
ISR/7/2011	Israel	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	08/06/2011
ISR/8/2011	Israel	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	08/06/2011
ISR/9/2011	Israel	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	08/06/2011
ISR/11/2011	Israel	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	08/09/2011
ISR/12/2011	Israel	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	08/09/2011
ISR/13/2011	Israel	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	08/09/2011
ISR/14/2011	Israel	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	08/09/2011
ISR/15/2011	Israel	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	08/09/2011
ISR/16/2011	Israel	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	08/09/2011
ISR/17/2011	Israel	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	08/09/2011
ISR/21/2011	Israel	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	08/09/2011
ISR/22/2011	Israel	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	08/09/2011
ISR/23/2011	Israel	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	08/09/2011
ISR/24/2011	Israel	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	08/09/2011
ISR/25/2011	Israel	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	08/09/2011
ISR/26/2011	Israel	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	08/09/2011
KEN/137/2010	Kenya	O	EA-2	unnamed	-	WRLFMD	09/02/2011
KEN/145/2010	Kenya	O	EA-2	unnamed	-	WRLFMD	09/02/2011
KEN/146/2010	Kenya	O	EA-2	unnamed	-	WRLFMD	09/02/2011

KEN/148/2010	Kenya	O	EA-2	unnamed	-	WRLFMD	09/02/2011
KEN/150/2010	Kenya	O	EA-2	unnamed	-	WRLFMD	09/02/2011
KEN/151/2010	Kenya	O	EA-2	unnamed	-	WRLFMD	09/02/2011
KEN/152/2010	Kenya	O	EA-2	unnamed	-	WRLFMD	09/02/2011
KEN/154/2010	Kenya	O	EA-2	unnamed	-	WRLFMD	09/02/2011
KEN/1/2011	Kenya	O	EA-2	unnamed	-	WRLFMD	09/02/2011
KUW/1/2011	Kuwait	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/07/2011
KUW/2/2011	Kuwait	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/07/2011
LAO/1/2010	Laos	O	SEA	Mya-98	-	WRLFMD	28/07/2011
LAO/2/2010	Laos	O	ME-SA	PanAsia	-	WRLFMD	28/07/2011
LAO/1/2011	Laos	O	ME-SA	PanAsia	-	WRLFMD	28/07/2011
LAO/2/2011	Laos	O	ME-SA	PanAsia	-	WRLFMD	28/07/2011
LIB/4/2010	Libya	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	04/01/2011
LIB/6/2011	Libya	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	09/02/2011
MAY/22/2009	Malaysia	O	SEA	Mya-98	-	WRLFMD	20/01/2011
MAY/23/2009	Malaysia	O	SEA	Mya-98	-	WRLFMD	20/01/2011
MAY/24/2009	Malaysia	O	SEA	Mya-98	-	WRLFMD	20/01/2011
MAY/25/2009	Malaysia	O	SEA	Mya-98	-	WRLFMD	20/01/2011
MAY/26/2009	Malaysia	O	SEA	Mya-98	-	WRLFMD	20/01/2011
MAY/27/2009	Malaysia	O	SEA	Mya-98	-	WRLFMD	20/01/2011
MAY/28/2009	Malaysia	O	SEA	Mya-98	-	WRLFMD	20/01/2011
MAY/29/2009	Malaysia	O	SEA	Mya-98	-	WRLFMD	20/01/2011
MAY/30/2009	Malaysia	O	SEA	Mya-98	-	WRLFMD	20/01/2011
MAY/2/2010	Malaysia	O	SEA	Mya-98	-	WRLFMD	20/01/2011
MAY/3/2010	Malaysia	O	SEA	Mya-98	-	WRLFMD	20/01/2011
MAY/7/2010	Malaysia	O	SEA	Mya-98	-	WRLFMD	20/01/2011
MAY/8/2010	Malaysia	O	SEA	Mya-98	-	WRLFMD	20/01/2011
MAY/10/2010	Malaysia	O	SEA	Mya-98	-	WRLFMD	20/01/2011
MAY/11/2010	Malaysia	O	SEA	Mya-98	-	WRLFMD	20/01/2011
MAY/12/2010	Malaysia	O	SEA	Mya-98	-	WRLFMD	20/01/2011
MAY/13/2010	Malaysia	O	SEA	Mya-98	-	WRLFMD	20/01/2011
MAY/13/2011	Malaysia	O	SEA	Mya-98	-	WRLFMD	09/12/2011
PAK/77/2010	Pakistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
PAK/78/2010	Pakistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
PAK/79/2010	Pakistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
PAK/80/2010	Pakistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011

PAK/81/2010	Pakistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
PAK/83/2010	Pakistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
PAK/84/2010	Pakistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
PAK/85/2010	Pakistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
PAK/86/2010	Pakistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
PAK/87/2010	Pakistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
PAK/88/2010	Pakistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
PAK/89/2010	Pakistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
PAK/90/2010	Pakistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
PAK/92/2010	Pakistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
PAK/93/2010	Pakistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
PAK/94/2010	Pakistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
PAK/95/2010	Pakistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
PAK/96/2010	Pakistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
PAK/98/2010	Pakistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
PAK/99/2010	Pakistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
PAK/100/2010	Pakistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
PAK/101/2010	Pakistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
PAK/102/2010	Pakistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
PAK/103/2010	Pakistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
PAK/104/2010	Pakistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
PAK/105/2010	Pakistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
PAK/106/2010	Pakistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
PAK/112/2010	Pakistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
PAK/113/2010	Pakistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
PAK/114/2010	Pakistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
PAK/116/2010	Pakistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
PAK/1/2011	Pakistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
PAK/2/2011	Pakistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
PAK/3/2011	Pakistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
PAK/4/2011	Pakistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
PAK/5/2011	Pakistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
PAK/9/2011	Pakistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
PAK/10/2011	Pakistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	18/01/2011
PAK/62/2011	Pakistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	31/03/2011
PAK/63/2011	Pakistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	31/03/2011

PAK/70/2011	Pakistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	31/03/2011
PAK/71/2011	Pakistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	31/03/2011
PAK/73/2011	Pakistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	31/03/2011
PAK/74/2011	Pakistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	31/03/2011
PAK/75/2011	Pakistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	31/03/2011
PAK/76/2011	Pakistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	31/03/2011
PAK/84/2011	Pakistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	31/03/2011
PAR/1/2011	Paraguay	O	EURO-SA	unnamed	-	WRLFMD	25/10/2011
SKR/5/2010	Republic of Korea	O	SEA	Mya-98	-	WRLFMD	07/02/2011
SKR/6/2010	Republic of Korea	O	SEA	Mya-98	-	WRLFMD	07/02/2011
SKR/7/2010	Republic of Korea	O	SEA	Mya-98	-	WRLFMD	07/02/2011
SKR/10/2010	Republic of Korea	O	SEA	Mya-98	-	WRLFMD	03/03/2011
SKR/12/2010	Republic of Korea	O	SEA	Mya-98	-	WRLFMD	21/05/2011
SKR/13/2010	Republic of Korea	O	SEA	Mya-98	-	WRLFMD	21/05/2011
SKR/1/2011	Republic of Korea	O	SEA	Mya-98	-	WRLFMD	07/02/2011
SKR/3/2011	Republic of Korea	O	SEA	Mya-98	-	WRLFMD	07/02/2011
SKR/8/2011	Republic of Korea	O	SEA	Mya-98	-	WRLFMD	21/05/2011
SRL/1/2010	Sri Lanka	O	ME-SA	unnamed	-	WRLFMD	28/07/2011
SRL/1/2011	Sri Lanka	O	ME-SA	PanAsia-2	-	WRLFMD	28/07/2011
TAI/9/2010	Thailand	O	SEA	Mya-98	-	WRLFMD	28/07/2011
TAI/10/2010	Thailand	O	SEA	Mya-98	-	WRLFMD	28/07/2011
TAI/2/2011	Thailand	O	SEA	Mya-98	-	WRLFMD	28/07/2011
TAI/4/2011	Thailand	O	SEA	Mya-98	-	WRLFMD	28/07/2011
TAI/5/2011	Thailand	O	SEA	Mya-98	-	WRLFMD	28/07/2011
TAI/7/2011	Thailand	O	ME-SA	PanAsia	-	WRLFMD	28/07/2011
TUR/42/2010	Turkey	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	25/02/2011
TUR/1/2011	Turkey	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	25/02/2011
TUR/4/2011	Turkey	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	25/02/2011
TUR/8/2011	Turkey	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	25/02/2011
TUR/9/2011	Turkey	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	25/02/2011
TUR/12/2011	Turkey	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	25/02/2011
TUR/25/2011	Turkey	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	25/02/2011
TUR/27/2011	Turkey	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	29/09/2011
TUR/28/2011	Turkey	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	29/09/2011
TUR/33/2011	Turkey	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	29/09/2011
TUR/43/2011	Turkey	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	29/09/2011

VIT/14/2010	Vietnam	O	ME-SA	PanAsia	-	WRLFMD	01/04/2011
VIT/15/2010	Vietnam	O	ME-SA	PanAsia	-	WRLFMD	01/04/2011
VIT/16/2010	Vietnam	O	ME-SA	PanAsia	-	WRLFMD	01/04/2011
VIT/18/2010	Vietnam	O	SEA	Mya-98	-	WRLFMD	28/07/2011
VIT/19/2010	Vietnam	O	ME-SA	PanAsia	-	WRLFMD	28/07/2011
VIT/20/2010	Vietnam	O	ME-SA	PanAsia	-	WRLFMD	28/07/2011
VIT/21/2010	Vietnam	O	ME-SA	PanAsia	-	WRLFMD	28/07/2011
VIT/22/2010	Vietnam	O	ME-SA	PanAsia	-	WRLFMD	28/07/2011
VIT/23/2010	Vietnam	O	ME-SA	PanAsia	-	WRLFMD	28/07/2011
VIT/1/2011	Vietnam	O	ME-SA	PanAsia	-	WRLFMD	01/04/2011
VIT/2/2011	Vietnam	O	ME-SA	PanAsia	-	WRLFMD	01/04/2011
VIT/3/2011	Vietnam	O	ME-SA	PanAsia	-	WRLFMD	01/04/2011
VIT/4/2011	Vietnam	O	ME-SA	PanAsia	-	WRLFMD	01/04/2011
VIT/5/2011	Vietnam	O	ME-SA	PanAsia	-	WRLFMD	01/04/2011
VIT/6/2011	Vietnam	O	ME-SA	PanAsia	-	WRLFMD	01/04/2011
VIT/7/2011	Vietnam	O	ME-SA	PanAsia	-	WRLFMD	01/04/2011
VIT/8/2011	Vietnam	O	ME-SA	PanAsia	-	WRLFMD	01/04/2011
VIT/9/2011	Vietnam	O	ME-SA	PanAsia	-	WRLFMD	01/04/2011
VIT/10/2011	Vietnam	O	ME-SA	PanAsia	-	WRLFMD	01/04/2011
VIT/11/2011	Vietnam	O	ME-SA	PanAsia	-	WRLFMD	01/04/2011
VIT/12/2011	Vietnam	O	ME-SA	PanAsia	-	WRLFMD	01/04/2011
VIT/13/2011	Vietnam	O	ME-SA	PanAsia	-	WRLFMD	01/04/2011
VIT/14/2011	Vietnam	O	ME-SA	PanAsia	-	WRLFMD	01/04/2011
VIT/15/2011	Vietnam	O	ME-SA	PanAsia	-	WRLFMD	01/04/2011
VIT/16/2011	Vietnam	O	ME-SA	PanAsia	-	WRLFMD	01/04/2011
VIT/17/2011	Vietnam	O	ME-SA	PanAsia	-	WRLFMD	01/04/2011
VIT/21/2011	Vietnam	O	ME-SA	PanAsia	-	WRLFMD	01/04/2011
VIT/22/2011	Vietnam	O	ME-SA	PanAsia	-	WRLFMD	01/04/2011
VIT/23/2011	Vietnam	O	ME-SA	PanAsia	-	WRLFMD	01/04/2011
VIT/25/2011	Vietnam	O	ME-SA	PanAsia	-	WRLFMD	01/04/2011
VIT/26/2011	Vietnam	O	ME-SA	PanAsia	-	WRLFMD	01/04/2011
VIT/27/2011	Vietnam	O	ME-SA	PanAsia	-	WRLFMD	01/04/2011
VIT/28/2011	Vietnam	O	ME-SA	PanAsia	-	WRLFMD	01/04/2011
VIT/29/2011	Vietnam	O	ME-SA	PanAsia	-	WRLFMD	01/04/2011
VIT/30/2011	Vietnam	O	ME-SA	PanAsia	-	WRLFMD	01/04/2011
VIT/31/2011	Vietnam	O	ME-SA	PanAsia	-	WRLFMD	01/04/2011

VIT/32/2011	Vietnam	O	ME-SA	PanAsia	-	WRLFMD	01/04/2011
VIT/34/2011	Vietnam	O	ME-SA	PanAsia	-	WRLFMD	01/04/2011
VIT/35/2011	Vietnam	O	ME-SA	PanAsia	-	WRLFMD	01/04/2011
VIT/36/2011	Vietnam	O	ME-SA	PanAsia	-	WRLFMD	01/04/2011
VIT/37/2011	Vietnam	O	ME-SA	PanAsia	-	WRLFMD	01/04/2011
Serotype SAT 1							
KEN/136/2010	Kenya	SAT 1	I (NWZ)	unnamed	-	WRLFMD	09/02/2011
KEN/138/2010	Kenya	SAT 1	I (NWZ)	unnamed	-	WRLFMD	09/02/2011
KEN/139/2010	Kenya	SAT 1	I (NWZ)	unnamed	-	WRLFMD	09/02/2011
KEN/140/2010	Kenya	SAT 1	I (NWZ)	unnamed	-	WRLFMD	09/02/2011
Serotype SAT 2							
BOT/1/2011	Botswana	SAT 2	III	unnamed	-	WRLFMD	10/06/2011
BOT/2/2011	Botswana	SAT 2	III	unnamed	-	WRLFMD	10/06/2011
BOT/3/2011	Botswana	SAT 2	I	unnamed	-	WRLFMD	10/06/2011
BOT/6/2011	Botswana	SAT 2	I	unnamed	-	WRLFMD	10/06/2011
BOT/7/2011	Botswana	SAT 2	I	unnamed	-	WRLFMD	10/06/2011
ZIM/5/2010	Zimbabwe	SAT 2	I	unnamed	-	WRLFMD	10/06/2011
ZIM/6/2010	Zimbabwe	SAT 2	I	unnamed	-	WRLFMD	10/06/2011

Data provided from other Laboratories

FMDV ID	Country of origin	Serotype	Topotype	Lineage/strain	Sub-lineage	Laboratory	Date received
ARRIAH-Russia							
O/Mongolia/SEP2010	Mongolia	O	SEA	Mya-98		ARRIAH	02/09/2010
O/Russia/2011	Russia	O	SEA	Mya-98		ARRIAH	18/03/2011
O/Kazakhstan/MAY2011	Kazakhstan	O	ME-SA	PanAsia	PanAsia-2	ARRIAH	24/05/2011
O/Kazakhstan/JUN2011	Kazakhstan	O	ME-SA	PanAsia	PanAsia-2	ARRIAH	22/06/2011
O/South Ossetia/2011	South Ossetia	O	ME-SA	PanAsia	PanAsia-2	ARRIAH	11/08/2011
O/Kazakhstan/AUG2011	Kazakhstan	O	ME-SA	PanAsia		ARRIAH	12/08/2011
O/Kyrgyzstan/JUN2011	Kyrgyzstan	O	ME-SA	PanAsia	PanAsia-2	ARRIAH	28/06/2011
A Kyrgyzstan/OCT2011	Kyrgyzstan	A	Asia	A/Iran/2005		ARRIAH	10/10/2011
O/South Ossetia/2011	South Ossetia	O	ME-SA	PanAsia-2	ANT-10	ARRIAH	29/08/2011
O/Kazakhstan/Aug2011	Kazakhstan	O	ME-SA	PanAsia		ARRIAH	29/08/2011
LVRI-P.R. China							
O/CHA/7/2011	P.R. China	O	ME-SA	PanAsia		LVRI	07/04/2011
O/CHA/7/2011	P.R. China	O	ME-SA	PanAsia		LVRI	19/05/2011
O/BY/CHA/2010	P.R. China	O	SEA	Mya-98		LVRI	15/11/2011
O/GZ/CHA/2010	P.R. China	O	SEA	Mya-98		LVRI	15/11/2011
PANAFTOSA-South America							
Pichincha/ECU/11/262-2	Ecuador	O	EURO-SA	O1		PANAFTOSA	
Tsachilas/ECU/11 276	Ecuador	O	EURO-SA	O1		PANAFTOSA	
San Pedro/PAR/277	Paraguay	O	EURO-SA	O1		PANAFTOSA	
SENASA-South America							
15-11 Guayas	Ecuador	O	EURO-SA	O		SENASA	
18-11Pichincha	Ecuador	O	EURO-SA	O		SENASA	
31-11Tsachilas	Ecuador	O	EURO-SA	O		SENASA	
11-11 San Pedro	Paraguay	O	EURO-SA	O1		SENASA	

ARC-OVI-South Africa					
SAR/1/11/1	South Africa	SAT 1	I	ARC-OVI	7 & 18/3/2011
KNP/1/10/2	South Africa TFCA (buffalo)	SAT 2	I	ARC-OVI	07-Feb-10
KNP/2/10/2		SAT 2	I	ARC-OVI	
KNP/3/10/2		SAT 2	I	ARC-OVI	
ZIM/3/10/3		SAT 3	VI	ARC-OVI	
ZIM/2/10/3		SAT 3	VI	ARC-OVI	
KNP/4/10/3		SAT 3	II	ARC-OVI	
KNP/4/08/1				ARC-OVI	
KNP/8/08/1	South Africa (KNP) (buffalo)	SAT 1	I	ARC-OVI	07-Jul-08
KNP/10/08/1				ARC-OVI	
KNP/11/08/1				ARC-OVI	
KNP/14/08/1		SAT 1	I	ARC-OVI	
KNP/15/08/1		SAT 1	I	ARC-OVI	
KNP/17/08/1		SAT 1	I	ARC-OVI	
KNP/18/08/1		SAT 1	I	ARC-OVI	
KNP/26/08/1		SAT 1	I	ARC-OVI	
KNP/22/08/1		SAT 1	I	ARC-OVI	
KNP/23/08/1				ARC-OVI	
KNP/24/08/1		SAT 1	I	ARC-OVI	
KNP/7/08/2				ARC-OVI	
KNP/9/08/2		SAT 2		ARC-OVI	
KNP/12/08/2		SAT 2	III	ARC-OVI	
KNP/20/08/2				ARC-OVI	
KNP/3/08/3		SAT 3	II	ARC-OVI	
KNP/5/08/3		SAT 3	II	ARC-OVI	
KNP/6/08/3		SAT 3	V	ARC-OVI	
KNP/16/08/3		SAT 3	I	ARC-OVI	
KNP/19/08/3		SAT 3	I	ARC-OVI	
KNP/21/08/3		SAT 3	I	ARC-OVI	
KNP/28/08/3				ARC-OVI	
NAM/6/10/1	Namibia	SAT 1	III	ARC-OVI	23-Feb-11
NAM/8/10/1		SAT 1		ARC-OVI	
NAM/5/10/2		SAT 2		ARC-OVI	
NAM/3/10/2		SAT 2		ARC-OVI	

NAM/7/10/3		SAT 3				ARC-OVI	
NAM/1/10/3		SAT 3				ARC-OVI	
NAM/11/10/3		SAT 3				ARC-OVI	
NAM/2/10/3		SAT 3				ARC-OVI	
NAM/4/10/3		SAT 3				ARC-OVI	
NAM/9/10/3		SAT 3				ARC-OVI	
NAM/10/10/3		SAT 3				ARC-OVI	
NVQRS- South Korea							
NCVD-8	Vietnam	O	SEA	Mya-98	-	NVRQS	15/02/2011
NCVD-9	Vietnam	O	SEA	Mya-98	-	NVRQS	15/02/2011
NCVD-17	Vietnam	O	SEA	Mya-98	-	NVRQS	15/02/2011
NCVD-18	Vietnam	O	SEA	Mya-98	-	NVRQS	15/02/2011
NCVD-19	Vietnam	O	SEA	Mya-98	-	NVRQS	15/02/2011
NCVD-20	Vietnam	O	SEA	Mya-98	-	NVRQS	15/02/2011
RRLSEA- Thailand							
SLR 1/11	Sri Lanka	O	SEA	Mya 98		RRLSEA	16/02/2011
LAO 6/11	LAO PDR	O	SEA	Mya 98		RRLSEA	08/06/2011
LAO 7/11	LAO PDR	O	SEA	Mya 98		RRLSEA	08/06/2011
VIT 13/10	Vietnam	O	SEA	Mya 98		RRLSEA	26/10/2011
TAI 1/11	Thailand	A	Asia			RRLSEA	16/02/2011
TAI 5/11	Thailand	A	Asia			RRLSEA	16/02/2011
TAI 6/11	Thailand	A	Asia			RRLSEA	16/02/2011
TAI 8/11	Thailand	A	Asia			RRLSEA	16/02/2011
TAI 10/11	Thailand	A	Asia			RRLSEA	18/02/2011
TAI 16/11	Thailand	A	Asia			RRLSEA	06/06/2011
TAI 19/11	Thailand	A	Asia			RRLSEA	06/06/2011
TAI 25/11	Thailand	A	Asia			RRLSEA	06/06/2011
TAI 29/11	Thailand	A	Asia			RRLSEA	08/06/2011

TAI 49/11	Thailand	A	Asia			RRLSEA	08/06/2011
TAI 89/11	Thailand	A	Asia			RRLSEA	19/10/2011
TAI 92/11	Thailand	A	Asia			RRLSEA	25/10/2011
TAI 93/11	Thailand	A	Asia			RRLSEA	25/11/2011
TAI 94/11	Thailand	A	Asia			RRLSEA	24/11/2011
TAI 98/11	Thailand	A	Asia			RRLSEA	01/12/2011
TAI 99/11	Thailand	A	Asia			RRLSEA	02/12/2011
VIT 1/10	Vietnam	A	Asia			RRLSEA	02/01/2011
MYA 1/10	Myanmar	A	Asia			RRLSEA	02/01/2011
MYA 2/10	Myanmar	A	Asia			RRLSEA	02/01/2011
THA 66-1/10	Thailand	A	ASIA	Sea-97		RRLSEA	12/01/2011
THA 67-3/10	Thailand	A	ASIA	Sea-97		RRLSEA	12/01/2011
THA 69-6/10	Thailand	A	ASIA	Sea-97		RRLSEA	12/01/2011
VIT 1/10	Vietnam	A	ASIA	Sea-97		RRLSEA	12/01/2011
FMDI-Ankara- Turkey							
O/Ardahan/395/2010	Turkey	O	ME-SA	PanAsia-2	ANT-10	FMDI-Ankara	15/02/2011
O/Corum/458/2010	Turkey	O	ME-SA	PanAsia-2	ANT-10	FMDI-Ankara	15/02/2011
O/Samsun/627/2010	Turkey	O	ME-SA	PanAsia-2	ANT-10	FMDI-Ankara	15/02/2011
O/Agri/840/2010	Turkey	O	ME-SA	PanAsia-2	ANT-10	FMDI-Ankara	15/02/2011
O/Eskisehir/868/2010	Turkey	O	ME-SA	PanAsia-2	ANT-10	FMDI-Ankara	15/02/2011
O/Kastamonu/883/2010	Turkey	O	ME-SA	PanAsia-2	ANT-10	FMDI-Ankara	15/02/2011
O/Balikesir/901/2010	Turkey	O	ME-SA	PanAsia-2	ANT-10	FMDI-Ankara	15/02/2011
O/Amasya/917/2010	Turkey	O	ME-SA	PanAsia-2	ANT-10	FMDI-Ankara	15/02/2011
O/Bursa/926/2010	Turkey	O	ME-SA	PanAsia-2	ANT-10	FMDI-Ankara	15/02/2011
O/Corum/971/2010	Turkey	O	ME-SA	PanAsia-2	ANT-10	FMDI-Ankara	15/02/2011
O/Sivas/1003/2010	Turkey	O	ME-SA	PanAsia-2	ANT-10	FMDI-Ankara	15/02/2011
O/Tokat/1070/2010	Turkey	O	ME-SA	PanAsia-2	ANT-10	FMDI-Ankara	15/02/2011
O/Antalya/1086/2010	Turkey	O	ME-SA	PanAsia-2	ANT-10	FMDI-Ankara	15/02/2011
O/Samsun/1091/2010	Turkey	O	ME-SA	PanAsia-2	ANT-10	FMDI-Ankara	15/02/2011
O/Giresun/1094/2010	Turkey	O	ME-SA	PanAsia-2	ANT-10	FMDI-Ankara	15/02/2011
O/Giresun/1394/2010	Turkey	O	ME-SA	PanAsia-2	ANT-10	FMDI-Ankara	15/02/2011
O/Kastamonu/1400/2010	Turkey	O	ME-SA	PanAsia-2	ANT-10	FMDI-Ankara	15/02/2011

O/Istanbul/1410/2010	Turkey	O	ME-SA	PanAsia-2	ANT-10	FMDI-Ankara	15/02/2011
O/Isparta/1547/2010	Turkey	O	ME-SA	PanAsia-2	ANT-10	FMDI-Ankara	15/02/2011
A/Denizli/1538/2010.904	Turkey	A	ASIA	Iran-05	AFG-07	FMDI-Ankara	17/02/2011
A/Kutahya/3/2011.000	Turkey	A	ASIA	Iran-05	AFG-07	FMDI-Ankara	17/02/2011
A/Burdur/9/2011.000	Turkey	A	ASIA	Iran-05	AFG-07	FMDI-Ankara	17/02/2011

PDFMD- INDIA						
PD5/2011 ( )	INDIA	O	ME-SA	Ind2001		PDFMD
PD13/2011	INDIA	O	ME-SA	Ind2001		PDFMD
PD15/2011	INDIA	O	ME-SA	Ind2001		PDFMD
PD16/2011	INDIA	O	ME-SA	Ind2001		PDFMD
PD17/2011	INDIA	O	ME-SA	Ind2001		PDFMD
PD35/2011	INDIA	O	ME-SA	Ind2001		PDFMD
PD46/2011	INDIA	O	ME-SA	Ind2001		PDFMD
PD48/2011	INDIA	O	ME-SA	Ind2001		PDFMD
PD56/2011	INDIA	O	ME-SA	Ind2001		PDFMD
PD60/2011	INDIA	O	ME-SA	Ind2001		PDFMD
PD67/2011	INDIA	O	ME-SA	Pan Asia		PDFMD
PD77/2011	INDIA	O	ME-SA	Pan Asia		PDFMD
PD97/2011	INDIA	O	ME-SA	Ind2001		PDFMD
PD100/2011	INDIA	O	ME-SA	Ind2001		PDFMD
PD118/2011	INDIA	O	ME-SA	Ind2001		PDFMD
PD126/2011	INDIA	O	ME-SA	Pan Asia		PDFMD
PD129/2011	INDIA	O	ME-SA	Pan Asia		PDFMD
PD130/2011	INDIA	O	ME-SA	Pan Asia		PDFMD
PD136/2011	INDIA	O	ME-SA	Ind2001		PDFMD
PD143/2011	INDIA	O	ME-SA	Ind2001		PDFMD
PD145/2011	INDIA	O	ME-SA	Ind2001		PDFMD
PD147/2011	INDIA	O	ME-SA	Ind2001		PDFMD
PD148/2011	INDIA	O	ME-SA	Ind2001		PDFMD
PD149/2011	INDIA	O	ME-SA	Ind2001		PDFMD
PD151/2011	INDIA	O	ME-SA	Pan Asia		PDFMD
PD154/2011	INDIA	O	ME-SA	Ind2001		PDFMD
PD195/2011	INDIA	O	ME-SA	Ind2001		PDFMD

PD197/2011	INDIA	O	ME-SA	Ind2001	PDFMD
PD233/2011	INDIA	O	ME-SA	Ind2001	PDFMD
PD235/2011	INDIA	O	ME-SA	Ind2001	PDFMD
PD237/2011	INDIA	O	ME-SA	Ind2001	PDFMD
PD240/2011	INDIA	O	ME-SA	Ind2001	PDFMD
PD243/2011	INDIA	O	ME-SA	Ind2001	PDFMD
PD254/2011	INDIA	O	ME-SA	Ind2001	PDFMD
PD255/2011	INDIA	O	ME-SA	Ind2001	PDFMD
PD263/2011	INDIA	O	ME-SA	Ind2001	PDFMD
PD268/2011	INDIA	O	ME-SA	Pan Asia	PDFMD
PD280/2011	INDIA	O	ME-SA	Ind2001	PDFMD
PD281/2011	INDIA	O	ME-SA	Ind2001	PDFMD
PD289/2011	INDIA	O	ME-SA	Pan Asia	PDFMD
PD321/2011	INDIA	O	ME-SA	Ind2001	PDFMD
PD333/2011	INDIA	O	ME-SA	Ind2001	PDFMD
PD18/2011	INDIA	Asia 1		Lineage C	PDFMD
PD106/2011	INDIA	Asia 1		Lineage C	PDFMD
PD107/2011	INDIA	Asia 1		Lineage C	PDFMD
PD108/2011	INDIA	Asia 1		Lineage C	PDFMD
PD109/2011	INDIA	Asia 1		Lineage C	PDFMD
PD110/2011	INDIA	Asia 1		Lineage C	PDFMD
PD177/2011	INDIA	Asia 1		Lineage C	PDFMD
PD212/2011	INDIA	Asia 1		Lineage C	PDFMD
PD214/2011	INDIA	Asia 1		Lineage C	PDFMD
PD322/2011	INDIA	Asia 1		Lineage C	PDFMD
PD323/2011	INDIA	Asia 1		Lineage C	PDFMD
PD324/2011	INDIA	Asia 1		Lineage C	PDFMD
PD326/2011	INDIA	Asia 1		Lineage C	PDFMD
PD327/2011	INDIA	Asia 1		Lineage C	PDFMD
PD331/2011	INDIA	Asia 1		Lineage C	PDFMD
PD68/2011	INDIA	A		Genotype 18 non-deletion	PDFMD
PD202/2011	INDIA	A		Genotype 18 VP3^{59}-deletion	PDFMD
PD259/2011	INDIA	A		Genotype 18 VP3^{59}-deletion	PDFMD

1.7.2. Summary of antigenic typing

Vaccine efficacy is influenced by both vaccine potency and vaccine match and it is possible that a poor match may to some extent be compensated by high potency vaccines and by administering more than one dose at suitable intervals. The use of oil adjuvant is also expected to improve efficacy. Thus, a vaccine with a weak antigenic match to a field isolate, as determined by serology, may nevertheless afford some protection if it is of sufficiently high potency. Therefore, in the absence of a good match, or where the match is unknown, vaccines of high potency should preferably be used. The r_1 values shown below, represent the one way serological match between vaccine strain and field isolate, calculated from the comparative reactivity of an antiserum, raised against the vaccine in question, to the vaccine virus and the field isolate.

1.7.3. Antigenic characterisation of field isolates by matching with vaccine strains at FGI-ARRIAH

Antigenic characterisation of FMD field isolates by matching with vaccine strains r_1 values were obtained by VNT.

FMDV Serotype O

Table 4. Antigenic characterisation of field isolates by matching with vaccine strains

FMDV ID	r_1 value in VNT		
	Vaccine strain O_1 Manisa	Vaccine strain O/Russia/2000	O PanAsia2
O/Mongolia/APR2010	0,4	0,63	0,63
O/Kazakhstan/2010	0,5	0,8	0,74
O/Russia/JUL2010	0,31	0,36	0,33
O/Russia/AUG2010	0,33	0,62	0,42
O/Lebanon/2010	0,25	0,43	0,34
O/Mongolia/SEP2010	0,6	0,8	0,39

Interpretation of r_1 values

In the case of VNT:

$r_1 = \geq 0.3$ suggests that there is a close relationship between field isolate and vaccine strain. A potent vaccine containing the vaccine strain is likely to confer protection.

$r_1 = < 0.3$ suggests that the field isolate is so different from the vaccine strain that the vaccine is unlikely to protect.

1.7.4. Antigenic characterisation of field isolates from Ecuador and Paraguay by matching with vaccine strain O1 Campos- r_1 values obtained by 2d VNT at SENASA Laboratory.

Pool Sera monovalent vaccine O1 Campos 27 DPV				
r1 values	O Ecuador 18-11	O Ecuador 31-11	O Ecuador 15-11	O1 San Pedro-Py 2011
	0,11	0,08	0,16	0,25

The EPP was estimated using serum from revaccinated animals kept at the SENASA serum bank which were tested against a commercial trivalent vaccine (A,O,C) and the field strain O1 San Pedro Py 11/2011of Paraguay. The results are presented in the following table (Table 5.) .

Table 5. EPP estimation

EXPECTED PERCENTAGE OF PROTECTION
Trivalent Vaccine O1 Campos-A24 Cruzeiro-C3 Indaial 28DPRV

Sera Nº	O1 Campos **VN Titers**	O1 Campos **% EPP**	O1 San Pedro Py 11/2011 **VN Titers**	**% EPP**
7	2,44	97,62	2,14	93,86
8	1,78	82,32	1,64	74,58
9	2,25	95,78	1,97	90,01
10	2,34	96,73	1,94	88,76
11	2,27	96,04	2,02	91,14
12	1,74	80,32	1,92	88,08
14	2,44	97,62	1,84	85,02
15	2,32	96,51	1,87	86,63
16	2,39	97,30	1,93	88,76
17	2,38	97,12	2,06	92,15
18	2,44	97,62	1,76	81,34

19	1,93	88,75	1,66	75,81
20	2,45	97,77	1,83	85,02
21	2,29	96,28	1,77	82,32
22	2,33	96,73	2,44	97,62
23	2,42	97,47	1,75	81,34
24	2,41	97,47	1,93	88,76
MEAN (n=17)	**2,27**	**94,67**	**1,91**	**86,54**
DS	0,23	5,45	0,19	6,09

- Strain O/San Pedro/Par/2011 (emergency episode in Paraguay, 2011), corresponds to an indigenous variant.
- Genetically related to strains responsible for emergencies in the Southern Cone (2000-2006), with approximately 95% homology (O-Pozo Hondo cluster).
- Only one difference in the reactivity profile with MAbs, when compared to O Corrientes 2006
- Considerable genetic divergence with O1 Campos vaccine strain (over 17%)
- Reactivity profile differs from that of the O1 Campos vaccine strain.

1.7.5. Antigenic characterization of field isolates from Ecuador and Paraguay by matching with vaccine strain O1 Campos- r_1 values obtained at PANAFTOSA Laboratory.

Table 6. Antigenic characterization of field isolates from Ecuador and Paraguay

	Antigenic typing of FMD virus isolates submitted (VACCINE MATCHING)					
FMDV ID	Country	Antigenic Typing	EPP/ELISA-CFL	EPP/VN	r1 value by LPBE	r1 value by VN
			Vaccine strain O1 Campos	Vaccine strain O1 Campos	Vaccine strain O1 Campos	Vaccine strain O1 Campos
262-1	Ecuador	O1	30dpv:61.77 30dpR:97.02	30dpv:69.87 30dpR:95.48	Mean:0.165	Mean: 0.139
262-2	Ecuador	O1	30dpv:76.96 30dpR:98.67	30dpv:72.70 30dpR:98.18	Mean:0 .248	Mean: 0.178
276	Ecuador	O1	30dpv:49.75 30dpR:99.33	30dpv:43.25 30dpR:92.41		Mean: 0.084
277	Paraguay	O1	30dpv:78.99 30dpR:99.70	30dpR:99.92	Mean: 0.244	Mean: 0.69

Epidemiological data received from Ecuador correlates with vaccine matching results obtained using Expectancy of Protection (EPP). Field observations do not support the r1 values obtained by LPBE and VN, (which suggest the field virus is different from the vaccine strain). In our experience vaccine matching tests using EPP are a more reliable

methodology to predict vaccine protection in cattle population under prophylactic vaccination programs.
A revision and harmonization of vaccine matching methodologies recommended by OIE is needed, considering laboratory data and epidemiological observations.

Expected Percentage of Protection of Vaccine strain against a field O1 strain Ecuador 2011

	EPP Lp-ELISA		EPP VN	
Viral strain	30 dpv	30 dpR	30 dpv	30 dpR
O/Tsachilas/ECU/11(276)	49.75	99.33	43.25	92.41

EPP ≥ 70 panel 30dpR

Expected Percentage of Protection of Vaccine strain against a field O1 strain Paraguay 2011

	EPP Lp-ELISA		EPP VN
Viral strain	30 dpv	30 dpR	30 dpR*
O1/S.Pedro/PAR/11(277)	78.99	99.70	99.92

CONCLUSIONS from 2010-2011 sample analysis

- FMDV type O is circulating in restricted areas of South America
- National surveillance systems are detecting cases
- Samples are being collected and analyzed by lab
- Antigenic and molecular studies indicate that strains are endogenous to the region
- Vaccine matching (EPP) results indicate that vaccine strain O1 Campos protect against field viruses if applied in vaccination programs
- Massive and systematic vaccination program with oil adjuvanted vaccines containing O1 Campos is recommended.

1.7.6. Antigenic characterisation of field isolates by matching with vaccine strains by LPBE at RRLSEA Pakchong, Thailand

Serotype A

Antigenic typing of FMD virus isolates submitted r_1 value by LPBE	
FMDV ID	**Vaccine strain #1 (A/Sakolnakorn/97) (Thai vaccine strain)**
FMDV Type A	
A/TAI/3-2/11	>1.00
A/TAI/8/11	>1.00
A/TAI/10-2/11	>1.00
A/TAI/17-2/11	0.84
A/TAI/19/11	>1.00
A/TAI/25-2/11	>1.00
A/TAI/27/11	>1.00
A/TAI/29-1/11	>1.00
A/TAI/31-2/11	>1.00
A/TAI/32/11	>1.00
A/TAI/53-1/11	0.50
A/TAI/59-2/11	0.66
A/TAI/57-2/11	>1.00
A/TAI/58/11	0.83
A/TAI/64/11	0.57
A/TAI/63/11	0.88
A/TAI/65/11	1.00
A/TAI/67/11	0.33
A/TAI/67-3/10	>1.00
A/TAI/69/11	0.33
A/TAI/70-2/11	0.33
A/TAI/71-2/11	0.50
A/TAI/73/10	>1.00
A/TAI/73-2/11	0.75
A/TAI/74/11	0.50
A/TAI/75/11	0.90
A/TAI/76-1/11	>1.00
A/TAI/83/11	>1.00
A/TAI/84/11	0.99
A/TAI/85/11	>1.00
A/TAI/89-2/11	0.66
A/TAI/92-2/11	>1.00
A/TAI/92-4/11	>1.00
A/TAI/93-1/11	1.00
A/TAI/94-3/11	0.60
A/TAI/98/11	0.75
A/TAI/99-1/11	0.75
A/VIT/1/10	0.99

Serotype O

Antigenic typing of FMD virus isolates submitted r_1 value by LPBE	
FMDV ID	**Vaccine strain #1 O/189/87 (Thai vaccine strain)**
FMDV Type O	
O/TAI/66/2011	>1.00
O/TAI/37-1/2011	0.67
O/TAI/39-1/2011	0.67
O/TAI/39-2/2011	0.50
O/TAI/82-1/2011	>1.00
O/TAI/82-1/2011	>1.00
O/TAI/95/2011	>1.00
O/TAI/97/2011	>1.00
O/CAM/5/2011	>1.00
O/CAM/7/2011	1.00
O/LAO/1/2011	0.66
O/LAO/2/2011	0.66
O/LAO/3/2011	1.00
O/VIT/5/2011	>1.00
O/VIT/6/2011	>1.00
O/VIT/13/2011	1.00
O/VIT/14/2011	0.58
O/VIT/20/2011	0.66

1.7.7. Antigenic characterisation of field isolates by matching with vaccine strains by VNT at PDFMD, India.

Antigenic typing of FMD virus isolates submitted r_1 value by VNT	
FMDV ID	**Vaccine strain** INDR2/1975 (Serotype O)
FMDV Type O	
PD126/2011	0.74
PD136/2011	0.63
PD137/2011	0.63
PD233/2011	0.65
PD235/2011	1.00
PD236/2011	0.79
PD237/2011	0.51
PD240/2011	0.58
PD242/2011	0.40
PD254/2011	0.40
PD255/2011	0.64
PD321/2011	0.97
PD329/2011	1.00
PD333/2011	1.00
PD352/2011	0.51
PD357/2011	0.70
PD370/2011	0.51

PD376/2011	0.77
PD382/2011	0.74

Antigenic typing of FMD virus isolates submitted r_1 value by VNT	
FMDV ID	**Vaccine strain** IND63/1972 (Serotype Asia1)
FMDV Type Asia 1	
PD177/2011	1
PD323/2011	1
PD322/2011	0.56
PD324/2011	0.69
PD326/2011	0.46
PD327/2011	0.96
PD330/2011	0.56
PD331/2011	0.49

Antigenic typing of FMD virus isolates submitted r_1 value by VNT	
FMDV ID	**Vaccine strain** IND40/2000 (Serotype A)
FMDV Type A	
PD68/2011	0.36
PD202/2011	0.46
PD259/2011	0.58

1.7.8. Antigenic characterisation of field isolates by matching with vaccine strains by WRLFMD: *r_1 values were obtained by VNT or ELISA at WRLFMD*

Vaccine matching data for 2011 from the WRLFMD Pirbright Laboratory, UK.

Vaccine matching - 1st January to 31st March 2011

Thirty five FMDV type O isolates (See Table 7, Type O for details) from Bulgaria, Cambodia, Ecuador, Hong Kong, Iran, Israel, Kenya, Libya, Mongolia, Nepal, Pakistan, South Korea, Thailand and Turkey collected in 2009, 2010 and 2011 were analysed antigenically by the two dimensional virus neutralisation test (2dmVNT). Isolates from Bulgaria, Cambodia, Iran, Israel, Libya, Nepal (not tested against O 4625), Kenya, Pakistan and Turkey showed antigenic matching with vaccines of O 4625, O Campos, O Manisa and O TUR except one virus from Cambodia and one from Kenya which did not match with O Manisa , respectively. Virus from Ecuador showed no match with O Campos with 1 out of two viruses showing antigenic match with the O TUR vaccine strain. Both viruses from Hong Kong; one out of three from Mongolia (not tested against O TUR) and one out of two from Thailand were not antigentically close to either O Manisa or O Tur vaccine strain. Three out of five tested S. Korea viruses showed close matching with O Manisa, while two gave close antigenic match with O 4625, O IND R2/75 O TAW 98 and O TUR vaccine strains. (Table 7).

Six FMDV type A viruses (see Table 7, Type A for details) from Afghanistan collected in 2010 and 2011 were antigenically matched with three type A vaccine strains. All viruses, except one virus from Turkey, showed antigenic matching with A IRAN 05 and A TUR 06 vaccine strains (Table 7).

Four FMDV type Asia 1 viruses (see Table 7, Type Asia 1 for details) from Bahrain and Pakistan collected in 2010 and 2011were antigenically matched with three type Asia 1 vaccine strains. All viruses showed no antigenic matching all of Asia 1 IND 8/79, Asia 1 Shamir and Asia 1 WBN (Table 7).

Two FMDV type SAT 1 viruses (see Table 7, Type SAT 1 for details) from Kenya collected in 2010 were analysed for antigenic relationships with two vaccine strains by 2dmVNT. Both showed an antigenic match with SAT 1 RHO (Table 7).

TABLE 7: Antigenic characterisation of FMD field isolates by matching with vaccine strains by VNT– r1 value data from 1st January to 31st March 2011

Type O:

Vaccine matching for type O FMDV by VNT-WRL FMD													
Isolates	**O 3039**	**O 4625**	**O BFS**	**O Campos**	**O Ind R2/75**	**O Manisa**	**O Manisa ≥6PD50**				**O Taw98**	**O TNN 24/84**	**O Tur 5/09**
Bul 3/2011	M	M		M		M							M
Bul 7/2011	M	M		M		M							M
Bul 10/11		M		M		M							M
Bul 15/11		M		M		M							M
Cam 01/2010	M		N			N					M	N	M
Cam 05/2010	M		N			M					M	M	M
Ecu 01/10				N									N
Ecu 09/10				N									M
Hkn 24/2010		N	N			N					N	N	N
Hkn 26/2010		M	N			N					M	N	N
Irn 225/2010		M	N		M	M							M
Isr 01/2011		M		M		M							M
Isr 02/2011		M		M		M							M
Ken 137/10		M		M		N							M
Ken 01/11		M		M		M							M
Lib 04/2010		M	M		M	M							M
Mog 03/2010													M
Mog 04/2010													N
Mog 09/2010													N
Nep 03/2010	M		N			M					M	M	M
Nep 16/2010	M		N			M					M	M	M
Pak 46/10	M		N		M	N					M	M	M
Pak 76/10	M		M		M	M					M	M	M
Pak 116/10		M		M		M							M
Pak 10/11		M		M		M							M
Skr 04/2010				M			M						
Skr 05/2010						M	M	M	N	N			
Skr 06/2010		M	N	N	M	N					M	N	M
Skr 07/2010						M			M	M			
Skr 10/2010						N	N	M	N	N			
Skr 03/2011		M	N	N	M	M	M	M	M	M	M	N	M
Tai 06/2010			N			M					M	M	M
Tai 27/2009			N			N					M	N	N
Tur 08/11		M		M		M							M
Tur 25/11		M		M		M							M

Type A:

Vaccine matching for type A FMDV by VNT-WRL FMD			
Isolates	**Iran 2005**	**Irq 24/64**	**Tur06**
Afg 140/10	**M**	**N**	**M**
Afg 163/10	**M**	**M**	**M**
Tur 40/10	**M**	**M**	**M**
Tur 43/10	**N**	**N**	**N**
Tur 02/11	**M**	**N**	**M**
Tur 13/10	**M**	**N**	**M**

Type Asia 1:

Vaccine matching for type Asia 1 FMDV by VNT-WRL FMD			
Isolates	**Ind 8/79**	**Shamir**	**WBN**
Bar 03/11	**N**	**N**	**N**
Bar 04/11	**N**	**N**	**N**
Pak 108/10	**N**	**N**	**N**
Pak 50/11	**N**	**N**	**N**

Type SAT 1:

Vaccine matching for type SAT 1 FMDV by VNT-WRL FMD	
Isolates	**SAT 1 Rho**
Sat1 Ken 138/10	**M**
Sat1 Ken 140/10	**M**

M: the isolate was antigenically matched with the vaccine strain
N: the isolate showed no antigenic match with the vaccine strain

Vaccine matching 1st April to 30th June 2011

Seven FMDV type O isolates (See Table 8, Type O for details) from Afghanistan, Vietnam and Hong Kong collected in 2010 and 2011 were analysed antigenically by the two dimensional virus neutralisation test (2dmVNT). Isolates from Afghanistan and Vietnam showed antigenic matching with vaccines of O 4625, O Campos, O TAW 98 and O TUR except one virus from Vietnam which did not match with O Campos. Viruses from Hong Kong showed no match with any of the test vaccine strains; O Campos, O Manisa, O TAW 98 and O TUR 09 apart from one virus which was antigenically close to O 4625 (Table 8).

Six FMDV type Asia 1 viruses (see Table 8, Type Asia 1 for details) from Pakistan and Iran collected in 2011 showed no antigenic matching with vaccines Asia 1 IND 8/79, Asia 1 Shamir and Asia 1 WBN, apart from one virus from Pakistan which was antigenically close to Asia 1 Shamir (Table 8).

TABLE 8: Antigenic characterisation of FMD field isolates by matching with vaccine strains by VNT from 1st April to 30th June 2011

Type O:

Vaccine matching studies for type O FMDV by VNT-WRL FMD						
SAMPLE WRL REF	**SEROTYPE**	**O 4625**	**O Campos**	**O Manisa**	**O Taw 98**	**O Tur 09**
AFG 110/2010	**O**	**M**	**M**	**N**	**M**	**M**
AFG 268/2010	**O**	**M**	**M**	**N**	**M**	**M**
VIT 16/2010	**O**	**M**	**N**	**N**	**M**	**M**
VIT 3/2011	**O**	**M**	**M**	**N**	**M**	**M**
VIT 32/2011	**O**	**M**	**M**	**N**	**M**	**M**
HKN 1/2011	**O**	**M**	**N**	**N**	**N**	**N**
HKN 2/2011	**O**	**N**	**N**	**N**	**N**	**N**

Type Asia 1:

Vaccine matching studies for type Asia 1 FMDV by VNT-WRL FMD				
SAMPLE WRL REF	SEROTYPE	Asia1 IND 8/79	Asia1 Shamir	Asia1 WBN 117/85
PAK 51/2011	ASIA1	N	N	N
PAK 89/2011	ASIA1	N	M	N
IRN 33/2011	ASIA1	N	N	N
IRN 38/2011	ASIA1	N	N	N
IRN 43/2011	ASIA1	N	N	N
IRN 46/2011	ASIA1	N	N	N

M: the isolate was antigenically matched with the vaccine strain
N: the isolate showed no antigenic match with the vaccine strain

Vaccine matching July to 30th September 2011

Seventeen FMDV type O isolates (See Table 9, Type O for details) from Afghanistan, The Democratic People's Republic of Korea (DPRK), Iran, Iraq, Israel, Kuwait, Pakistan, Thailand and Vietnam collected in 2010 and 2011 were analysed antigenically by the two dimensional virus neutralisation test (2dmVNT). All isolates were antigentically matched with the vaccines O 4625 and O TUR 5/09. Apart from two isolates from Afghanistan which were not antigenically close to O Manisa, all isolates from Afghanistan, DPRK, Iran, Iraq, Israel, and Pakistan showed antigenic close to both O Campos and O Manisa. Viruses from Thailand and Vietnam were antigenically close to O 3039 and O TAW 98 (Table 9).

Six FMDV type A viruses (see Table 9, Type A for details) from Afghanistan, Iran, Iraq and Pakistan collected in 2011 and 2010 were analysed antigenically by the two dimensional virus neutralisation test (2dmVNT). All isolates except A AFG 12/2011 showed antigenic match with the A TUR 06 vaccine strain. Viruses from Iraq and Pakistan were also matched with A IRN 2005 and A_{22} Iraq. Virus A AFG 12/2011showed no antigenic matching with all vaccine strains tested (Table 9).

Two FMDV type Asia 1 viruses (see Table 9) from Afghanistan showed no antigenic matching with vaccines Asia 1 IND 8/79 and Asia 1 WBN. However, virus Asia 1 AFG 39/2011was antigenically close to Asia 1 Shamir (Table 9).

One FMDV type SAT 1 virus SAT 1 BOT 4/2011 from Botswana showed antigenic match with the vaccine strain SAT 1 RHO. Three SAT 2 virus from Botswana and Zimbabwe (see Table 9, Type SAT 1 and SAT 2 for details) showed no antigenic matching with vaccine SAT 2 Eritrea; but two isolates from Zimbabwe were antigenically close to the SAT 2 Zim vaccine strain (Table 9).

TABLE 9: Antigenic characterisation of FMD field isolates by matching with vaccine strains by VNT from 1st July to 30th September 2011

Type O:

Vaccine matching studies for type O FMDV by VNT-WRL FMD							
SAMPLE REF	O 3039	O 4625	O CAMPOS	O MANISA	O TNN 24/84	O TAW 98	O TUR 5/09
AFG 41/2011		M	M	N			M
AFG 6/2011		M	M	N			M
DRK 31/2011	M	M	M	M		M	M
IRN 34/2011		M	M	M			M
IRN 50/2011		M	M	M			M
IRQ 13/2010		M	M	M			M
IRQ 4/2010		M	M	M			M
ISR 4/2011		M	M	M			M
ISR 07/2011		M	M	M			M
KUW 1/2011		M	N	N			M
KUW 2/2011		M	N	N			M
PAK 62/2011	M	M	M	M		M	M
PAK 84/2011	M	M	M	M		M	M
TAI 2/2011	M	M		M	N	M	M
TAI 7/2011	M	M		N	N	M	M
VIT 18/2010	M	M		M	N	M	M
VIT 23/2010	M	M		N	N	M	M

Type A:

Vaccine matching studies for type A FMDV by VNT-WRL FMD							
SAMPLE REF	A IRN 87	A IRN 2005	A MAY 97	A SAU 41/91	A SAU 95	A TUR 06	A_{22} IRQ
AFG 12/2011		N		N	N	N	N
AFG 34/2011		N		N	N	M	N
IRN 36/2011	N	N				M	M
IRN 45/2011	N	N				M	N
IRQ 5/2010	N	M				M	M
PAK 86/2011		M	N			M	M

Type Asia 1:

Vaccine matching studies for type Asia 1 FMDV by VNT-WRL FMD				
SAMPLE REF	SEROTYPE	Asia 1 IND 8/79	Asia 1 SHAMIR	Asia 1 WBN 117/85
AFG 39/2011	ASIA1	N	M	N
AFG 45/2011	ASIA1	N	N	N

Types SAT 1 and SAT 2:

Vaccine matching studies for type SAT 1 and SAT 2 FMDV by VNT-WRL				
SAMPLE REF	SEROTYPE	SAT 1 RHO	SAT 2 ERITREA	SAT 2 ZIM
BOT 4/2011	SAT1	M		
BOT 1/11	SAT2		N	N
ZIM 5/2010	SAT2		N	M
ZIM 6/2010	SAT2		N	M

M: the isolate was antigenically matched with the vaccine strain
N: the isolate showed no antigenic match with the vaccine strain

Vaccine matching 1st October to 31st December 2011

Three FMDV type O isolates (See Table 10, Type O for details) from Turkey and Paraguay collected in 2011 were analysed antigenically by the two dimensional virus neutralisation test (2dmVNT). All isolates were antigentically matched with the testing vaccine strains O 4625, O Campos , O Manisa and O TUR 5/09, in addition, O TUR 33/2011 showed a close match with O TUR 07 (Table 10).

Five FMDV type A viruses (see Table 10, Type A for details) from Turkey, Democratic Republic of Congo and Bahrain collected in 2011 were analysed antigenically by the two dimensional virus neutralisation test (2dmVNT). All isolates except A TUR 29/2011 showed antigenic match with the A TUR 06 vaccine strain. Viruses from Congo were also matched with A IRN 2005 and A_{22} Iraq (Table 10).

Two FMDV type Asia 1 viruses (see Table 10, Type Asia 1 for details) from Turkey showed no antigenic matching with vaccine strains Asia 1 Shamir, Asia 1 IND 8/79 and Asia 1 WBN (Table 10).

TABLE 10: Antigenic characterisation of FMD field isolates by matching with vaccine strains by VNT from 1st October to 31st December 2011

Type O:

Vaccine matching studies for type O FMDV by VNT-WRL FMD					
WRL SAMPLE REF	O 4625	O Campos	O Manisa	O Tur 5/09	O Tur 07
TUR 28/2011	M	M	M	M	NT
TUR 33/2011	M	M	M	M	M
PAR 1/2011	M	M	M	M	NT

Type A:

Vaccine matching studies for type A FMDV by VNT-WRL FMD			
WRL SAMPLE REF	A Iran 2005	A TUR 06	A22 IRQ
TUR 29/2011	N	N	N
TUR 64/2011	N	M	N

COD 12/2011	M	M	M
COD 2/2011	M	M	M
BAR 18/2011	N	M	N

Type Asia 1:

Vaccine matching studies for type Asia 1 FMDV by VNT-WRL FMD			
WRL SAMPLE REF	Asia1 IND 8/79	Asia1 Shamir	Asia1 WBN 117/85
TUR 49/2011	N	N	N
TUR 51/2011	N	N	N

M: the isolate was antigenically matched with the vaccine strain- $r_1 = \geq 0.3$.
N: the isolate showed no antigenic match with the vaccine strain- $r_1 = < 0.3$.
NT: Not tested.

Interpretation of r_1 values

In the case of VNT:

$r_1 = \geq 0.3$. Suggests that there is a close relationship between field isolate and vaccine strain. A potent vaccine containing the vaccine strain is likely to confer protection.
$r_1 = < 0.3$. Suggests that the field isolate is so different from the vaccine strain that the vaccine is unlikely to protect

1.7.8.1 Summary of all r_1 vaccine matching tests carried out by WRLFMD in 2011

Date	Isolates tested	vaccine strains tested	r' values	isolate 'r' values
17.01.11	O Zam 4/10, O Irn 225/10, O Lib 4/10	O 4625,Bfs, Ind R2/75, Manisa,Tur 5/09	15	15
20.01.11	O Zam 4/10, O Irn 225/10, O Lib 4/10	O 4625,Bfs, Ind R2/75, Manisa,Tur 5/09	15	30
21.01.11	O Cam 1,5/10, Nep 3,16/10	O 3039,Bfs, Manisa,Taw98, TNN,Tur 5/09	24	54
24.01.11	O Hkn 24, 26/10, Pak 46, 76/10, Tai 6/10, 27/09			54
27.01.11	O Cam 1,5/10, Nep 3,16/10	O 3039,Bfs, Manisa,Taw98, TNN,Tur 5/09	24	78
28.01.11	O Hkn 24, 26/10, Tai 6/10, 27/09	O 3039,Bfs, Manisa,Taw98, TNN,Tur 5/09	24	102
03.02.11	O Hkn 24, 26/10, Tai 6/10, 27/09	O 3039,Bfs, Manisa, Taw98,TNN,Tur 5/09	24	126
04.02.11	O Pak 46, 76/10, Cam 1,5/10, Nep 3,16/10. Skr 4/10	O 4625,Bfs, Manisa, Ind R2/75,Taw98,TNN,Tur 5/09, Campos	21	147
10.02.11	O Pak 46, 76/10,Hkn 24, 26/10	O 4625,Bfs, Manisa, Ind R2/75,Taw98,TNN,Tur 5/09	16	163
07.02.11	O Skr 4/10, Ecu 1,9/10	O Campos, Tur 5/09	5	168
11.02.11	O Hkn 24, 26/10, Tai 6/10, 27/09	O 3039	7	175
11.02.11	Asia1 Irn 30/04	Asia1 Shamir (Isr 3/89)	1	176
07.02.11	O Skr 4/10, Ecu 1,9/10	O Campos, Tur 5/09	5	181
11.02.11	O Mog 3,4,9/10	O Tur 5/09	3	184
14.02.11	O Mog 3,4,9/10	O Tur 5/09	3	187
14.02.11	Asia1 Irn 30/04	Asia1 Shamir (Isr 3/89)	1	188
24.02.11	O Skr 6/10,3/11	O 4625,Bfs, Campos, Ind R2/75, Manisa, Taw98,TNN,Tur 5/09	16	204
25.02.11	O Skr 6/10,3/11	O 4625,Bfs, Campos, Ind R2/75, Manisa, Taw98,TNN,Tur 5/09	16	220
03.03.11	O Tur07 VV	O Tur07 VV	1	221
07.03.11	O Bul 3,7/11, Skr 5,7/10	O 3039,4625,Campos,Manisa,Tur 5/09	12	233
10.03.11	O Bul 3,7/11, Skr 5,7/10, 3/11	O 3039,4625,Campos,Manisa,Tur 5/09 Skr 21dpv, boost 12dpv	16	249
11.03.11	O Bul 3,7/11, Skr 5,7/10, 3/11	O 3039,4625,Campos,Manisa,Tur 5/09 Skr 21dpv, boost 12dpv	16	265
18.03.11	Asia1 Pak 108/10, 50/11	Asia1 Ind, Shamir (Isr 3/89) x2, WBN	8	273
18.03.11	O Pak 116/10, 10/11	O 4625,Campos,Manisa,Tur 5/09	8	281
18.03.11	Asia1 Pak 108/10, 50/11 Bar 3, 4/11	Asia1 Ind, Shamir (Isr 3/89) x2, WBN	16	297
18.03.11	O Pak 116/10, 10/11	O 4625,Campos,Manisa,Tur 5/09	8	305
17.03.11	O Bul 3,7/11, Skr 5,7/10 (x2), 3/11	O 3039,4625,Campos,Manisa,Tur 5/09 Skr 21dpv, boost 12dpv	23	328
18.03.11	O Bul 3,7/11, Skr 5,7/10 (x2), 3/11	O Manisa (intervet pool)	5	333
19.03.11	O Skr 7/10, 3/11	O Manisa (intervet pool), UV, Skr 21dpv, boost 12dpv	7	340
21.03.11	O Skr 5/10, 3/11	O Manisa (intervet pool), UV, Skr 21dpv, boost 12dpv	8	348
24.03.11	O Skr 5,7,10/10	O 4625,Campos,Manisa,Tur 5/09	8	356
24.03.11	O Bul 3,7/11, Skr 10/10	O 3039,4625,Campos,Manisa,Tur 5/09	11	367

25.03.11	O Bul 3,7/11, Skr 10/10	O 3039,4625,Campos,Manisa,Tur 5/09	11	378
28.03.11	Sat1 Ken 138,140/10	Sat1 Rho	2	380
31.03.11	Sat1 Ken 138,140/10	Sat1 Rho	2	382
31.03.11	O Ken 137/10, 1/11	O 4625,Campos,Manisa,Tur 5/09	12	394
01.04.11	O Ken 137/10, 1/11,Isr 1,2/11, Skr 10/10	O 4625,Campos,Manisa UV,(intervet poolx2),Skr 21dpv, boost 12dpv,Tur 5/09	20	414
01.04.11	Asia1 Bar 3, 4/11	Asia1 Ind, Shamir (Isr 3/89), WBN	6	422
04.04.11	Sat1 Ken 138,140/10	Sat1 Rho	2	428
04.04.11	Asia1 Bar 3, 4/11	Asia1 Ind, Shamir (Isr 3/89), WBN	6	428
04.04.11	O Ken 137/10, 1/11,Isr 1,2/11, Skr 10/10	O Manisa UV,(intervet poolx2), Skr 21dpv, boost 12dpv	8	436
07.04.11	O Bul 10,15/11,Ken 1/11,Isr 1,2/11, Skr10/10	O 4625,Campos,Manisa UV,Tur 5/09, Manisa intervet	20	456
08.04.11	O Bul 10,15/11, Tur8,25/11	O 4625,Campos,Manisa UV,Tur 5/09	16	472
08.04.11	A Tur 40,43/10, 2,13/11	A Irn05, A22	8	480
10.04.11	O Tur8,25/11	O 4625,Campos,Manisa UV,Tur 5/09	8	488
10.04.11	A Tur 40,43/10, 2,13/11	A Irn05, A22	8	496
11.04.11	A Tur 40,43/10, 2,13/11	A Irn05, Sau95,Tur06	12	508
12.04.11	A Tur 40,43/10, 2,13/11	A Irn05, Sau95,Tur06	12	520
11.04.11	O Tur 25/11	O 4625,Campos,Manisa UV,Tur 5/09	5	525
14.04.11	Asia1 Irn 33, 38,43,46/11	Asia1 Ind, Shamir (Isr 3/89), WBN	12	537
14.04.11	A Afg 140,163/10, Tur 40/10,13/11	A Irn05, A22,Tur06	12	549
14.04.11	O Tur07 VV	O Tur07 VV	1	550
15.04.11	Asia1 Irn 33, 38,43,46/11	Asia1 Ind, Shamir (Isr 3/89), WBN	12	562
15.04.11	A Afg 140,163/10		6	568
15.04.11	O Tur07 VV	O Tur07 VV	1	569
15.04.11	A Afg 140,163/10	A Tur06	2	571
05.05.11	A Afg 140,163/10	A Ind, May97	4	575
05.05.11	O Afg 110, 268/10	O 4625,Campos,Manisa UV,Tur 5/09	8	583
05.05.11	A Afg 140,163/10	A Ind, May97	4	587
19.05.11	O Afg 110, 268/10	O 4625,Campos,Manisa UV, Taw98,Tur 5/09	10	597
19.05.11	O Afg 110, 268/10, Hkn 1,2/11, Vit 16/10, 3,32/11	O Taw98	7	604
20.05.11	O Hkn 1,2/11, Vit 16/10, 3,32/11	O 4625,Campos,Manisa UV, Taw98,Tur 5/09	25	629
03.06.11	O Hkn 1,2/11	O 4625,Campos,Manisa UV, Tur 5/09	20	649
02.06.11	Asia1 Pak 51, 89/11	Asia1 Ind, Shamir (Isr 3/89), WBN	6	655
02.06.11	Asia1 Pak 51, 89/11	Asia1 Ind, Shamir (Isr 3/89), WBN	6	661
06.06.11	O Vit 16/10, 3,32/11	O 4625,Campos,Manisa UV, Tur 5/09	12	673
06.06.11	O Russia 2000 bvs pool (Arriah)	O Russia 2000 VV	1	674
06.06.11	A Tur06 bvs '8000' pool (Arriah)	A Tur06 VV	1	723

09.06.11	O Irn 34,50/11, Irq 4,13/10, Pak 62,84/11	O 3039, 4625, Taw98,Tur 5/09	16	691
10.06.11	O Irn 34,50/11, Irq 4,13/10, Pak 62,84/11	O 3039, 4625, Taw98,Tur 5/09	16	707
29.06.11	O Irn 34,50/11, Irq 4,13/10, Pak 62,84/11	O 3039, 4625, Taw98,Tur 5/09	16	723
01.07.11	O Irn 34,50/11, Irq 4,13/10, Pak 62,84/11	O Campos,Manisa UV	12	735
29.06.11	Asia1 Afg 39,45/11	Asia1 Ind, Shamir (Isr 3/89), WBN	6	741
01.01.11	Asia1 Afg 39,45/11	Asia1 Ind, Shamir (Isr 3/89), WBN	6	747
14.07.11	O Afg 6,41/11, Isr 4,7/11	O 4625,Campos,Manisa UV, Tur 5/09	16	763
28.07.11	O Afg 6,41/11, Drk 31/11, Isr 4,7/11	O 4625,Campos,Manisa UV, Tur 5/09	20	783
14.07.11	O Drk 31/11, O Pak 84/11	O 3039, Taw98	4	787
15.07.11	O Drk 31/11	O 3039, Taw98	2	789
15.07.11	O Irn 34,50/11, Irq 4,13/10, Pak 62,84/11	O Campos,Manisa UV	12	801
15.07.11	Sat1 Bot 4/11	Sat1 Rho	2	803
29.07.11	Sat2 Bot1/11, Zim 5,6/10	Sat2 Eri, Zim	6	809
12.08.11	Sat2 Bot1/11, Zim 5,6/10	Sat2 Eri, Zim	6	815
29.07.11	A Irn 36,45/11, Irq 5/10, Pak 86/11, Afg 12,34/11	A Irn05, A22,Tur06	18	833
11.08.11	A Irn 36,45/11, Irq 5/10, Pak 86/11, Afg 12,34/11	A Irn05, A22,Tur06	18	851
12.08.11	O Kuw 1,2/11	O 4625,Campos,Manisa UV, Tur 5/09	8	859
25.08.11	O Kuw 1,2/11	O 4625,Campos,Manisa UV, Tur 5/09	8	867
26.08.11	A Irn 36,45/11, Irq 5/10, Pak 86/11, Afg 12,34/11	A Irn87, May97, Sau95, Sau 41/91	8	875
11.08.11	A Irn 36,45/11, Irq 5/10, Pak 86/11, Afg 12,34/11	A Irn87, May97, Sau95, Sau 41/91	8	883
11.08.11	A Tur06 bvs '8000' pool (Arriah)	A Tur06 VV	2	885
25.08.11	A Afg 12,34/11	A Sau95	2	887
08.09.11	Asia1 Afg 45/11, Bar 4/11, Irn 30/04, Irn 38/11, Pak 89/11	Asia1 Shamir (Isr 3/89) - 1&2/10, 1x payload, 5x payload, VE pool	20	907
09.09.11	Asia1 Afg 45/11, Bar 4/11, Irn 30/04, Irn 38/11, Pak 89/11	Asia1 Shamir (Isr 3/89) - 1&2/10, 1x payload, 5x payload, VE pool	20	927
15.09.11	A Tai 1,13/11, Vit 17/10	A Irn05, A22,Tur06	9	936
23.09.11	A Tai 1,13/11, Vit 17/10	A Irn05, A22,Tur06	9	945
09.09.11	Asia1 Irn 30/04	Asia1 Shamir (Isr 3/89)	2	947
09.09.11	Asia1 Irn 30/04	Asia1 Shamir (Isr 3/89)	2	949
08.09.11	O Kuw 1,2/11	O 4625,Tur 5/09	4	953
19.08.11	O Tai 2,7/11, Vit 18,23/10	O 3039, 4625, Manisa,Taw98,TNN,Tur 5/09	24	977
20.09.11	O Tai 2,7/11, Vit 18,23/10	O 3039, 4625, Manisa,Taw98,TNN,Tur 5/09	24	1001
06.10.11	O Cam 6,8/11, Lao 1/11	O 3039, 4625, Manisa,Taw98,TNN,Tur 5/09	18	1019
07.10.11	O Cam 6,8/11, Lao 1/11	O 3039, 4625, Manisa,Taw98,TNN,Tur 5/09	18	1037
03.11.11	O Hkn 5,6/11, Isr 11,26/11	O 4625,Campos,Manisa, Taw98,Tur 5/09	13	1050
04.11.11	O Hkn 5,6/11, Isr 11,26/11	O 4625,Campos,Manisa, Taw98,Tur 5/09	13	1063
	A Tai 1,13/11, Vit 17/10	A Ind, May97	5	1068

	A Tai 1,13/11, Vit 17/10	A Ind, May97	5	1073
03.11.11	Asia1 Irn 30/04	Asia1 Shamir (Isr 3/89)	1	1074
03.11.11	Asia1 Irn 30/04	Asia1 Shamir (Isr 3/89)	1	1075
07.11.11	Asia1 Tur 49, 51/11	Asia1 Ind, Shamir (Isr 3/89), WBN	6	1081
07.11.11	O Par 1/11, Tur 28,33/11	O 4625,Campos,Campos Paraguay,Manisa,Tur 5/09	13	1094
10.11.11	Asia1 Tur 49, 51/11	Asia1 Ind, Shamir (Isr 3/89), WBN	6	1100
10.11.11	O Par 1/11, Tur 28,33/11	O 4625,Campos,Campos Paraguay,Manisa,Tur 5/09	13	1113
17.11.11	A Cod 2,12/11, Tur 29,64/11, Bar 18/11	A Irn05, A22,Tur06	15	1128
17.11.11	A Cod 2,12/11, Tur 29,64/11, Bar 18/11	A Irn05, A22,Tur06	15	1143

112 tests: 10.2 'r' values per test: 1143 'r' values total for year 2011

Average number of r_1 values generated per week = 22

Total number of r_1 values generated in 2011 = 1143

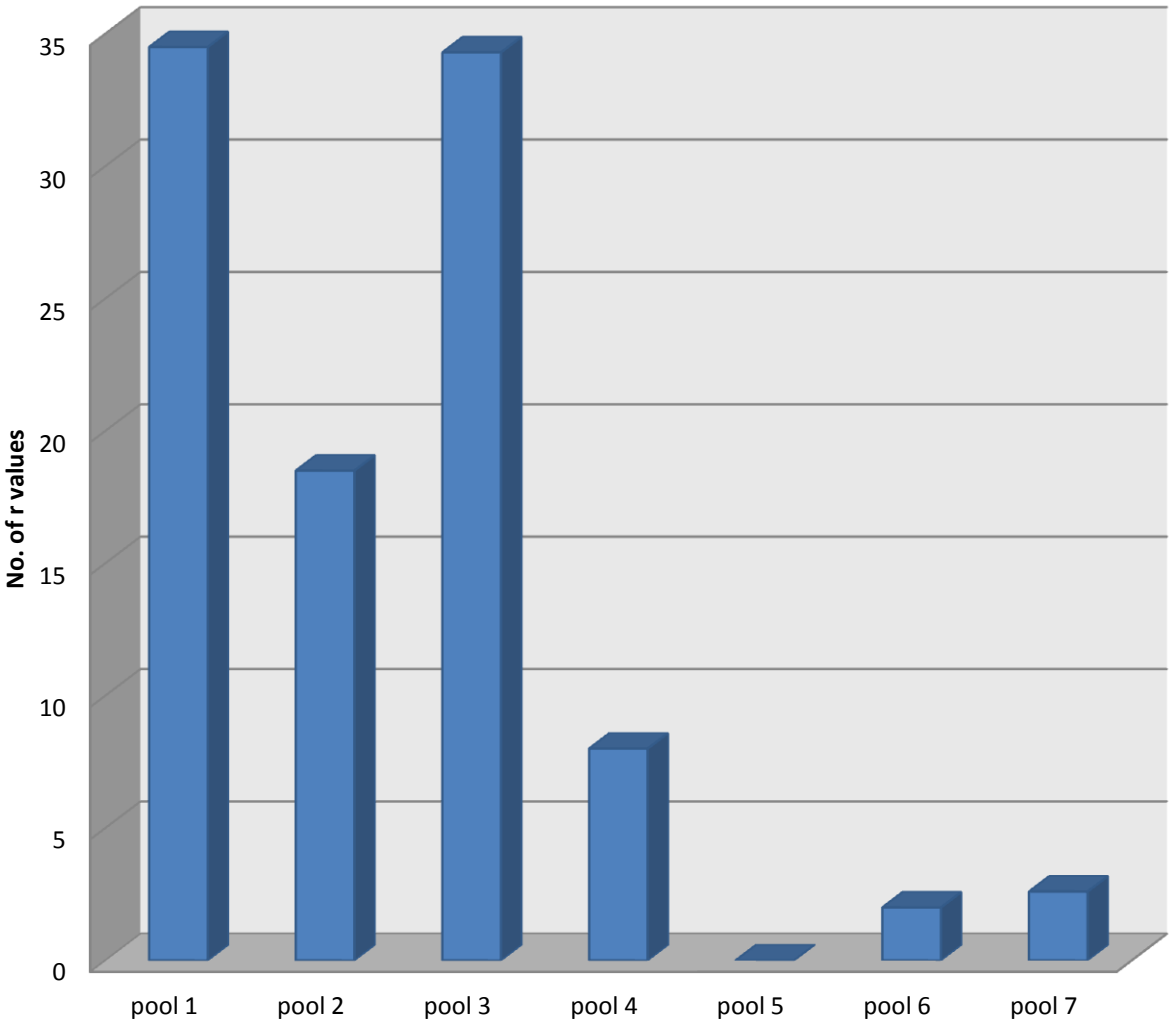


Figure 9. Number of r_1 values determined per pool by WRLFMD during 2011

1.7.9. WRLFMD Vaccine Recommendations

The recommendations made by the WRLFMD are drawn principally from a list of vaccine strains for which master seed vaccine viruses are believed to be available within the portfolios of vaccine suppliers able to fulfill the quality requirements for use in Europe. The ranking of the utility of the viruses is based on the results obtained by the WRLFMD from *in vitro* serological tests to match these vaccine viruses to recent field isolates. As such, the WRLFMD can only recommend vaccine virus strains for which it has received supplies of both the vaccine virus and the homologous antiserum. Since these vaccine strains are chosen to protect against threats from outside of Europe, it can be anticipated that the vaccines should also be useful to counter such threats at source. However, other vaccine viruses may have been produced, for example by vaccine manufacturers located in the regions from which the threats arise and using local isolates, that would also provide an equivalent or even better antigenic match to the field isolates that pose the threat (see Regional Recommendations at section 1.5).

WRLFMD Vaccine Recommendations

HIGH PRIORITY

O Manisa
O PanAsia 2
O BFS or O Campos
A24 Cruzeiro
Asia 1 Shamir
A Iran 05
A22 Iraq
SAT 2 Saudi Arabia or equivalent

MEDIUM PRIORITY

A Eritrea
A Iran 96
SAT 2 Zimbabwe
A Iran 87 or A Saudi 23/86
SAT 1 South Africa
A Malaysia 97
A Argentina 2001
O Taiwan 97 (or equivalent pig-adapted strain)
A Iran 99

LOW PRIORITY

A15 Bangkok related strain
A87 Argentina related strain
C Noville
SAT 2 Kenya
SAT 1 Kenya
SAT 3 Zimbabwe
A Kenya

NB Strains are not listed in order of importance within each priority grouping.

Acknowledgements
For the work carried out at Pirbright, the majority of the vaccine strains and vaccine antisera used for matching tests have been supplied to the WRLFMD by Merial. Some strains and/or antisera were supplied to WRLFMD by Intervet, ARRIAH and the Thai Regional Reference Laboratory at Pakchong

1.7.9.1 International Foot and Mouth Disease (FMD) Strategic Reserves Network

International Foot and Mouth Disease (FMD) Strategic Reserves Network

In 2011 a newly formed alliance named the 'International foot and mouth disease (FMD) strategic reserves network' was established. This comprises members from a number of countries that hold FMD vaccine banks. Dr Jef Hammond was elected as chair of this group.

The members of this Alliance were as follows;

- Pirbright Laboratory, Institute for Animal Health-
- North American Foot-and-Mouth Disease Vaccine Bank, Plum Island Animal Disease Center USDA, APHIS, FADDL-
- EC Commission, DG SANCO/E2
- Ministry of Agriculture and Forestry Biosecurity New Zealand

Rationale: Even though FMD is a global problem requiring a global partnership for its control, decisions about managing national or international FMD vaccine reserves concerning strain content and quantity held, are often considered in isolation. A coordinated approach to antigen/vaccine bank activities around the world through a unified network would increase cooperative effort and provide mutual support for vaccine bank network members and help improve international control of FMD by vaccination. Specifically, the network could consider issues such as vaccine dose requirements, virus strain selection, manufacturing processes, methods of formulation, efficacy testing and regulatory control.

PART 2

Improving the quality of laboratory tests from international and national reference laboratories

2. Inter-laboratory comparative testing exercises

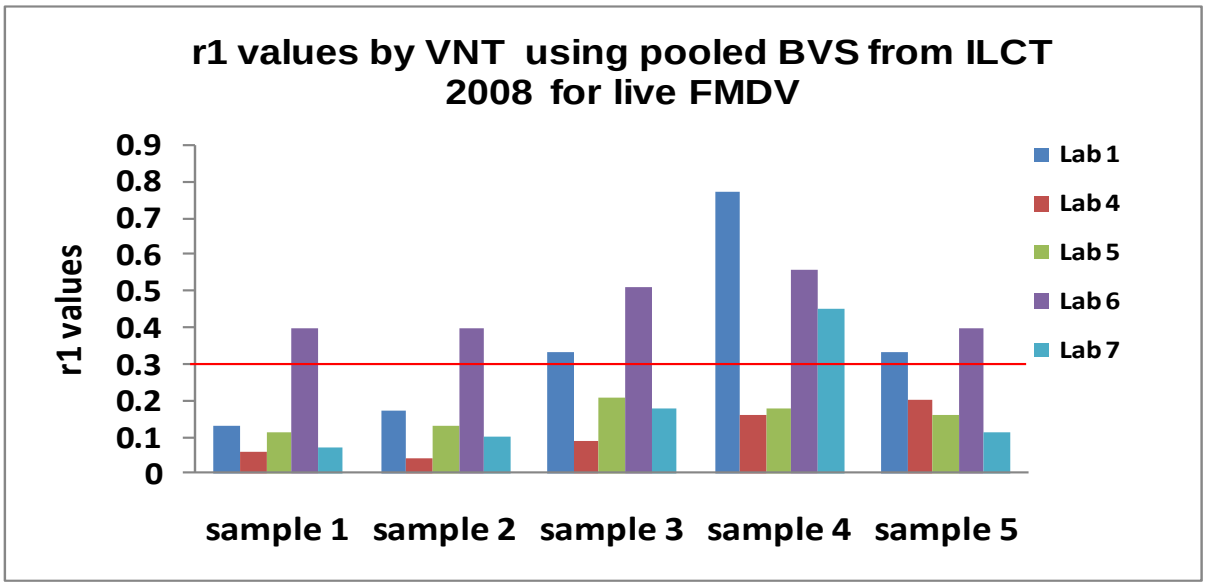
2.1 Vaccine Matching by serology

Background:
A vaccine matching inter-laboratory comparative test (ILCT) trial was organised for the first time in 2008 jointly by the FAO/OIE WRLFMD and EURL for FMD based at Pirbright Laboratory. It involved distribution of an A_{22} vaccine strain along with five bovine anti-A_{22} sera and five FMDV type A field isolates with r1 values ranging from high, moderate and low. Guinea-pig and rabbit anti-A_{22} sera were also distributed for ELISA testing. Eight laboratories were invited to participate. It was clear from these early results that outputs from the participating laboratories was variable. For 2009, it was decided to extend the study by supplying additional viruses to be matched and by using pooled BVS only. Four more (twelve in total) laboratories were invited to participate and eleven agreed to do so. All were encouraged to carry out the tests using their own methodology as well as specific methods supplied by WRLFMD. This initiative was subject to delays in obtaining licenses and transporting live FMDV samples and consequently the exercise was not completed until early 2011.

Results:
Results from ten participants were received by 2011 and they were decoded and collated. The analysis of the results received suggested that the outputs from different laboratories showed improvement compared to the results obtained in 2008 studies, where no single laboratory showed comparable results for all 5 samples either by VNT for the live virus panel or by LPBE for the inactivated panel. For the results from the 2009-2011 exercise, comparable results for all nine samples were observed in four out of eight labs testing live virus panels using LPBE and/or VNT and three out of four labs testing inactivated samples using LPBE, respectively. The overall interpretations were consistent from seven out of ten laboratories. This improvement is probably be due to the harmonistaion of methods enabled by the distribution of detailed protocols for both VNT and LPBE from WRLFMD to all the participants at the time of sending the samples.
The results so far therefore, demonstrate that the ability of network laboratories to carry out independent vaccine matching testing and to produce r1 values is improving and is becoming harmonised but still needs further improvement.

Figure 1. r_1 values using pooled BVS generated by participants from FMD vaccine matching ILCT 2008 by VNT (a) on the live virus and LPBE (b) on the inactivated virus

a.



b.

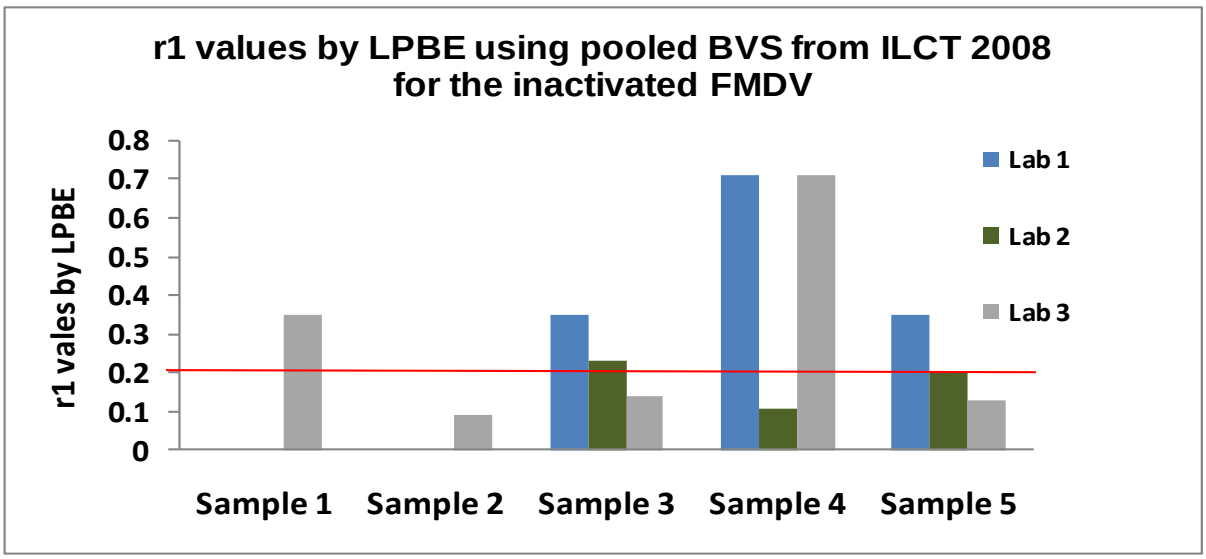
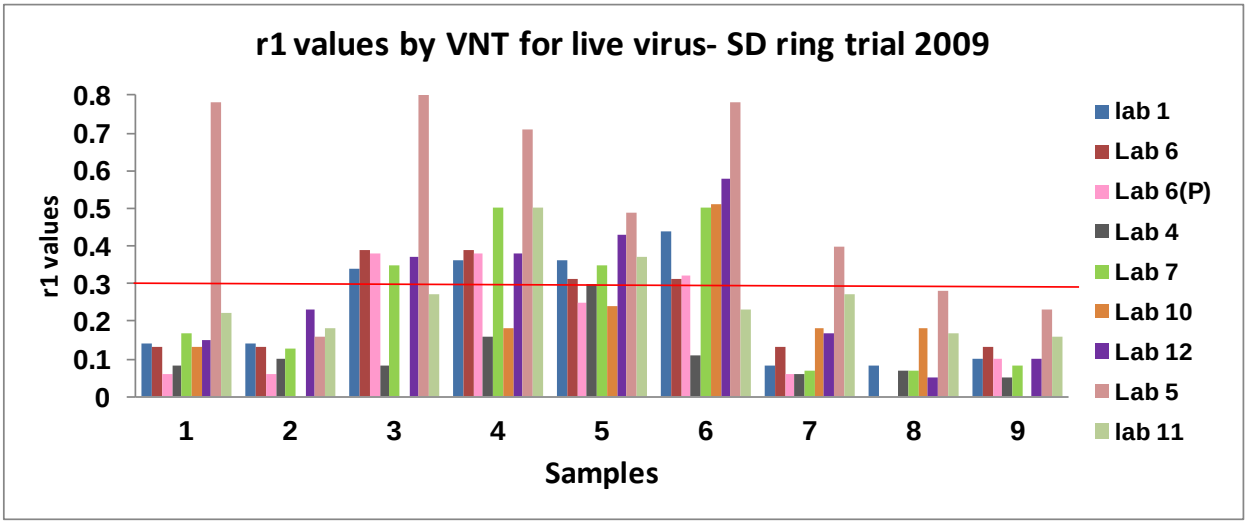
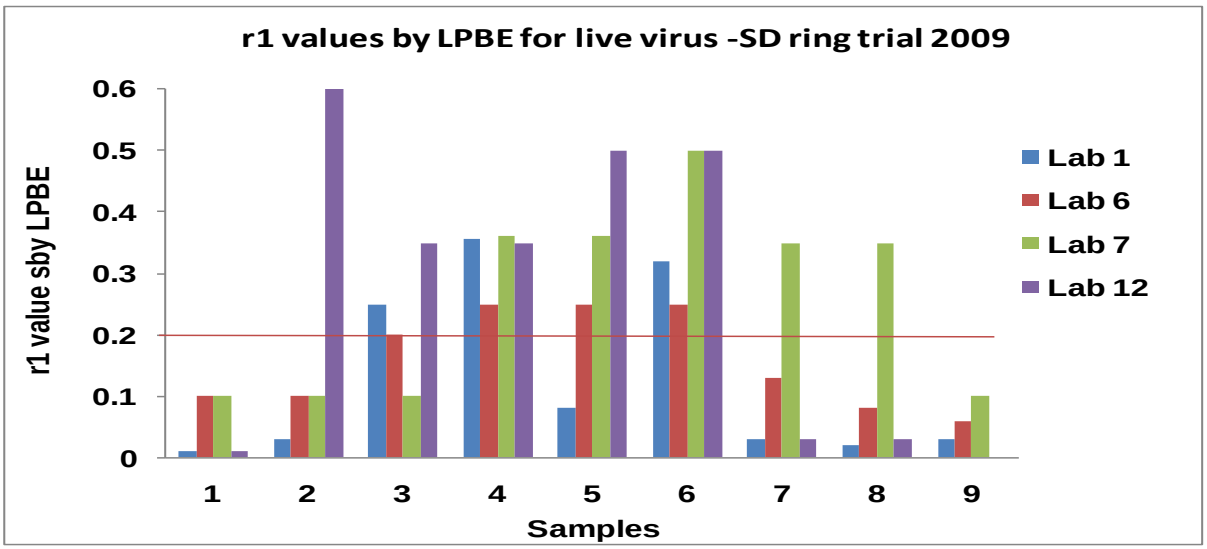


Figure 2. r_1 values using pooled BVS generated by participants from FMD vaccine matching ILCT 2009/2010 for live virus panel by VNT (a) and LPBE (b) and for BEI inactivated virus panel by LPBE (c)

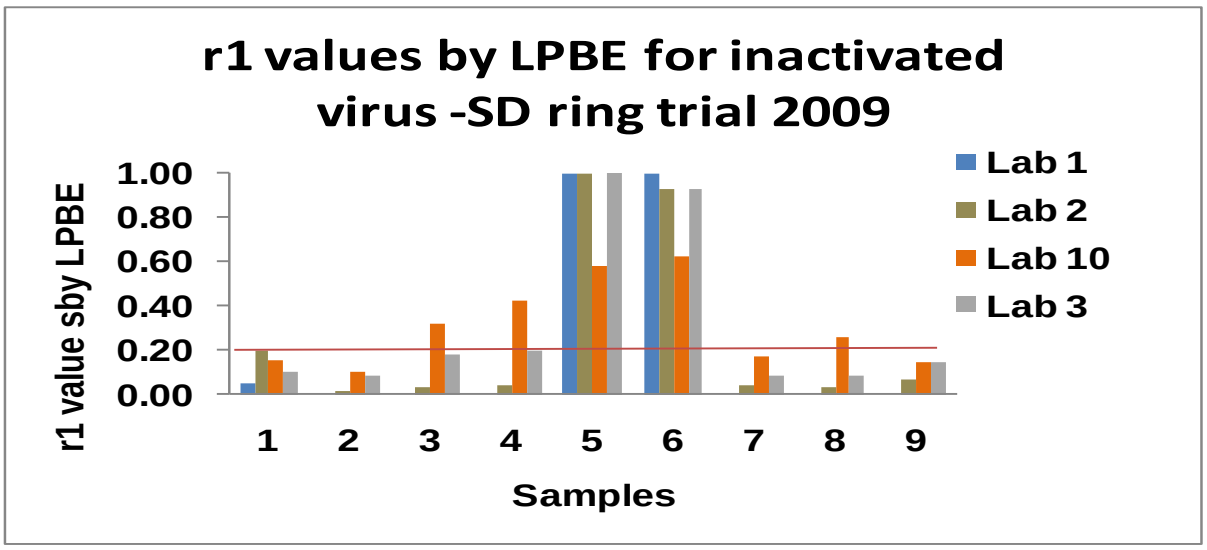
a.


r1 values by VNT for live virus- SD ring trial 2009
r1 values
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1
2
3
4
5
6
7
8
9
Samples
lab 1
Lab 6
Lab 6(P)
Lab 4
Lab 7
Lab 10
Lab 12
Lab 5
lab 11

b.


r1 values by LPBE for live virus -SD ring trial 2009
r1 value sby LPBE
0.6
0.5
0.4
0.3
0.2
0.1
0
1
2
3
4
5
6
7
8
9
Samples
Lab 1
Lab 6
Lab 7
Lab 12

c.


r1 values by LPBE for inactivated virus -SD ring trial 2009
r1 value sby LPBE
1.00
0.80
0.60
0.40
0.20
0.00
1
2
3
4
5
6
7
8
9
Samples
Lab 1
Lab 2
Lab 10
Lab 3

2.2 Virus isolation and serology

2.2.1. Proficiency testing study (PTS) organised by WRLFMD/EURLFMD-SVD

During 2011, the European Community Reference Laboratories for FMD and SVD, in association with WRLFMD, organised a round of inter-laboratory proficiency testing to help quality assure FMD and SVD diagnosis. The first priority was to supply proficiency panels to member states of the EU and of the EUFMD, but the panels were also made available more widely, including targeting of the OIE/FAO FMD Network Laboratories.

The test purposes evaluated in this PTS were outbreak detection by virus and virus genome detection and diagnosis by serology. The serology panel therefore comprised samples for testing after both vaccination and non-vaccination. All samples were analysed sufficiently prior to selection to ensure that they would give consistent results in tests by index methods. One panel included live virus so that virus isolation testing could be evaluated. Virus in other panels was inactivated so that they can be evaluated in laboratories that do not work at the highest containment levels.

Eighty labs from seventy six countries were invited to take part in this study supported by the EC and the EUFMD. Of the 58 labs that agreed to participate, 26 labs were from EU member countries; 32 labs from Non-EU countries. Participants were sent a package containing uniquely coded and labelled samples as described below. The aim of the exercise was to complete a proficiency testing study for virology and serology diagnosis for FMD and SVD during 2011. Particular tests were not specified, but labs were invited to select tests and interpret results based upon:

1. Virus detection – as if samples were from suspected FMD/SVD outbreak cases.
2. Serology - as if these serum samples were from FMD/SVD suspected cases with possible O_1 Manisa vaccination history.

Participants were asked to give results for individual tests on each sample and where multiple tests were used, an overall result for each sample. Overall interpretation for each suspect case under investigation for panels 1 was also requested. Participants were also requested to provide information on national surveillance for FMD and/or SVD. This was to enable a clear picture of the scale of activities, the state of QA accreditation and the tests actually being used by participants during 2010/2011 to be compiled.

Results of this study will be presented at the joint meeting of FMD/SVD national reference laboratory's expected to be held in Brussels, Belgium in May 2012 and a feedback letter including the overall results from all participants for 4 panels, comments and recommendations on each test for each panel will be prepared and sent to each laboratory.

Details of Panels

Panel 1: infectious material from 2 cases of suspected vesicular disease for virus detection

Case 1a: 2 epithelial and 1 faecal suspension samples from pigs in a herd affected with a vesicular condition.

Case 1b: 2 epithelial and 1 faecal suspension samples from pigs in a herd affected with a vesicular condition.

Panel 2: non-infectious material[1] from cattle or pigs for virus genome/antigen detection by RT-PCR and/or Ag-ELISA

6 samples from cattle or pigs, with each originating from a different case of a herd with a vesicular condition.

Panel 3: non-infectious material[2] for FMD serology
6 sera from suspected FMD sheep for serology diagnosis. Some of the animals were vaccinated with O1 Manisa vaccine.
Panel 4: non-infectious material[2] for SVD serology
6 sera from pigs for SVD post outbreak surveillance.

[1] Samples were inactivated using Binary ethyleneimine and inocuity tested by two passages in primary bovine thyroid cells (for FMDV) or RS cells (for SVDV) with negative results. [2] Sera were inocuity tested by two passages in primary bovine thyroid cells (for FMDV) or RS cells (for SVDV) with negative results and then inactivated using Binary ethyleneimine to kill any live virus not detected by inocuity testing.

Summary of the exercise

1. Eighty labs from 76 countries were invited to take part in this study and sixty labs that agreed to participate.
2. Twenty three, 52, 57 and 38 labs required and received panel 1, panel 2, panel 3 and panel 4, respectively.
3. Information was collected on tests in use, strains of virus used in tests, extent of ongoing testing, and quality accreditation status of tests. The decoding, collating and analysing of the results received is in progress while expecting some labs to return their results before the end of April 2012.

2.2.2. South American initiatives on laboratory testing harmonization

During 2011, PANAFTOSA continued its annual rounds of inter-laboratory test for FMD diagnosis and sero-surveillance. This involved panels of materials for testing by NSP/NCP-serology and PCR typing. 14 laboratories are participating and progress so far includes

- Sending letter of invitation
- Details of the exercise
- Letter of acceptance
- Delivery of materials
    - 16 test sera distributed
    - 6 sera non reactive
    - 1 serum weak reactive
    - 9 sera strong reactive

Laboratories will be given individual feedback on their results including observations and non-conformities according to predefined criteria. Laboratories with non-conformities will receive technical cooperation to identify and correct potential problems.

2.3. Training

2.3.1 WRLFMD, IAH Pirbright laboratory hosted its annual 2-week FMDV / SVDV diagnostics training course for overseas scientists between 16/5/11-27/5/11

Diagnostic Course Attendees:

- Hanan MOHAMED AHMED Ministry of Animal Resources - Sudan
- Yiltawe Simwal WUNGAK FMD National Veterinary Research Centre - Nigeria
- Daniel AFONIA ARRIAH, Russia
- Inas HABIBALLA Central Vet Research Laboratory - Sudan
- David PULFORD Investigation and Diagnostic Centre - New Zealand
- Martin ESAU National Animal Disease Diagnostics & Epidemiology Centre, Uganda

A number of IAH Pirbright staff also gave key lectures in the Defra Notifiable Diseases Course held at IAH Pirbright on the 30th June and 1st July. Notifiable Diseases Attendees: Approx 30 animal health officers attended.

OIE/FAO FMD Reference Laboratory Network- vaccine matching training workshop November 2011

WRLFMD organised and conducted an FMD vaccine matching training course/workshop for members of the Network held at Pirbright laboratory at 7-11th November 2011

Course/workshop Attendees :

• Eunice Cherono Chepkwony	FMD Lab, NVQCL, Embakasi	Kenya
• Kenneth Kipkurui Ketter	FMD Lab, NVQCL, Embakasi	Kenya
• Tom Willems	CODA-CERVA-VAR	Belgium
• Svetlana Krenenchugskaya	ARRIAH	Russia
• Daniel Afonina	ARRIAH	Russia
• Hussaini Gulak Ularamu	National Vet Research Institute	Nigeria
• Kingkarn Boonsuya Seeyo	National Institute of Animal Health	Thailand
• Gaolathe Thobokwe	SSARL, BVI	Botswana

Period training

During the year a number of overseas laboratory staff attended for various periods of training.

- Professor Wataru Yamazaki from the University of Miyazaki, Japan visited the IAH for 3 months (Aug/2011-Oct/2011) to participate in a collaborative project to develop LAMP assays for FMDV.
- JiJin He from Lanzhou Veterinary Research Institute visited Pirbright for 2 months. He participated in full-genome sequencing studies of Asian FMD viruses as part of EPIZONE (internal call project: FMDV in Asia)

- Annebel De Vleeschauwer from Department of Virology, CODA-CERVA-VAR, Belgium visited IAH for 4 weeks. She undertook training in full genome sequencing of viral escape mutants.
- Don King participated as a faculty member on a 1-week training course at Sokoine University of Agriculture, Tanzania. The title of the course was "One Health: Understanding human and veterinary diseases from molecular cell biology to successful interventions" and was sponsored by Carnegie Corporation of NY, USA and the American Society for Cell Biology.

2.3.2 SENASA:

DATE	SUBJECT OF TRAINING	SUPPLIER OF TRAINING	RECIPIENT OF TRAINING
May-July	FMDV vaccine control	SENASA	SENACSA Paraguay (4)
	FMDV isolation and diagnosis		
May	Herd Immunity-ELISA	SENASA	SENASA Peru (1)
August	FMDV isolation and diagnosis	SENASA	National Institute of Hygiene Ecuador (1)
September	FMDV isolation and diagnosis	SENASA	SENACSA Paraguay (1)
October	FMD vaccine control	SENASA	SENASAG Bolivia (2)

- Proficiency tests organized:
  - LP ELISA "r1" value ring test Serotype A
    - CEVAN-Argentina
    - IAH-P
    - VAR-Belgium
    - Onderstepoort Veterinary Institute-South Africa

Reagents supplied:

- **Inactivated virus**:
  A24 Cruzeiro
  A Argentina 2001
  A 87
  A 2000

- **Bovine pool sera:**
  Control Reference Sera
  High and medium LP ELISA titer pool sera

2.3.3 PANAFTOSA:

Date	Venue of training	Subject of training	Supplier of the training	Recipient of the training
May 23th to June 3rd	PANAFTOSA	Cell culture production and maintenance of cell lines	PANAFTOSA	Professionals from South American FMD laboratories
June 6th to 10th	PANAFTOSA	Use of I-ELISA/EITB for active surveillance	PANAFTOSA	Professionals from South American FMD laboratories
July 4th to 15th.	PANAFTOSA	Vesicular disease diagnosis and differential diagnosis by PCR	PANAFTOSA	Professionals from South American FMD laboratories
July 18th to 22nd	PANAFTOSA	Laboratory Biorisk Management	PANAFTOSA	Professionals from South American FMD laboratories
August 1th to 10th.	PANAFTOSA	LPBE for FMD antibody detection	PANAFTOSA	Professionals from South American FMD laboratories
August 15th to 19th.	PANAFTOSA	Use of control charts for laboratory process monitoring	PANAFTOSA	Professionals from South American FMD laboratories

2.3.4 PIADC-FADDL:

- Delivered reference standards, controls, and proficiency panels (CSF & FMD rRT-PCR)
    - 40 laboratories
- Deployed safe recombinant bacteriophage as controls for RP, ASF, LSD, CSF, FMD.
- 2010 Proficiency Test Reports completed and distributed to 40 Labs
    - Implemented an automated Results Collection System (PTRCS).
- Diagnostic training
    - FMD and CSF Dx
    - Rinderpest & ASF (Proficiency tested for negative cohort study)
- Deployed high-throughput methodologies (FMD & CSF)
    - 20 laboratories

2.3.5 RRLSEA:

Proficiency tests organised		
Type of test or trial	**Number of participants**	**Results**
1. Interlaboratory comparison on FMD typing and serology test organized by RRL, Pakchong and OIE-SRC during March – August 2011	17 (Laboratories within Thailand = 8 South East Asia laboratory = 9)	Inter-lab reports have already distributed to all participating labs
2. FMD and SVD PTS 2011 -	Participating laboratory in PT	Passed

Panel 2 Antigen Detection ELISA and Panel-3 Serology test by LP ELISA and NSP test - Organized by WRL, Pirbright laboratory, UK	scheme , organized by WRL, UK	

Training given or received				
Date	Venue of training	Subject of training	Supplier of the training	Recipient of the training
22-23 February 2011	National Institute of Animal Health, Thailand	Internal Audit for ISO 17025:2005	Department of Livestock Development, Thailand	Dr,Kingkarn Boonsuya Seeyo, Mrs. Nongnuch Petklang, Ms. Maliwan Naowsungnern, Mr.Surachai Kitiratch
8-10 March 2011	National Institute of Animal Health, Thailand	Statistic for Analysis testing	Department of Livestock Development, Thailand	Dr.Panithan Thongtha, Ms. Sopha Singclebuth, Ms. Julanee Noumjith, Ms. Janya Samanit, Mr.Surachai Kitiratch
19 April 2011	National Institute of Animal Health, Thailand	Analysis of Instrument Certification	Department of Livestock Development, Thailand	Dr.Kingkarn Boonsuya Seeyo, Ms. Sopha Singclebuth, Ms .Julanee munjith, Ms. Janya smanit, Mrs Ratthanee Thongtha
27 April 2011	National Institute of Animal Health, Thailand	Research Methodology	Department of Livestock Development, Thailand	Dr. Rompruke Udon, Dr. Dilok Ounplomma, Dr. Panithan Thongtha
25-27 April 2011	National Institute of Animal Health, Thailand	Avian Influenza testing by Real-time PCR	Department of Livestock Development, Thailand	Dr. Panithan Thongtha, Ms. Julanee Noumjith
10-11 May 2011	National Institute of Animal Health, Thailand	Knowledge Management	Department of Livestock Development, Thailand	Dr.Kingkarn Boonsuya Seeyo, Mrs Ratthanee Thongtha, Ms. Janya smanit, Ms. Sopha Singclebuth, Ms. Sasikorn Sangsanga
9-10 June2011	Yunnan Animal Science and Veterinary Institute P.R. China	Laboratory training course on “Foot and Mouth Disease in Cattle”	FAO, ADB and ASVI	Dr,Kingkarn Boonsuya Seeyo, Veterinary Office
23-24 June 2011	National Institute of Animal Health (NIAH), Thailand	Biosafety and Biosercurity in Laboratory	Department of Livestock Development, Thailand	Dr.Kingkarn Boonsuya Seeyo, Ms. Shalinee Deeplang, Mr. Paisan Ritthison
29 August-2 Septembe r 2011	Regional Reference Laboratory for FMD, Pakchong , Thailand	The exchange of the diagnostic and immune techniques for transboundary animals disease	Thailand International Development Cooperation Agency (TICA)	Mr. Li Le, Mr. Xin Aiguo, Ms. Liao Defang, Miao Haisheng and HuQi; from P.R. China

7-11 November 2011	Institute for Animal Health Pirbright Laboratory, UK	Foot and Mouth Disease(FMD) Vaccine Matching Technology	Department of Livestock Development, Thailand	Dr,Kingkarn Boonsuya Seeyo, Veterinary Office, Thailand
21-25 November 2011	Australia Animal Health Laboratory(AAHL) , Australia	Laboratory Engineering and Equipment Maintenance Training	USAID CSIRO and FAO collaboration project.	Mr. Charouy Yothakaew , Machanic Engineer , RRLSEA, Thailand

2.3.6 ARRIAH:

Date	Venue of training	Subject of training	Supplier of the training	Recipient of the training
17-28 May 2011	UK	FMD diagnostics	Institute for Animal Health (Pirbright)	Daniel AFONIA
16-22 June 2011	Belarus	FMD diagnostics	ARRIAH	Belarusian State Veterinary Centre (Minsk)

2.3.7 LVRI -China:

Date	Venue of training	Subject of training	Supplier of the training	Recipient of the training
19-22/07	Pyongyang, DPRK	FAO assistance DPRK Program, training on laboratory diagnostic techniques of FMD	FAO,CNFMDRL	DPRK
15-25/10	Beijing, China	Workshop on FMD Control Technologies for CAREC Countries	MoA of China, CNFMDRL	Mongolia, Kazakhstan, Tajikistan, Kyrghizstan,Uzbekistan

2.3.8 PDFMD- India:

Date	Venue of training	Subject of training	Supplier of the training	Recipient of the training
18/01/2011 to 22/01/2011	**Central FMD Laboratory, PDFMD, Mukteswar**	LPBELISA, DIVA and Sandwich ELISA	PDFMD	FMD Regional centre, Maharashtra, India
21/02/2011 to 05/03/2011	Central laboratory, Mukteswar	LPBELISA, DIVA and Sandwich ELISA	PDFMD	NIAH, Bagphat, India
22/03/2011 to 28/03/2011	Central laboratory, Mukteswar	LPBELISA, DIVA and Sandwich ELISA	PDFMD	FMD Regional centre, Assam, India

2/5/11 to 7/5/11	Central laboratory, Mukteswar	LPBELISA, DIVA and Sandwich ELISA	PDFMD	Animal virus laboratory, Sri Lanka
2/5/11 to 7/5/11	Central laboratory, Mukteswar	LPBELISA, DIVA and Sandwich ELISA	PDFMD	National centre for animal health, Bhutan
2/5/11 to 7/5/11	Central laboratory, Mukteswar	LPBELISA, DIVA and Sandwich ELISA	PDFMD	National Agricultural research center, Pakistan
2/5/11 to 7/5/11	Central laboratory, Mukteswar	LPBELISA, DIVA and Sandwich ELISA	PDFMD	Department of livestock services, Nepal (2)
2/5/11 to 7/5/11	Central laboratory, Mukteswar	LPBELISA, DIVA and Sandwich ELISA	PDFMD	Central veterinary investigation center, Sri Lanka (1)
2/5/11 to 7/5/11	Central laboratory, Mukteswar	LPBELISA, DIVA and Sandwich ELISA	PDFMD	RRC on FMD, Hisar, India
2/5/11 to 7/5/11	Central laboratory, Mukteswar	LPBELISA, DIVA and Sandwich ELISA	PDFMD	National center for aninmal health, Bhutan
20/6/11 to 25/6/11	Central laboratory, Mukteswar	LPBELISA, DIVA and Sandwich ELISA	PDFMD	Livestock research institute, Bangladesh
20/6/11 to 25/6/11	Central laboratory, Mukteswar	LPBELISA, DIVA and Sandwich ELISA	PDFMD	FMD vaccine production laboratory, Bangladesh
20/6/11 to 25/6/11	Central laboratory, Mukteswar	LPBELISA, DIVA and Sandwich ELISA	PDFMD	National FMD and TAD laboratory , Nepal
18/07/11 to 23/07/11	Central laboratory, Mukteswar	LPBELISA, DIVA and Sandwich ELISA	PDFMD	FMD Regional centre, Maharashtra, India (2)
25/08/11 to 30/08/11	Central laboratory, Mukteswar	LPBELISA, DIVA and Sandwich ELISA	PDFMD	CARI, A & N Island, India(2)
29/08/11 to 3/09/11	Central laboratory, Mukteswar	LPBELISA, DIVA and Sandwich ELISA	PDFMD	FMD Network Unit, Gujarat, India(2)
27/10/11 to 31/10/11	Central laboratory, Mukteswar	LPBELISA, DIVA and Sandwich ELISA	PDFMD	FMD Network Unit, Nagaland, India
12/12/11 to 15/12/11	Central laboratory, Mukteswar	LPBELISA, DIVA and Sandwich ELISA	PDFMD	FMD Network Unit, Kerala, India(2)

2.4 Reagent and test kit supply

2.4.1 WRLFMD:

For the period January to March, viruses, reagents or kits were sent to Egypt, Japan, India, Nepal, Jordan, Bulgaria, Uganda, Kenya, Germany, Bangladesh, Vietnam and Tunisia.

For the period April to June, viruses, reagents or kits were sent to India, Rwanda, Vietnam, Egypt, Denmark, Kyrgyzstan, USA, Mongolia, UAE, Morocco, Kazakhstan, Tanzania, Sweden, Turkey and Israel.

For the period July to September, viruses, reagents or kits were sent to Thailand, Zimbabwe, Qatar, Belarus, Latvia, Indonesia, Nigeria, Pakistan, Belgium, Kenya and China

For the period October to December, viruses, diagnostic reagents, antigen or antibody detection ELISA kits were sent to Czech Republic, Poland, Bhutan, Brasil, Canada, Israel, Japan, Malaysia, Singapore, Taiwan, Uganda and Vietnam.

- OIE Reference sera are available for serotypes O, A, Asia 1 and C. Rabbit and guinea pig antisera against O1 Manisa, SAT1, SAT 2 and SAT 3 are available for strain differentiation studies and other serology tests. Rabbit and guinea pig antisera against A22 Iraq, A Iran and SAT2 Eritrea are also available for strain differentiation by Liquid Phase Blocking Elisa. Bovine sera against O1 Manisa is also available.

WRLFMD: Reagents Supplied

Reagents produced	Supplied to EU Member States	Supplied to Other Countries
Rabbit and Guinea Pig Antisera	43ml	70ml
FMD Reference sera	34ml	13ml
Inactivated virus	83ml	103ml
Live virus	6ml	None
Antigen ELISA kits	3	28
Antibody ELISA kits	1	71

2.4.2 SENASA: Reagents Supplied/Received

Type of reagent	Quantity	Supplier of the reagent	Recipient of the reagent
Hyper-immune guinea pig serum	64 vials x 1ml	SENASA Argentina	Argentina, Paraguay, Ecuador
Vaccine strains	8 vials x 1ml	SENASA Argentina	Argentina
LP-ELISA kit	60 kits	CEVAN Argentina	Argentina, Brazil
Typing ELISA kit	11	CEVAN Argentina	Argentina, Brazil
Hemolisim	10 vials x 1ml	SENASA Argentina	Ecuador

Inactivated FMDV	132 ml	SENASA Argentina	Argentina, Ecuador, Belgium, Germany, Southafrica
Vaccinated Bovine sera	216 ml	SENASA Argentina	Argentina, Belgium, Germany, South Africa, UK

2.4.3 PANAFTOSA: Reagents Supplied/Received

National Laboratories of the South American countries by producing, controlling and distributing reference reagents for their diagnosis, sero-surveillance and vaccine control activities.

Sets and Biologicals

Tests	Argentina	Bolivia	Brasil	Chile	Colombia	Paraguay	Perú	Uruguay	Venezuela	Total
ELISA-SI (FMD/VSV)	1.400		700		3.850	2.100	350	700		**9.100**
HIPERIMMUNE SERA(FMD/VSV)			600						6.000	**6.600**
Lp-ELISA Seroepidemiology FMD	2.000	3.000	8.000	3.000			4.000	34.000		**54.000**
Lp-ELISA Seroepidemiology VSV	20.000		5.000	4.000		4.000		2.000		**35.000**
Lp-ELISA Vaccine control (FMD)	16.000		272.000		56.000	54.000				**398.000**
Lp-ELISA Vaccine Control (VSV)					3.000					**3.000**
IDGA-3D (FMD)			7.000				5.000	26.000		**38.000**
IDGA-BT			4.000							**4.000**
C- ELISA - BT			4.000			2.000				**6.000**
C- ELISA IBR						2.000				**2.000**

Kits

Tests	Argentina	Bolivia	Brasil	Chile	Colombia	Ecuador	Paraguay	Peru	Uruguay	Total
I-ELISA 3ABC	7.920	33.440	228.680	3.520	24.640	1.760	74.800	7.040	38.720	**421.520**
EITB	1.200	1.600	21.000	400	3.600	400	8.000	800	2.600	**39.600**

2.4.4 RRLSEA: Pakchong Reagents Supplied/Received

Type of reagent	Quantity	Supplier of the reagent	Recipient of the reagent
ELISA reagent 1. Rabbit trapping antibody type O, A , Asia1 2. Guinea pig detecting antibody type O, A, Asia1 3. Inactivated antigen type O, A, Asia1 4. Control serum for strong , weak and negative	39 sets (1 set can test ~ 1000 samples)	Regional reference Laboratory for FMD, Pakchong, Thailand	FMD laboratory within Thailand and South East Asia member countries under the SEACFMD control campaign

2.4.5 ARRIAH: Russia Reagents Supplied/Received

Type of reagent	Quantity	Supplier of the reagent	Recipient of the reagent
FMDV antisera	35 ml	ARRIAH	Azerbaijan, Kazakhstan
FMDV antigen	35 ml	ARRIAH	Azerbaijan, Kazakhstan
FMDV antibody kits	901	ARRIAH	Azerbaijan, Armenia, Kazakhstan, Syria, Belarus
FMDV antigen kits	20	ARRIAH	Azerbaijan, Ukraine
FMD vaccinated cattle sera	21000 ml	ARRIAH	Belarus, UK
FMD recovered cattle sera	1200 ml	ARRIAH	Poland

2.4.6 LVRI China

Type of reagent	Quantity	Supplier of the reagent	Recipient of the reagent
LPB-ELISA Kit	~8000 kits (3000 kits for type O, 3000 kits for Asia1 and 2000 kits for type A)	CNFMDRL	provincial Animal CDC lab in China
NSP-3ABC-ELISA kit	~900 kits	CNFMDRL	provincial Animal CDC lab in China
IHA Antigen(for type O)	45,000 ampoules of 5ml for each, which can detect 11,250,000 serum specimens.	CNFMDRL	provincial Animal CDC lab in China
multiple RT-PCR Kit	~500 kits used for 10,000 suspected samples.	CNFMDRL	provincial Animal CDC lab in China
IS-ELISA kit	~20 kits	CNFMDRL	used only in the CNFMDRL

2.4.7 PDFMD-India

Type of reagent	Quantity	Supplier of the reagent	Recipient of the reagent
Reagents for LPBELISA	2000	PDFMD	AICRP-FMD Center, Pune, India
Reagents for LPBELISA	5000	PDFMD	FMD Regional station, Mathura, India
Reagents for LPBELISA	8000	PDFMD	FMD Regional station, Hisar, India
Reagents for LPBELISA	1800	PDFMD	FMD Network unit, Kerala, India
Reagents for LPBELISA	500	PDFMD	NIAH, India
Reagents for LPBELISA	4000	PDFMD	AICRP-FMD Network unit, India
Reagents for LPBELISA	1500	PDFMD	FMD Regional station, Assam, India
Reagents for LPBELISA	1100	PDFMD	FMD Network unit, Nagaland, India
Reagents for LPBELISA	5000	PDFMD	FMD Network unit, Hyderabad, India
Reagents for LPBELISA	2000	PDFMD	FMD Network unit, HP, India
Reagents for LPBELISA	3000	PDFMD	Sri Lanka
Reagents for LPBELISA	3000	PDFMD	Pakistan
Reagents for LPBELISA	3000	PDFMD	Bhutan
Reagents for LPBELISA	3000	PDFMD	Nepal
Reagents for LPBELISA	6000	PDFMD	FMD Regional station, Hisar, India
Reagents for LPBELISA	5000	PDFMD	FMD Regional station, Pune, India
Reagents for LPBELISA	5600	PDFMD	FMD Network unit, Kerala, India
Reagents for LPBELISA	1600	PDFMD	FMD Regional station, West Bengal, India
Reagents for LPBELISA	1000	PDFMD	Delhi(Intervet)
Reagents for LPBELISA	3000	PDFMD	Bangladesh
Reagents for LPBELISA	3000	PDFMD	Bangladesh
Reagents for LPBELISA	6000	PDFMD	FMD Regional station, Bangalore, India
Reagents for LPBELISA	3000	PDFMD	FMD Regional station, Mathura, India
Reagents for LPBELISA	2000	PDFMD	FMD Regional station, Bangalore, India
Reagents for LPBELISA	2500	PDFMD	FMD Network unit, Bhopal , India
Reagents for LPBELISA	1200	PDFMD	FMD Network unit, Tripura, India
Reagents for LPBELISA	2000	PDFMD	Andaman & Nicobar, India
Reagents for LPBELISA	2000	PDFMD	FMD Network unit, Ahmedeabad
Reagents for LPBELISA	5000	PDFMD	FMD Regional station, Hyderabad
Reagents for LPBELISA	2000	PDFMD	Bagpat, India
Reagents for LPBELISA	1200	PDFMD	FMD Network unit, Manipur
Reagents for LPBELISA	2000	PDFMD	FMD Network unit, Nagaland
Reagents for LPBELISA	2000	PDFMD	FMD Network unit, Shimla
Reagents for LPBELISA	10000	PDFMD	FMD Network unit, Jalandhar
Reagents for LPBELISA	2000	PDFMD	FMD Network unit, Kerala
Reagents for LPBELISA	5000	PDFMD	Hyderabad(IIL) , India
Reagents for LPBELISA	4000	PDFMD	FMD Network unit, Patna
Reagents for LPBELISA	12000	PDFMD	FMD Network unit, Kerala
Reagents for LPBELISA	8000	PDFMD	FMD Regional station, Hyderabad
Reagents for LPBELISA	5000	PDFMD	FMD Regional station, Pune
Reagents for LPBELISA	8000	PDFMD	FMD Regional station, Ranipet
Reagents for LPBELISA	8000	PDFMD	FMD Regional station, Hisar, India
Reagents for Sandwich ELISA	500	PDFMD	FMD Regional station, Bangalore, India
Reagents for Sandwich ELISA	500	PDFMD	FMD Network unit, Kerala, India

Reagents for Sandwich ELISA	500	PDFMD	FMD Regional station, Ranipet, India
Reagents for Sandwich ELISA	500	PDFMD	NRDDL, India
Reagents for Sandwich ELISA	500	PDFMD	FMD Regional station, Assam, India
Reagents for Sandwich ELISA	500	PDFMD	Sri Lanka
Reagents for Sandwich ELISA	500	PDFMD	Pakistan
Reagents for Sandwich ELISA	500	PDFMD	Bhutan
Reagents for Sandwich ELISA	500	PDFMD	Nepal
Reagents for Sandwich ELISA	500	PDFMD	FMD Network unit, Kerala, India
Reagents for Sandwich ELISA	500	PDFMD	Pune (Intervet) , India
Reagents for Sandwich ELISA	500	PDFMD	Delhi(Intervet) , India
Reagents for Sandwich ELISA	500	PDFMD	Bangladesh
Reagents for Sandwich ELISA	500	PDFMD	Bangladesh
Reagents for Sandwich ELISA	500	PDFMD	Bhopal Network unit, India
Reagents for Sandwich ELISA	500	PDFMD	FMD Network unit, Tripura, India
Reagents for Sandwich ELISA	500	PDFMD	Andaman & Nicobar, India
Reagents for Sandwich ELISA	500	PDFMD	FMD Network unit, Manipur, India
Reagents for Sandwich ELISA	500	PDFMD	FMD Network unit, Kerala, India
Reagents for Sandwich ELISA	500	PDFMD	FMD Network unit, Kerala, India
Reagents for Sandwich ELISA	500	PDFMD	FMD Regional station, A.P, India
Reagents for DIVA	3000	PDFMD	IAHE&VB, Bangalore, India
Reagents for DIVA	2700	PDFMD	RDDL, Jalandhar, India
Reagents for DIVA	1800	PDFMD	FMD Regional station, Hyderabad, India
Reagents for DIVA	1800	PDFMD	FMD Network unit, HP
Reagents for DIVA	900	PDFMD	Sri Lanka
Reagents for DIVA	900	PDFMD	Pakistan
Reagents for DIVA	900	PDFMD	Bhutan
Reagents for DIVA	900	PDFMD	Nepal
Reagents for DIVA	3600	PDFMD	FMD Regional station, Hisar, India
Reagents for DIVA	1800	PDFMD	FMD Regional station, Pune, India
Reagents for DIVA	1800	PDFMD	FMD Network unit, Kerala, India
Reagents for DIVA	1260	PDFMD	FMD Regional station, West Bengal, India
Reagents for DIVA	900	PDFMD	Bangladesh
Reagents for DIVA	900	PDFMD	Bangladesh
Reagents for DIVA	1800	PDFMD	FMD Regional station, Pune, India
Reagents for DIVA	1800	PDFMD	FMD Regional station, Bangalore, India
Reagents for DIVA	500	PDFMD	FMD Regional station, Mathura, India
Reagents for DIVA	1800	PDFMD	FMD Network unit, Bhopal , India
Reagents for DIVA	900	PDFMD	FMD Network unit, Tripura, India
Reagents for DIVA	1800	PDFMD	Andaman & Nicobar, India
Reagents for DIVA	2340	PDFMD	FMD Network unit, Ahmadabad, India
Reagents for DIVA	900	PDFMD	FMD Network unit, Manipur
Reagents for DIVA	450	PDFMD	FMD Network unit, Nagaland
Reagents for DIVA	900	PDFMD	Bhutan
Reagents for DIVA	1800	PDFMD	FMD Network unit, Shimla, India
Reagents for DIVA	1800	PDFMD	FMD Network unit, Jalandhar, India
Reagents for DIVA	900	PDFMD	FMD Network unit, Kerala, India
Reagents for DIVA	900	PDFMD	FMD Regional station, Hyderabad, India
Reagents for DIVA	900	PDFMD	FMD Regional station, Pune, India
Reagents for DIVA	3600	PDFMD	FMD Regional station, Ranipet, India

Reagents for DIVA	3600	PDFMD	FMD Network unit ,Patna, India

2.5. Collaborative Research

2.5.1. WRLFMD is a founder member of the Global FMD Research Alliance (GFRA) that seeks to bring together FMD researchers from around the world with the aim of developing recommendations on research priorities and collaborative research projects. A major initiative in 2010 was to further broaden membership of GFRA and to arrange a meeting to discuss the Immune response to FMD virus and vaccines. IAH organised and hosted this GFRA meeting which was held on 21st-22nd January, 2010 at the Pirbright Laboratory, UK.

Combating Infectious Diseases of Livestock for International Development (CIDLID)

The CIDLID research programme, launched on 15th February 2010, is a £13M+ investment from the Biotechnology and Biological Sciences Research Council (BBSRC) and the Department for International Development (DFID), with contributions from the Scottish Government. The initiative is made up of 16 projects which over the next four years will look at some of the most prevalent, damaging and costly diseases of livestock in developing countries. It involves collaborations with more than 20 overseas institutes to not only control or prevent these diseases but also to build scientific capacity at a local and national level within these countries. This will enable them to manage these diseases and apply new findings and technologies to other disease areas, in both livestock and humans.

There is more information about the CIDLID programme at the BBSRC and DFID web sites. The Institute for Animal Health is leading eight of the projects 2 of which are concerned with FMD:

- Improving the quality of FMD vaccines by understanding the correlation of vaccine-induced protection with humoral and cellular immune responses.
- Towards the strategic control of endemic foot-and-mouth disease in Africa: new techniques for a neglected problem.

The IAH FMD research groups and WRLFMD maintain close research links with a wide range of partner laboratories worldwide.
WRLFMD chaired the annual meeting of the European FMD/SVD National Reference Laboratories in Brussels, Belgium in May 2011.
WRLFMD organised, hosted and chaired the OIE/FAO FMD Reference Laboratories Network Meeting and vaccine matching workshop held at the IAH ,Pirbright, UK. November 2011.

The laboratory is engaged in a wide range of research and development and validation of virological and serological diagnostic tests and next generation FMD vaccines.

- Continuation of participation in/coordination of the following collaborative research projects on FMD sponsored by the European Commission: (i) EU Network of Excellence EPIZONE (http://www.epizone-eu.net/) (ii) Disconvac (http://fmddisconvac.net/).

- The EPIZONE project has funded work to develop and share full genome sequencing approaches with laboratories in Turkey, PR China, Denmark, Italy and Belgium.
- Staff members are continuing to participate in projects funded by the Welcome Trust (Southern African Centre for Infectious Disease Surveillance) which aim to improve FMD control in East and Southern Africa.
- Continued collaboration with ISZLER, Brescia, Italy, in developing new FMD diagnostic kits for Antigen and antibody detection and validation of the SPCE kit for FMDV type O, A and Asia 1.

2.5.2 SENASA

Collaborators	Purpose of collaboration	Outcomes
RIIDFA (SENASA, INTA, CEVAN, Biogenesis Bago)	Coordinated research and development actions in FMD to grant the status of country without FMD	- Development and optimization of alternative FMD vaccine quality and efficacy control methods - FMD virus transmission quantification in vaccinated and non vaccinated bovines - Cross protection evaluation in bovines between vaccine and heterologous strains - Real time PCR development for the rapid FMD diagnostics - Development and scale up production of diagnostic reagents for the FMD virus and its antibodies - Study of FMDV molecular evolution in Argentine outbreaks using A Argentina 2001 strain as model - Biosafety training program
7th Framework Programme UE FMD DISCONVAC	Development, enhancement and complementation of animal sparing, FMD vaccine based control strategies for free and endemic regions-	- WP2 Reduction and refinement of in vivo vaccine quality test by in vitro methods - WP3 Assessment and improvement of heterologous protection by FMD vaccines - WP4 Development of vaccines and alternatives (antivirals) with rapid onset of immunity and based on safer production methods
IAEA (International Atomic Energy Agency)	FMD control	- FMD vaccine quality control

2.5.3 ARRIAH

In the framework of the Interstate Target Eurasian Economic Community (EurAsEC) programme «Innovative biotechnologies» there is development of test system Real time PCR for differential diagnosis of foot and mouth disease and swine vesicular disease. Development of test system Real time PCR for diagnosis of foot and mouth disease has been completed

7-th Framework programme EU-Russia (PLAPROVA) Testing- FMD recombinant proteins in pig. This is not yet completed.

2.5.4 PIADC-FADDL

Mongolia, Pakistan and Ireland: Evaluation of LFD Svanova Universal
IAH Pirbright: FMD Universal primers for P1 sequence : Completed and publication is in prepartion
Nigeria, Mongolia and Egypt Vet labs: Development and validation of 3D ELISA – Nigeria, Mongolia and Egypt
Mongolia: Twinning with Mongolia 'state central veterinary laboratory'

2.5.5 ARC-OVI

Collaborators	Purpose of collaboration	Outcomes
SADC –TADs project (Misheck Mulumba)	Testing of buffalo and cattle FMD samples from Tanzania, Mozambique, Zambia, Malawi	Expand the database of buffalo isolates in the region
OIE Collaborating Centre for training in Integrated Livestock and Wildlife Health and Management	FMD Bulletin	Information sharing in regionally and internationally
Southern African Centre for Infectious Disease Surveillance (SACIDS)	Postgraduate training	Improved regional understanding of the epidemiology of FMD

Sampling of buffalo in SADC

The FMD reference centres at ARC-OVI and BVI, in collaboration with the SADC TADs project undertook to sample buffalo herds in Zambia, Malawi, Mozambique and Tanzania. The SADC TADs project intends sampling buffalo in different national parks within these countries over a period of 3 years to determine the current status of FMD virus strains circulating in the buffalo herds. This project is continuing.

2.5.6 PANAFTOSA

MAPA/Brazil: Development of an ELISA kit for FMD vaccine control

PANAFTOSA Regional Activities

- Hemispheric Plan for FMD eradication - PHEFA
  - Version 2010 – 2020
  - Main target countries: Bolivia, Ecuador and Venezuela.
- FMD outbreaks simulations
- FMD control programmes in region
  - Virus characterization and advice on vaccine strains and vaccination programs

- Advice on vaccine quality control
- Training of human resources
- Provision of reference reagents
- Harmonization exercises

2.5.7 RRLSEA Pakchong

Collaborators	Purpose of collaboration	Outcomes
1. Collaboration with Regional Reference Laboratory for FMD , Pakchong and Australian Animal Health Laboratory, AAHL on Foot and Mouth Disease Risk management for Australia and South East Asia	To set up the collaborative project to analyse the samples collected from experimental animals, vaccine efficacy against South East Asia FMD isolates in cattle , sheep and pig	- Scientific information on FMD vaccine efficacy , molecular epidemiology of FMD in SEA - Enhance the capacity of RRL and introduce new technology for molecular analysis of full sequence genome

2.5.8 LVRI China

Collaborators	Purpose of collaboration	Outcomes
IAEA	Engineering Foot-and-Mouth Disease Vaccine with Increased Antigenic Match and Broadened Coverage of Antigen for the Development of effective Vaccine	continued
EPIZONE	molecular epidemiology of foot and mouth disease virus in Asia	finished
FMD-DISCONVAC	Development, enhancement and complementation of animal-sparing, foot-and-mouth disease vaccine-based control strategies for free and endemic regions	continued

2.5.9 PDFMD India

Collaborators	Purpose of collaboration	Outcomes
USDA	Title: Antigenic and genetic characterization of Foot-and-mouth disease viruses in India: Application to effective molecular vaccines Purpose: to develop human adenovirus serotype 5 (hAd-5) based vaccine construct using Indian strains of FMDV	1. Recombinant Human adenovirus serotype 5 (hAd5)-FMD virus was developed against five strains of Indian FMDV (O IND R2/1975, Asia 1 IND 63/1972, A IND 40/2000, A IND 195/2007 and A IND 281/2003) including the three vaccine strains currently being used in India 2. A pool of 7 capsid mutants ($VP2^{77}$, $VP2^{133}$, $VP3^{59}$, $VP3^{139}$, $VP1^{43\text{-}46}$, $VP1^{48}$, $VP1^{168}$, $VP1^{170}$, $VP1^{171}$ and $VP1^{142}$ & $VP1^{154}$) of Srotype A IND 40/2000 vaccine strain was developed which would be further used to understand neutralization-relevant antigenic site(s) on capsid of the virus.

Summary

The overall number of samples submitted to FMD reference laboratories in 2011 was slightly up on 2010 levels. The network laboratories received and characterised more than 2,400 samples in 2011 from 34 countries, of which approximately 590 had been collected in 2010 or earlier. As in previous years a large proportion of these samples were sent to the WRLFMD at Pirbright with more than 54% of the samples received and >60% of samples characterised worldwide reported by WRLFMD.

Characterisation and analysis of samples sent to Network laboratories revealed that in 2011, 630 virus isolates were obtained, with WRLFMD reporting >60% of those isolations. Again as in 2010, the predominant serotype reported from around the world was type O but with a reduced overall proportion of 60% of all the samples analysed in 2011. Serotype A was reported in 24% and Asia 1 in 12% of all samples analysed in 2011. There were no reports of serotype C and SAT 3 was only reported from probang sampling of buffalo in South Africa and Namibia. It is of great interest to note that serotype C has not been reported since 2004.

In total 721VP1 sequences were characterised for this report in 2011: 545 (76%) came from WRLFMD while the remaining 176 (24%) came from other laboratories.

Importantly, it should be noted that it was only possible to isolate FMD virus from approximately 60% of samples sent to WRLFMD. This was perhaps as a result of poor technique during collection of samples, transport problems resulting in poor quality material on arrival or insufficient viral load in samples before processing. However, it was possible to confirm FMDV genome in a further 20% of those samples using rRT-PCR. Nevertheless, this highlights an important recurring issue that for up to 40% of samples coming into the WRLFMD (and possibly other network laboratories) no virus isolate could be obtained and therefore no laboratory vaccine matching testing could be carried out.

This situation could be improved by carrying out a pre-dispatch FMDV screening process of important samples by regional or national FMD laboratories before samples are sent to reference laboratories for further characterization. Many laboratories could carry out rRT-PCR on important samples to ensure that they are at least FMDV genome positive prior to dispatch. This may help to ensure that better quality samples arrive in the reference laboratories for processing and less time and money is spent on attempting to isolate virus from poor quality material.

The re-emergence of serotype Asia 1 in pools 2 and 3 and the observed poor matching of circulating field strains with current Asia 1 vaccines in laboratory testing was a cause for concern. This highlights the continuous need for the collection of more field isolates and for testing to continue to monitor the lack of matching in the laboratory tests. In this regard, the EURLFMD will carry out an Asia 1 vaccine trial using high potency vaccine and challenge with a recent field isolate to monitor vaccine efficacy.

During 2011 both Japan and South Korea reported an end to FMDV activity but also coincidentally declared that the cost of these outbreaks to their country was in excess of $3 billion USD.

With regards to vaccine matching, towards the end of 2010, laboratory derived evidence began to accumulate that the O Manisa vaccine was not providing the broad protection coverage previously exhibited when used against a number of field isolates of the topotype ME-SA, lineage PanAsia-2 from pool 3. Continual monitoring of the ability of O Manisa to match field isolates in 2011 and comparison with the newly available O PanAsia 2 vaccine by WRLFMD has resulted in a review of the high priority vaccine list with the subsequent inclusion of O PanAsia 2.

Since serotype O viruses are the most commonly reported from around the world, it is essential that O type vaccines are continually monitored for effectiveness both in the laboratory and in the field.

The addition of the O PanAsia 2 strain to the vaccine portfolio offers further confidence that suitable vaccines are available for many circulating FMD viruses.

The International harmonisation of laboratory tests has progressed a great deal during the time of the network. In 2011 results further demonstrate that correlation of specified diagnostic assay results between a number of laboratories has improved as a direct result of the proficiency testing activities initiated by network members. The provision of a vaccine matching workshop at the Pirbright laboratory was an essential step in this process and was considered a great success by all who participated. Further workshops have been requested but these are costly both in time and money.

Further work is needed to continue to harmonise methodologies and materials used by network laboratories in order to produce comparable results to be utilized by any member of the network regardless of the laboratory of origin. This will be essential for provision of the necessary information and for management of the inevitable increased workload for virus characterization, and most importantly, vaccine matching in the coming year as the joint OIE/FAO joint initiative to progressively control FMD reaches a peak in the middle of the coming year with the meeting in Bangkok in June 2012.

3. Final comments

It is clear that the activities of the OIE/FAO FMD reference laboratory network provide essential information which serves to inform and influence national, regional and global FMD control policy. Importantly, there is now, and will be into the future, increasing pressure on those network laboratories to maintain and increase their outputs and required quality of service. It is vital that the fundamental activities of these laboratories are recognized and supported by funding bodies to enable continual improvement of this service and provide the necessary recognized expertise in training and building of additional regional laboratory capability and capacity that will be required if the joint FMD control initiative is to succeed in the coming years. I am certain that the national, regional and world reference laboratories for FMD will be the driving force behind the global FMD control initiative and it is essential that these laboratories must be adequately supported both financially and politically for the initiative to succeed.

Jef Hammond March 2012.