OIE/FAO FMD Reference Laboratory Network

Annual Report 2012

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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

January – December 2012

Comprising input from;

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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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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 is necessary to identify the current hazards and to predict heightened risk so that appropriate diagnostics and vaccines are available for 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 be applied to the 'Progressive Global Control of FMD' initiative overseen by the OIE and FAO and for which the FMD Network laboratories will play a pivotal role. The worldwide distribution

of the different serotypes and variants of FMD virus as compiled in 2012 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 and the requirements and methodologies for vaccine selection has been reviewed (Ferris and Donaldson, 1992; Kitching 2000; 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 complex 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 2012

In February 2012 outbreaks of FMD **type SAT 2** (topotype VII) were reported in Egypt affecting many governorates and causing the deaths of many young cattle and Buffalo. This was the first known occurrence of this serotype in Egypt since 1950 and was suspected to have moved into North Africa following the 'Arab Spring' with associated movements of people and animals into the region from further south. Related SAT 2 viruses were also reported in Libya and the Palestinian Autonomous Territories, Retrospective analysis by WRLFMD® identified a related virus in samples collected in 2010 from Sudan.

Following the loss of its OIE status as FMD free without vaccination in 2011 Bulgaria regained this free status on 31 August 2012. In September 2011 Turkish Thrace also lost its status as FMD free with vaccination and this was regained with effect from 17th October 2012.

The Republic of Korea continue their 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, only one sample collected from an outbreak in the previous year (2011) was submitted to a Network laboratory in 2012. This was from Paraguay and reported as serotype O with no wider FMDV circulation following the outbreaks in Paraguay and Ecuador in 2011.

Figure 1. OIE Member Countries' official FMD status map

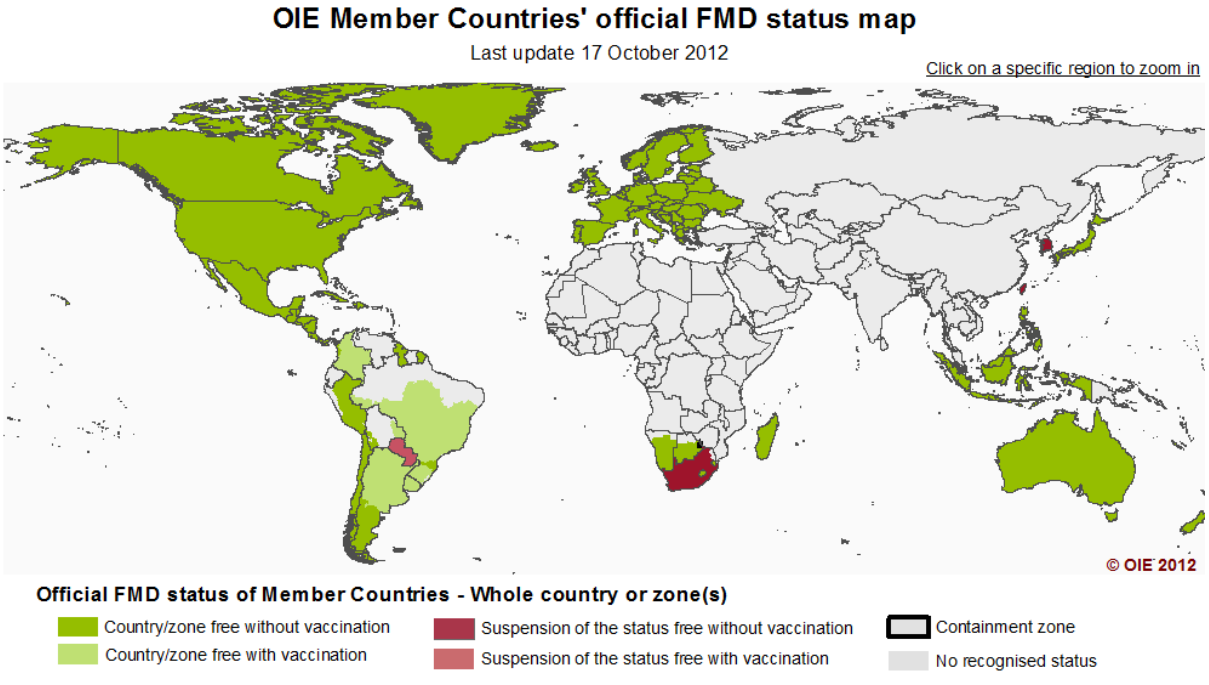


Figure 2. FMD situation by country according to OIE, Jan-Jun 2012[1]

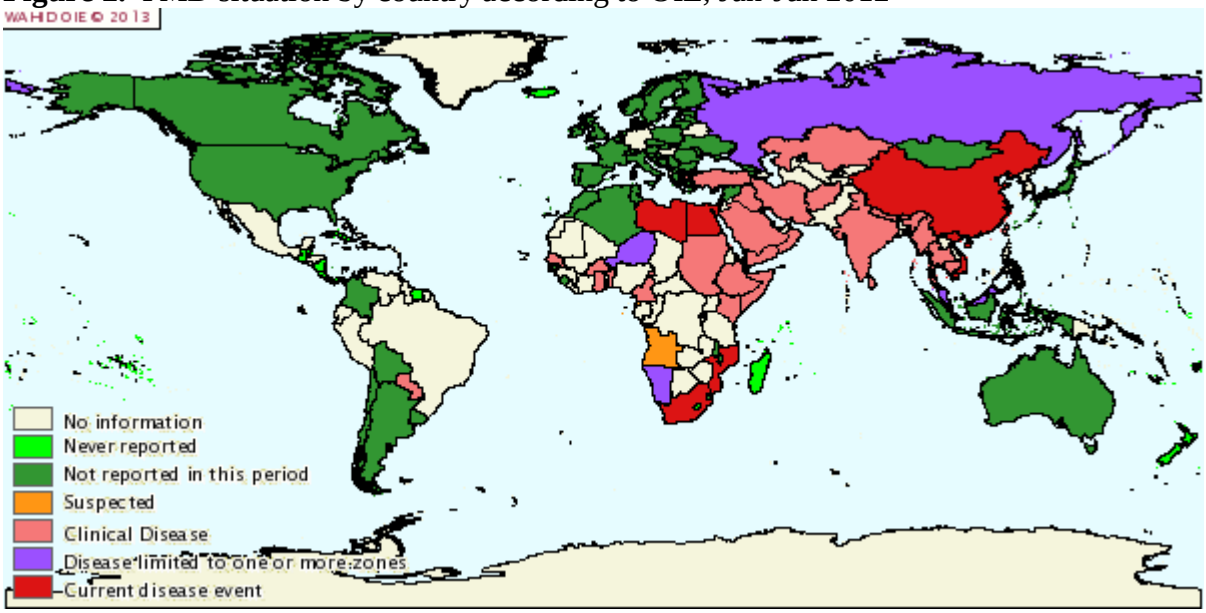
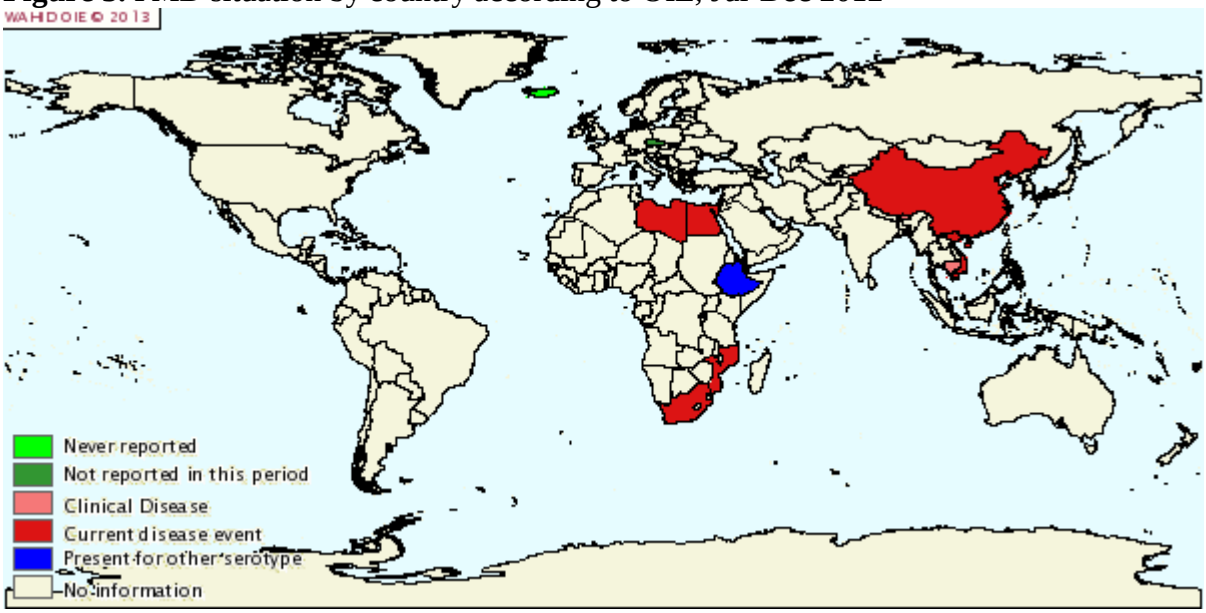
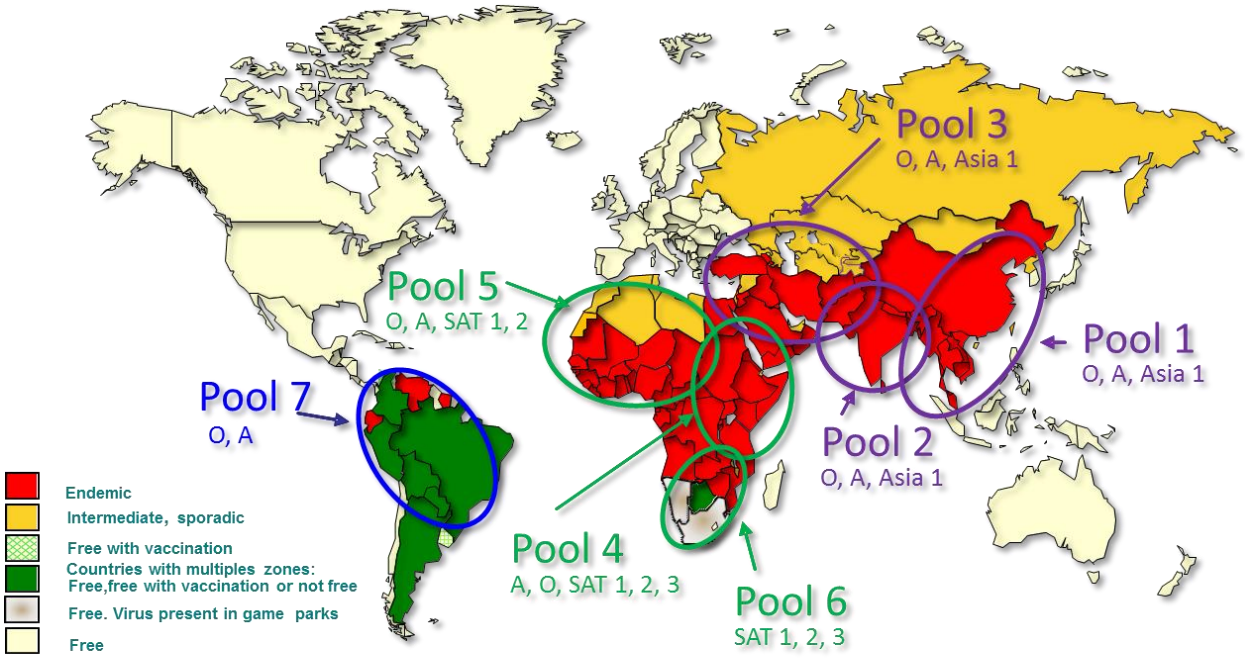


Figure 3. FMD situation by country according to OIE, Jul-Dec 2012



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 4. The conjectured status of FMD in 2012 showing approximate distribution of regional virus pools.



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.

OIE information: taken from the following address on the OIE website

http://www.oie.int/animal-health-in-the-world/official-disease-status/fmd/lossreinstatement-of-status

Restoration of "FMD free zone where vaccination is practised" status

Turkey

Subsequent to the suspension of the FMD free status on 6 September 2011, the Delegate of Turkey submitted a dossier on 31 August 2012 to the Director General requesting the recovery of the status of an FMD free zone where vaccination is practised in accordance with the relevant provisions of the OIE *Terrestrial Animal Health Code* (*Terrestrial Code*).
The Scientific Commission, by electronic correspondence amongst its members, considered the report and the recommendations of the *ad hoc* Group on evaluation of FMD status of Member Countries which met from 9 to 12 October 2012. Based on the documentation submitted and in accordance with Resolution No. 25 of the 80th General Session "Procedures for Member Countries for the official recognition and maintenance of status of certain animal diseases and the endorsement of a national official control programme for foot and mouth disease", the Scientific Commission concluded that the Thrace region of Turkey fulfils the requirements of the *Terrestrial Code* to regain its status of the FMD free zone where vaccination is practised as recognised by the OIE

World Assembly of Delegates in terms of Resolution No. XV in May 2010, with effect from 17 October 2012.

Restoration of status "FMD free country where vaccination is not practised"

Bulgaria

Subsequent to the suspension of the FMD free status on 7 January 2011 following an outbreak of foot and mouth disease (FMD) in Kosti Village, province of Burgas, the Delegate of Bulgaria submitted a dossier on 29 May 2012 to the Director General requesting the re-instatement of the status of an FMD free country where vaccination is not practised in accordance with the relevant provisions of the OIE *Terrestrial Animal Health Code* (*Terrestrial Code*). The Scientific Commission for Animal Diseases met from 27 to 31 August 2012 and considered the report and the recommendation of the ad hoc Group on evaluation of FMD status of Member Countries as well as the additional information Bulgaria submitted to the OIE on 23 July 2012. Based on the documentation submitted and in accordance with Resolution No.25 of the 80th General Session "Procedures for Member Countries for the official recognition and maintenance of status of certain animal diseases and the endorsement of a national official control programme for foot and mouth disease", the Scientific Commission concluded that Bulgaria fulfils the requirements of the OIE Terrestrial Code to regain its status as a Member Country free from FMD where vaccination is not practised as recognised by the OIE World Assembly of Delegates in terms of Resolution No. X in May 1998, with effect from 31 August 2012.

1.3.1 Summary Information from the WRLFMD® Quarterly Reports for 2012

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

Afghanistan: FMD **type O** PanAsia-2^{ANT-10} continues to circulate as does **type A** Iran-05HER-10 and **type Asia 1** Sindh-08 (newly designated name).

Bahrain: FMD **type O** PanAsia-2^{ANT-10} and **type SAT2** IV/Ken-09 were detected in imported animals in quarantine. This was the first known occurrence of SAT 2 in Bahrain. A further FMDV **type SAT2** IV/Ken-09 was detected in imported cattle sampled on 05/04/2012 on a quarantine farm in the Northern Governorate of Bahrain.

Egypt: FMD **type O** viruses were isolated from three samples collected in 2011 and were genotyped as O/ME-SA/PanAsia-2. They were most closely related to a virus from Egypt in 2010. Four **FMD type O** viruses from samples collected throughout Egypt belonged to topotype EA-3 and were very closely related to viruses from Eritrea and Ethiopia, suggesting a recent introduction and widespread occurrence in Egypt. A similar virus has also been detected in Libya, close to the Egyptian border.

FMD **type A** was detected in samples collected in 2010 and 2011. Genotyping showed these to belong to the ASIA topotype, Iran-05^{BAR-08} sublineage. A virus isolated from a single sample collected in 2012 belonged to the AFRICA topotype, sublineage G-IV^{ISM-12}. This was found to be most closely related to viruses from Sudan and Eritrea

suggesting yet another recent introduction of FMDV from sub-Saharan Africa. Three **FMD type A** viruses belonged to the AFRICA topotype, G-IV lineage and were closely related to viruses from Sudan in 2011, again suggesting a recent introduction of this lineage into Egypt. The samples came from Luxor and Giza, widely separated areas.

FMD **type SAT 2:** Between 18/02/2012 and 26/03/2012, 43 outbreaks of FMD **type SAT 2** were reported in Egypt affecting the governorates of Al Sharqia (Ash Sharqiyah), Alexandria (Al Iskandariyah), Beheira (Al Buhayrah), Dakahlia (Ad Daqahliyah), Damietta (Dumyat), Gharbia (Al Gharbiyah), Ismailia (Al Isma'Iliyah), Kafr el-Sheikh (Kafr Ash Shaykh), Luxor (Luxor), Minya (Al Minya), Monufia (Al Minufiyah), New Valley (Al Wadi Al Jadid), Qalyubia (Al Qalyubiyah), Sohag (Suhaj).

This was the first known occurrence of this serotype in Egypt since 1950.

It was found that the Egyptian viruses belonged to SAT2 topotype VII. However, within this topotype the VP1 sequences of the Egyptian viruses fell into 2 distinct lineages while the Libyan viruses were in a 3rd distinct lineage. Each lineage differed by more than 10 percent of the nucleotides in VP1. One genetic lineage, designated SAT2/VII/Ghb-12, has been found in the Egyptian provinces of Faiyum, Gharbia, Giza, Kafr el-Sheikh, Minya, Monufia, Qalyubia, and Suez. The 2nd lineage, named SAT2/VII/Alx-12, has been detected in Alexandria province. During April and May 2012, six additional outbreaks of FMD **type SAT 2** were reported in four Egyptian governorates: Damietta (2), Matrouh (2), Sohag (1) and Suez (1). Seven **FMD type SAT 2** viruses (all from the north-east Delta area) belonged to topotype VII, Ghb-12 lineage and were closely related to each other and to SAT 2's previously found to be widely distributed in Egypt.

Hong Kong SAR (PR China): Three samples were received from pigs in Hong Kong on 25th April 2012. FMDV genome was detected in two of the samples and the third was identified as FMDV **type O** by ELISA; however, no FMD virus was isolated in cell cultures and VP1 RT-PCR assays were negative.

Iran: Two FMD **type O** sublineages were found in Iran, PanAsia-2^{ANT-10} and PanAsia-2^{FAR-09}. Similarly, two FMD **type A** sublineages were also detected Iran/05^{HER-10} and Iran/05^{SIS-10}. FMD **type Asia 1** Sindh-08 was also detected. Eleven samples, collected from various locations during June and July 20012, were received. Two were **FMDV type O**, both belonging to the ME-SA topotype, PanAsia-2 lineage; however, one belonged to the FAR-09 sublineage and the other to the ANT-10 sublineage. Five samples typed as **FMDV A**, all of which belonged to the Iran-05 lineage; five belonged to the AFG-07 sublineage while one belonged to the SIS-10 sublineage. Three samples typed as **FMDV Asia 1** and belonged to the Sindh-08 lineage.

Israel: An outbreak of FMD **type O** occurred in sheep on 18/03/2012 at Rahat, Beer-Sheva, Hadarom. Genotyping showed the causative virus as O/ME-SA/PanAsia-2^{ANT-10}.

Kazakhstan & Kyrgyzstan: On 25/12/2011 and 26/12/2011 three outbreaks of FMD **type O** occurred in cattle and sheep in Urdzharsky, East Kazakhstan. No genotyping has been reported, however, results obtain by FGI-ARRIAH showed that previous outbreaks in the region belonged to O/ME-SA/PanAsia and were closely related to viruses from Vietnam and P.R. China (Guizhou) (see also the report on the Russian Federation below). Five outbreaks of FMD **type O** were reported in cattle and sheep

between 19/02/2012 and 27/02/2012 in South-east Kazakhstan (Dzhambul/Alma-Ata), close to the border with Kyrgyzstan. Two outbreaks of FMD **type A** were reported on the 15/02/2012 (cattle and sheep) and 19/02/2012 (cattle) in Moyinkumsky, Dzhambul. A further outbreak of FMDV **type O** occurred at Borovoe, Dmitriy, Borodulihinsky, East Kazakhstan on 30/05/2012. Six FMDV **type O** and two **type A** VP1 sequences were submitted to the public sequence databases on 12/03/2012 by the Ministry of Education and Science, Research Institute for Biological Safety Problems, Gvardeyskiy, Zhambyl oblast 080409, Kazakhstan.
Phylogenetic analyses showed that the **type O** viruses belonged to two virus lineages:

1. Zhambyl province, close to the Kyrgyzstan border. These viruses from Korday (May 2010), Tynali (May 2011), Akterek (February 2012) and Korday (February 2012) belonged to the O/ME-SA/PanAsia-2 linage and formed a distinct sub-lineage.
2. East Kazakhstan province, close to where the borders of Russia, Mongolia and China meet. These viruses from Kurchum (August 2011), Urdzhar (December 2011) belonged to the O/ME-SA/PanAsia linage and were closely related to viruses from Southeast Asia.

The two **type A** sequences were from an unknown location in Kyrgyzstan (November 2011) and Mainkum, Almaty province, Kazakhstan (Feb 2012). Both sequences were closely related to each other and belonged to the Iran-05^{HER-10} lineage, being most closely related to viruses from Afghanistan collected in 2011.

Kuwait: FMD **type O** ME-SA/PanAsia-2^{ANT-10} was found in various parts of the country.

Malaysia: Six FMD **type O** and three **type A** viruses were isolated from a batch of 18 samples received from Malaysia. FMDV genome was detected by real time RT-PCR in a further eight samples and VP1 RT-PCRs were able to amplify **type O** and **type A** sequences from three and two of these sample, respectively. All nine **type O** VP1 sequences belonged to the SEA/Mya-98 lineage, while all five **type A** sequences belonged to the ASIA/Sea-97 lineage.

Pakistan: FMD **type A** Iran-05^{HER-10} and **type Asia 1** Sindh-08 were detected.

Palestinian Autonomous Territories: An outbreak due to FMD **type SAT 2** was reported in cattle in Rafah, Gaza Strip (09/04/2012). Phylogenetic analysis showed this virus to belong to the SAT2/VII/Ghb-12 lineage and to be most closely related to viruses from Egypt in 2012.

People's Republic of China: An outbreak of FMD **type O** was reported in cattle on the 19/02/2012 at Gucheng, Pengyang, Guyuan, Ningxia. On 06/09/2012, a single outbreak of **FMD type O** was reported in cattle and pigs in Muyu, Bomi, Tibet. This was the only report of a new FMD outbreak received by the OIE during the reporting period. On the 19/11/2012 an outbreak of **FMD type O** was reported in pigs in Puwan New District, Dalian, Liaoning province (adjacent to the Democratic People's Republic of Korea). On 12/12/2012 another outbreak due to FMD type O was reported in pigs in Xinbei, Changzhou, Jiangsu province which lies on the east coast of China.

Russian Federation: Outbreaks of FMD **type O** occurred on 26/02/2012 (Village Usachevka, Khorol`sky raion, Primorskiy Kray in cattle, sheep and goats) and 04/03/2012 (Village Pospelovka, Oktyabrsky raion, Primorskiy Kray in cattle). Nucleotide sequencing was carried out at FGI-ARRIAH and showed that the viruses belonged to the O/ME-SA/PanAsia genetic lineage and were closely related to the isolates involved in the FMD outbreaks in China and Eastern Kazakhstan in 2011.

Saudi Arabia: Four samples collected in July 2012 from cattle in Durma near Riyadh were received. **FMDV type O** was isolated from all the samples and genotyping showed them to belong to the ME-SA topotype, PanAsia-2 lineages, ANT-10 sublineage.

Sri Lanka: Five **FMD type O** viruses collected from three Sir Lankan provinces between 2009 and 2012 were closely related to each other and to other Sri Lankan viruses previously submitted. The phylogenetic tree suggests that this unnamed linage has been in circulation in Sri Lanka since at least the late 1990's.

Taiwan POC (Chinese Taipei):

Peng-hu county

19/01/2012: Some of the feeder pigs at a quarantine station, which were transported from Taiwan Island to Makung City, Penghu Island, were found with vesicular lesions. FMD **type O** virus was isolated but No genotyping has yet been reported.

Kinmen county

Three outbreaks of FMD **type O** were reported in pigs showing clinical disease on the island of Kinmen (close to the Chinese mainland) on 01/02/2012 and 07/02/2012 in Jinning Township and on 09/02/2012 in Jinsha Township. The gene sequence of the isolated virus from outbreak 1 shows serotype O SEA topotype.

An FMD **type O** virus isolate, collected from a pig on 30/01/2012 in Jinning Township, Kinmen was received from Taiwan POC and shown to belong to the SEA/Mya-98 lineage. Kinmen consists of a small archipelago of several islands which lie very close to mainland China. This is the first report of this topotype/lineage in Taiwan.

Main island

Six outbreaks of FMD **type O** have been reported, all in clinically healthy pigs and based on serology only. These all occurred on the Taiwan main island: 18/02/2012 in Jhushan Township, Nan-T'ou; 16/02/2012 in Yanshuei District, T'ai-Nan; 18/02/2012 in Yanshuei District, T'ai-Nan; 01/03/2012 in Jiaosi Township, I-Lan; 06/03/2012 in Jhutian Township, P'ing-Tung; and 30/03/2012 in Erlin Township, Chang-Hua. No genotyping has yet been reported.

An outbreak of FMD type O was reported in pigs in Wandan Township, P'ing-Tung on 01/05/2012. This was detected by serology and no virus was isolated or detected by RT-PCR. On the 24/09/2012 and 03/10/2012 two outbreaks of **FMD type O** were reported in pigs in Yuanshan Township (Outbreak 2), I-Lan County. Subsequently, on 23/11/2012 a third outbreak was reported in pigs in Dongshih Township, Yun-Lin County. The later outbreak was confirmed as **FMD type O** only by serology. No genotyping has been reported on the first two outbreaks.

Thailand: The receipt of two FMD **type A** VP1 sequences from the Thailand Regional Reference Laboratory indicated the continued presence of the Sea-97 lineage. Four

FMD **type O** and 19 **type A** viruses were isolated from a batch of 24 samples received from Thailand (collected in 2011 and 2012). Two **type O** viruses belonged to the ME-SA/PanAsia lineage while the other two belonged to the SEA/Mya-98 lineage. All 19 **type A** viruses belonged to the ASIA/Sea-97 lineage.

Turkey: FMD **type O** PanAsia-2^{ANT-10} and **type A** Iran/05^{SIS-10} were detected. FMD **type Asia 1** Sindh-08 continues to cause outbreaks.

United Arab Emirates: FMD **type O** ME-SA/PanAsia-2^{ANT-10} was found in a single sample.

Vietnam: FMD viruses isolated from samples collected in 2011 and 2012 were identified as O ME-SA/PanAsia. Three **FMD type O** viruses from the south of Vietnam (collected in April and November 2012) belonged to the ME-SA topotype, PanAsia lineage. They were closely related to each other and to other viruses circulating in Southeast Asia. Six **FMD type A** viruses (collected in October 2012 in Ho Chi Minh City) belonged to the ASIA topotype, Sea-97 lineage and were closely related to each other and to viruses from Thailand and Malaysia from 2011-2012. Two older samples (from 2008) contained, in one case FMD **type O** ME-SA/PanAsia and in the other case O CATHAY.

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

Botswana: A new FMD **type SAT 2** outbreak was reported in cattle at Matsebe Crush, Ngami, Ngamiland, Maun on 23/05/2012. Partial VP1 sequence data received from the Botswana Vaccine Institute showed this outbreak to be due to topotype III. Twenty-one **FMDV SAT 2** viruses (received from the BVI) from outbreaks in the Maun Veterinary District (Matsebe Crush, Spanplek Crush and Nokaneng) all belonged to topotype III, but those from Matsebe Crush and Nokaneng could be distinguished from those from Spanplek Crush suggesting the presence of two distinct evolutionary lineages in the district.

Eritrea: Eighteen samples, collected from cattle and pigs during November and December 2011, were received. **FMDV type O** was identified in 15 samples, although only 14 of these were isolated in cell cultures. Genotyping showed that these 14 viruses belonged to the EA-3 topotype, but could be divided into three unnamed lineages. No virus was detected in three samples.

Ethiopia: FMD **type O** EA-3 was found, however, the single isolate from the Tigray region belonged to a lineage distinct from viruses found in the centre of the country. Fifteen samples, collected from cattle and sheep between January and June 2012, were received. Seven samples were typed as **FMDV O**, but only six were isolated in cell cultures. These six isolates were identified as the EA-3 topotype. FMDV genome was detected in four samples. No virus was detected in four samples.

Kenya: Six FMD **type O**, one **type SAT 1** and six **type SAT 2** viruses were isolated from a batch of samples received from Kenya. All additional samples typed as SAT 2, but no virus was isolated in cell culture and the VP1 RT-PCR was negative. All six type O viruses belonged to the EA-2 topotype, the SAT 1 virus belonged to topotype I and all six SAT 2 viruses belonged to topotype IV. All these topotypes are endemic in Kenya.

Libya: Between 18/12/2011 and 12/02/2012, 23 outbreaks of FMD **type O** were reported in cattle (and some sheep) in Benghazi, Derna, Khoms, Misrata, Zawiya and Zlitan. The VP1 sequences of 11 viruses isolated at the WRLFMD® were determined and shown to be O/ME-SA/PanAsia-2^{ANT-10}. On 11/02/2012 FMD **type SAT 2** was found at Abuatni, Benghazi. VP1 genotyping of three virus isolates showed them to belong to SAT 2 topotype VII, lineage Lib-12. This is the same topotype that occurred in Libya in 2003, but the two lineages differ by 8.8%. The 2003 virus has been designated as lineage Lib-03. In April, three outbreaks of FMD **type O** were reported:

a. 18/04/2012: Alnjela (Enjela), Tarabulus (Tripoli) in cattle.
b. 17/04/2012: Alhwari (Al Hawari), Benghazi in sheep/goats.
c. 30/04/2012: Altalhia, Benghazi in cattle.

The Enjela (Tripoli) outbreak was caused by O/ME-SA/PanAsia-2^{ANT-10} and was closely related to viruses which had occurred in Libya between 2010 and 2011. The Al Hawari (Benghazi) outbreak was caused by O/EA-3 and was closely related to viruses from the Tigray Region of northern Ethiopia (sampled in November 2011). This is the first record of the EA-3 topotype in Libya.

Namibia: Following two outbreaks of FMD **type SAT 1** in the Caprivi Strip in November and December 2011, two further outbreaks of the same serotype were reported in cattle on the 18/12/2011 (Ngoma Crushpen, Caprivi) and 05/01/2012 (Ikumwe Crushpen, Caprivi). It has been reported that both outbreaks were as a result of illegal movement of cattle from Masikili area.

South Africa: Two outbreaks of FMD **type SAT 2** were reported, three months apart, in cattle in Mbombela, Mpumalanga (30/12/2011) and Bushbuckridge, Mpumalanga (04/04/2012). Five outbreaks of FMD **type SAT 2** were reported in cattle between the 4th and the 30th April at Bushbuckridge, Mpumalanga. These were all within the surveillance zone of South Africa's FMD control zone. Cattle in this zone are vaccinated against FMD. No genotyping information is available.

Sudan: Twenty-five samples, collected from cattle between December 2009 and November 2011 were received. Five were typed as **FMDV O** and belonged to the EA-3 topotype. Five were typed as **FMDV A** and all belonged to the AFRICA topotype, G-IV lineage. A single sample (from 2010) was identified as **FMDV SAT 2** and belonged to topotype VII, lineage Alx-12. This lineage was also identified in a single sample from Alexandria, Egypt in 2012. No virus was detected in 14 samples.

Tanzania: FMD **type SAT 2** topotype IV was detected in the north of Tanzania, from samples collected in 2011. Two **FMD type O** viruses (from Arusha) belonged to the EA-2 topotype and were closely related to each other and next most closely related to viruses from Kenya in 2010-2011. Two **FMD type A** viruses (also from Arusha) belonging to the AFRICA topotype, G-I lineage, were identical to each other and related to viruses from Kenya and Tanzania in 2008-2009 and viruses from the DR Congo in 2011. Eight **FMD SAT 1** viruses from Manyara belonged to topotype I (NWZ) and were related to older viruses from Tanzania and Kenya (1999-2011). Seventeen **FMD type SAT 2** viruses (14 from Mara and three from Manyara belonged to topotype IV and were closely related to viruses from Tanzania and Kenya in 2011.

Zambia: An outbreak of FMD **type SAT 2** was found on 24/01/2012 in cattle in the Mwamba Kaka area, Mbala District, Northern Province. Partial VP1 sequencing was performed by the BVI and analysis performed at the WRLFMD®. The virus was shown to belong to SAT 2 topotype IV and to be most closely related to viruses isolated in the north of Tanzania in 2011.

Zambia: Two **FMDV SAT 2** samples (received from the BVI) from an outbreak in Mbala, Northern Zambia in February 2012 belonged to topotype IV and were closely related to viruses from Tanzania (2011-2012). Four **FMDV SAT 1** viruses from outbreaks in the Kazangula area in June 2012 belonged to topotype III (WZ) but were not closely related to other SAT 1 viruses.

Pool 7: South America

No new outbreaks of FMD were reported in the region.

Uncharacterised FMD viruses

A number of outbreaks have occurred where samples have not been sent to the WRLFMD®. It is probable that the countries involved have performed their own genetic characterisation; however, through the OIE/FAO FMD Reference Laboratory Network we would also like to encourage the submission of samples (or complete VP1 sequences) to the WRLFMD®.

An up-to-date list and reports of FMD viruses characterised by sequencing can be found at the following website: http://www.wrlfmd.org/fmd_genotyping/2012.htm.

1.3.2 Information gaps

Submission of samples from endemic regions has continued to be mainly in response to 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 endorsement and continuation of the OIE/FAO Progressive Control Pathway FMD initiative under the Global Framework for eradication of transboundary animal diseases which received unanimous backing at the 2nd Global Control for FMD meeting in Bangkok in June 2012 from all OIE member states. The progressive control pathway (PCP) tool will be an essential aid to countries that are currently endemically infected with FMDV and intend to carry out surveillance to identify the types of virus present and the extent 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. However, the OIE/FAO FMD Reference Laboratory Network has consistently identified a lack of 'real time' virus information coming from PR China and India which the network is attempting to address. PR China now report all new outbreaks immediately to the OIE.

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 and the more recent increased movement of refugees may alter this risk. This risk was highlighted in 2012 by the spread of serotype SAT 2 through North Africa into Egypt, Libya and Palestine Autonomous Territories most likely due to the movement of people and animals as a result of the 'Arab Spring'.
Despite growing efforts to control FMD in India and China and the 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 and are often not tested by laboratories outside the region for vaccine matching against other circulating strains.

The incursions into the Middle East and North Africa of the O PanAsia 2 and A Iran 05 strains have 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 2012, serotype Asia 1 has remained and spread in the Middle East and parts of Asia following its arrival in 2011. Asia 1 was reported in Iran, Turkey as well as Pakistan and Afghanistan, and the risk of Asia 1 spreading further westward should be borne in mind especially with the large number of outbreaks reported in Turkey in 2012. Importantly, a consistent pattern of poor matching of current isolates with Asia 1 Shamir and other commercial vaccines was observed. Therefore, in mid-2012 WRLFMD®, Pirbright, carried out a vaccine trial with Asia 1 Shamir high potency (emergency strength) vaccine for the EU vaccine bank. Challenge of vaccinated cattle was with a recent Turkish isolate of Asia 1 which did not match in laboratory tests with Asia 1 Shamir (publication in preparation). The extremely important result was that 'high potency' emergency vaccine protected all animals challenged with a current field isolate of Asia 1, thus allaying fears of a complete vaccine failure, however, WRLFMD® are keeping a very close watch on the occurrence of further Asia 1 outbreaks.

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. One sample from Paraguay was reported as serotype O in 2012.

The identification towards the end of 2010 and in 2011, of a variant type O virus in Ecuador, 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's, reintroduction of virus type 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 sero-sampling 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 and highlights the importance of the OIE/FAO FMD reference laboratory network and its role within the global plan to control FMD. 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 serotypes, 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/MSD in late 2010, the ability of this vaccine to match with field isolates has been carefully monitored throughout 2011 and 2012. 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 2012. Vaccines containing antigens from this lineage have 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. It is anticipated that efforts directed through the OIE/FAO Global Plan for the control of FMD will address these shortcomings.

1.5 Regional situation

1.5.1 Pool 1: EASTERN ASIA

Network labs receiving samples in 2012

Laboratory	Sample Nos.	Countries of origin
WRLFMD®	78	Hong Kong, Malaysia, Thailand, Vietnam
RRLSEA	49 (*5,722 Thailand)	Cambodia & Thailand
LVRI	84 (#7000 & *12000 PR China)	PR China

(* = serum samples and # = OP fluid)

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 2011 at the OIE general session.

PR China: In **PR China**, 5 outbreaks have been reported in 2012 by LVRI (Figure 5.). No outbreaks of A or Asia 1 serotype were reported this year. All outbreaks were of serotype O, 3 were SEA topotype Mya-98 lineage and 2 were ME-SA topotype PanAsia lineage. VP1 sequencing showed that these viruses were closely related to other viruses circulating in the SEA region.

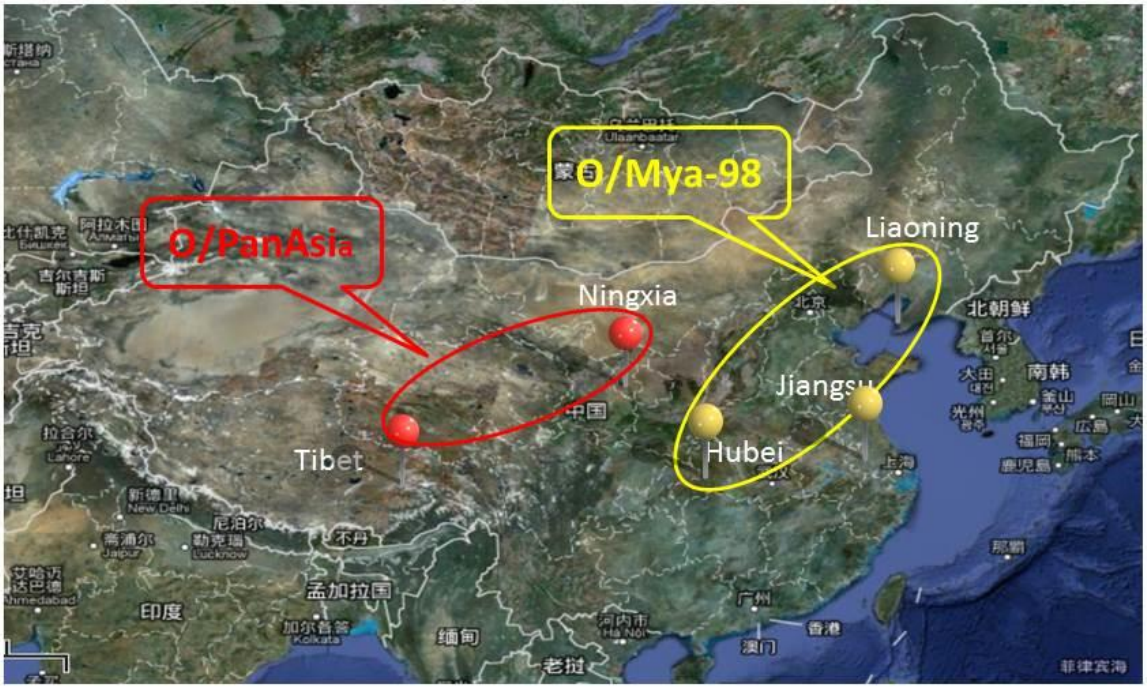
Number of samples collected

- 69 suspected samples detected, 10 positive and 59 negative.
- ~7000 O/P fluid and tissue samples were tested with RT-PCR/ Q-PCR for routine survey and emergency.
- 60 Vp1 sequences and CG for epidemic strain or isolations.
- ~12,000 serum tested by LPBE and 3ABC ELISA for SP and NSP antibody

Information from LVRI PR CHINA

Details associated with the cases confirmed by LVRI are shown in Figure 5 below: This information has been submitted directly by LVRI.

Figure 5. Map of China showing regions with reported outbreaks of FMD.



n=5

Molecular Epidemiology of FMD viruses in PR China 2012

- Both Mya-98 and PanAsia strains of FMD sequences from PR China showed a close relationship with those sequences from other outbreaks in Southeast Asia such as Vietnam, Cambodia and Thailand.
- Mya-98 and PanAsia strains came from SEA region.
- No other topotype strains (CATHAY) or PanAsia-2 strain were found in PR China mainland.

Figure 6. Serotype O Mya-98

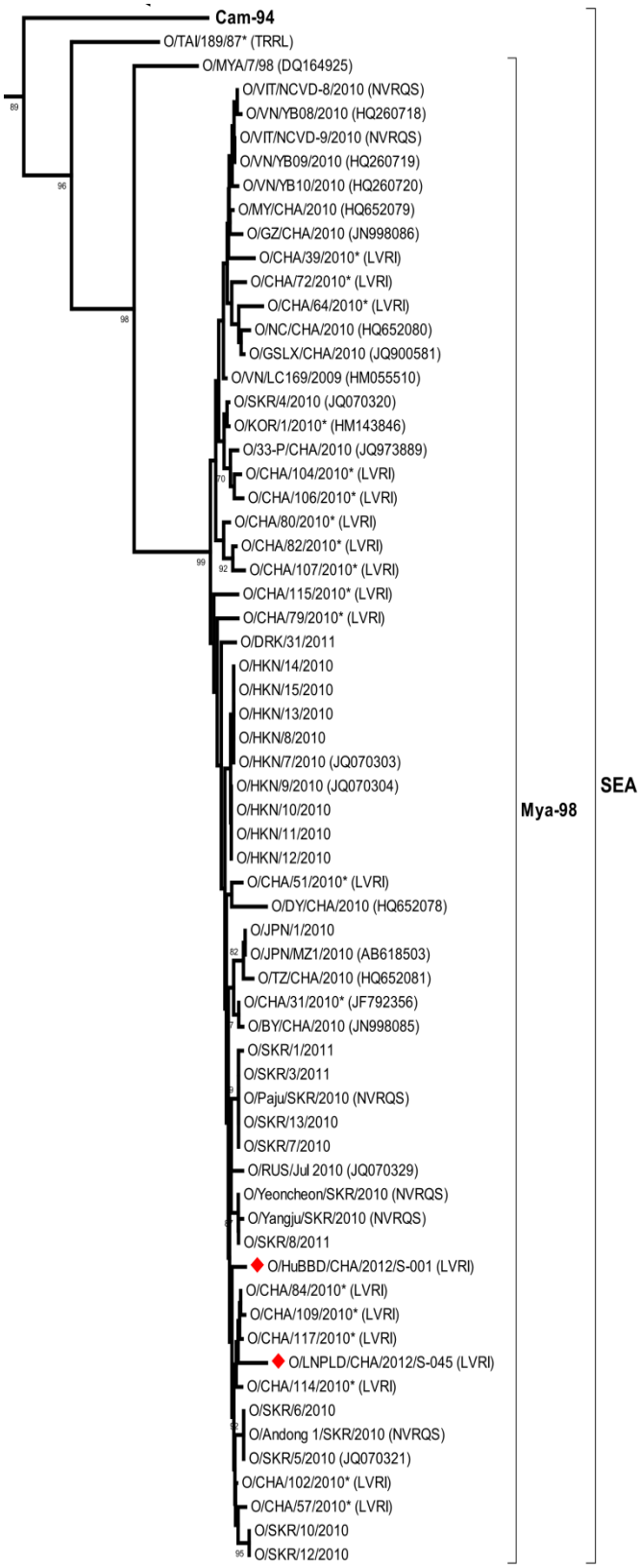
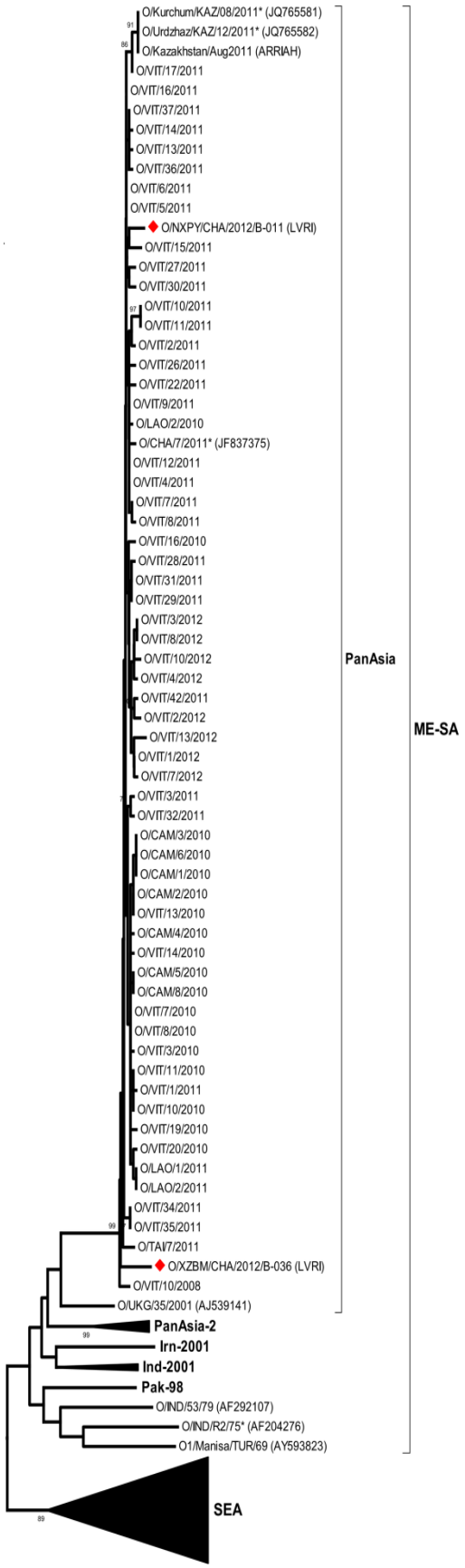


Figure 7. Serotype O PanAsia



Vaccine matching tests for the region

In 2010, an O Myanmar 98 vaccine strain (**O/Mya98/BY/2010)** was developed as a vaccine by LVRI. Very little efficacy data is available on the use of vaccines in PR China although 1.5 billion doses of vaccine are used in a twice a year vaccination strategy.

Inactivated vaccines	Protected rate
vaccine 1 (company A)	87.5% (14/16, PGP test)
vaccine 2 (company B)	81.3% (13/16 , PGP test)
vaccine 3 (company C)	81.3% (13/16 , PGP test)
Vaccine 4 (O/MYA98/BY/2010 strain)	10.81~13.59(PD_{50} value with pigs)

Isolates name	lineage	vaccine strains	
		O/Mya98/BY/2010	O/China99
O/CHA/31/2010	Mya-98	>1	ND
O/CHA/7/2011	PanAsia	0.62	>1

In PR China 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.

FMD surveillance:
FMD active surveillance was carried out by LVRI, on pig slaughterhouses in ten provinces (Sichuan, Hubei, Henan , Hebei, Shandong , Jiangsu, Guangdong , Anhui, Liaoning and Fujian) and the border areas in Xinjiang Uygur Autonomous Region in China in 2012. About 1,500 tissue samples and 1,500 serum were collected. 6 samples of pig lymph node were postive by RT-PCR test.

Control Strategy
The National Program for Long- and Medium-Term for Control and Prevention Against Animal Diseases
National Mid-and Long-term Plan on Animal Disease Prevention and Control was launched on 20th May, 2012 . FMD is identified as a priority disease to lead plan implementation.

Type A

- In 2015, no clinical cases nationwide
- In 2020, Free with vaccination nationwide

Type Asia I

- In 2015, Free with vaccination nationwide
- In 2020, Free without vaccination nationwide

Figure 8. FMD control 2015

Goals for 2015

Hainan： FMD-free without vaccination

Liaodong Peninsula and Shandong Peninsula： FMD-free with vaccination

Other regions： meeting criteria for disease controlled.

Goals for 2020

Hainan, Shandong Peninsula, and Liaodong Peninsula： FMD-free without vaccination.

Heilongjiang, Jilin, Liaoning,Beijing,Tianjin, and Shanghai： FMD-free with vaccination.

Other regions： meeting the criteria for disease controlled.

Figure 9. FMD control 2020

National Compulsory Vaccination Program
For all pigs; vaccination against type O
For all cattle, sheep, goats, camels and deer; vaccination against type O and Asia 1
For all cows and breeding bulls; vaccination against type A
For cattle, sheep and goats at border areas of Guangxi, Yunnan, Tibet and Xinjiang: vaccination against type A.

Post Vaccination Monitoring
Serology surveillance
Pig: 28 dpv
Cattle, Sheep/Goat: 21 dpv
Test method: LBP-ELISA

- If SP antibody title ≥1:64 (2^6), means up to standard requirements
- If SP antibody title ＜ 1:64 (2^6), booster Vaccination
- Vaccination coverage rate(density): 100%
- Vaccination eligible rate: 70%

Thailand- Information from RRLSEA Pakchong

Department of Livestock Development Pakchong, Nakhonratchasima,Thailand

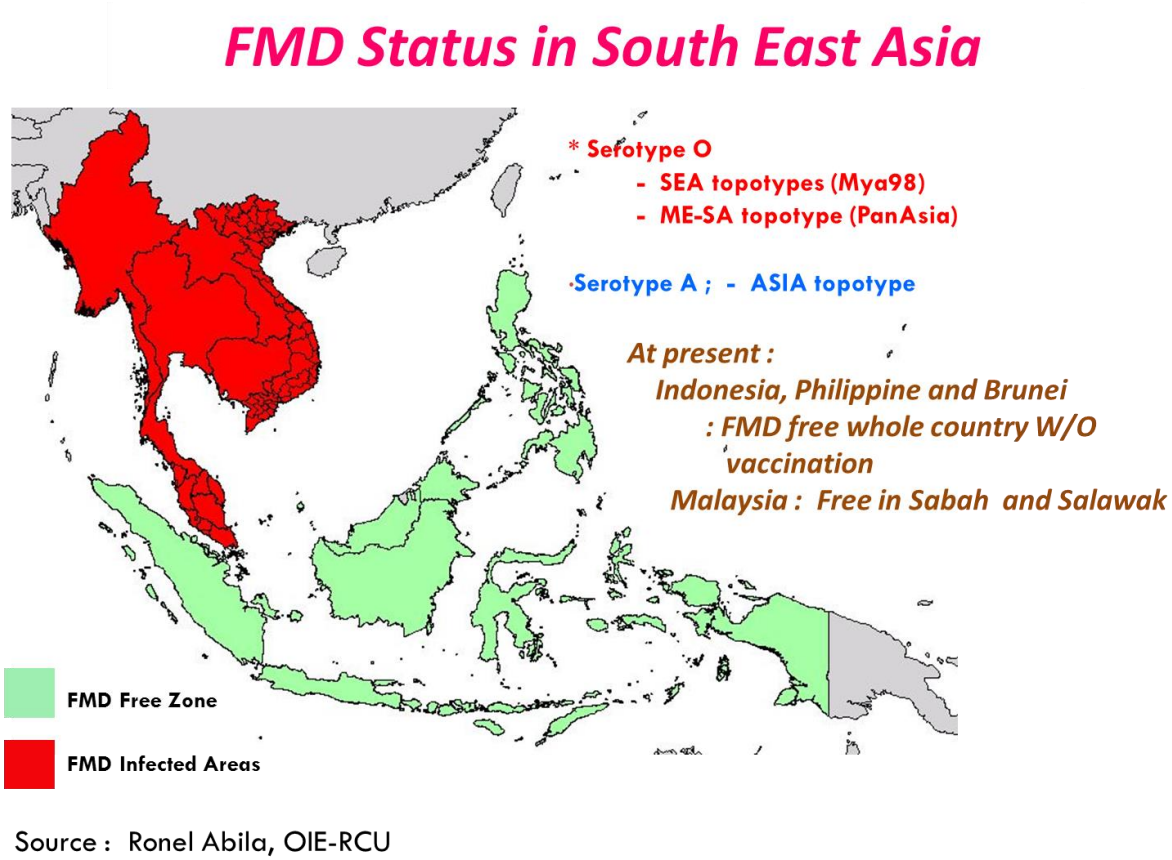


Figure 10. FMD status in SEA

FMD Status in South East Asia: Antigen Detection 2012

Country of origin	No of samples	Virus isolation in cell culture / ELISA.			RT-PCR for FMD (or SVD) virus	
		O	A	NVD	Positive	Negative
Thailand	70	13	28	29	56	14
Cambodia	5	4	-	1	5	-
Lao PDR	22	13	-	9	22	-

FMD Status in South East Asia: Outbreak details:

Outbreak date	Location	Report date	Serotype	Species	Number susceptible	Number of cases
03/01/2012	Pattani	09/01/2012	A	Cattle	18	1
03/01/2012	Pattani	09/01/2012	A	Cattle	33	1
20/02/2012	Lopburi	12/03/2012	A	Cattle	64	3
20/02/2012	Lopburi	12/03/2012	A	Cattle	60	4
14/03/2012	Ratchaburi	20/03/2012	A	Cattle	30	5
21/04/2012	Kanchanaburi	23/04/2012	A	Cattle	25	18
23/04/2012	Kanchanaburi	27/04/2012	A	Cattle	25	18
27/04/2012	Ratchaburi	30/04/2012	A	Cattle	93	5
03/04/2012	Mukdahan	01/05/2012	A	Cattle	1	1
03/04/2012	Ratchaburi	04/05/2012	A	Cattle	36	2
11/05/2012	Kanchanaburi	14/05/2012	A	Cattle	35	10
09/07/2012	Krabi	11/07/2012	O	Cattle	1	1
17/08/2012	Loei	21/08/2012	A	Cattle	104	14
11/09/2012	Lumpang	12/09/2012	A	Cattle	60	9
04/10/2012	Suratthani	09/10/2012	O	Cattle	3	1
15/10/2012	Suphanburi	24/10/2012	A	Cattle	4	4
15/10/2012	Suphanburi	24/10/2012	A	Cattle	1	1
15/10/2012	Prachuapkhirikhan	24/10/2012	A	Cattle	71	17
29/10/2012	Ratchaburi	24/10/2012	O	Cattle	35	2
26/11/2012	Ratchaburi	29/11/2012	O	Cattle	9	4
27/11/2012	Songkhla	29/11/2012	O	Cattle	2	2
27/11/2012	Songkhla	29/11/2012	O	Cattle	4	4
27/11/2012	Pattani	29/11/2012	O	Cattle	3	1
30/11/2012	Pattani	03/12/2012	O	Cattle	4	1
03/12/2012	Songkhla	12/12/2012	O	Cattle	1	1
20/12/2012-08/01/2013	Lamphun	10/01/2013	O	Pig	11	11
26/12/2012	Nakhonpathom	26/12/2012	A	Cattle	2	2
10/01/2013	Pattani	10/01/2013	O	Cattle	1	1
24/09/2012	Kratie.Cambodia	09/10/2012	O	Cattle	1	1
24/09/2012	Kratie,Cambodia		O	Cattle	1	1
24/09/2012	Kratie,Cambodia		O	Pig	1	1
24/09/2012	KratieCambodia		O	Pig	1	1
28/12/21012	Champasak,Lao	08/02/2013	O	Cattle	1	1
28/12/21012	Attapeu,Lao	08/02/2013	O	Pig	1	1
28/12/21012	Attapeu,Lao	08/02/2013	O	Buffalo	1	1
28/12/21012	VT capital ,Lao	08/02/2013	O	Pig	1	1

28/12/21012	VT capital,Lao	08/02/2013	O	Pig	1	1
28/12/21012	VT capital,Lao	08/02/2013	O	Pig	1	1
28/12/21012	VT capital,Lao	08/02/2013	O	Pig	1	1
28/12/21012	VT capital,Lao	08/02/2013	O	Pig	1	1
28/12/21012	Oudomxayl,Lao	08/02/2013	O	Cattle	1	1
28/12/21012	Xayabooly.Lao	08/02/2013	O	Cattle	1	1
28/12/21012	Xayabooly,Lao	08/02/2013	O	Cattle	1	1
28/12/21012	Xayabooly,Lao	08/02/2013	O	Cattle	1	1
28/12/21012	VT capital ,Lao	08/02/2013	O	Cattle	1	1

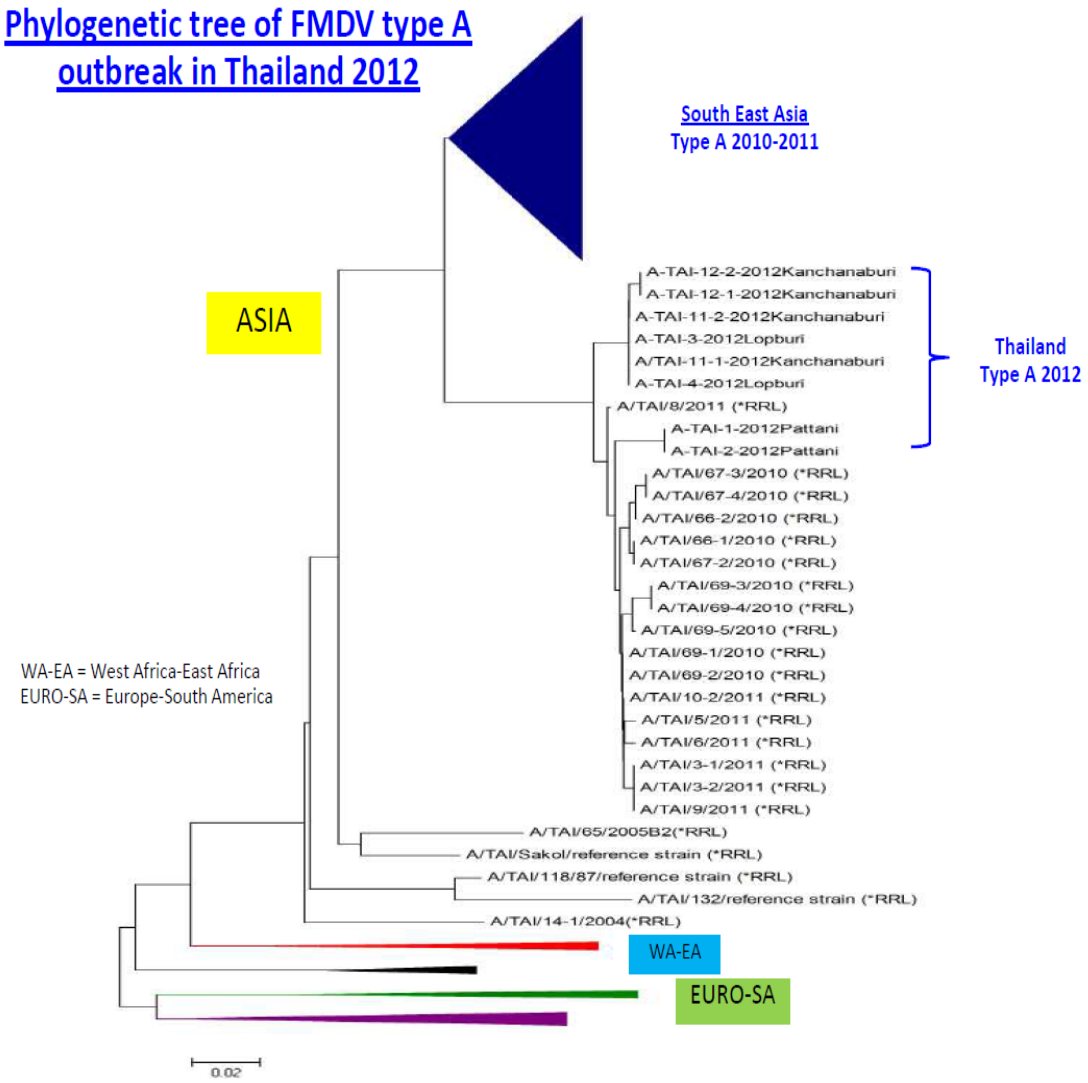


Figure 11. Type A

Antibody detection results 2011-2012

Country	2011						2012					
	No. of sample	LP ELISA	NSP TEST	NSP test			No. of sample	LP ELISA	NSP TEST	NSP test		
				positive	negative	(% positive)				positive	negative	(% positive)
Thailand	9,693	11,022	6,947	1,006	5,941	14.48	5,722	8,733	3,791	178	3,183	4.69
Cambodia	28	84	28	17	11	60.71	-	-	-	-	-	-
Myanmar	450	1,800	450	123	327	27.33	-	-	-	-	-	-

Vaccine suitability for region

Serotype	Internationally available vaccines	Locally produced vaccine
O	O/ Taiwan 98 O/ 3039 O /4625	O/ Thailand 189/87
A	A/Malaysia 97	A/Thailand 118/87, A/Sakolnakorn/97, A/Lopburi/12
Asia 1	Asia1 /Shamir	Asia1/ Thailand/85

Taiwan (Chinese Taipei) A number of outbreaks of type O were reported in 2012 but only one sample was sent to a network reference laboratory for characterisation. WRLFMD® found this to be serotype O SEA/Mya-98 lineage with this being the first report of this topotype/lineage in Taiwan.

WRLFMD® received 78 samples from **Hong Kong, Chinese Taipei (Taiwan), Malaysia, Thailand** and **Vietnam**. A sample from **Japan** from the 2010 outbreak was also received for characterisation.

The type O viruses from South East Asia that were tested for vaccine matching at WRLFMD® again continued to show 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).

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)	China 1999, Thailand O/189/87 (Thai vaccine strain), O-Mya 98(*China)
A	Malaysia 97	Thailand A/sakol/97, A/118/87, A/lopburi/2012(Thai vaccine strain)
Asia 1	Shamir	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.

* Developed for use in China.

1.5.2 Pool 2: SOUTHERN ASIA.

Network labs receiving samples in 2012:

Laboratory	Sample Nos.	Countries of origin
WRLFMD®	88	Afghanistan, Bhutan, Pakistan and Sri Lanka,
PDFMD	790	India

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

Samples received at WRLFMD® from **Afghanistan** (20), **Bhutan** (9), **Pakistan** (43) and **Sri Lanka** (16) : Samples from Afghanistan comprised serotypes O, A and Asia 1 while those from Pakistan comprised serotypes A and Asia 1. The O/ME-SA/PanAsia-2^{ANT-10} and A-Iran-05^{AFG-07} lineages continue to dominate in these countries.
Samples from Sri Lanka comprised serotype O ME-SA topotype.
No positive results were obtained from the samples from Bhutan.

The type O viruses from Southern Asia (along with those from pool 1 above) that were tested for vaccine matching at WRLFMD® again continued to show 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).

India:

Information from PDFMD, 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 2012.

Country	Situation	serotype	Viral strains
India	Endemically Infected	Serotype O	Ind2001, Ind2011 and Pan Asia
		Serotype A	Genotype 18: VP3^{59}-deletion
		Serotype Asia1	Lineage C

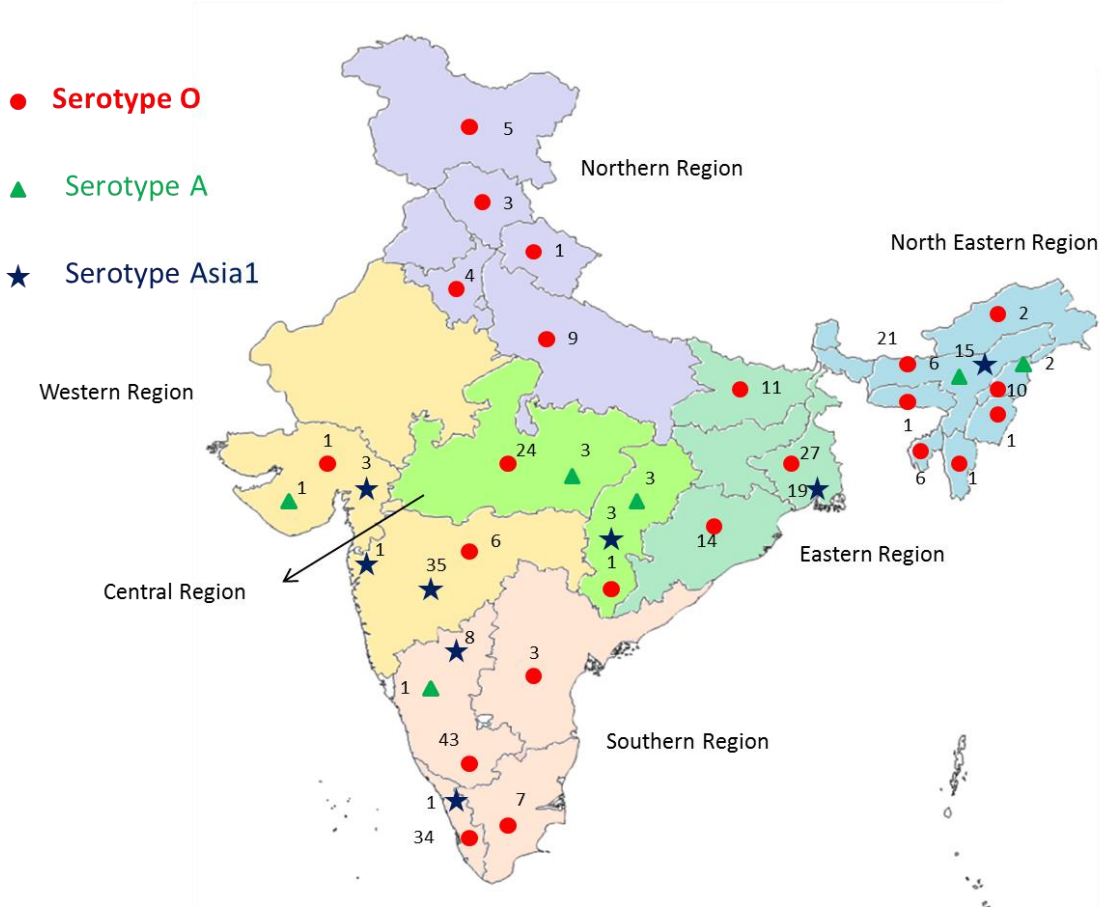
Country of origin	No of samples	Virus isolation in cell culture / ELISA. FMD virus serotypes.						
		O	A	C	SAT 1	SAT 2	SAT 3	Asia 1
INDIA	790	241	08	-	-	-	-	72

Table 2. Regional FMD Information from PDFMD, India.

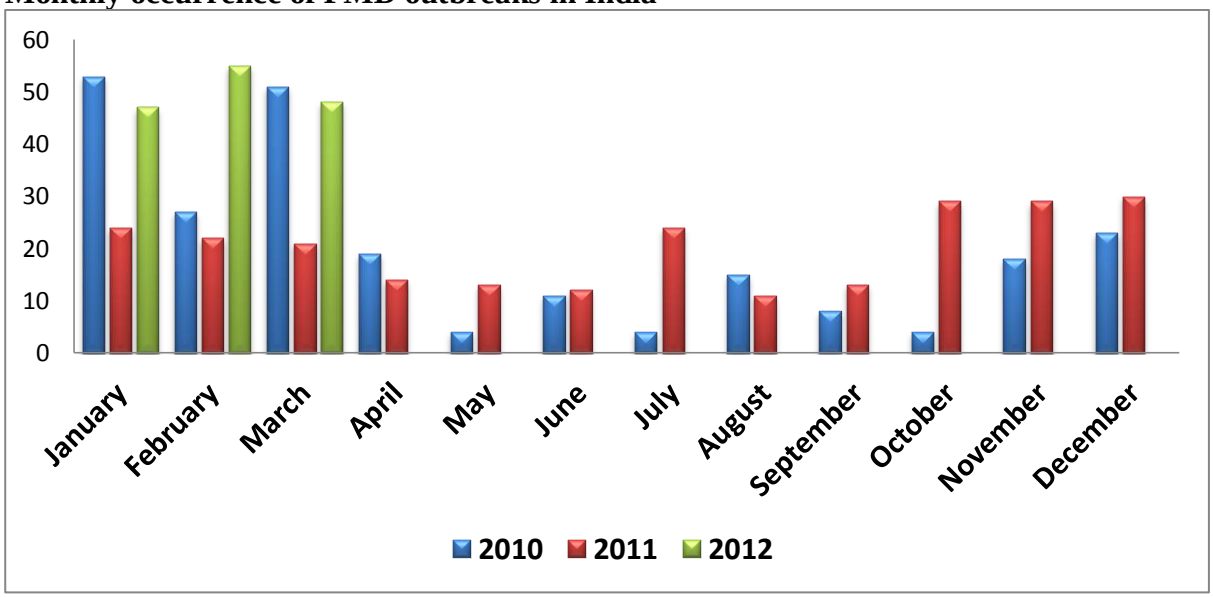
States	Reporting Centre/Unit	No. of. FMD cases/ outbreaks	No. of. Samples tested	Serotyping Results		
				O	A	Asia1
Southern Region						
Tamil Nadu	Ranipet	07	47	07(26)	-	-
Andhra Pradesh	Hyderabad	03	19	03(07)	-	-
Karnataka	Bangalore	52	135	43(71)	1(1)	08(11)
Kerala	Thiruvananthapuram	35	121	34(50)	-	1(1)
Total		97	322	87(154)	1(1)	09(12)
Northern Region						
Jammu & Kashmir	Jammu	05	15	05(08)	-	-
Haryana	Hisar	04	15	04(13)	-	-
Himachal Pradesh	Shimla	03	14	03(11)	-	-
Punjab	Jalandhar	-	03	-	-	-
Uttar Pradesh	Mathura CADRAD, PDFMD	07	42	07(26)	-	-
Uttarakhand	CADRAD	01	01	01(01)	-	-
Total		20	90	20(59)	-	-
Central Region						
Madhya Pradesh	Bhopal	27	85	24(57)	03(05)	-
Chhattisg	Pune	07	28	01(01)	03(03)	03(03)

arh						
Total		34	113	25(58)	06(08)	03(03)
Western Region						
Gujarat	Ahmedabad	05	26	01(07)	01(02)	03(12)
Maharashtra	Pune	41	108	06(06)	-	35(35)
Goa	Pune	01	02	-	-	01(01)
Total		47	136	07(13)	01(02)	39(48)
Eastern Region Asia 1					O	A
Odisha	Cuttack	14	19	14(05) †	-	-
Bihar	Patna	11	25	11(18)	-	-
West Bengal	Kolkata	46	84	27(46)	-	19(34)
Total		71	128	52(69)	-	19(34)
North Eastern Region						
Assam	Guwahati	42	65	21(28) †	06(11)	15(24)
Meghalaya	Guwahati	01	-	01(02) †	-	-
Arunachal	Itanagar	02	40	02(28)	-	-
Nagaland	Kohima	12	28	10(15)	02(05)	-
Mizoram	Aizwal	01	03	01(03)	-	-
Manipur	Imphal	01	04	01(04)	-	-
Tripura	Agartala	06	31	06(17)	-	-
Total		65	173	42(97)	09(19)	15(24)
Grand Total		**334**	**959**	**233(450)**	**16(27)**	**85(121)**

Figure 11. Number of FMD outbreak/cases in different geographical regions during the last six years



Monthly occurrence of FMD outbreaks in India



Monthly occurrence of FMD outbreaks in India

FMD Outbreaks by month 2012						
Month	**District**	**No. of Outbreaks**	**Serotype**			**Remarks**
			O	A	Asia 1	
January	Assam	*5*	1	-	4	Total-26 O-18 A-3 Asia 1-5
	Kerala	*5*	4	-	1	
	Tamilnadu	*2*	2	-	-	
	Madhya Pradesh	*9*	6	3	-	
	West Bengal	*1*	1	-	-	
	Karnataka	*4*	4	-	-	
February	Assam	3	3	-	-	Total-44 O-24 A-1 Asia 1-19
	Kerala	1	1	-	-	
	Tamilnadu	1	1	-	-	
	Madhya Pradesh	2	2	-	-	
	Chhattisgarh	4	-	1	3	
	West Bengal	9	2	-	7	
	Karnataka	15	15	-		
	Gujarat	1	-	-	1	
	Maharashtra	8	-	-	8	
March	Assam	*1*		-	1	Total-42 O-21 A-1 Asia 1-20
	Haryana	*1*	1	-	-	
	Kerala	*2*	2	-	-	
	Himachal Pradesh	*2*	2	-	-	
	MP	*6*	6	-	-	
	West Bengal	*7*	2	-	5	
	Karnataka	*10*	4	-	6	
	Maharashtra	*7*	1	-	6	
	Gujarat	*2*	-	1	1	
	Goa	*1*	-		1	
	J&K	*3*	3	-	-	
April	Assam	2	2	-	-	Total-41 O-29 Asia 1- 12
	Haryana	3	3	-	-	
	Kerala	2	2	-	-	
	Tamilnadu	1	1	-	-	
	Manipur	1	1	-	-	
	Odisha	2	1	-	1	
	Bihar	1	1	-	-	
	MP	6	6	-	-	
	West Bengal	8	5	-	3	
	Karnataka	4	2	-	2	
	Maharashtra	8	2	-	6	
	Uttar Pradesh	3	3	-	-	
May	Assam	*3*	3	-	-	Total-18 O-16 Asia 1- 02
	J&K	*3*	3	-	-	
	West Bengal	*1*	1	-	-	
	Bihar	*3*	3	-	-	
	MP	*4*	4	-	-	
	Karnataka	*3*	2	-	1	
	Maharashtra	*1*	-	-	1	
June	Uttarakhand	3	3	-	-	Total-44 O-30 A- 08
	Bihar	1	1	-	-	
	Meghalaya	2	2	-	-	
	Assam	20	12	8	-	

	Mizoram	1	1	-	-	Asia 1- 06
	Nagaland	1	1	-	-	
	MP	2	2	-	-	
	Karnataka	2	2	-	-	
	West Bengal	12	6	-	6	
July	J&K	*1*	1	-	-	
	West Bengal	*5*	1	-	4	Total-21
	Kerala	*2*	2	-	-	O-11
	Assam	*2*	2	-	-	A-2
	Manipur	*1*	1	-	-	Asia 1-8
	Madhya Pradesh	*2*	2	-	-	
	Karnataka	*8*	2	2	4	
August	J&K	3	3	-	-	
	West Bengal	2	2	-	-	Total-15
	Assam	4	3	1		O-12
	Karnataka	6	4	-	2	A-1
						Asia 1-2
September	West Bengal	*5*	5	-	-	
	Assam	*8*	8	-	-	Total-23
	Karnataka	*5*	5	-	-	O-22
	Bihar	*3*	3	-	-	Asia 1-1
	Himanchal Pradesh	*1*	1	-	-	
	Tamilnadu	*1*	-	-	1	
October	West Bengal	6	6	-	-	
	Karnataka	3	1	2	-	Total-23
	Manipur	1	1	-	-	O-19
	Himanchal Pradesh	1	1	-	-	A-2
						Asia 1- 2
	Tamilnadu	1	1	-	-	
	Odisha	2	2	-	-	
	Rajasthan	6	4	-	2	
	Kerala	2	2	-	-	
	Andhra Pradesh	1	1	-	-	
November	West Bengal	*6*	6	-	-	
	Karnataka	*3*		2	1	Total-32
	Manipur	*1*	1	-	-	O-26
	Rajasthan	*1*	1	-	-	A-2
	Madhya Pradesh	*4*	1	-	3	Asia 1- 4
	J&K	*1*	1	-	-	
	Assam	*6*	6	-	-	
	Meghalaya	*1*	1	-	-	
	Bihar	*7*	7	-	-	
	Arunachal Pradesh	*2*	2	-	-	
December	West Bengal	6	6	-	-	
	Karnataka	2	-	1	1	Total-33
	Madhya Pradesh	3	2	-	1	O-26
	J&K	1	1	-	-	A-1
	Assam	11	11	-	-	Asia1-6
	Bihar	4	4	-	-	
	Kerala	4	1	-	3	
	Odisha	1	-	-	1	
	Nagaland	1	1	-	-	
Total		**362**	**254**	**21**	**87**	**Total-362 O-254**

						A-21 Asia1-87

% proportion of samples diagnosed for the FMD virus serotypes in different geographical regions of the country during 2005-2012

Year	South			North			Central			West			East			North East			Total Material serotyped
	O	A	Asia 1	O	A	Asia1	O	A	Asia1	O	A	Asia1	O	A	Asia1	O	A	Asia1	
2005-06	91	8	1	75	19	6	70	22	8	71	7	22	85	4	11	53	30	17	**1571**
2006-07	85	7	8	100	0	0	66	0	34	65	8	27	60	14	26	16	6	78	**1207**
2007-08	92	7	1	68	22	10	39	48	13	88	1	11	80.5	12	7.5	70	4	26	**1269**
2008-09	86	14	0	80	0	20	71	0	29	69	8	23	91	3.5	5.5	88	10	2	**401**
2009-10	91	9	0	66	23	11	93	7	0	57	3	40	99	0.8	0.2	100	0	0	**1049**
2010-11	99	1	0	100	0	0	94	6	0	83	0	17	77	0	23	62	14	24	**377**
2011-12	92	1	7	100	0	0	84	12	4	21	3	76	67	0	33	71	12	18	**601**

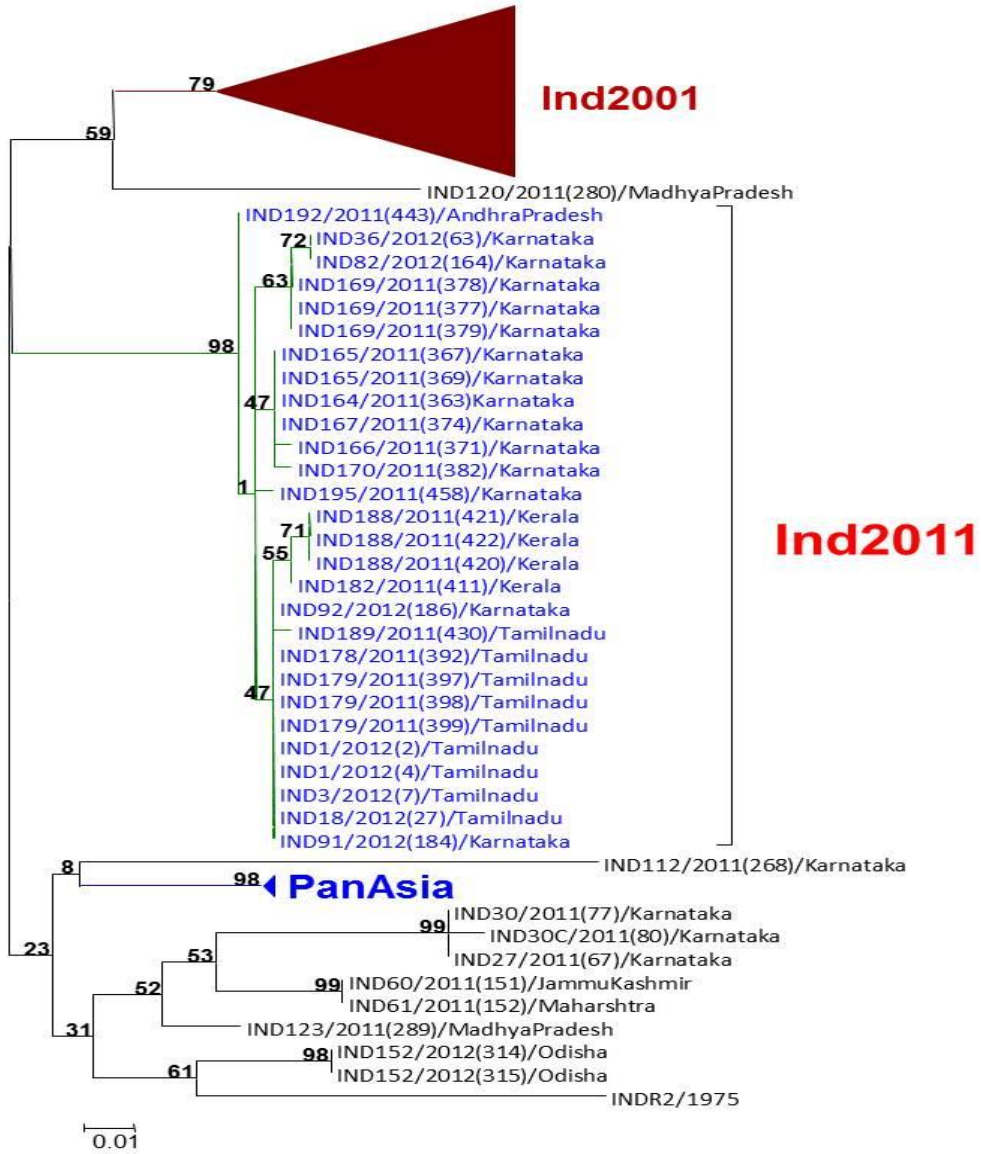
Cell culture Virus isolation (BHK21 or IBRS2 cells)

Isolates revived	O	A	Asia1	Total
2010-11	06	17	02	25
2011-12	46	03	13	62

Phylogenetic analysis: Number of field isolates subjected to VP1 and P1 sequence analysis

Year	Type O	Type A	Type Asia1
2006-2007	25	11	5
2007-2008	49	17	19
2008-2009	40	7	6
2009-2010	116	7	11
2010-2011	46	11	7
2011-20112	110	3	27
Total	**386**	**56**	**75**

Figure 12. Serotype O FMD virus isolates during 2011-2012



- 3 major lineages within the 'Middle East-South Asia' topotype co-circulating in India: Ind2001, PanAsia and New group named Ind2011
- Dominance of 'Ind2001' lineage continues since 2009
- Emerging Ind2011 cluster has spread in all the southern states
- Ind2011 recorded in 15 states of the country (76 of 110 serotype O isolates sequenced)

Figure 13. Serotype A (2011-2012)

- Exclusive presence of Genotype 18 of Asia topotype
- Co-circulation of both VP3[59]-deletion and non-deletion variants
- Post-2010, Clade 18c apparently the only active clade in the deletion group
- Clade 18c of deletion group expands its territorial domain further to reach Rajasthan

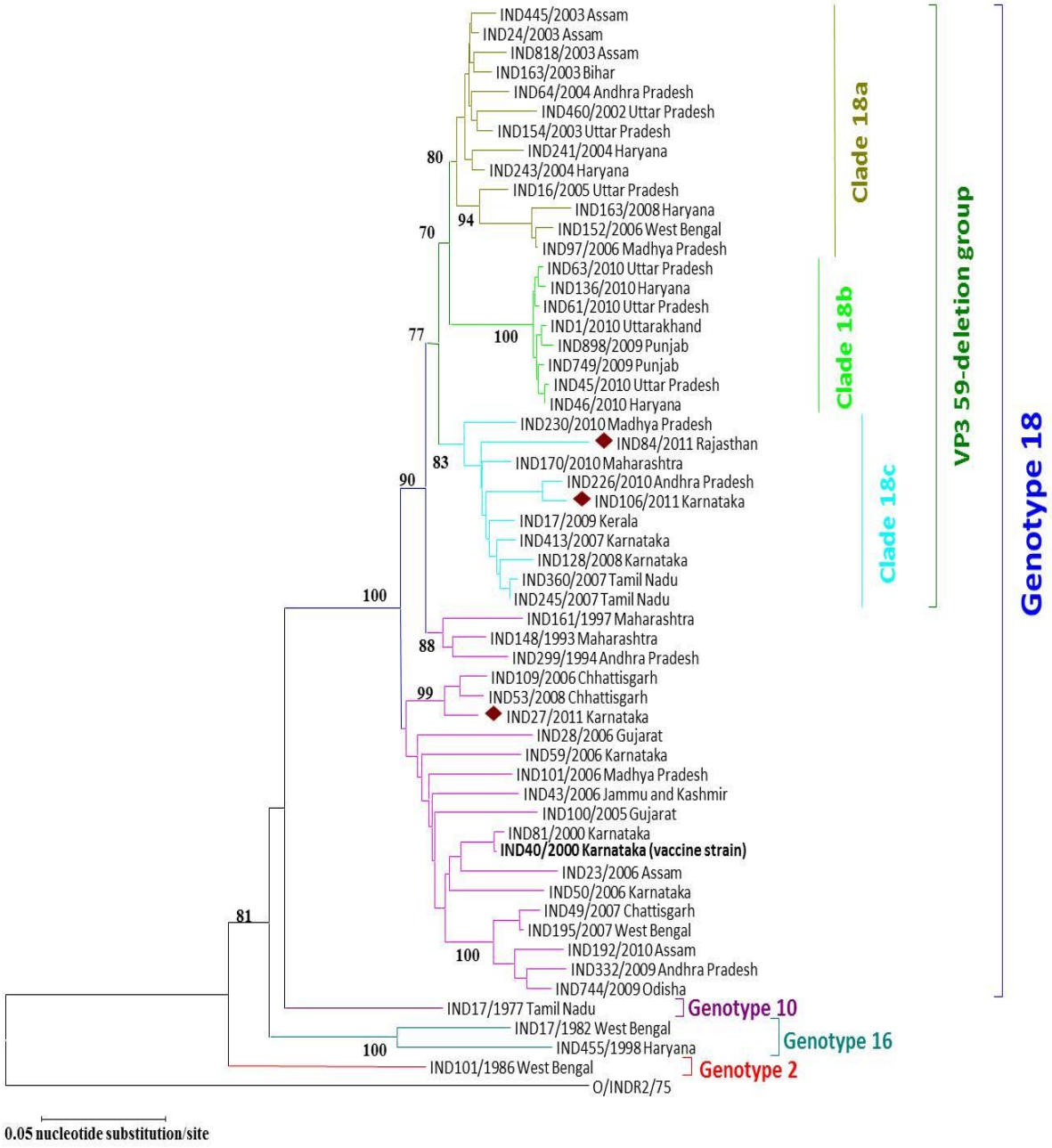
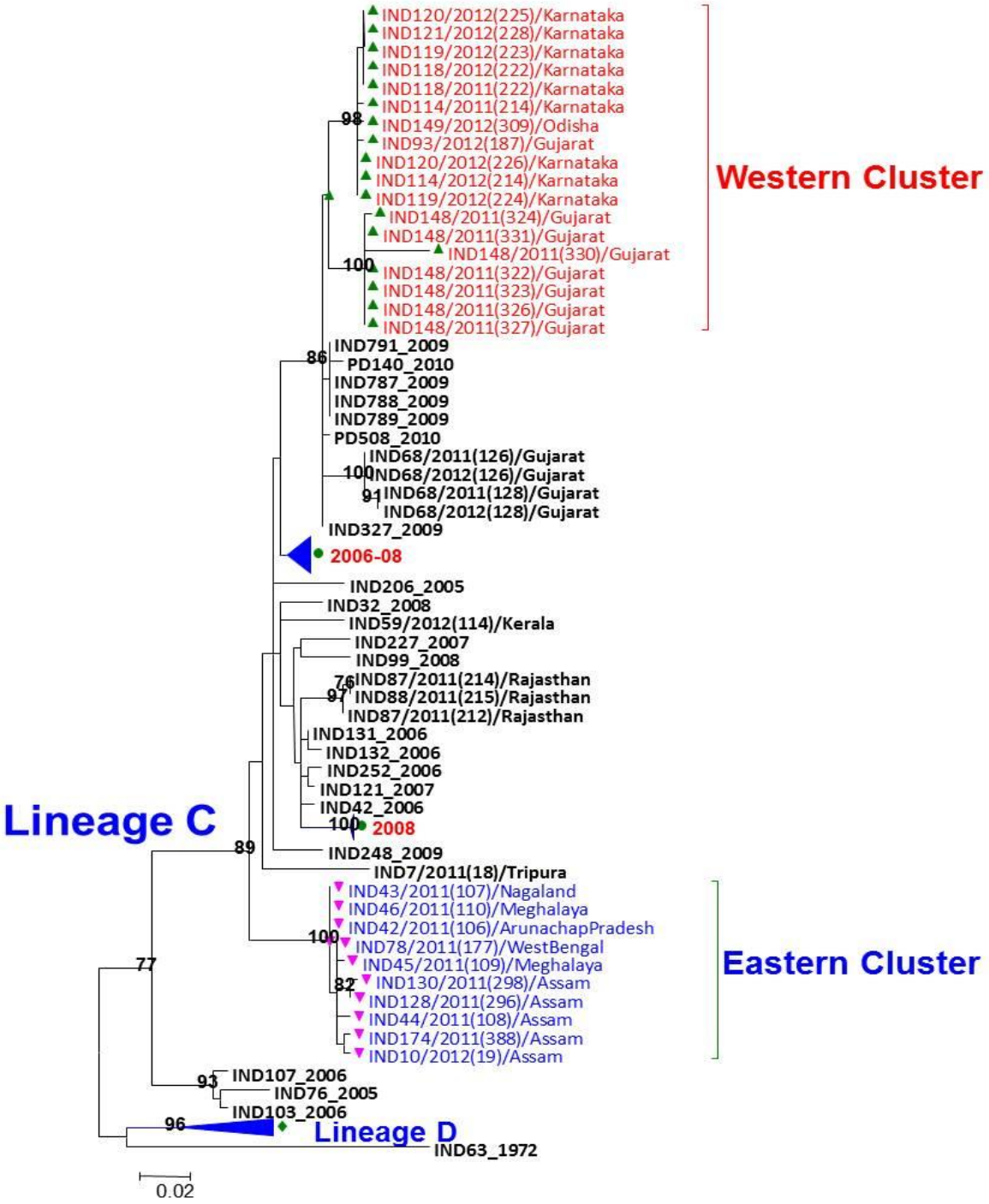


Figure 14. Serotype Asia-1 (2011-2012)

- Exclusive presence of Lineage C since 2005
- Two spatially distinct genetic clusters evolving independent of each other, named 'Eastern' and 'Western' clusters



Summary of Molecular Epidemiology 2010-12

- 'Ind2001' lineage of serotype O, which reemerged in late part of 2008, spread to majority of states and became the dominant lineage
- Decline in circulation of PanAsia lineage in the country
- A new genetic group appeared in 2011 (Ind2011 lineage); restricted so far to southern region

- In the case of type A, exclusive presence of genotype 18
- Co-circulation of both VP3[59]-deletion and non-deletion sub-lineages
- Clades within the VP3[59]-deletion group except 18c remain silent in support of epochal evolution
- The Asia1 field isolates were grouped with lineage C reiterating the dominance of this lineage since 2005
- Spatially distinct Eastern and Western genetic clusters with independent evolutionary trajectories

Antigenic relationship of FMDV isolates recovered during 2011-2012 with the vaccine strains

Figure 15. Type O isolates with INDR2/75

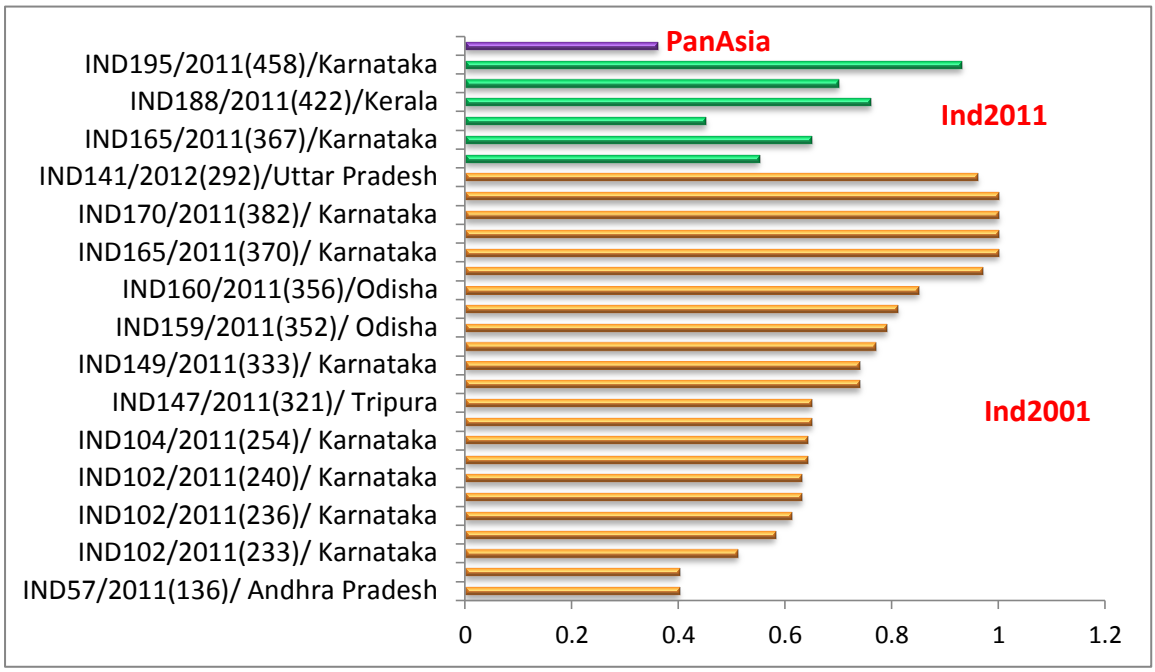
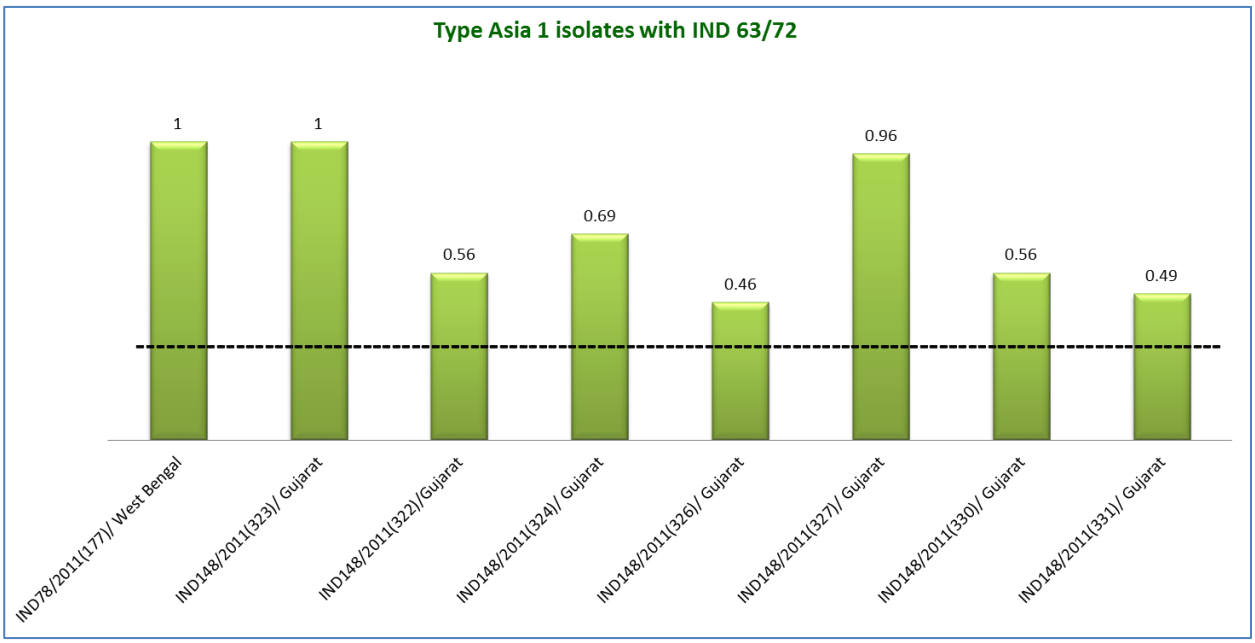


Figure 16. Type Asia 1



Antigenic profile of field outbreak strains

Field isolates subjected to vaccine matching during the last five years

Year	Type O	Type A	Type Asia1	Total
2007-2008	38 (37)	13 (11)	14 (14)	65 (62)
2008-2009	35 (35)	8 (7)	16 (16)	59 (58)
2009-2010	20 (20)	6 (6)	9 (9)	35 (35)
2010-2011	16 (16)	10 (8)	1 (1)	27 (25)
2011-2012	23 (23)	3 (3)	8 (8)	34 (34)
Total	132 (131)	40 (35)	48 (48)	220 (214)

Isolates that demonstrated an r-value of > 0.3 are shown in parentheses
A few recent field strains of serotype A are antigenically not related to the vaccine strain

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 2012:

Laboratory	Sample Nos.	Countries of origin
WRLFMD®	417	Bahrain, Egypt, Iran, Israel, Kuwait, Libya, Palestine Autonomous Territories, Kingdom of Saudi Arabia, Sudan, Turkey, United Arab Emirates
FGI-ARRIAH	15	East Kazakhstan, Tajikistan & Russia

FMD viruses continue to circulate in many Middle-Eastern countries, the prevailing serotypes in 2012, being as in 2011, O (PanAsia-2 lineage) and A (Iran 05 lineage). There were also a number of Asia 1 outbreaks reported in 2012.
Overall, fewer countries reported outbreaks in the Middle East in 2012, 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. In Turkey the predominant serotype in 2012 appeared to be Asia 1.
Turkey recorded more than 1000 outbreaks in 2012.

Serotype SAT 2
Of great significance was the outbreak of serotype SAT 2 in North Africa, especially Egypt in early 2012. The SAT Serotypes have a restricted circulation in that they have

never established themselves outside of Africa. SAT 1 and 2 are commonly found in cattle whereas SAT 3 appears to be mainly limited to buffalo. In 2012 there was an unusually rapid and widespread movement of SAT 2 into North Africa, mainly Egypt and Libya and from there into the Palestine Autonomous Territories. This rapid spread was thought to coincide with the mass movement of refugees and their animals arising from the 'Arab Spring' and the large numbers of susceptible animals in Egypt which had not experienced an outbreak of SAT 2 since 1950. Such rapid spread and the large number of mortalities in young animals were of great concern and were monitored as closely as possible by WRLFMD®, however, regular and accurate information from Egypt and Libya continues to be in short supply.
As far as we know the SAT 2 virus did not spread further into the Middle East, and there have been no further reports from North Africa recently.

Note: A very reassuring result was that vaccine matching carried out by WRLFMD® demonstrated a very good match with SAT 2 Eritrea (Merial) vaccine for the majority of isolates tested in 2012.
However, it should be carefully noted that the supply of SAT 2 Eritrea vaccine is very limited.

Information from FGI-ARRIAH, Russia

Table 2. Serotyping and molecular detection results of samples collected in 2012

Country of origin	No of samples	Serotype O	Serotype A	Serotype Asia-1
Tajikistan	2	1	0	1
Russia	7	6	0	0
East Kazakhstan	6	2	0	0
Total	15	9	0	1

Table 3. Genetic typing of FMD virus isolates

FMDV ID	Country of origin	Topotype	Lineage/strain	Sub-lineage
O/Tajikistan/2011	Tajikistan	ME-SA	PanAsia	PanAsia-2
O/Russia/2012	Russia	ME-SA	PanAsia	
O/Kazakhstan/1/2012	Kazakhstan	ME-SA	PanAsia	
O/Kazakhstan/2/2012	Kazakhstan	ME-SA	PanAsia	
Asia-1/Tajikistan/2011	Tajikistan			

- The virus isolate O/Russia/2012 was identified as ME-SA topotype PanAsia lineage. Isolates are closely related to isolates O/CHA/7/2011 (JF837375) and O/Kazakhstan/AUG2011
- The virus isolate O/Tajikistan/2011 was identified as ME-SA topotype PanAsia-2 Sub-lineage
- The virus isolate O/Kazakhstan/1/2012 and O/Kazakhstan/2/2012 are most closely related to isolates O/CHA/7/2011 (JF837375) and O/Kazakhstan/AUG2011

Figure 17. Type O FMD virus

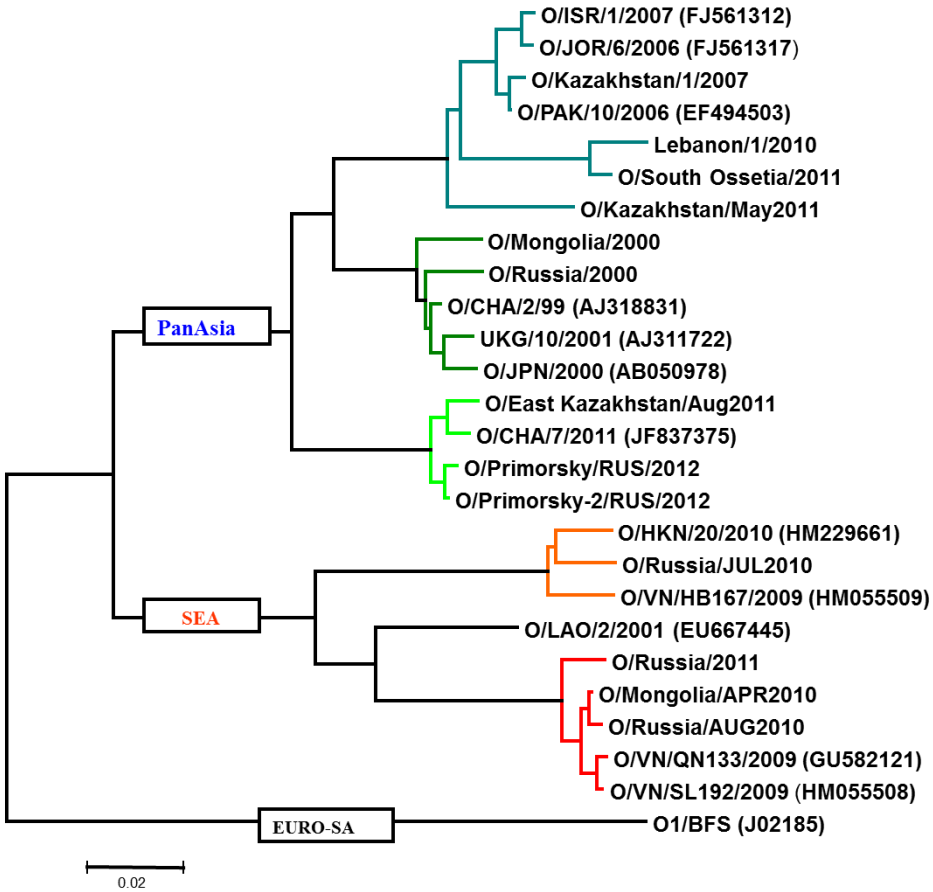
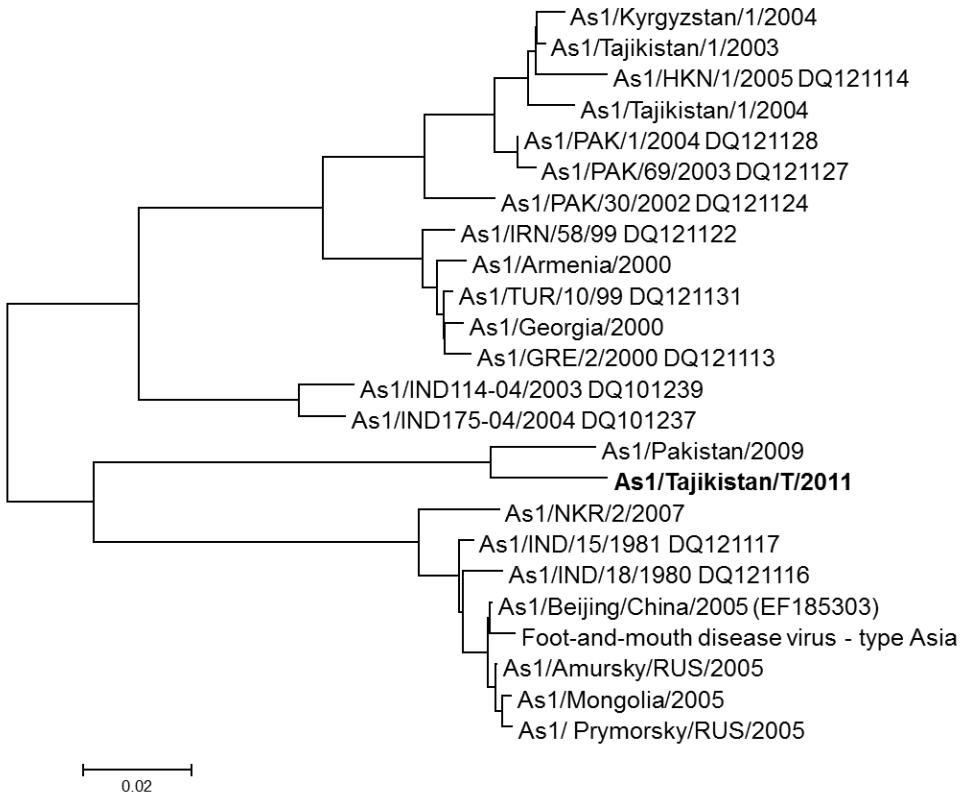


Figure 18. Type Asia-1 FMD virus



Complete genome sequencing

Information from The SAP Institute, Ulus, Ankara, Turkey

Serotype	No. of outbreaks
Type O	106
Type A	177
Type Asia-1	565
Unidentified	191
Total	**1038**

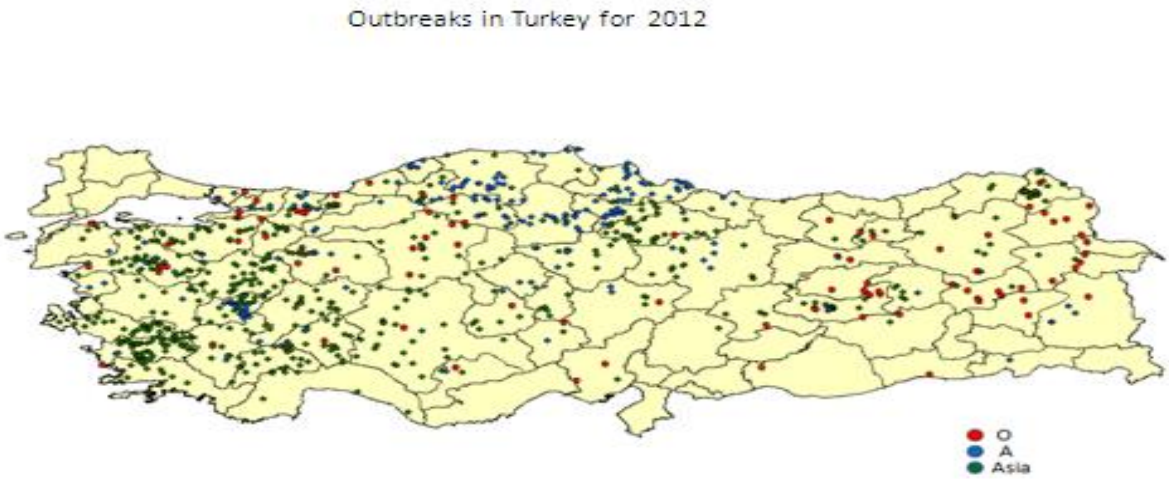


Figure 19. Map distribution of outbreaks by serotypes for 2012

Vaccine strains for the region:
Serotype O is in widespread circulation globally. There are 2 topotypes making up the majority of characterised outbreaks. These are the ME-SA topotype (PanAsia-2 lineage) and the SEA topotype (Mya-98 lineage).
Vaccine information: Standard potency ($3PD_{50}$) O Manisa vaccine failed to match with a number of 'O' field isolates tested in 2012 at Pirbright. However, other commercially available vaccines did provide matching in the same tests.
These vaccines are;

1. O PanAsia 2 from Intervet/MSD
2. O 4625 and O 3039 from Merial which are used in combination with the base O Manisa vaccine depending upon requirements and location

It is important to note that 'High Potency' ($>6PD_{50}$) vaccines have been demonstrated to provide protection even when laboratory matching has shown no match, but further studies are needed to build a useful dataset on these observations.

Even with vaccine matching failure in the laboratory testing, the introduction of the new O PanAsia 2 vaccine (Intervet/MSD), the availability of supplementary strains such as O

4625 and O 3O39 from Merial and the use of these vaccines as high potency formulations should increase confidence that there are vaccines to cover the majority of known circulating O viruses.

Serotype Asia 1 vaccine matching in 2012

The laboratory matching of Asia 1 Shamir and related vaccines with current circulating field isolates was again poor in 2012. It is generally considered that there is only one topotype of Asia 1 with a limited number of genetic variants. Asia 1 is limited in its circulation but there is a continuous risk of further spread. Numerous outbreaks reported from 6 countries in 2011 and the spread to Turkey and Iran in 2012 have required increased laboratory testing for vaccine matching from numerous field isolates. Reports of significant sequence variation in recent field isolates, Asia 1 Shamir vaccine failure in the field and the poor to no matching of field isolates with Asia 1 Shamir at Pirbright raised concerns that the current vaccines (in use for many years) would not provide protection when used in an emergency outbreak situation.

Therefore, in mid-2012 WRLFMD®, Pirbright, carried out a vaccine trial with Asia 1 Shamir high potency (emergency strength) vaccine for the EU vaccine bank. Challenge of vaccinated cattle was with a recent Turkish isolate of Asia 1 which did not match in laboratory tests with Asia 1 Shamir (Li et al, publication in preparation). The extremely important result was that 'high potency' emergency vaccine protected all animals challenged with a current field isolate of Asia 1, thus allaying fears of a complete vaccine failure, however, WRLFMD® are keeping a very close watch on the occurrence of further Asia 1 outbreaks.

Therefore, priority vaccines for the region still remain O Manisa plus supplemental strains (O 4625 and O 3039), PanAsia 2, A Iran 05 strain and Asia 1 Shamir (or similar strains).

It should also be noted that The SAP Institue, Turkey have produced a local Asia 1 vaccine for use in country (Asia 1 Tur 11) and that other major manufacturers are looking to develop new Asia 1 vaccine strains.

There continue to be major gaps in submissions 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 A Iran-05 vaccine strains against other circulating A viruses. Importantly, information on the efficacy of the PanAsia 2 vaccine in the field is required.

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

Serotype	Internationally available	Locally produced*
O	O_1 Manisa, O4625, 3039, O PanAsia 2	Russian O_1 PanAsia and O PanAsia 2, Turkish O Tur07
A	A Iran 05, A_{22} Iraq	Turkey 1/2006 (A Iran 05 lineage)
Asia 1	Shamir	Georgia 2000, Russia/2005, Asia 1 Tur 11
SAT 2	Eritrea 98	Locally produced Egypt strain (no details available)

* 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 2012:

Laboratory	Sample Nos.	Countries of origin
WRLFMD®	151	Eritrea, Ethiopia, Kenya & Tanzania

Additional information provided by Embakassi FMD laboratory, Nairobi, Kenya

Laboratory	Sample Nos.	Countries of origin
Embakassi	127	Kenya

		Virus isolation in cell culture / ELISA. FMD virus serotypes.						
Country of origin	**No of samples**	**O**	**A**	**C**	**SAT 1**	**SAT 2**	**SAT 3**	**Asia 1**
Kenya Serotyping	127	67	0	0	1	20	0	0

FMD vaccination

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, AK35/80
SAT 1	See pool 6	Kenya T155/71
SAT 2	Saudi 2000, Eritrea 98, see pool 6	Kenya 52/84, SAT2 K65/82

1.5.5 Pool 5: WESTERN AFRICA

Network labs receiving samples in 2012:

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 continuing to be built. Labs are being encouraged to collaborate in the area of sample collection, analysis and shipment. In addition laboratories capacities for FMD diagnosis is being enhanced through training focusing on FMDV detection and identification, and serology studies. It is intended that the information generated for the region will be disseminated to the international community.
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.

The following is information kindly supplied by Dr. Joseph Adongo Awuni from the Accra veterinary laboratory, Accra, Ghana in collaboration with FAO/EuFMD.

RESOLAB is the West & Central Africa Veterinary Laboratories network for Avian influenza and TADs which was launched in December 2007 in response to the rapid spread of HPAI / H5N1 in 2006 in order to harmonize control and surveillance activities for the disease and other TADs. The coordination Unit – FAO-ECTAD at the Regional Animal Health Centre in BAMAKO, Mali and covers this area. In 2010 the network formed sub-networks for a number of priority diseases such as FMD, Rabies & PPR with the aim of harmonizing & enhancing FMD surveillance and diagnostic activities, collection of sample for virus identification.

FMD Sub-Network Outputs
The sub-network has attempted to collate information on the FMD situation including;

- Number of reported outbreaks
- Number/types of samples collected
- Type of tests conducted
- Serotypes detected
- Capacity of labs to diagnose FMD
- Number of samples sent to reference labs for confirmation
- Control measure employed (type of vaccine)

Unfortunately few of the 23 labs have been active in FMD diagnosis.

Below is a table detailing the information collected in 2012 by this network.

UPDATE ON FMD SITUATION – 2012- RESOLAB AREA (POOL 5)

COUNTRY	Serotypes detected previously	Outbreaks in 2012	Serotypes detected in 2012
BENIN	O, A, SAT 1, SAT 2	No Information	
BURKINA FASO	A, O, SAT 2	No Information	
CAMEROON	A, O, SAT 2	13	Not tested
CAPE VERDE	No Information	No Information	
CENTRAL AFRICAN Republic	No Information	No Information	
CHAD	A, SAT 1	No Information	
CONGO Democratic Republic	A, SAT1	No Information	
CONGO REPUBLIC	No Information	No Information	
COTE D'IVOIRE	A, O, SAT2	No outbreaks reported	
EQUITORIAL GUINEA	No Information	No Information	
GABON	No Information	No Information	
GAMBIA	A O SAT2	3	O
GHANA	A, O, SAT 1, SAT 2	6	O
GUINEA BISSAU	No Information	No Information	
GUINEA	No Information	No Information	
LIBERIA	A, SAT 2	No Information	
MALI	O, A,SAT 1, SAT2	No Information	
MAURITANIA	No Information	No Information	
NIGER	O, A, SAT1, SAT 2	No Information	
NIGERIA	A, SAT1,	more than 100 reported	O, A, SAT1, SAT2
SAO TOME PRINCIPE	No Information	No Information	
SENEGAL	O, A, SAT2	5	A, SAT1, SAT2
SIERRA LEONE	No Information	No outbreaks reported	
TOGO	O, SAT 1	3	O

Importantly this network has reported the first outbreak of SAT 1 in Nigeria since 1981 and the very first report of SAT 1 in Senegal.

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 2012:

Laboratory	Sample Nos.*	Countries of origin
WRLFMD®	30	Botswana, & Zambia
ARC-OVI	123? (24,994)	South Africa (other country details not available)

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

Thirty samples were sent to WRLFMD® from **Botswana** and **Zambia** in 2012 for characterisation and analysis.

Botswana: A new FMD **type SAT 2** outbreak was reported in cattle at Matsebe Crush, Ngami, Ngamiland, Maun on 23/05/2012. Partial VP1 sequence data received from the Botswana Vaccine Institute showed this outbreak to be due to topotype III. Twenty-one **FMDV SAT 2** viruses (received from the BVI) from outbreaks in the Maun Veterinary District (Matsebe Crush, Spanplek Crush and Nokaneng) all belonged to topotype III, but those from Matsebe Crush and Nokaneng could be distinguished from those from Spanplek Crush suggesting the presence of two distinct evolutionary lineages in the district.

Zambia: An outbreak of FMD **type SAT 2** was found on 24/01/2012 in cattle in the Mwamba Kaka area, Mbala District, Northern Province. Partial VP1 sequencing was performed by the BVI and analysis performed at the WRLFMD®. The virus was shown to belong to SAT 2 topotype IV and to be most closely related to viruses isolated in the north of Tanzania in 2011.

Information from The Botswana Veterinary Institute

Countries covered by BVI

Botswana, Namibia, Zambia, Zimbabwe, Malawi, Angola, Swaziland, Seychelles, Cameroon, Lesotho

SADC BUFFALO Samples Surveillance

Country	Region	District	Village	Isolate	No samples
Zambia	Mbala	Mbala	Mbala	SAT 2	4
Botswana	Zone 2	Maun	Matsebe crush	SAT 2	5
Botswana	Zone 2	Maun	Matsebe crush	SAT 2	5
Zambia	Kazungula		Livingstone	SAT 2	3
Botswana	Zone 2	Maun	Spanplek crush	SAT 2	13
Botswana	Zone 2	Maun	Nokaneng	SAT 2	4
Zambia	Kazungul		Kazungula	SAT 1	5

	a				
Cameroon				SAT 2	37
Botswana	Zone 6	Surveillance		SAT 2	81

Vaccine suitability for Region

SAT 2 – New Vaccine strain used in Botswana
- From 2007/2008 strains
- Suitability for region being evaluated

SAT 2 Eritrea – supplied to Libya, Israel, Egypt, Senegal and Mali
O and A – supplied to Zambia and TZ.

Information from South Africa Agricultural Research Council, Onderstepoort Veterinary Institute (OVI), South Africa.

Number of samples dealt with: FMD

January-September 2012

	Sera	Clinical samples
DAFF	14 229	97
Commercial	10 191	0
Foreign	574	25

Definitions: Commercial- disease free projects/translocation projects
DAFF: Dept of Agriculture, Forestry and Fisheries

Vaccine suitablility

SAT 2: SAR/3/04, KNP/2/10, KNP/19/89, BOT/4/06, ZIM/7/83 and ZIM/14/90
SAT 3: KNP/10/90, SAR/1/06, BOT/6/98

The priority vaccines are SAT 2 and SAT 1, with SAT 3 being confined mainly to buffalo, but there is insufficient information to be more precise about the strains that should be included. For both SAT 1 and 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 2012:

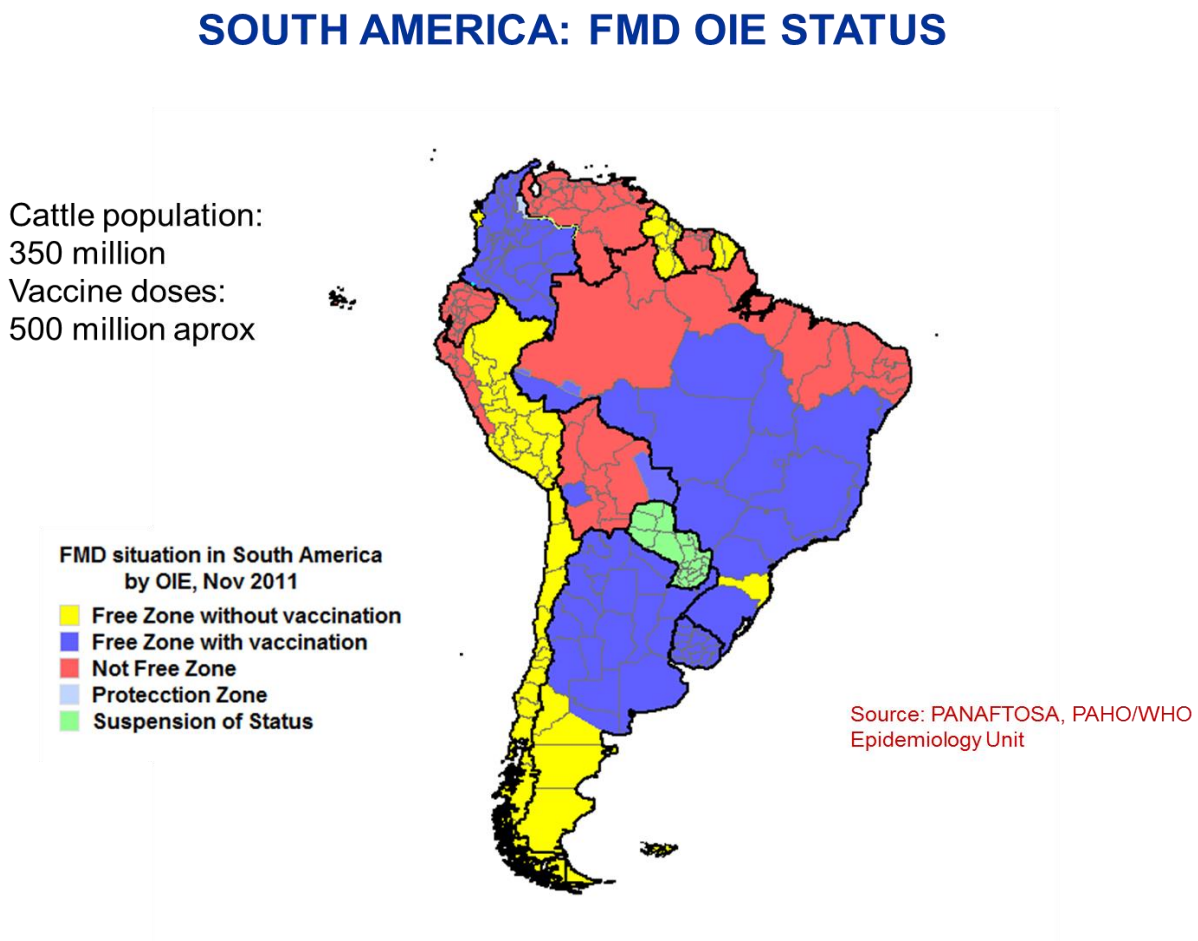
Laboratory	Sample Nos.	Countries of origin
PANAFTOSA	1	Paraguay

Information from SENASA, Argentina on country status

Country	Current FMD status	Serotypes	Frequency of regular outbreaks
Argentina	Free with and without vaccination		
Paraguay	Status free with vaccination suspended since last outbreaks in 2011	O	
Ecuador	Endemically infected	O	Monthly until year 2011. No outbreaks reported in yea 2012.
Bolivia	Free with vaccination areas (Chiquitania y Oruro)	O	Last outbreak:2007
Uruguay	Free with vaccination		

Information from PANAFTOSA, Brazil

Figure 20. South America FMD status

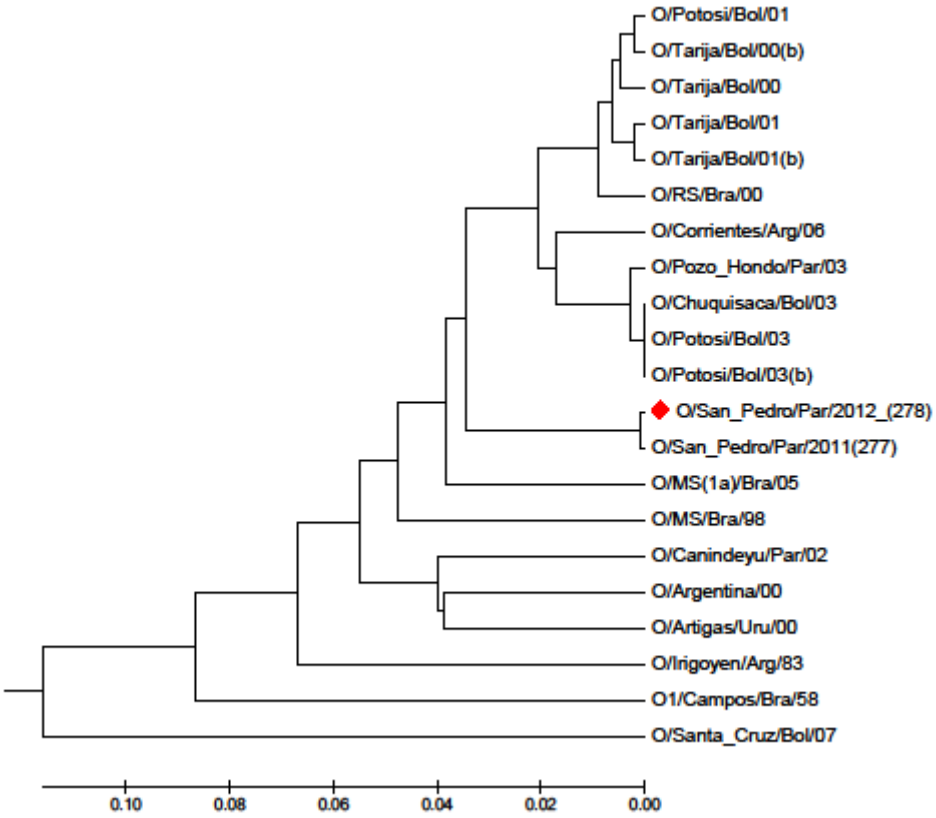


FMDV PARAGUAY 2012

Year	Country	Number of samples	Virus
2012*	Paraguay	01	FMDV O

***** sample received in 2012 from an outbreak in 2011

Figure 21. Phylogenetic Tree – "SOUTH CONE"



Serological relation "r1" with O1 Campos

Viral strain	"r1"
O1/San Pedro/PAR/2012	0.40

Expectancy of Protection

	Expectancy of Protection (EPP)	
Viral strain	**30 dpv**	**30 dpR**
O1/S.Pedro/PAR/12	89.00	94.24

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, careful monitoring of vaccine quality and vaccination programs continue to be required.

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

1.6 Clinical samples and FMDV isolates submitted to reference laboratories of the FMD network during 2012.

1.6.1 Overview of samples received and serotyping results

The network laboratories received and characterised more than 1800 samples in 2012 from 35 countries.
The proportion of the different serotypes detected in 2012 is shown below demonstrating that almost 60% of the samples characterised in 2012 were of the O serotype which is similar to 2011. However, the proportion of serotype A has reduced and the proportions of serotype Asia 1 and serotype SAT 2 have increased.

Note that serotypes C and SAT 3 were not detected.

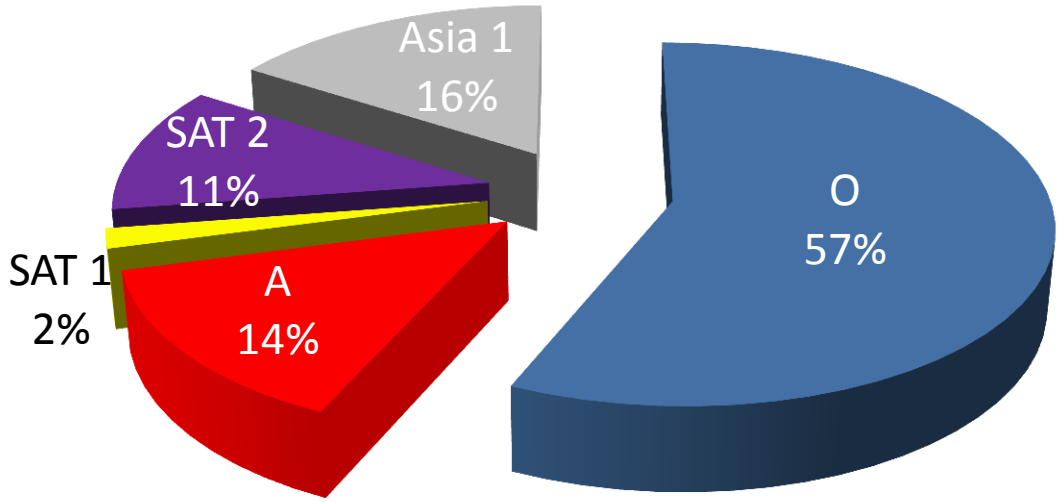


Figure 22. Serotypes detected in 2012

The approximate number of samples and number of viruses characterised by serotyping by region is shown below for samples collected in 2012:

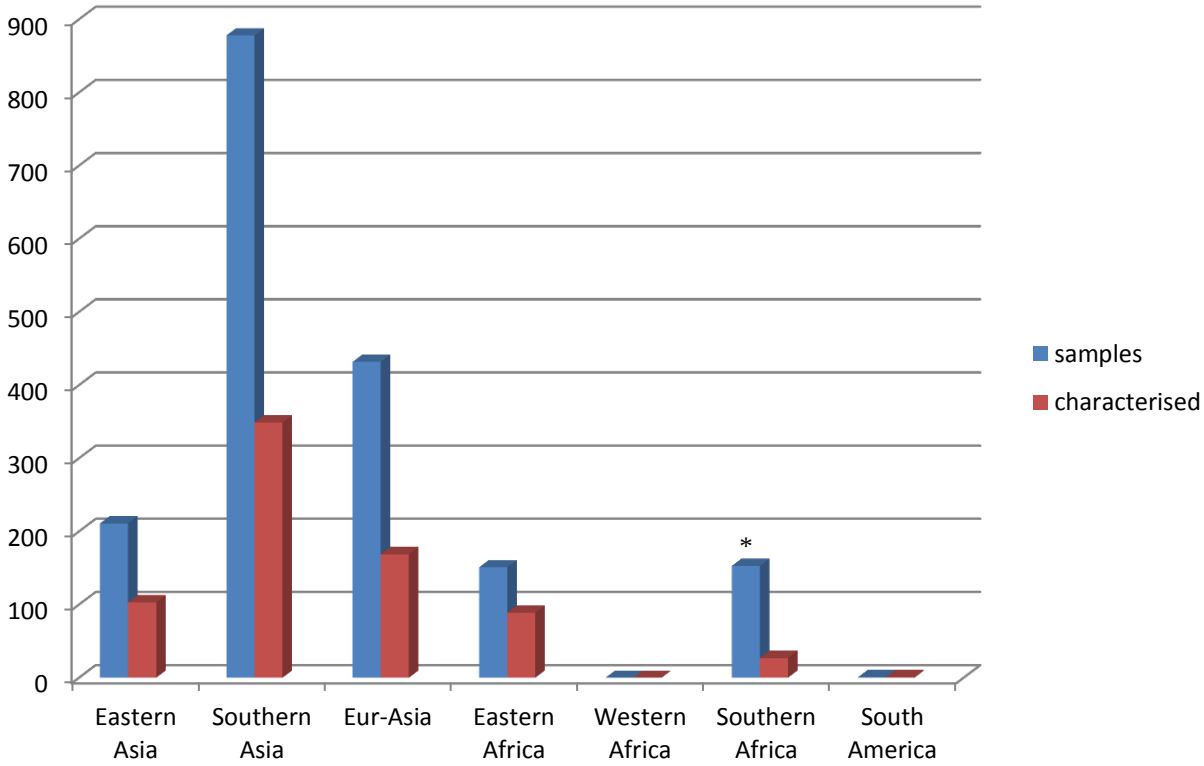


Figure 23. Samples and virus isolates made by region. * information on isolates not complete

The approximate numbers of samples received for FMDV detection and characterised in 2012 by the different network laboratories is tabulated below: In total 35 different countries submitted 1,826 samples in 2012 to the network laboratories with 42% being sent to WRLFMD®.

Characterisation and analysis of samples sent to Network laboratories revealed that in 2012, 738 viruses were characterised by serotyping with WRLFMD® reporting almost 50% of those isolations.

Table 3. Samples received for FMDV detection in 2012

Laboratory	Samples	Countries
WRLFMD®	764	27
PANAFTOSA	1	1
FGI-ARRIAH	15	3
ARC-OVI	123	1
LVRI	84	1
PDFMD	790	1
RRLSEA	49	3
Total	**1,826**	**37#**

[#] 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://new.paho.org/panaftosa.

1.6.2. Details of Serotyping for samples received in 2012 by Network Laboratories

Country	No. of samples	FMD virus serotypes O	A	C	SAT 1	SAT 2	SAT 3	Asia 1	Laboratory
Pool 1: EASTERN ASIA									
CAMBODIA	5	5							RRLSEA
PR CHINA	84	10	-	-	-	-	-	-	LVRI
HONG KONG	3	1	-	-	-	-	-	-	WRLFMD
JAPAN	1	1							WRLFMD
TAIWAN	1	1							WRLFMD
MALAYSIA	18	6	3	-	-	-	-	-	WRLFMD
THAILAND	24	4	19	-	-	-	-	-	WRLFMD
THAILAND	44	4	23	-	-	-	-	-	RRLSEA
VIETNAM	31	20	6	-	-	-	-	-	WRLFMD
TOTAL	**211**	**52**	**51**						
Pool 2: SOUTHERN ASIA									
AFGHANISTAN	20	3	4	-	-	-	-	5	WRLFMD
PAKISTAN	43	-	3	-	-	-	-	7	WRLFMD
SRI LANKA	16	6	-	-	-	-	-	-	WRLFMD
INDIA	790	241	8					72	PDFMD
BHUTAN	9								WRLFMD
TOTAL	**878**	**250**	**15**					**84**	
Pool 3: EUR-ASIA									
BAHRAIN	129	2	-	-	-	5	-	4	WRLFMD
EGYPT	49	7	11	-	-	18	-	-	WRLFMD
SUDAN	25	6	4	-	-	1	-	-	WRLFMD
IRAN	48	9	15	-	-	-	-	20	WRLFMD
ISRAEL	2	2	-	-	-	-	-	-	WRLFMD
EAST KAZAKHSTAN	6	2	-	-	-	-	-	-	ARRIAH
TAJIKISTAN	2	1						1	ARRIAH
UNITED ARAB EMIRATES	1	1	-	-	-	-	-	-	WRLFMD
SAUDI ARABIA	4	4	-	-	-	-	-	-	WRLFMD
PALESTINIAN AUTONOMOUS TERRITORIES	2	-	-	-	-	1	-	-	WRLFMD

KUWAIT	12	12	-	-	-	-	-	-	WRLFMD
LIBYA	125	15	-	-	-	3	-	-	WRLFMD
RUSSIA	7	6	-	-	-	-	-	-	ARRIAH
TURKEY	20	1	6	-	-	-	-	12	WRLFMD
TOTAL	**432**	**68**	**36**			**28**		**37**	
Pool 4: EASTERN AFRICA									
ERITREA	18	15							WRLFMD
KENYA	23	9	-	-	1	10	-	-	WRLFMD
ETHIOPIA	51	19							WRLFMD
TANZANIA	59	2	2	-	8	23	-	-	WRLFMD
TOTAL	**151**	**45**	**2**		**9**	**33**			
Pool 5: WESTERN AFRICA									
Pool 6: SOUTHERN AFRICA									
BOTSWANA	21	-	-	-	-	21	-	-	WRLFMD
ZAMBIA	9				4	2			WRLFMD
SOUTH AFRICA	123	-	-	-	-	-	-	-	ARC-OVI
TOTAL	**153**				**4**	**23**			
Pool 7: SOUTH AMERICA									
PARAGUAY	1	1	-	-	-	-	-	-	PANAFTOSA
TOTAL	**1**	**1**							
Totals	**1,826**	**416**	**104**		**13**	**84**		**117**	

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 2012.

In total **537** VP1 sequences were characterised for this report in 2012 by the Network Laboratories: **435 (81%)** came from WRLFMD® while the remaining **102 (19%)** 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.

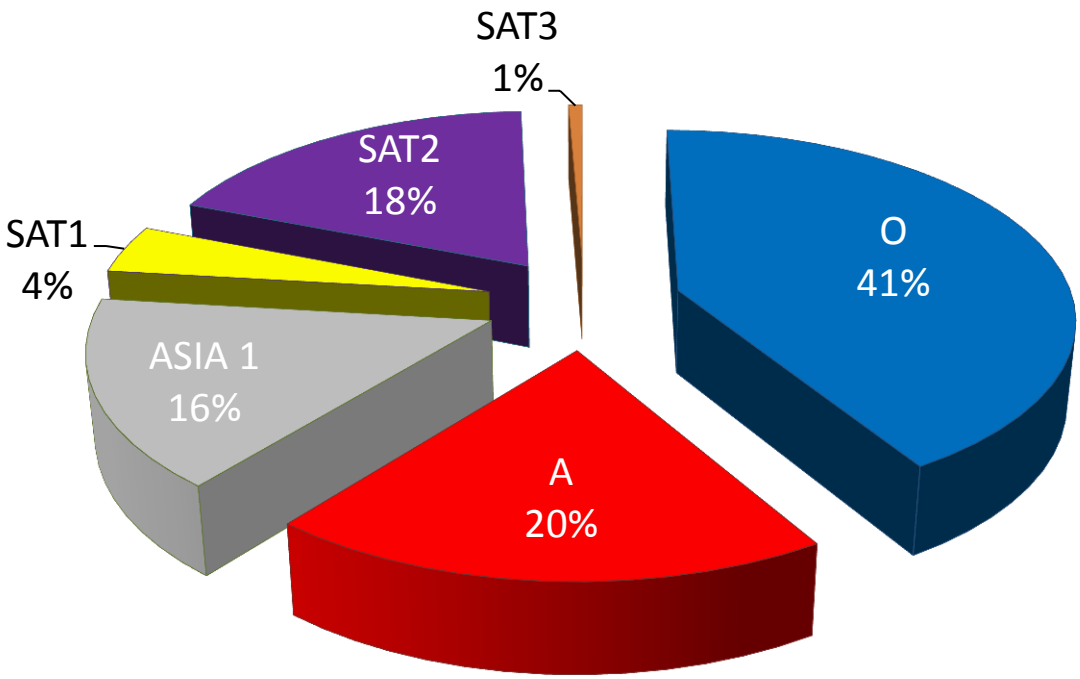
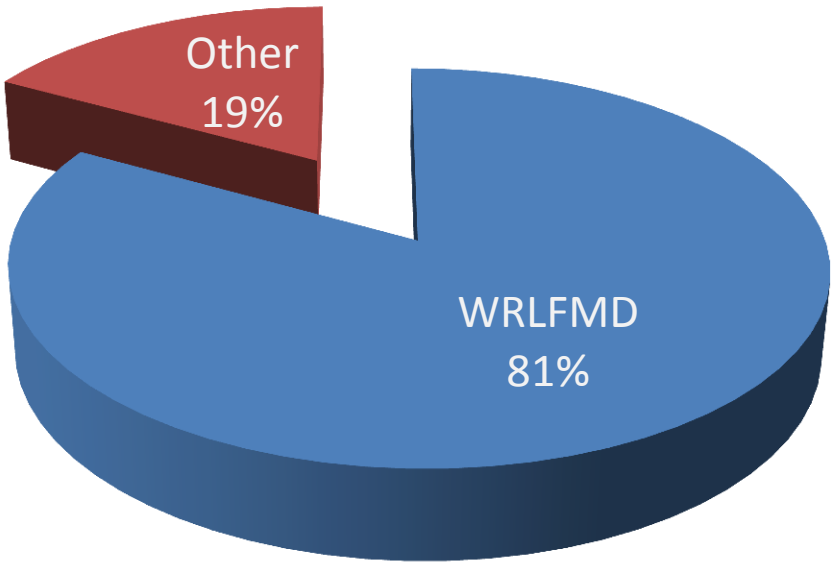


Figure 24. Serotype distribution of VP1 sequences obtained by Network Laboratories during 2012

Figure 25. VP1 gene sequences obtained by Network Laboratories during 2012



Data from WRLFMD® 2012

FMDV ID	Country of origin	Serotype	Topotype	Lineage/strain	Sub-lineage	Laboratory	Date received
Serotype A							
AFG/69/2011	Afghanistan	A	ASIA	Iran-05	HER-10	WRLFMD	16/02/2012
AFG/71/2011	Afghanistan	A	ASIA	Iran-05	HER-10	WRLFMD	16/02/2012
AFG/74/2011	Afghanistan	A	ASIA	Iran-05	HER-10	WRLFMD	16/02/2012
AFG/75/2011	Afghanistan	A	ASIA	Iran-05	HER-10	WRLFMD	16/02/2012
EGY/1/2010	Egypt	A	ASIA	Iran-05	BAR-08	WRLFMD	12/03/2012
EGY/2/2010	Egypt	A	ASIA	Iran-05	BAR-08	WRLFMD	12/03/2012
EGY/3/2010	Egypt	A	ASIA	Iran-05	BAR-08	WRLFMD	12/03/2012
EGY/2/2011	Egypt	A	ASIA	Iran-05	BAR-08	WRLFMD	12/03/2012
EGY/5/2011	Egypt	A	ASIA	Iran-05	BAR-08	WRLFMD	12/03/2012
EGY/8/2011	Egypt	A	ASIA	Iran-05	BAR-08	WRLFMD	12/03/2012
EGY/9/2011	Egypt	A	ASIA	Iran-05	BAR-08	WRLFMD	12/03/2012
EGY/1/2012	Egypt	A	AFRICA	G-IV		WRLFMD	12/03/2012
EGY/18/2012	Egypt	A	AFRICA	G-IV		WRLFMD	02/10/2012
EGY/20/2012	Egypt	A	AFRICA	G-IV		WRLFMD	02/10/2012
EGY/30/2012	Egypt	A	AFRICA	G-IV		WRLFMD	02/10/2012
IRN/55/2011	Iran	A	ASIA	Iran-05	SIS-10	WRLFMD	24/02/2012
IRN/63/2011	Iran	A	ASIA	Iran-05	HER-10	WRLFMD	24/02/2012
IRN/65/2011	Iran	A	ASIA	Iran-05	SIS-10	WRLFMD	24/02/2012
IRN/68/2011	Iran	A	ASIA	Iran-05	SIS-10	WRLFMD	24/02/2012
IRN/69/2011	Iran	A	ASIA	Iran-05	SIS-10	WRLFMD	24/02/2012
IRN/5/2012	Iran	A	ASIA	Iran-05	HER-10	WRLFMD	24/02/2012
IRN/8/2012	Iran	A	ASIA	Iran-05	HER-10	WRLFMD	24/02/2012
IRN/11/2012	Iran	A	ASIA	Iran-05	HER-10	WRLFMD	24/02/2012
IRN/12/2012	Iran	A	ASIA	Iran-05	HER-10	WRLFMD	24/02/2012
IRN/15/2012	Iran	A	ASIA	Iran-05	AFG-07	WRLFMD	20/07/2012

IRN/16/2012	Iran	A	ASIA	Iran-05	AFG-07	WRLFMD	20/07/2012
IRN/17/2012	Iran	A	ASIA	Iran-05	AFG-07	WRLFMD	20/07/2012
IRN/18/2012	Iran	A	ASIA	Iran-05	AFG-07	WRLFMD	20/07/2012
IRN/20/2012	Iran	A	ASIA	Iran-05	AFG-07	WRLFMD	20/07/2012
IRN/22/2012	Iran	A	ASIA	Iran-05	SIS-10	WRLFMD	20/07/2012
MAY/1/2012	Malaysia	A	ASIA	Sea-97		WRLFMD	11/05/2012
MAY/3/2012	Malaysia	A	ASIA	Sea-97		WRLFMD	11/05/2012
MAY/4/2012	Malaysia	A	ASIA	Sea-97		WRLFMD	11/05/2012
MAY/5/2012	Malaysia	A	ASIA	Sea-97		WRLFMD	11/05/2012
MAY/7/2012	Malaysia	A	ASIA	Sea-97		WRLFMD	11/05/2012
PAK/6/2012	Pakistan	A	ASIA	Iran-05	HER-10	WRLFMD	16/02/2012
PAK/7/2012	Pakistan	A	ASIA	Iran-05	HER-10	WRLFMD	16/02/2012
PAK/8/2012	Pakistan	A	ASIA	Iran-05	HER-10	WRLFMD	16/02/2012
SUD/6/2011	Sudan	A	AFRICA	G-IV		WRLFMD	20/07/2012
SUD/13/2011	Sudan	A	AFRICA	G-IV		WRLFMD	20/07/2012
SUD/1/2011	Sudan	A	AFRICA	G-IV		WRLFMD	20/07/2012
SUD/7/2011	Sudan	A	AFRICA	G-IV		WRLFMD	20/07/2012
SUD/12/2011	Sudan	A	AFRICA	G-IV		WRLFMD	20/07/2012
SUD/1/2011	Sudan	A	AFRICA	G-IV		WRLFMD	20/07/2012
SUD/7/2011	Sudan	A	AFRICA	G-IV		WRLFMD	20/07/2012
SUD/12/2011	Sudan	A	AFRICA	G-IV		WRLFMD	20/07/2012
SUD/1/2011	Sudan	A	AFRICA	G-IV		WRLFMD	20/07/2012
SUD/12/2011	Sudan	A	AFRICA	G-IV		WRLFMD	20/07/2012
SUD/12/2011	Sudan	A	AFRICA	G-IV		WRLFMD	20/07/2012
TAN/40/2012	Tanzania	A	AFRICA	G-I		WRLFMD	08/08/2012
TAN/41/2012	Tanzania	A	AFRICA	G-I		WRLFMD	08/08/2012
TAI/15/2011	Thailand	A	ASIA	Sea-97		WRLFMD	22/06/2012
TAI/16/2011	Thailand	A	ASIA	Sea-97		WRLFMD	22/06/2012
TAI/17/2011	Thailand	A	ASIA	Sea-97		WRLFMD	22/06/2012
TAI/18/2011	Thailand	A	ASIA	Sea-97		WRLFMD	22/06/2012
TAI/19/2011	Thailand	A	ASIA	Sea-97		WRLFMD	22/06/2012

TAI/20/2011	Thailand	A	ASIA	Sea-97		WRLFMD	22/06/2012
TAI/23/2011	Thailand	A	ASIA	Sea-97		WRLFMD	22/06/2012
TAI/24/2011	Thailand	A	ASIA	Sea-97		WRLFMD	22/06/2012
TAI/1/2012	Thailand	A	ASIA	Sea-97		WRLFMD	22/06/2012
TAI/2/2012	Thailand	A	ASIA	Sea-97		WRLFMD	22/06/2012
TAI/3/2012	Thailand	A	ASIA	Sea-97		WRLFMD	22/06/2012
TAI/4/2012	Thailand	A	ASIA	Sea-97		WRLFMD	22/06/2012
TAI/5/2012	Thailand	A	ASIA	Sea-97		WRLFMD	22/06/2012
TAI/6/2012	Thailand	A	ASIA	Sea-97		WRLFMD	22/06/2012
TAI/7/2012	Thailand	A	ASIA	Sea-97		WRLFMD	22/06/2012
TAI/8/2012	Thailand	A	ASIA	Sea-97		WRLFMD	22/06/2012
TAI/9/2012	Thailand	A	ASIA	Sea-97		WRLFMD	22/06/2012
TAI/10/2012	Thailand	A	ASIA	Sea-97		WRLFMD	22/06/2012
TAI/12/2012	Thailand	A	ASIA	Sea-97		WRLFMD	22/06/2012
TUR/77/2011	Turkey	A	ASIA	Iran-05	SIS-10	WRLFMD	02/02/2012
TUR/78/2011	Turkey	A	ASIA	Iran-05	SIS-10	WRLFMD	02/02/2012
TUR/79/2011	Turkey	A	ASIA	Iran-05	SIS-10	WRLFMD	02/02/2012
TUR/3/2012	Turkey	A	ASIA	Iran-05	SIS-10	WRLFMD	02/02/2012
TUR/4/2012	Turkey	A	ASIA	Iran-05	SIS-10	WRLFMD	02/02/2012
TUR/5/2012	Turkey	A	ASIA	Iran-05	SIS-10	WRLFMD	02/02/2012
VIT/15/2012	Vietnam	A	ASIA	Sea-97		WRLFMD	16/11/2012
VIT/16/2012	Vietnam	A	ASIA	Sea-97		WRLFMD	16/11/2012
VIT/17/2012	Vietnam	A	ASIA	Sea-97		WRLFMD	16/11/2012
VIT/18/2012	Vietnam	A	ASIA	Sea-97		WRLFMD	16/11/2012
VIT/19/2012	Vietnam	A	ASIA	Sea-97		WRLFMD	16/11/2012
VIT/20/2012	Vietnam	A	ASIA	Sea-97		WRLFMD	16/11/2012
Serotype Asia 1							
AFG/66/2011	Afghanistan	Asia 1	ASIA	Sindh-08		WRLFMD	16/02/2012
AFG/68/2011	Afghanistan	Asia 1	ASIA	Sindh-08		WRLFMD	16/02/2012
AFG/72/2011	Afghanistan	Asia 1	ASIA	Sindh-08		WRLFMD	16/02/2012

AFG/73/2011	Afghanistan	Asia 1	ASIA	Sindh-08	WRLFMD	16/02/2012
AFG/78/2011	Afghanistan	Asia 1	ASIA	Sindh-08	WRLFMD	16/02/2012
IRN/54/2011	Iran	Asia 1	ASIA	Sindh-08	WRLFMD	24/02/2012
IRN/56/2011	Iran	Asia 1	ASIA	Sindh-08	WRLFMD	24/02/2012
IRN/58/2011	Iran	Asia 1	ASIA	Sindh-08	WRLFMD	24/02/2012
IRN/59/2011	Iran	Asia 1	ASIA	Sindh-08	WRLFMD	24/02/2012
IRN/60/2011	Iran	Asia 1	ASIA	Sindh-08	WRLFMD	24/02/2012
IRN/67/2011	Iran	Asia 1	ASIA	Sindh-08	WRLFMD	24/02/2012
IRN/73/2011	Iran	Asia 1	ASIA	Sindh-08	WRLFMD	24/02/2012
IRN/74/2011	Iran	Asia 1	ASIA	Sindh-08	WRLFMD	24/02/2012
IRN/75/2011	Iran	Asia 1	ASIA	Sindh-08	WRLFMD	24/02/2012
IRN/76/2011	Iran	Asia 1	ASIA	Sindh-08	WRLFMD	24/02/2012
IRN/1/2012	Iran	Asia 1	ASIA	Sindh-08	WRLFMD	24/02/2012
IRN/2/2012	Iran	Asia 1	ASIA	Sindh-08	WRLFMD	24/02/2012
IRN/3/2012	Iran	Asia 1	ASIA	Sindh-08	WRLFMD	24/02/2012
IRN/6/2012	Iran	Asia 1	ASIA	Sindh-08	WRLFMD	24/02/2012
IRN/7/2012	Iran	Asia 1	ASIA	Sindh-08	WRLFMD	24/02/2012
IRN/9/2012	Iran	Asia 1	ASIA	Sindh-08	WRLFMD	24/02/2012
IRN/10/2012	Iran	Asia 1	ASIA	Sindh-08	WRLFMD	24/02/2012
IRN/14/2012	Iran	Asia 1	ASIA	Sindh-08	WRLFMD	20/07/2012
IRN/19/2012	Iran	Asia 1	ASIA	Sindh-08	WRLFMD	20/07/2012
IRN/23/2012	Iran	Asia 1	ASIA	Sindh-08	WRLFMD	20/07/2012
PAK/91/2011	Pakistan	Asia 1	ASIA	Sindh-08	WRLFMD	16/02/2012
PAK/92/2011	Pakistan	Asia 1	ASIA	Sindh-08	WRLFMD	16/02/2012
PAK/1/2012	Pakistan	Asia 1	ASIA	Sindh-08	WRLFMD	16/02/2012
PAK/2/2012	Pakistan	Asia 1	ASIA	Sindh-08	WRLFMD	16/02/2012
PAK/3/2012	Pakistan	Asia 1	ASIA	Sindh-08	WRLFMD	16/02/2012
PAK/4/2012	Pakistan	Asia 1	ASIA	Sindh-08	WRLFMD	16/02/2012
PAK/5/2012	Pakistan	Asia 1	ASIA	Sindh-08	WRLFMD	16/02/2012
TUR/65/2011	Turkey	Asia 1	ASIA	Sindh-08	WRLFMD	02/02/2012
TUR/66/2011	Turkey	Asia 1	ASIA	Sindh-08	WRLFMD	02/02/2012

TUR/67/2011	Turkey	Asia 1	ASIA	Sindh-08		WRLFMD	02/02/2012
TUR/68/2011	Turkey	Asia 1	ASIA	Sindh-08		WRLFMD	02/02/2012
TUR/69/2011	Turkey	Asia 1	ASIA	Sindh-08		WRLFMD	02/02/2012
TUR/70/2011	Turkey	Asia 1	ASIA	Sindh-08		WRLFMD	02/02/2012
TUR/72/2011	Turkey	Asia 1	ASIA	Sindh-08		WRLFMD	02/02/2012
TUR/73/2011	Turkey	Asia 1	ASIA	Sindh-08		WRLFMD	02/02/2012
TUR/74/2011	Turkey	Asia 1	ASIA	Sindh-08		WRLFMD	02/02/2012
TUR/76/2011	Turkey	Asia 1	ASIA	Sindh-08		WRLFMD	02/02/2012
TUR/1/2012	Turkey	Asia 1	ASIA	Sindh-08		WRLFMD	02/02/2012
TUR/2/2012	Turkey	Asia 1	ASIA	Sindh-08		WRLFMD	02/02/2012
Serotype O							
AFG/61/2011	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	16/02/2012
AFG/64/2011	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	16/02/2012
AFG/67/2011	Afghanistan	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	16/02/2012
BAR/4/2012	Bahrain	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	30/03/2012
BAR/5/2012	Bahrain	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	30/03/2012
EGY/6/2011	Egypt	O	ME-SA	PanAsia-2		WRLFMD	12/03/2012
EGY/7/2011	Egypt	O	ME-SA	PanAsia-2		WRLFMD	12/03/2012
EGY/10/2011	Egypt	O	ME-SA	PanAsia-2		WRLFMD	12/03/2012
EGY/19/2012	Egypt	O	EA-3	unnamed		WRLFMD	02/10/2012
EGY/25/2012	Egypt	O	EA-3	unnamed		WRLFMD	02/10/2012
EGY/26/2012	Egypt	O	EA-3	unnamed		WRLFMD	02/10/2012
EGY/27/2012	Egypt	O	EA-3	unnamed		WRLFMD	02/10/2012
ERI/1/2011	Eritrea	O	EA-3	unnamed		WRLFMD	01/08/2012
ERI/2/2011	Eritrea	O	EA-3	unnamed		WRLFMD	01/08/2012
ERI/3/2011	Eritrea	O	EA-3	unnamed		WRLFMD	01/08/2012
ERI/4/2011	Eritrea	O	EA-3	unnamed		WRLFMD	01/08/2012
ERI/8/2011	Eritrea	O	EA-3	unnamed		WRLFMD	01/08/2012
ERI/10/2011	Eritrea	O	EA-3	unnamed		WRLFMD	01/08/2012
ERI/11/2011	Eritrea	O	EA-3	unnamed		WRLFMD	01/08/2012

ERI/12/2011	Eritrea	O	EA-3	unnamed		WRLFMD	01/08/2012
ERI/13/2011	Eritrea	O	EA-3	unnamed		WRLFMD	01/08/2012
ERI/14/2011	Eritrea	O	EA-3	unnamed		WRLFMD	01/08/2012
ERI/15/2011	Eritrea	O	EA-3	unnamed		WRLFMD	01/08/2012
ERI/16/2011	Eritrea	O	EA-3	unnamed		WRLFMD	01/08/2012
ERI/17/2011	Eritrea	O	EA-3	unnamed		WRLFMD	01/08/2012
ERI/18/2011	Eritrea	O	EA-3	unnamed		WRLFMD	01/08/2012
ETH/29/2011	Ethiopia	O	EA-3	unnamed		WRLFMD	03/02/2012
ETH/32/2011	Ethiopia	O	EA-3	unnamed		WRLFMD	03/02/2012
ETH/34/2011	Ethiopia	O	EA-3	unnamed		WRLFMD	03/02/2012
ETH/38/2011	Ethiopia	O	EA-3	unnamed		WRLFMD	03/02/2012
ETH/42/2011	Ethiopia	O	EA-3	unnamed		WRLFMD	03/02/2012
ETH/45/2011	Ethiopia	O	EA-3	unnamed		WRLFMD	03/02/2012
ETH/46/2011	Ethiopia	O	EA-3	unnamed		WRLFMD	03/02/2012
ETH/48/2011	Ethiopia	O	EA-3	unnamed		WRLFMD	03/02/2012
ETH/49/2011	Ethiopia	O	EA-3	unnamed		WRLFMD	03/02/2012
ETH/50/2011	Ethiopia	O	EA-3	unnamed		WRLFMD	03/02/2012
ETH/51/2011	Ethiopia	O	EA-3	unnamed		WRLFMD	03/02/2012
ETH/59/2011	Ethiopia	O	EA-3	unnamed		WRLFMD	03/02/2012
ETH/3/2012	Ethiopia	O	EA-3	unnamed		WRLFMD	20/07/2012
ETH/4/2012	Ethiopia	O	EA-3	unnamed		WRLFMD	20/07/2012
ETH/7/2012	Ethiopia	O	EA-3	unnamed		WRLFMD	20/07/2012
ETH/11/2012	Ethiopia	O	EA-3	unnamed		WRLFMD	20/07/2012
ETH/12/2012	Ethiopia	O	EA-3	unnamed		WRLFMD	20/07/2012
ETH/15/2012	Ethiopia	O	EA-3	unnamed		WRLFMD	20/07/2012
IRN/61/2011	Iran	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	24/02/2012
IRN/62/2011	Iran	O	ME-SA	PanAsia-2	FAR-09	WRLFMD	24/02/2012
IRN/66/2011	Iran	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	24/02/2012
IRN/70/2011	Iran	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	24/02/2012
IRN/71/2011	Iran	O	ME-SA	PanAsia-2	FAR-09	WRLFMD	24/02/2012
IRN/77/2011	Iran	O	ME-SA	PanAsia-2	FAR-09	WRLFMD	24/02/2012

IRN/78/2011	Iran	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	24/02/2012
IRN/13/2012	Iran	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	20/07/2012
IRN/21/2012	Iran	O	ME-SA	PanAsia-2	FAR-09	WRLFMD	20/07/2012
ISR/1/2012	Israel	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	03/04/2012
ISR/2/2012	Israel	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	03/04/2012
JPN/1/2010	Japan	O	SEA	Mya-98		WRLFMD	18/01/2012
KEN/4/2011	Kenya	O	EA-2	unnamed		WRLFMD	29/06/2012
KEN/5/2011	Kenya	O	EA-2	unnamed		WRLFMD	29/06/2012
KEN/6/2011	Kenya	O	EA-2	unnamed		WRLFMD	29/06/2012
KEN/11/2011	Kenya	O	EA-2	unnamed		WRLFMD	29/06/2012
KEN/15/2011	Kenya	O	EA-2	unnamed		WRLFMD	29/06/2012
KEN/16/2011	Kenya	O	EA-2	unnamed		WRLFMD	29/06/2012
KEN/1/2012	Kenya	O	EA-1	unnamed		WRLFMD	29/06/2012
KEN/2/2012	Kenya	O	EA-1	unnamed		WRLFMD	29/06/2012
KEN/3/2012	Kenya	O	EA-1	unnamed		WRLFMD	29/06/2012
KUW/3/2011	Kuwait	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	13/03/2012
KUW/4/2011	Kuwait	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	13/03/2012
KUW/5/2011	Kuwait	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	13/03/2012
KUW/6/2011	Kuwait	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	13/03/2012
KUW/7/2011	Kuwait	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	13/03/2012
KUW/8/2011	Kuwait	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	13/03/2012
KUW/9/2011	Kuwait	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	13/03/2012
KUW/10/2011	Kuwait	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	13/03/2012
KUW/11/2011	Kuwait	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	13/03/2012
KUW/1/2012	Kuwait	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	13/03/2012
KUW/2/2012	Kuwait	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	13/03/2012
KUW/3/2012	Kuwait	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	13/03/2012
LIB/25/2011	Libya	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	31/01/2012
LIB/26/2011	Libya	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	31/01/2012
LIB/29/2011	Libya	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	31/01/2012
LIB/31/2011	Libya	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	31/01/2012

LIB/33/2011	Libya	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	31/01/2012
LIB/1/2012	Libya	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	31/01/2012
LIB/2/2012	Libya	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	31/01/2012
LIB/3/2012	Libya	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	31/01/2012
LIB/5/2012	Libya	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	31/01/2012
LIB/7/2012	Libya	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	31/01/2012
LIB/48/2012	Libya	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	27/02/2012
LIB/54/2012	Libya	O	EA-3	unnamed		WRLFMD	22/05/2012
LIB/74/2012	Libya	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	22/05/2012
MAY/6/2012	Malaysia	O	SEA	Mya-98		WRLFMD	11/05/2012
MAY/10/2012	Malaysia	O	SEA	Mya-98		WRLFMD	11/05/2012
MAY/11/2012	Malaysia	O	SEA	Mya-98		WRLFMD	11/05/2012
MAY/12/2012	Malaysia	O	SEA	Mya-98		WRLFMD	11/05/2012
MAY/13/2012	Malaysia	O	SEA	Mya-98		WRLFMD	11/05/2012
MAY/14/2012	Malaysia	O	SEA	Mya-98		WRLFMD	11/05/2012
MAY/15/2012	Malaysia	O	SEA	Mya-98		WRLFMD	11/05/2012
MAY/16/2012	Malaysia	O	SEA	Mya-98		WRLFMD	11/05/2012
MAY/17/2012	Malaysia	O	SEA	Mya-98		WRLFMD	11/05/2012
SAU/1/2012	Saudi Arabia	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	12/07/2012
SAU/2/2012	Saudi Arabia	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	12/07/2012
SAU/3/2012	Saudi Arabia	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	12/07/2012
SAU/4/2012	Saudi Arabia	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	12/07/2012
SRL/3/2009	Sri Lanka	O	ME-SA	unnamed		WRLFMD	25/10/2012
SRL/3/2010	Sri Lanka	O	ME-SA	unnamed		WRLFMD	25/10/2012
SRL/9/2010	Sri Lanka	O	ME-SA	unnamed		WRLFMD	25/10/2012
SRL/13/2010	Sri Lanka	O	ME-SA	unnamed		WRLFMD	25/10/2012
SRL/2/2012	Sri Lanka	O	ME-SA	unnamed		WRLFMD	25/10/2012
SUD/1/2009	Sudan	O	EA-3	unnamed		WRLFMD	20/07/2012
SUD/1/2010	Sudan	O	EA-3	unnamed		WRLFMD	20/07/2012
SUD/2/2010	Sudan	O	EA-3	unnamed		WRLFMD	20/07/2012
SUD/9/2011	Sudan	O	EA-3	unnamed		WRLFMD	20/07/2012

SUD/11/2011	Sudan	O	EA-3	unnamed		WRLFMD	20/07/2012
TAW/1/2012	Taiwan	O	SEA	Mya-98		WRLFMD	16/05/2012
TAN/38/2012	Tanzania	O	EA-2	unnamed		WRLFMD	08/08/2012
TAN/39/2012	Tanzania	O	EA-2	unnamed		WRLFMD	08/08/2012
TAI/21/2011	Thailand	O	SEA	Mya-98		WRLFMD	22/06/2012
TAI/22/2011	Thailand	O	ME-SA	PanAsia		WRLFMD	22/06/2012
TAI/25/2011	Thailand	O	SEA	Mya-98		WRLFMD	22/06/2012
TAI/11/2012	Thailand	O	ME-SA	PanAsia		WRLFMD	22/06/2012
TUR/71/2011	Turkey	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	02/02/2012
UAE/1/2011	United Arab Emirates	O	ME-SA	PanAsia-2	ANT-10	WRLFMD	20/01/2012
VIT/9/2008	Vietnam	O	CATHAY	unnamed		WRLFMD	03/01/2012
VIT/10/2008	Vietnam	O	ME-SA	PanAsia		WRLFMD	03/01/2012
VIT/41/2011	Vietnam	O	ME-SA	PanAsia		WRLFMD	03/01/2012
VIT/42/2011	Vietnam	O	ME-SA	PanAsia		WRLFMD	03/01/2012
VIT/1/2012	Vietnam	O	ME-SA	PanAsia		WRLFMD	28/03/2012
VIT/2/2012	Vietnam	O	ME-SA	PanAsia		WRLFMD	28/03/2012
VIT/3/2012	Vietnam	O	ME-SA	PanAsia		WRLFMD	28/03/2012
VIT/4/2012	Vietnam	O	ME-SA	PanAsia		WRLFMD	28/03/2012
VIT/5/2012	Vietnam	O	ME-SA	PanAsia		WRLFMD	28/03/2012
VIT/6/2012	Vietnam	O	ME-SA	PanAsia		WRLFMD	28/03/2012
VIT/7/2012	Vietnam	O	ME-SA	PanAsia		WRLFMD	28/03/2012
VIT/8/2012	Vietnam	O	ME-SA	PanAsia		WRLFMD	28/03/2012
VIT/9/2012	Vietnam	O	ME-SA	PanAsia		WRLFMD	28/03/2012
VIT/10/2012	Vietnam	O	ME-SA	PanAsia		WRLFMD	28/03/2012
VIT/11/2012	Vietnam	O	ME-SA	PanAsia		WRLFMD	28/03/2012
VIT/12/2012	Vietnam	O	ME-SA	PanAsia		WRLFMD	28/03/2012
VIT/13/2012	Vietnam	O	ME-SA	PanAsia		WRLFMD	28/03/2012
VIT/14/2012	Vietnam	O	ME-SA	PanAsia		WRLFMD	16/11/2012
VIT/21/2012	Vietnam	O	ME-SA	PanAsia		WRLFMD	16/11/2012
VIT/22/2012	Vietnam	O	ME-SA	PanAsia		WRLFMD	16/11/2012

Serotype SAT 1						
KEN/2/2011	Kenya	SAT 1	I (NWZ)	unnamed	WRLFMD	29/06/2012
MOZ/P13/2010 BUF B16	Mozambique	SAT 1	II (SWZ)	unnamed	WRLFMD	27/01/2012
TAN/P12/2010 BUF B1	Tanzania	SAT 1	I (NWZ)	unnamed	WRLFMD	27/01/2012
TAN/P12/2010 BUF B3	Tanzania	SAT 1	I (NWZ)	unnamed	WRLFMD	27/01/2012
TAN/P12/2010 BUF B7	Tanzania	SAT 1	I (NWZ)	unnamed	WRLFMD	27/01/2012
TAN/P12/2010 BUF B15	Tanzania	SAT 1	I (NWZ)	unnamed	WRLFMD	27/01/2012
TAN/11/2012	Tanzania	SAT 1	I (NWZ)	unnamed	WRLFMD	08/08/2012
TAN/12/2012	Tanzania	SAT 1	I (NWZ)	unnamed	WRLFMD	08/08/2012
TAN/22/2012	Tanzania	SAT 1	I (NWZ)	unnamed	WRLFMD	08/08/2012
TAN/23/2012	Tanzania	SAT 1	I (NWZ)	unnamed	WRLFMD	08/08/2012
TAN/25/2012	Tanzania	SAT 1	I (NWZ)	unnamed	WRLFMD	08/08/2012
TAN/44/2012	Tanzania	SAT 1	I (NWZ)	unnamed	WRLFMD	08/08/2012
TAN/45/2012	Tanzania	SAT 1	I (NWZ)	unnamed	WRLFMD	08/08/2012
TAN/27/2012	Tanzania	SAT 1	I (NWZ)	unnamed	WRLFMD	08/08/2012
TAN/27/2012	Tanzania	SAT 1	I (NWZ)	unnamed	WRLFMD	08/08/2012
ZAM/6/2012	Zambia	SAT 1	III (WZ)	unnamed	WRLFMD	28/09/2012
ZAM/7/2012	Zambia	SAT 1	III (WZ)	unnamed	WRLFMD	28/09/2012
ZAM/8/2012	Zambia	SAT 1	III (WZ)	unnamed	WRLFMD	28/09/2012
ZAM/9/2012	Zambia	SAT 1	III (WZ)	unnamed	WRLFMD	28/09/2012
Serotype SAT 2						
BAR/10/2012	Bahrain	SAT 2	IV	unnamed	WRLFMD	30/03/2012
BAR/12/2012	Bahrain	SAT 2	IV	unnamed	WRLFMD	30/03/2012
BAR/13/2012	Bahrain	SAT 2	IV	unnamed	WRLFMD	30/03/2012
BAR/16/2012	Bahrain	SAT 2	IV	unnamed	WRLFMD	30/03/2012
BAR/28/2012	Bahrain	SAT 2	IV	Ken-09	WRLFMD	12/06/2012
BOT/1/2012	Botswana	SAT 2	III	unnamed	WRLFMD	28/09/2012
BOT/2/2012	Botswana	SAT 2	III	unnamed	WRLFMD	28/09/2012
BOT/3/2012	Botswana	SAT 2	III	unnamed	WRLFMD	28/09/2012
BOT/4/2012	Botswana	SAT 2	III	unnamed	WRLFMD	28/09/2012

BOT/5/2012	Botswana	SAT 2	III	unnamed	WRLFMD	28/09/2012
BOT/8/2012	Botswana	SAT 2	III	unnamed	WRLFMD	28/09/2012
BOT/9/2012	Botswana	SAT 2	III	unnamed	WRLFMD	28/09/2012
BOT/10/2012	Botswana	SAT 2	III	unnamed	WRLFMD	28/09/2012
BOT/11/2012	Botswana	SAT 2	III	unnamed	WRLFMD	28/09/2012
BOT/12/2012	Botswana	SAT 2	III	unnamed	WRLFMD	28/09/2012
BOT/13/2012	Botswana	SAT 2	III	unnamed	WRLFMD	28/09/2012
BOT/14/2012	Botswana	SAT 2	III	unnamed	WRLFMD	28/09/2012
BOT/15/2012	Botswana	SAT 2	III	unnamed	WRLFMD	28/09/2012
BOT/16/2012	Botswana	SAT 2	III	unnamed	WRLFMD	28/09/2012
BOT/17/2012	Botswana	SAT 2	III	unnamed	WRLFMD	28/09/2012
BOT/18/2012	Botswana	SAT 2	III	unnamed	WRLFMD	28/09/2012
BOT/19/2012	Botswana	SAT 2	III	unnamed	WRLFMD	28/09/2012
BOT/20/2012	Botswana	SAT 2	III	unnamed	WRLFMD	28/09/2012
BOT/21/2012	Botswana	SAT 2	III	unnamed	WRLFMD	28/09/2012
BOT/6/2012	Botswana	SAT 2	III	unnamed	WRLFMD	28/09/2012
BOT/7/2012	Botswana	SAT 2	III	unnamed	WRLFMD	28/09/2012
BOT/6/2012	Botswana	SAT 2	III	unnamed	WRLFMD	28/09/2012
BOT/7/2012	Botswana	SAT 2	III	unnamed	WRLFMD	28/09/2012
EGY/2/2012	Egypt	SAT 2	VII	Alx-12	WRLFMD	12/03/2012
EGY/3/2012	Egypt	SAT 2	VII	Ghb-12	WRLFMD	12/03/2012
EGY/4/2012	Egypt	SAT 2	VII	Ghb-12	WRLFMD	12/03/2012
EGY/5/2012	Egypt	SAT 2	VII	Ghb-12	WRLFMD	12/03/2012
EGY/6/2012	Egypt	SAT 2	VII	Ghb-12	WRLFMD	12/03/2012
EGY/9/2012	Egypt	SAT 2	VII	Ghb-12	WRLFMD	12/03/2012
EGY/10/2012	Egypt	SAT 2	VII	Ghb-12	WRLFMD	12/03/2012
EGY/11/2012	Egypt	SAT 2	VII	Ghb-12	WRLFMD	12/03/2012
EGY/13/2012	Egypt	SAT 2	VII	Ghb-12	WRLFMD	12/03/2012
EGY/14/2012	Egypt	SAT 2	VII	Ghb-12	WRLFMD	12/03/2012
EGY/15/2012	Egypt	SAT 2	VII	Ghb-12	WRLFMD	12/03/2012
EGY/16/2012	Egypt	SAT 2	VII	Ghb-12	WRLFMD	02/10/2012

EGY/17/2012	Egypt	SAT 2	VII	Ghb-12	WRLFMD	02/10/2012
EGY/21/2012	Egypt	SAT 2	VII	Ghb-12	WRLFMD	02/10/2012
EGY/22/2012	Egypt	SAT 2	VII	Ghb-12	WRLFMD	02/10/2012
EGY/28/2012	Egypt	SAT 2	VII	Ghb-12	WRLFMD	02/10/2012
EGY/29/2012	Egypt	SAT 2	VII	Ghb-12	WRLFMD	02/10/2012
EGY/31/2012	Egypt	SAT 2	VII	Ghb-12	WRLFMD	02/10/2012
KEN/12/2011	Kenya	SAT 2	IV	unnamed	WRLFMD	29/06/2012
KEN/17/2011	Kenya	SAT 2	IV	unnamed	WRLFMD	29/06/2012
KEN/18/2011	Kenya	SAT 2	IV	unnamed	WRLFMD	29/06/2012
KEN/19/2011	Kenya	SAT 2	IV	unnamed	WRLFMD	29/06/2012
KEN/20/2011	Kenya	SAT 2	IV	unnamed	WRLFMD	29/06/2012
KEN/21/2011	Kenya	SAT 2	IV	unnamed	WRLFMD	29/06/2012
KEN/1/2012	Kenya	SAT 2	IX	unnamed	WRLFMD	29/06/2012
KEN/2/2012	Kenya	SAT 2	IX	unnamed	WRLFMD	29/06/2012
KEN/3/2012	Kenya	SAT 2	IX	unnamed	WRLFMD	29/06/2012
LIB/39/2012	Libya	SAT 2	VII	Lib-12	WRLFMD	27/02/2012
LIB/40/2012	Libya	SAT 2	VII	Lib-12	WRLFMD	27/02/2012
LIB/41/2012	Libya	SAT 2	VII	Lib-12	WRLFMD	27/02/2012
MOZ/P13/2010 BUF B22	Mozambique	SAT 2	I	unnamed	WRLFMD	27/01/2012
PAT/1/2012	Palestinian Autonomous Territories	SAT 2	VII	Ghb-12	WRLFMD	21/04/2012
SUD/4/2010	Sudan	SAT 2	VII	Alx-12	WRLFMD	20/07/2012
TAN/3/2011	Tanzania	SAT 2	IV	unnamed	WRLFMD	13/01/2012
TAN/4/2011	Tanzania	SAT 2	IV	unnamed	WRLFMD	13/01/2012
TAN/6/2011	Tanzania	SAT 2	IV	unnamed	WRLFMD	13/01/2012
TAN/7/2011	Tanzania	SAT 2	IV	unnamed	WRLFMD	13/01/2012
TAN/8/2011	Tanzania	SAT 2	IV	unnamed	WRLFMD	13/01/2012
TAN/1/2012	Tanzania	SAT 2	IV	unnamed	WRLFMD	08/08/2012
TAN/3/2012	Tanzania	SAT 2	IV	unnamed	WRLFMD	08/08/2012
TAN/5/2012	Tanzania	SAT 2	IV	unnamed	WRLFMD	08/08/2012
TAN/7/2012	Tanzania	SAT 2	IV	unnamed	WRLFMD	08/08/2012
TAN/9/2012	Tanzania	SAT 2	IV	unnamed	WRLFMD	08/08/2012

TAN/10/2012	Tanzania	SAT 2	IV	unnamed	WRLFMD	08/08/2012
TAN/13/2012	Tanzania	SAT 2	IV	unnamed	WRLFMD	08/08/2012
TAN/14/2012	Tanzania	SAT 2	IV	unnamed	WRLFMD	08/08/2012
TAN/15/2012	Tanzania	SAT 2	IV	unnamed	WRLFMD	08/08/2012
TAN/16/2012	Tanzania	SAT 2	IV	unnamed	WRLFMD	08/08/2012
TAN/18/2012	Tanzania	SAT 2	IV	unnamed	WRLFMD	08/08/2012
TAN/19/2012	Tanzania	SAT 2	IV	unnamed	WRLFMD	08/08/2012
TAN/32/2012	Tanzania	SAT 2	IV	unnamed	WRLFMD	08/08/2012
TAN/34/2012	Tanzania	SAT 2	IV	unnamed	WRLFMD	08/08/2012
TAN/36/2012	Tanzania	SAT 2	IV	unnamed	WRLFMD	08/08/2012
TAN/37/2012	Tanzania	SAT 2	IV	unnamed	WRLFMD	08/08/2012
ZAM/P11/2010	Zambia	SAT 2	II	unnamed	WRLFMD	27/01/2012
ZAM/1/2012	Zambia	SAT 2	IV	unnamed	WRLFMD	28/09/2012
ZAM/2/2012	Zambia	SAT 2	IV	unnamed	WRLFMD	28/09/2012
Serotype SAT 3						
MOZ/P13/2010 BUF B7	Mozambique	SAT 3	I	unamed	WRLFMD	27/01/2012
MOZ/P13/2010 BUF B11	Mozambique	SAT 3	I	unamed	WRLFMD	27/01/2012
MOZ/P13/2010 BUF B12	Mozambique	SAT 3	I	unamed	WRLFMD	27/01/2012

Analysis carried out by WRLFMD® on sequence data sent from other laboratories in 2012

FMDV ID	Country of origin	Serotype	Topotype	Lineage/strain	Sub-lineage	Laboratory	Date received
Serotype O							
EGY-4-2011	Egypt	O	ME-SA	PanAsia-2		AHRI	05/03/2012
EGY-7-2011	Egypt	O	ME-SA	PanAsia-2		AHRI	05/03/2012
EGY-10-2011	Egypt	O	ME-SA	PanAsia-2		AHRI	05/03/2012
EGY-13-2011	Egypt	O	ME-SA	PanAsia-2		AHRI	05/03/2012
Saloum/EGY/2012	Egypt	O	EA-3	unnamed		AHRI	14/05/2012
IRN 3917/2012	Iran	O	ME-SA	PanAsia-2	FAR-09	IVO	13/03/2012
IRN 3921/2012	Iran	O	ME-SA	PanAsia-2	FAR-09	IVO	13/03/2012
IRN 3922/2012	Iran	O	ME-SA	PanAsia-2	FAR-09	IVO	13/03/2012
IRN 10003/2012	Iran	O	ME-SA	PanAsia-2	FAR-09	IVO	13/03/2012
IRN 12463/2012	Iran	O	ME-SA	PanAsia-2	FAR-09	IVO	13/03/2012
IRQ/19/2010	Iraq	O	ME-SA	PanAsia-2	ANT-10	JUST	25/09/2012
IRQ/20/2010	Iraq	O	ME-SA	PanAsia-2	ANT-10	JUST	25/09/2012
Serotype A							
IRN FMD-15/2012	Iran	A	ASIA	Iran-05	SIS-10	IVO	27/02/2012
IRN FMD-18/2012	Iran	A	ASIA	Iran-05	SIS-10	IVO	27/02/2012
IRN FMD-19/2012	Iran	A	ASIA	Iran-05	SIS-10	IVO	27/02/2012
EGY-2-2011	Egypt	A	ASIA	Iran-05	BAR-08	AHRI	05/03/2012
EGY-3-2011	Egypt	A	ASIA	Iran-05	BAR-08	AHRI	05/03/2012
EGY-5-2011	Egypt	A	ASIA	Iran-05	BAR-08	AHRI	05/03/2012
EGY-8-2011	Egypt	A	ASIA	Iran-05	BAR-08	AHRI	05/03/2012

EGY-11-2011	Egypt	A	ASIA	Iran-05	BAR-08	AHRI	05/03/2012
EGY-12-2011	Egypt	A	ASIA	Iran-05	BAR-08	AHRI	05/03/2012
EGY-14-2011	Egypt	A	ASIA	Iran-05	BAR-08	AHRI	05/03/2012
EGY-B-2012	Egypt	A	AFRICA	G-IV		AHRI	06/03/2012
EGY-5-2012	Egypt	A	AFRICA	G-IV		AHRI	06/06/2012
IRN/Gods/2012	Iran	A	ASIA	Iran-05	SIS-10	IVO	17/12/2012
IRQ/2012	Iraq	A	ASIA	Iran-05	SIS-10	JUST	14/11/2012
IRQ/A218/2012	Iraq	A	ASIA	Iran-05	SIS-10	FMDI	24/12/2012
IRQ/A222/2012	Iraq	A	ASIA	Iran-05	SIS-10	FMDI	24/12/2012
IRQ/A223/2012	Iraq	A	ASIA	Iran-05	SIS-10	FMDI	24/12/2012
IRQ/A233/2012	Iraq	A	ASIA	Iran-05	SIS-10	FMDI	24/12/2012
TAI 3/12	Thailand	A	ASIA	Sea-97		TRRL	22/03/2012
TAI 4/12	Thailand	A	ASIA	Sea-97		TRRL	22/03/2012
TUR/1204/2012	Turkey	A	ASIA	Iran-05	SIS-10	FMDI	24/12/2012
TUR/1233/2012	Turkey	A	ASIA	Iran-05	SIS-10	FMDI	24/12/2012
Serotype Asia 1							
IRN FMD-2/2012	Iran	Asia 1	ASIA	Sindh-08		IVO	27/02/2012
IRN 1/2012	Iran	Asia 1	ASIA	Sindh-08		IVO	13/03/2012
IRN 286/2012	Iran	Asia 1	ASIA	Sindh-08		IVO	13/03/2012
IRN 3903/2012	Iran	Asia 1	ASIA	Sindh-08		IVO	13/03/2012
IRN 5428/2012	Iran	Asia 1	ASIA	Sindh-08		IVO	13/03/2012
IRN 30004/2012	Iran	Asia 1	ASIA	Sindh-08		IVO	13/03/2012
IRN F254/2012	Iran	Asia 1	ASIA	Sindh-08		IVO	13/03/2012
IRN F261/2012	Iran	Asia 1	ASIA	Sindh-08		IVO	13/03/2012
IRN F262/2012	Iran	Asia 1	ASIA	Sindh-08		IVO	13/03/2012
IRQ/4/2011	Iraq	Asia 1	ASIA	Sindh-08		JUST	25/09/2012
IRQ/31/2011	Iraq	Asia 1	ASIA	Sindh-08		JUST	25/09/2012
IRQ/73/2011	Iraq	Asia 1	ASIA	Sindh-08		JUST	25/09/2012

Serotype SAT 1						
ZAM/7/2012	Zambia	SAT 1	III (WZ)	unnamed	BVI	04/07/2012
Serotype SAT 2						
BOT/01/2012	Botswana	SAT 2	III	unnamed	BVI	04/07/2012
BOT/04/2012	Botswana	SAT 2	III	unnamed	BVI	04/07/2012
BOT/07/2012	Botswana	SAT 2	III	unnamed	BVI	04/07/2012
BOT12/12	Botswana	SAT 2	III	unnamed	BVI	03/08/2012
BOT14/12	Botswana	SAT 2	III	unnamed	BVI	03/08/2012
BOT/p08/2012	Botswana	SAT 2	III	unnamed	BVI	12/10/2012
BOT/p11/2012	Botswana	SAT 2	III	unnamed	BVI	12/10/2012
BOT/p52/2012	Botswana	SAT 2	III	unnamed	BVI	12/10/2012
ZAM 01/12	Zambia	SAT 2	IV	unnamed	BVI	05/04/2012
ZAM 02/12	Zambia	SAT 2	IV	unnamed	BVI	05/04/2012
EGY-A-2012	Egypt	SAT 2	VII	unnamed	AHRI	06/03/2012
EGY/7/2012	Egypt	SAT 2	VII	Ghb-12	AHRI	02/08/2012
EGY/23/2012	Egypt	SAT 2	VII	Ghb-12	AHRI	02/08/2012
EGY/26/2012	Egypt	SAT 2	VII	Ghb-12	AHRI	02/08/2012

BVI, Botswana Vaccine Institute
IVO, Iran Veterinary Organisation
JUST, Jordan University of Science and Technology
AHRI, Animal Health Research Institute, Egypt
TRRL, Thailand Regional Reference Laboratory

Data provided from other Laboratories in 2012

FMDV ID	Country of origin	Serotype	Topotype	Lineage/strain	Sub-lineage	Laboratory
ARRIAH-Russia (5)						
O/Tajikistan/2011	Tajikistan	O	ME-SA	PanAsia	PanAsia-2	ARRIAH
O/Russia/2012	Russia	O	ME-SA	PanAsia		ARRIAH
O/Kazakhstan/1/2012	Kazakhstan	O	ME-SA	PanAsia		ARRIAH
O/Kazakhstan/2/2012	Kazakhstan	O	ME-SA	PanAsia		ARRIAH
Asia 1/Tajikistan/2011	Tajikistan	Asia 1				
PANAFTOSA-South America (1)						
San Pedro/PAR/2012/278	Paraguay	O	EURO-SA	O1		PANAFTOSA

PDFMD-INDIA (80)

FMDV ID	Country of origin	Serotype	Topotype	Lineage/strain	Sub-lineage	Laboratory
IND 70/2012	INDIA	O	ME-SA	Ind2001	-	PDFMD
IND 70/2012	INDIA	O	ME-SA	Ind2001	-	PDFMD
IND 95/2012	INDIA	O	ME-SA	Ind2001	-	PDFMD
IND 141/2012	INDIA	O	ME-SA	Ind2001	-	PDFMD
IND 141/2012	INDIA	O	ME-SA	Ind2001	-	PDFMD
IND 192/2011	INDIA	O	ME-SA	Ind2011	-	PDFMD
IND 25/2011	INDIA	O	ME-SA	Ind2011	-	PDFMD
IND 71/2011	INDIA	O	ME-SA	Ind2011	-	PDFMD
IND 169/2011	INDIA	O	ME-SA	Ind2011	-	PDFMD
IND 169/2011	INDIA	O	ME-SA	Ind2011	-	PDFMD
IND 169/2011	INDIA	O	ME-SA	Ind2011	-	PDFMD
IND 165/2011	INDIA	O	ME-SA	Ind2011	-	PDFMD
IND 165/2011	INDIA	O	ME-SA	Ind2011	-	PDFMD
IND 164/2011	INDIA	O	ME-SA	Ind2011	-	PDFMD
IND 167/2011	INDIA	O	ME-SA	Ind2011	-	PDFMD

IND 69/12	INDIA	O	ME-SA	Ind2001	-	PDFMD
IND 70/12	INDIA	O	ME-SA	Ind2001	-	PDFMD
IND 141/12	INDIA	O	ME-SA	Ind2001	-	PDFMD
IND 193/12	INDIA	O	ME-SA	Ind2001	-	PDFMD
IND 3/12	INDIA	O	ME-SA	Ind2011	-	PDFMD
IND 1/2012	INDIA	O	ME-SA	Ind2011	-	PDFMD
IND 18/12	INDIA	O	ME-SA	Ind2011	-	PDFMD
IND 92/12	INDIA	O	ME-SA	Ind2011	-	PDFMD
IND 91/12	INDIA	O	ME-SA	Ind2011	-	PDFMD
IND 82/12	INDIA	O	ME-SA	Ind2011	-	PDFMD
IND 47/12	INDIA	O	ME-SA	Ind2001	-	PDFMD
IND 263/12	INDIA	O	ME-SA	Ind2001	-	PDFMD
IND 263/12	INDIA	O	ME-SA	Ind2001	-	PDFMD
IND 250/12	INDIA	O	ME-SA	Ind2001	-	PDFMD
IND 251/12	INDIA	O	ME-SA	Ind2001	-	PDFMD
IND 252/12	INDIA	O	ME-SA	Ind2001	-	PDFMD
IND 247/12	INDIA	O	ME-SA	Ind2001	-	PDFMD
IND 23/12	INDIA	O	ME-SA	Pan Asia	-	PDFMD
IND 279/12	INDIA	O	ME-SA	Ind2001	-	PDFMD
IND 290/12	INDIA	O	ME-SA	Ind2001	-	PDFMD
IND 210/12	INDIA	O	ME-SA	Ind2001	-	PDFMD
IND 319/12	INDIA	O	ME-SA	Ind2001	-	PDFMD
IND 320/12	INDIA	O	ME-SA	Ind2001	-	PDFMD
IND 22/12	INDIA	O	ME-SA	Ind2001	-	PDFMD
IND 36/12	INDIA	O	ME-SA	Ind2011	-	PDFMD
IND 133/12	INDIA	O	ME-SA	Pan Asia	-	PDFMD
IND 313/2012	INDIA	O	ME-SA	Ind2001	-	PDFMD
IND 281/2012	INDIA	O	ME-SA	Ind2001	-	PDFMD
IND 324/2012	INDIA	O	ME-SA	Ind2001	-	PDFMD
IND 10/2012	INDIA	Asia 1	Unknown	Lineage C	-	PDFMD
IND 59/2012	INDIA	Asia 1	Unknown	Lineage C	-	PDFMD
IND 93/2012	INDIA	Asia 1	Unknown	Lineage C	-	PDFMD
IND 68/2012	INDIA	Asia 1	Unknown	Lineage C	-	PDFMD
IND 68/2012	INDIA	Asia 1	Unknown	Lineage C	-	PDFMD
IND 114/2012	INDIA	Asia 1	Unknown	Lineage C	-	PDFMD
IND 118/2012	INDIA	Asia 1	Unknown	Lineage C	-	PDFMD
IND 119/2012	INDIA	Asia 1	Unknown	Lineage C	-	PDFMD
IND 119/2012	INDIA	Asia 1	Unknown	Lineage C	-	PDFMD

IND 120/2012	INDIA	Asia 1	Unknown	Lineage C	-	PDFMD
IND 120/2012	INDIA	Asia 1	Unknown	Lineage C	-	PDFMD
IND 121/2012	INDIA	Asia 1	Unknown	Lineage C	-	PDFMD
IND 149/2012	INDIA	Asia 1	Unknown	Lineage C	-	PDFMD
IND 10/2012	INDIA	Asia 1	Unknown	Lineage C	-	PDFMD
IND 59/2012	INDIA	Asia 1	Unknown	Lineage C	-	PDFMD
IND 93/2012	INDIA	Asia 1	Unknown	Lineage C	-	PDFMD
IND 59/12	INDIA	Asia 1	Unknown	Lineage C	-	PDFMD
IND 114/12	INDIA	Asia 1	Unknown	Lineage C	-	PDFMD
IND 115/12	INDIA	Asia 1	Unknown	Lineage C	-	PDFMD
IND 115/12	INDIA	Asia 1	Unknown	Lineage C	-	PDFMD
IND 120/12	INDIA	Asia 1	Unknown	Lineage C	-	PDFMD
IND 177/12	INDIA	Asia 1	Unknown	Lineage C	-	PDFMD
IND 178/12	INDIA	Asia 1	Unknown	Lineage C	-	PDFMD
IND 179/12	INDIA	Asia 1	Unknown	Lineage C	-	PDFMD
IND 183/12	INDIA	Asia 1	Unknown	Lineage C	-	PDFMD
IND 141/12	INDIA	Asia 1	Unknown	Lineage C	-	PDFMD
IND 143/12	INDIA	Asia 1	Unknown	Lineage C	-	PDFMD
IND306/2012	INDIA	Asia 1	Unknown	Lineage C	-	PDFMD
IND 264/2012	INDIA	A	Asian	Genotype 18 VP3[59]-deletion group	-	PDFMD
IND 255/2012	INDIA	A	Asian	Genotype 18 VP3[59]-deletion group	-	PDFMD
IND 256/2012	INDIA	A	Asian	Genotype 18 VP3[59]-deletion group	-	PDFMD
IND 257/2012	INDIA	A	Asian	Genotype 18 VP3[59]-deletion group	-	PDFMD
IND 267/2012	INDIA	A	Asian	Genotype 18 VP3[59]-deletion group	-	PDFMD
IND 270/2012	INDIA	A	Asian	Genotype 18 VP3[59]-deletion group	-	PDFMD
IND 272/2012	INDIA	A	Asian	Genotype 18 VP3[59]-deletion group	-	PDFMD
IND 307/2012	INDIA	A	Asian	Genotype 18 VP3[59]-deletion group	-	PDFMD

RRL Pakchong Thailand (16)						
FMDV ID	**Country of origin**	**Serotype**	**Topotype**	**Lineage/strain**	**Sub-lineage**	**Laboratory**
TAI 1/12	Thailand	A	Asia	Sea-97	-	RRL
TAI 12/2	Thailand	A	Asia	Sea-97	-	RRL
TAI 12/3	Thailand	A	Asia	Sea-97	-	RRL
TAI 4/12	Thailand	A	Asia	Sea-97	-	RRL
TAI 612/	Thailand	A	Asia	Sea-97	-	RRL
TAI 11-1/12	Thailand	A	Asia	Sea-97	-	RRL
TAI 11-2/12	Thailand	A	Asia	Sea-97	-	RRL
TAI 12-1/12	Thailand	A	Asia	Sea-97	-	RRL
TAI 12-2/12	Thailand	A	Asia	Sea-97	-	RRL
TAI 14-1/12	Thailand	A	Asia	Sea-97	-	RRL
TAI 14-2/12	Thailand	A	Asia	Sea-97	-	RRL
TAI 1512/	Thailand	A	Asia	Sea-97	-	RRL
TAI 16-112/	Thailand	A	Asia	Sea-97	-	RRL
TAI 16-2/12	Thailand	A	Asia	Sea-97	-	RRL
TAI 17-1/12	Thailand	A	Asia	Sea-97	-	RRL
TAI 17-2/12	Thailand	A	Asia	Sea-97	-	RRL

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.

Table 4. Antigenic characterisation of field isolates of FMDV Serotype O 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/Tadjikistan/2011	**M**	**N**	**M**
O/Kyrgyzstan/2011	**M**	**M**	**M**
O/East Kazakhstan/2011	**M**	**M**	**M**
O/Primorsky/Russia/1/2012	**M**	**N**	**N**
O/Primorsky/Russia/2/2012	**M**	**N**	**N**

Antigenic typing of FMD virus isolates type Asia-1 in VNT

FMDV ID	r_1 value in VNT
	Vaccine strain Asia-1/Shamir/89
Asia-1/Tadjikistan/2011	**N**

Interpretation of r_1 values

In the case of VNT:

M= Match - r_1 is $\geq$ 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.

N= no Match- r_1 is < 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 isolate from Paraguay by matching with vaccine strain O1 Campos- r_1 values obtained by 2d VNT at PANAFTOSA Laboratory.

Serological relation "r1" with O1 Campos

Viral strain	"r1"
O1/San Pedro/PAR/2012	0.40

EXPECTED PERCENTAGE OF PROTECTION

The EPP was estimated using panels of sera from vaccinated (30 days post vaccination) and revaccinated (30 days post booster vaccination) cattle kept at the PANAFTOSA serum bank. Both panels were tested against the field strain O1 San Pedro/PAR/12 of Paraguay. The results are presented in table 5 below.

Table 5. EPP estimation

	Expectancy of Protection (EPP)	
Viral strain	**30 dpv**	**30 dpR**
O1/S.Pedro/PAR/12	89.00	94.24

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

Figure 26. Vaccine matching by LPB ELISA

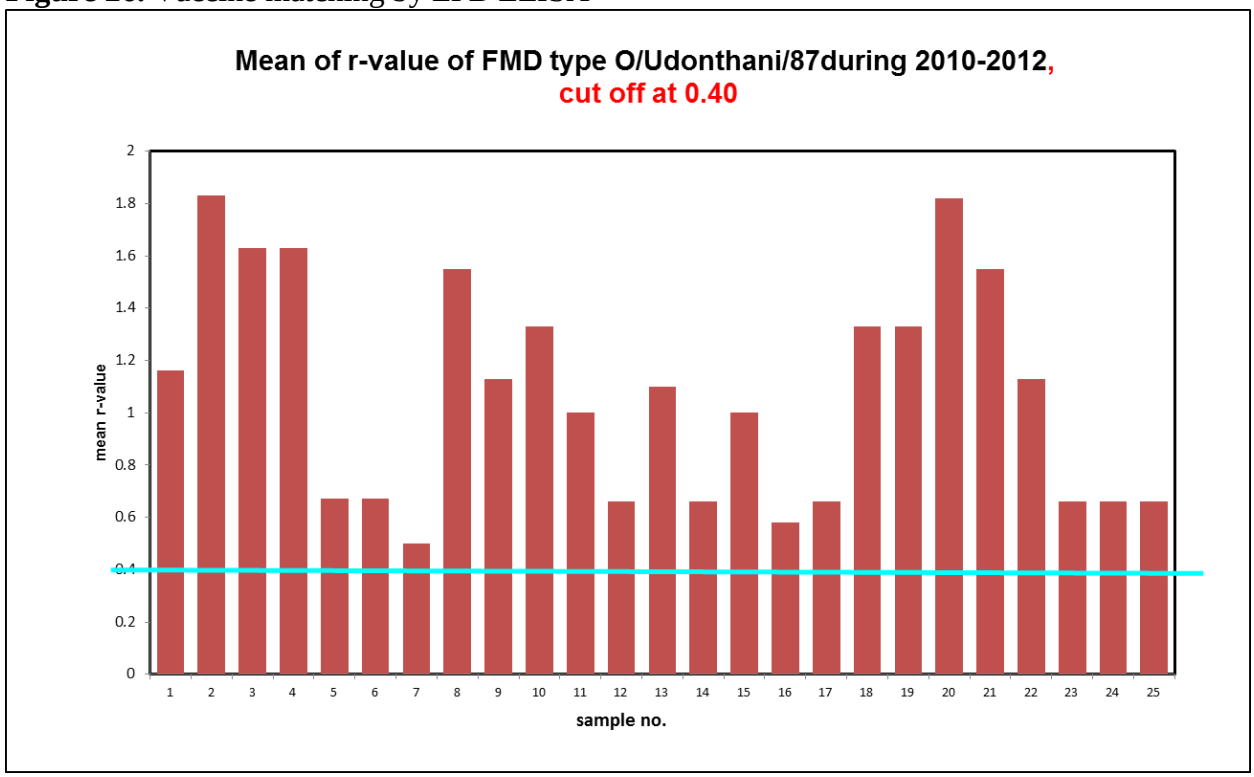
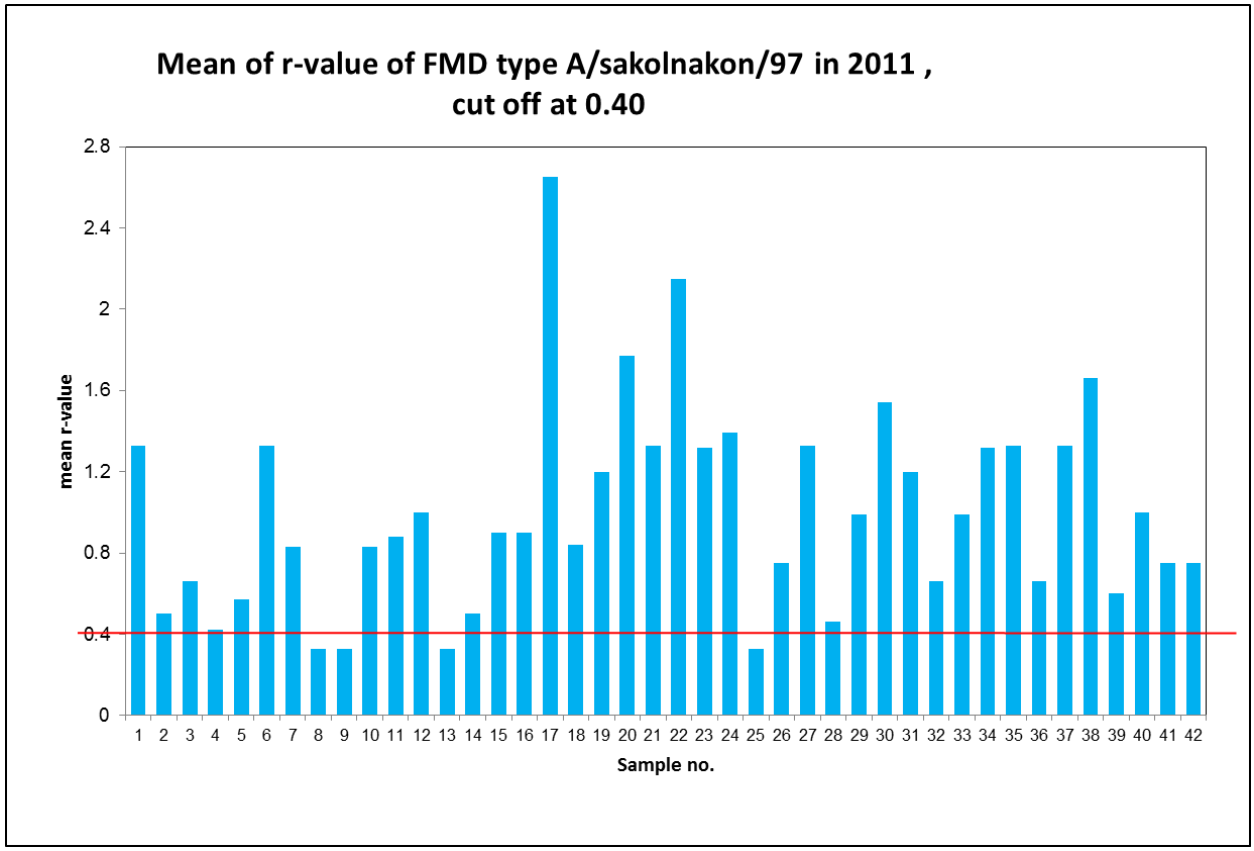


Figure 27. Vaccine matching by LPB ELISA



Vaccine matching or r-value of FMDV type A (A118/87) and A/Sakolnakorn/97 in SEA region (specimens received in 2009-2012)

Country	Year	Total samples	Range of values by LP ELISA			
			A118/87		A/Sakolnakorn/97	
			0.2-0.39	0.4-1.0	0.2-0.39	0.4-1.0
LAO PDR	2009	1		1	ND	
Vietnam		6	1	5	ND	
Thailand		9		9	ND	
Thailand	2010	3				3*
Vietnam		1				1*
Myanmar		2	ND		ND	
Thailand	2011	43			4	39*
	2012	2				2*

FMDV ID	r_1 value by LPBE	
	Vaccine strain #1 (A/Lopburi/2012; Local Thai vaccine strain)	Vaccine strain #2 (O/ Udornthani 189/87) ; Local Thai vaccine strain)
TAI 1/12	0.33	
TAI 2/12	0.66	
TAI 3/12	1.33	
TAI 4/12	0.33	
TAI 6/12	1.22	
TAI 11-1/12	0.56	
TAI 12-1/12	1.22	
TAI 14-1/12	0.31	
TAI 15/12	0.66	
TAI 16-1/12	1.33	
TAI 17-1/12	0.66	
TAI 33/12	0.66	
TAI 36/12	0.66	
TAI 41-1/12	0.56	
TAI 42/12	0.66	
TAI 57-1/12	0.89	
TAI 29/12		0.66
CAM 1/12		0.67
CAM 4/12		0.66
LAO	In Progress	

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

r_1 value by VNT			
FMDV ID	**INDR2/1975 (Serotype O)**	**IND63/1972 (Serotype Asia1)**	**IND40/2000 (Serotype A)**
IND 159/2011	0.51	-	-
IND 161/2011	0.7	-	-
IND 165/2011	0.51	-	-
IND 168/2011	0.77	-	-
IND 170/2011	0.74	-	-
IND 69/2012	0.81	-	-
IND 165/2011	0.64	-	-
IND 165/2011	0.47	-	-
IND 182/2011	0.49	-	-
IND 188/2011	0.70	-	-
IND 192/2011	0.60	-	-
IND 195/2011	0.60	-	-
IND 141/2012	0.73	-	-
IND 163/2012	0.35	-	-
IND 223/2012	0.56	-	-
IND 250/2012	0.56	-	-
IND 251/2012	0.62	-	-
		IND63/1972 (Serotype Asia1)	
IND 11/2012	-	0.4	-
IND 12/2012	-	0.4	-
IND 114/2012	-	0.65	-
IND 115/2012	-	0.68	-
IND 120/2012	-	0.77	
IND 121/2012	-	0.48	
IND 283/2012	-	0.36	-
IND 285/2012	-	0.47	-
IND 288/2012	-	0.58	-
IND 300/2012	-	0.32	-
IND 303/2012	-	0.31	-
IND 15/2012	-	0.62	-
IND 115/2012	-	0.63	-
IND 162/2012	-	0.73	-
IND 8/2012	-	0.40	-
IND 10/2012	-	0.38	
IND 109/2012	-	0.20	-
IND 111/2012	-	0.22	-
IND 114/2012	-	0.34	-
IND 115/2012	-	0.29	-
IND 120/2012	-	0.23	-
			IND40/2000 (Serotype A)
IND 255/2012	-	-	0.32
IND 256/2012	-	-	0.88
IND 256/2012	-	-	0.60
IND 264/2012	-	-	0.42
IND 264/2012	-	-	0.58
IND 267/2012	-	-	0.39
IND 270/2012	-	-	0.32

IND 307/2012	-	-	0.43

1.7.7. 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 2012 from the WRLFMD®, The Pirbright Institute, UK.

Vaccine matching - 1st January to 31st March 2012

Eleven FMDV type O isolates (See Table C, Type O for details) from Turkey, Kuwait, Ethiopia, Hong Kong Special Administrative Region of the People's Republic of China and Democratic Republic of Congo collected in 2010 and 2011 were analysed antigenically by the two dimensional virus neutralisation test (2dmVNT). All isolates from Kuwait and Turkey were antigentically matched with the testing vaccine strains O 3039 and O TUR 07, respectively. Isolates from Ethiopia and Democratic Republic of Congo were all closely matched with O 4625 and O TUR 5/09 vaccine strains. In addition, O ETH 1/2011, O ETH 7/2011 and O COD 3/2010 showed a close match with O Campos and O Manisa (Table C).

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

Two FMDV type SAT 2 viruses (see table C, Type SAT 2 for details) from Libya showed no antigenic matching with either SAT 2 Zim or SAT 2 Eritrea vaccine strains. However, two SAT2 viruses from Egypt both gave a close match with SAT 2 Eritrea vaccine strain but also a poor to no match with SAT 2 Zim (Table C).

TABLE C: Antigenic characterisation of FMD field isolates by matching with vaccine strains by VNT from 1st JANUARY to 31st MARCH 2012

Type O:

Vaccine matching studies for type O FMDV by VNT-WRL FMD							
WRL Sample Ref	**O 3039**	**O 4625**	**O Campos**	**O Manisa**	**O Taw98**	**O Tur 5/09**	**O Tur 07**
O Kuw 02/2011	M						
O Kuw 01/2011	M						
O Hkn 8/2011	M	N	N	N	M	N	
O Hkn 9/2011	M	N	N	N	M	M	
O Eth 1/2011		M	M	M		M	
O Eth 7/2011		M	M	M		M	
O Eth 13/2011		M	N	N		M	
O Eth 28/2011		M	M	N		M	
O Tur 25/2011							M
O Tur 33/2011							M
O Cod 3/2010		M	M	M		M	

Type A:

Vaccine matching studies for type A FMDV by VNT-WRL FMD								
WRL Sample Ref	**A Iran 2005**	**A22 Irq**	**A Sau95**	**A Tur06**	**A Ind 17/82**	**A May97**	**A Sau 41/91**	**A Eri 3/98**
A TUR 64/11	N	N	N	M			N	
A TUR 78/11	M	M	N	M				
A TUR 3/12	M	M	N	M				
A May 2/11	M	M		M	N	N		
A May 20/11	M	M		M	N	N		
A Cod 2/11	M	M	N	M				M
A Cod 12/11	N	M	N	M				M
A Bar 18/11	N	N	N	M			N	N

Type SAT 2:

Vaccine matching studies for type SAT2 FMDV by VNT-WRL FMD		
WRL Sample Ref	**Sat2 Eri**	**Sat2 Zim**
Sat2 Lib 40/2012	N	N
Sat2 Lib 41/2012	N	N
Sat2 Egy 6/2012	M	N
Sat2 Egy 9/2012	M	N

M: $r_1 = \geq 0.3$. 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.
N: $r_1 = < 0.3$. Suggests that the field isolate is so different from the vaccine strain that the vaccine is unlikely to protect

Vaccine matching 1st April to 30th June 2012

Eight FMDV type O isolates (See Table C, Type O for details) from United Arab Emirates, Libya, Egypt, Israel, Kuwait and Vietnam collected in 2011and 2012 were analysed antigenically by the two dimensional virus neutralisation test (2dmVNT). All isolates were antigenically matched with O TUR 5/09 and O4625 vaccine strains except the virus from Vietnam which showed no matching with any vaccine strain examined. One virus from Egypt and Israel also showed close matching with O Manisa. (Table C).
Seven FMDV type A viruses (see table C, Type A for details) from Turkey, Egypt, Pakistan, Thailand, Vietnam and Bahrain collected in 2010, 2011 and 2012 were analysed antigenically by the two dimensional virus neutralisation test (2dmVNT). All isolates showed antigenic match with the A TUR 06 vaccine strain except one virus from Thailand. One virus from Turkey, Pakistan, Thailand and Vietnam were also antigenically close to A_{22} IRAQ vaccine virus. (Table C).
Six FMDV type Asia 1 viruses (see table C, Type Asia 1 for details) from Pakistan, Iran and Turkey collected in 2011 and 2012 all showed no antigenic match with ASIA 1 IND 8/79 vaccine strain by the two dimensional virus neutralisation test (2dmVNT). One virus from Pakistan and Turkey gave a good match with Asia 1 Shamir vaccine virus antigenically. Two viruses from Turkey showed a close match with Asia 1 TUR 11 vaccine virus (Table C).
Eight FMDV type SAT 2 viruses (see table C, Type SAT 2 for details) from Libya, Bahrain, Egypt, Tanzania and Palestinian Autonomous Territories were analysed antigenically by the two dimensional virus neutralisation test (2dmVNT). All viruses except two from Libya showed antigenic matching with SAT 2 Eritrea vaccine strains.

The two SAT2 viruses from Libya showed no match with either SAT 2 Eritrea or SAT 2 Zim vaccine strains (Table C).

TABLE C: Antigenic characterisation of FMD field isolates by matching with vaccine strains by VNT from 1st APRIL to 30th JUNE 2012

Type O:

Vaccine Matching studies for serotype O FMDV by VNT-WRL FMD				
WRL SAMPLE REF	TYPE	O 4625	O Manisa	O Tur 5/09
UAE 1/2011	O	M	N	M
LIB 48/2012	O	M	N	M
EGY 10/2011	O	M	N	M
EGY 6/2011	O	M	M	M
ISR 1/2012	O	M	N	M
ISR 2/2012	O	M	M	M
KUW 3/2012	O	M	N	M
VIT 12/2012	O	N	N	N

Type A:

Vaccine Matching studies for serotype A FMDV by VNT-WRL FMD										
WRL SAMPLE REF	TYPE	A MAY 97	A IND 17/82	A Eri 98	A IRN 87	A Iran 2005	A SAU 41/91	A SAU 95	A TUR 06	A22 IRQ
TUR 78/2011	A					M		N	M	M
EGY 1/2012	A			N	N	N		N	M	N
PAK 6/12	A	N				N			M	M
TAI 1/11	A	N	N			M			N	N
TAI 13/11	A	N	N			M			M	M
VIT 17/10	A	N	M			M			M	M
BAR 18/11	A			M		N	N	M	M	N

Type Asia 1

Vaccine Matching studies for serotype Asia 1 FMDV by VNT-WRL FMD				
WRL SAMPLE REF	TYPE	Asia1 IND 8/79	Asia1 Shamir	Asia1 Tur11
PAK 5/2012	ASIA1	N	N	
PAK 91/2011	ASIA1	N	M	
IRN 10/2012	ASIA1	N	N	
IRN 54/2011	ASIA1	N	N	
TUR 2/2012	ASIA1	N	M	M
TUR 65/2011	ASIA1	N	N	M

Type SAT 2:

Vaccine Matching studies for serotype SAT 2 FMDV by VNT-WRL FMD				
WRL SAMPLE REF	**TYPE**	**SAT2 Eritrea**	**SAT2 ZIM**	**SAT2 ZIM 7/83**
LIB 40/2012	**SAT2**	**N**	**N**	
LIB 41/2012	**SAT2**	**N**	**N**	
TAN 3/2011	**SAT2**	**M**		**M**
TAN 7/2011	**SAT2**	**M**		**N**
BAR 10/2012	**SAT2**	**M**		**M**
BAR 12/2012	**SAT2**	**M**		**M**
EGY 2/2012	**SAT2**	**M**		**N**
PAT 1/2012	**SAT2**	**M**		**M**

M: $r_1 = \geq 0.3$. 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.
N: $r_1 = < 0.3$. Suggests that the field isolate is so different from the vaccine strain that the vaccine is unlikely to protect

Vaccine matching July to 30th September 2012

Fourteen FMDV type O isolates (See Table C, Type O for details) from Japan, Iran, Turkey, Vietnam, Bahrain, Afghanistan, Malaysia and Sudan collected in 2011and 2012 were analysed antigenically by the two dimensional virus neutralisation test (2dmVNT). All isolates were antigenically matched with O TUR 5/09 except the virus from Vietnam which showed matching with O TAW 98. Two viruses from Malaysia and one from Sudan showed close matching with O Manisa and O 4625 (Table C). Viruses from Japan, Malaysia and one virus from Vietnam also showed antigenic matches with the O 3039 vaccine.

Six FMDV type A viruses (See Table C, Type A for details) from Afghanistan and Iran collected during 2011 and 2012 showed antigenic matching with the A TUR 06 vaccine strain except two viruses from Iran by the two dimensional virus neutralisation test (2dmVNT) studies. One virus from Iran was antigenically matched with both A IRN 2005 and A Irq 24/64 (Table C).

Two FMDV type Asia 1 viruses (see table C, Type Asia 1 for details) from Iran collected in 2012 showed no antigenic match with ASIA 1 IND 8/79 and Asia 1 Shamir standard potency vaccine. However, when using antisera raised against high potency Asia 1 Shamir vaccine ($\geq 6PD_{50}$), both isolates showed matching (Table C).

One FMDV type SAT 1 virus (see table C, Type SAT 1 for details) from Kenya was analysed antigenically by the two dimensional virus neutralisation test (2dmVNT). There was no antigenic match between this virus and the SAT1 Rho vaccine (Table C).

TABLE C: Antigenic characterisation of FMD field isolates by matching with vaccine strains by 2dmVNT from 1st July to 30th September 2012

Type O:

Vaccine Matching studies for serotype O FMDV by VNT-WRL FMD					
WRL SAMPLE REF	**O 3039**	**O 4625**	**O Manisa**	**O Taw98**	**O Tur 5/09(boost)**
Jpn 01/2010	M	N	N	M	M
Irn 61/2011		M	N		M
Irn 78/2011		M	N		M
Tur 71/2011		M	N		M
Vit 1/2012	N	N	N	M	N
Vit 12/2012	M	N	N	M	N
Bar 4/2012		M	N		M
Bar 5/2012		M	N		M
Afg 67/2011		N	N		M
May 06/12	M	N	N	N	M
May 12/12	M	N	M	M	M
May 16/12	N	M	M	M	M
Sud 1/09		M	M		M
Sud 11/11		M	M		M

Type A:

Vaccine Matching studies for serotype A FMDV by VNT-WRL FMD					
WRL SAMPLE REF	**A Iran 2005**	**A Irn 87**	**A Irn 96**	**A Irq 24/64**	**A Tur 06**
Afg 69/2011	N			N	M
Afg 75/2011	N			N	M
Irn 55/2011	M			M	M
Irn 12/2012	N			N	M
Irn 15/2012	N	N	N	N	N
Irn 22/2012	N	N	N	N	N

Type Asia 1

Vaccine Matching studies for serotype Asia 1 FMDV by VNT-WRL FMD				
WRL SAMPLE REF	**TYPE**	**Asia1 IND 8/79**	**Asia1 Shamir**	**Asia1 Shamir(≥6PD$_{50}$)**
IRN 14/2012	ASIA1	N	N	M
IRN 23/2012	ASIA1	N	N	M

Type SAT 2:

Vaccine Matching studies for serotype SAT 1 FMDV by VNT-WRL FMD		
WRL SAMPLE REF	**TYPE**	**SAT1 Rho**
Ken 02/11	**SAT1**	**N**

In the case of VNT:

M: $r_1 = \geq 0.3$. 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.
N: $r_1 = < 0.3$. Suggests that the field isolate is so different from the vaccine strain that the vaccine is unlikely to protect

Vaccine matching 1st October to 31st December 2012

Twenty one FMDV type O isolates (See Table C, Type O for details) from Eritrea, Kenya, Egypt, Ethiopia, Iran, Turkey, Vietnam, Saudi Arabia, Sudan and Tanzania collected in 2011and 2012 were analysed antigenically by the two dimensional virus neutralisation test (2dmVNT). All isolates from Saudi Arabia, Eritrea, Ethiopia, Iran and Sudan and one virus from Kenya were antigenically matched with O TUR 5/09. All isolates from Vietnam were all antigenically close to O 3039. Two viruses from Egypt and one virus fromTanzania showed no match with any of the vaccine strains against which they were tested (Table C).
Four FMDV type A viruses (See Table C, Type A for details) from Egypt and Sudan collected during 2011 and 2012 showed antigenic matching with A Eritrea and/or A TUR 06 vaccine strains by the two dimensional virus neutralisation test (2dmVNT) studies (Table C).
One FMDV type SAT 1 virus (see table C, Type SAT 1 for details) from Tanzania was antigenically matched with vaccine strain SAT 1 105 by the two dimensional virus neutralisation test (2dmVNT) (Table C).
One FMDV type SAT 2 virus (see table C, Type SAT 2 for details) from Tanzania was antigenically matched with both SAT 2 Eritrea and SAT 2 ZIM vaccine strains (Table C).

TABLE C: Antigenic characterisation of FMD field isolates by matching with vaccine strains by 2dmVNT from 1st OCTOBER to 30th DECEMBER 2012

Type O:

Vaccine Matching studies for serotype O FMDV by VNT-WRL FMD

SAMPLE REF	O 3039	O 4625	O Manisa	O Tur 5/09	O Campos
VIT 13/2012	M		M		
VIT 2/2012	M		N		
VIT 7/2012	M		M		
VIT 8/2012	M		M		
SAU 1/2012		M	N	M	
SAU 4/2012		M	M	M	
ERI 1/2011		M	N	M	
ERI 18/2011		M	N	M	
ERI 3/2011		M	N	M	

VIT 22/2012	M		M		
O KEN 6/11		M	N	M	
O KEN 11/11		M	N	N	
O EGY 19/12		N	N	N	N
O EGY 27/12		N	N	N	N
O TAN38/12		N	N	N	
O ETH29/2011		N	M	M	
O ETH 4/12		N	N	M	
O ETH 7/12		N	N	M	
O ETH 12/11		M	M	M	
O IRN 13/12		M	N	M	
O IRN 21/12		N	M	M	

Type A:

Vaccine Matching studies for serotype A FMDV by VNT-WRL FMD

SAMPLE REF	A Eritrea	A Iran 2005	A SAU 41/91	A SAU 95	A TUR 06	A22 IRQ
SUD 6/2011	N	N	N	N	M	N
SUD13/2011	M	N	N	N	N	N
EGY 18/2012	M	N		N	M	N
EGY 30/2012	M	N		N	M	N

Type SAT 1

Vaccine Matching studies for serotype SAT 1 FMDV by VNT-WRL FMD	
SAMPLE REF	SAT 1 105
SAT 1 TAN 11/12	M

TYPE SAT 2

Vaccine Matching studies for serotype SAT 2 FMDV by VNT-WRL FMD		
SAMPLE REF	SAT 2 Eritrea	SAT 2 ZIM
SAT2 SUD 4/10	M	M

In the case of VNT:

M: $r_1 = \geq 0.3$. 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.
N: $r_1 = < 0.3$. Suggests that the field isolate is so different from the vaccine strain that the vaccine is unlikely to protect

1.7.8 Summary of all r_1 vaccine matching tests carried out by WRLFMD® in 2012

Date	Isolates tested	vaccine strains	r' values	isolate 'r' values
12.01.12	O Kuw 1,2/11, Tur 25,33/11, Intervet sera analysis	O 3039, Tur07, O Ind R2/75, Tur 5/09, Asia1 Sham	7	7
13.01.12	O Kuw 1,2/11, Tur 25,33/11, Intervet sera analysis	O 3039, Tur07, O Ind R2/75, Tur 5/09, Asia1 Sham	7	14
25.01.12	A Cod 2,12/11, Tur 29,64/11, Bar 18/11	A Eri, A22, Irn05,Sau95, Sau 41/91, Tur06	15	29
07.02.12	A Cod 2,12/11, Tur 64/11, Bar 18/11	A Eri, A22, Irn05,Sau95, Sau 41/91	15	44
23.01.12	O Cod 3/10, O Eth 1,7/11, Hkn 8,9/11, Vit 9/08, 41/11	O 4625,Campos,Manisa,Taw98,Tur 5/09	24	68
24.01.12	O Cod 3/10, O Eth 1,7/11, Hkn 8,9/11, Vit 9/08, 41/11	O 4625,Campos,Manisa,Taw98,Tur 5/09	24	92
14.01.12	Asia1 Irn 38, Pak 51, Tur 49/11	Asia1 Shamir Intervet	3	95
15.01.12	Asia1 Irn 38, Pak 51, Tur 49/11	Asia1 Shamir Intervet	3	98
24.02.12	A Tai1,13/11, A Vit 17/10,A May 2,20/11	A Ind, A22, Irn05, May97, Tur06	17	115
13.02.12	A Tai1,13/11, A Vit 17/10	A Ind, May97, Tur06	6	121
29.01.12	O Eth 13,28/11	O 4625,Campos,Manisa,Tur 5/09	8	129
29.01.12	O Eth 13,28/11	O 4625,Campos,Manisa,Tur 5/09	8	137
29.01.12	A May 2,20/11	A Ind, A22, Irn05, May97, Tur06	10	147
02.03.12	O Hkn 8,9/11, Vit 9/08, 41/11	O 3039, 4625,Campos,Manisa,Taw98,Tur 5/09	12	159
06.03.12	O Hkn 8,9/11, Vit 9/08, 41/11	O 3039, 4625,Campos,Manisa,Taw98,Tur 5/09	12	171
16.03.12	A Tur 78/11, 3/12	A22, Irn05, Sau95, Tur06, Tur06(Tur)	10	181
23.03.12	A Tur 78/11, 3/12	A22, Irn05, Sau95, Tur06, Tur06(Tur)	10	191
	A Bar 18/11, Vit 17/10	A Eri, Ind, Sau95	3	194
16.03.12	O Vit 9/08, 41/11 - test fail	O Manisa,Tur09	3	197
23.03.12	Sat2 Egy 6,9/12	Sat2 Eri,Zim	4	201
26.03.12	Sat2 Egy 6,9/12	Sat2 Eri,Zim	4	205
29.03.12	Sat2 Lib 40,41/12	Sat2 Eri,Zim	4	209
05.04.12	Sat2 Lib 40,41/12	Sat2 Eri,Zim	4	213
	O Vit 9/08, 41/11	O Manisa,Tur09	4	217
19.04.12	O Egy 6,10/11, Isr 1,2/12	O 4625,Manisa,Tur 5/09	12	229
20.04.12	O Egy 6,10/11, Isr 1,2/12	O 4625,Manisa,Tur 5/09	12	241
19.04.12	A Egy 8,9/11	A22, Irn05,Tur06	6	247
20.04.12	A Egy 8,9/11	A22, Irn05,Tur06	6	253
30.04.12	A Egy 8,9/11 and various titrations	A Tur06	3	256

	A Egy 8,9/11	A Eri, Irn87, Sau95	6	262
	A Egy 8,9/11	A Eri, Irn87, Sau95	6	268
03.05.12	Sat2 Bar 10,12/12, PAT 1/12, Tan 3,7/11, Egy 2/12	Sat2 Eri,Zim	12	280
04.05.12	Sat2 Bar 10,12/12, PAT 1/12, Tan 3,7/11, Egy 2/12	Sat2 Eri,Zim	12	292
02.05.12	Asia1 Sham, Irn30/04	Asia1 Shamir VE61	2	294
02.05.12	Asia1 Sham, Irn30/04	Asia1 Shamir VE61	2	296
03.05.12	Asia1 Sham, Irn30/04	Asia1 Shamir VE61	2	298
17.05.12	Asia1 Irn 54/11, 10/12, Pak 91/11, 5/12, Tur 65/11,2/12	Ind, Shamir 1&2/10, 1-5/12 6pd50	18	316
18.05.12	Asia1 Irn 54/11, 10/12, Pak 91/11, 5/12, Tur 65/11,2/12	Ind, Shamir 1&2/10, 1-5/12 6pd50	18	344
24.05.12	A Egy 1/12, Pak 6/12	A Eri, A22, Irn87, Irn05, May97, Sua95, Tur06	10	354
19.06.12	A Egy 1/12, Pak 6/12	A Eri, A22, Irn87, Irn05, May97, Sua95, Tur06	10	354
18.05.12	O Skr 6/10, 3/11	O Skr 7/10 intervet bvs pool B632-6	3	357
19.05.12	O Skr 6/10, 3/11	O Skr 7/10 intervet bvs pool B632-6	3	360
31.05.12	O UAE 1/11, Lib 48/12, Kuw 3/12, Vit 1,12/12	O 4625,Manisa,Tur 5/09	15	375
01.06.12	O UAE 1/11, Lib 48/12, Kuw 3/12, Vit 1,12/12	O 4625,Manisa,Tur 5/09	15	390
21/05/12	O Irn 61,78/11, Tur 71/11	O 4625,Manisa,Tur 5/09	9	399
22/05/12	O Irn 61,78/11, Tur 71/11	O 4625,Manisa,Tur 5/09	9	408
25/05/12	O Vit 9/08, 41/11	O Manisa	2	410
31.05.12	A Tur 78/11, 3/12	A Tur06 (turkey)	2	412
31.05.12	A Tur 78/11, 3/12	A Tur06 (turkey)	2	414
29/05/12	O manisa, O 4625, O Tur 5/09, A Tur 11	O manisa, O 4625, O Tur 5/09, A Tur 11	10	424
12.07.12	A Afg 69,75/11 May 1,7/12	A22, Irn05, Irn87, May97,Tur06	16	440
13.07.12	A Afg 69,75/11 May 1,7/12	A22, Irn05, Irn87, May97,Tur06	16	456
12.07.12	Asia1 Afg 66, 78/11	Ind, Shamir 1&2/10, 1-5/12 6pd50	6	462
13.07.12	Asia1 Afg 66, 78/11	Ind, Shamir 1&2/10, 1-5/12 6pd50	6	468
08/06/12	O manisa, O 4625, O Tur 5/09, A Tur 11	O manisa, O 4625, O Tur 5/09, A Tur 11	10	478
28/06/12	Asia1 Shamir/ Asia1 Tur 49/11	Asia1 Shamir Vaccinates bvs 1-15, 18&19+ pools	42	520
29/06/12	Asia1 Shamir/ Asia1 Tur 49/11	Asia1 Shamir Vaccinates bvs 1-15, 18&19+ pools	42	562
18/06/12	O May 6,12, 16/12	O manisa, O 4625, O Tur 5/09	9	571
10/07/12	O May 12, 16/12	O 4625, O Tur 5/09	4	575
19/06/12	O May 6,12, 16/12	O manisa, O 4625, O Tur 5/09	9	584
n/a	O May 6,12, 16/12	O 3039, O Taw98	6	590
29.06.12	A Irn55/11, Irn 12/12	A22, Irn05, Tur06	6	596
06.07.12	A Irn55/11, Irn 12/12	A22, Irn05, Tur06	6	602
29.06.12	A Egy 1/12	A Eri, Irn87	2	604
23.07.12	O Bar 4,5/12, Jpn 1/10, Afg 67/11, Vit 1, 12/12	O 3039, O manisa, Taw98 O 4625, O Tur 5/09	16	620

25.07.12	O Bar 4,5/12, Jpn 1/10, Afg 67/11, Vit 1, 12/12	O 3039, O manisa, Taw98 O 4625, O Tur 5/09	16	636
23.08.12	Sat2 Bar 28/12, Ken 12, 21/11	Sat2 Eri,Zim	6	642
24.08.12	Sat2 Bar 28/12, Ken 12, 21/11	Sat2 Eri,Zim	6	657
12.07.12	Asia1 Shamir/ Asia1 Tur 49/11	Asia1 Shamir Vaccinates bvs 11/12, 14/12	4	652
13.07.12	Asia1 Shamir/ Asia1 Tur 49/11	Asia1 Shamir Vaccinates bvs 11/12, 14/12	4	656
02/07/12	O May 6/12	O 3039	1	657
06/07/12	O May 6/12	O 3039	1	658
13.07.12	A Irn55/11, Irn 12/12	A22 - MN60/12 repeat	2	660
09/07/12	O May 6/12	O 4625, O Tur 5/09	2	662
13/07/12	O May 6, 12, 16/12	O Manisa	3	665
17.07.12	O May 6, 12, 16/12	O Tur 5/09	3	668
23.07.12	A Afg 69,75/11 May 1,7/12	A22, Irn05, Irn87, May97,Tur06		668
24.07.12	A Afg 69,75/11 May 1,7/12	A22, Irn05, Irn87, May97,Tur06		668
20.07.12	O May 6, 12, 16/12	O Tur 5/09, O 4625	6	674
23.07.12	O May 6, 12, 16/12	O Manisa, O4625	6	680
24.07.12	O May 6, 12, 16/12	O 3039, O Taw98	6	686
09.08.12	O Afg 67/11, Eth 29/11,Irn 61,78/11, Sau 1,4/12, Tur 71/11	O 4625,Manisa,Tur 5/09	19	705
10.08.12	O Eth 29/11,Irn 61,78/11, Sau 1,4/12, Tur 71/11	O 4625,Manisa,Tur 5/09	18	723
27.07.12	O May 6, 12, 16/12	O 4625, O 3039	6	729
?	O Vit 9/08, 41/11	O Manisa,Tur09	3	732
?	O Vit 9/08, 41/11	O Manisa,Tur09	3	735
09.08.12	Sat1 Ken 2/11	Sat1 Rho	1	736
10.08.12	Sat1 Ken 2/11	Sat1 Rho	1	737
10.08.12	O Jpn 1/10, Bar 4, 5/12,Afg 67/11, Vit 1, 12/12	O 4625, Taw98	7	744
31.07.12	O Ken 4, 16/11	O Manisa, O Tur 5/09, O 4625	6	750
30.07.12	O May 6, 12, 16/12	O Manisa, O Taw98	6	756
31.07.12	A Afg 75/11 A May 1/12	A Tur '06	2	758
07.08.12	O Ken 4/11, O Lib 54/12	O Manisa, O Tur 5/09, O 4625	6	764
03.08.12	O May 6, 12, 16/12	O 3039, O 4625, O Taw98	8	772
17.08.12	O Ken 4/11, O Lib 54/12, O Eth 29/11	O Manisa, O Tur 5/09, O 4625	7	779
20.08.12	O Ken 4/11, O Lib 54/12	O Manisa, O Tur 5/09, O 4625	6	785
23.08.12	A Irn15/12, Irn 22/12	A22, Irn05, Tur06	6	791
24.08.12	A Irn15/12, Irn 22/12	A22, Irn05, Tur06	6	797
27.08.12	Asia1 Irn 14, 23/12	Ind, Shamir 1&2/10, 1-5/12 6pd50	6	803
28.08.12	Asia1 Irn 14, 23/12	Ind, Shamir 1&2/10, 1-5/12 6pd50	6	809
31.08.12	O Eth 4, 7, 12/12, O Irn 13, 21/12, O Lib 54/12, O Ken 4/11	O 4625, O Tur 5/09	13	822

27.08.12	Sat2 Bar 28/12, Ken 12, 21/11	Sat2 Zim	3	825
27.08.12	A Irn15/12, Irn 22/12	A Irn87, Irn96	4	829
28.08.12	A Irn15/12, Irn 22/12	A Irn87, Irn96	4	833
07.09.12	O Eth 4, 7, 12/12, O Irn 13, 21/12	O 4625, O Tur 5/09	10	843
03.09.12	O Eth 4, 7, 12/12, O Irn 13, 21/12, O Lib 54/12	O Manisa	6	849
04.09.12	O Eth 4, 7, 12/12, O Irn 13, 21/12, O Ken 4/11	O Manisa	6	855
20.09.12	A Sud 6,13/11	A Eri, Irn05, A22, Sau 41/91, Sau95, Tur06	12	867
21.09.12	A Sud 6,13/11	A Eri, Irn05, A22, Sau 41/91, Sau95, Tur06	12	879
20.09.12	O Eri 1,3,18/11	O Manisa, O Tur 5/09, O 4625	9	888
21.09.12	O Eri 1,3,18/11	O Manisa, O Tur 5/09, O 4625	9	897
11.09.12	O Eth 4, 7, 12/12, O Irn 13, 21/12,	O 4625, O Manisa	7	904
14.09.12	O Sud 1/09, 11/11, O Eth 4/12,	O Manisa, O Tur 5/09	5	909
17.09.12	O Sud 1/09, 11/11, O Ken 6, 11/11, O Eth 4/12, O Irn 13/12	O 4625, O Manisa	10	919
18.09.12	O Sud 1/09, 11/11, O Ken 6, 11/11	O Tur 5/09, O 4625	8	927
21.09.12	O Ken 6, 11/11, O Sud 1/09, O Sud 11/11	O Manisa, O Tur 5/09	7	934
04.10.12	Asia1 Irn30/04, Pak 5/12, Tur49/11, Shamir VV	Shamir 1&2/10, 1-5/12 6pd50, 18&19/12 - Ring Trial	12	946
05.10.12	Asia1 Irn30/04, Pak 5/12, Tur49/11, Shamir VV	Shamir 1&2/10, 1-5/12 6pd50, 18&19/12 - Ring Trial	12	958
04.10.12	O Eri 1,3,18/11	O 4625	3	947
05.10.12	A Sud 6,13/11	A Eri, Sau95, Tur06	5	966
25.09.12	O Ken 6, 11/11	O Manisa, O Tur 5/09	4	970
18.10.12	Asia1 Irn30/04, Pak 5/12, Tur49/11, Shamir VV	Shamir 1&2/10, 1-5/12 6pd50, 18&19/12 - Ring Trial	12	982
19.10.12	Asia1 Irn30/04, Pak 5/12, Tur49/11, Shamir VV	Shamir 1&2/10, 1-5/12 6pd50, 18&19/12 - Ring Trial	12	994
12.10.12	Sat2 Sud 4/10	Sat2 Eri, Sat2 Zim	4	998
18.10.12	A Sud 6,13/11	A Tur06	3	1001
16.10.12	Sat2 Sud 4/10	Sat2 Eri, Sat2 Zim	4	1005
19.10.12	A Sud 6,13/11	A Tur06	3	1008
29.10.12	Asia1 Irn30/04, Pak 5/12, Tur49/11, Shamir VV	Shamir 1&2/10,1-5/12,18&19/12,VE61 - Ring Trial	16	1024
30.10.12	Asia1 Irn30/04, Pak 5/12, Tur49/11, Shamir VV	Shamir 1&2/10,1-5/12,18&19/12,VE61 - Ring Trial	16	1040
22.10.12	Sat2 Sud 4/10	Sat2 Eri	1	1041
	A Egy 18,30/12	A Eri, Irn05, A22, Sau95, Tur06	10	1051
	A Egy 18,30/12	A Eri, Irn05, A22, Sau95, Tur06	10	1061
	Asia1 Irn30/04, Pak 5/12, Tur49/11, Shamir VV	Shamir 1&2/10,1-5/12,18&19/12,VE61 - Ring Trial	16	1077
	Asia1 Irn30/04, Pak 5/12, Tur49/11, Shamir VV	Shamir 1&2/10,1-5/12,18&19/12,VE61 - Ring Trial	16	1093
05.11.12	O Egy 19, 27/2012	O Manisa, O Tur 5/09, O 4625	6	1093
06.11.12	O Egy 19, 27/2012	O Manisa, O Tur 5/09, O 4625	6	1099
04.12.12	O Tan 38/12	O Manisa, O Tur 5/09, O 4625	3	1102

23.11.12	O Tan 38/12	O Manisa, O Tur 5/09, O 4625	3	1105
30.11.12	O Tan 38/12, O Egy 19, 27/2012	O Manisa, O Tur 5/09, O 4625	9	1114
*	O manisa ,O 3039, Vit 2,7,8,13/12	O Man/3039 bivalent sera 1438-42, + pool	26	1140
*	O manisa ,O 3039, Vit 2,7,8,13/12	O Man/3039 bivalent sera 1438-42, + pool	26	1166
07.12.12	Sat1 Tan 11/12	Sat1 Rho	1	1167
14.12.12	O Srl 3/09, O Srl 2/12, O Srl 9/10, O Egy 19,27/12	O Manisa, O Tur 5/09, O 4625, O Campos	11	1178
03.12.12	Sat1 Tan 11/12	Sat1 Rho	1	1179
10.12.12	O Egy 19, 27/12	O Campos	2	1181
11.12.12	O Egy 19, 27/12	O Campos	2	1183
18.12.12	O Srl 3/09, O Srl 2/12, O Srl 9/10	O Manisa, O Tur 5/09, O 4625	9	1192

Average number of r_1 values generated per week = 23

Total number of r_1 values generated in 2011 = 1192

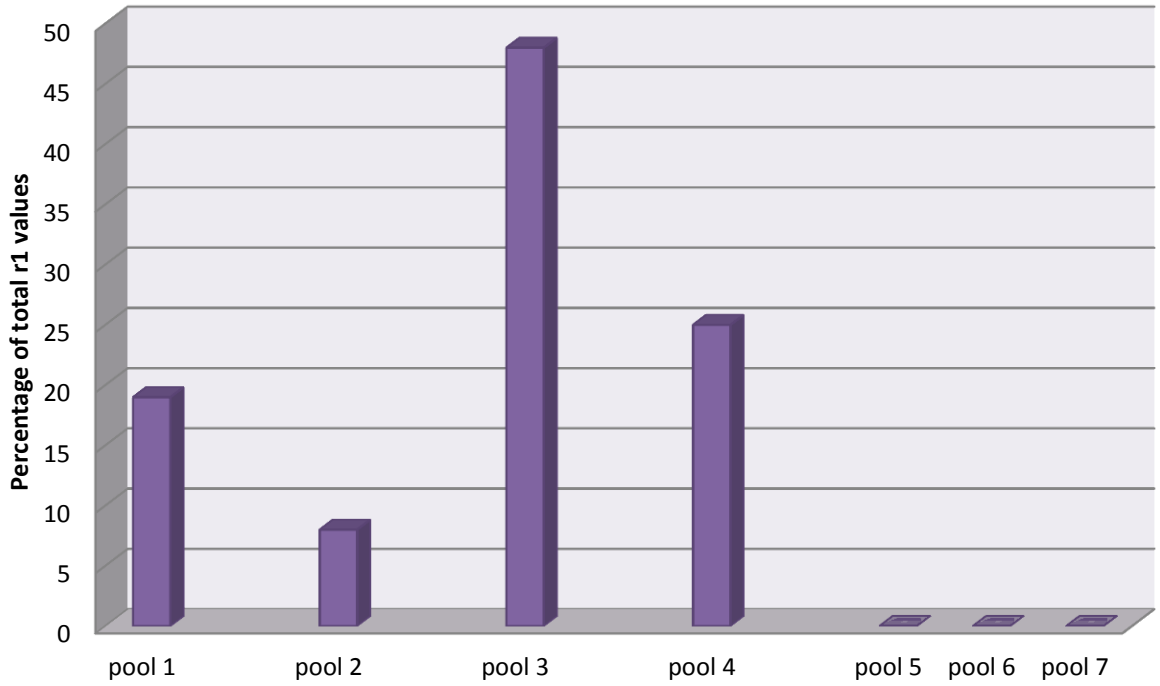


Figure 28. r_1 values determined per pool by WRLFMD® during 2012

WRLFMD® carried out individual vaccine matching tests on 1192 samples from 24 countries in 2012. When the samples tested were divided into viral pools it could be clearly seen that the majority of r1 values generated were for isolates from pool 3 with almost 50% of the results generated being for this region. Field isolates from pools 1, 2 and 4 were also tested by vaccine matching. As pool 7 is carefully monitored by the Network laboratories in South America, these results highlight the gaps in vaccine matching information from pools 5 and 6 as in previous years. Further effort is required in obtaining samples and getting these samples to competent reference laboratories for characterisation and analysis to improve our knowledge of circulating strains and to inform the choice of suitable existing vaccines or the need for the development of new vaccines to protect against current circulating strains in these regions.

1.7.9. WRLFMD® Vaccine Recommendations 2012

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 2012

HIGH PRIORITY

O Manisa- *can be supplemented with strains O3039 and/or O4625*
O PanAsia 2
O BFS or O Campos
A24 Cruzeiro
Asia 1 Shamir
A Iran 05
A22 Iraq
SAT 2 Saudi Arabia or equivalent (SAT 2 Eritrea)

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 The Pirbright Institute, the majority of the vaccine strains and vaccine antisera used for matching tests have been supplied to the WRLFMD® by Merial Animal Health. Some strains and/or antisera were supplied to WRLFMD® by Intervet/MSD, 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

The 'International foot and mouth disease (FMD) strategic reserves network' continues to function with the same membership as in 2011. This network comprises members from a number of countries that hold FMD vaccine banks. At the end of 2012 Dr Jef Hammond passed chair duties to Dr Katherine Clift (Chair) New Zealand and the secretariat duties were also taken on by Dr Andre van Halderen (Secretariat) also of New Zealand.

The members of this Alliance remain as follows;

- The Pirbright Institute, UK.
- North American Foot-and-Mouth Disease Vaccine Bank, Plum Island Animal Disease Center USDA, APHIS, FADDL- USA
- EC Commission, DG SANCO/E2, Brussels
- 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

Following the previous highly successful two rounds over three years inter-laboratory comparative test (ILCT) trial for FMD vaccine matching, which was organised jointly by the FAO/OIE WRLFMD® and EURL for FMD based at The Pirbright Institute. Preparations for the 3rd round exercise was planned and started during 2012. The 3rd round will involve distribution of an Asia 1 vaccine strain along with three to four FMDV type Asia 1 field isolates with r_1 values ranging from high, moderate to low. An inactivated panel of viruses, guinea-pig and rabbit anti-Asia 1 sera have also been prepared for ELISA testing. The invitation letter will be sent to all members and observers of the OIE/FAO FMD reference laboratory network during May/June 2013 and the study is expected to be completed by the end of 2013 or early in 2014.

2.2 Virus isolation and serology

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

During 2012, the European Union Reference Laboratories for FMD and SVD, in association with WRLFMD®, organised a round of combined FMD/SVD proficiency test scheme 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 laboratory capabilities evaluated in this PTS were outbreak detection by virus, virus antigen and virus genome detection and diagnosis by serology. The serology panel therefore was compiled to provide samples for testing after both vaccination and non-vaccination. All samples were analysed by WRLFMD® 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 BEI inactivated so that they could be evaluated in laboratories that are not able to handle live FMDV but still require the capability to diagnose a suspect FMD sample from the field, or carry out FMDV serology for surveillance.

Details of PTS:

Seventy six labs from seventy two countries were invited to take part in this study supported by the EC and the EuFMD. Of the 59 labs that agreed to participate, 26 labs were from EU member countries and 33 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 2012. Particular tests were not specified, but labs were invited to select tests and interpret results based upon:

a. Virus detection – as if samples were from suspected FMD/SVD outbreak cases.
b. Serology - as if these serum samples were from FMD/SVD suspected cases with possible O_1 Manisa or Asia 1 Shamir vaccination history for FMD panel (3).

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 panel 1 was also requested. Participants were also asked 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 2011/2012 to be compiled. Results of this study will be presented at the annual joint meeting of FMD/SVD national reference laboratories. Comprehensive feedback letters including the overall coded results from all participants for each panel including comments and recommendations on each test have been prepared and sent to each laboratory.

Details of Panels

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

1ml (containing glycerol) of each sample supplied to each participating laboratory as a single aliquot; 6 samples in total in this panel.

Case 1a

2 epithelial and 1 faecal suspension samples from pigs in a herd affected with a vesicular condition. Each sample is uniquely coded and labelled as "Panel 1a" with the sample number.

Case 1b

2 epithelial and 1 faecal suspension samples from pigs in a herd affected with a vesicular condition. Each sample is uniquely coded and labelled as "Panel 1b" with the sample number.

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

4 ml of each sample supplied to each participating laboratory as a single aliquot;
6 samples from pigs, with each originating from a different case within a herd with a vesicular condition. Each sample is uniquely coded and labelled as "Panel 2" with the sample number.

Panel 3: non-infectious material[2] for FMD serology

2.0 ml of each sample supplied to each participating laboratory;
6 sera from suspected FMD infected cattle for serology diagnosis. Some of the animals were vaccinated with FMD O1 Manisa vaccine or Asia 1 Shamir. Each sample is uniquely coded and labelled as "Panel 3" with the sample number.

Panel 4: non-infectious material[2] for SVD serology

0.5 ml of each sample supplied to each participating laboratory as a single aliquot;
6 sera from pigs for suspected SVD cases. Each sample is uniquely coded and labelled as "Panel 4" with the sample number

Summary of the exercise

Seventy six labs from seventy two countries were invited to take part in this study and fifty-nine labs agreed to participate.

1. 23 labs received panel 1 (live)
2. 53 labs received panel 2
3. 57 labs received panel 3
4. 38 labs received panel 4

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, collation and analysis of the results received so far is in progress with all results expected to have been received by the end of April 2013.

2.3. Training

2.3.1 WRLFMD®, The Pirbright Institute hosted its annual 2-week FMDV / SVDV diagnostics training course for overseas scientists between 30/04/12-11/05/12

Diagnostic Course Attendees:

Name	Affiliation	Country
A. Leite	LANAGRO-PE, Recife	Brazil
M. N. Tucho	National Animal health diagnostic and Investigation Centre (NAHDIC), Sebeta	Ethiopia
R. Clough	Investigation and Diagnostic Centre, Upper Hutt	New Zealand
R. Martinez	Laboratorio Central de Veterinaria, Madrid	Spain
E. Martin	National Animal Disease Diagnostics and Epidemiology, Entebe	Uganda
M. Dhikusooka	National Animal Disease Diagnostics and Epidemiology, Entebe	Uganda
R. Mwebe	National Animal Disease Diagnostics and Epidemiology, Entebe	Uganda
J. Dawson	WHWT, Victoria Falls	Zimbabwe

Period training

During the year a number of overseas laboratory staff attended for various periods of training and a number of WRLFMD® staff provided training at overseas laboratories.

Name	Affiliation
Dr Christopher Kasanga visited the Pirbright Institute for 2 months (November-December 2012) to undertake training in FMDV sequencing.	Sokoine University of Agriculture Tanzania
Dr Yanmin Li provided a week on site training and consultancy programme on serology diagnostic technologies in Botswana 19th-23rd November 2012	The National Veterinary Laboratory, Gaborone, Botswana
Raphael Sallu visited on the 1st February	Central Veterinary Laboratory, Dar-es-salaam, Tanzania
Dr Tiziana Lembo is visiting to participate in testing of samples collected in Tanzania (as part of the UoG BBSRC CIDLID project)	Tanzania/University of Glasgow
Dr Guido Konig visited on 26th February	INTA, Argentina

Proficiency training - see section 2.2.1

2.3.2 SENASA:

Proficiency tests organized:

Type of test or trial	Number of participants	Results
"r1" value determination by 2dVNT for serotype A.	4: VAR, Belgium, IAH-p, UK, FLI, Germany and SENASA, Argentina.	Ongoing

Date	Subject Of Training	Supplier Of Training	Recipient Of Training
July 10th until August 3rd	GMP and Biosecurity audits	SENASA; Argentina	SENACSA, Paraguay (1)
August 13 until September 5th	FMD vaccine control (In laboratory))	SENASA; Argentina	SENACSA, Paraguay (5)
August 13 until September 5th	FMD vaccine control (In field: bovine selection and handle)	SENASA; Argentina	SENACSA, Paraguay (4)

2.3.3 PANAFTOSA:

Training offered

Date	Venue of Training	Subject of training	Supplier of Training	Recipient of Training
March 20th to April 13th	*LANAGRO/RS and LANAGRO/PE, Brazil*	*FMD vaccine quality control*	*MAPA-Brasil, PANAFTOSA*	*INIA - Venezuela*
October 15th to 26th	*IBSP- SP, Brazil*	*Vesicular disease diagnosis by PCR*	*PANAFTOSA, IBSP*	*AGROCALIDAD - Ecuador*
October 22nd to November 1st	*PANAFTOSA Reference Laboratory*	*Cell culture production and maintenance*	*PANAFTOSA*	*AGROCALIDAD – Ecuador* *SENACSA - Paraguay*
November 19th to 23rd.	*PANAFTOSA Reference Laboratory*	*Laboratory biorisk management*	*PANAFTOSA*	*MAPA – Brasil* *SENACSA - Paraguay*
December 10th to 20th	*PANAFTOSA Reference Laboratory*	*FMDV antibody detection by Lp-ELISA*	*PANAFTOSA*	*SENASAG – Bolivia* *SENACSA - Paraguay*

Proficiency tests 2012

Type of test or trial	Number of participants	Results
FMDV/VSV Antigen detection by ELISA	*11 laboratories from:* *Argentina, Brasil, Chile, Colombia, Mexico, Panamá, Paraguay, Uruguay, Venezuela*	*ongoing*

2.3.4 PIADC-FADDL:

Training

- Deployment of SOPs and training to the NAHLN for FMD serology surveillance plan
- Providing SOPs and FMD rRT-PCR test controls to Tunisia and Bangladesh
- FAD school

Proficiency tests 2012

- US NAHLN, 40 laboratories

Reagents provided 2012

- Panama: vesicular disease Ag ELISA standard reagents

2.3.5 RRLSEA:

Training given or received

Date	Venue of training	Subject of training	Supplier of the training	Recipient of the training
04/2012	**Regional Reference Laboratory for FMD in South East Asia**	Foot and mouth disease diagnosis in RRLSEA	Government of Singapore	Singapore
05/2012	**Regional Reference Laboratory for FMD in South East Asia**	Foot and mouth disease diagnosis in RRLSEA	OIE	Myanmar
20-24/03/2012	Melbourn University, Australia	OIE Strategic Planning workshop	OIE	RRL Staff; Dr,Kingkarn Boonsuya Seeyo, Veterinary Office
24 /09 /2012– 5 /10/ 2012	Australian Animal Health Laboratory (AAHL), Australia	QA and Proficiency Test standardization of Diagnostic reagent program training	FAO	RRL Staff; Dr,Kingkarn Boonsuya Seeyo, Veterinary Office
7-14/10/2012	Lijiang, China	New Technique PCR	FAO	RRL Staff; Panithan Thongtha
21-25/05/2012	NIAH,THAILAND	DNA Sequencing	Department of	RRL Staff;

			Livestock Development, Thailand	Panithan Thongtha
5-6/06/2012	NIAH,THAILAND	ISO/IEC 17025:2005	Department of Livestock Development, Thailand	RRL Staff
1-5/10/2012	NIAH,THAILAND	Biological safety Cabinet Workshop	Department of Livestock Development, Thailand	RRL Staff
12/03/2012	NIAH,THAILAND	ISO 9001:2008	Department of Livestock Development, Thailand	RRL Staff
18-19/01/2012	NIAH,THAILAND		USDA-APHIS	RRL Staff

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 December 2012- April 2013	13 (Laboratories within Thailand = 8 South East Asia laboratory = 5)	Inter-laboratory comparison on FMD typing and serology test is under process.
2. FMD and SVD PTS 2011 - Panel 2 Antigen Detection ELISA and Panel-3 Serology test by LP ELISA and NSP test - Organized by WRL, Pirbright laboratory, UK	Participating laboratory in PT scheme , organized by WRL, UK	Passed

Regional activities- supporting the region

- Scientific Developments and Technical Challenges in the Progressive Control of FMD in South Asia, 13 – 15 February 2012, New Delhi, India
- 18th Meeting of the OIE Sub-Commission for FMD in South East Asia and China Lijiang, China, 5-9 March 2012
- FAO/OIE Global Conference on Foot and Mouth Disease Control, 27-29 June 2012
- 15th National Coordinators Meeting; Philippines, 5-7 September 2012
- 3rd Director Laboratory Meeting, Vietnam, October 2012
- 7th SEACFMD LabNet meeting Lanzhou, People's Rep. of China, October 15 - 17 2012.
- Future collaboration with the RRLSEA , Pakchong, Thailand and Australian Animal Health Laboratory (AAHL, Geelong, Australia, entitled: Foot and Mouth Disease) Risk Management for Australia and South East Asia, duration 5 years, from 2011 - 2015.
- Supporting recognition of Foot and Mouth Disease Free Zone with Vaccination in the Eastern Region of Thailand
- Providing diagnosis reagent to member countries through OIE support

Quality assurance programme

- Maintain the ISO 17025:2005 certification
    - conducted Internal audit for the RRL staff and training for new RRL staff

- Improve and update the ISO documents such as Quality manual, Procedure manual, work instruction, test method, validation and verification of reference diagnostic reagents, calibration of equipment

2.3.6 ARRIAH:

Training
Proficiency tests
Organized proficiency tests for the countries covered by the ARRIAH: Ukraine, Belarus, Moldavia, Tajikistan, Kazakhstan, Kyrgyzstan and we sent the samples of inactivated FMDV antigens and sera from recovered and vaccinated animals. Laboratories of the Republic of Belarus, Kyrgyzstan, Kazakhstan and Ukraine have comparable results.

2.3.7 LVRI -China:

Training

- Training courses on prevention and control FMD to veterinarians from all over China every year.
- Biosafety and Biosecurity Management Training
- Training on Dangerous Goods (infectious materials)Transport by civil aviation of China.

Training: international

- FAO assistance DPRK Program, training on laboratory diagnostic techniques of FMD. July, 2011.
- Workshop on FMD Control Technologies for CAREC Countries(Mongolia, Kazakhstan, Tajikistan, Kyrghizstan, Uzbekistan) . Oct,2011.
- Experts from WRLFMD® gave reports on FMD diagnosis and epidemiology . Lanzhou

Proficiency tests organized
2011: FMD Multiple RT-PCR, LPB-ELISA
2012: 3ABC-I-ELISA
Organized by: Veterinary Bureau of Ministry of Agriculture, PRC
Carried out by: Chinese Center of Animal Disease Control and Prevention
LVRI (reference materials, sample panels)

Regional activities

FMD routine surveillance
A. FMD epidemiological survey covered 7 provinces (Yunnan, Guangxi, Guizhou, Guangdong, Hunan, Sichuan and Chongqing) in southwest of China (15th April ~15th June, 2011)
B. FMD surveillance on pig slaughterhouses in ten provinces in China (10th May~20th June, 2012)
C. FMD Special epidemiological investigation around border areas in Xinjiang Uygur Autonomous Region

D.10 emergency epidemiological surveys were carried out in Xinjiang Autonomous Region, Guizhou Province and Tibet and other regions after FMD outbreaks in 2011 and 2012
E. Quarterly monitoring for Hainan Island FMD-free zone with vaccination

2.3.8 PDFMD- India:

Proficiency tests organised

Type of test or trial	Number of participants	Results
LPBE and Real time PCR	24	Variations in test results were within the limit

Training given or received

Date	Venue of training	Subject of training	Supplier of the training	Recipient of the training
09.01.12 to 13.01.12	Central FMD Laboratory, PDFMD, Mukteswar	LPB & DIVA ELISA	PDFMD	AICRP on FMD Regional centre, Ranipet, Tamilnadu, India
11.03.12 to 17.03.12	Central FMD Laboratory, PDFMD, Mukteswar	LPB, DIVA& TYPING ELISA	PDFMD	AICRP on FMD Regional centre, Bengaluru, Karnataka, India
12.03.12 to 17.03.12	Central FMD Laboratory, PDFMD, Mukteswar	LPB, DIVA& TYPING ELISA	PDFMD	CARI, Port-Blair, Andaman & Nicobar Islands, India
12.03.12 to 17.03.12	Central FMD Laboratory, PDFMD, Mukteswar	LPB, DIVA& TYPING ELISA	PDFMD	AICRP on FMD Network Unit, Cuttack, Odisha, India
16.04.12 to 21.04.12	Central FMD Laboratory, PDFMD, Mukteswar	LPB & DIVA ELISA	PDFMD	CADRAD, IVRI, Izatnagar, Uttar Pradesh, India
21.05.12 to 26.05.12	Central FMD Laboratory, PDFMD, Mukteswar	FAO training: regional training on Proficiency Testing for Veterinary Diagnostic Laboratories in SAARC Countries	PDFMD	CSIRO Australian Animal Health Laboratory, Australia
21.05.12 to 26.05.12	Central FMD Laboratory, PDFMD, Mukteswar	FAO training: regional training on Proficiency Testing for Veterinary Diagnostic Laboratories in SAARC Countries	PDFMD	Ministry of Agriculture, Irrigation and livestock, Afghanistan
21.05.12 to 26.05.12	Central FMD Laboratory, PDFMD, Mukteswar	FAO training: Regional training on Proficiency Testing for Veterinary Diagnostic Laboratories in SAARC Countries	PDFMD	Livestock Research Institute, Bangladesh
21.05.12 to 26.05.12	Central FMD Laboratory,	FAO training: Regional training on Proficiency	PDFMD	National Centre for Animal Health, Bhutan

	PDFMD, Mukteswar	Testing for Veterinary Diagnostic Laboratories in SAARC Countries		
21.05.12 to 26.05.12	Central FMD Laboratory, PDFMD, Mukteswar	FAO training: Regional training on Proficiency Testing for Veterinary Diagnostic Laboratories in SAARC Countries	PDFMD	Department of Livestock Services, Nepal
21.05.12 to 26.05.12	Central FMD Laboratory, PDFMD, Mukteswar	FAO training: Regional training on Proficiency Testing for Veterinary Diagnostic Laboratories in SAARC Countries	PDFMD	Department of Animal Production & Health, Sri Lanka
21.05.12 to 26.05.12	Central FMD Laboratory, PDFMD, Mukteswar	FAO training: Regional training on Proficiency Testing for Veterinary Diagnostic Laboratories in SAARC Countries	PDFMD	High Security Animal disease Laboratory, Bhopal, Madhya Pradesh, India
21.05.12 to 26.05.12	Central FMD Laboratory, PDFMD, Mukteswar	FAO training: Regional training on Proficiency Testing for Veterinary Diagnostic Laboratories in SAARC Countries	PDFMD	AICRP on FMD Regional Centre, Hisar, Haryana, India
21.05.12 to 26.05.12	Central FMD Laboratory, PDFMD, Mukteswar	FAO training: Regional training on Proficiency Testing for Veterinary Diagnostic Laboratories in SAARC Countries	PDFMD	AICRP on FMD Network Unit, Ahemdabad, Gujarat, India
05.06.12 to 08.06.12	Central FMD Laboratory, PDFMD, Mukteswar	LPB & DIVA ELISA	PDFMD	AICRP on FMD Network Unit, Shimla, Himachal Pradesh, India
06.06.12	Central FMD Laboratory, PDFMD, Mukteswar	LPB ELISA	PDFMD	CALF, NDDB, Anand, Gujarat, India
07.06.12	Central FMD Laboratory, PDFMD, Mukteswar	LPB, DIVA& TYPING ELISA	PDFMD	AICRP on FMD Network Unit, Jaipur, Rajasthan, India
30.07.12 to 03.08.12	Central FMD Laboratory, PDFMD, Mukteswar	LPB ELISA	PDFMD	AICRP on FMD Regional Center, Hyderabad, Andhra Pradesh, India
21.08.12 to 25.08.12	Central FMD Laboratory, PDFMD, Mukteswar	LPB & DIVA ELISA, mPCR & Software training	PDFMD	AICRP on FMD Network Unit, Jaipur, Rajasthan, India
21.08.12 to 25.08.12	Central FMD Laboratory, PDFMD, Mukteswar	LPB & DIVA ELISA, mPCR & Software training	PDFMD	AICRP on FMD Regional Center, Hyderabad, Andhra Pradesh, India
21.08.12 to 25.08.12	Central FMD Laboratory, PDFMD, Mukteswar	LPB & DIVA ELISA, mPCR & Software training	PDFMD	AICRP on FMD Network Unit, Thiruvananthapuram, Kerala, India
21.08.12 to	Central FMD	LPB & DIVA ELISA, mPCR &	PDFMD	AICRP on FMD Regional Center,

25.08.12	Laboratory, PDFMD, Mukteswar	Software training		Bengaluru, Karnataka, India
21.08.12 to 25.08.12	Central FMD Laboratory, PDFMD, Mukteswar	LPB & DIVA ELISA, mPCR & Software training	PDFMD	AICRP on FMD Regional Center, Hisar, Haryana, India
21.08.12 to 25.08.12	Central FMD Laboratory, PDFMD, Mukteswar	LPB & DIVA ELISA, mPCR & Software training	PDFMD	AICRP on FMD Regional Center, Mathura, Uttar Pradesh, India
21.08.12 to 25.08.12	Central FMD Laboratory, PDFMD, Mukteswar	LPB & DIVA ELISA, mPCR & Software training	PDFMD	AICRP on FMD Regional Center, Kolkata, West Bengal, India
21.08.12 to 25.08.12	Central FMD Laboratory, PDFMD, Mukteswar	LPB & DIVA ELISA, mPCR & Software training	PDFMD	AICRP on FMD Regional Center, Pune, Maharashtra, India
21.08.12 to 25.08.12	Central FMD Laboratory, PDFMD, Mukteswar	LPB & DIVA ELISA, mPCR & Software training	PDFMD	CARI, Port-Blair, Andaman & Nicobar Islands, India
21.08.12 to 25.08.12	Central FMD Laboratory, PDFMD, Mukteswar	LPB & DIVA ELISA, mPCR & Software training	PDFMD	AICRP on FMD Network Unit, Jalandhar, Punjab, India
21.08.12 to 25.08.12	Central FMD Laboratory, PDFMD, Mukteswar	LPB & DIVA ELISA, mPCR & Software training	PDFMD	AICRP on FMD Network Unit, Ahmedabad, Gujarat, India
21.08.12 to 25.08.12	Central FMD Laboratory, PDFMD, Mukteswar	LPB & DIVA ELISA, mPCR & Software training	PDFMD	AICRP on FMD Regional Center, Ranipet, Tamilnadu, India
29.10.12 to 07.11.12	Central FMD Laboratory, PDFMD, Mukteswar	FAO training "Regional Training on Vaccine Matching for analyzing the homology of field isolates/strains in relation to the in-use vaccine strain(s) of Foot and Mouth"	PDFMD	Central disease Investigation Laboratory, & FMD vaccine Production Section Livestock Research Institute Bangladesh
29.10.12 to 07.11.12	Central FMD Laboratory, PDFMD, Mukteswar	FAO training "Regional Training on Vaccine Matching for analyzing the homology of field isolates/strains in relation to the in-use vaccine strain(s) of Foot and Mouth"	PDFMD	Regional Livestock Development Centre, & National Centre for Animal Health, Bhutan
29.10.12 to 07.11.12	Central FMD Laboratory, PDFMD, Mukteswar	FAO training "Regional Training on Vaccine Matching for analyzing the homology of field isolates/strains in relation to the in-use vaccine	PDFMD	Veterinary Research Institute, Gannoruwa, Peradeniya, Sri Lanka

		strain(s) of Foot and Mouth"		
29.10.12 to 07.11.12	Central FMD Laboratory, PDFMD, Mukteswar	FAO training "Regional Training on Vaccine Matching for analyzing the homology of field isolates/strains in relation to the in-use vaccine strain(s) of Foot and Mouth"	PDFMD	Department of Livestock Services, Budhanilkantha, Kathmandu, Nepal
29.10.12 to 07.11.12	Central FMD Laboratory, PDFMD, Mukteswar	FAO training "Regional Training on Vaccine Matching for analyzing the homology of field isolates/strains in relation to the in-use vaccine strain(s) of Foot and Mouth"	PDFMD	Animal Health Laboratories, Animal Sciences Institute, National Agricultural Research Center, Park Road, Islamabad, Pakistan
29.10.12 to 07.11.12	Central FMD Laboratory, PDFMD, Mukteswar	FAO training "Regional Training on Vaccine Matching for analyzing the homology of field isolates/strains in relation to the in-use vaccine strain(s) of Foot and Mouth"	PDFMD	All India Coordinated Research Project on FMD, Assam Agricultural University, Khanpara, Guwahati, Assam, India
29.10.12 to 07.11.12	Central FMD Laboratory, PDFMD, Mukteswar	FAO training "Regional Training on Vaccine Matching for analyzing the homology of field isolates/strains in relation to the in-use vaccine strain(s) of Foot and Mouth"	PDFMD	FMD Regional Center, Institute of Animal Health and Veterinary Biologicals Hebbal, Bangalore, Karnataka, India
29.10.12 to 07.11.12	Central FMD Laboratory, PDFMD, Mukteswar	FAO training "Regional Training on Vaccine Matching for analyzing the homology of field isolates/strains in relation to the in-use vaccine strain(s) of Foot and Mouth"	PDFMD	FMD Regional Center, Department of Veterinary Microbiology, Lala Lajpat Rai Veterinary and Animal Sciences University, Hisar, Haryana, India
05.11.12 to 07.11.12	Central FMD Laboratory, PDFMD, Mukteswar	LPB ELISA	PDFMD	Brilliant Bio-Pharma Ltd., Hyderabad

2.3.9 National Centre for Foreign Animal Disease (NCFAD), Canada.

Proficiency tests organised

Type of test or trial	Number of participants	Results
Annual FMD ELISA proficiencytesting (FMDV 3ABC cELISA)	11 CAHSN Labs in Canada	11? labs completed
FMDV RT-PCR proficiency testing (3D primers assay)	10 CAHSN Lab in Canada	10 labs completed

Training given or received

Date	Venue of training	Subject of training	Supplier of the training	Recipient of the training
Feb 2012	NCFAD, Winnipeg, Canada	The early recognition and diagnosis of foreign animal disease	CFIA ,NCFAD, Winnipeg, Canada	Veterinarians
2012	NCFAD, Winnipeg, Canada	FMD RRT-PCR	NCFAD, Winnipeg, Canada	3 analysts from CAHSN Labs in Canada
2012	NCFAD, Winnipeg, Canada	3ABC FMD ELISA	NCFAD, Winnipeg, Canada	2analysts from CAHSN Labs in Canada

2.4 Reagent and test kit supply

2.4.1 WRLFMD®:

WRLFMD®: Reagents Supplied

For the period January to March, viruses, diagnostic reagents, antigen or antibody detection ELISA kits were sent to Pakistan, Iraq, Japan, Turkey, Czech Repub, Algeria, Rwanda, Ethiopia, Kenya, Croatia, South Korea, Vietnam, Bulgaria, Oman, Egypt and Sweden.
For the period April to June, viruses, diagnostic reagents, antigen or antibody detection ELISA kits were sent to South Korea, Vietnam, Bulgaria, Oman, Egypt, Sweden, UAE, Kuwait, Indonesia, New Zealand, Turkey, Kyrgyzstan, Tunisia, Estonia, Belarus and Israel.
For the period July to September, viruses, diagnostic reagents, antigen or antibody detection ELISA kits were sent to: Mozambique, Vietnam, Tanzania, Malawi, Hong Kong, China, Singapore, Romania, USA, ROK, Iraq, Israel, Mongolia, Denmark, Poland, Malaysia & Japan.
For the period October to December, viruses, diagnostic reagents, antigen or antibody detection ELISA kits were sent to: Bangladesh, Canada, Kazakhstan, Kenya, Kuwait, LAO PDR, Russia, South Korea, Uganda, USA, Vietnam and Zambia.

Type of reagent available	Related diagnostic test	Name of recipient OIE Member Countries and of institutions	
Rabbit and Guinea Pig Antisera	Ag and Ab ELISA	Canada	NCFAD, Winnipeg
		Israel	Kimron Veterinary Institute
		Kenya	SAHSP, Nairobi
		Iraq	Vet. Central Lab, Bagdad
		Tunisia	Institut Pasteur de Tunis
		Turkey	SAP Institute, Ankara
		Vietnam	National Centre Vet. Diag., Ha Noi
		Uganda	NADDEC, Entebe
FMD Reference sera	Ag and Ab ELISA	Iraq	Vet. Central Lab, Bagdad
		Romania	Inst. Diagn. Animal Health
		South Korea	Animal Plant & Fish. Q&I Agency, Gyeonggi Province
		Vietnam	National Centre Vet. Diag.
Inactivated virus	Ag and Ab ELISA	Iraq	Vet. Central Lab, Bagdad
		Kenya	SAHSP, Nairobi
		Romania	Inst. Diagn. Animal Health
		Turkey	SAP Institute, Ankara
		Vietnam	National Centre Vet. Diag.
Live virus	VNT	The Netherlands- Central Veterinary Institute Merial-UK Intervet/MSD- Germany	
Antigen ELISA kits	Ag ELISA	Bulgaria	Bulgarian Food Safety Agency
		Croatia	Serology Lab. Viral disease, Zagreb
		Egypt	Animal Health Research Institute, Giza
		Estonia	Estonian Veterinary & Food Lab, Tartu
		Ethiopia	Nat. Animal Health Diagnostic & Investigation Centre, Sebeta
		HongKong	Agricult. Fish. & Conserv. Dept.,HKSAR
		New Zealand	Animal Health Laboratory, Upper Hutt
		Oman	Vet. Research Laboratory, Muscat
		South Korea	Animal Plant & Fish. Q&I Agency, Gyeonggi Province
		UAE	Dept. of President's Affairs, Abu Dhabi
		Uganda	NADDEC, Entebe
		Japan	Animal Quarantine Service, Kanagawa
		Kazakhstan	Research Institute for Biol. Safety
		Mongolia	State Central Veterinary Laboratory
		Kuwait	Central Vet. Lab. & Animal Research
Antibody ELISA kits	Ab ELISA	Algeria	Inst. National de la Med. Veterinaire
		Bangladesh	Livestock Research Institute, Dhaka
		Belarus	Belarusian State Vet. Centre, Minsk
		Bulgaria	Bulgarian Food Safety Agency
		Croatia	Serology Lab. Viral disease, Zagreb

		Estonia	Estonian Veterinary & Food Lab, Tartu
		Indonesia	Veterinary Biological Centre, Surabaya
		Iraq	Veterinary Central Laboratory, Bagdad
		Japan	Animal Quarantine Service, Kanagawa
		Kazakhstan	Research Institute for Biol. Safety
		Kenya	SAHSP, Nairobi
		Kuwait	Central Vet. Lab. & Animal Research
		Kyrgyzstan	State Veterinary Laboratory, Bishkek
		LAO PD	Dept. of Livestock & Fisheries, Vientiane
		Malaysia	Dept. Veterinary Services, Putrajaya
		Mongolia	State Central Veterinary Laboratory
		Mozambique	Regional Animal Health Dept., Kan Tho
		Pakistan	Animal Sciences Institute, Islamabad
		Russia	Federal Centre Animal Health, Vladimir
		Rwanda	National Veterinary Laboratory, Rubirizi
		South Korea	Animal Plant & Fish. Q&I Agency, Gyeonggi Province
		Sudan	Institute Endemic Diseases, Khartoum
		Turkey	SAP Institute, Ankara
		Vietnam	National Centre Vet. Diag.
		Zambia	Central Vet. Res. Inst., Lusaka

2.4.2 SENASA: Reagents Supplied/Received

Type of reagent	Quantity	Supplier of the reagent	Recipient of the reagent
Reference vaccine strain C3 Indaial for vaccine production and quality control.	10 vials x 1ml	SENASA OIE Reference Laboratory	Argentina
FMD A24 Cruzeiro, A Argentina 2001, A Argentina 2000 and A Argentina 87 strains.	6 vials x 1ml of each strain	SENASA OIE Reference Laboratory	Belgium
FMD O1 Campos viral suspension for virus challenge in PPG test.	75 ml	SENASA OIE Reference Laboratory	Argentina
Monovalent O1 Campos bovine sera-27 DPV	16 vials x 5 ml	SENASA OIE Reference Laboratory	Argentina
FMD A2001 and C3 Indaial hyper immune guinea pigs sera	2 vials x 1 ml / 4 vials x 1 ml	SENASA OIE Reference Laboratory	Argentina
FMD A2001, O1 Campos and C3 Indaial hyper immune guinea pigs sera	5 vials x 1ml of each serum	SENASA OIE Reference Laboratory	Paraguay
FMD A2001, O1 Campos, A24 Cruzeiro and C3 Indaial hyper immune guinea pigs sera	2 vials x 1ml of each serum	SENASA OIE Reference Laboratory	Argentina
FMD O1Campos and C3 Indaial hyper immune guinea pigs sera	2 vials x 1ml of each serum	SENASA OIE Reference Laboratory	Argentina
FMD O1Campos hyper immune guinea pigs sera	2 vials x 1ml of each serum	SENASA OIE Reference Laboratory	Argentina

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.

Type of reagent available	Related diagnostic test	Quantity supplied at international level (ml, mg)	Name of recipient OIE Member Countries and/ or Institutions
Antibody kit	*I-ELISA 3ABC/EITB*	*304 kits*	*Brasil, Chile, Colombia, Ecuador, Paraguay, Uruguay, Venezuela*
Antibody kit	*EITB*	*263 kits*	*Argentina, Brasil, Chile, Colombia, Ecuador, Paraguay, Perú, Uruguay, Venezuela*
Antigen set	*FMD/VSV antigen typing ELISA*	*15 sets*	*Brasil, Chile, Colombia, Ecuador, Paraguay, Perú*
Antibody set	*FMDV Ab Lp-ELISA*	*340 sets*	*Brasil, Chile, Colombia, Ecuador, Paraguay, Uruguay, Venezuela*
Antibody set	*VSV Ab Lp-ELISA*	*49 sets*	*Brasil, Chile, Colombia, Paraguay, Venezuela*
FMDV reference hiperimune sera (O1 Campos and A24 Cruzeiro)	*Ag typing*	*02 ml*	*Venezuela*
VSV reference hiperimune sera New Jerseyande Indiana)	*Ag typing*	*03 ml*	*Colombia, Venezuela*
Live virus	*Vaccine production*	*15 ml*	*Paraguay*
BHK cells	*Vaccine production*	*3.200 ml*	*Brasil, Paraguay*
BHK cells	*Viral isolation and VNT*	*1 ml*	*Brasil*

2.4.4 RRLSEA: Pakchong Reagents Supplied/Received

Type of reagent	Quantity	Supplier of the reagent	Recipient of the reagent
- Rabbit trapping antibody - Type O - Type A - Type Asia1	 18 sets 22 sets 16 sets	Department of Livestock Development, Thailand, RRL	FMD laboratory within Thailand and South East Asia member countries under the SEACFMD control campaign
- Guinea pig detecting antibody - Type O - Type A - Type Asia1	 19 sets 25 sets 17 sets	Department of Livestock Development, Thailand, RRL	
- Inactivated FMDV Concentrate antigen - Type O - Type A - Type Asia1	 72.5 ml 86.5 ml 93 ml	Department of Livestock Development, Thailand, RRL	
- Control serum - C++(Strong) - C+ (Moderate) - C- (Negative)	 120 ml 105 ml 105 ml	Department of Livestock Development, Thailand, RRL	

2.4.5 ARRIAH: Russia Reagents Supplied/Received

Reagents supplied

Type of reagent	Quantity	Recipient of the reagent
FMDV antibody kits	529	Azerbaijan, Armenia, Kazakhstan, Belarus
FMDV antigen kits	22	Azerbaijan, Kazakhstan

2.4.6 LVRI China

Reagents provided

Type of reagent	Quantity	Recipient of the reagent
LPB-ELISA Kit	~13,000 kits (5000 kits for type O, 5000 kits for Asia1 and 3000 kits for type A)	provincial Animal CDC lab
NSP-3ABC-ELISA kit	~1,800 kits	provincial Animal CDC lab

IHA Antigen(for type O)	45,000 ampoules of 5ml for each, which can detect 11,250,000 serum specimen	provincial Animal CDC lab
multiple RT-PCR Kit	~800 kits used for 16,000 suspected samples	provincial Animal CDC lab
IS-ELISA kit	~20 kits	CNFMDRL only

2.4.7 PDFMD-India

Reagents supplied or received

Type of reagent	Quantity (No. of test)	Supplier of the reagent	Recipient of the reagent
Reagents for LPBELISA	8000	PDFMD, Mukteswar, India	AICRP on FMD Regional Centre, Ranipet, Tamilnadu , India
Reagents for LPBELISA	8000	PDFMD, Mukteswar, India	AICRP on FMD Regional Centre, Hisar, Haryana , India
Reagents for LPBELISA	5000	PDFMD, Mukteswar, India	AICRP on FMD Network Unit, Bhopal, Madhya Pradesh, India
Reagents for LPBELISA	6000	PDFMD, Mukteswar, India	Biovet Pvt. Ltd., Malur, India
Reagents for LPBELISA	1000	PDFMD, Mukteswar, India	CARI, Port-Blair, A&N Islands, India
Reagents for LPBELISA	3000	PDFMD, Mukteswar, India	AICRP on FMD Regional Centre, Bengaluru, Karnataka , India
Reagents for LPBELISA	2500	PDFMD, Mukteswar, India	AICRP on FMD Network Unit, Cuttack, Odisha, India
Reagents for LPBELISA	3000	PDFMD, Mukteswar, India	AICRP on FMD Regional Centre, Mathura, Uttar Pradesh , India
Reagents for LPBELISA	5000	PDFMD, Mukteswar, India	AICRP on FMD Regional Centre, Hyderabad, Andhra Pradesh , India
Reagents for LPBELISA	3000	PDFMD, Mukteswar, India	AICRP on FMD Regional Centre, Hisar, Haryana , India
Reagents for LPBELISA	3000	PDFMD, Mukteswar, India	CCNIAH, Baghpat, Uttar Pradesh, India
Reagents for LPBELISA	500	PDFMD, Mukteswar, India	CADRAD, IVRI, Izatnagar, Uttar Pradesh, India
Reagents for LPBELISA	3000	PDFMD, Mukteswar, India	AICRP on FMD Network Unit, Imphal, Manipur, India
Reagents for LPBELISA	3000	PDFMD, Mukteswar, India	AICRP on FMD Regional Centre, Hyderabad, Andhra Pradesh , India
Reagents for LPBELISA	3000	PDFMD, Mukteswar, India	National centre of Animal Health, Thimpu, Bhutan
Reagents for LPBELISA	3000	PDFMD, Mukteswar, India	Veterinary Research Institute, Dept. of Animal Production & Health, Sri Lanka
Reagents for LPBELISA	3000	PDFMD, Mukteswar, India	AICRP on FMD Network Unit, Ahmadabad, Gujarat, India
Reagents for LPBELISA	1000	PDFMD, Mukteswar, India	AICRP on FMD Network Unit, Shimla, Himachal Pradesh, India
Reagents for LPBELISA	3000	PDFMD, Mukteswar, India	AICRP on FMD Network Unit, Bhopal, Madhya Pradesh, India
Reagents for LPBELISA	3000	PDFMD, Mukteswar, India	AICRP on FMD Network Unit, Jalandhar, Punjab, India

Reagents for LPBELISA	2300	PDFMD, Mukteswar, India	AICRP on FMD Network Unit, Jaipur, Rajasthan, India
Reagents for LPBELISA	3000	PDFMD, Mukteswar, India	AICRP on FMD Regional Centre, Pune, Maharashtra, India
Reagents for LPBELISA	6000	PDFMD, Mukteswar, India	AICRP on FMD Regional Centre, Bengaluru, Karnataka, India
Reagents for LPBELISA	3000	PDFMD, Mukteswar, India	AICRP on FMD Regional Centre, Ranipet, Tamilnadu, India
Reagents for LPBELISA	2200	PDFMD, Mukteswar, India	AICRP on FMD Regional Centre, Bengaluru, Karnataka, India
Reagents for LPBELISA	3000	PDFMD, Mukteswar, India	AICRP on FMD Regional Centre, Hyderabad, Andhra Pradesh, India
Reagents for LPBELISA	3000	PDFMD, Mukteswar, India	IIL, Hyderabad, Andhra Pradesh
Reagents for LPBELISA	5000	PDFMD, Mukteswar, India	AICRP on FMD Regional Centre, Hisar, Haryana, India
Reagents for LPBELISA	12000	PDFMD, Mukteswar, India	AICRP on FMD Regional Centre, Bengaluru, Karnataka, India
Reagents for LPBELISA	10000	PDFMD, Mukteswar, India	AICRP on FMD Regional Centre, Pune, Maharashtra, India
Reagents for LPBELISA	6000	PDFMD, Mukteswar, India	AICRP on FMD Network Unit, Palode, Kerala, India
Reagents for LPBELISA	8000	PDFMD, Mukteswar, India	AICRP on FMD Network Unit, Ahmadabad, Gujarat, India
Reagents for LPBELISA	1000	PDFMD, Mukteswar, India	CARI, Port-Blair, A&N Islands, India
Reagents for LPBELISA	5100	PDFMD, Mukteswar, India	AICRP on FMD Regional Centre, Ranipet, Tamilnadu , India
Reagents for LPBELISA	6000	PDFMD, Mukteswar, India	AICRP on FMD Regional Centre, Hisar, Haryana , India
Reagents for LPBELISA	2000	PDFMD, Mukteswar, India	AICRP on FMD Regional Centre, Guwahati, Assam, India
Reagents for LPBELISA	2000	PDFMD, Mukteswar, India	Central disease Investigation Laboratory, & FMD vaccine Production Section Livestock Research Institute, Bangladesh
Reagents for LPBELISA	3000	PDFMD, Mukteswar, India	Regional Livestock Development Centre, & National Centre for Animal Health, Bhutan
Reagents for LPBELISA	2000	PDFMD, Mukteswar, India	Veterinary Research Institute, Gannoruwa, Peradeniya, Sri Lanka
Reagents for LPBELISA	2000	PDFMD, Mukteswar, India	Department of Livestock Services, Budhanilkantha, Kathmandu, Nepal
Reagents for LPBELISA	6000	PDFMD, Mukteswar, India	AICRP on FMD Regional Centre, Hyderabad, Andhra Pradesh, India
Reagents for LPBELISA	3000	PDFMD, Mukteswar, India	AICRP on FMD Network Unit, Imphal, Manipur, India
Reagents for LPBELISA	1250	PDFMD, Mukteswar, India	AICRP on FMD Network Unit, Kohima, Nagaland, India
Reagents for LPBELISA	3500	PDFMD, Mukteswar, India	AICRP on FMD Regional Centre, Mathura, Uttar Pradesh, India
Reagents for LPBELISA	2000	PDFMD, Mukteswar, India	AICRP on FMD Network Unit, Cuttack, Odisha, India
Reagents for Sandwich ELISA	500	PDFMD, Mukteswar, India	AICRP on FMD Regional Centre, Pune, Maharashtra, India

Reagents for Sandwich ELISA	500	PDFMD, Mukteswar, India	AICRP on FMD Regional Centre, Bengaluru, Karnataka, India
Reagents for Sandwich ELISA	500	PDFMD, Mukteswar, India	AICRP on FMD Network Unit, Cuttack, Odisha, India
Reagents for Sandwich ELISA	500	PDFMD, Mukteswar, India	AICRP on FMD Regional Centre, Hisar, Haryana , India
Reagents for Sandwich ELISA	500	PDFMD, Mukteswar, India	AICRP on FMD Regional Centre, Mathura, Uttar Pradesh, India
Reagents for Sandwich ELISA	500	PDFMD, Mukteswar, India	National Centre for Animal Health, Bhutan
Reagents for Sandwich ELISA	500	PDFMD, Mukteswar, India	Department of Livestock Services, Nepal
Reagents for Sandwich ELISA	1000	PDFMD, Mukteswar, India	Department of Animal Production & Health, Sri Lanka
Reagents for Sandwich ELISA	500	PDFMD, Mukteswar, India	AICRP on FMD Network Unit, Jalandhar, Punjab, India
Reagents for Sandwich ELISA	500	PDFMD, Mukteswar, India	AICRP on FMD Network Unit, Jaipur, Rajasthan, India
Reagents for Sandwich ELISA	500	PDFMD, Mukteswar, India	AICRP on FMD Regional Centre, Ranipet, Tamilnadu , India
Reagents for Sandwich ELISA	500	PDFMD, Mukteswar, India	AICRP on FMD Network Unit, Palode, Kerala, India
Reagents for Sandwich ELISA	1000	PDFMD, Mukteswar, India	AICRP on FMD Regional Centre, Bengaluru, Karnataka, India
Reagents for Sandwich ELISA	500	PDFMD, Mukteswar, India	Central disease Investigation Laboratory, & FMD vaccine Production Section Livestock Research Institute, Bangladesh
Reagents for Sandwich ELISA	500	PDFMD, Mukteswar, India	Regional Livestock Development Centre, & National Centre for Animal Health, Bhutan
Reagents for Sandwich ELISA	500	PDFMD, Mukteswar, India	Department of Livestock Services, Nepal
Reagents for Sandwich ELISA	500	PDFMD, Mukteswar, India	AICRP on FMD Network Unit, Imphal, Manipur, India
Reagents for Sandwich ELISA	500	PDFMD, Mukteswar, India	AICRP on FMD Regional Centre, Guwahati, Assam, India
Reagents for DIVA	3600	PDFMD, Mukteswar, India	AICRP on FMD Network Unit, Patna, Bihar, India
Reagents for DIVA	3600	PDFMD, Mukteswar, India	AICRP on FMD Regional Centre, Ranipet, Tamilnadu , India
Reagents for	3060	PDFMD, Mukteswar, India	AICRP on FMD Regional Centre, Hisar,

DIVA			Haryana , India
Reagents for DIVA	3060	PDFMD, Mukteswar, India	AICRP on FMD Network Unit, Bhopal, Madhya Pradesh, India
Reagents for DIVA	6000	PDFMD, Mukteswar, India	Biovet Pvt. Ltd., Malur, Karnataka, India
Reagents for DIVA	900	PDFMD, Mukteswar, India	CARI, Port-Blair, Andaman & Nicobar Islands, India
Reagents for DIVA	4500	PDFMD, Mukteswar, India	AICRP on FMD Regional Centre, Bengaluru, Karnataka, India
Reagents for DIVA	3600	PDFMD, Mukteswar, India	AICRP on FMD Network Unit, Cuttack, Odisha, India
Reagents for DIVA	2700	PDFMD, Mukteswar, India	AICRP on FMD Regional Centre, Mathura, Uttar Pradesh, India
Reagents for DIVA	3600	PDFMD, Mukteswar, India	AICRP on FMD Regional Centre, Hyderabad, Andhra Pradesh, India
Reagents for DIVA	900	PDFMD, Mukteswar, India	CADRAD, IVRI, Izatnagar, Uttar Pradesh, India
Reagents for DIVA	1000	PDFMD, Mukteswar, India	AICRP on FMD Network Unit, Imphal, Manipur, India
Reagents for DIVA	3600	PDFMD, Mukteswar, India	AICRP on FMD Regional Centre, Hyderabad, Andhra Pradesh, India
Reagents for DIVA	2250	PDFMD, Mukteswar, India	National Centre for Animal Health, Bhutan
Reagents for DIVA	900	PDFMD, Mukteswar, India	Department of Animal Production & Health, Sri Lanka
Reagents for DIVA	3600	PDFMD, Mukteswar, India	AICRP on FMD Network Unit, Ahmadabad, Gujarat, India
Reagents for DIVA	900	PDFMD, Mukteswar, India	AICRP on FMD Network Unit, Shimla, Himachal Pradesh, India
Reagents for DIVA	3600	PDFMD, Mukteswar, India	AICRP on FMD Network Unit, Bhopal, Madhya Pradesh, India
Reagents for DIVA	1800	PDFMD, Mukteswar, India	AICRP on FMD Network Unit, Jalandhar, Punjab, India
Reagents for DIVA	1800	PDFMD, Mukteswar, India	AICRP on FMD Network Unit, Jaipur, Rajasthan, India
Reagents for DIVA	1800	PDFMD, Mukteswar, India	AICRP on FMD Regional Centre, Pune, Maharashtra, India
Reagents for DIVA	3600	PDFMD, Mukteswar, India	AICRP on FMD Regional Centre, Bengaluru, Karnataka, India
Reagents for DIVA	3600	PDFMD, Mukteswar, India	AICRP on FMD Regional Centre, Ranipet, Tamilnadu, India
Reagents for DIVA	1800	PDFMD, Mukteswar, India	AICRP on FMD Regional Centre, Bengaluru, Karnataka, India
Reagents for DIVA	450	PDFMD, Mukteswar, India	AICRP on FMD Regional Centre, Pune, Maharashtra, India
Reagents for DIVA	2700	PDFMD, Mukteswar, India	AICRP on FMD Network Unit, Jaipur, Rajasthan, India
Reagents for DIVA	4500	PDFMD, Mukteswar, India	AICRP on FMD Regional Centre, Hisar, Haryana , India
Reagents for DIVA	1800	PDFMD, Mukteswar, India	AICRP on FMD Regional Centre, Pune, Maharashtra, India
Reagents for DIVA	900	PDFMD, Mukteswar, India	AICRP on FMD Network Unit, Palode, Kerala, India
Reagents for DIVA	900	PDFMD, Mukteswar, India	CARI, Port-Blair, Andaman & Nicobar Islands, India
Reagents for	3600	PDFMD, Mukteswar, India	AICRP on FMD Network Unit, Cuttack,

DIVA			Odisha, India
Reagents for DIVA	3600	PDFMD, Mukteswar, India	AICRP on FMD Regional Centre, Guwahati, Assam, India
Reagents for DIVA	450	PDFMD, Mukteswar, India	Central disease Investigation Laboratory, & FMD vaccine Production Section Livestock Research Institute, Bangladesh
Reagents for DIVA	900	PDFMD, Mukteswar, India	Regional Livestock Development Centre, & National Centre for Animal Health, Bhutan
Reagents for DIVA	1800	PDFMD, Mukteswar, India	AICRP on FMD Network Unit, Shimla, Himachal Pradesh, India
Reagents for DIVA	1000	PDFMD, Mukteswar, India	AICRP on FMD Network Unit, Imphal, Manipur, India
Reagents for DIVA	1800	PDFMD, Mukteswar, India	AICRP on FMD Network Unit, Kohima, Nagaland, India

2.4.8 National Centre for Foreign Animal Disease (NCFAD), Canada.

Reagents supplied or received

Type of reagent	Quantity	Supplier of the reagent	Recipient of the reagent
3ABC FMD ELISA proficiency panels	25 panels @ 7.0ml/panel	NCFAD	CAHSN Labs in Canada
3ABC FMD ELISA Control Sera : Strong Positive, Weak Positive & Negative	39 vials of EACH control	NCFAD	CAHSN Labs in Canada
FMD Real-time PCR proficiency panels 53 panels	53 panels @ 10.00mL/panel	NCFAD	CAHSN Labs in Canada
FMD *in vitro* transcribed RNA control for FMD Real-time PCR assay	17 vials @ 50µL/vial	NCFAD	CAHSN Labs in Canada
ßactin *in vitro* transcribed RNA control for FMD Real-time PCR assay	20 vials @ 100µL/vial	NCFAD	CAHSN Labs in Canada
3ABC FMD ELISA Monoclonal Antibody	6vials @ 300µL/vial = 1.8mL	NCFAD	CAHSN Labs in Canada
FMD monoclonal antibody	2 Mabs @ 1mg each	NCFAD, Canada	Merial, USA
FMD/SVD PTS panels	4 panels	WRL FMD, Pirbright Institute, UK	NCFAD, Canada
FMD virus	18 isolates @ 1ml each	WRL FMD, Pirbright Institute, UK	NCFAD, Canada

2.5. Collaborative Research

2.5.1. WRLFMD®

Project	Scope	Name of collaborator
Continued collaboration with ISZLER, Brescia, Italy,	Developing new FMD diagnostic kits for Antigen and antibody detection and validation of the SPCE kit for FMDV type O, A and Asia 1.	ISZLER, Brescia, Italy, WRLFMD® at the Pirbright Institute.
Validation of Diagnostic assay for vesicular diseases:	Development of in-house FMDV Asia I strip test and SVD empty capsid cELISA"	The NCFAD, Canadian Food Inspection Agency and the WRLFMD® at the Pirbright Institute.
SADC TADs	Surveillance campaign of buffalo from Malawi, Tanzania and Zambia	OIE RL for FMD, South Africa and OIE RL for FMD, Botswana WRLFMD® at the Pirbright Institute.
EPIZONE	Develop a full genome sequence approach within OIE RLs	OIE RL for FMD, Russia and WRLFMD® at the Pirbright Institute.
Combating Infectious Diseases in Livestock for International Development (CIDLID)	to improve FMD control in East and Southern Africa.	BBSRC/DfID/ Scottish Executive and the Welcome Trust (Southern African Centre for Infectious Disease Surveillance)
RAPIDIA-FIELD (http://rapidia.eu/)	develop and evaluate new diagnostic tools that can be used in the field and in simple laboratories;	EU collaborative research projects:
Epi-Seq	develop new approaches for molecular epidemiology using next-generation sequencing platforms.	EU collaborative research projects:
Global FMD Research Alliance (GFRA)	developing recommendations on research priorities and collaborative research projects.	Now more than 30 laboratories

The Pirbright Institute FMD research groups and WRLFMD® maintain close research links with a wide range of partner laboratories worldwide.
WRLFMD® organised, hosted and chaired the OIE/FAO FMD Reference Laboratories Network Meeting held in Jerez, Spain, in November 2012.

2.5.2 SENASA

Collaborative research projects

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 transmition quantification in vaccinated and non-vaccinated bovines. - Cross protection evaluation in bovines between vaccine and heterologous FMDV strains. - Real time PCR development for the rapid FMD diagnostic. - Study of FMDV molecular evolution in Argentine outbreak using A Argentina 2001 strain as model.	National Epidemiologic I Meeting-Oral presentation: "FMD virus transmition quantification in vaccinated and non-vaccinated bovines." San Pablo, Brazil Open Session of the EuFMD Standing Technical Committee; appliance of science in the progressive control of FMD. Jerez de la Frontera, España Poster: *Phylogeographic study of foot and mouth disease virus A/argentina/2001 strain.*
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 vaccine and alternatives (antivirals) with rapid onset of immunity and based on safer production methods
International Atomic Energy Agency (IAEA)	FMD control	FMD vaccine quality control and A 2001 *in vivo -in vitro* VN test correlation
SENASA Argentina- SENACSA FMD Laboratory - Paraguay	OIE Twinning Project	FMD quality control
SENASA,Argentina-SENACSA, Paraguay	FMDV Characterization	"Characterization of a type O foot-and-mouse disease virus re-emerging in the year 2011 in free areas of the Souther Cone of South America and cross-portection studies with

		the vaccine strain in use in the region". Eduardo Maradei, Viviana Malirat, Claudia Perez Beascoechea, Elizabeth Oviedo Benitez, Andrea Pedemonte, Cristina Seki, Sabrina Galdo Novo, Cristina Balette, Ricardo D'Aloia, José La Torre, Nora mattion, Jorge Rodriguez Toledo, Ingrid Bergmann. Veterinary Microbiology, 2012 (in press) Open Session of the EuFMD Standing Technical Committee; appliance of science in the progressive control of FMD. Jerez de la Frontera, España Oral presentation: Adaptive inmune responses in the respiratory tract of fmd-vaccinated cattle after oronasal infection.
SENASA-INTA-CONICET-Plum Island Animal Disease Center	Early adaptative immune response in FMD infected cattle	"Early adaptive immune responses in the respiratory tract of foot and mouth disease-infected cattle." J. Pega, D. Bucafusco, S. Di Giacomo, JM. Schammas, D. Malacari, A. Capozzo, J. Arzt, C. Perez-Beascoechea, E. Maradei, LL. Rodríguez, MV. Borca, M. Pérez-Filgueira. 2012, J Virol (in press)

2.5.3 ARRIAH

Collaborative research projects

Collaborators	Purpose of collaboration	Outcomes
In the framework of the Interstate Target Eurasian Economic Community (EurAsEC) programme «Innovative biotechnologies»	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
ARRIAH plans to participate in Mongolia and China joint collaboration to control foot-and-mouth disease in East Asia		

2.5.4 PIADC-FADDL

Collaborative projects and partners

- Development of a multiplex qPCR for simultaneous detection of endemic and FADs in swine oral fluids with the National Center for Foreign Animal and Zoonotic disease Defense (FAZD).
- Milk screening qRT-PCR test for detecting FMD from bulk tank milk samples in collaboration with Pirbright Institute, FAZD, NAHLN and dairy industry.
- Pilot testing rope collection of oral fluids for detection of FMD in swine.
- Development of a 3ABC ELISA for detection of antibodies against Non-Structural proteins of FMDV
- O/ECU/2010:
- Vaccine (A24-O1 Campos) and challenge (O/ECU/2010) experiment in cattle and reagent collection (Dr Hernando Duque)
- A12 FMD infectious clone chimera (ARS, Dr. Elizabeth Rieder)
- O1 Campos FMD infectious clone mutagenesis (ARS-USDA, SENASA and CEVAN)

- NAFMDVB master seed viruses and master cell stocks testing, PGP and PD50 evaluations

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	FMD Bulletin	Information sharing in regionally and internationally

and Management		
Southern African Centre for Infectious Disease Surveillance (SACIDS)	Postgraduate training	Improved regional understanding of the epidemiology of FMD

Regional activities

Sampling of buffalo in SADC

Testing of samples taken from buffalo/cattle sampling in four SADC countries during 2011:

- Malawi
- Tanzania
- Zambia
- Mozambique
- Angola

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

PANAFTOSA Regional Activities

Project	Scope	Name of collaborator
FMDV Serosurvey	Serosurvey for (abscence) FMDV viral circulation in Guiana	GLDA, Guiana PANAFTOSA/PAHO-WHO
FMDV Serosurvey	Serosurvey for FMDV viral circulation in Paraguay	SENACSA, Paraguay PANAFTOSA/PAHO-WHO
Improving herd immunity	Serology for herd immunity in defined regions of Equador	AGROCALIDAD, Equador PANAFTOSA/PAHO-WHO
FMDV molecular epidemiology in Brazil (retrospective analysis)	Development of harmonized strategies for sequencing and philogenetic análisis between national and reference laboratories	IB-SP, SP-Brasil LANAGRO, MG- Brasil PANAFTOSA/PAHO-WHO Pirbright Laboratory

2.5.7 RRLSEA Pakchong

Collaborative research projects

Collaborators	Purpose of collaboration	Outcomes
Future Collaboration with Regional Reference Laboratory for FMD , Pakchong and Australian Animal Health Laboratory, Australian Animal Health Laboratory (AAHL), Australia on Foot and Mouth Disease Risk management for Australia and South East Asia	Foot and Mouth Disease Risk Management for Australia and South East Asia	To test the vaccine efficacy against FMD SEA strains, to enhance the existing laboratory capability, introduce new technology in molecular technique, and to maintain the biocontainment and microsecurity system checking by expert.

2.5.8 LVRI China

Collaborative projects

Collaborators	Purpose of collaboration
IAEA	Engineering Foot-and-Mouth Disease Vaccine
FAO/IAEA	molecular diagnostics for trans-boundary animal diseases
EPIZONE	molecular epidemiology of foot and mouth disease virus in Asia
BBSRC	Characterization and comparison of Asian FMDV isolates from multiple host species
others	Control strategy

(most) projects supported by national finance

2.5.9 PDFMD India

- FAO designated Regional Leading Diagnostic Laboratory for South Asia
- Member participant in OIE/FAO Global network of FMD Reference Laboratories
- Member of GFRA (Global Foot and Mouth Disease Research Alliance)
- Global FMD Vaccine Matching Exercise
- FMD seromonitoring and serosurveillance in the SAARC region is being initiated through an FAO programme "Diagnostic laboratory Network coordination for FMD surveillance and vaccine evaluation in South Asia"
- Collaborative programme with USDA on "Antigenic and genetic characterization of Foot-and-mouth disease viruses in India: Application to effective molecular vaccines"
- Participation (laboratory support) in FMD CP being run by DAHD&F, GOI
- Collaborative project on economics of FMD is underway in association with NCAP
- Linkage with Indian FMD vaccine industry in the field of diagnostics and vaccine matching

2.5.10 National Centre for Foreign Animal Disease (NCFAD), Canada.

Collaborators	Purpose of collaboration	Outcomes
gRAD, Demark	To develop LFDs for "point of care" FMDV serotyping	Individual LFD test was developed for FMDV A, O and Asia1 serotyping
WRLFMD, Pirbright Institute, Nexogen Inc., USA	To develop portable electronic microarrays for detection and typing of FMD in swine	Optimization of primers and probes with different FMDV serotypes

Summary

The overall number of samples submitted to FMD reference laboratories in 2012 was down on 2011 levels. Even so the network laboratories received and characterised more than 1,800 samples in 2012 from 35 countries. As in previous years a large proportion of these samples were sent to the WRLFMD® at Pirbright with more than 40% of the samples received and >50% of samples characterised worldwide reported by WRLFMD®.

Characterisation and analysis of samples sent to Network laboratories revealed that in 2012, 738 viruses were characterised by serotyping with WRLFMD® reporting almost 50% of those isolations.
Again as in 2011, the predominant serotype reported from around the world was type O again with an overall proportion of 60% of all the samples analysed in 2012. The proportion of Serotype A reported was 10% below that seen in 2011 at 14% with corresponding increases in Asia 1 and SAT 2. Asia 1 continued to be reported from a number of countries in 2012 comprising 16% of all samples analysed and the unexpected outbreaks of SAT 2 in North Africa provided 11% of the total output in 2012. There were no reports of serotype C and SAT 3 was only reported from 3 probang samples taken from buffalo in Mozambique. Serotype C has still not been reported since 2004.

In total **537** VP1 sequences were characterised for this report in 2012 by the Network Laboratories: **435 (81%)** came from WRLFMD® while the remaining **102 (19%)** came from other laboratories

As in previous years, it was not possible to isolate FMD virus from all samples, but virus isolates were prepared from approximately 50% of samples sent to WRLFMD®. This is still probably 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 15% 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.

The OIE/FAO plan for the progressive global control of FMD which was further endorsed at a joint meeting in Bangkok in June 2012 can play a major role in improving this situation by providing essential training and providing local and regional FMD reference laboratories with the necessary resources to carry out much of the necessary initial FMD virus characterisation such as rRT-PCR and/or serotyping in their own laboratories. Such an improved system of functional local FMD reference laboratories would enable a pre-dispatch FMDV screening process of important samples to be undertaken and provide a mechanism whereby only a selected set of samples requiring further characterisation are sent on to regional FMD laboratories or WRLFMD® for analysis. At a very minimum, 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 continued presence 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. However, the successful vaccine protection trial carried out at Pirbright with Asia 1 Shamir from the EU emergency vaccine bank provided some reassurance that the current vaccine will protect against current field strains when used as a high potency, oil adjuvanted product. This issue recognised following laboratory observations based upon the testing of field samples, highlights the continuous need for the collection of more field isolates from all pools and for testing to continue to monitor for vaccine matching in laboratory tests.

As previously reported, 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® resulted in a review of the high priority vaccine list with the subsequent inclusion of O PanAsia 2.
Along with O PanAsia 2, other commercially available vaccines also demonstrated matching with O isolates in the same tests. These are O 4625 and O 3039 (see vaccine matching sections).

Since serotype O is in widespread circulation with 2 topotypes responsible for the majority of characterised outbreaks, it is vital that suitable vaccines that will provide protection in the field are available.

The addition of the O PanAsia 2 strain to the vaccine portfolio and the potential to provide mixed O antigens in blended formulations both provide further confidence that suitable vaccines will be and are available to control for many circulating FMD serotype O viruses.

An important observation is that 'High Potency' (>6PD_{50}) vaccines have been demonstrated to provide protection even when laboratory matching has shown no match. Further studies should be carried out on these observations.

The International harmonisation of laboratory tests continues through network activities. In 2012 results continue to demonstrate that harmonization of diagnostic assays between a number of laboratories is improving as a direct result of the proficiency testing activities initiated by network members. There are plans to hold another vaccine matching workshop, to build upon the success of the one held in 2011, at the Pirbright laboratory in 2013/2014, and further training and capability building of national and regional reference laboratories will hopefully be strongly supported through the OIE/FAO global control of FMD initiative.

Further work is still 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 years as the joint OIE/FAO global initiative to control FMD gains momentum.

3. Final comments

Once again, this annual document provides a detailed and highly practical view of the current global incidence of FMD and presents the most up to date understanding of the circulating virus strains, their locations and the available vaccines, which should allow effective disease control if used appropriately. While putting together this report and through various discussions it has become very clear to me that the activities of the OIE/FAO FMD reference laboratory network provide the engine room to power the delivery of the unique and vital information which on a daily basis serves to inform and influence national, regional and global FMD control strategies and policy. Importantly, there is now, and will be into the future, increasing pressure on those network laboratories to maintain and further increase their outputs and required quality of service. Accordingly, it is imperative 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.

The next year will see further consolidation and progress of the recommendations and plans agreed at the 2nd OIE/FAO Global FMD conference in Bangkok in June 2012. The FMD reference laboratory network has made extraordinary progress in the sharing and dissemination of information enabling the prospect of 'real time' reporting and action for the control of FMD worldwide to become a realistic goal. The network continues to provide central enabling capability to national and regional diagnostic laboratories through the training of core staff, identifying gaps and needs and providing the most comprehensive and accurate data to political decision makers.

It is obvious that the national, regional and coordinating reference laboratories which comprise this network have a fundamental role to inform and shape the structure and progress of the OIE/FAO global initiative for the control of FMD. Accordingly, it is crucial that the network has a voice in any discussions and a seat at the table where any decisions to take the plan forward are formulated.

Finally, I would like to thank all those who contributed their data, time and good will to make this network such a success and look forward to the coming year with optimism and the determination to continue to improve our relationships and our global knowledge of one of the most serious animal disease threats to global food security.

Jef Hammond March 2013.