



옵티팜  
OPTIPHARM

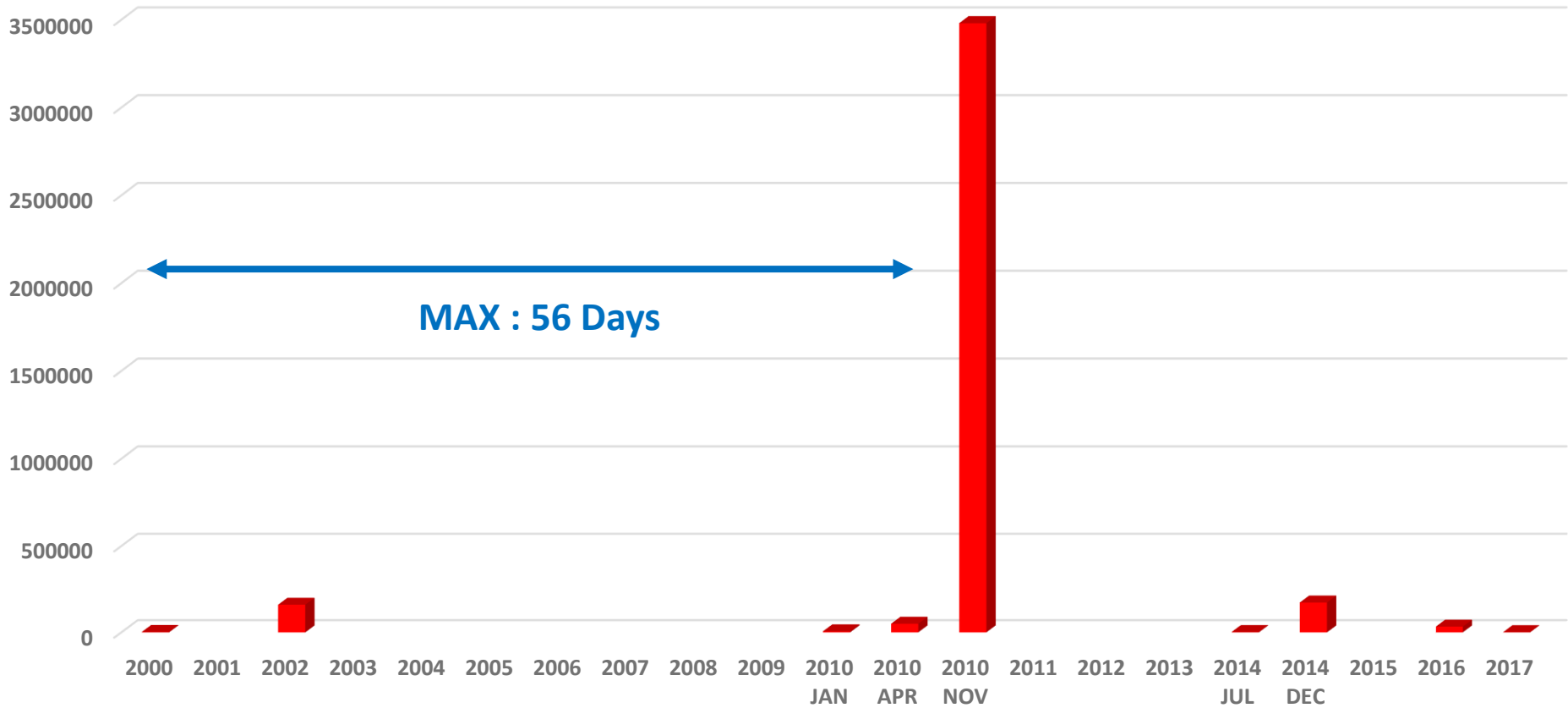
GFRA Scientific Meeting  
Incheon, Korea / Oct. 25, 2017.

Science and Innovation for FMD control & Response  
**Characteristics of Recent Foot-and-Mouth Disease Outbreak in Korea**

Hyunil Kim<sup>1</sup>, Won Hyung Lee<sup>2</sup>, Sang Chul Kang<sup>1</sup>, Sungho Shin<sup>1</sup>

<sup>1</sup>Optipharm Inc., Cheongju, Korea, <sup>2</sup>XP Bio Inc., Anseong, Gyeonggi, Korea

# History of FMD outbreak in Korea (2000-2010)



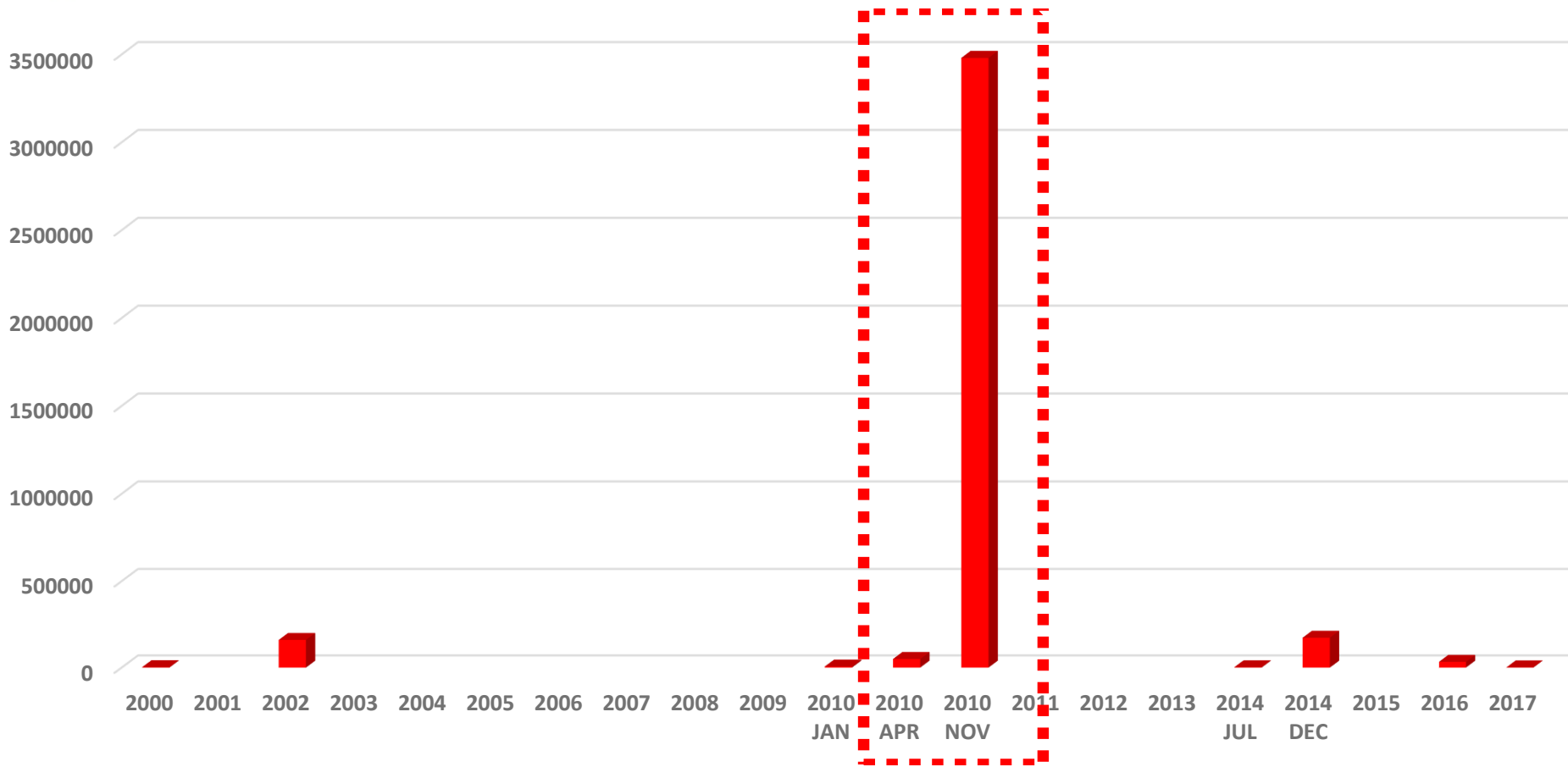
	2000	2002	2010 (J)	2010(A)
Duration of Outbreak	23 Days	<b>56 Days</b>	28 Days	29 Days

# Strong and rapid preventive **Stamping out**



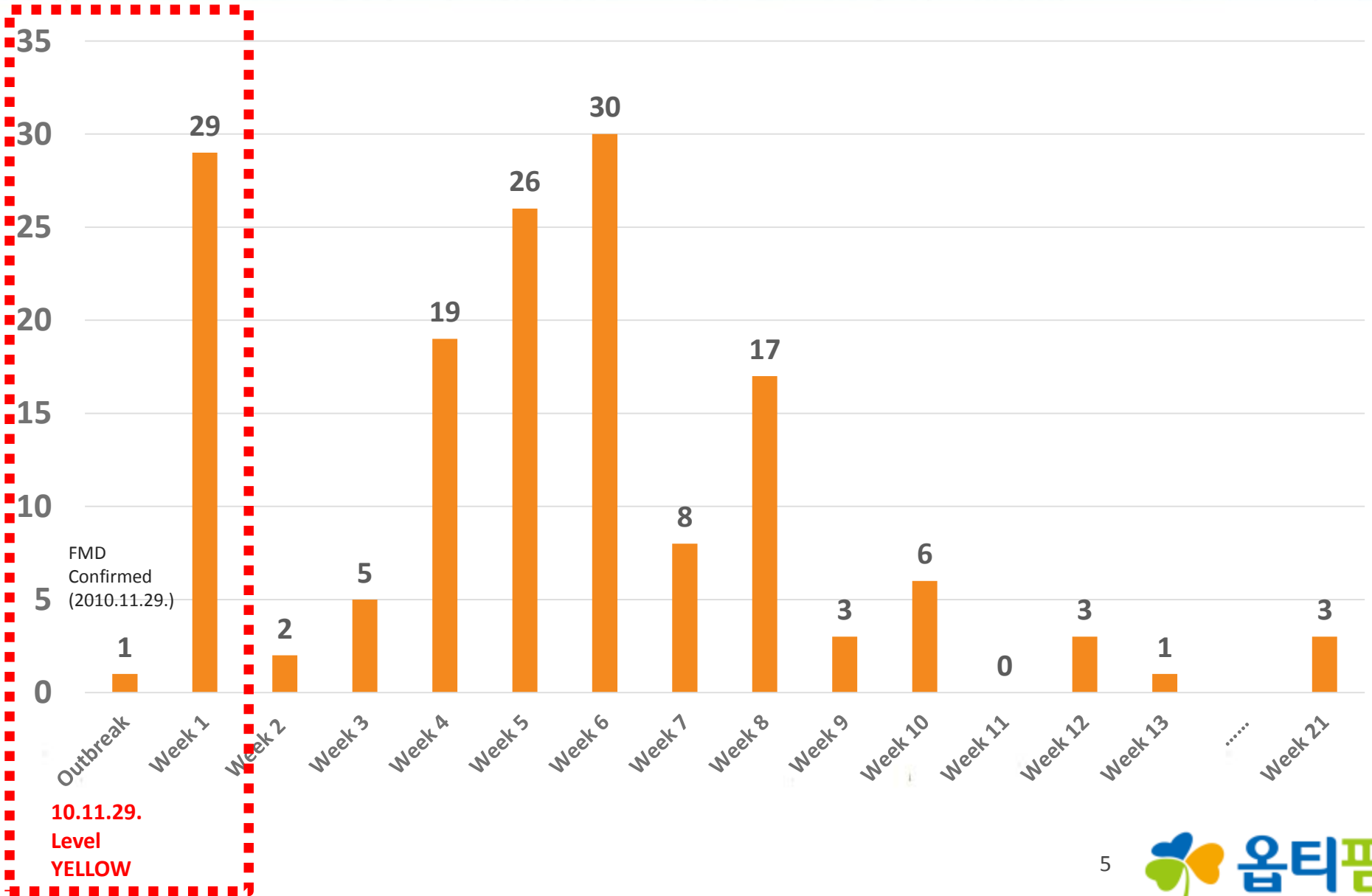


# History of FMD outbreak in Korea (2010-2011)



	2000	2002	2010 (J)	2010(A)	2010(N)
Duration of Outbreak	23 Days	56 Days	28 Days	29 Days	<b>145 Days</b>

# Mistakes in early diagnosis

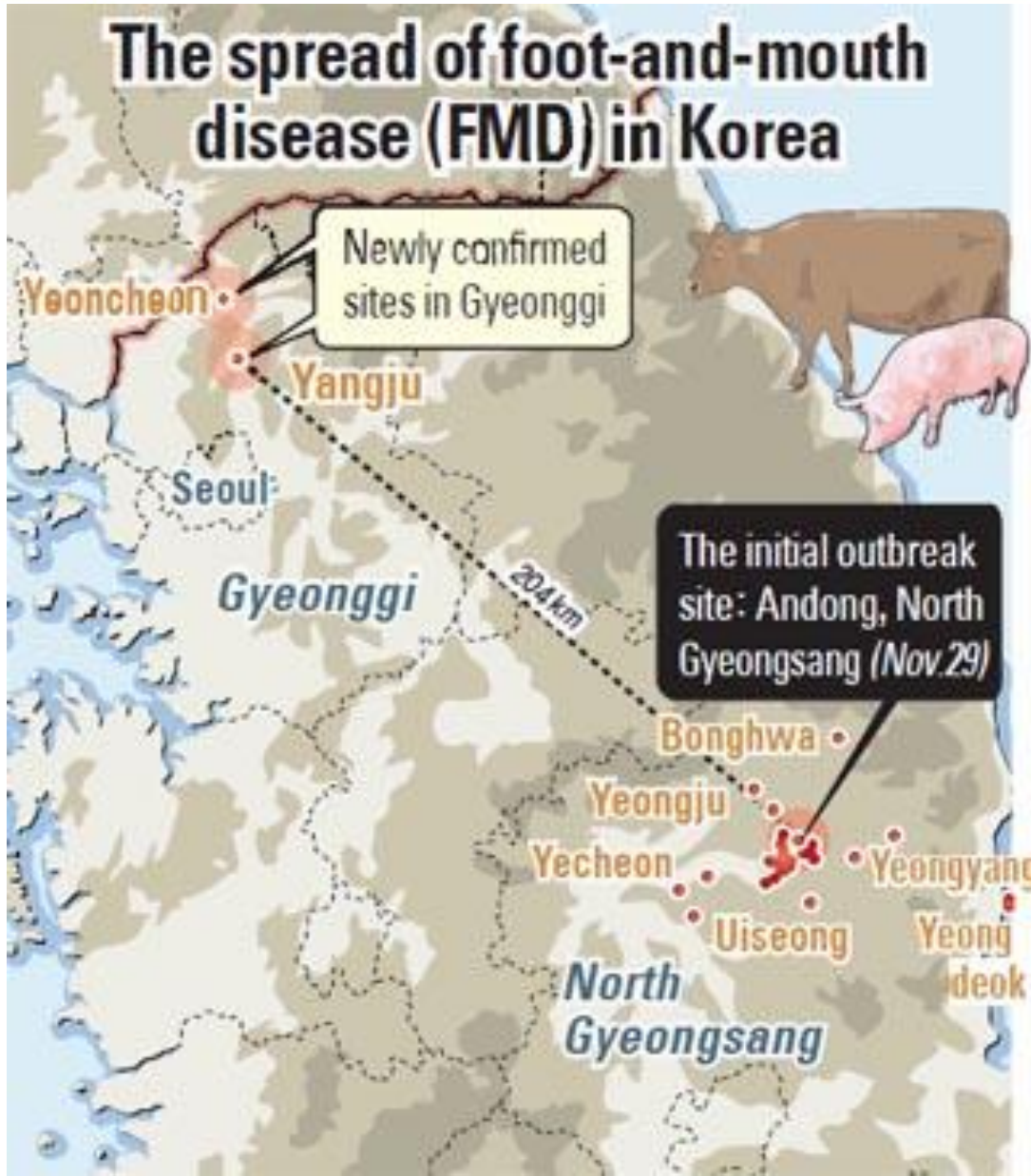


# Suckling Piglets Death regarded as cupric toxicity



# FMDV jumped over 200km!

## The spread of foot-and-mouth disease (FMD) in Korea



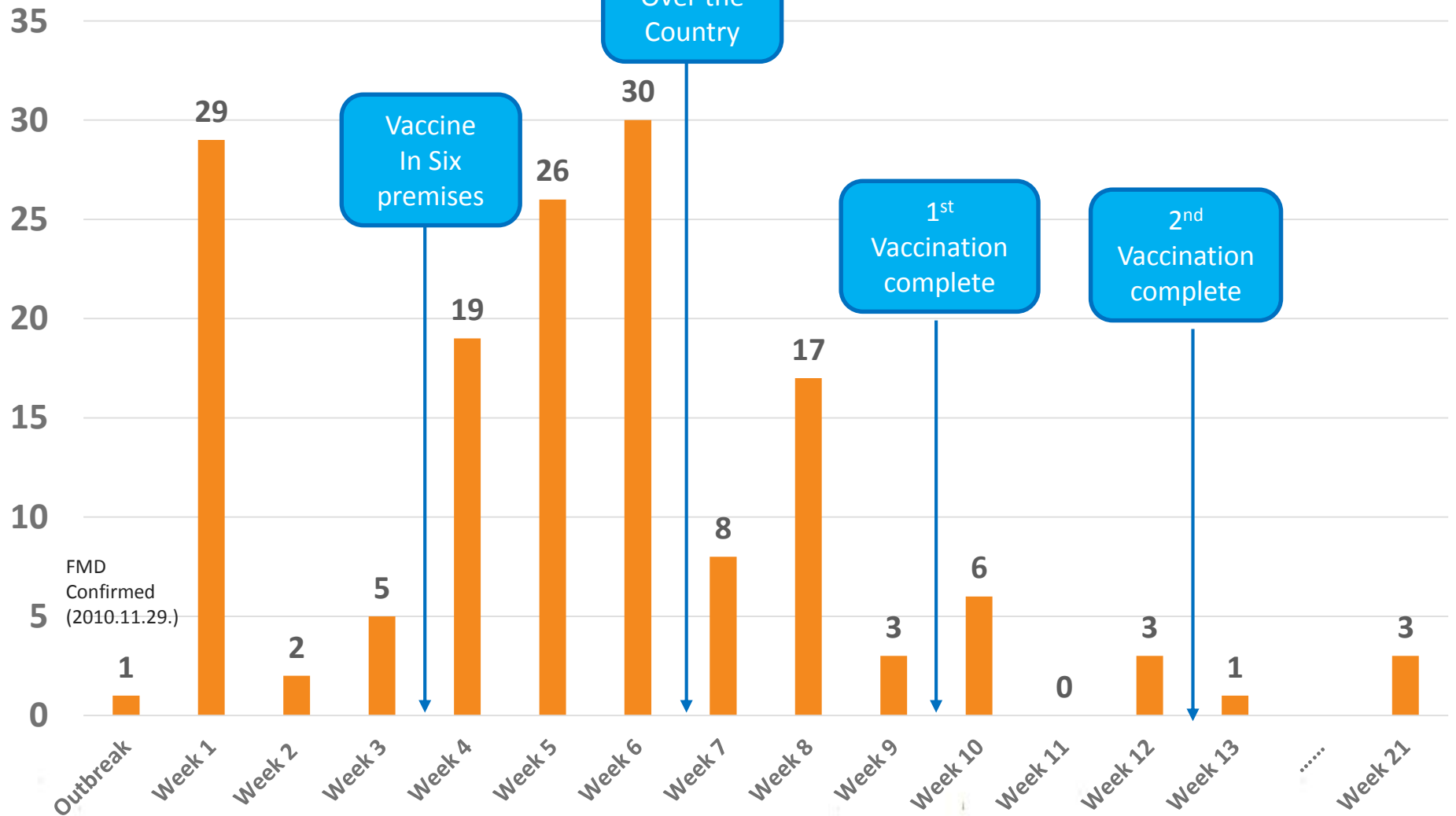
**Manuer Vehicle** visited North Gyeongsang area

- . 2010.11.17.

- . 2010.11.25.



# Decided to vaccinate all over the country



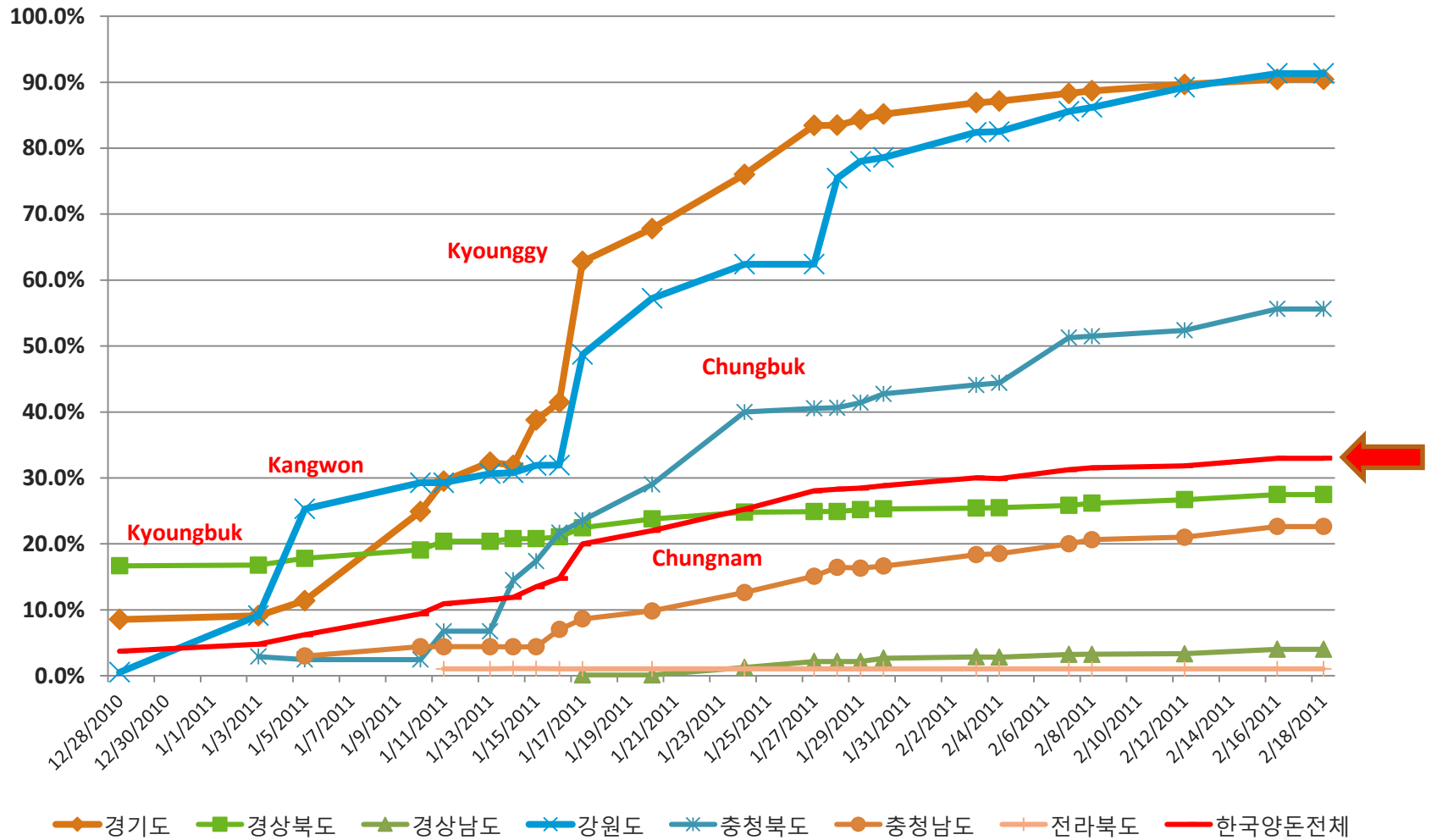
10.11.29.  
Level  
YELLOW

10.12.15.  
Level  
ORANGE

10.12.29.  
Level  
RED



# FMDV spreads to near premises rapidly



# The farmer who travelled Vietnam was suspected

2010. November

Nov. 1

**2010. 11. 02. Travel to Northern Vietnam**

Nov. 8

**2010. 11. 07. Came back to Korea**

Nov.  
15.

**2010.11.17. : Manuer vehicle visited**

Nov.  
22.

2010. 11. 23 – First suspected report (FMD Ab test :  
Negative)

**2010. 11. 25 : Manuer vehicle visted**

2010. 11. 26 – Second suspected report from different farm.

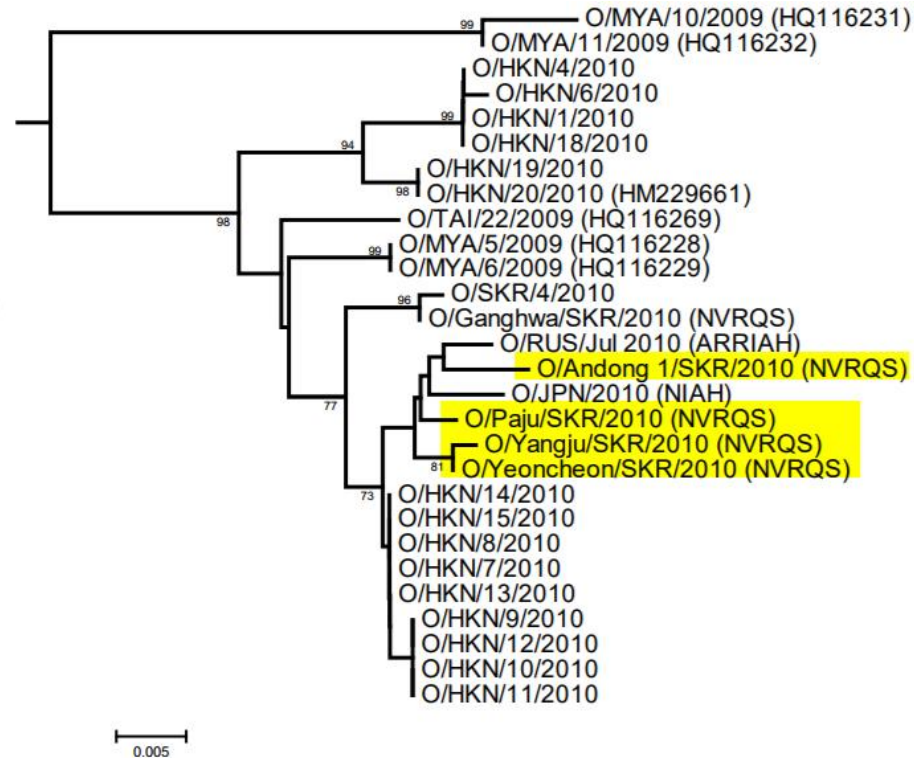
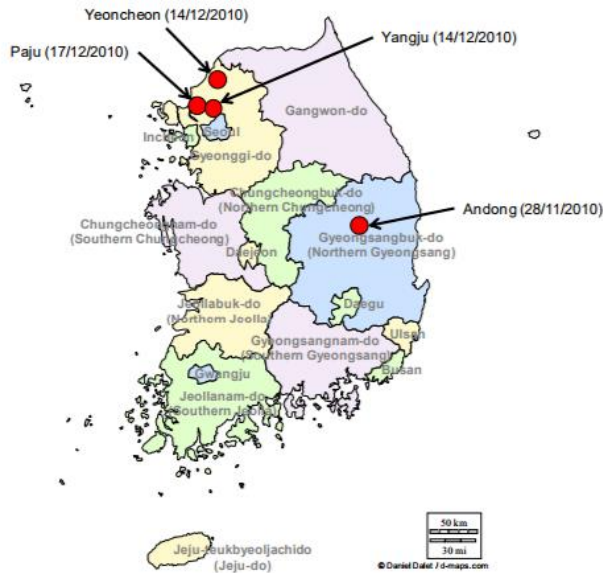
2010. 11. 28. – Confirmed FMD outbreak

2017-11-17  
Nov.

# Korean FMDV showed closer homology with HKN Virus

**Republic of Korea (South Korea)**  
 VP1 sequences received from National  
 Veterinary Research and Quarantine  
 Service (NVRQS), Anyang, Gyeonggi  
 430-824, Republic of Korea  
 Date received: 30/11/2010 to 17/12/2010  
 No. sequences: 4  
 O: 4

All four sequences belonged to the SEA  
 topotype, Mya-98 lineage.





# Korean Gov. suspected International travelers and Overseas workers

(Emerging infectious disease 20(12):2014)

Table. Characteristics of 5 outbreaks of foot-and-mouth-disease, South Korea, 2000–2011\*

Characteristic	2000 Mar	2002 May	2010 Jan	2010 Apr	2010 Nov– 2011 Apr
<b>Disease status</b>					
No. cases	15	16	7	13	153
No. virus-positive cases	15	16	7	29	3,700
Duration virus detected, d	22	52	28	29	145
Period of virus detection	Mar 24–Apr 15	May 2–Jun 23	Jan 2–Jan 29	Apr 8–May 6	Nov 28–2011 Apr 21
Host tropism	Ruminant	Pig (cattle)	Ruminant	Ruminant, pig	Ruminant, pig
Serotype (topotype/lineage)	O (ME-SA/PanAsia)	O (ME-SA/PanAsia)	A (ASIA/SEA-97)	O (SEA/Mya-98)	O (SEA/Mya-98)
No. affected provinces (cities or counties)	3 (6)	2 (4)	1 (2)	4 (4)	11 (75)
Economic losses, US\$, millions	300	143	29	124	3,000
Date of disease-free status	2001 Sep 16	2002 Nov 29	2010 Sep 27	2010 Sep 27	2014 May 29
<b>Control measures</b>					
Eradication policy	Culling, vaccination	Culling	Culling	Culling	Culling, vaccination
No. cattle culled	2,021	1,372	2,905	10,858	150,864
No. pigs culled	63	158,708	2,953	38,274	3,318,298
No. other animals culled	132	75	98	742	10,800
Total culled	2,216	160,155	5,956	49,874	3,479,962
Area of culling, km radius	0.5 (all)	0.5 (all), 3 (pigs)	0.5	0.5, 3 (on 2 farms)	0.5
Vaccine strain	O Manisa	NA	NA	NA	O Manisa
No. animals vaccinated	1st: 860,700, booster: 661,700	NA	NA	NA	All susceptible animals
Vaccination range, km radius	10	NA	NA	NA	Nationwide
Serosurveillance area, km radius	20	10	10	10	10
<b>Restricted zones, km radius</b>					
Management	NA	NA	10–20	10–20	10–20
Surveillance	10–20	3–10	3–10	3–10	3–10
Protection	0–10	0–3	0–3	0–3	0–3
<b>Putative sources</b>					
Regions in Asia as possible sources	Northeastern	Northeastern	Northeastern	Northeastern	Southeastern
Major sources of first outbreak	International travelers, imported hay	Overseas travel, foreign workers	Foreign workers, international parcels	Overseas travel	Overseas travel
Low possibility sources of first outbreak	Windborne spread of contaminated yellow sand, wild birds	Swine, saw dust, wild animals and birds, yellow sand	Overseas travel, imported forage, TMR feed, saw dust	Imported forage, TMR feed	Foreign workers, illegal livestock products
Possible transmission factor for domestic regions	Imported hay	Humans and vehicles	Humans (veterinarians,	Vehicles, humans	Vehicles, humans

# Disinfection for Korean Travelers (since Jul. 25. 2011)



# Since Travellers disinfection...



2010

2011

2012

2013

2014

2015

2016

2017



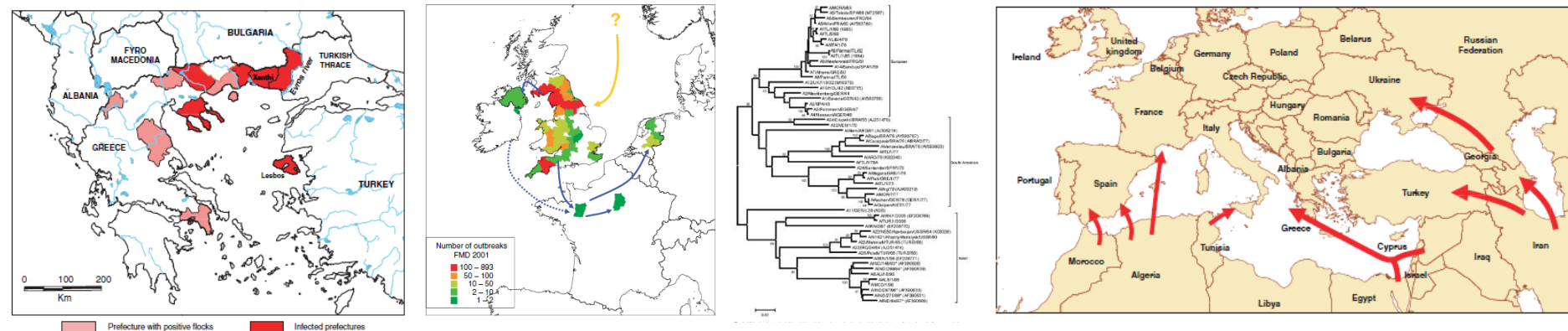


ORIGINAL ARTICLE

# Incursions of Foot-and-Mouth Disease Virus into Europe between 1985 and 2006

J.-F. Valarcher<sup>1,\*</sup>, Y. Leforban<sup>2,\*</sup>, M. Rweyemamu<sup>3</sup>, P. L. Roeder<sup>4</sup>, G. Gerbier<sup>5</sup>, D. K. J. Mackay<sup>6</sup>, K. J. Sumption<sup>4</sup>, D. J. Paton<sup>6</sup> and N. J. Knowles<sup>6</sup>

- <sup>1</sup> VI – Animal Health, Lärkbacken, 74020 Vänge, Uppsala, Sweden
- <sup>2</sup> Ministry of Agriculture and Fisheries, Paris, France
- <sup>3</sup> Royal Veterinary College London and Woking, Surrey GU21 2LQ, UK
- <sup>4</sup> Food and Agriculture Organization of the United Nations, Rome, Italy
- <sup>5</sup> CIRAD, Montpellier, France
- <sup>6</sup> FAO FMD World Reference Laboratory for FMD, Department of Vesicular diseases, IAH, Pirbright, Surrey, GU24 ONF, UK

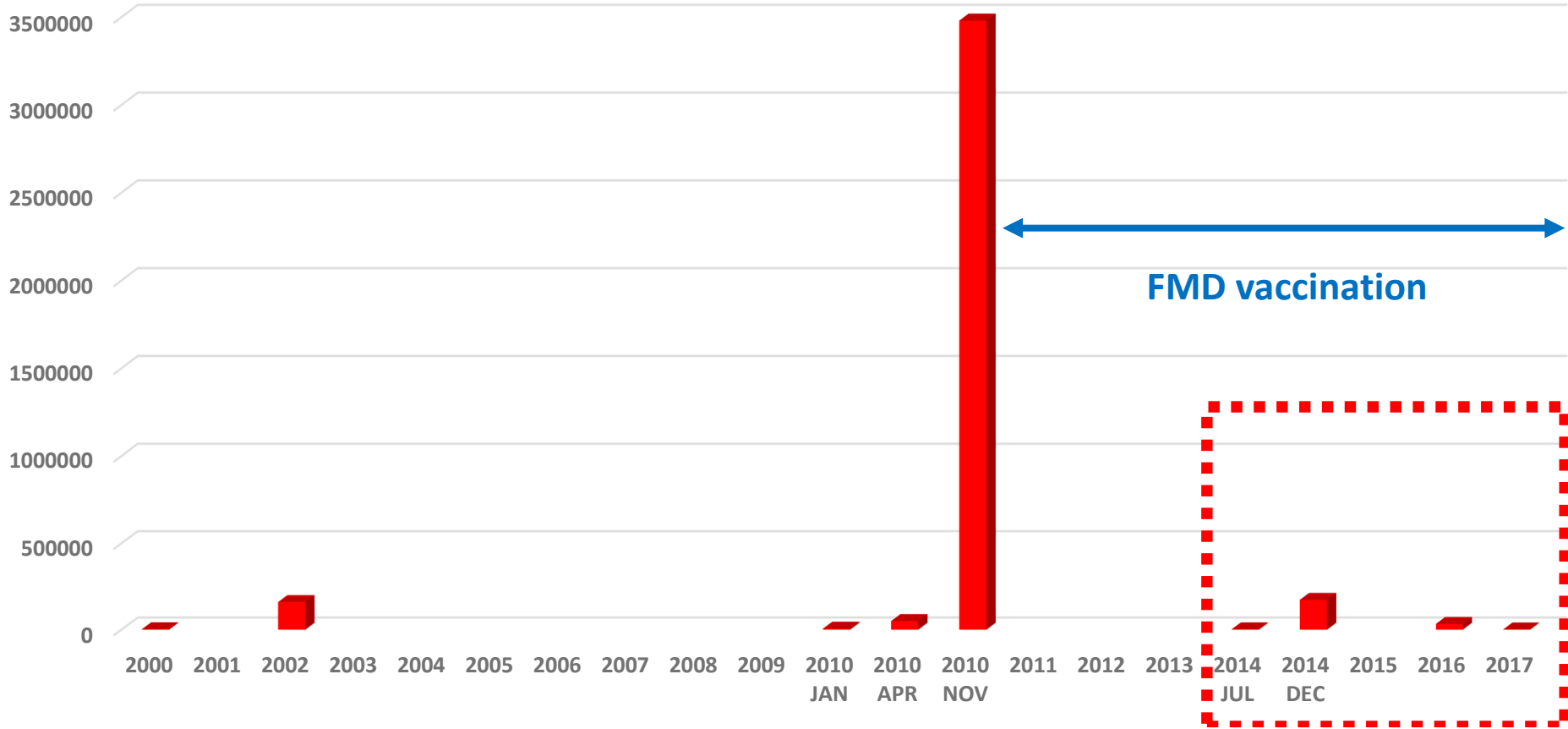


**Investigated over 37 times FMD outbreak in 14 European countries '85~'06.**

**The cause of 59.5% (22/37) cases were not clarified yet.**

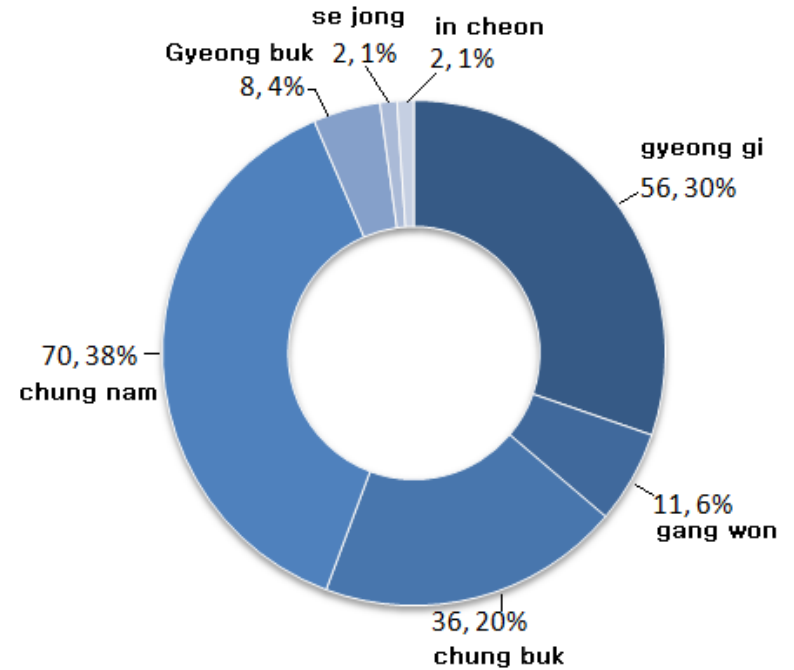
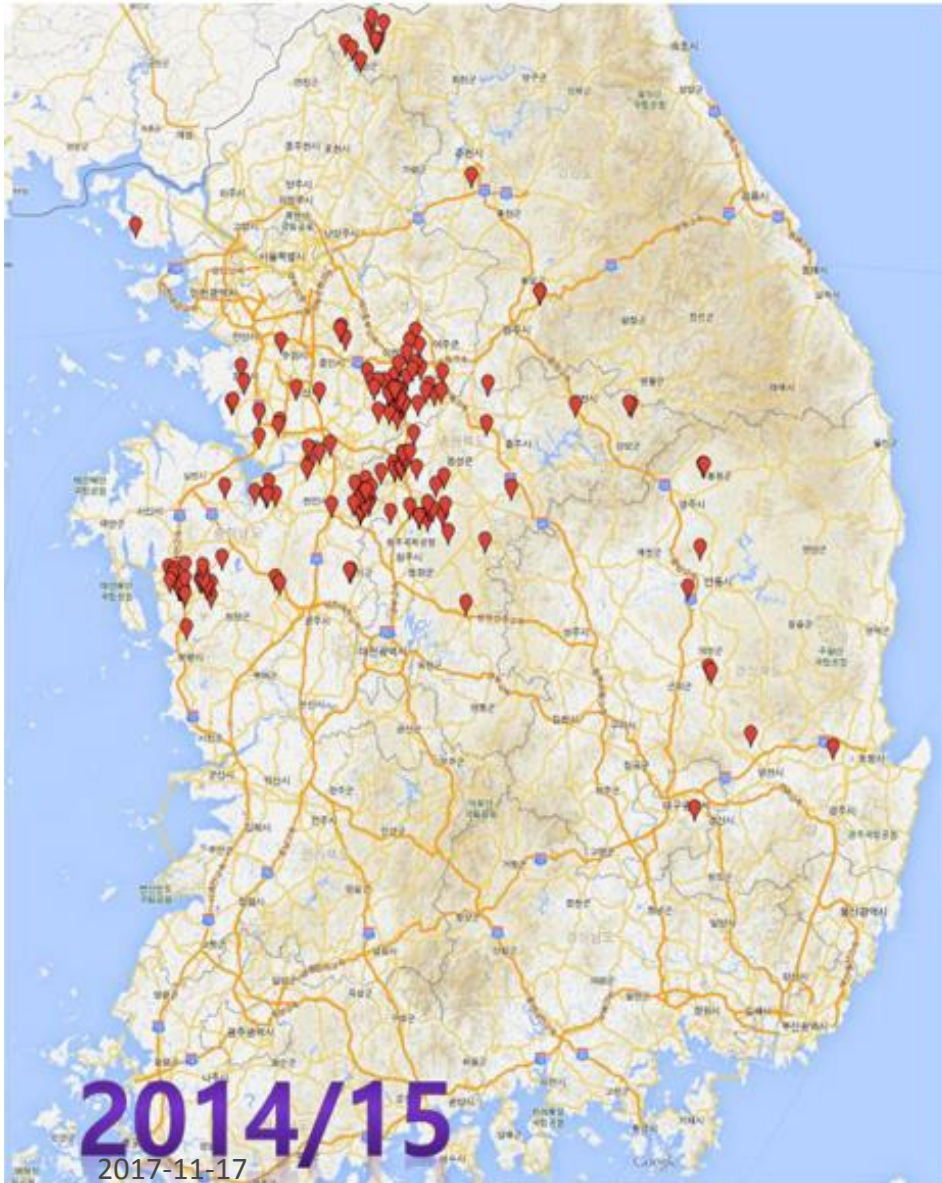
2017-11-17

# History of FMD outbreak in Korea



	2000	2002	2010 (J)	2010(A)	2010(N)
Duration of Outbreak	23 Days	56 Days	28 Days	29 Days	<b>145 Days</b>

# FMD outbreak from 2014 to 2015



33 Cities (7 Province)  
185 Cases (Cattle 5, Pigs 180)



# Poor vaccine matching



**Table 4: Antigenic characterisation of FMD field isolates by matching with vaccine strains by 2dmVNT from January to March 2015**

## Vaccine Matching Studies for Serotype O FMDV by VNT

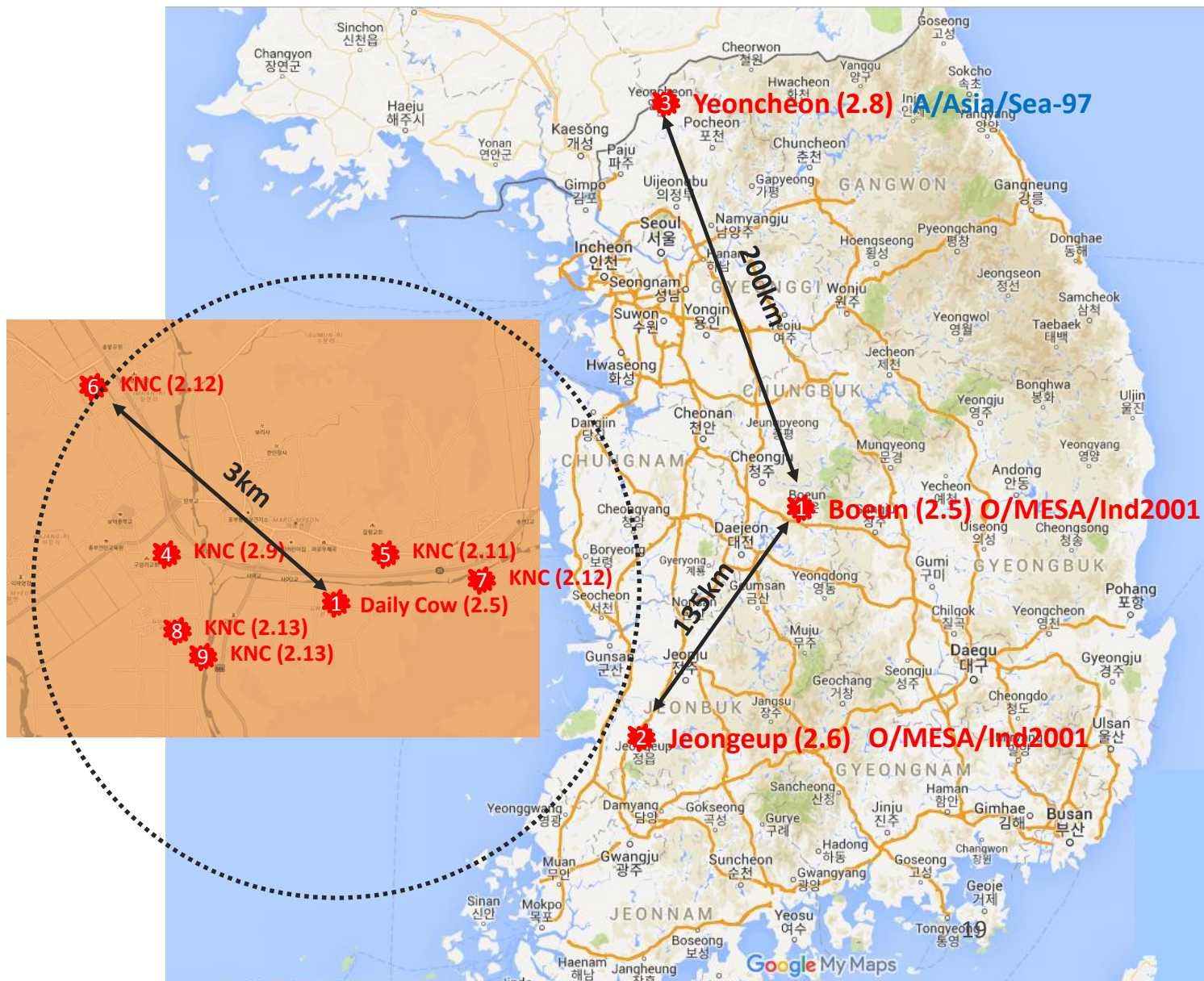
Sample Reference	O 3039	O Mansia	O/SKR/7/10**	O TAW/98	O/TUR/5/09
O/SKR/13/2014*	M	N	M	M	M
O/SKR/14/2014	M	N	M	N	M
O/SKR/15/2014*	M	N	M	M	M
O/SKR/16/2014	M	N	M	B	M
O/SKR/18/2014	M	N	M	M	M
O/SKR/19/2014*	M	B	M	M	M

\* These isolates provided by Merial Animal Health from the shipment sent to The Pirbright Institute

\*\* This test used a closely related field strain, not the homologous vaccine strain

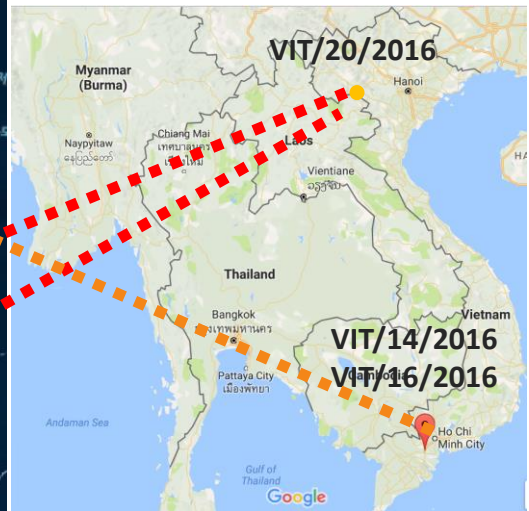
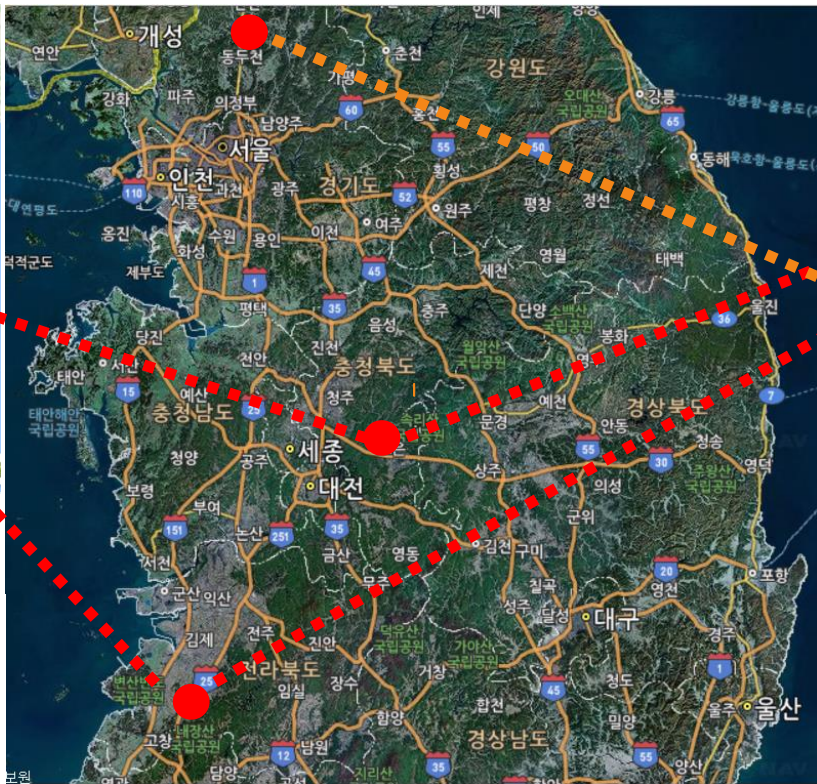
we received six samples from South Korea for vaccine matching. These were all serotype O viruses (from the O/SEA/Mya-98 lineage), from recent field cases in South Korea, of which three were originally isolated at Merial before being tested at TPI. There was a good vaccine match for O 3039, O/SKR/7/2010, O Taw98 and O/TUR/5/09; however there was poor vaccine match with O Manisa.

# Summary of FMD Outbreak in 2017





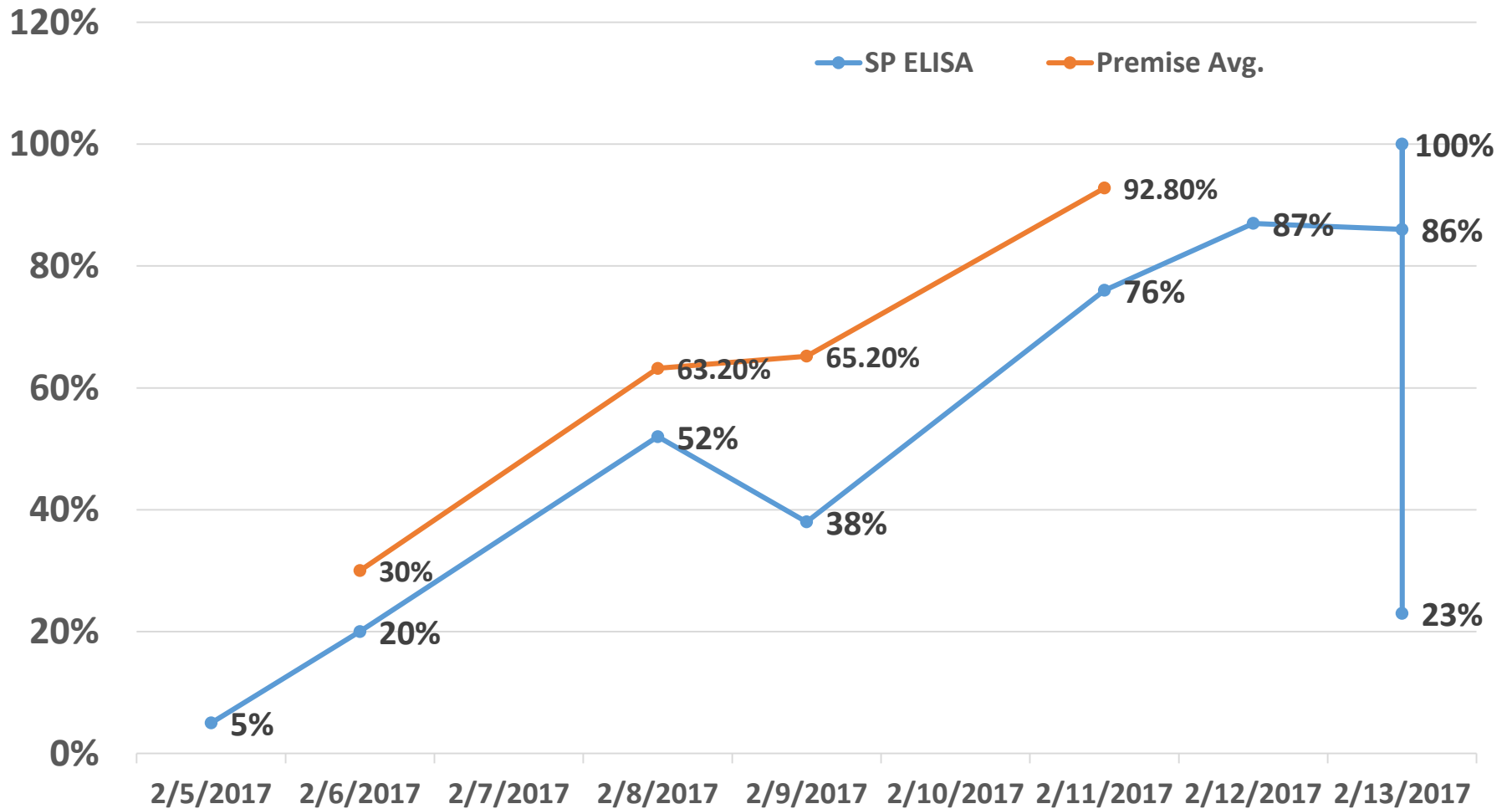
# What were the routes of FMD infection?



- Zabaikalskiy/3/RUS/2016\*
- 170206/SKR/2017\*
- VIT/20/2016
- 98 TAI-225-2016R3\*
- TAI-269-2-2016\*
- Zabaikalskiy/4/RUS/2016\*
- Zabaikalskiy/2/RUS/2016\*
- Zabaikalskiy/1/RUS/2016\*
- 170205/SKR/2017\*

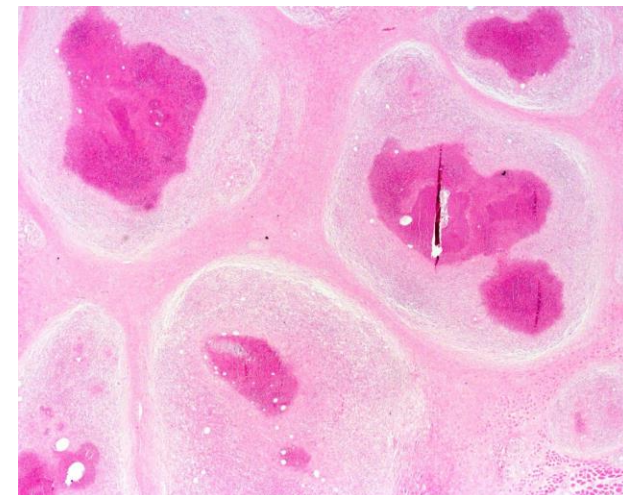
We can suspect, but cannot confirm where they come from.

# FMD ELISA S/P ratio

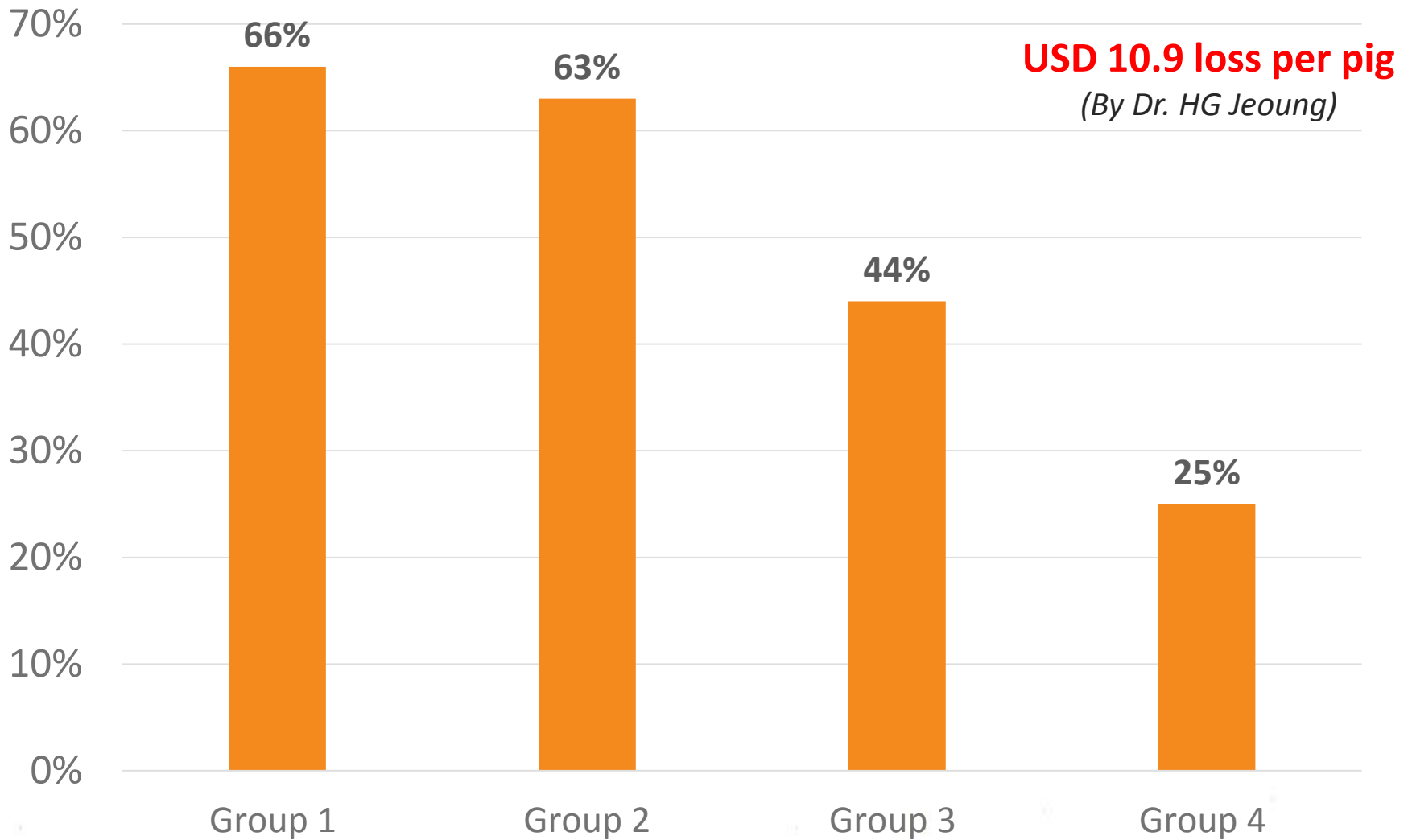




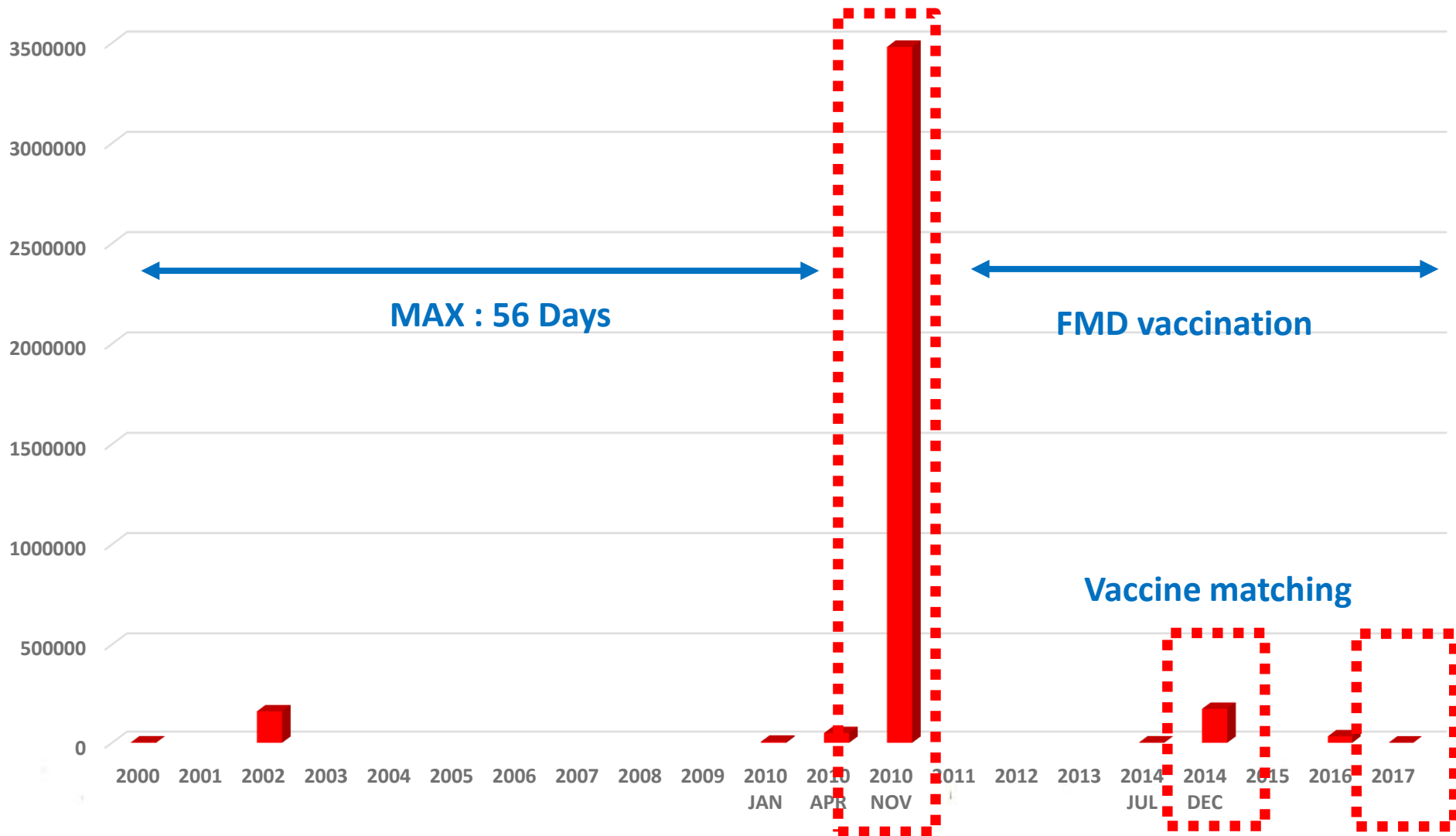
# Abnormal Meat occurrence after FMD vaccination



# Abnormal Meat detection rate in Slaughterhouse



# Summary



2017-11-17

24

# Thank you for attention!



2017-11-17

25

SAFETY INNOVATION PRECISION CLEANLINESS

