

PED & Swine Disease Matrix

USAHA Annual Meeting

Kansas City, MO

October 20, 2014

Dr. Harry Snelson
American Association of Swine Veterinarians



PED Timeline



Sun	Mon	Tues	Weds	Thurs	Fri	Sat
28	29	30	1	2	3	4
5 1 st Phone Call	6 1 st Indiana – Sow Farm	7 2 nd Indiana – Sow	8 Initial TGE PCR neg	9 IHC results neg – call vdl	10 EM pos for corona	11
12	13	14	15	16 NVSL confirms PEDV	17 USDA announc s	18
19	20	21	22	23	24	25
26	27	28	29	30	31	1

Sun	Mon	Tues	Weds	Thurs	Fri	Sat
28	29	30	1 May	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17 4 cases known (3 in IA, 1 in IN)	18
19	20	21	22	23	24	25
26	27	28	29	30	31	1

Stop Movement?

- Don't impose if you don't know how to lift the order.
- Sends negative message to:
 - Trading partners
 - Domestic markets
 - Public
 - Neighboring swine producers
- Unlikely to have had an impact

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY (TOTALS)
	15 APRIL	16 OH – GF	17	18	19	20 1 GF
21	22	23	24	25	26 IN – GF	27 1 GF
28	29 IA (W. Central) – SOW	30 IA (NE) – SOW OH – GF IA – GF	1 MAY IA – GF	2 IA – GF	3 IA – GF	4 4 GF 2 SOW
5	6 IA (NW) – SOW	7 IA – GF IA – GF	8 IN – SOW MN – SOW IA – GF	9 IA – GF IA – GF IA – GF	10 CO (Eastern) – SOW IA – GF IN – ?? IN – ?? PA – ??	11 7 GF 4 SOW 3 UNKNOWN
12	13 MN – GF	14 CO – SOW MN – GF	15 MN – SOW MN – GF	16 IA – SOW	17 IA – SOW IA – SOW IA – GF	18 4 GF 5 SOW (31 actual cases)
19	20 IA – SOW IN – SOW IN – SOW IA – GF MN – GF MN – GF	21 CO – GF IA – GF IA – GF IA – GF IA – GF IA – GF IA – GF IA – GF IA – GF IA – GF MN – GF OH – GF	22 CO – SOW CO – SOW IA – GF IA – GF IA – GF IA – GF IA – GF IA – GF IA – GF OK – GF	23 IA – SOW IA – SOW GF OH MN – ??	24 IA – GF IA – GF IA – GF IA – GF IA – GF CO – GF CO – GF MN – GF MN – GF MO – GF MN – ??	25 34 GF 7 SOW 2 UNKNOWN

Outcome of retrospective testing & on-boarding PEDV PCR

PEDV Positive Cases Ascertained from Multiple VDLs

Week Received @ VDL	Total Number of PEDv Positive Diagnostic Case Submissions (Premises) via PCR or IHC	Farm Type			CO	IA	IL	IN	KS	MI	MN	MO	NC	NY	OH	OK	PA	SD	?
		Sow	Growing Pig	?															
4/15/2013	(1), 2	0	1											1					
4/22/2013	(1), 1	0	1				1												
4/29/2013	(6), 9	2	4			5								1					
5/6/2013	(14), 17	4	7	3	1	8	3			1							1		
5/13/2013	(9), 10	5	3	1	1	4				4									
5/20/2013	(43), 44	7	33	3	5	25	2			7	1			2	1				
Total	(74), 83	18	49	7	7	42	6			12	1			11	1	1			

At the time of the announcement on May 17:

Diagnosed: 4 cases in 2 states

Reality: 39 cases on 31 premises in 6 states

* for the weeks prior to 6-17-13, laboratories were able to provide diagnostic case submissions and number of premises testing positive for PEDv. Starting 6-17-13, the data are limited to ONLY diagnostic case submission numbers (aka Swine Accessions)



Response

- USDA designated PED a “transboundary” disease
 - Not reportable
 - Non-regulatory
 - Production disease like PRRS or PCV
 - Turned the response over to the swine industry
- We had never exercised responding to an exotic production disease

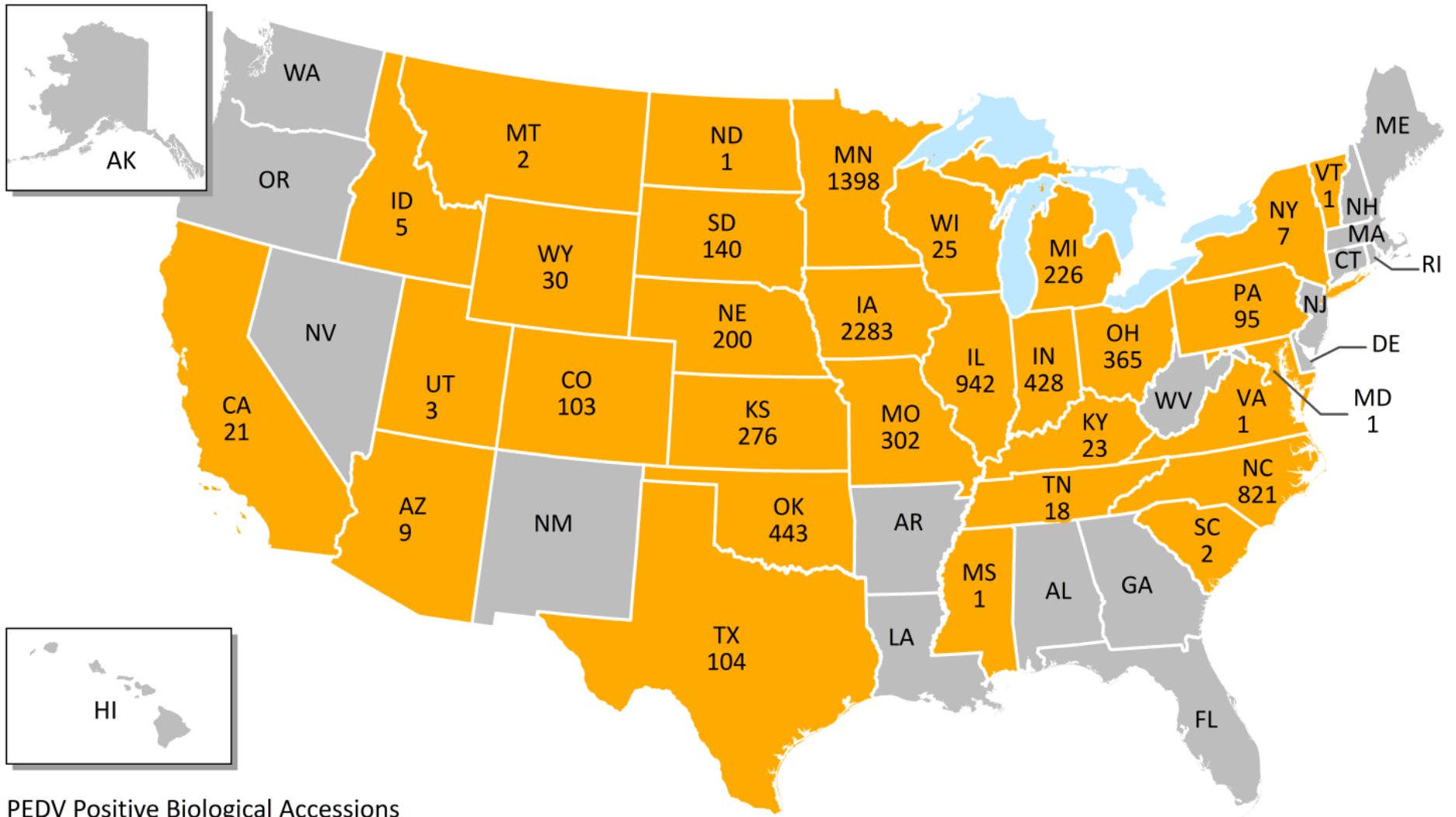


Current Status as of 09/17/14

Test Results	Cumulative
PEDv Positive Accessions	8,386
Total Accessions Tested	32,211
Percent PED Positive Accessions	26%
Number of States Reporting Positive Accessions	31

Courtesy of NAHLN





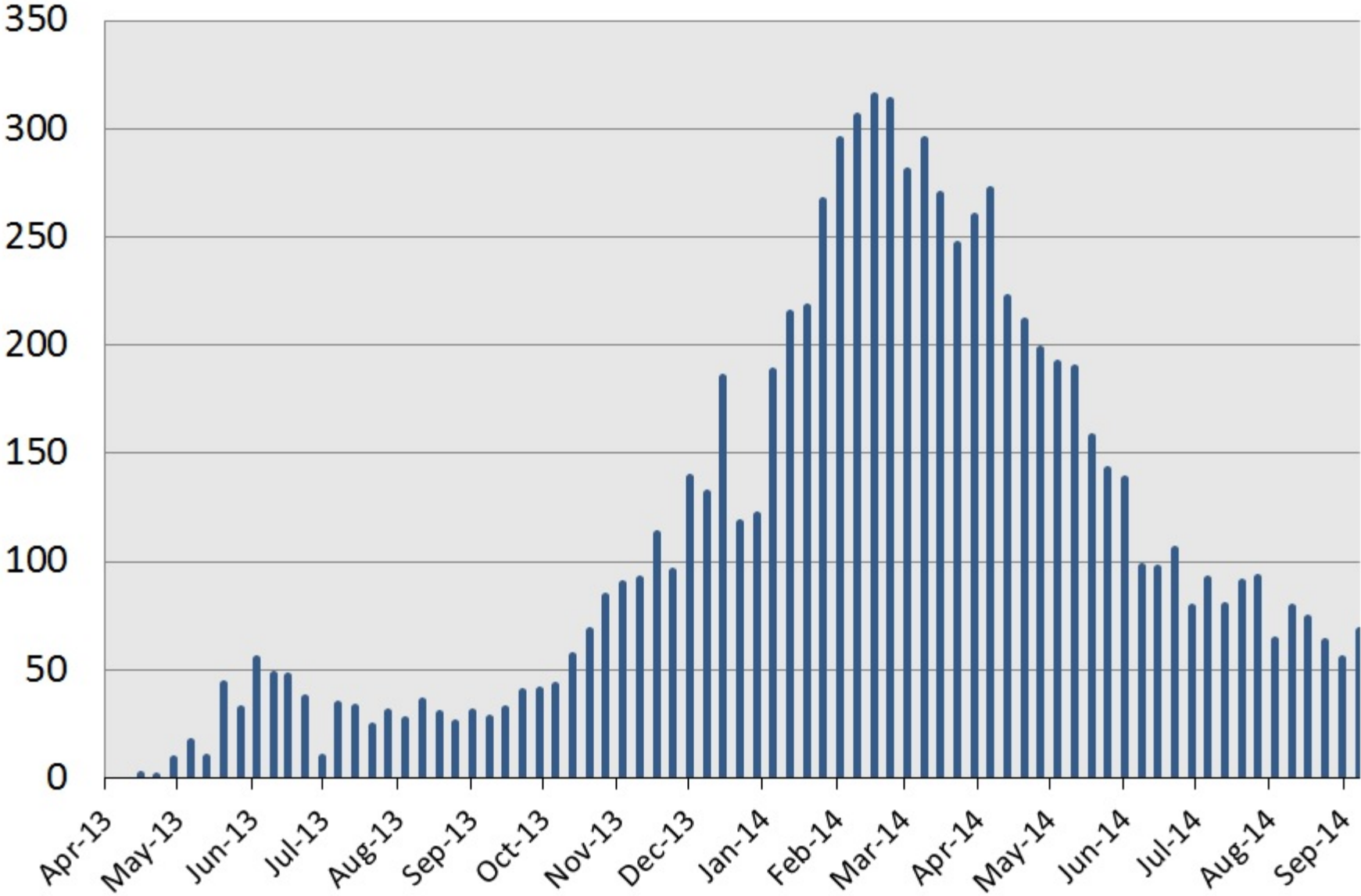
PEDV Positive Biological Accessions
 Created: September 17, 2014

Positive Accessions with No State Recorded: 91

Courtesy of NAHLN



New PEDv Case Reports by Week



PEDv Wasn't a Surprise

- Anecdotal reports from the region
- Published papers from researchers
- Researcher to researcher communications
- Reports to AASV Swine Health Committee
- BUT, what do we do with this information?



Preparing for the next emerging disease

There are known knowns. These are things we know that we know. There are known unknowns. That is to say, there are things that we know we don't know. But there are also unknown unknowns. There are things we don't know we don't know.

[Donald Rumsfeld](#) – U.S. Secretary of Defense



Baltimore classification group	Families affecting homeotherm vertebrates	Genera known to affect swine	Representative virus affecting swine	Exotic or endemic	Enveloped or non-enveloped	Resistance to physicochemical treatments
Group I (dsDNA) ¹	<i>Herpesviridae</i>	Varicellovirus	pseudorabies virus	Exotic ²	Enveloped	Medium
		unassigned	porcine cytomegalovirus	Endemic	Enveloped	Medium
	<i>Adenoviridae</i>	Mastadenovirus	swine adenovirus	Endemic	Enveloped	Medium
	<i>Asfarviridae</i>	Asfivirus	African swine fever virus	Exotic	Enveloped	Medium
	<i>Papillomaviridae</i>	Alphapapillomavirus	swine papillomavirus	Endemic	Non-enveloped	Very High
	<i>Polyomaviridae</i>		none known to be pathogenic	N/A	Non-enveloped	Very High
Group II (ssDNA) ³	<i>Poxviridae</i>	Suipoxvirus	swine pox	Endemic	Enveloped	Medium
	<i>Anelloviridae</i>	Alphatorquevirus	none known to be pathogenic	N/A	Non-enveloped	Very High
		Circovirus	porcine circovirus	Endemic	Non-enveloped	Very High
	<i>Parvoviridae</i>	Parvovirus	porcine parvovirus	Endemic	Non-enveloped	Very High
Bocaparvovirus		porcine bocavirus (?)	Endemic	Non-enveloped	Very High	
Group III (dsRNA) ⁴	<i>Birnaviridae</i>		none known to be pathogenic	N/A	Non-enveloped	Medium
	<i>Picobirnaviridae</i>		none known to be pathogenic	N/A	Non-enveloped	Medium
	<i>Reoviridae</i>	Rotavirus	porcine rotavirus	Endemic	Non-enveloped	Medium
Group IV (+ssRNA) ⁵	<i>Arteriviridae</i>	Arterivirus	porcine reproductive and respiratory syndrome virus	Endemic	Enveloped	Low
	<i>Astroviridae</i>	Mamastrovirus	swine astrovirus	Endemic	Non-enveloped	High
	<i>Caliciviridae</i>	Sapovirus	porcine sapovirus	Endemic	Non-enveloped	High
		Vesivirus	vesicular exanthema of swine virus	Exotic	Non-enveloped	High
	<i>Coronaviridae</i>	Alphacoronavirus	porcine epidemic diarrhea virus	Endemic	Enveloped	Low
		Alphacoronavirus	transmissible gastroenteritis	Endemic	Enveloped	Low
		Deltacoronavirus	porcine deltacoronavirus	Endemic	Enveloped	Low
		Torovirus	porcine torovirus	Endemic	Enveloped	Low
	<i>Hepeviridae</i>	Hepevirus	hepatitis e virus	Endemic	Non-enveloped	High
	<i>Picornaviridae</i>	Aphovirus	foot and mouth disease virus	Exotic	Non-enveloped	High
		Cardiovirus	encephalomyocarditis virus	Endemic	Non-enveloped	High
		Enterovirus	swine vesicular disease virus	Exotic	Non-enveloped	High
		Kobuvirus	porcine kobuvirus	Endemic	Non-enveloped	High
		Sapelovirus	porcine sapelovirus	Endemic	Non-enveloped	High
		Senecavirus	Seneca valley virus	Endemic	Non-enveloped	High
		Teschovirus	porcine teschovirus	Exotic	Non-enveloped	High
	<i>Flaviviridae</i>	Pestivirus	classical swine fever	Exotic	Enveloped	Low
Flavivirus		Japanese encephalitis	Exotic	Enveloped	Low	
<i>Togaviridae</i>	Alphavirus	Getah virus	Exotic	Enveloped	Low	
Group V (-ssRNA) ⁶	<i>Bornaviridae</i>		none known to be pathogenic	N/A	Enveloped	Low
	<i>Filoviridae</i>	Ebolavirus	none known to be pathogenic ?	N/A	Enveloped	Low
	<i>Paramyxoviridae</i>	Henipavirus	Nipah virus	Exotic	Enveloped	Low
		Respirovirus	Sendai virus	Endemic	Enveloped	Low
		Rubulavirus	porcine rubulavirus	Exotic	Enveloped	Low
			Menangle virus	Exotic	Enveloped	Low
	<i>Rhabdoviridae</i>	Vesiculovirus	vesicular stomatitis virus	Exotic	Enveloped	Low
		Lyssavirus	rabies	Endemic	Enveloped	Low
	<i>Arenaviridae</i>		none known to be pathogenic	N/A	Enveloped	Low
	<i>Bunyaviridae</i>		none known to be pathogenic	N/A	Enveloped	Low
	<i>Orthomyxoviridae</i>	Influenzavirus A	Influenza A virus	Endemic	Enveloped	Low
Influenzavirus C		Influenza C virus	Endemic	Enveloped	Low	
Group VI (ssRNA-RT) ⁷	<i>Retroviridae</i>		none known to be pathogenic	N/A	Enveloped	Low
Group VII (DNA-RT) ⁸	<i>Hepadnaviridae</i>		none known to be pathogenic	N/A	Enveloped	Low

Baltimore classification group	Families affecting homeotherm vertebrates	Genera known to affect swine	Representative virus affecting swine	AASV Average Score	AASV SHC Rank	NPB Rank
Group IV (+ssRNA) ⁵	<i>Picornaviridae</i>	Aphthovirus	foot and mouth disease virus	8.50	1.00	1
Group I (dsDNA) ¹	<i>Asfarviridae</i>	Asfivirus	African swine fever virus	8.50	1.00	3
Group V (-ssRNA) ⁶	<i>Orthomyxoviridae</i>	Influenzavirus A	Influenza A virus	7.33	2.00	5
Group IV (+ssRNA) ⁵	<i>Flaviviridae</i>	Pestivirus	classical swine fever	7.17	3.00	2
Group I (dsDNA) ¹	<i>Herpesviridae</i>	Varicellovirus	pseudorabies virus	6.67	4.00	7
Group IV (+ssRNA) ⁵	<i>Picornaviridae</i>	Enterovirus	swine vesicular disease virus	6.33	5.00	6
Group V (-ssRNA) ⁶	<i>Rhabdoviridae</i>	Vesiculovirus	vesicular stomatitis virus	6.17	6.00	8
Group IV (+ssRNA) ⁵	<i>Arteriviridae</i>	Arterivirus	porcine reproductive and respiratory syndrome virus	6.17	6.00	10
Group IV (+ssRNA) ⁵	<i>Flaviviridae</i>	Flavivirus	Japanese encephalitis	6.17	6.00	
Group V (-ssRNA) ⁶	<i>Paramyxoviridae</i>	Henipavirus	Nipah virus	5.83	7.00	
Group IV (+ssRNA) ⁵	<i>Caliciviridae</i>	Vesivirus	vesicular exanthema of swine virus	5.83	7.00	
Group IV (+ssRNA) ⁵	<i>Coronaviridae</i>	Alphacoronavirus	porcine epidemic diarrhea virus	5.83	7.00	
Group IV (+ssRNA) ⁵	<i>Picornaviridae</i>	Teschovirus	porcine teschovirus	5.00	8.00	4
Group V (-ssRNA) ⁶	<i>Paramyxoviridae</i>	Rubulavirus	porcine rubulavirus ("blue eye")	4.50	9.00	9
Group V (-ssRNA) ⁶	<i>Orthomyxoviridae</i>	Influenzavirus C	Influenza C virus	3.83	10.00	

Expert Working Group

- Patrick Webb - NPB
- Joe Connor - Practitioner
- Doug MacDougald – Practitioner (Canada)
- Kent Schwartz – ISU VDL
- Eric Bush – USDA Epidemiologist
- Dick Hesse – KSU Virologist
- Jane Christopher-Henning – SDSU VDL
- Mike McIntosh – USDA FADDL
- Dermott Hayes – Ag Economist
- Kurt Rossow – MN VDL
- John Waddell – AASV SHC Chair
- Harry Snelson – AASV
- Mark Engle – WG Chair (unable to attend)



Representative virus affecting swine	U.S. status	risk	zoonotic risk (none known or yes)	comment	Action items
pseudorabies virus -- hot Chinese strain	exotic	very high	none known	emerging strain, need to evaluate, 1)confirmation of anecdotal info, 2)vx challenge study, 3)develop dx and vx	1) lit search, 2) genbank search, 3) contacts in and working in China
porcine cytomegalovirus	present	low	none known		Lit search
swine adenovirus	present	low	none known		
African swine fever virus	exotic	high risk	none known		need surveillance program; update NAHLN PCR (ongoing currently)
swine papillomavirus	present	low impact does not cause severe disease	unknown		
none known to be pathogenic					
swine pox	present		none known	doesn't spread easily,	
none known to be pathogenic	present	low		possible co-factor, seem to potentiate PCV	
porcine circovirus	present			Chinese variant appears to be emerging, some anecdotal evidence that a new strain may be impacting vaccine.	If active in China it may move up the list

Resource Categories

1. Diagnostics
 - a. PCR
 - b. Serology
 - c. Oral fluids
 - d. Virus isolation
 - e. Preferred tissues
2. Epidemiology
 - a. Global distribution
 - b. Strain variability
 - c. Species affected
 - d. Control methods
3. Routes of transmission
4. Viral viability
 - a. Environmental survivability
 - i. Seasonality
 - ii. Temperatures
 - iii. Humidity
 - b. Disinfectants
 - c. Viral storage
5. Immunity
 - a. Post-exposure
 - b. Vaccines
 - c. Cross-protection
6. Pathogenesis
7. Global distribution



Next Steps

- Emerging disease surveillance/monitoring is critical on a global scale
- Assign a person or persons to monitor and report
- Literature search on each virus – Result would
 - Identify basic knowledge gaps
 - Focus resource deployment
- Develop a one pager on each
- Ongoing monitoring of news reports and scientific lit
- Establish “trip wires”
- Remove the barriers to discovery
- Work with USDA and SAHOs to determine roles and outcomes – data control, confidentiality, disease control measures



Key Points

- Focus on global production diseases (the “known knowns”)
- Establish a mechanism for evaluating disease implications and prioritizing threats
- Work towards recognizing and filling resource/knowledge gaps (the “known unknowns”)
- Establish a diagnostic/surveillance system that searches for the introduction of emerging diseases





*Let's not get caught
like this again!*

Questions?

