



Summary of Studies Supporting USDA Product Licensure

Establishment Name	Boehringer Ingelheim Animal Health USA Inc.
USDA Vet Biologics Establishment Number	124
Product Code	1995.21
True Name	West Nile Virus Vaccine, Killed Virus
Tradename(s) / Distributor or Subsidiary (if different from manufacturer)	Equi-Jec WNV - No distributor specified Vetera WNV - No distributor specified
Date of Compilation Summary	October 28, 2020

Disclaimer: Do not use the following studies to compare one product to another. Slight differences in study design and execution can render the comparisons meaningless.

Study Type	Efficacy									
Pertaining to	West Nile Virus (WNV)									
Study Purpose	Demonstration of twelve month duration of immunity against disease caused by WNV									
Product Administration	Two doses, administered intramuscularly, 25 days apart									
Study Animals	30 horses (20 vaccinates, 10 placebo controls) 4-5 months of age									
Challenge Description	West Nile Virus was administered at 380 days (10 vaccinated and 5 placebo control animals) or 408 days (10 vaccinated and 5 placebo control animals) post-final vaccination.									
Interval observed after challenge	Horses were observed twice daily for 14 days post-challenge and once daily for an additional 7 days post-challenge.									
Results	<p>An animal was considered affected by challenge if it developed neurological disease, as measured by mortality and microscopic evidence of virus-induced brain disease (histopathology).</p> <p>Animals were also monitored for viremia (detection of WNV in the blood).</p> <p>Results are summarized as follows:</p> <table border="1"> <thead> <tr> <th>Outcome</th> <th>Controls</th> <th>Vaccinates</th> </tr> </thead> <tbody> <tr> <td>Mortality</td> <td>7/10 (70%)</td> <td>1/20 (5%)</td> </tr> <tr> <td>Viremia at least one day</td> <td>10/10 (100%)</td> <td>2/20 (10%)</td> </tr> </tbody> </table> <p>See raw data on following pages.</p>	Outcome	Controls	Vaccinates	Mortality	7/10 (70%)	1/20 (5%)	Viremia at least one day	10/10 (100%)	2/20 (10%)
Outcome	Controls	Vaccinates								
Mortality	7/10 (70%)	1/20 (5%)								
Viremia at least one day	10/10 (100%)	2/20 (10%)								
USDA Approval Date	September 3, 2010									

Treatment	#	Died or Euthanized due to disease severity	Severity Histopathological lesions	
			Medulla	Pons
Controls (10 horses)	1	Yes	3	3
	2	Yes	3	3
	3	Yes	3	3
	4	Yes	3	3
	5	Yes	3	3
	6	Yes	2	2
	7	Yes	1	1
	8	No	1	1
	9	No	1	1
	10	No	1	0.5
Vaccinates (20 horses)	1	Yes	3	3
	2	No	2	0.5
	3	No	1	1
	4	No	1	0.5
	5	No	1	0.5
	6	No	1	0.5
	7	No	0.5	0.5
	8	No	0.5	0.5
	9	No	0.5	0
	10	No	0	0.5
	11	No	0	0
	12	No	0	0
	13	No	0	0
	14	No	0	0
15	No	0	0	
16	No	0	0	
17	No	0	0	
18	No	0	0	
19	No	0	0	
20	No	0	0	

Scoring of histopathological lesions:	
0 =	No significant lesions.
0.5 =	Rare, small, multifocal glial nodules scattered throughout the parenchyma.
1 =	Mild, nonsuppurative encephalitis characterized by mild multifocal perivascular cuffs with lymphocytes and plasma cells and a rare neutrophil and scattered multifocal glial nodules composed of glial cells with a few mononuclear inflammatory cells. Occasionally within this grade, there may be minimal perivascular cuffing and more moderate scattered glial nodules.
2 =	Moderate nonsuppurative encephalitis characterized by moderate lymphoplasmacytic perivascular cuffs around many vessels and multifocal accumulations of glial nodules scattered throughout the parenchyma.
3 =	Severe nonsuppurative encephalitis characterized by severe and thick lymphoplasmacytic perivascular cuffing with multiple scattered glial nodules throughout the parenchyma.

Viremia:		#	Days Post-challenge																					
			0		1		2		3		4		5		6		7	8	9	10	14	21		
			AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM								
Controls (10 horses)	1				15	25	10																	
	2					30	5	20														D	D	
	3				25	470	160	210	75	100												D	D	
	4			5	20	205	175	90	75	50												D	D	
	5			40	130	30	25	50	10													D	D	
	6				165	110	65	55	10													D	D	
	7				10	330	200	180	225	115	15											N	D	
	8					50	90	35	105	20	10													
	9				5	30	95	25	135	240	40	20												
	10						80	70	40	10														
Vaccinates (20 horses)	1																							
	2																							
	3																							
	4																							
	5																							
	6						95																	
	7																							
	8						40																	
	9																							
	10																							
11																								
12																								
13																								
14																								
15																								
16																								
17																								
18																								
19																								
20																								

Actual value in plaque-forming units per milliliter equivalents (PFUeg/mL) = Positive for virus isolation
 Blank = Negative for virus isolation (<5 PFUeg/mL)
 D = Dead
 N = Not recorded; horse was circling with sporadic head / neck tremors.

Study Type	Efficacy				
Pertaining to	West Nile Virus				
Study Purpose	Demonstration of efficacy against WNV				
Product Administration	Two doses, administered intramuscularly 21 days apart				
Study Animals	28 horses (19 vaccinates, 9 placebo controls) 4-5 months of age				
Challenge Description	West Nile Virus was administered intrathecally at 14 days (to 10 vaccinated and 5 placebo control animals) and 28 days (to 9 vaccinated and 4 placebo control animals) after the second vaccination				
Interval observed after challenge	Horses were bled on the day of challenge, twice daily for 6 days post-challenge, once daily for an additional 4 days post-challenge, and on day 14 post-challenge				
Results	<p>The primary outcome was viremia (detection of WNV in the blood). While the test method was quantitative, an animal was considered to be positive (affected by challenge) if any virus was detected in the blood on one or more occasions post-challenge.</p> <p>The number of animals positive for (affected by) viremia at least once is summarized as follows:</p> <table border="1"> <thead> <tr> <th>Controls</th> <th>Vaccinates</th> </tr> </thead> <tbody> <tr> <td>8/9 (89%)</td> <td>1/19 (5%)</td> </tr> </tbody> </table> <p>See raw data on the following page.</p>	Controls	Vaccinates	8/9 (89%)	1/19 (5%)
Controls	Vaccinates				
8/9 (89%)	1/19 (5%)				
USDA Approval Date	August 25, 2008				

Viremia:		Days Post-Challenge																		
		0		1		2		3		4		5		6		7	8	9	10	14
		Horse ID	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM				
Treatment	13	15	20	390	280	135		20												
	19		5		40			5	20	65	45									
	20		125	1475	645	355	495	120	15											
	45		20	85	235	140	235	145	80	15										
	67			165																
	71			110	675	110	70	120	70											
	72																			D
	74			5	60	30	15	20	15			10								
	79			10	15	20		15			10	5								
14																				
16																				
21																				
22																				
23																				
24																				
25																				
26																				
27																				
37																				
73																				
75																				
77																				
80																				
81																				
82																				
83																				
84																				
85				5		5		5												

Actual value in plaque-forming units per milliliter equivalents (PFUeq/mL) = Positive for virus isolation
Blank = Negative for virus isolation (<5 PFUeq/mL)
D = Dead (euthanized on Day 11 due to West Nile Virus)

Study Type	Efficacy												
Pertaining to	West Nile Virus (WNV)												
Study Purpose	Demonstration of six month duration of immunity against WNV												
Product Administration	Two doses, administered intramuscularly 21 days apart												
Study Animals	30 horses (20 vaccinates, 10 placebo controls) 4-5 months of age												
Challenge Description	Challenge by West Nile Virus was administered at 180 days (Challenge Group 1: 10 vaccinated and 5 placebo control animals) or 243 days (Challenge Group 2: 10 vaccinated and 5 placebo control animals) after second vaccination												
Interval observed after challenge	Horses were bled on the day of challenge, twice daily for 6 days post-challenge, once daily for an additional 4 days post-challenge, and on day 14 post-challenge												
Results	<p>The primary outcome was viremia (detection of WNV in the blood). While the test method was quantitative, an animal was considered to be positive (affected by challenge) if any virus was detected in the blood on one or more occasions post-challenge.</p> <p>The number of animals positive for viremia at least once (affected) is summarized as follows:</p> <table border="1"> <thead> <tr> <th>Challenge Group</th> <th>Controls</th> <th>Vaccinates</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>5/5 (100%)</td> <td>2/10 (20%)</td> </tr> <tr> <td>2</td> <td>5/5 (100%)</td> <td>4/10 (40%)</td> </tr> <tr> <td>Combined</td> <td>10/10 (100%)</td> <td>6/20 (30%)</td> </tr> </tbody> </table> <p>See raw data on the following page.</p>	Challenge Group	Controls	Vaccinates	1	5/5 (100%)	2/10 (20%)	2	5/5 (100%)	4/10 (40%)	Combined	10/10 (100%)	6/20 (30%)
Challenge Group	Controls	Vaccinates											
1	5/5 (100%)	2/10 (20%)											
2	5/5 (100%)	4/10 (40%)											
Combined	10/10 (100%)	6/20 (30%)											
USDA Approval Date	October 21, 2009												

Viremia:	Treatment	Horse ID	Days Post-challenge														Final Outcome								
			0		1		2		3		4		5		6			7	8	9	10	14			
			AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM									
Controls (5 horses) Challenge 1	S2				170	170	165	55	105	45															Positive
	S4				425	20	30	40	85	60	65														Positive
	S10				10	300	125	125	80	45															Positive
	S11					50	30	40	40	25															Positive
	S13					410	110	135	110	55	15														Positive
Vaccinates (10 horses) Challenge 1	S1																								Negative
	S3																								Negative
	S5																								Negative
	S6																								Negative
	S7				470		45	5																	Positive
	S8				15																				Positive
	S9																								Negative
	S12																								Negative
	S14																								Negative
	S15																								Negative
Controls (5 horses) Challenge 2	S50			5	535	500	80	100	50	10															Positive
	S53			20	320	380	100	135	45	10															Positive
	S54								5		5	5	5												Positive
	S55			10	95	70	30	25	40																Positive
	S59				90	265	20	70	45	45	5														Positive
Vaccinates (10 horses) Challenge 2	S46																								Negative
	S47								5																Positive
	S48																								Negative
	S49																								Positive
	S51				15																				Negative
	S52																								Negative
	S56																								Negative
	S57								5	5															Positive
	S58							5																	Positive
	S60																								Negative

Actual value in plaque-forming units per milliliter equivalents (PFU eq/mL) = Positive for virus isolation
Blank = Negative for virus isolation (<5 PFU eq/mL)
N = Not recorded
Positive = affected by challenge if virus was detected in the blood on one or more occasions post-challenge.
Negative = virus was detected in the blood on zero occasions post-challenge.

Study Type	Safety
Pertaining to	All fractions
Study Purpose	To demonstrate safety in pregnant mares under field conditions at two different test sites
Product Administration	Two intramuscular doses, given 16-28 days apart. 54 pregnant mares were injected with placebo and 325 pregnant mares were vaccinated with test product.
Study Animals	Three hundred seventy-nine pregnant mares at two locations were included in the study. The mares were confirmed to be pregnant by serum hormonal evaluation on the day of the first vaccination.
Challenge Description	Not applicable
Interval observed after vaccination	1 st and 2 nd trimester: Mares observed immediately after vaccination and daily for overall health and for abortion. Resulting foals were observed daily for 7 days following birth. 3 rd trimester: Mares observed immediately after vaccination and daily for overall health and for abortion. Resulting foals were observed daily for 30 days following birth.
Results	Results shown on next page

Results**Study 2013-PM-1009****North Dakota Site:**

Group	Vaccinated	Confirmed Pregnant	Foals	Parturition Rate
1 st trimester/ product	143	127	114	90%
1st trimester/ placebo	59	54	49	91%
2 nd trimester/ product	6	6	6	100%
3 rd trimester/ product	140	117	117	100%
Total – all animals	348	304	286	94%
Total – product only	289	250	237	95%
Total – placebo only	59	54	49	91%

Study 2013-PM-1009**Missouri Site:**

Group	Vaccinated	Confirmed Pregnant	Foals	Parturition Rate
2011 3 rd trimester	5	5	5	100%
2012 1 st trimester	1	1	1	100%
2012 2 nd trimester	53	43	39	91%
2012 3 rd trimester	26	26	25	96%
Total – product	85	75	70	93%

Study 2014-PM-1009**North Dakota Site:**

Group	Vaccinated	Confirmed Pregnant	Foaled	Parturition Rate	Foals Survived to End of Observation Period
2 nd trimester vaccinated	52	52	52	100%	51*
3 rd trimester vaccinated	69	69	67**	97.1%	67

*Lost foal affirmed by study cooperator to be due to causes other than vaccination.

**One mare died due to causes other than vaccination, as affirmed by study cooperator.

All other foals were normal and healthy

USDA Approval Date

September 12, 2014

Study Type	Safety																																												
Pertaining to	All fractions																																												
Study Purpose	To demonstrate safety under field conditions																																												
Product Administration	Two doses, administered intramuscularly 3 – 4 weeks apart																																												
Study Animals	556 horses, including 438 foals between 2 months and approximately 1 year of age																																												
Challenge Description	Not applicable																																												
Interval observed after challenge	Not applicable																																												
Results	<p>Horses were observed at least daily following each vaccination, until resolution of any observed reactions. Observations ended 14 days after the second vaccination.</p> <p>There were no systemic reactions observed at any of the sites. One horse died from causes affirmed by licensee not associated with vaccination.</p> <p>Scoring Method for Injection Site Reactions: 0 = No reaction 1 = Localized swelling at or near the injection site which is not visible; detectable only by palpation. Not painful. 2 = Localized visible swelling at or near the injection site. Not painful. 3 = Localized visible swelling at or near the injection site. Raised, circumscribed and painful when palpated.</p> <p>Local injection site reactions are summarized below across the sites:</p> <table border="1"> <thead> <tr> <th rowspan="2">Site</th> <th rowspan="2">Total Number Of Vaccinates</th> <th rowspan="2">Number Of Vaccinates Administered 2 doses</th> <th colspan="2">Vaccinates With Transient Injection Site Swelling</th> <th colspan="2">Number Of Normal Vaccinates</th> </tr> <tr> <th>After 1st dose</th> <th>After 2nd dose</th> <th>After 1st dose</th> <th>After 2nd dose</th> </tr> </thead> <tbody> <tr> <td>Missouri</td> <td>315</td> <td>314</td> <td>3 (1.0%)</td> <td>9 (2.9%)</td> <td>312 (99.0%)</td> <td>305 (97.1%)</td> </tr> <tr> <td>Oklahoma</td> <td>110</td> <td>110</td> <td>1 (0.9%)</td> <td>2 (1.8%)</td> <td>109 (99.1%)</td> <td>108 (98.2%)</td> </tr> <tr> <td>Texas</td> <td>131</td> <td>131</td> <td>0 (0%)</td> <td>0 (0%)</td> <td>131 (100%)</td> <td>131 (100%)</td> </tr> <tr> <td>Total</td> <td>556</td> <td>555</td> <td>4 (0.7%)</td> <td>11 (2.0%)</td> <td>552 (99.3%)</td> <td>544 (98.0%)</td> </tr> </tbody> </table> <p>Results from each site are summarized on the following page.</p>						Site	Total Number Of Vaccinates	Number Of Vaccinates Administered 2 doses	Vaccinates With Transient Injection Site Swelling		Number Of Normal Vaccinates		After 1 st dose	After 2 nd dose	After 1 st dose	After 2 nd dose	Missouri	315	314	3 (1.0%)	9 (2.9%)	312 (99.0%)	305 (97.1%)	Oklahoma	110	110	1 (0.9%)	2 (1.8%)	109 (99.1%)	108 (98.2%)	Texas	131	131	0 (0%)	0 (0%)	131 (100%)	131 (100%)	Total	556	555	4 (0.7%)	11 (2.0%)	552 (99.3%)	544 (98.0%)
Site	Total Number Of Vaccinates	Number Of Vaccinates Administered 2 doses	Vaccinates With Transient Injection Site Swelling		Number Of Normal Vaccinates																																								
			After 1 st dose	After 2 nd dose	After 1 st dose	After 2 nd dose																																							
Missouri	315	314	3 (1.0%)	9 (2.9%)	312 (99.0%)	305 (97.1%)																																							
Oklahoma	110	110	1 (0.9%)	2 (1.8%)	109 (99.1%)	108 (98.2%)																																							
Texas	131	131	0 (0%)	0 (0%)	131 (100%)	131 (100%)																																							
Total	556	555	4 (0.7%)	11 (2.0%)	552 (99.3%)	544 (98.0%)																																							

Missouri Site:

Summary	Number Of Vaccinates	Number Of Vaccinates Administered 2 doses	Vaccinates With Transient Injection Site Swelling		Number Of Normal Vaccinates	
			After 1 st dose	After 2 nd dose	After 1 st dose	After 2 nd dose
Age						
2-4 months	55	55	0	0	55	55
5-7 months	8	8	0	0	8	8
8-11 months	1	1	0	0	1	1
1 year	170	170	1	2	169	168
≥ 2 years	81	80	2	7	79	73
Total	315	314	3	9	312	305

Horse No.	Age	Reaction Description	Injection #	Day	Score	Resolution Day
10	11 y	Swelling on day 3, 5.5 cm x 2.25 cm x 5mm	2	3	2	7
22	8 y	Swelling on day 3, 12 cm circle, raised 1.5 cm, painful,	2	3	3	7
129	1 y	Swelling on day 3, 2.3 cm circle, raised 4 mm, painful but no heat	2	3	3	7
183	1 y	Swelling on day 7, raised lesion 1.5 cm circle, height 0.2 cm	1	7	2	14
183	1 y	Swelling on day 1, 3 cm lesion, not raised but palpable	2	1	1	3
222	9 y	Swelling on day 3, 6 cm x 7 cm x 1.2 cm, raised lesion hard and painful	2	3	3	7
266	10 y	Swelling localized in several places unsure if related to vaccine	1	1	2	3
266	10 y	Swelling small palpable mass ~ 2 cm size, still present day 3 no worse	2	1	2	3
271	13 y	Swelling 5cm circle, raised 5 mm, solid and painful	2	3	3	7
288	8 y	Swelling < 2 cm, raised lesion ~ 1 mm deep	1	3	2	7
288	8 y	Swelling ~ 8.5 cm circle raised ~ 1.3 cm, painful, not hot to touch	2	3	3	7
300	10 y	Swelling 6 cm circle, solid swelling not painful	2	3	2	7

Oklahoma Site:

Summary	Number Of Vaccinates	Number Of Vaccinates Administered 2 doses	Vaccinates With Transient Injection Site Swelling		Number Of Normal Vaccinates	
			After 1 st dose	After 2 nd dose	After 1 st dose	After 2 nd dose
Age						
4-6 months	49	49	1	1	48	48
1 year	25	25	0	1	25	24
≥ 2 years	36	36	0	0	36	36
Total	110	110	1	2	109	108

Horse No.	Age	Reaction Description	Injection #	Day	Score	Resolution Day
19-A	4 m	Swelling redness painful injection area 6 cm in diameter, reaction subsided in 10 days	1	7	3	17
33-A	5 m	Small swelling, 3 cm diameter, subsided in 3 days	2	1	2	4
43	1 y	Mid-sized swelling, 5 cm diameter, reduced to 2.5 cm in 6 days; small, hard 2 cm at 10 days, probable subcutaneous leakage	2	1	2	Study End

Texas Site:

Summary	Number Of Vaccinates	Number Of Vaccinates Administered 2 doses	Vaccinates With Transient Injection Site Swelling		Number Of Normal Vaccinates	
			After 1 st dose	After 2 nd dose	After 1 st dose	After 2 nd dose
7-9 months	130	130	0	0	130	130
≥ 2 years	1	1	0	0	1	1
Total	131	131	0	0	131	131

USDA Approval Date

September 14, 2009