Summary of Studies Supporting USDA Product Licensure

Establishment Name	Intervet Inc.
USDA Vet Biologics Establishment Number	165A
Product Code	1861.01
True Name	Mannheimia Haemolytica-Pasteurella Multocida Vaccine, Avirulent Live Culture
Tradename(s) / Distributor or Subsidiary (if different from manufacturer)	Bovilis Once PMH SQ - Intervet Mexico S.A. de C.V. Bovilis Once PMH SQ - Intervet Mexico S.A. de C.V. - Merck Sharpe and Dohme (MSD) Bovilis Once PMH SQ - No distributor specified Once PMH SQ - Intervet Mexico S.A. de C.V. Once PMH SQ - Merck Animal Health Once PMH SQ - No distributor specified
Date of Compilation Summary	September 30, 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.

<table>
<tr><td>Study Type</td><td>Efficacy</td></tr>
<tr><td>Pertaining to</td><td>Mannheimia haemolytica</td></tr>
<tr><td>Study Purpose</td><td>To demonstrate efficacy against M. haemolytica 16 weeks after vaccination.</td></tr>
<tr><td>Product Administration</td><td>1 dose administered by the subcutaneous route</td></tr>
<tr><td>Study Animals</td><td>34, 5-month-old calves; 17 controls (placebo), 17 vaccinates</td></tr>
<tr><td>Challenge Description</td><td>All calves were challenged with M. haemolytica 113 days after vaccination.</td></tr>
<tr><td>Interval observed after challenge</td><td>All calves were monitored daily for 7 days post-challenge for clinical signs of respiratory disease then tissues were examined.</td></tr>
<tr><td>Results</td><td><u>Lung Lesions</u>:
The percent of the affected lung tissue was determined, and a lung lesion score was calculated for each animal.
<table>
<tr><th>Group</th><th>Minimum</th><th>Q1</th><th>Median</th><th>Q3</th><th>Maximum</th></tr>
<tr><td>Placebo</td><td>0</td><td>1</td><td>2</td><td>8</td><td>44</td></tr>
<tr><td>Vaccinates</td><td>0</td><td>0</td><td>0</td><td>1</td><td>19</td></tr>
</table>
Raw data shown on attached page.</td></tr>
<tr><td>USDA Approval Date</td><td>July 15, 2014</td></tr>
</table>

Table 1: Lung Lesion Scores

Calf ID	Treatment Group	Lung Lesion Score - 1	Lung Lesion Score - 2
569	Placebo	20.66	20.11
570	Placebo	1.44	2.33
571	Placebo	1.79	1.40
573	Placebo	7.61	7.62
576	Placebo	19.43	18.27
578	Placebo	1.69	2.48
579	Placebo	1.31	0.90
582	Placebo	3.97	4.11
585	Placebo	0.08	0.08
587	Placebo	9.16	5.82
588	Placebo	0.53	0.38
589	Placebo	0.25	0.24
594	Placebo	5.07	7.97
595	Placebo	18.17	20.57
596	Placebo	44.35	43.11
598	Placebo	1.08	0.47
600	Placebo	0.44	0.03
568	Vaccinate	0.50	0.55
572	Vaccinate	0.82	1.32
574	Vaccinate	19.71	18.91
575	Vaccinate	0.00	0.00
577	Vaccinate	0.00	0.00
580	Vaccinate	0.22	0.40
581	Vaccinate	0.16	0.00
583	Vaccinate	0.08	0.06
584	Vaccinate	0.62	2.60
586	Vaccinate	0.00	0.11
590	Vaccinate	0.00	0.00
591	Vaccinate	0.61	1.20
592	Vaccinate	0.82	2.12
593	Vaccinate	0.00	0.00
597	Vaccinate	0.00	0.43
599	Vaccinate	8.80	10.02
601	Vaccinate	0.17	0.00

Study Type	Efficacy
Pertaining to	*Mannheimia haemolytica*
Study Purpose	To demonstrate effectiveness against respiratory disease caused by *M. haemolytica*
Product Administration	Subcutaneous
Study Animals	Bovine
Challenge Description	
Interval observed after challenge	
Results	Study data were evaluated by USDA-APHIS prior to product licensure and met regulatory standards for acceptance at the time of submission. No data are published because this study was submitted to USDA-APHIS prior to January 1, 2007, and APHIS only requires publication of data submitted after that date.
USDA Approval Date	March 17, 2004

<table>
<tr><td>Study Type</td><td>Efficacy</td></tr>
<tr><td>Pertaining to</td><td>Pasteurella multocida</td></tr>
<tr><td>Study Purpose</td><td>To demonstrate efficacy against P. multocida 16 weeks after vaccination.</td></tr>
<tr><td>Product Administration</td><td>1 dose administered by the subcutaneous route</td></tr>
<tr><td>Study Animals</td><td>30, 3-month-old calves; 15 controls, 15 vaccinates</td></tr>
<tr><td>Challenge Description</td><td>All calves were challenged with P. multocida 113 days after vaccination.</td></tr>
<tr><td>Interval observed after challenge</td><td>All calves were monitored daily for 7 days post-challenge for respiratory disease. Lungs were evaluated 7 days following challenge.</td></tr>
<tr><td>Results</td><td><u>Lung Lesions</u>:
The percent of the lung tissue that was abnormal was determined, and a lung lesion score was calculated for each animal.
<table>
<tr><th>Group</th><th>N</th><th>Min</th><th>Q1</th><th>Median</th><th>Q3</th><th>Max</th></tr>
<tr><td>Vaccinates</td><td>15</td><td>0.000</td><td>0.000</td><td>0.682</td><td>1.900</td><td>8.754</td></tr>
<tr><td>Control</td><td>15</td><td>0.000</td><td>2.765</td><td>3.887</td><td>11.522</td><td>32.211</td></tr>
</table>
Raw data shown on attached page.</td></tr>
<tr><td>USDA Approval Date</td><td>July 15, 2014</td></tr>
</table>

Table 1: Lung Lesion Scores

Calf ID	Treatment Group	Lung Lesion Score - 1	Lung Lesion Score - 2
132	Control	19.63	19.24
134	Control	3.35	3.15
135	Control	17.11	12.87
137	Control	0.00	0.00
140	Control	2.52	3.46
143	Control	0.00	0.00
148	Control	1.91	3.17
149	Control	2.08	2.41
150	Control	5.14	5.23
151	Control	18.74	16.02
152	Control	4.22	4.31
154	Control	7.45	8.66
155	Control	4.02	3.62
157	Control	3.53	4.24
161	Control	34.66	29.76
133	Vaccinate	0.51	0.86
136	Vaccinate	10.17	7.34
138	Vaccinate	0.00	0.00
139	Vaccinate	0.00	0.00
141	Vaccinate	0.00	0.29
142	Vaccinate	0.00	0.00
144	Vaccinate	7.44	7.33
145	Vaccinate	3.96	3.25
146	Vaccinate	0.31	0.51
147	Vaccinate	1.56	2.22
153	Vaccinate	0.00	0.00
156	Vaccinate	1.95	1.87
158	Vaccinate	0.96	0.94
159	Vaccinate	1.25	1.25
160	Vaccinate	0.00	0.00

Study Type	Efficacy
Pertaining to	*Pasteurella multocida*
Study Purpose	To demonstrate effectiveness against respiratory disease caused by *P. multocida*
Product Administration	Subcutaneous
Study Animals	Bovine
Challenge Description	
Interval observed after challenge	
Results	Study data were evaluated by USDA-APHIS prior to product licensure and met regulatory standards for acceptance at the time of submission. No data are published because this study was submitted to USDA-APHIS prior to January 1, 2007, and APHIS only requires publication of data submitted after that date.
USDA Approval Date	March 17, 2004

Study Type	Safety
Pertaining to	ALL
Study Purpose	To demonstrate safety under field conditions.
Product Administration	Subcutaneous
Study Animals	Bovine
Challenge Description	
Interval observed after challenge	
Results	Study data were evaluated by USDA-APHIS prior to product licensure and met regulatory standards for acceptance at the time of submission. No data are published because this study was submitted to USDA-APHIS prior to January 1, 2007, and APHIS only requires publication of data submitted after that date.
USDA Approval Date	May 31, 2005