Summary of Studies Supporting USDA Product Licensure

Establishment Name	Ceva Animal Health, LLC
USDA Vet Biologics Establishment Number	368
Product Code	16N1.R0
True Name	Marek's Disease-Newcastle Disease Vaccine, Serotype 3, Live Marek's Disease Vector
Tradename(s) / Distributor or Subsidiary (if different from manufacturer)	Biomune Company VECTORMUNE HVT NDV - Biomune Company VECTORMUNE HVT NDV - CEVA Animal Health (Pty) Ltd - Biomune Company VECTORMUNE HVT NDV - Ceva Polchem Pvt. LTD. (India) VECTORMUNE HVT NDV - No distributor specified
Date of Compilation Summary	February 05, 2021

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>Marek’s Disease Virus (MDV)</td></tr>
<tr><td>Study Purpose</td><td>To demonstrate effectiveness against virulent Marek’s Disease Virus</td></tr>
<tr><td>Product Administration</td><td>Subcutaneous (SQ) and in ovo</td></tr>
<tr><td>Study Animals</td><td>1. 35 SPF chicken embryos vaccinated at 18 days of incubation with product (in ovo vaccinate)
2. 35 SPF chickens vaccinated at day of age with product (SQ vaccinate)
3. 35 SPF chickens non-vaccinated and challenged (positive control)
4. 25 SPF chickens non-vaccinated and non-challenged (negative control)</td></tr>
<tr><td>Challenge Description</td><td>Marek’s Disease Virus GA strain at five days of age for all groups except the negative control group</td></tr>
<tr><td>Interval observed after challenge</td><td>Daily observation for 51 days post challenge; Tissues examined at 51 days post challenge.</td></tr>
<tr><td>Results</td><td>A chicken was considered affected by the challenge (positive) if grossly observable lesions caused by the MDV GA challenge were present.

<table>
<tr><th>Treatment Group</th><th>Number Affected</th><th>Percentage Affected</th></tr>
<tr><td>In ovo vaccination</td><td>6/35</td><td>17%</td></tr>
<tr><td>SQ vaccination</td><td>3/35</td><td>9%</td></tr>
<tr><td>Negative Controls</td><td>0/25</td><td>0%</td></tr>
<tr><td>Positive Controls</td><td>34/35</td><td>97%</td></tr>
</table>

The study fulfilled 9 CFR 113.330(c).

Raw data are shown on the attached page.</td></tr>
<tr><td>USDA Approval Date</td><td>January 31, 2007</td></tr>
</table>

In ovo Vaccinate ID	MDV Lesions[1]	SQ Vaccinate ID	MDV Lesions[1]	Positive Control ID	MDV Lesions[1]	Negative Control ID	MDV Lesions[1]
1	NA	1	K, Sp, L, H, G, N	1	Sp, L, H	1	NA
2	Sp, L, H	2	NA	2	K, Sp, H	2	NA
3	N	3	NA	3	K, Sp, H, G	3	NA
4	K, Sp, L, H, G	4	NA	4	K, Sp, G	4	NA
5	NA	5	NA	5	Sp	5	NA
6	NA	6	NA	6	Sp, L	6	NA
7	NA	7	NA	7	Sp, L, H	7	NA
8	NA	8	NA	8	Sp, H	8	NA
9	NA	9	NA	9	K, Sp, L, H	9	NA
10	NA	10	NA	10	Sp, L	10	NA
11	NA	11	NA	11	H	11	NA
12	K, Sp, L, H	12	NA	12	Sp, L, H	12	NA
13	NA	13	NA	13	Sp, L, H	13	NA
14	NA	14	NA	14	H	14	NA
15	NA	15	NA	15	Sp, L	15	NA
16	NA	16	NA	16	Sp, L, H	16	NA
17	NA	17	NA	17	Sp, H	17	NA
18	NA	18	NA	18	Sp, L, H	18	NA
19	NA	19	K, G	19	K, L, H, G	19	NA
20	NA	20	NA	20	N	20	NA
21	NA	21	NA	21	H	21	NA
22	NA	22	NA	22	Sp, L, H	22	NA
23	NA	23	NA	23	K, H, G, N	23	NA
24	NA	24	NA	24	Sp, H	24	NA
25	NA	25	NA	25	Sp	25	NA
26	NA	26	NA	26	Sp, L, H		
27	NA	27	NA	27	Sp, L, H		
28	L	28	NA	28	NA		
29	NA	29	G	29	Sp, H		
30	NA	30	NA	30	Sp, L, H, G		
31	NA	31	NA	31	Sp, H		
32	NA	32	NA	32	K, Sp, L, H		
33	NA	33	NA	33	H		
34	NA	34	NA	34	K, Sp, H, N		
35	Sp	35	NA	35	Sp, H		

[1]Tissue with lesion: K=kidney, Sp=spleen, L=liver, H=heart, G=gonad, N=nerves, Sk=skin, E=eye, M=muscle, NA=not applicable (no lesions)

<table>
<tr><td>Study Type</td><td>Efficacy</td></tr>
<tr><td>Pertaining to</td><td>Newcastle Disease Virus (NDV)</td></tr>
<tr><td>Study Purpose</td><td>To demonstrate effectiveness against NDV</td></tr>
<tr><td>Product Administration</td><td>One dose administered via the subcutaneous route</td></tr>
<tr><td>Study Animals</td><td>SPF chickens; 29 vaccinates vaccinated at day of age; 31 non-vaccinated, challenged positive controls; 10 non-vaccinated, non-challenged negative controls</td></tr>
<tr><td>Challenge Description</td><td>NDV Texas GB Standard strain at four weeks of age</td></tr>
<tr><td>Interval observed after challenge</td><td>Daily observation for 14 days post challenge</td></tr>
<tr><td>Results</td><td>A chicken was considered affected by the challenge (positive) if clinical signs of Newcastle disease were present. The clinical signs included:

1. Respiratory signs: Increased respiration, nasal exudate, and swelling of eyes and head
2. Neurological signs: Tremors, loss of coordination, and paralysis
3. Viscerotropic signs: Listlessness, weakness, diarrhea, and prostration

<table>
<tr><th>Treatment Group</th><th>Number Affected</th><th>Percentage Affected</th></tr>
<tr><td>SQ Vaccinates</td><td>0/29</td><td>0%</td></tr>
<tr><td>NDV challenged, positive controls</td><td>31/31</td><td>100%</td></tr>
<tr><td>Negative Controls</td><td>0/10</td><td>0%</td></tr>
</table>

The study fulfilled 9CFR 113.329(c).

Raw data are shown on the attached page.</td></tr>
<tr><td>USDA Approval Date</td><td>May 20, 2003</td></tr>
</table>

Vaccinate ID	Clinical Signs of Newcastle Disease	Positive Control ID	Clinical Signs of Newcastle Disease	Negative Control ID	Clinical Signs of Newcastle Disease
1	Neg	1	Pos	1	Neg
2	Neg	2	Pos	2	Neg
3	Neg	3	Pos	3	Neg
4	Neg	4	Pos	4	Neg
5	Neg	5	Pos	5	Neg
6	Neg	6	Pos	6	Neg
7	Neg	7	Pos	7	Neg
8	Neg	8	Pos	8	Neg
9	Neg	9	Pos	9	Neg
10	Neg	10	Pos	10	Neg
11	Neg	11	Pos		
12	Neg	12	Pos		
13	Neg	13	Pos		
14	Neg	14	Pos		
15	Neg	15	Pos		
16	Neg	16	Pos		
17	Neg	17	Pos		
18	Neg	18	Pos		
19	Neg	19	Pos		
20	Neg	20	Pos		
21	Neg	21	Pos		
22	Neg	22	Pos		
23	Neg	23	Pos		
24	Neg	24	Pos		
25	Neg	25	Pos		
26	Neg	26	Pos		
27	Neg	27	Pos		
28	Neg	28	Pos		
29	Neg	29	Pos		
		30	Pos		
		31	Pos		

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<tr><td>Study Type</td><td>Efficacy</td></tr>
<tr><td>Pertaining to</td><td>Newcastle Disease Virus (NDV)</td></tr>
<tr><td>Study Purpose</td><td>To demonstrate effectiveness against NDV</td></tr>
<tr><td>Product Administration</td><td>One dose administered via the in ovo route</td></tr>
<tr><td>Study Animals</td><td>SPF chickens; 36 vaccinates vaccinated at 18 day embryonation; 31 non-vaccinated, challenged positive controls: 10 non-vaccinated, non-challenged negative controls</td></tr>
<tr><td>Challenge Description</td><td>NDV Texas GB Standard strain at four weeks of age</td></tr>
<tr><td>Interval observed after challenge</td><td>Daily observation for 14 days post challenge</td></tr>
<tr><td>Results</td><td>A chicken was considered affected by the challenge (positive) if clinical signs of Newcastle disease were present. The clinical signs included:

1. Respiratory signs: Increased respiration, nasal exudate, and swelling of eyes and head
2. Neurological signs: Tremors, loss of coordination, and paralysis
3. Viscerotropic signs: Listlessness, weakness, diarrhea, and prostration

<table>
<tr><th>Treatment Group</th><th>Number Affected</th><th>Percentage Affected</th></tr>
<tr><td>In ovo vaccinates</td><td>3/36</td><td>8%</td></tr>
<tr><td>NDV challenged, positive controls</td><td>31/31</td><td>100%</td></tr>
<tr><td>Negative Controls</td><td>0/10</td><td>0%</td></tr>
</table>

The study fulfilled 9CFR 113.329(c)

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</table>

Vaccinate ID	Clinical Signs of Newcastle Disease	Positive Control ID	Clinical Signs of Newcastle Disease	Negative Control ID	Clinical Signs of Newcastle Disease
1	Pos	1	Pos	1	Neg
2	Pos	2	Pos	2	Neg
3	Pos	3	Pos	3	Neg
4	Neg	4	Pos	4	Neg
5	Neg	5	Pos	5	Neg
6	Neg	6	Pos	6	Neg
7	Neg	7	Pos	7	Neg
8	Neg	8	Pos	8	Neg
9	Neg	9	Pos	9	Neg
10	Neg	10	Pos	10	Neg
11	Neg	11	Pos		
12	Neg	12	Pos		
13	Neg	13	Pos		
14	Neg	14	Pos		
15	Neg	15	Pos		
16	Neg	16	Pos		
17	Neg	17	Pos		
18	Neg	18	Pos		
19	Neg	19	Pos		
20	Neg	20	Pos		
21	Neg	21	Pos		
22	Neg	22	Pos		
23	Neg	23	Pos		
24	Neg	24	Pos		
25	Neg	25	Pos		
26	Neg	26	Pos		
27	Neg	27	Pos		
28	Neg	28	Pos		
29	Neg	29	Pos		
30	Neg	30	Pos		
31	Neg	31	Pos		
32	Neg				
33	Neg				
34	Neg				
35	Neg				
36	Neg				

Study Type	Safety
Pertaining to	ALL
Study Purpose	Demonstrate safety under typical use conditions
Product Administration	Subcutaneous and *in ovo* route
Study Animals	Chickens at day of age and chicken embryos at 18-19 days of embryonation
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	February 12, 2007