

Summary of Studies Supporting USDA Product Licensure

Establishment Name	Intervet Inc.
USDA Vet Biologics Establishment Number	165A
Product Code	1071.20
True Name	Bovine Rhinotracheitis-Parainfluenza 3-Respiratory Syncytial Virus Vaccine, Modified Live Virus
Tradename(s) / Distributor or Subsidiary (if different from manufacturer)	Bovilis Nasalgen 3 - Merck Animal Health Bovilis Nasalgen 3 - No distributor specified
Date of Compilation Summary	April 13, 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	Infectious bovine rhinotracheitis (IBR)
Study Purpose	Demonstrate Duration of Immunity (effectiveness) of the
	infectious bovine rhinotracheitis (IBR) fraction against respiratory
	disease caused by IBR
Product Administration	One dose administered intranasally
Study Animals	Forty-six colostrum deprived calves, less than 1 week of age,
	divided into two groups: 21 vaccinates and 20 controls
Challenge Description	Challenged intranasally with virulent Cooper strain of IBR 195
	days after vaccination
Interval observed after challenge	Calves observed daily for 16 days after challenge
Results	Animals were considered affected by the challenge if they moderate to severe (severity score of 2) clinical signs (nasal or ocular discharge, nasal lesions, dyspnea, depression, anorexia, and/or cough) on any day during the post-challenge period, or a rectal temperature $\geq 104.0^{\circ}$ F for two or more consecutive days post-challenge. Nasal virus shedding was evaluated.
	For fever, an affected calf was one with a rectal temperature $\geq 104.0^{\circ}$ F for two or more consecutive post-challenge days.
	Totals: Affected: 9/21 vaccinates with IBR Morbidity 20/20 controls with IBR Morbidity
	Fever:
	9/21 vaccinates
	20/20 controls
	Duration of Nasal Shedding
	TreatmentMin.1st Qu.Median3rd Qu.MaxControl667810
	Vaccinate 8 9 10 10 12
	Raw data: See attached.
USDA Approval Date	September 9, 2019

TABLE 1:	Clinical	Observations
-----------------	----------	---------------------

	i I												•									Duration
Group	Calf ID	-1	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Affected ¹	Duration ¹	w/Fever ²
	2	0	0	0	0	0	0	N1,L1,R1	N2,L1,R1	N2,L1,R2	N2,L1,R1	N2,L1,R1	L2	0	0	0	0	0	0	Yes	5	8
	4	0	0	0	0	0	0	N1,R1	N1,L1	N2,L2,R2	N1,L1	N1,L2	N1	0	0	0	0	0	0	Yes	3	6
	7	0	0	0	0	0	0	N2,L2,R1	N2,L2,R1	N2,L2,R2	N2,L2,R2	N2,L2,R2	N2,L2,R2	N2,L2,R1	L2	N2,L2	L2	L2	0	Yes	11	12
	9	01	0	0	0	0	0	N1,L1,R1	N2,L1,R2	N2,01,L1,R2	N2,01,L2,R2	N2,L2,R2	N2,L2,R2	N2,L2,R1	N2,L2,R1	N2,L2	L2	L2	0	Yes	10	13
	10	0	0	0	0	0	0	N1	L1	N2,L1	N2,L1	N2,L2	N2,L2	N2,L2	N1,L2	L2	L2	0	0	Yes	8	12
	12	0	0	0	0	01	0	N1,R1 0	N1,L1 L1	N1,L1,R1 N1,L1	N2,L1,R1 N2,L2,R2	0 N1.L1	0	0	0	0	0	0	0	Yes	1	7
	13 17	0	0	ŏ	0	ő	0	N2,L1,R1	N2.L2.R1	N2.L1.R1	N2,L2,N2 N2,L1,R2	N2,L2,R2	N2.L1	N2	0	ő	0	ŏ	ő	Yes Yes	1	6 8
S	19	ŏ	ő	ŏ	ŏ	ő	ŏ	NZ,LI,RI N1	N2,L2,R1	N1,L1	N2,L1,R2	0	0	0	ő	ŏ	ŏ	ŏ	ŏ	Yes	3	5
Controls	20	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	N1,L1	N1.L1	N2.L2.R1	N2.L2.R2	N2.L2.R2	L2	Ľ2	ŏ	ŏ	ŏ	ŏ	ŏ	Yes	5	9
Ę	21	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	N2.R1	N2.L2.R1	N2.L2.R2	N2.01.L1.R2	N2.02.L2.R2	N2.02.R2		ŏ	Ň1	ŏ	ŏ	ŏ	Yes	7	10
8	27	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	N2,L1,R1	N2,L1,R1	N2,L2,R2	N2.L1.R2	N2 L2 R2	N2 L2 R2	0	Ľ2	L2	ŏ	ŏ	ŏ	Yes	9	11
Ŭ	28	0	0	0	0	0	0	N2.L2.R1	N2.L1	N2.L2.R2	N2.L2.R2	N2 L2 R2	Ó	0	0	0	0	0	0	Yes	5	7
	32	0	0	0	0	0	0	0	N2,D1,R1	N2,L1,R2	N2,L2,R2	0	0	0	0	0	0	0	0	Yes	3	6
	37	0	0	0	0	0	0	N2,L2,R1	N2,L2,R1	N2,L2,R2	N2,L2,R2	N2,L2,R2	L2	L2	0	L2	0	0	0	Yes	9	10
	38	0	0	0	0	0	0	N2,L1,R1	N2,L1,R1	N2,L1,R2	N2,L1,R2	N2,L1,R2	N1,01,R1	N1	0	0	0	0	0	Yes	5	7
	39	0	0	0	0	0	N1	0	N2,L1	N2,L2,R2	N2,L2,R2	N2,L2,R2	N2,L2	N2,L2	N1,L2		N2,L2		0	Yes	9	11
	42	0	0	0	0	0	0	N1	N1	N1,L1,R2	N1	N2,L1,R2	N1	N1	0	0	0	0	0	Yes	3	9
	45 46	0	0	0	0	0	0	L1 0	N1,D1 N2,L1,R2	L1 N2.L2.D1.R2	N1,L1 N2,L2,D1,R2	N2,R1 N2.01.D1.R2	N1 N2 L2 R2	0 N2.L2.R2	0 N2.R2	0 N2.L2.R2	0	0	0	Yes Yes	1	6 11
	40						0		MZ,LI,NZ	N2,L2,01,N2	M2,L2,01,N2	N2,01,01,N2	112,12,112	MZ,LZ,IVZ	112,112	112,L2,IV	112			168	3	
	1	0	0	0	0	0	0	N1,L1	N1,L1	N1,L1	N2,L2,R2	N1,L1,R1	0	0	0	0	0	0	0	Yes	1	4
	3	0	0	0	0	0	0	N1	0	0	N1	N2,L2,R1	0	0	0	0	0	0	0	Yes	1	7
	5	0	0	0	0	0	0	N1,R1	L1	0	N2,L1,R1	N1,L1	0	0	0	0	0	0	0	Yes	1	5
	6	0	0	0	0	0	0	R1	N1	0	0	N1 0	0	0	0	0	0	0	0	No	0	0
	8	0	0	0	0	0	0	0	0	01	0 N1	0	0	0	0	0	0	0	0	No No	0	0
	14	ő	ő	ŏ	ŏ	ő	0	0	ő	N1,L1	0	ő	ő	ő	8	ő	ő	ŏ	ő	No	ő	ő
	15	ŏ	ŏ	ŏ	ő	ŏ	ŏ	N1	N2,L1	0	ŏ	Ň	ő	ŏ	ő	ŏ	ŏ	ŏ	ŏ	Yes	1	10
Se	16	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	N1.R1	N1	N1	N1	0	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	No	ó	2
Vaccinates	18	õ	õ	ō	ō	õ	ō	R1	0	N1,L1	0	õ	ō	õ	õ	õ	ō	ō	ō	No	0	ō
<u>, ü</u>	22	0	0	0	ō	0	0	0	0	Ó	0	0	0	0	0	0	0	0	0	No	Ō	ō
8	23	0	0	0	0	0	0	N1,L1	N2,L2	L1	N1	0	0	0	0	0	0	0	0	Yes	1	1
\a	25	0	0	0	0	0	0	N1	0	N1,L1	N1	N1	0	0	0	0	0	0	0	No	0	0
-	29	0	0	0	0	0	0	N2,L2,R1	N2,L2,R2	N2,L2,R2	N2,L2,R2	N2,L2,R1	0	0	0	0	0	0	0	Yes	5	7
	30	0	0	0	0	0	0	N1	N1,R1	N1,L1	0	N1,L2,R1	N1,L2	L2	0	L2	L2	0	0	Yes	6	11
	34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	No	0	0
	35	0	0	0	0	0	0	R1	D1	0	0	0	0	0	0	0	0	0	0	No	0	0
	40	0	0	0	0	0	0	0 R1	N1,R1 N2,L1,R1	N1,L1 N2,L2,R2	N1 N2,L2,R2	N2.L2.R2	0	0	0	0	0	0	0	No	0	8
	41 43	0	0	ő	0	ő	0	0	N2,L1,K1 N1,L1	N2,L2,K2 N2,L2	N2,L2,K2 N1,L2	NZ,LZ,KZ N1	0	0	0	ő	0	ŏ	ő	Yes Yes	2	6
	43	ő	ő	ŏ	ŏ	ŏ	ŏ	ŏ	N1.L1	0	N1	0	ő	ŏ	ő	0	ő	ŏ	ŏ	No	ó	3

Clinical Descriptions: N=Nasal Discharge, O=Ocular Discharge, C=Cough, L=Nasal Lesions, D=Depression, R=Dyspnea; Severity: 0=Normal, 1=Mild, 2=Moderate to Severe **Bold** indicates an affected calf with moderate to severe clinical signs ¹An affected calf is one with moderate to severe clinical signs of disease on any post-challenge day (score of 2) ²An affected calf is one with moderate to severe clinical signs of disease or rectal temperature ≥ 104.0°F on any post-challenge day

TABLE 2: Rectal Temperatures

	CalfID	-1	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Affected ¹	Duration ²	Maximum
	2	101.4	101.8	101.7	103.6	105.1	105.8	105.6	104.5	102.9	101.6	101.8	101.5	101.3	101.6	101.6	101.8	101.6	102.0	Yes	Durduori-	105.8
	4	102.2	102.0	101.5	103.0	102.4	103.0	105.5	104.5	102.5	100.3	101.3	101.5	101.8	101.8	100.6	101.0	101.0	102.0	Yes	2	105.5
	7	102.2	102.0	102.2	102.0	102.4	104.5	105.5	105.4	102.7	100.3	101.5	100.9	102.6	101.3	101.2	101.4	101.3	102.0	Yes	5	105.5
	9	101.5	102.0	102.2	102.0	105.4	104.2	105.4	105.7	104.4	104.4	102.2	102.5	102.6	102.1	103.6	101.5	101.5	102.5	Yes	12	105.7
	10	101.6	102.1	101.5	102.3	105.4	104.2	105.4	104.8	104.4	104.4	102.2	101.6	100.6	102.6	103.6	104.0	103.5	102.5	Yes	4	105.7
	12	102.3	102.1	102.8	104.5	106.0	105.8	106.0	104.0	103.1	101.1	102.2	101.2	101.0	101.0	101.3	101.9	102.0	102.2	Yes	5	106.0
	13	102.5	102.1	102.6	104.5	104.8	105.9	105.5	104.2	103.4	101.2	102.3	101.2	101.9	101.3	101.4	101.9	102.0	102.2	Yes	4	105.9
	17	101.4	101.8	101.6	102.0	102.5	104.7	105.3	105.2	105.5	104.5	104.4	103.1	101.7	102.3	102.1	102.3	101.7	101.5	Yes	6	105.5
S	19	102.8	101.0	101.9	102.0	103.5	105.7	106.5	104.8	105.1	104.0	103.3	101.6	102.5	102.4	101.8	102.4	101.3	102.0	Yes	5	106.5
Controls	20	102.6	101.1	101.5	101.6	104.3	105.7	104.7	104.1	103.2	102.5	101.9	101.7	101.4	101.7	101.4	101.4	101.9	101.4	Yes	4	105.7
Ē	21	102.1	102.1	102.3	104.5	105.2	106.3	106.1	105.0	104.3	102.7	103.9	103.2	103.1	103.2	103.5	103.2	102.2	102.0	Yes	6	106.3
ŏ	27	102.3	101.8	101.6	101.7	104.1	105.5	106.1	105.0	104.1	103.1	103.6	101.0	101.6	101.7	102.0	102.3	102.1	102.8	Yes	5	106.1
-	28	101.6	102.4	101.9	102.6	104.8	105.2	105.5	104.5	102.7	100.3	100.6	100.7	101.2	102.3	101.5	102.0	101.9	103.2	Yes	4	105.5
	32	101.8	101.2	101.5	102.9	104.9	105.8	105.9	104.8	103.8	102.5	102.8	101.8	101.0	102.0	101.3	102.1	102.4	101.9	Yes	4	105.9
	37	101.2	101.9	101.9	101.8	103.8	105.5	106.4	106.1	104.8	103.7	102.8	101.7	101.4	101.5	100.6	101.5	101.7	101.6	Yes	4	106.4
	38	101.9	102.0	101.8	101.7	104.3	105.5	106.2	105.1	103.9	102.5	101.8	101.0	101.7	101.5	101.8	101.9	101.1	101.5	Yes	4	106.2
	39	102.1	101.9	102.4	101.2	103.6	104.6	105.7	104.9.	104.7	104.0	103.6	102.1	100.5	101.7	101.5	101.9	101.0	101.7	Yes	5	105.7
	42	102.1	101.6	105.1	104.0	104.0	105.2	105.3	105.2	104.7	104.6	102.8	102.1	101.4	102.2	100.7	101.7	101.5	101.2	Yes	8	105.3
	45	101.8	101.7	101.7	101.9	102.6	104.0	104.7	104.3	102.6	101.4	102.4	101.4	101.5	101.7	101.4	101.5	101.6	101.2	Yes	3	104.7
	46	102.7	101.2	102.1	101.9	103.3	104.8	106.1	105.0	104.6	103.6	104.1	102.8	102.2	102.1	101.7	101.5	101.2	102.0	Yes	6	106.1
	· · ·	101.5	101.2	101.4	102.7	103.2	102.8	104.3	103.8	102.9	102.7	102.6	100.9	101.6	101.1	100.8	101.3	101.5	101.7	No	4	104.3
	3	101.5	101.2	101.4	102.7	103.2	102.6	104.3	103.5	102.5	102.7	102.0	100.9	101.5	101.5	100.8	101.3	101.3	101.9	Yes	2	104.5
	5	101.8	101.6	102.0	101.8	101.9	104.0	105.4	102.8	101.9	101.2	101.4	102.2	102.3	103.4	103.8	103.4	101.2	101.8	Yes	2	105.4
	ĕ	102.2	101.7	102.0	101.2	101.6	102.3	102.7	101.6	101.8	101.4	102.1	101.9	102.0	101.7	101.8	102.0	101.4	102.0	No	õ	102.7
	8	101.6	101.6	101.9	102.4	101.7	101.9	102.4	101.7	101.9	101.1	101.7	101.5	101.5	101.6	101.8	101.7	102.0	102.4	No	ō	102.4
	11	101.2	101.3	102.0	102.3	101.4	102.9	104.1	102.0	101.7	101.6	100.8	103.0	101.3	104.6	103.1	102.3	102.1	102.1	No	8	104.6
	14	101.3	101.3	102.2	102.9	102.1	102.5	102.0	101.8	102.8	100.4	101.4	101.2	101.4	101.0	101.7	101.8	101.6	101.4	No	0	102.9
S	15	102.3	102.2	101.3	102.1	103.0	103.8	104.0	102.7	101.9	101.0	101.3	100.6	102.2	101.8	104.2	104.3	102.7	101.9	Yes	10	104.3
ŏ	16	102.4	102.1	101.7	101.8	103.1	104.6	104.0	103.2	102.0	101.1	101.4	101.9	101.7	101.7	101.7	102.0	101.5	101.4	Yes	2	104.6
at	18	102.4	102.0	101.8	101.7	102.5	102.5	102.1	102.6	101.9	101.0	101.3	101.8	101.5	101.1	101.7	102.0	101.6	102.1	No	0	102.6
Vaccinate	22	102.2	102.0	101.3	102.2	102.1	102.2	102.2	102.4	101.7	101.1	101.9	101.2	101.9	101.5	100.9	101.9	101.4	102.3	No	0	102.4
l õ	23	102.4	101.6	101.2	102.2	103.7	103.5	103.5	102.2	101.4	101.0	101.4	102.1	100.8	101.0	101.7	101.6	102.3	101.8	No	0	103.7
S	25	101.3	102.1	102.3	101.4	103.3	103.0	103.7	102.3	102.3	101.5	101.7	101.7	101.4	101.8	100.9	101.4	102.4	101.5	No	0	103.7
	29	102.1	101.6	101.7	102.7	104.8	105.2	104.3	105.7	102.5	102.4	101.9	101.3	101.3	101.6	101.9	102.1	102.1	101.6	Yes	4	105.7
	30	102.0	101.8	101.5	102.0	101.6	104.4	104.0	103.8	103.0 101.8	102.1 103.4	102.5	101.0	101.8	101.1	101.7	101.6	101.4	102.0	Yes	2	104.4
	34 35	102.2 101.8	101.3 102.0	102.5 101.6	102.1 102.8	101.4 103.5	101.6 103.0	102.3 102.5	102.1 102.0	101.8	103.4	103.1 101.2	103.9 101.5	102.2 101.2	101.7 101.3	101.6 100.4	102.3 101.3	101.6 102.5	102.0 101.9	No	0	103.9 103.5
	35 40	101.8	102.0	101.6	102.8	103.5	103.0	102.5	102.0	102.3	101.9	101.2	101.5	101.2	101.3	100.4	101.3	102.5	101.9	No No	1	103.5
	40	102.7	102.5	102.3	102.1	102.5	104.7	103.4	103.0	102.7	101.0	101.5	102.0	100.9	102.1	101.9	101.7	102.0	101.9	Yes	4	104.7
	43	102.2	102.1	102.2	102.7	104.0	104.8	103.4	102.6	102.0	102.4	101.5	102.3	102.2	101.0	101.5	101.6	101.2	102.1	Yes	2	103.4
	44	101.9	101.5	101.5	101.9	101.4	103.9	105.6	102.8	104.2	101.5	101.3	102.5	101.9	101.8	101.4	102.6	102.3	102.1	Yes	3	104.5
	77	101.0	101.0	101.0	101.0	191.7	100.0	. 100.0	104.0	191.4	101.0	101.0	191.0	101.0	101.0	101.1	102.0	102.0	192.1	100	~	100.0

Bold indicates fever ≥104.0°F ¹An affected calf is one with a rectal temperature ≥104.0°F for two or more consecutive days ²For determining duration, an affected calf is one with a rectal temperature ≥ 104.0°F on any post-challenge day

TABLE 3:	Nasal Swab	Virus	Shedding
-----------------	------------	-------	----------

	Calf ID	-1	. 1	2	3	4	5	6	7	8	. 9	10	11	12	13	14
	2	0	3.5	6.5	7.3	7.5	7.1	7.3	5.7	4.5	2.5	1.9	0	0	0	0
	4	0	4.7	6.1	7.3	7.3	6.5	5.9	5.5	3.1	0	0	0	0	0	0
	7	0	5.1	8.1	8.9	7.7	6.9	6.9	6.5	5.5	4.3	3.1	1.9	0	0	0
	9	0	6.1	8.1	7.3	6.9	7.1	7.1	5.5	4.5	2.3	1.9	1.7	0	0	0
	10	0	5.1	7.1	8.1	7.1	5.9	6.5	5.3	3.7	2.7	0	0	0	0	0
	12	0	3.9	6.7	7.7	7.5	6.5	6.9	5.5	4.3	2.9	1.9	0	0	0	0
	13	0	4.7	6.1	7.7	7.3	6.5	6.7	4.5	3.9	1.7	0	0	0	0	0
	17	0	5.9	7.3	7.7	8.1	7.5	7.5	5.9	4.7	2.5	0	0	0	0	0
<u>s</u>	19	0	4.7	6.7	8.5	7.7	6.9	7.3	5.9	4.5	3.7	2.3	0	0	0	0
Controls	20	0	6.5	7.5	8.3	6.3	5.7	6.1	4.7	3.7	2.3	0	0	0	0	0
u u	21	0	3.7	7.1	8.5	7.7	7.3	6.5	5.9	3.9	2.7	2.1	0	0	0	0
Ŭ	27	0	4.7	7.1	7.3	8.7	7.3	6.7	4.5	3.7	1.7	0	0	0	0	0
	28	0	4.5	6.7	7.5	7.7	7.5	7.1	5.3	4.3	3.7	2.7	0	0	0	0
	32	0	5.7	7.1	7.7	8.1	7.3	7.3	5.7	4.3	2.7	1.7	0	0	0	0
	37	0	4.9	6.7	6.9	7.9	6.7	7.1	5.9	4.7	3.1	2.3	0	0	0	0
	38	0	3.9	5.7	7.7	6.9	6.5	7.1	5.9	3.5	2.5	1.7	0	0	0	0
	39	0	4.1	7.1	8.5	8.3	7.1	6.9	5.9	4.5	3.7	2.1	1.7	1.7	0	0
	42	0	3.5	6.3	7.3	7.7	6.7	6.7	5.5	4.7	4.5	2.1	1.9	0	0	0
	45	0	4.7	6.5	8.3	7.7	6.7	7.3	5.5	3.7	3.3	1.9	0	0	0	0
	46	0	4.9	7.1	8.1	7.7	5.7	6.7	6.3	5.5	3.5	1.9	. 0	. 0	. 0	. 0
	-	1														
	1	0	3.7	6.3	7.9	7.5	6.9	6.7	5.3	3.9	2.5	1.9	0	0	0	0
	3	0	4.9	8.3	7.9	7.5	6.5	5.3	0	0	0	0	0	0	0	0
	5	0	3.5	7.1	7.1	6.9	7.1	6.3	3.1	0	0	0	0	0	0	0
	6	0	4.9	6.5	6.3	6.7	5.5	3.3	1.7	0	0	0	0	0	0	0
	8	0	3.9	5.9	5.1	4.5	4.1	2.5	0	0	0	0	0	0	0	0
	11	0	5.1	6.5	6.9	7.1	6.3	3.5	1.7	0	0	0	0	0	0	0
	14	0	4.7	5.9	7.3	6.3	7.3	4.7	1.9	1.7	0	0	0	0	0	0
S	15	0	4.9	7.1	7.9	7.9	5.5	4.7	3.1	0	0	0	0	0	0	0
Vaccinates	16	0	4.7	6.3	7.5 5.3	6.5	6.5	5.3	2.3	0	0	0	0	0	0	0
na	18	0	4.5	5.7		5.7	4.3	3.3	0	0	0	0	0	0	0	0
<u>Ö</u>	22 23	0	2.5 5.3	3.5 6.7	1.9 6.9	3.3 6.9	2.1 6.5	1.9 4.1	0 0	0	0	0 0	0 0	0 0	0 0	0 0
ac		-								0	0	0		0	0	
>	25 29	0	5.1 4.3	6.9 6.9	6.7 7.9	5.9 8.3	5.5 7.5	3.7 6.5	0	2.3	0	0	0 0	0	0	0
	29 30	0	4.3 4.5	6.9 7.3	7.9	8.3 7.5	7.5 6.7	6.5 5.7	4.1	2.3	0	0		0	0	0
	30 34	0	4.5 4.5	3.5	7.5 3.5	4.7	3.9	2.9	4.1	2.1	0	0	0	0	0	0 0
	34	0	4.5	3.5 7.3	5.5 6.9	4.7	5.7	4.1	3.7 1.9	0	0	0	0	0	0	0
	40	0	4.9 5.9	7.3	7.5	7.3	7.1	6.9	4.7	2.7	0	0	0	0	0	0
	40	0	5.9 5.1	6.9	7.9	7.7	6.9	6.5	3.9	3.1	0	0	0	0	0	0
	41	0	4.5	7.3	6.9	7.3	6.7	6.5 5.7	3.9	3.1 0	0	0	0	0	0	0
	43	0	4.5 3.1	4.3	4.7	3.7	2.1	3.7	0	0	0	0	0	0	0	0
		v	3.1	4.3	4./	3.1	4.1	3.1								

Bold indicates positive nasal shedding (results are reported as Log10 TCID50/mL)

Study Type	Efficacy
Pertaining to	infectious bovine rhinotracheitis (IBR)
Study Purpose	Demonstrate effectiveness of the infectious bovine rhinotracheitis
	(IBR) fraction against respiratory disease caused by IBR
Product Administration	One dose administered intranasally
Study Animals	Forty-four colostrum deprived calves, less than 1 week of age,
	divided into two groups: 22 vaccinates and 22 controls
Challenge Description	Challenged intranasally with the virulent Cooper strain of IBR 29
	days after vaccination
Interval observed after	Calves observed daily for 17 days after challenge
challenge	
Results	Animals were considered affected by the challenge if they had moderate to severe (severity score of 2) clinical signs (nasal or ocular discharge, nasal lesions, dyspnea, depression, anorexia, and/or cough) on any day during the post-challenge period, or a rectal temperature ≥104.0°F on any post-challenge day. For fever, an affected calf was one with a rectal temperature ≥104.0°F for two or more consecutive post-challenge days. Totals: 22/22 controls affected 5/22 vaccinates affected Raw data: See attached.
USDA Approval Date	January 3, 2018

TABLE 1: Clinical Observations

Duration ²	;	0		2	12	÷		57	~		50	0		20	v		0	5	0		0	٩	÷	40	2		σ		2	2		•			0	m	-		Ş	20	-	0	**	•	80	0	0					-	>;	2	•	-			
Affected ⁴ Di	Vac	V	2,	89	Yes	Ves	,	¥68	Vee		Yes	Vas		Yes	~~~		Yes	Ves	~~~~		Yes	Ves	Van	201	Yes	Ves	Vec		Yes	Ves		ž		2 :	2	Yes	2	2			2:	2	Ves	<mark>ہ</mark>	Ves	Ŷ	2	eN.	2	2	2	2	2;	Yes	۶ ۷	٩ ۷	-	ever	2741
17 A	-				5																	•	_				č			•	┝					•	5						•	5	•	•	5							•	•		Η	1	7
9		č			5																				N				_								5						•	5	•		0											evere	2010
					21.10													_																										Ő														e to S	2
5	ž				0 IN	N		•	0			C		0		•		20	C		•	•	-	1:	2	0	C		•	•		ľ	•		•	•	6	•	1010	2		•	•	•	•	•	0	•		• •	•			•	•	٩		derat	AUTON O
14	5	5 2	2	•	V1,01,U2	0	•	•	5	; (•	c	•	0	c	> 2	5	N2	•	•	•	•	in.		•	•	c		ž	N2		-	•		•	•	9		1011	2	• ;	5	•	•	•	•	•	5	5	5	•			•	•	•		d 2=Mo	
₽ 13	C I CN	1		•	ž	N112		•	ž		D	•		5	•		•	•	5	; •	•	•	N2 011 2		10'11	•	•		N1,01	ž			•		•	•	0			2		•	5	•	•	•	•	•		• •		•	5	N2,L2	•	•		val. 1=Mi	100
	[Nom	
12	CICN	- 9	1	71	N2.L2	ŝ	•	0	N112			c	•	0	c		0	•	N2 O1 B3		0	•	CO C 1 1 0 CN	ĺ	2	•	c		N2,L2	N2.L2		6		•	•	•	0	-	1000			•	•	•	•	•	•	•		•	•		•	N2,L2	•	•		wentyr. 0:	WOINT. V
7	ŝ	CO CN		2	N2,01	N2 O1 12 R2		NZ	N1 01 R1		N1,LZ	C1 CN		N1,01,L2	•		N2,LZ	N1.R2	N2 01 12 R2		IN I	IN 1	CB C I CN		Z	•	C 1 CN		N2,01,L2	N2		•			•	•	6	5	ND 01 02	antio an		•	N2	•	N1,L2	0	0	0						•	N	•		Dvspnea: Se	C VORTIGE, US
9	00 CN	C B CN	ant'au	2	N1,01	*CB C I CN		NZ	N2.01.R1		N2,LZ	CN N		N2,R1	N4		NZ,01,LZ,K1	N2.R2	N2 O11 2 R2*		N1,LZ	LN I	N2 OF 12 B2	and and the last	NZ,KZ	N2.R2	N2 OF 12 R1	10,00,000	NZ,K1	N1		•			0	0	0		ND OF BO	anti otan		•	N2,R1	0	N2.L2	0	0	0	5	5			IO'IN	N2,01,R2	•	•		pression. R=L	All Goothers, I'v
თ	N21102	01 CU CN	100,000	z	N1,01	N2 1 2 D1 R2*		NZ,L	N2 O111 R2		NZ,LZ,KT	N4		N2,R1	N.		NZ,01	N2.L1.R2	00101120182*	and a share's a 's a 's	LN.	N1	CO 1 1 CN		NZ,LI,KZ	N2.L1	C2 C1 CN	Me, Le, Me	N2,01,N2	N2.L2		•			0	0	0	ō	N3 011 1 102			•	N2,R2	•	N2,L2,R2	0	N1	5	N1 D1			•	N	N2,L1,D1,R2	0	N		Lesions. D=De	LCORNED, U-U-
80	CO FI CM	64 1 64		UZ,LI	N2,01,L2,R2	NO 1 2 D1 82*		NZ,LT,KZ	N2 O1 L1 R2		N2,LZ	CS C1 CN		N2,L2,R2	00 C 1 1 0 CN	14. VI, LA, NA	N2,LZ	N2 L1 R2	N COLLECTION ROP NO		N2,LZ	N2,L2	N2 0111 B2		NZ,LI,KZ	N2.L1.R2	C I CN	and and	N2,L2,K2	N2.R2		•			•	N	0	N I	N3 011 02		NIT	•	N2,L1,R2	N	N2.L2.R2	N	N	N1	N	2		•	5	N2,L2,D1,R2	N	•		Cough, L=Nasal	VUMMII, L'ITROVID
7	NO 11 821	NO DI BO		NZ, UZ, NZ	N2,01,R2	N2 OF L2 D1 R2		N1,L1	N2 1 1 R2		NZUZIKZ	C311CN		N2,L1,R2*	1 CN		NZ,U1,LZ,KZ	N2 L1 R2	à		NZ	N2.L2.R2	C 8 1 CN		NZ,L1,KZ	N2.L1*	Callon		N2,L1,K2	N2,L2		•			•	N1,L1	0		N3 OF L 1 D2			•	N2,L1,R2	•	N2,L1,R2	0	N1.01	N	N	i			-	N2,L1,R2"	ž	•		Clinical Descriptions: N=Nasal Discharge 0=Ocular Discharge C=Couch L=Nasal Lesions. D=Depression. R=Dostnea: Severity: 0=Normal 1=Mild. 2=Moderate to Severe :*=Fever	NUMBER OF AGE AND A
9	NO LE DE	10 1 CM		UZ'TT'ZN	N2,01,L1,R1"	N2 R1*		NZ,L	N2 O111 R1*		NZ,UT,LZ	111 R11		N2,L1,R1*	110 CN		NZ,LI,KI	N211.R1	N2 O111 R1*		N2.	IN I	101100		NZ,KT	N2.L1*	*13 CN	11/24	N2,01,L1,KT	N2,L2		•	, č	5 9	•	N1,L1	6	N.	1001100		Z	•	N2,01,L1,R1*	•	N2,L1,R1*	0	IN I	0	N			•	Z	N2,L2,R1*	ž	•		ne 0=0cula	AG. CTUMER
5	12N	10 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		21	N	*1 R CN		NZ	N2 O1 R1		.7N	11 10 CN		N2	22.24		NZ,01,L1	N2.R1	N2 01 R1*		N2,L1	N2.R1	N2 01 84		-LN	N2	12 CN	1	N2,01,L1,R1	N2.L2		N.	ð	5 3	LN N	N2	0		1010		Z	IN	N2,01*	•	N2.L2.R1*	N	N1.01	N	N	N.	2	5 :		N2,01,R1*	•	N.		teal Dischart	TOOL LOUGH TOOL
4			1	5	N1.01	*CN	1	5	i N		5	N101		5			10'IN	5	N1 O1			i.		1	ь	-1N	-in		10 ¹ N	•		•	-	Ē	•	N	0	5	ō	5 <		•	5	•	N	•	•	•	-	• •	•		•	N	•	•		S. N=Na	
m	5	, •	2	5	•	5	, ;	ь	0	•	•	i.		•	c	2	5	•	ð	; ;	ь	5	C	•	0	5	ð		ь	0		•	•	•	0	5	ò	ò	ò	5		0	0	0	0	0	0	0		•	•	•	5	0	0	•		intion	Contraction of the local division of the loc
2	L .	5			_												_															L .					_											•						•	•	•		Descr	San A
•	Ι.																	_	_													0																0						•	•	0		vical	ŝ
7																																																							- -	_		0	ŝ
_	F	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	_	-	-	-	-	-	-	-	-	-	-	_		⊢	_	-	-	-	_	_	_	_	_	-	_	-	_	_	_	113	_	_	-	_	_	_	_	+			
Group Calf ID													s	×	5	μ	10		>												F	t									,	se	at e	2U	q	DE	<u>،</u>												

Ounst on	ŝ	0	4	m		4	-	6	4	4	0	1.01	-	-	4	0	-	4	50	4	50			•	•	•	2		•	-	•	•	m	•	m	•	•	•	•	•	•	•	4	•	•]	
				_			_						_				_					_			_	_		_	_	_	_	_		_		_	_	_	_	_	_	_		_		+	
Alloc ed	ž	ž	Yes	Ž	ž	ř	Ž		_	_	Ĭ.	ş	Ž	, in the second	ž	ž	Ŷ	ž	_	ž	ž	Ž		Ň	_	2		2		ž	_	_	ž	2	Ň	å	Ŷ	2	2	ź	2			ž	ž		
2	101.4	101.0	101.2	101.7	102.3	101.6	101.0	101.2	101.4	101	101.0	101.4	101.6	101.1	101.5	1020	10.3	101.1	100.5	10.9	101.0	101.0		101.4	101.6	101.0	101.6	101.6	101.3	101.1	100.8	100.8	101.0	101.6	101.2	101.2	101.7	100.9	101.6	101.5	101.2	101.8	10.6	18.7	101		
13	1009	1012	101.6	1016	101.1	1008	1004	1010	1014	1010	1000	1017	1009	1008	1012	101.1	1005	1015	1006	1008	1007	1011		101.1	1017	101.3	101.3	1006	1014	101.1	1029	1015	1008	1014	101.1	101.6	1013	1007	100.8	1010	1009	101.1	1008	1002	1008		
12	101.2	101.2	101.9	102.6	101.2	101.1	101.6	101.3	101.3	101.1	101.5	101.5	101.3	101.3	101.6	102.0	100.6	100.2	101.2	102.1	101.0	101.1		101.7	102.1	100.9	101.1	101.8	101.7	102.3	100.2	101.8	101.0	101.3	101.1	101.9	101.2	100.5	102.4	102.2	101.0	102.0	101.4	102.6	101.2		
11	10.4	100.6	101.4	101.5	101.9	10.2	10.4	10.0	101.1	88	100.6	186	101.1	101.0	19	100.2	10.2	100.7	100.3	100.8	10.5	100.2		100.2	101.0	100.1	100.3	100.2	10.4	101.6	100.9	100.6	267	101.3	18.2	101.1	184	101.3	101.0	101.4	666	10.3	184	103.4	28		
9	1019	101.8	1023	1015	1049	1017	1015	1014	1012	102.0	1011	1014	1017	1041	1020	1017	1030	1019	1015	101.1	1026	1017		1015	1009	1010	1010	1019	1020	1027	1024	101.6	1012	1013	1013	1016	1017	1013	1020	1018	1012	1025	1020	1029	1013		
6	103.3	102.0	102.1	103.0	104.9	102.5	101.1	101.0	101.3	101.6	1012	101.4	102.4	104.6	101.6	101.6	102.1	101.9	101.6	101.5	102.3	101.3		101.6	101.7	101.3	101.0	101.4	102.0	101.5	101.0	101.7	102.5	101.6	101.1	101.1	102.1	101.4	101.0	101.5	101.4	102.0	102.5	101.6	103.6		
8	103.7	10.9	102.7	103.7	105.0	102.7		101.1	101.6	103.0	101.5	οp	103.4	104.6	187	100	103.3	180	102.2	101.1	103.1	102.4		101.5	102.4	101.0	101.4	100	180	103.7	101.0	101.6	103.6	102.2	101.8	101.9		101.3	101.8	101.8 101.8	101.0	101.8	103.6	101.5	189		
7	1046	1035	103.6	103.8	1038	1028	1033	1022	103.3	1048	1013	1024	1031	1043	1036	1026	1030	1044	104.1	1024	1045	1027		1014	1025	1012	1017	1014	1010	1035	101 D	102.1	1030	1020	103.1	001 001	1016	101.1	1018	1020	1010	1019	1043	1013	1015		svep
9	105.0	103.9	104.8	104.0	104.2	104.8	104.0	103.8	104.0	104.2	101.5	102.8	102.9	104.3	104.3	103.6	103.9	103.6	104.5	104.3	104.3	102.7		102.2	102.0	101.2	102.1	101.6	101.1	104.0	101.5	102.0	104.6	102.0	104.5	102.8	102.0	101.4	101.3	101.5	101.4	102.0	104.4	101.6	101.1		onsecutive
9	104.4	104.0	106.1	102.6	104.2	103.5	103.6	104.0	104.2	103.6	104.0	9	187	104.2	103.9	103.5	103.3	104.8	104.0	103.6	106.1	101.2		100.4	101.4	100.8	103.0	100.8	98 8	102.5	10.4	101.2	104.0	101.0	105.1	ā	100.5	10.8	101.1	101.2	101.2	101.9	104.2	18.0	10.5		o or morec
4	105.1	1043	105.6	1043	1048	1044	1036	1047	105.0	105.0	1040	1043	104.4	1046	1052	1052	1043	104.4	1043	1052	1044	1038		1015	1023	1013	105.1	1028	1015	1025	1022	1017	104.4	1013	1048	1037	1027	1024	1026	1017	1014	1022	1045	101.1	1010		LO'F for two
e0	104.1	103.2	104.0	103.1	104.5	104.5	103.6	102.5	104.8	103.2	102.4	103	103.7	103.0	105.0	105.1	103.2	103.0	104.0	104.0	104.5	101.5		101.3	102.4	101.4	104.2	102.4	101.6	102.8	102.5	101.8	102.1	102.0	101.5	103.5	102.2	102.2	102.1	103.0	102.0	102.2	103.6	101.3	101.1		ature >104
8	101.3	101.0	102.4	102.3	101.8	101.0	101.6	101.4	101.9	101.0	101.1	101.0	101.3	101.5	101.6	102.2	101.0	101.6	101.3	100.9	101.7	101.6		101.3	18.0	101.0	101.7	101.4	101.3	101.5	101.1	101.6	101.5	101.5	101.4	101.5	10.9	101.3	180	102.2	101.4	101.7	101.7	101.3	182		rectal temperature >104.015 for two or more consecutive days
-	101.3	101.1	1023	1018	101.1	1013	101.1	101.6	101.3	1009	1010	1014	1018	1018	1005	101.8	1001	1023	1009	1004	1010	1010		1008	1019	101.1	100.6	101.6	1012	101.1	1010	101.6	101.1	1010	1010	1014	101.1	1012	1010	1024	1009	1013	1019	101.3	1008	And of E	e with a re-
•	101.7	101.2	102.2	101.7	102.4	101.1	102.0	101.2	101.6	101.3	101.0	102.0	100.8	101.4	101.0	101.5	100.8	101.1	101.1	101.1	101.3	1019		101.0	101.7	101.6	101.0	101.2	101.1	101.5	101.2	100.9	101.7	101.8	101.4	101.6	101.4	100.6	102.0	102.0	101.5	101.8	101.2	101.4	101.0	the fame -	d calf is on
Ţ	101.6		101.9	102.8	101.7	101.7	102.0	102.5	102.2	101.3	102.2	101.3	102.2	102.8		102.4	101.3	101.4	101.7	101.7	101.7	101.0		101.4	101.1	101.8	101.6	102.0	101.8	101.7	101.8	102.0	10.9	181	101.3	101.6	18 0	102.0	102.2	102.9	101.5	101.9	184	101.2	101.5	Bold indestes fear stor of	An afected calf is one with a
2	뷶	뢂	R.	<u>1</u>	矈	驛	驔	聲	<u>1</u>	尋	髩	肾	ģ	ę	ę	ß	ę	ę	<u>19</u>		臀	8		ą	7	4	왉	6 4	6 3	귷	1Ş	ģ	덬	ц <u>а</u>	髥	噚	Ģ	ę	¢	Ģ	ę	윩	S.	尊	\$	ſ	
-										9	011	μο	С										\vdash	\vdash								s	ape	u	201	۶A									+	+	

TABLE 2: Rectal Temperatures

Study Type	Efficacy
Pertaining to	Parainfluenza 3 (PI3)
Study Purpose	Demonstrate effectiveness of the <i>Parainfluenza 3</i> fraction against respiratory disease caused by <i>Parainfluenza 3</i>
Product Administration	One dose administered intranasally at 6 or 7 days of age
Study Animals	Colostrum deprived calves, 6 or 7 days of age, divided into two groups:
	Group A vaccinates, 22 calves, test vaccine with <i>Parainfluenza 3</i> antigen at the minimum protective dose (MPD) and the other seven antigen fractions at or above release levels
	Group B controls, 13 calves, placebo vaccine with the seven antigen fractions at or above release levels and without the <i>Parainfluenza 3</i> fraction
Challenge Description	Challenged with a virulent <i>Parainfluenza 3</i> at either 39 (1 st shipment) or 32 (2 nd shipment) days post vaccination
Interval observed after	Observed for clinical signs of the disease for 14 days post
challenge	challenge
Results	Vaccinates and controls were evaluated for viral shedding as virus shedding is the primary criteria related to <i>Parainfluenza 3</i> infection.
	Number of calves with viral shedding and days duration during post-challenge period:
	Group A Vaccinates: 13/22 shed PI3 post-challenge Group B Controls: 13/13 shed PI3 post-challenge
	Group B Controls. 15/15 shed 115 post-chantenge
	Duration (days) of shedding, five number summaryGroupMin Q_1 Median Q_3 Max
	$\frac{Oroup}{Vaccinates} 0 0 1 4 8$
	Controls 5 7 9 9 10
	Raw data attached
USDA Approval Date	September 24, 2014

					N	asal Pl	3 Virus	Titer (l	_0a10 T(CID ₅₀ /m	L)			
								ost-Cha			,			
Group	ID	Vac. ¹	-1	0	1	2	3	4	5	6	7	8	9	10
	202	0	0	0	0	1.7	2.5	2.7	3.5	3.5	2.3	1.9	3.9	2.9
	206	0	0	0	3.1	4.3	5.3	5.5	5.9	4.1	2.1	0	0	0
	207	0	0	0	0	1.7	3.9	4.9	4.5	3.7	2.3	0	0	1.7
	212	0	0	0	0	0	3.7	3.1	4.7	5.9	3.3	3.1	3.3	0
	213	0	0	0	1.7	2.5	3.7	3.9	4.5	5.5	4.5	2.9	2.3	0
<u>v</u>	220	0	0	0	0	3.1	3.9	4.5	5.7	6.3	3.1	2.5	3.9	1.7
Controls	222	0	0	0	0	1.9	2.5	3.7	5.7	4.9	3.3	2.3	2.7	3.7
l lo	223	0	0	0	0	2.1	2.7	2.7	3.1	3.5	2.5	1.9	2.1	2.1
0	230	0	0	0	0	1.9	3.9	4.7	5.3	4.5	2.9	2.5	3.5	2.7
	231	0	0	0	0	1.7	1.7	1.7	2.3	2.5	0	0	0	0
	234	0	0	0	0	0	1.7	3.7	4.9	3.9	2.1	0	0	0
	236	0	0	0	3.3	4.3	4.5	5.7	5.7	4.9	2.7	3.5	2.5	2.1
	242	0	0	0	0	0	1.9	3.7	4.7	5.1	3.7	2.7	0	0
	Average:	0	0	0	0.6	1.9	3.2	3.9	4.7	4.5	2.7	1.8	1.9	1.3
	201	0	0	0	0	0	0	0	0	0	0	0	0	0
	203	0	0	0	0	0	1.9	0	0	0	0	0	0	0
	204	0	0	0	0	0	0	0	0	0	0	0	0	0
	205	0	0	0	0	3.5	4.3	4.7	3.9	0	0	0	0	0
	208	0	0	0	0	0	0	1.7	0	0	0	0	0	0
	211	0	0	0	1.7	2.7	5.7	3.7	1.7	0	0	0	0	0
	215	0	0	0	0	1.7	0	0	0	0	0	0	0	0
	217	0	0	0	0	0	0	1.7	0	0	0	0	0	0
	218	0	0	0	0	0	0	0	0	0	0	0	0	0
S	224	0	0	0	1.7	2.9	2.7	3.7	3.3	0	0	0	0	0
Vaccinates	225	0	0	0	0	0	1.7	2.1	2.3	3.3	3.1	0	1.7	0
Sci-	226	0	0	0	0	0	0	0	0	0	0	0	0	0
Vac	227	0	0	0	0	0	2.3	3.5	2.5	0	0	0	0	0
	228	0	0	0	0	1.7	1.7	1.7	0	0	0	0	0	0
	229	0	0	0	0	1.7	2.9	3.3	2.7	0	0	0	0	0
	232	0	0	0	0	0	2.7	3.5	3.7	3.9	2.7	1.9	2.5	1.9
	233	0	0	0	0	1.9	2.5	0	0	0	0	0	0	0
	235	0	0	0	0	0	0	0	0	0	0	0	0	0
	237	0	0	0	0	0	0	0	0	0	0	0	0	0
	239	0	0	0	0	0	0	0	0	0	0	0	0	0
	240	0	0	0	0	0	0	0	0	0	0	0	0	0
	241	0	0	0	0	0	0	0	0	0	0	0	0	0
	Average:	0	0	0	0.2	0.7	1.3	1.3	0.9	0.3	0.3	0.1	0.2	0.1

Table 1: Nasal Swab Virus Shedding Results

¹Prior to vaccination (study day 0 or 7)

Study Type	Efficacy					
Pertaining to	Parainfluenz	a 3				
Study Purpose	Demonstrate D Parainfluenza Parainfluenza	a 3 fraction aga		•		
Product Administration	One dose adm		nasall	y at 3 to 5 d	lays of	fage
Study Animals		deprived calv	es, 3 t	o 5 days of		ivided into two
	Group B cont	-	-			
Challenge Description	Challenged w vaccination					s post
Interval observed after	Observed for	clinical signs	of the	disease for	14 day	/s post
challenge Results	challenge Number of ca					
	period: Group A Vaco Group B Cont Duration of sh	trols: 20/20 sł	ned PI	-	0	e
1						
	Group	Minimum	Q1	Median	Q3	Maximum
	Group Vaccinate	Minimum 0	Q1 2	Median 3.5	Q 3 5	Maximum 7
					~	
	Vaccinate	0 6 I animal was ren and 1 control ani ated to vaccinati	2 6 noved fi mal we	3.5 6.0 rom the study re removed or	5 7 prior to human	7 8 o vaccination.

Duration (days)	9	y) a	2	<u>ي</u> ر	2	. 9	7	. 00	7	9	NA	7	9	9	9	9	9	. 4	0 00	0.00	5	2	-	NA	5	4	ي ع		- c	~	r m	4	2	M	7	4	e	5	2	m c	7	
10 PC	0	C				00	0	0	0	0	0	NA	0	0	0	0	0	0			00	0	0	0	NA	0	0	0	00			0	0	0	M	0	0	0	0	0	00	>	
9 PC	0	C	• •	00	0	00	0	0	0	0	0	AN	0	0	0	0	0	0		00	0	0	0	0	M	0	0	0	00			0	0	0	AA	0	0	0	0	0	00		
8 PC	0	C	ţ	c	00	00	0	0	1.7	0	0	M	0	0	0	0	0	0		;	1	0	0	0	M	0	0	0	0 0			0	0	0	A	0	0	0	0	0	00	>	
7 PC	0	C	;	c	0	17	0	1.7	2.7	2.1	0	M	2.1	0	0	0	0	0		, ;	2	0	0	0	M	0	0	0	0 0			0	0	0	A	1.9	0	0	0	0	00	>	
6 PC	2.9	4.9	5	47	49	3.5	6.1	2.9	5.7	4.5	2.9	M	4.3	3.5	3.5	3.9	3.1	2.7	00	4 5	45	0	0	0	A	0	0	0	0 0			0	0	0	AA	5.1	0	0	0	0	00	>	
5 PC	6.1	61	45	5	, u	6,9	5.1	6.3	6.3	6.7	4.9	M	5.9	5.5	5.1	4.5	4.7	6.1	9		2	2.7	1.9	0	M	3.1	0	1.7	- ;	3 -		0	0	0	M	5.5	0	0	4.5	2.9	00	5	
4 PC	5.3	57	45	47	22	6.7	5.1	5.1	6.1	4.9	5.3	M	4.9	5.5	5.7	4.7	4.7	5.3	2 3	27	67	2.9	1.7	0	A	4.5	1.7	0	0 0		;	0	1.7	0	A	5.5	2.3	0	4.9	2.9	00	>	
3 PC	4.5	47	10	4.5	45	5.5	3.9	4.5	4.7	5.9	6.7	AN	4.9	4.1	5.1	4.3	3.3	4.7	9	- 6	69	3.5	0	0	M	3.5	1.7	0	0 0			2.1 2	0	0	AN	4.5	0	1.7	4.1	2.5	5 9	5	
2 PC	3.7	41	~		35	4.3	4	5.9	4.9	4.3	4.9	M	4.7	4.1	4.9	4.3	3.3	4.5	u u	64	6	2.5	0	0	M	2.9	0	1.7	0 0		;	3.3	0	1.7	AN	3.3	0	2.1	2.7	2.9	21	21	
1 PC	2.7	25	12	6	3.5	2.7	3.7	4.3	4.1	2.9	2.9	M	3.7	3.9	2.9	3.1	3.1	3.3	C V	2 F 6	20	3.3	0	2.3	M	2.5	1.9	53	0 0		35	51	1.7	1.9	A	3.5	1.9	2.3	3.3	4.1	21		:
-1 PC	0	0				00	0	0	0	0	0	AN	0	0	0	0	0	0			0	0	0	0	A	0	0	0	0 0			0	0	0	AA	0	0	0	0	0	00	0	
0 PV	0	C				00	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0	0	0	0	0	0			0	0	0	0	0	0	0	0	0	00		ľ
CalfID	214	215	212	218	910	222	227	230	231	233	236	237	239	241	243	245	247	248	250	36	255	212	213	216	220	221	223	225	972	077	520	234	235	238	240	242	244	246	249	251	523 223	101	
									S	10.	цu	0	2																	SƏ	iei	cir	эe	٨									

Table 1: Nasal Swab Virus Shedding Results

Study Type	Efficacy										
Pertaining to		piratory S	vncvtial V	irus (BRS	V)						
Study Purpose		Bovine Respiratory Syncytial Virus (BRSV) To demonstrate efficacy of the BRSV fraction									
Product Administration		One dose administered intranasally at 1 week of age									
Study Animals	Forty-four										
	groups:	,,			.8-,						
	1 ·	lose (MPE) and the		•	he minimun actions at or					
	Group 2, 22 above prop	· 1			•	antigens at o	or				
Challenge Description	Challenged challenge v at 31 days a	irus was a	dministere		(wo mL of ays and agai	in				
Interval observed after challenge	Observed d	aily for 8 o	days.								
Results	Three Grou therefore G BRSV Nasa Group 1 Va Group 2 Cc	roup 2 is 1 al Virus Sl accinates:	9 calves. nedding: 7/22	ere euthan	iized prior	to challenge	e,				
	Lung Lesio	n Score (L	LLS):								
	Group	Min	Q1	Med	Q3	Max					
	Vaccinate	0	0	0	0.1	11.3					
	Control	0.2	0.9	2.1	5.35	13.7					
	Min is mini Q is quartil Med is med Max is max Raw data at	e lian imum									
USDA Approval Date	January 3,										
USDA Approval Date	January 3,	2010									

Group	ID	-1	2	3	4	5	6	7	8	Duration (days)
	342	0	0	0	0	0	0	0	0	0
	343	0	0	ō	0	ō	1.21E+02	2.70E+01	0	2
	344	0	0	0	0	1.28E+01	2.56E+02	1.86E+01	2.70E+01	4
	346	0	0	0	0	3.93E+01	5.72E+01	1.86E+01	1.28E+01	4
	348	0	0	0	0	0	0	1.28E+01	0	1
	349	0	0	0	0	0	0	1.86E+01	1.28E+01	2
	352	0	0	0	0	1.86E+01	2.70E+01	0	0	2
	355	0	0	0	1.86E+01	1.28E+01	5.72E+01	2.70E+01	0	4
so a	360	0	0	0	0	0	3.93E+01	5.72E+01	0	2
Controls	361	0	0	0	1.86E+01	2.70E+01	2.70E+01	0	0	3
Ê	366	0	0	0	0	1.86E+01	1.86E+01	0	0	2
- č	367	0	0	0	2.70E+01	2.70E+01	2.70E+01	1.28E+01	0	4
-	368	0	0	0	0	1,28E+01	0	1.21E+02	0	3
	371	0	0	0	1.28E+01	8.32E+01	2.70E+01	8.32E+01	1.28E+01	5
	373	0	0	0	1.28E+01	0	3.93E+01	2.70E+01	0	4
	375	0	0	0	0	0	0	0	0	0
	377	ō	0	ō	ō	ō	ō	ō	ō	ō
	382	0	0	ō	0	3.93E+01	3.93E+01	ō	0	2
	384	0	0	0	0	0	2.70E+01	1.28E+01	1.28E+01	3
					-					
	347	0	0	0	0	0	0	0	0	0
	350	0	0	0	1.28E+01	3.93E+01	1.76E+02	5.72E+01	0	4
	351	0	0	0	0	0	0	0	0	0
	353	0	0	0	0	1.28E+01	2.70E+01	1.28E+01	0	3
	354	0	0	0	0	0	0	0	0	0
	356	0	0	0	0	1.86E+01	1.28E+01	0	0	2
	357	0	0	0	0	0	0	0	0	0
	358	0	0	0	0	0	0	0	0	0
	359	0	0	0	0	0	0	0	0	0
8	362	0	0	1.28E+01	0	1.86E+01	1.28E+01	0	0	4
Vaccinates	363	0	0	0	1.28E+01	1.86E+01	0	0	0	2
E I	364	0	0	0	0	0	0	0	0	0
ğ	369	0	0	0	0	0	0	0	0	0
×	370	0	0	0	0	0	0	1.28E+01	1.28E+01	2
	372	0	0	0	0	0	0	0	0	0
	374	0	0	0	0	0	0	0	0	0
	376	0	0	0	3.93E+01	1.76E+02	5.43E+02	1.86E+01	0	4
	379	0	0	0	0	0	0	0	0	0
	380	0	0	0	0	0	0	0	0	0
	381	0	0	0	0	0	0	0	0	0
	383	0	0	0	0	0	0	0	0	0
	385	0	0	0	0	0	0	0	0	0
ſ										

Nasal BRSV Titer (TCID₆₀/mL)

Bold indicates presence of viral shedding

Group	Calf ID	L Cranial	L Middle	L Caudal	R Cranial	R Post Cranial	R Middle	R Caudal	Accessory	Total Lung Score
	342 343	2	5	1	0	0	0	0	0	0.7
I		0	0	0	5	0	0	0	0	0.3
I	344	30	20	10	40	10	10	5	10	11.7
I	346	0	5	0	5	5	0	0	0	0.9
I	348	0	5	5	2	0	2	0	0	2.2
I	349	0	0	2	10	0	0	0	5	1.4
I	352	0	20	10	25	0	15	10	10	10.9
	355	0	0	2	5	5	15	5	5	4.2
Controls	360	5	5	2	10	2	10	5	0	4.3
Į I	361	1	50	15	60	2	30	ō	2	13.7
5	366	5	15	5	2	2	15	2	1	4.8
0	367	ŏ	ő	ŏ	20	ō	2	ō	ò	1.3
I		2	2	ŏ	0	ŏ	ó	ő	ő	0.2
I	368					-				0.2
	371	5	10	2	20	0	15	5	10	5.9
I	373	0	5	2	2	0	2	0	5	1.4
I	375	0	10	0	5	2	15	0	0	2.1
I	377	0	0	2	2	0	2	0	0	0.9
I	382	0	0	0	15	0	60	2	10	6.2
I	384	0	0	0	0	0	10	0	0	0.7
	347	0	0	0	0	0	0	0	0	0
I	350	15	20	10	15	0	10	12	8	11.3
I	351	0	0	0	0	0	0	0	0	0
I	353	0	2	0	60	5	30	10	10	10.0
I	354	0	0	0	0	2	0	0	0	0.1
I	356	0	0	0	0	0	0	0	0	0
- 1	357	0	0	0	0	0	0	0	0	0
I	358	ō	ō	ō	õ	ō	õ	ō	õ	Ō
	359	ŏ	ŏ	ŏ	ŏ	õ	ŏ	ŏ	ŏ	ŏ
es		ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ
at	362	-	-	-	-	-	-	-	-	
Vaccinates	363	0	0	0	0	0	0	0	0	0
8	364	0	0	0	0	0	0	0	0	0
S I	369	0	0	0	0	0	0	0	0	0
-	370	0	0	0	0	0	0	0	0	0
I	372	0	0	0	0	0	0	0	0	0
I	374	0	0	0	10	0	15	2	2	2.4
I	376	0	5	0	15	2	2	0	0	1.4
I	379	0	0	0	0	0	0	0	0	0
	380	ŏ	ž	ŏ	ŏ	ŏ	õ	ŏ	õ	0.1
	381	ŏ	õ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	0
		ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ
			U	0	0	0	0	0	0	
	383 385	ŏ	õ	0	0	0	0	0	0	0

Lung Lesion Score by Lung Lobe

Bold indicates animal considered affected L= Left; R= Right

Study Type	Efficacy							
Pertaining to	Bovine Respira	tory Syncytial	Viru	s (BRSV)				
Study Purpose	Demonstrate D	uration of Im	muni	ty (effecti	venes	ss) of the BRSV	7	
	fraction			•				
Product Administration	One 2 mL dose	e administered	l intra	anasally (S	Study	Day 0)		
Study Animals	Forty-four colo	strum depriv	ed ca	lves, 5-7 d	lays c	of age, divided		
	into two groups	s: 22 vaccina	tes a	nd 22 cont	rols			
Challenge Description	Challenged with	n aerosolized v	virule	ent BRSV v	irus ((2 mL of challen	ige	
	virus per naris),	on Study Day	ys 78	and 79 po	st vac	ccination		
Interval observed after	Calves observe	d daily for 8	days	after chall	enge	then lung tissue	tu	
challenge	was examined.							
Results	Lung Lesion Se	cores:						
	Table 1: Tot	tal lung lesior	ns (Pe	ercent)				
	Group	Minimum	Ql	Median	Q3	Maximum		
	Vaccinate	0	1	2	4	7		
	Control	3	4	6	9	27		
	Q=Quartile							
	Raw Data is Attached							
	Raw Data is At	ttached						

Group	Calf ID	Ave, LLS (Scorer 1 & 2)
	445	3.52
	446	4.22
	451	2.89
	454	16.72
	456	4.86
	457	6.45
	459	14.70
	460	9.31
(0	461	8.26
Controls	464	3.59
Itr	466	11.98
D L	467	5.36
O	469	7.96
	471	9.95
	472	3.53
	473	27.30
	476	4.22
	479	4.83
	480	6.11
	483	9.08
	484	5.74
	487	3.86
	444	4.24
	447	1.54
	448	4.02
	449	0.39
	450	1.52
	452	4.97
	453	0.59
	455	1.15
S	458	0.35
Vaccinates	462	1.63
Ľ.	463	6.03
8	465	3.65
a(468	6.85
>	470	1.11
	474	2.13
	475	1.57
	477	3.43
	478	5.47
	481	0.83
	482	2.15
	485	2.63
	486	0.36

AVERAGE LUNG LESION SCORES*

* Lung Lesion Score average is based on the mean of two independent scorers.

Study Type	Saf	etv								
Pertaining to	AL	2								
Study Purpose			e conditions							
Product										
Administration		ngle 2 mL dose administered by the intranasal (IN) route								
Study Animals		calves, 0 to 63 days of age, at 3 different ge cinates and 333 controls	ographical loca	ations consistin	g of 665					
Challenge	NA									
Description										
Interval	Ani	imals were observed daily for 14 days post v	accination.							
observed after challenge		<i>y y</i> 1								
Results		nical Observations: Numbers of animals wit	h specific clinio	cal observation	s post-					
	vac	cination:								
	ſ	Adverse Events (AE): VeDDRA Preferred Term	Number*	Number*						
		(Total 998 animals in study)	Vaccinates	Control						
		NORMAL	556	290						
		RESPIRATORY TRACT DISORDER NOS	64	23						
		DIARRHOEA	54	22						
		DEATH	10	4						
		LETHARGY	7	4						
		LAMENESS	2	1						
		PNEUMONIA	3	0						
		DIGESTIVE TRACT HAEMORRHAGE NOS	1	0						
	-	SEPTICAEMIA	1	0						
		NOS = Not otherwise specified		-						
	appı	abjects may have had AE in more than one VeDDRA ropriate class. VeDDRA is the Veterinary Dictionary I deaths were considered not vaccine product	for Drug Regulate	ory Activities.						
USDA	July	y 5, 2019								
Approval Date										

Study Type	Safety
Pertaining to	All fractions
Study Purpose	Safety by intranasal administration to pregnant cows and calves
	nursing pregnant cows
Product Administration	
Study Animals	
Challenge Description	
Interval observed after	
challenge	
Results	Scientific data were evaluated by USDA-APHIS prior to product licensure and met regulatory standards for acceptance at the time of submission.