Summary of Studies Supporting USDA Product Licensure

Establishment Name	Zoetis Inc.
USDA Vet Biologics Establishment Number	190
Product Code	4469.25
True Name	Bovine Rhinotracheitis-Virus Diarrhea-Parainfluenza 3-Respiratory Syncytial Virus Vaccine, Modified Live & Killed Virus, Leptospira Canicola-Grippotyphosa-Hardjo-Icterohaemorrhagiae-Pomona Bacterin
Tradename(s) / Distributor or Subsidiary (if different from manufacturer)	CattleMaster Gold FP 5 L5 - No distributor specified CattleMaster Gold FP 5 L5 - Zoetis Colombia S.A.S. CattleMaster Gold FP 5 L5 - Zoetis Ecuador Cia Ltda. CattleMaster Gold FP 5 L5 - Zoetis Industria Produtos Veterinarios Ltda. CattleMaster Gold FP 5 L5 - Zoetis Industria de Produtos CattleMaster Gold FP 5 L5 - Zoetis Mexico CattleMaster Gold FP 5 L5 - Zoetis Russia
Date of Compilation Summary	February 16, 2023

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	Bovine Viral Diarrhea Virus, type 1 (BVDV 1)
Study Purpose	Demonstrate efficacy against respiratory disease caused by BVDV 1
Product Administration	
Study Animals	
Challenge Description	BVDV 1 virus (non-cytopathic type 1b strain New York-1)
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	08/11/2003

<table>
<tr><td>Study Type</td><td>Efficacy</td></tr>
<tr><td>Pertaining to</td><td>Bovine Viral Diarrhea Virus, type 1 (BVDV 1)</td></tr>
<tr><td>Study Purpose</td><td>Demonstrate efficacy against persistently infected calves caused by BVDV 1</td></tr>
<tr><td>Product Administration</td><td>Two doses, three weeks apart, administered subcutaneously (SC)</td></tr>
<tr><td>Study Animals</td><td>10 SC-vaccinated, and 10 control cows</td></tr>
<tr><td>Challenge Description</td><td>BVDV 1 virus (non-cytopathic BVD virus type 1, strain 816317), administered 117 days after vaccination and approximately 80-83 days of gestation</td></tr>
<tr><td>Interval observed after challenge</td><td>Peripheral blood mononuclear cells (PBMCs) were collected from dams on days 117, 119, 121, 123, 125, 127, 131, 138, and 145 after vaccination. Amniotic fluid and blood samples were collected on day 145 after vaccination (28 days post challenge). Approximately 1-2 weeks prior to calving, all calves (fetuses) were derived by cesarean section and tissues evaluated for BVDV 1.</td></tr>
<tr><td>Results</td><td>Dams were considered positive for BVDV 1 if virus was ever isolated from PBMCs or amniotic fluid.

Number of BVDV 1 positive dams:

<table>
<tr><td></td><td>PBMCs</td><td>Amniotic Fluid</td></tr>
<tr><td>Controls</td><td>9/10 (90%)</td><td>10/10 (100%)</td></tr>
<tr><td>Vaccinates (SC)</td><td>0/10 (0%)</td><td>0/10 (0%)</td></tr>
</table>

Calves (fetuses) were considered persistently infected if tissues examined were positive for BVDV 1 antigen (immunohistochemistry (IHC) and/or virus isolation).

Number of BVDV 1 positive calves (fetuses):

<table>
<tr><td></td><td>IHC</td><td>Virus Isolation</td></tr>
<tr><td>Controls</td><td>8/8 (100%)</td><td>8/8 (100%)</td></tr>
<tr><td>Vaccinates (SC)</td><td>0/9 (0%)</td><td>0/9 (0%)</td></tr>
</table>
Two control and one vaccinated animal were not pregnant at the time of caesarian section, abortions were not observed.

See individual data attached.</td></tr>
<tr><td>USDA Approval Date</td><td>01/28/2000</td></tr>
</table>

BVDV 1 Infection of Dams and Persistent Infection of Calves (Fetuses) Summary

Treatment Group	Animal ID	Dam BVD Positive		BVD Virus Isolation						BVD Immunohistochemistry					Persistently Infected
		PBMCs	Amniotic Fluid	Blood	Brain	Eye	Spleen	Thymus	Overall	Brain	Eye	Spleen	Thymus	Overall	
Control	1296	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Control	1309	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Control	1310	+	+	Cow was not pregnant at the time of caesarian section											
Control	1311	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Control	1317	+	+		+	+	-	+	+	+	+	+	+	+	+
Control	1325	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Control	1350	-	+	+	+	+	+	+	+	+	+	+	+	+	+
Control	1423	+	+	Cow was not pregnant at the time of caesarian section											
Control	1428	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Control	1433	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Vaccinated SC	1302	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vaccinated SC	1304	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vaccinated SC	1313	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vaccinated SC	1314	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vaccinated SC	1331	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vaccinated SC	1339	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vaccinated SC	1348	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vaccinated SC	1426	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vaccinated SC	1437	-	-	Cow was not pregnant at the time of caesarian section											
Vaccinated SC	1445	-	-	-	-	-	-	-	-	-	-	-	-	-	-

<table>
<tr><td>Study Type</td><td>Efficacy</td></tr>
<tr><td>Pertaining to</td><td>Bovine Viral Diarrhea Virus, type 2 (BVDV 2)</td></tr>
<tr><td>Study Purpose</td><td>Demonstrate efficacy against persistently infected caused by BVDV 2</td></tr>
<tr><td>Product Administration</td><td>Two doses, three weeks apart, administered subcutaneously (SC) prior to breeding</td></tr>
<tr><td>Study Animals</td><td>11 vaccinated, and 8 control cows</td></tr>
<tr><td>Challenge Description</td><td>BVDV 2 virus (non-cytopathic type 2 strain 94B-5359a), administered 119 days after vaccination and approximately 80-82 days of gestation</td></tr>
<tr><td>Interval observed after challenge</td><td>All calves (fetuses) were harvested on days 155-157 of gestation. Calves (fetuses) were assessed for persistent infection.</td></tr>
<tr><td>Results</td><td>Calves (fetuses) were considered persistently infected if tissues examined were positive for BVD antigen by virus isolation.

Number of BVD positive calves (fetuses):

<table><tr><td></td><td>Virus Isolation</td></tr><tr><td>Controls</td><td>7/8 (88%)</td></tr><tr><td>Vaccinates</td><td>0/11 (0%)</td></tr></table>
See individual data attached.</td></tr>
<tr><td>USDA Approval Date</td><td>11/26/2003</td></tr>
</table>

BVD Virus Isolation and Persistent Infection of Calves (Fetuses) Summary

Treatment Group	Animal ID	BVDV Virus Isolation in Calves (Fetuses)				Persistently Infected
		Brain	Liver	Lung	Spleen	
Control	126	Yes	Yes	Yes	Yes	Yes
Control	132	Yes	Yes	Yes	Yes	Yes
Control	137	Yes	Yes	Yes	Yes	Yes
Control	138	Yes	Yes	Yes	Yes	Yes
Control	142	Yes	Yes	Yes	Yes	Yes
Control	145	Yes	Yes	Yes	Yes	Yes
Control	157	Yes	Yes	Yes	Yes	Yes
Control	164	No	No	No	No	No
Vaccinated	118	No	No	No	No	No
Vaccinated	130	No	No	No	No	No
Vaccinated	136	No	No	No	No	No
Vaccinated	139	No	No	No	No	No
Vaccinated	141	No	No	No	No	No
Vaccinated	146	No	No	No	No	No
Vaccinated	152	No	No	No	No	No
Vaccinated	153	No	No	No	No	No
Vaccinated	160	No	No	No	No	No
Vaccinated	163	No	No	No	No	No
Vaccinated	174	No	No	No	No	No

Study Type	Efficacy
Pertaining to	Herpes Virus, Bovine [Infectious Bovine Rhinotracheitis (IBR) virus]
Study Purpose	Demonstrate efficacy against respiratory disease caused by IBR virus
Product Administration	
Study Animals	
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	02/06/2001

Study Type	Efficacy
Pertaining to	Bovine herpesvirus 1 [Infectious Bovine Rhinotracheitis (IBR) Virus]
Study Purpose	Demonstrate efficacy against abortion caused by IBR virus
Product Administration	Two doses, three weeks apart, administered subcutaneously (SC) prior to breeding
Study Animals	15 vaccinated, and 15 control cows
Challenge Description	Bovine herpesvirus 1, Cooper strain, administered 216 days after vaccination
Interval observed after challenge	Dams were followed through calving. All calves, including aborted, stillborn, and neonatal calves were evaluated for weakness and bovine herpesvirus 1 isolation.
Results	Abortions attributable to bovine herpesvirus 1 infection was the efficacy variable. Number of abortions: Controls: 11/12 (92%) Vaccinated: 1/13 (8%) See individual data attached.
USDA Approval Date	02/06/2001

Aborted Calves Summary

Controls

Animal	Abortion
520	Yes
528	Yes
529	Yes
567	Yes
742	Yes
764	Yes
797	Yes
811	No
838	Yes
846	Yes
972	Yes
978	Yes

Vaccinates

Animal	Abortion
509	Yes
552	No
555	No
564	No
587	No
589	No
739	No
775	No
812	No
845	No
966	No
981	No
1021	No

Study Type	Efficacy
Pertaining to	*Leptospira interrogans* serovar c*anicola* (*L canicola*)
Study Purpose	Demonstration of efficacy against leptospirosis caused by *L. canicola*
Product Administration	One dose administered intramuscularly
Study Animals	15 Calves approximately 6 months of age; 10 vaccinates and 5 controls. All animals were seronegative for *Leptospira canicola, icterohaemorrhagiae, hardjo, grippotyphosa, pomona*.
Challenge Description	Animals were challenged 3 weeks following vaccination.
Interval observed after challenge	Animals were observed post challenge for 8 days. Body temperatures and blood samples were collected daily.
Results	Leptospira Isolation Results in Blood: Controls: 5/5 (100%) positive Vaccinates: 0/10 (0%) positive Temperature Results: Controls: 5/5 (100%) positive Vaccinates: 0/10 (0%) positive See the following tables for individual raw data
USDA Approval Date	09/13/1977

Blood culture for isolation of Leptospires:

Treatment Group	Animal ID	Study Day (Challenge was on Day 0)							
		1	2	3	4	5	6	7	8
CONTROLS	45	+	+	+	-	-	-	-	-
	68	+	+	-	-	-	-	-	-
	75	+	+	+	-	-	-	-	-
	86	+	+	-	-	-	-	-	-
	106	+	+	+	-	-	-	-	-
VACCINATES	39	-	-	-	-	-	-	-	-
	57	-	-	-	-	-	-	-	-
	63	-	-	-	-	-	-	-	-
	67	-	-	-	-	-	-	-	-
	82	-	-	-	-	-	-	-	-
	85	-	-	-	-	-	-	-	-
	92	-	-	-	-	-	-	-	-
	99	-	-	-	-	-	-	-	-
	103	-	-	-	-	-	-	-	-
	104	-	-	-	-	-	-	-	-

+: Leptopires detected; -: Leptopires not detected

Temperature in ºF:

Treatment Group	Animal ID	Study Day (Challenge was on Day 0)								
		0	1	2	3	4	5	6	7	8
CONTROLS	45	102.4	101.0	104.4	107.2	106.2	103.6	103.8	101.6	100.8
	68	102.2	102.0	106.6	106.8	103.6	101.2	102.8	101.0	100.6
	75	102.0	102.0	102.0	106.6	106.4	101.4	101.6	101.6	101.8
	86	102.4	103.4	105.6	106.4	105.2	101.8	102.4	102.0	102.0
	106	102.0	102.0	104.0	104.8	104.4	102.8	101.6	101.4	101.0
VACCINATES	39	102.2	101.6	102.0	102.0	102.0	102.0	102.6	103.0	102.2
	57	101.2	102.0	101.4	101.0	101.0	100.2	100.8	100.8	100.2
	63	101.6	101.0	101.0	100.8	100.6	100.4	101.0	101.0	101.4
	67	102.0	102.0	101.6	101.0	101.4	101.8	101.8	101.6	102.0
	82	102.4	102.4	101.6	100.8	101.4	101.0	101.8	102.2	100.2
	85	100.8	102.8	101.4	100.4	100.6	100.2	100.6	101.0	100.8
	92	102.0	101.6	101.0	100.6	100.8	100.0	101.4	101.6	101.2
	99	102.0	102.0	101.4	101.8	102.0	101.4	101.6	101.6	100.6
	103	102.8	102.0	102.0	101.4	100.8	100.0	101.0	101.0	100.8
	104	101.8	101.6	102.0	101.2	101.2	101.2	101.4	101.4	100.6

Temperature >103 ºF was considered as pyrexia

Study Type	Efficacy
Pertaining to	*Leptospira interrogans* serovar *grippotyphosa* (*L Grippotyphosa*)
Study Purpose	Demonstration of efficacy against leptospirosis caused by *L. Grippotyphosa*
Product Administration	One dose
Study Animals	15 Calves; 10 vaccinates and 5 controls. All animals were seronegative for *Leptospira Grippotyphosa, hardjo, pomona*.
Challenge Description	Animals were challenged 8 weeks following vaccination.
Interval observed after challenge	Animals were observed for 8 days post challenge. Body temperatures and blood samples were collected daily.
Results	Leptospira Isolation Results in Blood: Controls: 5/5 (100%) positive Vaccinates: 0/10 (0%) positive Temperature Results: Controls: 5/5 (100%) positive Vaccinates: 0/10 (0%) positive See the following tables for individual raw data
USDA Approval Date	12/09/1975

Blood culture for isolation of Leptospires:

Treatment Group	Animal ID	Study Day (Challenge was on Day 0)							
		1	2	3	4	5	6	7	8
CONTROLS	161	+	+	+	+	+	-	-	-
	164	+	+	+	+	-	-	-	-
	165	+	+	+	+	-	-	-	-
	241	+	+	-	-	-	-	-	-
	248	+	+	+	-	-	-	-	-
VACCINATES	130	-	-	-	-	-	-	-	-
	137	-	-	-	-	-	-	-	-
	143	-	-	-	-	-	-	-	-
	145	-	-	-	-	-	-	-	-
	155	-	-	-	-	-	-	-	-
	247	-	-	-	-	-	-	-	-
	250	-	-	-	-	-	-	-	-
	255	-	-	-	-	-	-	-	-
	260	-	-	-	-	-	-	-	-
	261	-	-	-	-	-	-	-	-

+: Leptospires detected; -: Leptospires not detected

Temperature in ºF:

Treatment Group	Animal ID	Study Day (Challenge was on Day 0)								
		0	1	2	3	4	5	6	7	8
CONTROLS	161	101.6	102.4	102.2	105.4	104.8	104.4	99.4	100.6	102.8
	164	101.4	101.8	105.8	104.6	106.4	103.6	101.4	101.4	101.4
	165	102.0	102.6	102.2	104.0	104.4	104.8	101.8	102.2	102.0
	241	102.2	101.8	101.2	105.4	103.8	104.2	100.4	101.0	101.2
	248	101.6	100.4	101.8	106.0	104.4	103.6	101.0	101.2	101.6
101.4VACCINATES	130	102.0	102.0	102.0	102.4	101.6	101.4	100.2	101.4	101.8
	137	101.6	101.8	101.8	102.0	101.8	101.4	100.6	100.8	101.0
	143	102.0	101.8	101.8	101.8	102.4	101.8	100.4	99.8	101.2
	145	102.0	101.4	101.4	101.8	102.4	101.6	99.6	101.2	101.4
	155	102.2	102.0	102.0	102.4	102.2	101.2	100.0	100.4	100.8
	247	101.4	100.8	101.6	101.6	101.6	101.8	100.0	100.6	100.8
	250	101.8	102.0	102.2	101.4	101.6	101.6	101.2	101.4	101.8
	255	102.4	101.8	101.8	102.6	102.2	102.4	101.8	102.0	101.4
	260	102.0	102.6	102.8	102.4	102.0	101.6	100.0	101.2	101.2
	261	102.2	100.6	101.2	101.4	101.4	101.0	100.2	100.4	100.6

Temperature >103.5 ºF was considered as pyrexia

<table>
<tr><td>Study Type</td><td>Efficacy</td></tr>
<tr><td>Pertaining to</td><td>Leptospira hardjo (L. hardjo)</td></tr>
<tr><td>Study Purpose</td><td>Demonstrate efficacy against leptospirosis caused by L. hardjo</td></tr>
<tr><td>Product Administration</td><td>One dose</td></tr>
<tr><td>Study Animals</td><td>Sera (pre-vaccination and 3 weeks post-vaccination, 1:4 diluted and undiluted) from 20 vaccinated cattle were obtained and were administered intraperitoneally to hamsters. Four hamsters were used for each sera..</td></tr>
<tr><td>Challenge Description</td><td>Hamsters were challenged with a virulent L. hardjo inoculate one day post administration of cattle sera.</td></tr>
<tr><td>Interval observed after challenge</td><td>Hamsters were humanely euthanized 14 days post challenge and kidneys examined for L. hardjo culture.</td></tr>
<tr><td>Results</td><td><u>L. hardjo Isolation in Hamster Kidneys Summary:</u>

<table>
<tr><th>Cattle Sera</th><th>Hamsters Positive for L. hardjo / Tested (%)</th></tr>
<tr><td>Pre vaccination</td><td>76/80 (95%)</td></tr>
<tr><td>1:4 dilution Post-vaccination</td><td>50/80 (62.5%)</td></tr>
<tr><td>Undiluted Post-vaccination</td><td>25/80 (31.25%)</td></tr>
</table>

See table for individual data</td></tr>
<tr><td>USDA Approval Date</td><td>08/22/1978</td></tr>
</table>

Bovine Serological Titers and Hamster Passive protection testing:

Cattle ID	Bovine Serological Titers		Hamster Kidney Isolations Positive / Total
354	Pre vaccination	-	4/4
	1:4 dilution		1/4
	Undiluted	64	0/4
355	Pre vaccination	-	4/4
	1:4 dilution		4/4
	Undiluted	4	1/4
358	Pre vaccination	-	3/4
	1:4 dilution		4/4
	Undiluted	16	2/4
359	Pre vaccination	-	4/4
	1:4 dilution		4/4
	Undiluted	32	0/4
390	Pre vaccination	-	4/4
	1:4 dilution		3/4
	Undiluted	8	3/4
361	Pre vaccination	-	4/4
	1:4 dilution		1/4
	Undiluted	64	1/4
375	Pre vaccination	-	3/4
	1:4 dilution		1/4
	Undiluted	128	1/4
376	Pre vaccination	-	4/4
	1:4 dilution		2/4
	Undiluted	128	0/4
381	Pre vaccination	-	4/4
	1:4 dilution		3/4
	Undiluted	16	3/4
382	Pre vaccination	-	4/4
	1:4 dilution		2/4
	Undiluted	32	0/4
357	Pre vaccination	4	4/4
	1:4 dilution		3/4
	Undiluted	32	3/4
386	Pre vaccination	-	4/4
	1:4 dilution		3/4
	Undiluted	32	2/4
389	Pre vaccination	-	4/4
	1:4 dilution		0/4
	Undiluted	32	0/4

394	Pre vaccination	-	4/4
	1:4 dilution		3/4
	Undiluted	16	1/4
No Ears	Pre vaccination	-	4/4
	1:4 dilution		3/4
	Undiluted	64	0/4
424	Pre vaccination	-	4/4
	1:4 dilution		3/4
	Undiluted	32	1/4
426	Pre vaccination	-	4/4
	1:4 dilution		3/4
	Undiluted	16	2/4
427	Pre vaccination	-	4/4
	1:4 dilution		4/4
	Undiluted	16	2/4
435	Pre vaccination	-	3/4
	1:4 dilution		0/4
	Undiluted	256	1/4
438	Pre vaccination	-	3/4
	1:4 dilution		3/4
	Undiluted	32	2/4

1:4 dilution Post-vaccination
Undiluted Post-vaccination
- is Negative

Study Type	Efficacy
Pertaining to	*Leptospira interrogans* serovar icterohaemorrhagiae (*L. icterohaemorrhagiae*)
Study Purpose	Demonstration of efficacy against leptospirosis caused by *L. icterohaemorrhagiae*
Product Administration	One dose administered intramuscularly
Study Animals	15 Calves approximately 6 months of age; 10 vaccinates and 5 controls. All animals were seronegative for *Leptospira canicola, icterohaemorrhagiae, hardjo, grippotyphosa, pomona*.
Challenge Description	Animals were challenged 7 weeks following vaccination.
Interval observed after challenge	Animals were observed for 8 days post challenge. Body temperatures and blood samples were collected daily.
Results	Leptospira Isolation Results in Blood: Controls: 4/5 (80 %) positive Vaccinates: 0/10 (0 %) positive Temperature Results: Controls: 5/5 (100 %) positive Vaccinates: 0/10 (0 %) positive See the following tables for individual raw data
USDA Approval Date	09/13/1977

Blood culture for isolation of Leptospires:

Treatment Group	Animal ID	Study Day (Challenge was on Day 0)							
		1	2	3	4	5	6	7	8
CONTROLS	66	+	+	-	-	-	-	-	-
	71	+	+	-	-	-	-	-	-
	79	+	+	+	-	-	-	-	-
	113	+	+	-	-	-	-	-	-
	120	-	-	-	-	-	-	-	-
VACCINATES	58	-	-	-	-	-	-	-	-
	69	-	-	-	-	-	-	-	-
	80	-	-	-	-	-	-	-	-
	102	-	-	-	-	-	-	-	-
	107	-	-	-	-	-	-	-	-
	114	-	-	-	-	-	-	-	-
	121	-	-	-	-	-	-	-	-
	122	-	-	-	-	-	-	-	-
	124	-	-	-	-	-	-	-	-
	128	-	-	-	-	-	-	-	-

+: Leptopires detected; -: Leptopires not detected

Temperature in ºF:

Treatment Group	Animal ID	Study Day (Challenge was on Day 0)								
		0	1	2	3	4	5	6	7	8
CONTROLS	66	101.0	103.6	104.8	101.0	100.8	101.2	100.0	100.4	101.0
	71	101.0	104.0	102.0	102.2	101.8	101.4	100.4	102.0	101.4
	79	101.6	103.0	104.8	103.0	102.4	102.0	102.0	101.8	102.4
	113	101.4	104.4	104.2	102.8	100.8	100.2	101.0	101.2	101.4
	120	100.0	105.4	103.0	102.6	102.0	101.2	100.6	101.0	100.8
VACCINATES	58	99.8	101.6	101.4	101.4	101.8	101.6	101.0	101.2	102.4
	69	101.0	100.2	102.4	102.4	102.0	101.2	101.2	101.2	101.6
	80	101.4	101.8	101.4	101.0	102.0	101.6	100.6	101.0	101.6
	102	101.2	101.6	101.4	102.0	102.0	100.6	101.4	101.0	102.0
	107	101.2	102.0	101.8	99.8	101.8	101.0	100.8	101.6	101.4
	114	101.0	101.8	101.6	101.6	101.6	102.0	101.0	101.4	101.4
	121	101.4	101.8	102.0	101.8	101.8	101.4	102.0	101.2	102.2
	122	101.2	100.4	101.8	102.0	101.6	101.6	101.8	101.8	101.4
	124	101.4	101.4	101.4	101.0	101.6	100.8	101.0	101.2	101.8
	128	101.2	101.4	101.2	101.4	102.4	101.4	100.8	102.2	101.2

Temperature >103 ºF was considered as pyrexia

Study Type	Efficacy
Pertaining to	*Leptospira interrogans* serovar p*omona* (*L pomona*)
Study Purpose	Demonstration of efficacy against leptospirosis caused by *L. Pomona*
Product Administration	One dose
Study Animals	15 Calves; 10 vaccinates and 5 controls. All animals were seronegative for *Leptospira grippotyphosa, hardjo, pomona*.
Challenge Description	Animals were challenged 5 weeks following vaccination.
Interval observed after challenge	Animals were observed for 8 days post challenge. Body temperatures and blood samples were collected daily.
Results	Leptospira Isolation Results in Blood: Controls: 5/5 (100%) positive Vaccinates: 0/10 (0%) positive Temperature Results: Controls: 5/5 (100%) positive Vaccinates: 0/10 (0%) positive See the following tables for individual raw data
USDA Approval Date	12/09/1975

Blood culture for isolation of Leptospires:

Treatment Group	Animal ID	Study Day (Challenge was on Day 0)							
		1	2	3	4	5	6	7	8
CONTROLS	159	+	+	+	+	-	-	-	-
	163	+	+	+	-	-	-	-	-
	244	+	+	+	-	-	-	-	-
	252	+	+	+	-	-	-	-	-
	265	+	+	+	-	-	-	-	-
VACCINATES	134	-	-	-	-	-	-	-	-
	135	-	-	-	-	-	-	-	-
	142	-	-	-	-	-	-	-	-
	149	-	-	-	-	-	-	-	-
	151	-	-	-	-	-	-	-	-
	242	-	-	-	-	-	-	-	-
	245	-	-	-	-	-	-	-	-
	246	-	-	-	-	-	-	-	-
	257	-	-	-	-	-	-	-	-
	262	-	-	-	-	-	-	-	-

+: Leptospires detected; -: Leptospires not detected

Temperature in ºF:

Treatment Group	Animal ID	Study Day (Challenge was on Day 0)								
		0	1	2	3	4	5	6	7	8
CONTROLS	159	102.6	102.2	104.6	105.8	106.2	103.4	100.8	102.0	102.8
	163	102.6	102.2	105.6	106.0	106.6	103.2	101.0	103.0	102.6
	244	101.6	102.2	103.2	104.6	103.8	102.4	101.8	101.8	102.4
	252	102.6	102.4	103.0	107.4	104.6	103.0	102.2	103.0	103.0
	265	101.8	102.8	103.6	106.4	105.6	103.0	102.0	103.8	102.0
101.4VACCINATES	134	102.2	101.4	101.6	101.6	102.0	102.2	101.4	102.0	103.0
	135	102.6	102.6	102.6	102.4	103.2	102.8	102.0	102.8	102.4
	142	102.6	102.6	101.6	102.0	102.0	102.8	99.8	102.2	102.6
	149	102.4	102.0	102.6	102.0	101.6	102.0	101.6	102.0	102.4
	151	101.6	101.4	102.0	101.4	101.4	101.6	101.4	102.2	101.8
	242	101.6	101.2	101.6	102.0	101.6	102.0	100.8	101.4	101.0
	245	102.8	102.6	102.4	102.0	101.8	102.6	101.0	102.6	102.8
	246	102.4	101.6	102.0	102.0	102.2	102.6	101.0	102.0	102.6
	257	102.2	101.6	101.0	101.6	102.0	101.6	101.2	101.6	101.0
	262	102.6	102.0	101.0	102.0	101.6	101.8	101.0	102.6	101.4

Temperature >103.5 ºF was considered as pyrexia

Study Type	Efficacy
Pertaining to	Bovine Parainfluenza type 3 Virus (PI_3)
Study Purpose	Demonstrate efficacy against respiratory disease caused by PI_3
Product Administration	
Study Animals	
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	02/06/2001

Study Type	Efficacy
Pertaining to	Bovine Respiratory Syncytial Virus (BRSV)
Study Purpose	Demonstrate efficacy against respiratory disease caused by BRSV
Product Administration	
Study Animals	
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	02/06/2001

<table>
<tr><td>Study Type</td><td>Safety</td></tr>
<tr><td>Pertaining to</td><td>ALL</td></tr>
<tr><td>Study Purpose</td><td>Demonstrate safety in non-pregnant and pregnant cattle under field conditions</td></tr>
<tr><td>Product Administration</td><td>Two doses, three weeks apart, administered subcutaneously (SC)</td></tr>
<tr><td>Study Animals</td><td>109 vaccinated, including 79 vaccinated pregnant cows and heifers (1st trimester)</td></tr>
<tr><td>Challenge Description</td><td>NA</td></tr>
<tr><td>Interval observed after challenge</td><td>Animals were observed approximately four hours post-vaccination and monitored daily until 21 days after the second vaccination. Pregnancy evaluations were performed on days 0 and 42. Injection sites were observed on day 21 and 42.</td></tr>
<tr><td>Results</td><td><u>Adverse Events</u>

<table>
<tr><th></th><th>Normal</th><th>Ataxia</th><th>Hypersalivation</th><th>Recumbency</th><th>Respiratory Distress</th></tr>
<tr><td>Vaccinates</td><td>109</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
</table>

<u>Pregnancy Evaluation</u>

<table>
<tr><th></th><th>Pregnant</th><th>Not Pregnant</th></tr>
<tr><td>Vaccinates</td><td>79</td><td>0</td></tr>
</table>

<u>Injection Site Reactions</u>

<table>
<tr><th></th><th>Day 21</th><th>Day 42</th></tr>
<tr><td>Vaccinates</td><td>0</td><td>0</td></tr>
</table>
</td></tr>
<tr><td>USDA Approval Date</td><td>04/23/2004</td></tr>
</table>

<table>
<tr><td>Study Type</td><td>Safety</td></tr>
<tr><td>Pertaining to</td><td>ALL</td></tr>
<tr><td>Study Purpose</td><td>Demonstrate safety in non-pregnant and pregnant cattle under field conditions</td></tr>
<tr><td>Product Administration</td><td>Two doses, three weeks apart, administered subcutaneously (SC)</td></tr>
<tr><td>Study Animals</td><td>112 vaccinated, including 57 vaccinated pregnant cows and heifers (1st trimester) and 22 vaccinated pregnant cows and heifers (2nd trimester)</td></tr>
<tr><td>Challenge Description</td><td>NA</td></tr>
<tr><td>Interval observed after challenge</td><td>Animals were observed approximately four hours post-vaccination and monitored daily until 21 days after the second vaccination. Pregnancy evaluations were performed on days 0 and 42. Injection sites were observed on day 21 and 42.</td></tr>
<tr><td>Results</td><td><u>Adverse Events</u>

<table>
<tr><td></td><td>Normal</td><td>Ataxia</td><td>Hypersalivation</td><td>Recumbency</td><td>Respiratory Distress</td></tr>
<tr><td>Vaccinates</td><td>112</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
</table>

<u>Pregnancy Evaluation</u>

<table>
<tr><td></td><td>Pregnant</td><td>Not Pregnant</td></tr>
<tr><td>Vaccinates</td><td>79</td><td>0</td></tr>
</table>

<u>Injection Site Reactions</u>

<table>
<tr><td></td><td>Day 21</td><td>Day 42</td></tr>
<tr><td>Vaccinates</td><td>0</td><td>0</td></tr>
</table>
</td></tr>
<tr><td>USDA Approval Date</td><td>04/23/2004</td></tr>
</table>

<table>
<tr><td>Study Type</td><td>Safety</td></tr>
<tr><td>Pertaining to</td><td>ALL</td></tr>
<tr><td>Study Purpose</td><td>Demonstrate safety in non-pregnant and pregnant cattle under field conditions</td></tr>
<tr><td>Product Administration</td><td>Two doses, three weeks apart, administered subcutaneously (SC)</td></tr>
<tr><td>Study Animals</td><td>120 vaccinated animals, including 30 vaccinated pregnant cows (3rd trimester)</td></tr>
<tr><td>Challenge Description</td><td>NA</td></tr>
<tr><td>Interval observed after challenge</td><td>Animals were observed approximately four hours post-vaccination and monitored daily until 21 days after the second vaccination. Pregnancy evaluations were performed on days 0 and 42. Injection sites were observed on day 21 and 42.</td></tr>
<tr><td>Results</td><td><u>Adverse Events</u>

<table>
<tr><td></td><td>Normal</td><td>Ataxia</td><td>Hypersalivation</td><td>Recumbency</td><td>Respiratory Distress</td></tr>
<tr><td>Vaccinates</td><td>120</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
</table>

<u>Pregnancy Evaluation</u>

<table>
<tr><td></td><td>Pregnant*</td><td>Not Pregnant</td></tr>
<tr><td>Vaccinates</td><td>25</td><td>0</td></tr>
</table>
*Five animals calved normally prior to the conclusion of the study.

<u>Injection Site Reactions</u>

<table>
<tr><td></td><td>Day 21</td><td>Day 42</td></tr>
<tr><td>Vaccinates</td><td>4</td><td>3</td></tr>
</table>
Swellings were observed on Day 21 and Day 42</td></tr>
<tr><td>USDA Approval Date</td><td>04/23/2004</td></tr>
</table>