Summary of Studies Supporting USDA Product Licensure

Establishment Name	Zoetis Inc.
USDA Vet Biologics Establishment Number	190
Product Code	1081.02
True Name	Bordetella Bronchiseptica Vaccine, Avirulent Live Culture
Tradename(s) / Distributor or Subsidiary (if different from manufacturer)	Vanguard Intranasal Rapid RESP B - No distributor specified Vanguard Intranasal Rapid RESP B SF - No distributor specified
Date of Compilation Summary	December 07, 2017

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>Bordetella bronchiseptica (B. bronchiseptica)</td></tr>
<tr><td>Study Purpose</td><td>To demonstrate effectiveness against B. bronchiseptica infection one year after vaccination</td></tr>
<tr><td>Product Administration</td><td>One dose, administered intranasally</td></tr>
<tr><td>Study Animals</td><td>Study involved 16 vaccinated and 16 control puppies, 8 weeks of age</td></tr>
<tr><td>Challenge Description</td><td>Challenged with B. bronchiseptica, one year after vaccination</td></tr>
<tr><td>Interval observed after challenge</td><td>After challenge, dogs were observed daily 28 days post-challenge.</td></tr>
<tr><td>Results</td><td>Number of days of coughing
Five number summary (Q=quartile)
<table>
<tr><th>Treatment</th><th colspan="5">Number of Days Animal Coughed</th></tr>
<tr><th></th><th>Min</th><th>Q1</th><th>Median</th><th>Q3</th><th>Max</th></tr>
<tr><td>Control</td><td>4.0</td><td>10.0</td><td>18.0</td><td>25.5</td><td>28.0</td></tr>
<tr><td>Vaccine</td><td>0.0</td><td>1.5</td><td>4.0</td><td>9.5</td><td>20.0</td></tr>
</table>
If coughing was observed at either of the two daily observation periods on a day, that day was positive for coughing.

The raw data is shown on the attached page</td></tr>
<tr><td>USDA Approval Date</td><td>June 20, 2014</td></tr>
</table>

Table 3: Individual Animal Data for Coughing Post-challenge

Animal	QHB-2	QEA-2	QDA-2	QBB-2	PFB-2	PEB-2	OBA-2	OAB-2	LWA-2	LUB-2	LTB-2	LSA-2	LQB-2	LPA-2	LLA-2	LIB-2	QIB-2	QFA-2	QCB-2	QAB-2	PDB-2	PCB-2	ODA-2	OCA-2	LXA-2	LVA-2	LRA-2	LQA-2	LKB-2	LJB-2	LHA-2	LGA-2
Trt	Vaccinates																Controls																
Day 370	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	2	0	0
	0	0	0	0	0	0	0	0	2	0	0	2	0	0	0	0	1	0	0	0	0	2	0	0	0	0	1	0	0	2	0	2
Day 371 AM	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	2	0	2	0	0	0
Day 371 PM	0	0	0	1	0	0	0	0	0	0	0	0	0	2	0	0	0	0	1	0	0	2	0	0	0	0	2	0	0	2	0	1
Day 372 AM	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2	0	0	2	0	0
Day 372 PM	0	0	0	0	0	0	1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2	0	0	2	0	0
Day 373 AM	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	2	0	0	1	0	0	0	0	2	0	0	2	0	0
Day 373 PM	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	2	0	0	2	0	0	0	0	2	0	0	1	0	0
Day 374 AM	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	2	0	2	0	0	2	0	0	0	0	2	0	0	2	0	0
Day 374 PM	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	2	0	2	0	0	2	2	2	1	1	2	0	2
Day 375 AM	0	2	0	0	0	0	0	0	1	0	2	0	0	2	0	0	2	0	2	2	0	2	0	2	2	0	2	0	2	2	0	2
Day 375 PM	0	0	0	0	0	0	0	0	2	0	0	2	0	0	2	0	2	0	2	2	2	2	0	2	2	0	2	0	2	2	0	2
Day 376 AM	0	0	1	0	0	0	0	0	2	0	0	0	0	0	1	0	2	0	2	2	2	2	1	2	0	2	2	0	2	2	1	1
Day 376 PM	1	0	0	0	2	0	0	0	1	0	0	0	0	0	1	0	2	0	2	2	2	2	2	2	0	2	2	0	2	2	0	2
Day 377 AM	0	0	0	0	0	0	0	0	2	0	0	0	0	0	2	0	0	0	2	2	0	2	2	2	1	2	2	0	2	2	0	2
Day 377 PM	0	0	2	0	0	0	1	0	2	0	0	0	0	0	0	0	0	2	2	2	2	2	2	2	2	2	2	1	0	2	0	2
Day 378 AM	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	2	2	2	2	0	2	2	2	0	0	2	0	2
Day 378 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	1	2	1	1	0	2	2	0	0	2	1	2
Day 379 AM	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	2	0	1	2	1	0	1	2	2	1	0	2	0	2
Day 379 PM	0	0	0	0	0	0	0	1	1	0	0	0	0	0	1	0	1	0	2	2	2	2	1	0	2	2	2	0	1	2	0	2
Day 380 AM	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	2	0	2	2	1	1	0	2	2	0	2	2	0	2
Day 380 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	2	0	1	2	2	0	0	2	2	1	2
Day 381 AM	0	2	0	0	0	0	0	0	0	0	0	2	0	2	0	0	0	0	2	0	2	2	0	1	2	0	2	0	2	2	0	2
Day 381 PM	0	2	2	0	0	0	0	0	0	0	0	2	0	2	0	0	0	1	0	0	2	2	0	1	2	0	2	0	2	2	0	2
Day 382 AM	0	0	0	0	0	0	0	0	2	0	2	0	0	0	0	0	2	0	2	2	0	2	0	1	1	2	2	0	0	2	0	2
Day 382 PM	0	0	0	0	0	0	0	0	2	0	2	0	0	0	0	0	0	0	2	2	0	2	0	1	0	2	2	0	0	2	0	2
Day 383 AM	0	0	1	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	2	0	2	2	0	2	0	2	2	0	2	2	0	2
Day 383 PM	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	2	0	2	2	0	2	0	1	0	0	2	2	0	2
Day 384 AM	0	0	1	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	2	2	2	2	0	2	0	2	3	1	0	2	0	2
Day 384 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	2	0	2	0	2	2	0	0	2	0	2
Day 385 AM	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	2	0	2	2	0	1	0	2	2	0	0	2	0	2
Day 385 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	2	0	1	0	2	2	0	0	2	0	2
Day 386 AM	0	0	1	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	2	0	2	2	0	2	0	1	2	0	2	2	0	2
Day 386 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	2	0	2	0	1	0	2	2	0	0	2	0	2
Day 387 AM	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	2	0	2	2	0	2	0	2	2	0	2	2	0	2
Day 387 PM	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	2	2	0	2	0	1	0	2	2	0	0	2	0	2
Day 388 AM	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	2	0	2	2	0	1	0	2	2	0	0	2	0	2
Day 388 PM	0	0	2	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	2	2	0	2	0	1	0	2	2	0	0	2	0	2
Day 389 AM	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	2	0	2	2	0	2	0	2	2	0	2	2	0	2
Day 389 PM	0	0	0	0	0	0	2	0	0	0	1	0	0	2	1	0	0	0	2	2	0	2	0	2	0	2	2	0	0	2	0	2
Day 390 AM	0	0	0	0	0	0	2	0	0	0	1	0	0	1	0	0	0	0	2	0	2	2	0	2	0	2	2	0	2	2	0	2
Day 390 PM	0	0	2	0	0	0	2	0	2	0	1	2	0	1	0	0	0	0	2	0	2	2	0	2	0	2	3	1	0	2	0	2
Day 391 AM	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	2	0	1	2	0	2	0	2	2	0	2	2	0	2
Day 391 PM	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	2	0	1	2	0	2	0	2	2	0	2	2	0	2
Day 392 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	1	2	0	2	0	1	0	0	2	2	0	2
Day 392 PM	0	2	0	0	0	0	0	0	2	0	2	0	0	0	0	0	2	0	2	0	2	2	0	2	0	1	0	0	2	2	0	2
Day 393 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	0	1	2	0	2	0	2	2	0	2	2	0	2
Day 393 PM	0	0	0	0	0	0	0	0	0	0	2	0	0	1	0	0	0	0	2	0	2	2	0	2	0	2	2	0	0	2	0	2
Day 394 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	2	0	1	0	1	2	0	2	2	0	2
Day 394 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	2	0	1	2	0	1	0	1	2	0	2	2	0	2
Day 395 AM	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	2	0	1	2	0	2	0	1	2	0	2	2	0	2
Day 395 PM	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	2	0	1	2	0	2	0	1	2	0	2	2	0	2
Day 396 AM	0	0	0	0	0	0	0	0	1	0	1	0	0	0	1	0	0	0	2	0	1	2	0	2	0	1	2	0	2	2	0	2
Day 396 PM	0	0	0	0	0	0	1	0	1	0	0	2	0	0	0	0	0	0	2	0	1	2	0	2	0	2	2	0	2	2	0	2
Day 397 AM	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	2	0	2	2	0	2	0	2	2	0	2	2	0	2
Day 397 PM	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	2	0	2	2	0	2	0	2	2	0	2	2	0	2
Day 398 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	2	0	2	2	0	2	0	2	2	0	1	2	0	2

Key

Trt = treatment 1 = mild cough

2 = moderate cough 3 = severe cough

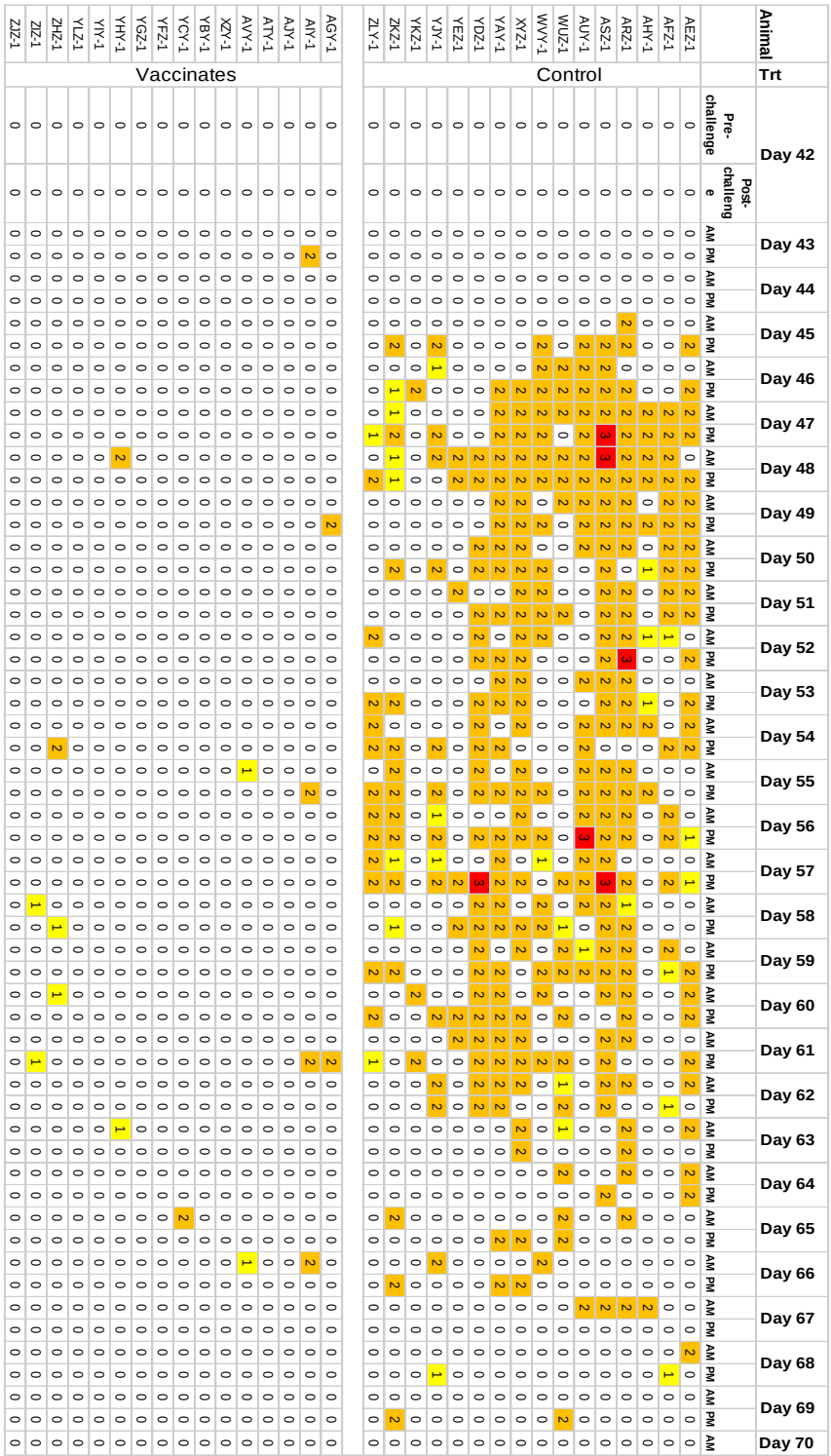
<table>
<tr><td>Study Type</td><td>Efficacy</td></tr>
<tr><td>Pertaining to</td><td>Bordetella bronchiseptica (B. bronchiseptica)</td></tr>
<tr><td>Study Purpose</td><td>To demonstrate efficacy against B. bronchiseptica infection</td></tr>
<tr><td>Product Administration</td><td>One dose, administered intranasally</td></tr>
<tr><td>Study Animals</td><td>Study involved 16 vaccinated and 16 control puppies, 8 weeks of age</td></tr>
<tr><td>Challenge Description</td><td>Challenged with B. bronchiseptica, 42 days after vaccination</td></tr>
<tr><td>Interval observed after challenge</td><td>After challenge, dogs were observed daily for coughing for 28 days</td></tr>
<tr><td>Results</td><td>A dog was considered affected if coughing was observed at least once on 2 or more consecutive days.

Table 1: Clinical Respiratory Sign (Coughing)

<table>
<tr><th rowspan="2">Treatment</th><th rowspan="2">Total</th><th colspan="2">At least 1 day</th><th colspan="2">At least one occurrence of 2 consecutive days</th><th colspan="3">Duration</th></tr>
<tr><th>Positive</th><th>Negative</th><th>Positive</th><th>Negative</th><th>Q1</th><th>Median</th><th>Q3</th></tr>
<tr><td>Control</td><td>16</td><td>16/16 (100%)</td><td>0/16 (0%)</td><td>15/16 (94%)</td><td>1/16 (6%)</td><td>18.5</td><td>22.0</td><td>23.5</td></tr>
<tr><td>Vaccinated</td><td>16</td><td>7/16 (44%)</td><td>9/16 (56%)</td><td>0/16 (0%)</td><td>16/16 (100%)</td><td>0</td><td>0</td><td>9.5</td></tr>
</table>

Please see attached page for individual raw data.</td></tr>
<tr><td>USDA Approval Date</td><td>April 18, 2013</td></tr>
</table>

Table 2: Individual Animal Data of Coughing



Key

Trt = treatment group 1 = mild cough

2 = moderate cough 3 = severe cough

<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>To demonstrate safety under conditions of normal use</td></tr>
<tr><td>Product Administration</td><td>One dose, administered intranasally</td></tr>
<tr><td>Study Animals</td><td>Study involved 674 dogs total, with 239 dogs approximately 7-9 weeks of age and 435 dogs 10 weeks of age or older. Dogs were assigned to one of two lots of vaccine (T01- 309 animals; T02- 305 animals) or to a non-treated control group (T03- 60 animals).</td></tr>
<tr><td>Challenge Description</td><td>N/A</td></tr>
<tr><td>Interval observed after challenge</td><td>Immediate abnormal health events were assessed for approximately 10-15 minutes post-vaccination and late abnormal health events were assessed for 14 days post-vaccination.</td></tr>
<tr><td>Results</td><td>There were no immediate post-vaccination reactions observed in any of the vaccinated groups (T01, T02). There were no abnormal health events associated with the control group (T03).

<u>Frequency Distribution of Late Abnormal Health Events with dogs administered the product (T01 and T02)</u>
<table>
<tr><th>Clinical Signs Associated with Abnormal Health Event †</th><th>Number/Total Number of Animals (%)</th></tr>
<tr><td>Anorexia</td><td>3/614 (0.49%)</td></tr>
<tr><td>Ataxia</td><td>1/614 (0.16%)</td></tr>
<tr><td>Cough*</td><td>7/614 (1.14%)</td></tr>
<tr><td>Cystitis</td><td>2/614 (0.33%)</td></tr>
<tr><td>Dermatitis</td><td>1/614 (0.16%)</td></tr>
<tr><td>Diarrhea</td><td>4/614 (0.65%)</td></tr>
<tr><td>Emesis*</td><td>3/614 (0.49%)</td></tr>
<tr><td>Emesis</td><td>5/614 (0.80%)</td></tr>
<tr><td>Internal ear disorder (head tilt)</td><td>1/614 (0.16%)</td></tr>
<tr><td>Lethargy</td><td>5/614 (0.81%)</td></tr>
<tr><td>Nystagmus</td><td>1/614 (0.16%)</td></tr>
<tr><td>Otitis externa</td><td>2/614 (0.33%)</td></tr>
<tr><td>Pruritis</td><td>1/614 (0.16%)</td></tr>
<tr><td>Pyrexia</td><td>2/614 (0.33%)</td></tr>
<tr><td>Rhinitis</td><td>2/614 (0.33%)</td></tr>
<tr><td>Sneezing*</td><td>8/614 (1.30%)</td></tr>
<tr><td>Urticaria**</td><td>1/614 (0.16%)</td></tr>
</table>
†One dog accounted for the abnormal health events of anorexia, ataxia, head tilt, nystagmus, lethargy, and otitis externa which was affirmed by licensee to not be related to vaccination.
*Mild, transient, and associated with the normal response to vaccination by licensee.</td></tr>
</table>

	**Urticaria occurred six days after administration of the vaccination.
USDA Approval Date	July 09, 2015