Summary of Studies Supporting USDA Product Licensure

Establishment Name	Zoetis Inc.
USDA Vet Biologics Establishment Number	190
Product Code	1081.01
True Name	Bordetella Bronchiseptica Vaccine, Avirulent Live Culture
Tradename(s) / Distributor or Subsidiary (if different from manufacturer)	Vanguard B Oral - No distributor specified Vanguard B Oral SF - No distributor specified Vanguard CC B Oral - Zoetis New Zealand Ltd
Date of Compilation Summary	October 06, 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.

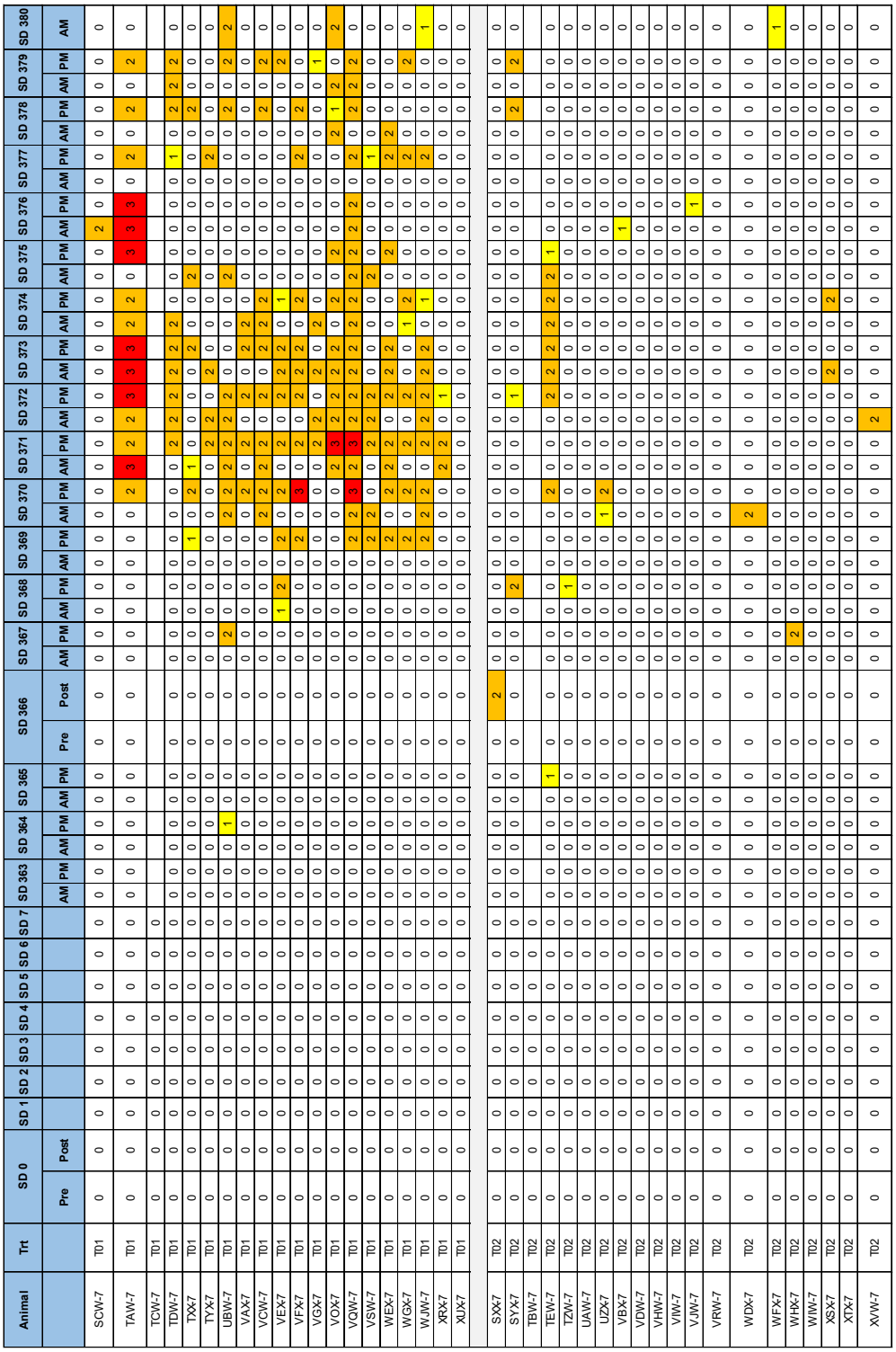
<table>
<tr><td>Study Type</td><td>Efficacy</td></tr>
<tr><td>Pertaining to</td><td>Bordetella bronchiseptica (B. bronchiseptica)</td></tr>
<tr><td>Study Purpose</td><td>Demonstrate efficacy against Bordetella bronchiseptica at 1 year post-vaccination.</td></tr>
<tr><td>Product Administration</td><td>One dose administered orally.</td></tr>
<tr><td>Study Animals</td><td>40 dogs, 7.4 to 8.3 weeks of age, were randomly assigned to either a control group or a vaccinate group (20 animals/group).</td></tr>
<tr><td>Challenge Description</td><td>Animals were challenged with B. bronchiseptica 366 days (1 year and 1 day) post-vaccination.</td></tr>
<tr><td>Interval observed after challenge</td><td>Animals were observed after challenge for 14 days for clinical signs of respiratory disease (cough).</td></tr>
<tr><td>Results</td><td>Two animals were removed from study prior to the challenge phase, one from each treatment group.

Table 1: Frequency Distribution of Cough due to B. bronchiseptica Challenge.

<table>
<tr><th>Treatment Group</th><th>Cough (2 or more consecutive days)*</th></tr>
<tr><td>Control</td><td>17/19 (89.5%)</td></tr>
<tr><td>Vaccinate</td><td>3/19 (15.8%)</td></tr>
</table>
*Dogs were considered to be positive if coughing persisted for 2 or more consecutive days.

Please see raw data on the next page.</td></tr>
<tr><td>USDA Approval Date</td><td>December 5, 2019</td></tr>
</table>

Table 2: Cough Scores Post-Challenge (The score of (0) indicates no cough, (1) mild, (2) moderate, and (3) severe).



Animal	Trt	SD 0		SD 1	SD 2	SD 3	SD 4	SD 5	SD 6	SD 7	SD 363		SD 364		SD 365	SD 366		SD 367		SD 368		SD 369		SD 370		SD 371		SD 372		SD 373		SD 374		SD 375		SD 376		SD 377		SD 378		SD 379		SD 380
		Pre	Post								AM	PM	AM	PM	PM	Pre	Post	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM
SCW-7	T01	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	0	0	2	0	0	0	0	0	0	0	0
TAW-7	T01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	3	2	3	3	2	2	0	3	3	2	0	2	0	2	0	2	0
TCW-7	T01	0	0	0	0	0	0	0	0	0																																
TDW-7	T01	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	0	0	0	0	0	0	0	0	0	0	0
TXX-7	T01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0	2	2	0	0	2	0	0	0	0	0	2	2	0	0
TYX-7	T01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0
UBW-7	T01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	2	2	2	2	0	0	2	0	0	0	0	0	2	2	0	2
VAX-7	T01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	2	2	2	2	2	0	0	0	0	0	0	0	0	0	0	0
VCW-7	T01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	2	2	2	2	1	0	0	0	0	0	0	0	0	0	0	0
VEX-7	T01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	2	2	0	2	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0
VFX-7	T01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	3	0	2	2	2	2	0	0	0	0	0	0	0	0	0	0	0
VGX-7	T01	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	2	2	2	2	0	0	0	0	0	0	0	0	1	0	0	0
VOX-7	T01	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	2	3	2	2	0	0	0	0	0	0	2	1	2	0	2	0
VQW-7	T01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	3	2	2	2	2	2	0	0	0	0	0	2	0	2	2	2	0
VSW-7	T01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WEX-7	T01	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	2	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0
WGX-7	T01	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	2	2	2	2	1	0	0	0	0	0	0	0	0	0	0	0
WJW-7	T01	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	2	2	2	2	0	0	0	0	0	0	0	0	0	0	0	1
XRX-7	T01	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	2	2	2	1	0	0	0	0	0	0	0	0	0	0	0	0
XUX-7	T01	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	0	0	0	0	0	0	0	0	0	0	0
SXX-7	T02	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
SYX-7	T02	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	1	0	0	0	0	0	0	0	0	2	0	0	0
TBW-7	T02	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	0	0	0	0	0	0	0	0	0	0	0
TEW-7	T02	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	2	0	0	0	0	0	2	2	1	0	0	0	0	0	0	0	0	0	0
TZW-7	T02	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
UAW-7	T02	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	0	0	0	0	0	0	0	0	0	0	0
UZX-7	T02	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
VBX-7	T02	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	0	0	1	0	0	0	0	0	0	0	0
VDW-7	T02	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	0	0	0	0	0	0	0	0	0	0	0
VHW-7	T02	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	0	0	0	0	0	0	0	0	0	0	0
VIW-7	T02	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	0	0	0	0	0	0	0	0	0	0	0
VJW-7	T02	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	0	0	0	1	0	0	0	0	0	0	0
VRW-7	T02	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	0	0	0	0	0	0	0	0	0	0	0
WDX-7	T02	0	0	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	0	0	0	0	0	0	0	0	0	0
WFX-7	T02	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	0	0	0	0	0	0	0	0	0	1	0
WHK-7	T02	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	0	0	0	0	0	0	0	0	0	0	0
WIW-7	T02	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	0	0	0	0	0	0	0	0	0	0	0
XSX-7	T02	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	0	0	0	0	0	0	0	0	0	0	0
XTX-7	T02	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	0	0	0	0	0	0	0	0	0	0	0
XVW-7	T02	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	2	0	0	0	0	0	0	0	0	0	0	0	0

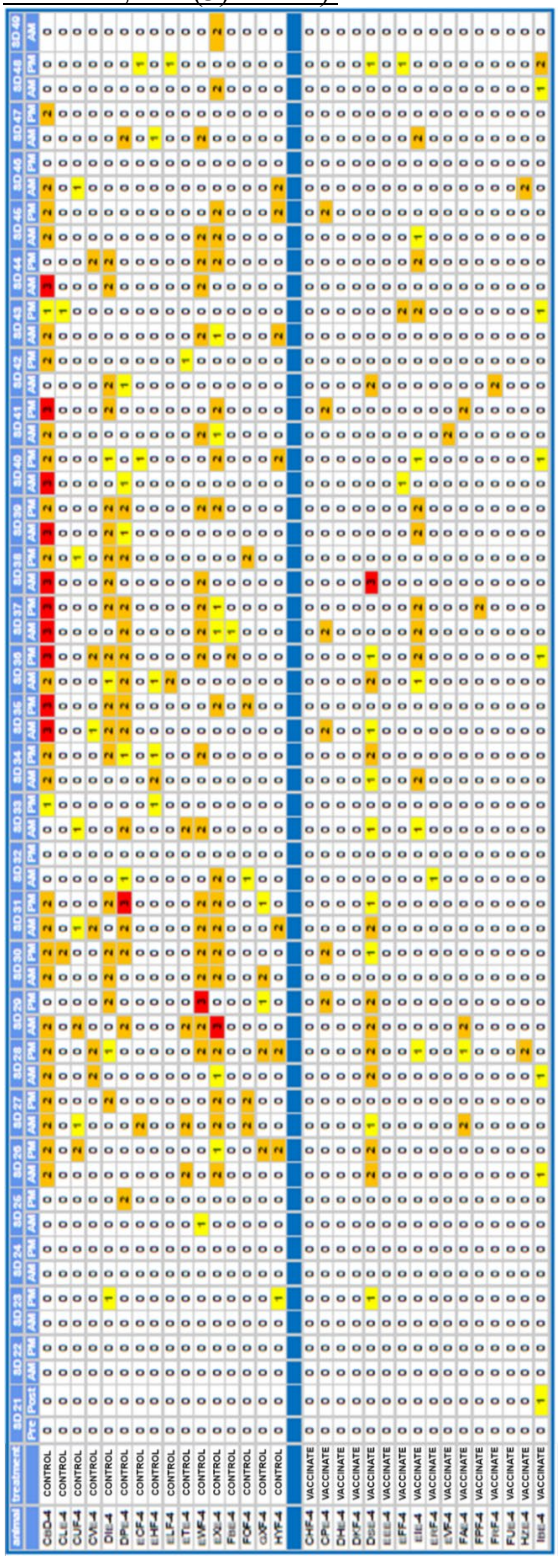
Trt = Treatment Group; T01 = Control; T02 = *Bordetella bronchiseptica* Oral Vaccine; SD = Study Day

<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>Demonstrate efficacy against respiratory disease due to Bordetella bronchiseptica</td></tr>
<tr><td>Product Administration</td><td>One dose administered orally.</td></tr>
<tr><td>Study Animals</td><td>32 dogs, 53 to 59 days of age, were randomly assigned to either a control group or a vaccinate group (16 animals/group).</td></tr>
<tr><td>Challenge Description</td><td>Animals were challenged with B. bronchiseptica 3 weeks post-vaccination.</td></tr>
<tr><td>Interval observed after challenge</td><td>Animals were observed twice daily for 28 days for clinical signs of respiratory disease (cough).</td></tr>
<tr><td>Results</td><td>Table 1: Frequency Distribution of Cough due to B. bronchiseptica Challenge

<table>
<tr><th>Treatment Group</th><th>Cough (2 or more consecutive days)*</th></tr>
<tr><td>Control</td><td>12/16 (75%)</td></tr>
<tr><td>Vaccinate</td><td>4/16 (25%)</td></tr>
</table>
*Dogs were considered to be positive if coughing persisted for 2 or more consecutive days.

Please see attached pages for individual animal data.</td></tr>
<tr><td>USDA Approval Date</td><td>July 15, 2015</td></tr>
</table>

Table 2: Cough Scores Post-Challenge (The score of (0) indicates no cough, (1) mild, (2) moderate, and (3) severe).



SD = Study Day

<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 evaluate safety under typical field conditions.</td></tr>
<tr><td>Product Administration</td><td>One dose, administered orally.</td></tr>
<tr><td>Study Animals</td><td>321 dogs, at minimum age (7-9 weeks; 120 animals) and ≥10 weeks of age (201 animals), were tested at 12 distinct veterinary practices representing 4 different geographical regions.</td></tr>
<tr><td>Challenge Description</td><td>N/A</td></tr>
<tr><td>Interval observed after challenge</td><td>No challenge. Animals were observed for 10-15 minutes for any immediate post-vaccination reactions. Additionally, animals were observed for 14 days post-vaccination for any abnormal health events.</td></tr>
<tr><td>Results</td><td>All enrolled animals completed this study.

Immediate post-vaccination events only included vomiting in one of the 201 ≥10 weeks of age animals (0.5%).

<u>Table 1: Frequency Distribution of Late Abnormal Health Events</u>
<table>
<tr><th>Age</th><th>Clinical Signs</th><th>Number/Total (%)</th></tr>
<tr><td rowspan="10">Minimum Age (7-9 weeks)</td><td>Alopecia</td><td>1/120 (0.83%)</td></tr>
<tr><td>Anorexia</td><td>1/120 (0.83%)</td></tr>
<tr><td>Dermatitis/eczema</td><td>1/120 (0.83%)</td></tr>
<tr><td>Diarrhea</td><td>7/120 (5.83%)</td></tr>
<tr><td>Vomiting</td><td>2/120 (1.67%)</td></tr>
<tr><td>Eye disorder (uveitis)</td><td>1/120 (0.83%)</td></tr>
<tr><td>Lethargy</td><td>1/120 (0.83%)</td></tr>
<tr><td>Fever</td><td>2/120 (1.67%)</td></tr>
<tr><td>Retching</td><td>2/120 (1.67%)</td></tr>
<tr><td rowspan="6">Older (≥10 weeks)</td><td>Anorexia</td><td>1/201 (0.5%)</td></tr>
<tr><td>Diarrhea</td><td>1/201 (0.5%)</td></tr>
<tr><td>Vomiting</td><td>3/201 (1.49%)</td></tr>
<tr><td>Fungal skin infection (ringworm)</td><td>1/201 (0.5%)</td></tr>
<tr><td>Lethargy</td><td>2/201 (1%)</td></tr>
<tr><td>Skin swelling (edema)</td><td>1/201 (0.5%)</td></tr>
</table></td></tr>
<tr><td>USDA Approval Date</td><td>October 8, 2015</td></tr>
</table>