

# Canine Coronavirus

## Longitudinal shedding in dogs in a rescue shelter

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### Abstract

Canine Coronavirus (CECoV) is an enteric pathogen of dogs. It is associated with diarrhoea, which is typically mild and self-limiting. However, cases of severe, haemorrhagic diarrhoea, accompanied by anorexia, lethargy and vomiting sometimes occur. CECoV is particularly important in dogs housed in large groups, and outbreaks among dogs in boarding, rescue and working kennels can involve up to 95% morbidity. This represents a serious welfare and economic problem. Faecal samples were taken from dogs at a large rescue shelter. Dogs were sampled on admission, and at weekly intervals throughout their stay. Samples were screened using real-time PCR. This allowed the detection of different types of CECoV, including mixed infections within the same dog. This also enabled quantitative shedding patterns to be investigated. This shows each dog's potential contribution to the maintenance and spread of CECoV in this population.

### Introduction

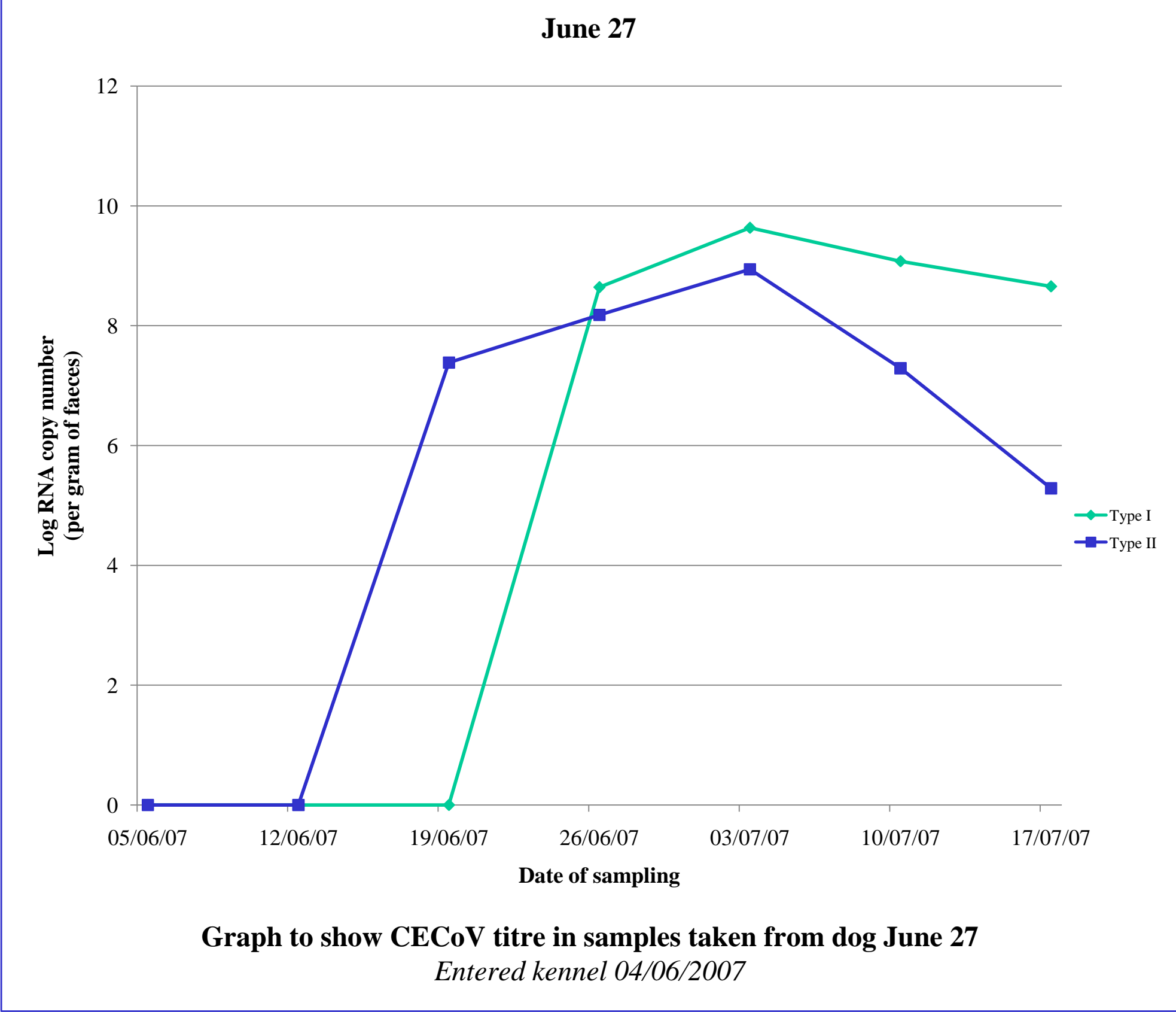
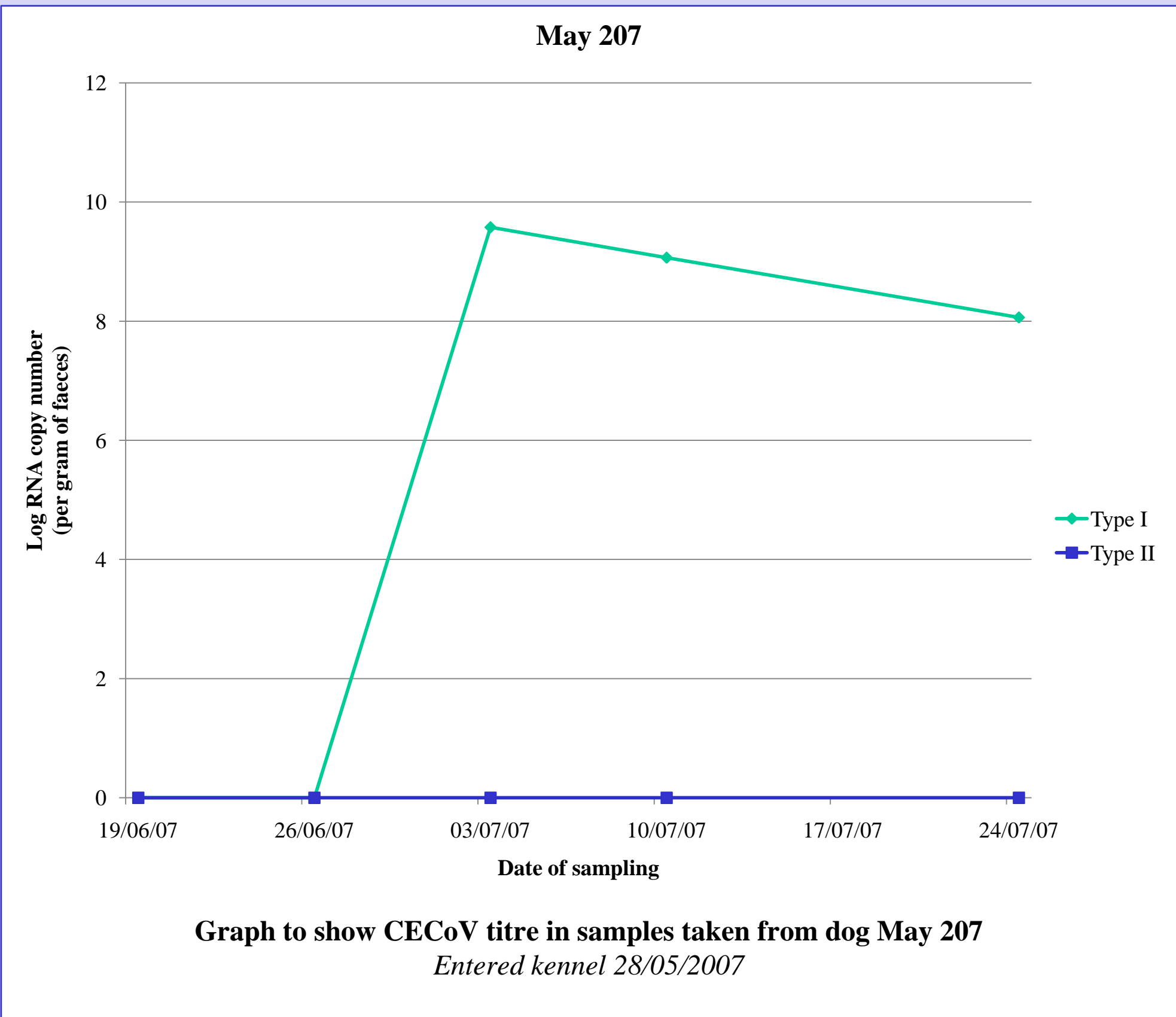
- CECoV is an emerging pathogen, with recently reported changes in both its clinical behaviour, and in its genetic composition.
- Although typically associated with mild disease, sporadic outbreaks of fatal enteritis, either due to virulent strains of CECoV, or dual infection with other agents such as Canine Parvovirus (CPV) and Canine Adenovirus (CAV) have been reported<sup>1,2</sup>.
- CECoV has recently been found to exist as two genetically distinct subtypes. The originally recognised form has been named type II CECoV, due to homologies with the closely-related type II feline coronavirus. The newly-recognised form has been designated type I CECoV<sup>3</sup>.

### Materials and methods

- At the beginning of the study, every available dog was sampled in three sampling episodes over one week, to give a baseline measure.
- Thereafter sampling occurred on a weekly basis. Every dog admitted within the previous 24 hours was enrolled on a sampling day and sampled weekly throughout its stay. Recruitment was ongoing throughout the study.
- Samples were screened using two separate fluorogenic real-time RT-PCR assays for type I and type II CECoV to obtain a mean RNA copy number<sup>4</sup>.



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| Preliminary results of longitudinal study of CECoV shedding.                                  |            |            |              |            |            |            |            |            |            |            |            |          |  |  |
|---|------------|------------|--------------|------------|------------|------------|------------|------------|------------|------------|------------|----------|--|--|
| Each vertical column represents one sampling date, and each horizontal row represents one dog |            |            |              |            |            |            |            |            |            |            |            |          |  |  |
| Dog ID  | 22/05/2007 | 24/05/2007 | 29/05/2007   | 05/06/2007 | 12/06/2007 | 19/06/2007 | 26/06/2007 | 03/07/2007 | 10/07/2007 | 17/07/2007 | 24/07/2007 |          |  |  |
| MAY94   | Negative   |            |              |            |            |            |            |            |            |            |            |          |  |  |
| MAY93   | Type 2     |            |              |            |            |            |            |            |            |            |            |          |  |  |
| MAY88   |            |            | Negative     |            |            |            |            |            |            |            |            |          |  |  |
| MAY86   |            |            |              |            |            |            |            |            |            |            |            |          |  |  |
| MAY74   | Negative   |            |              |            |            |            |            |            |            |            |            |          |  |  |
| MAY46   |            |            | Negative     |            |            |            |            |            |            |            |            |          |  |  |
| MAY44   |            |            |              |            |            |            |            |            |            |            |            |          |  |  |
| MAY218  |            |            |              |            |            |            |            |            |            |            |            |          |  |  |
| MAY207  |            |            | Negative     | Negative   | Negative   | Type 2     | Negative   | Type 1     | Type 1     |            | Type 1     |          |  |  |
| MAY156  |            |            | Negative     | Negative   | Negative   |            |            |            |            |            |            |          |  |  |
| MAY154  |            |            | Negative     |            |            |            |            |            |            |            |            |          |  |  |
| MAY133  | Negative   |            |              |            |            |            |            |            |            |            |            |          |  |  |
| MAY130  | Negative   |            |              |            |            |            |            |            |            |            |            |          |  |  |
| MAY129  | Type 2     |            |              |            |            |            |            |            |            |            |            |          |  |  |
| MAY124  |            |            | Negative     |            |            |            |            |            |            |            |            |          |  |  |
| MAY115  | Negative   |            |              |            |            |            |            |            |            |            |            |          |  |  |
| MAY103  | Negative   |            |              |            |            |            |            |            |            |            |            |          |  |  |
| MAY102  |            |            | Negative     |            |            |            |            |            |            |            |            |          |  |  |
| MAY101  |            |            | Negative     |            |            |            |            |            |            |            |            |          |  |  |
| MAY1  |            |            | Negative     |            |            |            |            |            |            |            |            |          |  |  |
| MAR69   |            |            | Negative     |            |            |            |            |            |            |            |            |          |  |  |
| MAR67   |            | Type 2     |              |            |            |            |            |            |            |            |            |          |  |  |
| MAR61   |            |            | Negative     |            |            |            |            |            |            |            |            |          |  |  |
| MAR178  |            | Negative   |              |            |            |            |            |            |            |            |            |          |  |  |
| MAR159  |            | Negative   |              |            |            |            |            |            |            |            |            |          |  |  |
| MAR156  | Type 2     |            |              |            |            |            |            |            |            |            |            |          |  |  |
| MAR148  |            |            | Negative     |            |            |            |            |            |            |            |            |          |  |  |
| MAR126  |            | Negative   |              |            |            |            |            |            |            |            |            |          |  |  |
| MAR106  |            | Type 1     |              |            |            |            |            |            |            |            |            |          |  |  |
| JUN91   |            |            |              |            |            |            |            |            |            |            |            |          |  |  |
| JUN69   |            |            |              |            |            |            |            |            |            |            |            |          |  |  |
| JUN67   |            |            |              |            | Negative   |            |            |            |            |            |            |          |  |  |
| JUN65   |            |            |              |            | Negative   |            |            |            |            |            |            |          |  |  |
| JUN64   |            |            |              |            | Negative   |            |            |            |            |            |            |          |  |  |
| JUN63   |            |            |              |            | Negative   |            |            |            |            |            |            |          |  |  |
| JUN30   |            |            |              |            | Negative   |            |            |            |            |            |            |          |  |  |
| JUN29   |            |            |              |            | Negative   |            |            |            |            |            |            |          |  |  |
| JUN28   |            |            |              |            | Negative   |            |            |            |            |            |            |          |  |  |
| JUN27   |            |            | Negative     | Negative   | Type 2     | Type 1 & 2 | Type 1 & 2 | Type 1 & 2 | Type 1 & 2 | Type 1 & 2 |            |          |  |  |
| JUN24   |            |            | Negative     | Negative   | Type 1     |            |            |            |            |            |            |          |  |  |
| JUN23   |            |            | Negative     |            |            |            |            |            |            |            |            |          |  |  |
| JUN22   |            |            | Negative     |            |            |            |            |            |            |            |            |          |  |  |
| JUN21   |            |            | Negative     | Negative   |            |            |            |            |            |            |            |          |  |  |
| JUN20   |            |            | Negative     | Negative   | Negative   | Type 2     |            |            |            |            |            |          |  |  |
| JUN19   |            |            |              |            |            |            |            |            |            |            |            |          |  |  |
| JUN18   |            |            | Negative     | Negative   |            | 0          |            | Negative   |            |            |            |          |  |  |
| JUN179  |            |            |              |            |            |            |            | Negative   |            |            |            |          |  |  |
| JUN178  |            |            |              |            |            |            |            |            |            |            |            |          |  |  |
| JUN176  |            |            |              |            |            |            |            | Negative   |            |            |            |          |  |  |
| JUN174  |            |            |              |            |            |            |            |            |            |            |            |          |  |  |
| JUN172  |            |            |              |            |            |            |            | Negative   | Type 1     |            |            |          |  |  |
| JUN171  |            |            |              |            |            |            |            | Negative   | Negative   |            |            |          |  |  |
| JUN17   |            |            | Negative     |            |            |            |            |            |            |            |            |          |  |  |
| JUN167  |            |            |              |            |            |            |            | Negative   |            |            |            |          |  |  |
| JUN122  |            |            |              |            |            |            |            | Negative   | Type 2     |            |            |          |  |  |
| JUN119  |            |            |              |            |            |            |            |            |            |            |            |          |  |  |
| JUL60   |            |            |              |            |            |            |            |            |            |            |            |          |  |  |
| JUL13   |            |            |              |            |            |            |            |            |            |            |            |          |  |  |
| JUL124  |            |            |              |            |            |            |            |            |            |            |            |          |  |  |
| JUL10   |            |            |              |            |            |            |            |            |            |            |            |          |  |  |
| JAN10   |            |            | Type 1       |            |            |            |            |            |            |            |            |          |  |  |
| FEB163  |            |            | Type 1       |            |            |            |            |            |            |            |            |          |  |  |
| FEB149  |            |            | Type 1       |            |            |            |            |            |            |            |            |          |  |  |
| APR99   |            |            | Type 1 and 2 |            |            |            |            |            |            |            |            |          |  |  |
| APR94   |            |            |              | Negative   | Negative   |            |            |            |            |            |            |          |  |  |
| APR43   |            |            |              |            |            |            |            |            |            |            |            |          |  |  |
| APR241  | Negative   |            |              |            |            |            |            |            |            |            |            |          |  |  |
| APR240  |            |            |              | Negative   | Negative   |            |            |            |            |            |            |          |  |  |
| APR230  |            |            |              | Negative   | Negative   |            |            |            |            |            |            |          |  |  |
| APR208  |            |            |              | Negative   | Negative   |            |            |            |            |            |            |          |  |  |
| APR205  |            |            |              | Negative   |            |            |            |            |            |            |            |          |  |  |
| APR190  |            |            |              |            |            |            |            |            |            |            |            |          |  |  |
| APR187  |            |            | Negative     |            |            |            |            |            |            |            |            |          |  |  |
| APR155  |            |            |              |            | Negative   |            |            |            |            |            |            |          |  |  |
| APR142  |            |            |              |            | Negative   |            |            |            |            |            |            |          |  |  |
| APR140  |            |            | Type 1       |            |            |            |            |            |            |            |            |          |  |  |
| APR137  |            |            |              |            |            |            |            |            |            |            |            |          |  |  |
| APR129  | Negative   |            |              |            |            |            |            |            |            |            |            |          |  |  |
| APR127  |            |            |              | Negative   |            |            |            |            |            |            |            |          |  |  |
| APR122  |            |            | Type 1       |            |            |            |            |            |            |            |            |          |  |  |
| JUN32   |            |            |              | Negative   |            |            |            |            |            |            |            |          |  |  |
| JUL192  |            |            |              |            |            |            |            |            |            |            |            | Negative |  |  |

| Key:       |                                 |
|------------|---------------------------------|
| Type 1     | Type 1 CECoV identified         |
| Type 2     | Type 2 CECoV identified         |
| Type 1 & 2 | Types I and II CECoV identified |
| Negative   | CECoV negative                  |
|            | Result not yet available        |
|            | Cross-sectional survey          |

### Results and Conclusions

Preliminary results indicate that both types I and II CECoV are circulating within this kennel. Previous reports suggest that type I CECoV may be shed for longer periods than type II, and at higher titres. Preliminary results indicate that a similar pattern appears to be occurring within this kennel; this will become more clear once the analysis is complete. CECoV is environmentally labile, and so for long-term maintenance within a population, a source of infectious faecal material is necessary. Spatial mapping of cases and molecular sequencing of positive samples will help to differentiate if infection in this environment is maintained by cycles of re-infection, or if long-term shedders are more important in the maintenance and spread of CECoV between dogs in this environment.

### Acknowledgements:

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### References:

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