Written Evidence Submitted by the National Physical Laboratory (NPL)

(C190094)

Context to NPL's response

1. The National Physical Laboratory (NPL) is the UK's National Metrology Institute (NMI), responsible for developing and maintaining the national primary measurement standards. NPL is owned and funded (in part) by BEIS. NPL is a Public Sector Research Establishment (PSRE), we work in partnership with government, academia, applied research labs and industry to deliver the greatest societal and economic benefit for the UK and the world. The Research and Development Roadmap[1] recognises the role that PSREs have to play in the research and innovation landscape and that there is an opportunity to further exploit our unique expertise and facilities.

2. NPL sits at the heart of the UK's National Measurement System (NMS) which provides the UK with a national measurement infrastructure and delivers the UK Measurement Strategy on behalf of BEIS. As the UK's NMI we represent the UK within an international network of metrology institutes.

3. At NPL we are working with the NHS, academia and industry to tackle some of the world's biggest health challenges and supporting the delivery of priorities set out in the NHS Long Term Plan. This includes the increased drive for earlier diagnosis of disease, innovation and acceleration in the use of precision medicine and personalised medicine, as well as leading the conception of new drugs, treatments and therapies.

4. In healthcare, **good measurement improves productivity, quality and safety - delivering better outcomes**; it underpins public confidence and is vital to innovation. NPL provides the infrastructure essential for the safe delivery of radiotherapy through the provision of primary standards and the dissemination of traceable dosimetry.

5. Below we set out NPL's responses to the questions that we consider most relevant to its area of expertise.

1. The contribution of research and development in understanding, modelling and predicting the nature and spread of the virus;

6. Modelling is a very important aspect in being able help predict the nature and spread of the virus and therefore plan the response accordingly. The model is only as good as the data that it is based upon. As research enables us to understand more about the virus lifecycle, modes of infection and virulence this can be fed into the models. It is essential that we understand the limitations and uncertainty associated with the models if we are going to be able to use them effectively.

7. As we highlighted in our response to the House of Lords Science and Technology Committee on the Science of COVID-19 - models depend on numerical parameters, and different values

[1] HM Government (2020) UK Research and Development Roadmap https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/896799/UK_Research_and_Development_Roadmap.pdf

of these parameters will lead to different predictions. The values of parameters used in a simulation can be derived from theory, experimentation or expert judgement. Very rarely can these values be treated as perfect: the theory may be approximate, experimental results are subject to random effects, and different experts may have different opinions. However, we can assign a best estimate for the value of a parameter and the likely spread about that estimate. We therefore say that the parameter estimates have an uncertainty associated with them.

8. If the model **predictions have a large uncertainty, we cannot be confident that the model predictions will match reality** and we **may risk making poor decisions** on the basis of the model results. **The uncertainty associated with the parameters can be reduced by improved measurement or by more extensive data collection** which can improve the model to better reflect the real-world situation, giving more accurate and reliable results.

2. The capacity and capability of the UK research base in providing a response to the outbreak, in terms of:

the development of testing, diagnostic methods and technologies; the development and testing of vaccines; and the development and testing of therapeutics;

9. It is widely acknowledged the life sciences sector faces issues with reproducibility in research, a well-defined biological measurement infrastructure is still emerging and being developed by the global NMI community. With the innate variability of living systems, the process for developing new means of testing, diagnostic methods, vaccines and therapeutics and getting them to market will take a substantial amount of time.

10. An essential aspect of the development of testing, diagnostic methods and technologies is being able to verify that these methods are effective and that they measure what they are supposed to measure. Metrology underpins this helping to provide standardised reference materials, procedures and processes to ensure the robustness of the research and is vital in the scale-up process.

11. As noted in our response to the House of Lords Science & Technology Committee Inquiry on the Science of COVID -19, vaccines and materials used for their production can often show variability, and manufacturers must take particular care to ensure performance consistency for the product from development to batch release.

12. The use of reference materials against which batches of biological products can be assessed is fundamental to ensuring quality, consistency of production, and ultimately the delivery of safe, consistent, and effective products. During pandemics and epidemics, these requirements become even more important as large quantities of vaccines must be produced increasing the impact of variability. It is essential that there is investment in the development of reference materials to accelerate the development, uptake and use of new vaccines.

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