



HILLINGDON
LONDON

Sir Howard Davies
6th Floor
Airports Commission
Sanctuary Buildings
20 Great Smith Street
London
SW1P 3BT

Air.quality@airports.gsi.gov.uk

Ref: JT/05/15 Davies

28th May 2015

Dear Sir Howard

2M RESPONSE TO THE AIRPORT COMMISSION'S CONSULTATION ON THE AIR QUALITY ASSESSMENT, MAY 2015

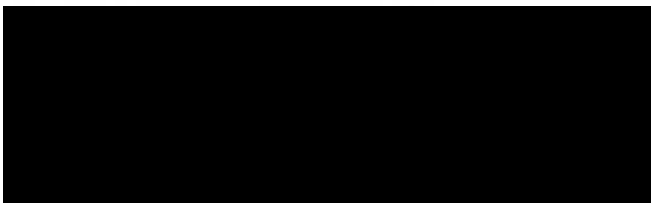
We would like to welcome and thank you for the opportunity to respond to your Consultation on Air Quality Assessment. We consider poor air quality to be one of the key adverse environmental impacts which would be inflicted on our local communities if either of the two Heathrow options were to be progressed.

It is unfortunate that despite our previous responses to you, that yet again we are in a position where we have to raise our concerns again. It is our opinion that, given that these concerns have still not been adequately addressed, that there remain serious flaws in the appraisal process.

We have detailed our concerns in our response below and we ask that the entirety of this letter is taken as our formal response to this consultation. You will note that the two Heathrow options are understandably the focus of our response.



INVESTOR IN PEOPLE



Background

As background information, on the 28th February 2014, we responded to your original consultation in relation to the Appraisal Framework. Our concerns at that time included:

- Lack of information about the trade off issues between objectives;
- A call for the inclusion of a specific health module.

In terms of the individual appraisal modules, our concerns included:

- There should be a full detailed assessment of the impacts on local air quality with suitable sensitivity tests and scrutiny built into the process to ensure there is confidence in the results that health limits will be met and maintained.
- There was no satisfactory level of scrutiny for all the surface access delivery elements.

We emphasised again in our letter to you dated 3rd February 2015, in response to your Consultation on the Appraisal of the Shortlisted Options, that in our opinion, these previous concerns had not been addressed and that they remained serious flaws in the appraisal process. You may recall that in February we stated that it is not acceptable to have a quality of life assessment which:

- does not include health and wellbeing impacts on children;
- states that air quality impacts are limited when there is clear evidence of air pollution affecting people's health, which reduces their capacity to lead full lives and hence impacts on their quality of life.

We made it clear that there must be absolute confidence that the health limits can be met and thereafter maintained. If the promoters' assumptions, such as cleaner aircraft; cleaner road vehicles; and no more airport related traffic on the roads, do not materialise in reality, it will be the local communities who will suffer the adverse impacts. If these improvements in air quality do not occur in reality, and if the runway were to be built but then not legally allowed to operate at a satisfactory capacity, this could become a constraint to the operation of the airport and therefore have a huge negative economic impact.

1 Inadequate consultation period

We regard a short three week period for such an important, highly technical consultation as totally unacceptable in terms of a timescale to establish fully informed views. For local communities attempting to work out the likely impacts on their health and local environment, three weeks, one of which is a school half term holiday, is an inappropriate and inadequate timescale in which to properly engage and consult with these stakeholders.

As local councils we have tried to work within your tight time constraints and we have outlined below our initial concerns about the air quality assessment and highlighted what we regard as substantially adverse impacts which will be inflicted upon our local communities.

Question 5

Do you have any comments on how the Commission has carried out its appraisal of specific topics (as defined by the Commission's 16 appraisal modules), including methodology and results?

Question 6

Do you have any comments on the Commission's sustainability assessment, including methodology and results?

2 The local air quality model assessment

The assessment has provided a snapshot of the expansion position in 2030 with the airport accommodating 125 million passengers per annum (mppa). This is not an appropriate approach given that the Carbon Traded, Global Growth scenario for Heathrow indicates by 2040 the passenger capacity will have increased to 138mppa and by 2050 to 148mppa (ref p number in Strategic fit document). In addition, the chosen principal study area is inadequate, excluding much of impacted boroughs such as the Royal Borough of Windsor and Maidenhead which includes a declared AQMA encompassing junction 13 of the M25.

There has been no additional work presented to indicate that the air quality assessment has been updated to include the impacts on the local road network or that there has been accompanying quantification for the predicted increases in freight associated with the schemes, including taking into account the position in 2040 and 2050.

- **The assessment does not present the full implications that the options to expand Heathrow could bring and it therefore potentially under-estimates the air quality impacts of the expansion proposals.**

There is a reliance on the impact of future vehicle technologies and predicted reductions in emissions to help solve the air quality issues in 2030. The over-reliance on technology to address the air quality issues to date have been misplaced as indicated in the 2011 Air Quality Plan submitted to Europe, which promised compliance in with European legislation in this area by 2020. The predictions were updated in 2014 by Defra to suggest that compliance would now be post-2030. The reason for the delay in compliance stated as:

This is largely due to the failure of the European vehicle emission standards for diesel cars to deliver the expected emission reductions of NOx". (Updated projections for Nitrogen Dioxide (NO₂) compliance, Defra 2014)

- **As history to date has shown, over-reliance on predicted reductions in emissions from, as yet unproven, future vehicle technologies, should be treated with caution. It will be the local communities who suffer the adverse impacts of the failure to meet the air quality objectives set to protect health and the ensuing consequences and costs of the need for further mitigation measures to ensure the health limits are met.**

3 Assessment against the EU limit values

The national model assessment shows that in 2030, the Heathrow area, even without further expansion, will still be non-compliant in terms of the EU limit value (page 66 of the Consultation document). The additional pollution from the expansion of the airport simply exacerbates this situation and entails the imposition of even more stringent mitigation measures in the surrounding area in order to secure compliance.

The recent Supreme Court Judgement has highlighted the importance of securing air quality compliance as soon as possible.

The CJEU judgment leaves no doubt as the seriousness of the breach, which has been continuing for more than five years, nor as to the responsibility on the national court to secure compliance. Further, during those five years the prospects of early compliance have become worse (2014 projections predicting non-compliance in some zones after 2030). The Secretary of State accepted that a new plan has to be prepared. The new government should be left in no doubt as to the need for immediate action, which is achieved by an order that new plans must be delivered to the Commission not later than 31 December 2015. (R (on the application of ClientEarth) (Appellant) v Secretary of State for the Environment, Food and Rural Affairs (Respondent), [2015] UKSC 28).

- **There should be plans in place to address the current poor air quality situation experienced by the local communities and ensure that the zone is fully compliant with European legislation as soon as possible. Until this is done, and the emission reductions fully secured, expansion at Heathrow should not be considered.**
- **We do not consider it is equitable for local communities to be subjected to ever more stringent mitigation measures, which may impinge further on their quality of life, simply to be able to account for the expansion of Heathrow airport.**

4 Health

Given the concerns about the likely impacts on health, Hillingdon Council commissioned Public Health by Design (PhD) to review the Consultation documents. The report by PhD, 'Equity Focused Review Report of the Airports Commission's Air Quality Local Assessment', dated May 2015 is attached to this response. The report confirms that the health impacts have been underestimated because it highlights that the Airports Commission Air Quality Assessment:

- has only provided a partial impact pathway assessment and presents estimates only for a snapshot in 2030, not the 60 year assessment period;
- there is no discussion of health impacts such as air quality impacts on children, other chronic effects or other additional morbidity effects of short term exposure;
- does not present the actual estimates of health impacts eg years of life lost, respiratory hospital admissions and cardiovascular hospital admissions;

- underestimates the total effected population as it confines the assessment to the principal study area as opposed to assessing the wider study area. This in turn underestimates the quantification and monetisation of the population health impacts as presented in the partial impact pathway;
- there is no consideration or discussion of the potential for widening inequalities in health from impacts on residents already facing significant environmental and socio-economic disadvantage.

Given the above, we consider that the Commission's assessment methodology is flawed.

- **The assessment does not present the full implications that the options to expand Heathrow could bring, therefore potentially under-estimating the adverse health impacts of the expansion proposals**

As we highlighted in our previous consultation response, the existing health burden of the populations surrounding Heathrow is already distinctly disadvantaged. The Airports Commission's recent assessment shows that, even taking into account reductions in emissions from future vehicle technologies, which are as yet untested, expansion at Heathrow will lead to the exposure of around 49,000 properties (over 121,000 people) being subjected to increases in pollution concentrations.

The monetised health impacts are far greater for the Heathrow options, with the Heathrow North West option the highest, including up to £10.8m in relation to extra hospital admissions (ref App G). In addition, the assessment highlights that the latest scientific evidence indicates adverse health impacts are associated with nitrogen dioxide levels far below the current EU limit value level. For the area around Heathrow this would indicate that many more communities would have a potentially harmful level of exposure than was previously thought.

- **It is not acceptable to knowingly give a recommendation to expand a pollution source which would lead to the exposure of over 121,000 people to increases in nitrogen dioxide. With the health evidence suggesting caution on health grounds for levels even lower than the current limit value, additional exposure on an area where the current population are already disadvantaged, in terms of health, cannot be supported.**

Of additional concern is the comment made in the Consultation documents in relation to the provision of a more detailed Impact Pathway Assessment which it is stated would accompany: *"a more detailed air quality analysis which is anticipated for any chosen scheme"*. (App G, p 171).

- **The Airports Commission appraisal process is meant to be assessing each scheme equally in order to inform a final recommendation. Any further "detailed air quality analysis" and full Impact Pathway Assessment must be done now before final recommendations on location are made.**

Question 7

Do you have any comments on the Commission's business case, including methodology and results?

In terms of the business case the following comments are made for your consideration.

5 Legal implications:

The report makes clear that the expansion of Heathrow by either option would delay compliance with the EU Limit Value. This could have legal and financial implications as the European legislation states compliance should be reached as soon as possible and it should be noted that the EU have the ability to pass down fines to failing Member States.

6 Constrained use of new infrastructure.

If the assumptions used to mitigate the air quality issues to do not prove to be adequate, the use of the new runway could be heavily constrained in terms of its use and its ability to realise full capacity. This will have knock on impacts for Heathrow's wider economic business case.

7 Adequate surface access

As has been stated above, the surface access appraisal is inadequate and has not properly assessed the full requirements needed to mitigate the impacts of the airport at full passenger capacity on both roads and public transport.

The Consultation documents cast doubt as to whether the HAL vision, which is for an increase to over 50% modal shift in public transport access to ensure total airport-related road vehicle trips to and from the airport do not increase relative to the baseline, is actually deliverable. The report goes on to highlight the potential need for two further mitigation measures; one aimed at reducing traffic volumes and the other at reducing emissions, namely a congestion charge and the implementation of an ultra low emission zone.

- **The mitigation measures in respect of local roads and public transport have not been appropriately addressed in terms of their implementation and their costs and other potential impacts such as on the local economy. These should be evaluated and costed before any decision is made as to the appropriate location for airport expansion.**

8 Health Impacts

The impacts on health of the full airport expansion have not been properly assessed. Recent scientific evidence suggests that health impacts could be apparent at lower levels than EU current limits and a full Impact Pathway analysis has yet to be undertaken.

- **Additional costs in terms of monetised health impacts have not been assessed and therefore have not factored into the business case. The Public**

Health by Design advice on this matter, as presented as part of the London Borough of Hillingdon response, is attached for your information.

Question 8

Do you have any further comments?

9 Wrong location

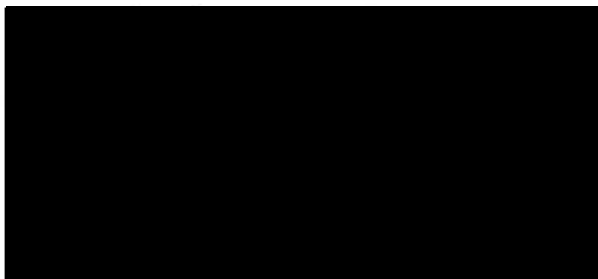
This assessment cannot be read in isolation from the previous appraisal modules. We firmly believe that there remain serious flaws in the appraisal process and that the implications of the air quality assessment, even as they have been assessed, simply add weight to the argument that this part of west London is not the right place for airport expansion.

Given the above, and together with the consultation documents that the Airports Commission published in November 2014, it is clear that the Heathrow options should be rejected on the grounds of the severe environmental impacts arising from both options which will:

- put 100,000-121,000 people, already at a distinct health disadvantage, at further risk from increased air pollution;
- escalate hospital costs by up to £10m which may prove, given the emerging health evidence, to be an under-estimate;
- potentially cost the UK Government in fines for non-compliance with EU air quality legislation;
- expose 580,500 people to aviation noise, increasing to 637, 700 by 2050, along with the additional health costs this brings including impacts on children and their educational attainment, which, to date, have also not been properly assessed;
- put further pressures on the surrounding local authorities to provide for up to an extra 70,800 houses, 50 new primary schools, and 6 new secondary schools in areas; and
- for Hillingdon, the NWR option destroys three local villages at a cost of over 1,000 houses and associated community buildings such as schools.

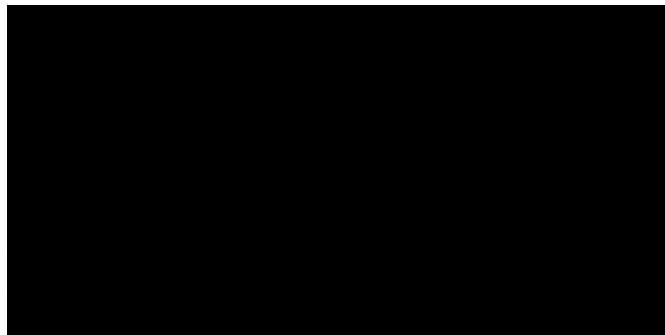
Once again we would like to thank you for the opportunity to submit our views to you and we would be happy to discuss these issues further if you feel that would be helpful. Should you have any queries on this, please do contact me.

Yours sincerely



On behalf of the Leaders of Hillingdon, Richmond, Wandsworth, Royal Borough of Kensington & Chelsea and Royal Borough of Windsor and Maidenhead

Enc: 'Equity Focused Review Report of the Airports Commission's Air Quality Local Assessment' dated May 2015 by Public Health by Design



Airports Commission's Air Quality Local
Assessment May 2015 Consultation

Equity Focused Review Report of the Airports Commission's Air Quality Local Assessment

*Supplementary and follow on review report to the earlier review report **Equity Focused
Review Report of the Airports Commission's Community Health Relevant Assessments***

FINAL REPORT

May 2015

Commissioned by the London Borough of Hillingdon

Public Health by Design is a public health consultancy whose goal is to deliver innovative, effective and value-for-money consultancy, research and capacity building in health impact assessment, health impact evaluation, healthy urban planning and healthy public policy.

We want to help you – businesses, local and national government, NGOs - to deliver better public and community health and wellbeing at policy, plan, programme, project and service levels; as a direct objective, as part of social responsibility programmes and as part of best practice proposal design, implementation, operation, decommissioning/ closure and restoration.

PhD QUALITY ASSURANCE

TITLE: Equity Focused Review Report of the Airports Commission's Air Quality Local Assessment			
PREPARED BY: Public Health by Design [REDACTED]			
COMMISSIONED BY: London Borough of Hillingdon			
PROJECT NO: 14-021-SV – LBH UK HA SHEFPR			
	Name	Signature	Date
Prepared by	Dr Salim Vohra (SV) Dr Filipe Silva (FS)	[REDACTED]	21-05-2015
Approved by	Dr Salim Vohra	[REDACTED]	21-05-2015

DRAFTS

Revision Number	Details	Prepared by	Reviewed by	Approved by	Date
01	Draft	SV/FS	SV/FS	SV	20-05-2015

- ❖ This report has been prepared by Public Health By Design Limited ("PhD") for the use of the Client and any other stakeholders that the Client considers appropriate.
 - ❖ It has been produced in line with generally accepted international best practice public health consultancy principles and the project's terms of reference.
 - ❖ Information provided by third parties and referred to in the report has been assumed to be correct and has not been separately verified by PhD unless explicitly stated in the report.
 - ❖ No third parties should make decisions based on this report without discussing it first with the Client and PhD.
-

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Executive Summary

Introduction

- ES.1 This review report has been commissioned by the London Borough of Hillingdon (LBH).
- ES.2 It is a supplementary and follow on review report to the earlier review report *Equity Focused Review Report of the Airports Commission's Community Health Relevant Assessments* that was also commissioned by LBH.
- ES.3 The aim of this Review was to review the Airports Commission's (AC's) Air Quality Local Assessment, published in May 2015, from a health equity perspective i.e. using a "health equity lens".

Local air quality assessment

- ES.4 The AC's Appraisal Framework and the Air Quality Local Assessment states that DEFRA's supplementary Green Book guidance will be used. DEFRA's guidance recommends the use of the damage cost approach, as an initial screening estimate, followed by the impact pathway approach where a more detailed assessment is appropriate and proportionate.
- ES.5 The AC's Air Quality Local Assessment aimed to use both the damage cost approach and the impact pathway approach to assess the health impacts of air pollution from the three proposed airport schemes. However, only a partial impact pathway assessment was undertaken.
- ES.6 A comprehensive impact pathway assessment could have been attempted by using a set of scenarios that used extrapolations into the future of the modelled levels of air pollution and modelling of future mortality rates with support from DEFRA and Public Health England.
- ES.7 The assessment undertook what it called a partial impact pathway assessment quantifying only the short-term health impacts of Nitrogen Dioxide (NO₂) and

Particulate Matter (PM) on morbidity. It presents estimates only for 2030 ("2030 snapshot") and not the 60-year assessment period. It also did not consider long-term impacts of PM on mortality and loss of life expectancy. The partial impact pathway assessment therefore does not fulfil the purpose of being a comprehensive assessment as recommended by the DEFRA guidance as it provides an incomplete analysis of the full range of quantifiable health impacts.

- ES.8 There is also no discussion of health impacts where quantification is not currently recommended by DEFRA such as air quality impacts on children, other chronic effects, other additional morbidity effects of short-term exposure.
- ES.9 The assessment does not present the actual estimates of health impacts e.g. years of life lost, respiratory hospital admissions and cardiovascular hospital admissions.
- ES.10 The way the affected population is calculated also underestimates the affected population because only the population in the Principal Study Area is reported and the population living along key routes in the Wider Study Area is not discussed. Apart from underestimating an important output of the air quality assessment in its own right, this underestimation in turn affects the quantification and monetisation of the population health impacts in the partial impact pathway assessment.
- ES.11 Most importantly, there is no consideration and discussion of the potential for widening inequalities in health from impacts on residents already facing significant environmental and socio-economic disadvantage. This lack is not equivalent as there are more disadvantaged residents living around Heathrow than Gatwick in both the Principal and Wider Study Areas.

Conclusion

- ES.12 Overall, the Airports Commission's Air Quality Local Assessment would have benefited from a comprehensive impact pathway assessment.
- ES.13 There are some potentially significant gaps in estimating the full range of health impacts and in considering and assessing (qualitatively or quantitatively) the potential

inequality/equity aspects of changes in air pollution both at the airports as they currently operate and for future with and without scheme options.

ES.14 The recommendations identified in this review report if undertaken are likely to improve the quality of the analysis of the existing Air Quality Local Assessment undertaken by the Airports Commission.

1 Introduction

1.1 Background

- 1.1.1 This Review Report has been commissioned by the London Borough of Hillingdon (LBH).
- 1.1.2 It is a supplementary and follow on review report to the earlier review report *Equity Focused Review Report of the Airports Commission's Community Health Relevant Assessments* that was also commissioned by LBH.
- 1.1.3 The aim of this Review was to review the Airports Commission's Air Quality Local Assessment, published in May 2015, from a health equity perspective i.e. using a "health equity lens".
- 1.1.4 The objectives, similar to the previous review report, were to:
- i. Assess how, and to what extent, the health and wellbeing impacts, and their equitable/inequitable distribution, have been taken into account.
 - ii. Provide, where possible and appropriate, recommendations for enhancing the comprehensiveness and quality of the assessment undertaken.

1.2 Health Equity

- 1.2.1 The World Health Organization (WHO) describes health equity in the following way:¹

Equity is the absence of avoidable or remediable differences among groups of people, whether those groups are defined socially, economically, demographically, or geographically. Health inequities therefore involve more than inequality with respect to health determinants and access to the resources needed to improve and maintain health or health outcomes. They also entail a failure to avoid or overcome inequalities that infringe on fairness and human rights norms.

¹ World Health Organization (WHO). (2015). Equity. Health systems. Available at <http://www.who.int/healthsystems/topics/equity/en/>

- 1.2.2 Reducing health inequities is important because health is a fundamental human right and its progressive realization will eliminate inequalities that result from differences in health status (such as disease or disability) in the opportunity to enjoy life and pursue one's life plans.
- 1.2.3 A characteristic common to groups that experience health inequities—such as poor or marginalized persons, racial and ethnic minorities, and women—is lack of political, social or economic power. Thus, to be effective and sustainable, interventions that aim to redress inequities must typically go beyond remedying a particular health inequality and also help empower the group in question through systemic changes, such as law reform or changes in economic or social relationships.
- 1.2.4 Internationally the WHO Commission on the Social Determinants of Health in “Closing the Gap in a Generation” (2008) and the Marmot Review in the UK in “Fair Society, Healthy Lives” (2010) demonstrated and advocated the importance of considering health inequities and inequalities when assessing the health and wellbeing impacts of policies and projects.^{2 3}

1.3 Health Impact Assessment (HIA)

- 1.3.1 The international Gothenburg consensus definition of HIA is: “A combination of procedures, methods and tools by which a policy, program or project may be judged as to its potential effects on the health of a population, and the distribution of those effects within the population.”⁴
- 1.3.2 The more recent International Association for Impact Assessment’s definition of HIA, which updates the earlier Gothenburg Consensus definition, is that HIA is:
- “A combination of procedures, methods and tools that systematically judges the potential, sometimes unintended, effects of a policy, plan, programme or project on the

² World Health Organization (WHO). (2008). Closing the gap on a generation: Health equity through action on the social determinants of health. Commission on Social Determinants of Health. Available at: <http://www.instituteofhealthequity.org/projects/commission-on-social-determinants-of-health>

³ The Marmot Review. (2010). Fair Society, Healthy Lives: Strategic Review of Health Inequalities in England post-2010.

⁴ WHO European Centre for Health Policy. (1999). Health impact assessment: main concepts and suggested approach. Gothenburg consensus paper. WHO Regional Office for Europe.

health of a population, including the distribution of those effects within the population, and identifies appropriate actions to manage those effects.”⁵

- 1.3.3 HIA uses both a biomedical and social definition of health, recognising that though illness and disease (mortality and morbidity) are useful ways of measuring health they need to be fitted within a broader understanding of health and wellbeing to be properly useful (see Figure 1). This definition builds on and is complementary to the longer established World Health Organization definition that “Health is a state of complete physical, social and mental wellbeing and not simply the absence of disease or infirmity”.⁶

Figure 1 Determinants of health and wellbeing⁷



⁵ International Association for Impact Assessment. Health Impact Assessment International Best Practice Principles. Special Publication Series No. 5. Fargo, USA. 2006.

⁶ World Health Organization. (1948). Preamble to the Constitution of the World Health Organization as adopted by the International Health Conference. New York, 19-22 June 1946, and entered into force on 7 April 1948.

⁷ Department of Health. (2007). Draft guidance on health in strategic environmental assessment. Original Source: Hugh Barton and Marcus Grant (2006), drawing on Whitehead and Dahlgren (1991) and Barton (2005). United Kingdom Public Health Association (UKPHA) Strategic Interest Group and the WHO Healthy Cities Programme.

2 Methodology and Scope of this Review

2.1 Introduction

2.1.1 The Review reviewed the following key documents:

- Air quality local assessment including associated appendices.

2.2 Review approach

2.2.1 All documents were reviewed by both members of the team.

2.2.2 Where appropriate and possible key references mentioned in the above documents were reviewed.

2.2.3 Notes were made and preliminary synthesis review briefings were produced.

2.2.4 The preliminary review briefings were then reviewed and commented on by officers at LBH.

2.2.5 Where recommendations are identified for improving the comprehensiveness and quality of the assessment they take account of the constraints and limitations discussed within the assessments documents i.e. the recommendations are extensions of the existing methodologies used and based on existing data sets.

2.3 Limitations of this Review

2.3.1 The traffic and air quality modelling assumptions and detailed methodology have been not been scrutinised in relation to transport and air quality modelling best practice.

3 Air Quality Local Assessment

3.1 Introduction

- 3.1.1 A review of the Airports Commission's (AC's) Air Quality Local Assessment was undertaken to:
- 3.1.2 Assess how and to what extent the health and wellbeing impacts, and their equitable/inequitable distribution, have been taken into account.
- 3.1.3 Provide, where possible and appropriate, recommendations for enhancing the comprehensiveness and quality of the assessment undertaken.

3.2 Review findings

- 3.2.1 The AC's Appraisal Framework and the Air Quality Local Assessment states that DEFRA's supplementary Green Book guidance will be used. DEFRA's guidance recommends the use of the damage cost approach, as an initial screening estimate, followed by the impact pathway approach where a more detailed assessment is appropriate and proportionate.
- 3.2.2 The damage cost approach provides a good overall estimate, in monetary terms, but is judged to not be sufficient on its own in cases where the adverse air quality impacts are judged to be significant. For example, when the damage cost approach estimates the adverse impacts to be greater than £50 million in damage costs. This is because this method is an approximation of the likely average health impacts of air pollution on an average population (and non-health impacts such as building soiling from PM) and does not account for the health, demographic and socio-economic characteristics of the affected local population.
- 3.2.3 When damage cost estimates are greater than £50 million (and compliance with legally binding air quality objectives is expected) the impact pathway approach should be undertaken. DEFRA considers this to be the central methodology and it provides a fuller assessment. Appendix A provides a summary of the Green Book and DEFRA's guidance that is relevant for health impacts and air quality.

- 3.2.4 The AC's Air Quality Local Assessment aimed to use both the damage cost approach and the impact pathway approach to assess the health impacts of air pollution from the three proposed airport schemes.
- 3.2.5 The damage cost part of the assessment was undertaken and estimated that the damage cost for each of the schemes would be greater than £50 million.
- 3.2.6 However, only a partial impact pathway assessment was undertaken. The reasons presented were:
- “the level of detail available on future pollution concentrations, and
 - the difficulty in predicting mortality rates of the relevant populations from 2030 to 2050 and beyond.”
- 3.2.7 A comprehensive impact pathway assessment could have been attempted by using a set of scenarios that used extrapolations into the future of the modelled levels of air pollution and modelling of future mortality rates with support from DEFRA and Public Health England. Given that incremental changes to the concentrations of air pollutants have been estimated for 2030 and, while uncertainty increases for estimations further into the future, assumptions could have been made to allow for reasonable scenarios and extrapolations further into the future.
- 3.2.8 Future mortality rates of relevant populations could have been developed from assumptions about secular trends in mortality rates and demographic changes, the use of life tables, or assuming that existing mortality rates held true for future years. In addition, statistical methods such as Monte Carlo could have been used to take account of uncertainties.
- 3.2.9 The assessment undertook what it called a partial impact pathway assessment quantifying only the short-term health impacts of Nitrogen Dioxide (NO₂) and Particulate Matter (PM) on morbidity. It presents estimates only for 2030 (“2030 snapshot”) and not the 60-year assessment period. It also did not consider long-term impacts of PM on mortality and loss of life expectancy. The partial impact pathway assessment therefore does not fulfil the purpose of being a comprehensive assessment as recommended by

the DEFRA guidance as it provides an incomplete analysis of the full range of quantifiable health impacts.

- 3.2.10 There is also no discussion of health impacts where quantification is not currently recommended by DEFRA such as air quality impacts on children, other chronic effects, other additional morbidity effects of short-term exposure.
- 3.2.11 The assessment does not present the actual estimates of health impacts e.g. years of life lost, respiratory hospital admissions and cardiovascular hospital admissions. It would have been straightforward to report these estimates, as shown in Appendix B.
- 3.2.12 The way the affected population is calculated also underestimates the affected population because only the population in the Principal Study Area is reported and the population living along key routes in the Wider Study Area is not discussed. Apart from underestimating an important output of the air quality assessment in its own right, this underestimation in turn affects the quantification and monetisation of the population health impacts in the partial impact pathway assessment.
- 3.2.13 Most importantly, there is no consideration and discussion of the potential for widening inequalities in health from impacts on residents already facing significant environmental and socio-economic disadvantage. This lack is not equivalent as there are more disadvantaged residents living around Heathrow than Gatwick in both the Principal and Wider Study Areas. One approach to analysing equity issues would be to qualitatively and quantitatively assess the numbers of people experiencing airport and non-airport related air pollution and the magnitude of their exposure to this air pollution, both now (existing) and future (with and without the proposed schemes) and weight this by level of socio-economic deprivation. For example, the Index of Multiple Deprivation can be overlain on the air quality spatial maps to enable a qualitative consideration and discussion of where existing air pollution burdens are and whether future modelled increases and decreases in air pollution are likely to be experienced in areas already facing high levels of deprivation. Then an estimate of the number of people experiencing airport-related air pollution by level of deprivation could be developed. One additional way of accounting for the existing unequal burden of disease related to air pollution, given that air pollution has no threshold for adverse health impacts, would

be to estimate the quantifiable health impacts from the existing baseline, future with and without scheme, and between schemes, using a lower public health threshold, such as $20\mu\text{gm}^{-3}$, for both annual means of PM10 and NO2 rather than the current $40\mu\text{gm}^{-3}$.

3.3 Recommendations

3.3.1 The earlier review report sent to the AC recommended the following approach in relation to the AC's air quality assessment:

3.3.2 An impact pathway assessment approach as part of the second stage assessment should be used as this approach can provide a more comprehensive quantification of health endpoints (using established exposure response functions from the Committee on the Medical Effects of Air Pollution (COMEAP), Clean Air For Europe Cost-Benefit Analysis modelling framework (CAFE-CBA) or the World Health Organization (WHO), including impacts from Ozone (O_3), to take full account of potential impacts on public health from changes to air quality.^{8 9 10}

3.3.3 We would again reiterate this recommendation and add the following to improve the quality and depth of the AC's Air Quality Local Assessment.

3.3.4 The AC's Air Quality Local Assessment should:

- Undertake a comprehensive impact pathway assessment of the air quality health and wellbeing impacts, for both the Principal and Wider Study Areas, for all three schemes.
- Explicitly consider and discuss the inequality/equity impacts on residents already experiencing disadvantage by taking account of the existing baseline health status as well as existing environmental and socio-economic burdens.

⁸ Committee on the Medical effects of Air Pollution (COMEAP) Available at <https://www.gov.uk/government/groups/committee-on-the-medical-effects-of-air-pollutants-comeap#publications>

⁹ Clean Air For Europe (CAFE-CBA) Available at <http://www.cafe-cba.org/>

¹⁰ WHO Available at http://www.who.int/topics/air_pollution/en/

- Explicitly report the number of properties and population affected by scheme-related air pollution for both the Principal and Wider Study Areas (not just the Principal Study Area).
- Explicitly report the estimated health impacts that are used to derive the monetary values e.g. years of life lost, respiratory hospital admissions and cardiovascular hospital admissions.
- Explicitly acknowledge and discuss the implications of the health impacts where quantification is not currently recommended by DEFRA such as air quality impacts on children, other chronic effects, other additional morbidity effects of short-term exposure.

4 Conclusion

- 4.1.1 Overall, the Airports Commission's Air Quality Local Assessment would have benefited from a comprehensive impact pathway assessment.
- 4.1.2 There are some potentially significant gaps in estimating the full range of health impacts and in considering and assessing (qualitatively or quantitatively) the potential inequality/equity aspects of changes in air pollution both at the airports as they currently operate and for future with and without scheme options.
- 4.1.3 The recommendations identified in this Review Report if undertaken are likely to improve the quality of the analysis of the existing Air Quality Local Assessment undertaken by the Airports Commission.

Appendix A:

Key Summary Extracts from Green Book and DEFRA Supplementary Guidance on Health impacts and Air Quality

HM Treasury's Green Book (July 2011)

This publication states that all new policies, programmes and projects should be subject to comprehensive but proportionate assessment so as best to promote the public interest. It presents the techniques and issues that should be considered when carrying out assessments and describes how the economic, financial, social and environmental assessments of a policy, programme or project should be combined.

The first step is to justify the action, ensuring there is a clearly identified need and that any proposed intervention is likely to be worth the cost. The second step is to set out the desired outcomes and objectives to identify the full range of options that may be available to deliver them.

The third step is to carry out an option appraisal, often the most significant part of the analysis. More fully, the appraisal may develop as follows:

- Identify and value the costs of each option.
- Identify and value the benefits of each option.
- If required, adjust the valued costs and benefits for:
 - Distributional impacts (the effects of proposals on different sections of society);
 - Relative price movements.
- Adjust for the timing of the incidence of costs and benefits by discounting them, to obtain their present values.
- If necessary, adjust for material differences in tax between options.
- Adjust for risk and optimism to provide the Base Case, and consider the impacts of changes in key variables and of different future scenarios on the Base Case.
- Consider unvalued impacts (both costs and benefits), using weighting and scoring techniques if appropriate.

Following option appraisal, decision criteria and judgment should be used to select the best option or options, which should then be refined into a solution. Evaluation is similar in technique to appraisal, although it uses historic rather than forecast data, and takes place after the event.

The ultimate outcome of any appraisal is a decision whether or not to proceed with a proposal or a particular option. As these decisions will often have far reaching consequences, the presentation of the conclusions and recommendations to decision makers and key stakeholders can be as important as the analysis itself. In all cases, transparency is vital. Presentations and reports should be clear, logical, well founded, and geared towards helping the decision at hand. Summary reports in particular should be drafted in non-technical language wherever possible.

Reports should provide sufficient evidence to support their conclusions and recommendations. They should provide an easy audit trail for the reader to check calculations, supporting evidence and assumptions. Major costs and benefits should be described, and the values attached to each clearly shown rather than netted off in the presentation of the analysis. This should help to ensure that decision makers understand the assumptions underlying the conclusions of the analysis, and the recommendations put forward. Appraisal reports should contain sufficient information to support the conduct of any later evaluation.

There is a wide range of generic issues that may need to be considered as part of any assessment. Two of which are: 1) Equality – Impacts on various groups in society should be considered as part of an appraisal; 2) Health – the impacts of proposals on health should be considered, and evaluation made of the impact on health of poverty, deprivation and unemployment, as well as poor housing or workplace conditions.

Most appraisals will identify some costs and benefits for which there is no readily available market data. In these cases, a range of techniques can be applied to elicit values, even

though they may in some cases be subjective. There will be some impacts, such as environmental, social or health impacts, which have no market price, but are still important enough to value separately. Regarding this valuation of non-market impacts, the Green Book, Annex 2 page 62, provides examples of how the Department for Transport (DfT) values the reduction of the risk of death and the prevention of non-fatal casualties in the context of road transport, with values uprated in line with assumed changes in GDP per head.

Regarding air quality sophisticated modelling tools exist to forecast emissions from different sources and estimate the impact on ambient concentration levels of different pollutants at different locations. Research has been funded to develop a methodology for quantifying and monetising, where appropriate, the health and environmental impacts of air quality changes.

Adjustments will often be required to take account of distributional impacts, and relative price changes to develop the Base Case. As for all adjustments, they should be shown separately, clearly and explicitly in any supporting tables of data.

Regarding distributional analysis, it is important that the distributional implications of each option are considered, enhancing the understanding of the fairness of proposals, their social impacts and their scale. The impact of a policy, programme or project on an individual's well-being will vary according to his or her income; the rationale being that an extra pound will give more benefit to a person who is deprived than to someone who is well off. Other distributional issues may also arise, and should be considered e.g. a proposal may have differing impacts according to age, gender, ethnic group, health, skill, or location. These effects should be explicitly stated and quantified wherever feasible. Generally though, these other distributional issues are largely correlated with income. Therefore, if more in depth analysis is undertaken, it should focus on how the cost and benefits of a proposal are spread across different socio-economic groups. For the purposes of project appraisal, relative prosperity may often be best defined by relative income, adjusted for household size, and divided into quantiles (e.g. quintiles or deciles). The equity impact of competing options can

be compared by charting the impact each has on different 'quantiles' of the income distribution. Proposals that deliver greater net benefit to households or individuals in lower income quantiles are rated more favourably than those that benefit higher quantiles. A more in depth analysis uses distributional weights to adjust explicitly for distributional impacts in the cost- benefit analysis. Benefits accruing to households in a lower quantile would be weighted more heavily than those that accrue to households in higher quantiles. Conversely, costs would be weighted more heavily for households in lower quantiles. Where appraisers decide not to adjust explicitly for distributional impacts, they must provide a justification for this decision. This judgement should be informed by the following considerations:

- The significance of the impact of distributional analysis to the proposal under consideration;
- The ease with which distributional impacts can be measured; and
- The scale of the impact associated with a particular project or proposal.

Regarding the consideration of unvalued costs and benefits, the Green Book states these should also be appraised; they should not be ignored simply because they cannot easily be valued. All costs and benefits must therefore be clearly described in an appraisal, and should be quantified where this is possible and meaningful. Fully involving stakeholders is very important in making judgments between monetised and non-monetised effects.

Regarding equity, an important rationale for government intervention is the achievement of equity objectives. Before acting, an assessment should be made of the extent of the inequality to be redressed, and the reasons it exists.

Any distributional effects identified should be explicitly stated and quantified as far as possible. At a minimum, this requires appraisers to identify how the costs and benefits accrue to different groups in society.

It follows from this that a rigorous analysis of how the costs and benefits of a proposal are spread across different socio-economic groups is recommended. Where it is considered

necessary and practical, this might involve explicitly recognising distributional effects within a project's Net Present Value.

Valuing impacts on air quality: Supplementary Green Book guidance (DEFRA, May 2013)¹¹

The supplementary Green Book guidance should be used in conjunction with the Green Book when assessing proposals that lead to changes in UK air pollution. Three approaches to value changes in air quality are presented: 1) the damage cost approach (DCA), 2) the impact pathway approach (IPA) and 3) the abatement cost approach (ACA).

Damage-cost approach (DCA) assesses the scale of air quality impacts where they are less significant, i.e. valued at less than £50m. DCA was derived from the impact pathway approach (IPA) methodology to offer an approximation of the value of impacts, as it is a simpler approach, estimating an average impact on an average population affected by changes in air quality (Source: <https://www.gov.uk/air-quality-economic-analysis>). Since they are approximations it is recommended they should be reported only when they are less than £50m and when air quality is not the main objective of the policy decision.

Impact-pathway approach (IPA) is the central methodology. It is more resource and time intensive, requiring estimation of emissions, dispersion, population exposure and outcomes. IPA provides a fuller assessment and is suitable for cases where air quality impacts are significant, i.e. valued at more than £50m. Using the IPA also depends on a range of other factors such as the importance of air quality to the specific decision. This approach should be considered in consultation with DEFRA¹².

Abatement-cost approach (ACA) is suitable for cases where the change in air quality is likely to affect compliance with legally binding obligations. The ACA only values those changes in air quality in excess of the relevant obligation i.e. the cost of abatement to restore compliance. Changes below the obligation should be valued using the impact pathway approach. Additional guidance documents on each approach are provided by DEFRA.

¹¹https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/197893/pu1500-air-quality-greenbook-supp2013.pdf

¹² If estimates are higher than £50m, consider using an impact pathway assessment and contact igcb@defra.gsi.gov.uk for advice.

Air Quality Appraisal – Damage Cost Methodology (DEFRA, February 2011)¹³

At present damage costs are recommended for use in policy analysis where cost-benefit analysis is appraising the policy over a period of 20 years or less and either:

- the policy does not have air quality improvements as its main objectives; or
- scoping analysis is being carried out to help filter potential policy options at the initial stage of the process.

The damage costs are dominated by chronic mortality health impacts and are based on a 6% per 10µg.m-3 PM2.5 change in hazard rate.

The damage costs presented in this paper exclude several key effects as quantification and valuation is not possible or is highly uncertain. These are listed below and should be highlighted when presenting valuation results where appropriate. The key health effects that have not been included are:

- Potential additional morbidity from acute exposure to PM;
- Potential mortality effects in children from acute exposure to PM;
- Potential morbidity effects from chronic (long-term) exposure to PM or other pollutants;
- Effects of exposure to ozone, including health impacts;

The effects on health of air pollution changes can also be presented as quantified health impacts instead of the monetised impacts discussed in the main part of this paper. These show:

- Chronic mortality effects – by quantifying the numbers of life years lost (over 100 years) per tonne of pollutant reduced
- Morbidity effects – by quantifying the number of hospital admissions saved per year (for both respiratory and cardiovascular illnesses) per tonne of pollutant reduced.

¹³ https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/182391/air-quality-damage-cost-methodology-110211.pdf

The table below sets out the health benefits per tonne consistent with the annual pulse approach. As no valuation is necessary the calculation to determine the air quality related health benefits of your policy is simply:

Total health impact = Sum of number of tonnes of pollutant reduced (across appraisal period) x Health benefits per tonne.

	Years of life lost over 100 years		Respiratory hospital admissions (per annum)	Cardiovascular hospital admissions (per annum)
	No lag	40 year lag		
PM (Transport) ¹⁴	2.059	2.238	0.017	0.017
• Central London	10.226	9.409	0.079	0.080
• Inner London	10.517	9.677	0.082	0.082
• Outer London	6.870	6.321	0.053	0.053
• Inner conurbation	5.438	5.003	0.042	0.042
• Outer conurbation	3.379	3.109	0.026	0.026
• Urban big	4.028	3.706	0.031	0.031
• Urban large	3.245	2.985	0.025	0.025
• Urban medium	2.551	2.347	0.020	0.020
• Urban small	1.611	1.482	0.013	0.013
• Rural	0.694	0.638	0.005	0.005
PM (ESI)	0.112	0.103	0.001	0.001
PM (Domestic)	1.298	1.194	0.010	0.010
PM (Agriculture)	0.448	0.412	0.003	0.003
PM (Waste)	0.962	0.885	0.007	0.007
PM (Industrial)	1.164	1.071	0.009	0.009
NO _x	0.082	0.089	0.001	0.001
SO ₂	0.121	0.132	0.001	0.001

¹⁴ Damage costs for PM (transport) are at a UK-wide level, with disaggregated damage costs presented below split by current National Transport Model area. For further information on the breakdown of National Transport Model and populations covered by each sub-area, to help determine which area is most appropriate to use, please visit http://www.dft.gov.uk/stellent/groups/dft_econappr/documents/divisionhomepage/030708.hcs p.

Impact pathway guidance for valuing changes in air quality (DEFRA, May 2013)¹⁵

Impact-pathway approach (IPA) is the central methodology. It is more resource and time intensive, requiring estimation of emissions, dispersion, population exposure and outcomes. IPA provides a fuller assessment and is suitable for cases where air quality impacts are significant, i.e. valued at more than £50m. Using the IPA also depends on a range of other factors such as the importance of air quality to the specific decision. This approach should be considered in consultation with DEFRA¹⁶.

The location of emissions has a substantial effect upon the scale of air quality impacts, particularly for health impacts, as impacts in highly populated areas will be much larger. The impact pathway approach recognises the importance of geographical location.

A large volume of information is needed to complete an impact pathway assessment fully and there are uncertainties in each step. The following steps are required for the IPA:

1. Emissions and dispersion
2. Quantification of impacts

The first stage for the IPA is to estimate the changes in both the level of different pollutants emitted and the resulting change in ambient concentration.

The second stage concerns quantification of impacts. Air pollution has a range of impacts, grouped into the broad areas of health, amenity, productivity and ecosystems. Evidence is most developed for health impacts. Impacts on productivity and ecosystems are at present usually expressed qualitatively. There is unlikely to be a significant amenity impact at prevailing levels of air pollution as it is generally not detectable in ambient concentrations. Regarding health, impacts are quantified for short-term and long-term exposure.

¹⁵ <https://www.gov.uk/government/publications/air-quality-impact-pathway-guidance>

¹⁶ If estimates are higher than £50m, consider using an impact pathway assessment and contact igcb@defra.gsi.gov.uk for advice.

A range of morbidity and mortality effects of short-term exposure to PM₁₀, SO₂, O₃ and NO₂ are quantified using COMEAP recommended concentration-response coefficients. The evidence supporting the association between respiratory hospital admissions and short-term exposure to NO₂ used to be considered less robust than for the other pollutants and calculation of these effects used to be recommended for sensitivity analysis only and not for central estimates.¹⁷ The emerging international scientific consensus is now that the evidence is strong enough for these to be included in the central estimates.¹⁸

Calculating the short-term health effects of pollutants requires 1) estimating pollutants concentrations and resident population affected to calculate population-weighted mean concentrations; 2) collecting baseline rates of the relevant health endpoints from national statistics; 3) estimating changes in concentrations of pollutants from a comparison of the baseline concentrations with the “with measure” scenario; and 4) producing an estimate of the health impact by first combining the concentration-response coefficient with the estimated change in emissions to give the change in risk and apply it to the baseline rate of each health endpoint.

For long-term effects, the impact of long-term exposure to particles is estimated in terms of mortality and life expectancy. Calculations entail first obtaining information on current mortality rates, predict future mortality rates using current rates, life tables and assumptions about future demography in the absence of air pollution changes. Then, an alternative scenario capturing the effect of the change in air pollution is estimated by adjusting mortality rates based on exposure-response coefficients. Comparing the predicted life expectancy with between the baseline scenario and the with pollution scenario provides an estimate of the effect of the change in pollution. Sensitivity analysis can be undertaken to

¹⁷ This is the position expressed the “Impact pathway guidance for valuing changes in air quality” from Defra, May 2013

¹⁸ See WHO REVIHAAP and HRAPIE projects for a detailed discussion of this issue. Available at <http://www.euro.who.int/en/health-topics/environment-and-health/air-quality/activities/health-aspects-of-air-pollution-and-review-of-eu-policies-the-revihaap-and-hrapie-projects>

test underlying assumptions. Detailed information on this methodology is provided by COMEAP.¹⁹

Valuation of impacts

Values for a range of morbidity and mortality health endpoints have been agreed, drawing on evidence on the willingness to pay to reduce the health impacts associated with air pollution. These values are reported in the DEFRA impact pathway guidance for valuing changes in air quality and should be updated to current prices. It is also recommended for the health values to be uplifted by 2% per year for analyses spanning a number of years, following an approach taken by the Department of Health.²⁰ Values calculated also need to be discounted to reflect the fact that current benefits have greater value in the present than future benefits. To do this a 3.5% discount rate should be applied in line with Treasury Green Book recommendations.

Values are given for acute mortality, chronic mortality, respiratory hospital admissions and cardiovascular hospital admissions.

Uncertainties

There are uncertainties along each step of the IPA. Assumptions for both central modelling and sensitivity analysis should be set out clearly to ensure that results can be interpreted correctly.

Emissions and dispersions often need to be projected into the future, inevitably introducing uncertainty about future projections. It is recommended that these uncertainties are reflected as modelling uncertainties rather than in the monetary valuation with the exception of trans-boundary air pollution.

The main uncertainty around the quantification of health impacts concerns the size of the concentration-response coefficients, especially for the long-term effects of particles.

¹⁹ COMEAP (2009), 'Long-term exposure to air pollution: effect on mortality', available from www.comeap.org.uk/documents/reports/

²⁰ Policy appraisal and health: a guide from the Department of Health, Department of Health, 2004.

Additional uncertainties relate to the impact on respiratory hospital admissions from changes to NO₂ i.e. whether to include them as part of the central or sensitivity analysis, and the different assumptions about coefficients and the lags on effects that could be applied. A detailed discussion of these uncertainties is found elsewhere.²¹

Uncertainties about valuation relate to the chosen values attributable to each health outcome and changes in technology costs. A range is provided for the recommended health values in Table F of DEFRA's impact pathway guidance for valuing changes in air quality.

Given the range of uncertainties the IGCB also recommends the use of alternate methodologies which may reflect a range of differing assumptions across the impact pathway methodology. In particular it is recommended that the Clean Air for Europe values also be applied as a sensitivity.

Social cost benefit analysis and the consideration of inequalities

Social cost benefit analysis (SCBA) provides a framework to compare different policies. It focuses on the overall societal impact of any decision. Simply put, the social costs and benefits of each policy are quantified and valued in monetary terms. Costs can be subtracted from the benefits to estimate the net cost or benefit and alternative options can be ranked. However, a monetised net cost does not automatically mean a measure is not worthwhile and a monetised net benefit may not mean a measure is worthwhile. Not all concerns can be captured by the quantified costs and benefits, such as distributional considerations and non-monetised impacts. These should also inform the decision making process.²²

Often supplementary qualitative assessments are needed where monetary values are unavailable. Uncertainties surrounding the quantification and valuation of costs and benefits

²¹ See Chapter 5 of Volume 3 of the Air Quality Strategy, available from www.gov.uk/government/publications/an-economic-analysis-to-inform-the-air-quality-strategy

²² Impact pathway guidance for valuing changes in air quality. Defra, May 2013

also need to be considered when results are interpreted. Any distributional impacts should still be reflected in the wider consideration of any policy.⁷

Appendix B:

Illustrative Presentation of the Estimated Health Impacts of Each Proposed Scheme

Illustrative Presentation of the Estimated Health Impacts of Each Proposed Scheme

The DEFRA Air Quality Appraisal Damage Cost Methodology describes a simple method to estimate health impacts as quantified health impacts instead of the monetised impacts. A table²³ is provided that sets out the health effects attributable to each tonne of emissions on Page 21. As no valuation is necessary the calculation to determine the air quality related health effects of a policy is obtained by simply multiplying the sum of number of tonnes of pollutant emitted (across the appraisal period) by the health effects factor per tonne.

Applying this simple approach to the estimated emissions in 2030 attributable to each proposed scheme as presented in the AC's Air Quality Local Assessment (Tables 4.3, 5.3 and 6.3) enables the quantification of health impacts attributable to each proposed scheme. These effects are presented in Table 1 below.

Table 1: Estimates of annual (2030) health effects from scheme-related emissions using damage-cost approach

	YoLL ^a	RHA ^b	CVHA ^b
Gatwick 2R	321.6	3	3
Heathrow NWR	994.9	9	9
Heathrow ENR	739.1	6	6

YoLL = years of life lost; RHA = respiratory hospital admissions; CVHA = cardiovascular hospital admissions

^a Figures rounded to 1 decimal place

^b Figures rounded to the nearest unit

NB: For simplicity, the quantification of health impacts is the sum of the health impacts of NO_x and PM₁₀

These estimations should be undertaken for the entire appraisal period, which in this case is 60 years. Assuming the emissions estimated for 2030 occur every year of the appraisal

²³ Table in Annex 2 of Air Quality Appraisal – Damage Cost Methodology, DEFRA, February 2011.

period²⁴, the health effects presented in the table below can be attributed to each proposed scheme.

Table 2: Estimates health effects from scheme-related emissions for the 60 year appraisal period using damage-cost approach

	YoLL ^a	RHA ^b	CVHA ^b
Gatwick 2R	19,295.5	192	192
Heathrow NWR	59,691.0	517	517
Heathrow ENR	44,347.5	386	386

YoLL = years of life lost; RHA = respiratory hospital admissions; CVHA = cardiovascular hospital admissions;

^a Figures rounded to 1 decimal place;

^b Figures rounded to the nearest unit;

This calculation method used above follows the same methodology as the damage cost approach. However, and as already discussed in the main text of this report, for situations where the health-related air quality impacts are significant, as is the case in each of the three proposed schemes, an impact pathway assessment approach should be used to estimate and monetise the health impacts. The AC local air quality assessment has generated the majority of the data required to undertake this calculation.²⁵ However, as the detailed data on the population exposed is not presented in their report, we are unable to attempt a calculation of our own.

²⁴ This is likely to not be the case but we do not have the data on the estimated emissions for each year to be able to perform a more accurate estimation.

²⁵ The AC local air quality assessment reports that future incremental pollutants concentrations have been calculated at least for the 2030 scenario; an estimation of the population within each study area has been undertaken based on the datasets provided by CACI.

Appendix C:

Review Team Biography

REVIEW TEAM

Salim Vohra

Dr Salim Vohra has 22 years of experience in public health medicine in various settings and over 12 years of experience of undertaking health impact assessment (HIA).

He has led HIAs in a range of sectors – economic, energy, health services, housing, transport, regeneration and waste at project and policy levels - either as stand-alone HIAs or ones that were part of environmental and social assessments and strategic environmental assessments/sustainability appraisals. His recent HIAs include High Speed 2, Thames Tideway Tunnel, A6-Manchester Airport Relief Road, gas refining project in Qatar, tight gas fracking project in Ukraine and an oilfield redevelopment in Iraq.

He was lead author for three guides: a Health Scotland HIA guide of greenspace and an international guide on HIA and an occupational health risk assessment guide for the International Council on Mining and Metals.

He led a review for the English Department of Health on how HIA is carried out by government departments '*Putting Health in the Policy Picture*'.

He led the wellbeing stream for the Scottish Governments '*Environmental Determinants of Public Health*' (EDPHiS) research project and was a leading member of the health work package for the European Commission research project '*Improving the Implementation of Environmental Impact Assessment*' (IMP3).

He has worked with the World Health Organization on capacity building and incorporating HIA into environmental assessments.

His educational background is in medicine (MBChB), environmental epidemiology (MSc) and public health policy (PhD). He is an Honorary Fellow of Staffordshire University and Conjoint Lecturer at the University of South Wales for his expertise in HIA. He is also co-Chair of the Health (HIA) Section of the International Association for Impact Assessment and an Editorial Board member for Environmental Impact Assessment Review. He is an Associate of the Faculty of Public Health and member of the Transport and Health Study Group.

Filipe Silva

Filipe has 6 years of experience in public health medicine in various settings. He has experience of undertaking health impact assessment and health assessment components of environmental and social assessments, public health research and epidemiology, epidemiological surveillance, health systems management, community development and health promotion work in both high income and low to middle income countries, within public, private and voluntary sector organisations. He has a strong interest in quantification, particularly in relation to the health impacts of air pollution.

He has participated in twelve projects including stand-alone health impact assessments and the health assessment component of ESIAs and SESAs on policies, plans and projects in the oil and gas, extractives, transport and urban planning sectors. He has a strong focus on the quantitative assessment of health effects, particularly in relation to air pollution. He is currently a director at PhD responsible for business development in Latin America.

Filipe has a Bachelor and Masters in Medicine by the University of Oporto and a Masters in Public Health by the London School of Hygiene and Tropical Medicine with a focus on health in EIA and SEA, environmental health and environmental epidemiology. He has undertaken additional specific training in geographical information systems applied to public health research and practice, health impact assessment (IMPACT, University of Liverpool), strategic environmental assessment and environmental impact assessment principles and practice.

Filipe is clinically registered with the Portuguese Medical Association. He is also a member of the Portuguese Impact Assessment Association and the International Association for Impact Assessment.

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Registered Office: 15 Shelburne Drive Hounslow Middlesex TW4 5LA