

Environment, Food and Rural Affairs Committee

Oral evidence: Air quality, HC 479

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Written evidence from witnesses:

- [Professor Paul Wilkinson, Kings College London](#)
- [Professor Mark Sutton, NERC Centre for Ecology & Hydrology, Edinburgh Research Station](#)

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Members present: Neil Parish (Chair); Chris Davies; Jim Fitzpatrick; Dr Paul Monaghan; Rebecca Pow; Ms Margaret Ritchie; Angela Smith; Rishi Sunak

Questions 1-88

Witnesses: **Professor Martin Williams**, London School of Hygiene and Tropical Medicine, **Professor Paul Wilkinson**, King's College London, and **Professor Mark Sutton**, Centre for Ecology and Hydrology, Edinburgh, gave evidence.

Q1 Chair: Good afternoon. Thank you very much for coming to join us. This is our first evidence session on air quality, and we really appreciate you coming. Would you like to introduce yourselves? Then we will set upon you, in a manner of speaking.

Professor Williams: Pleasure to be here. I am Professor Martin Williams. I am a professor of air quality research at King's College in London.

Professor Wilkinson: I am Paul Wilkinson. I am a professor of environmental epidemiology at the London School of Hygiene and Tropical Medicine.

Professor Sutton: I am Mark Sutton from the UK's Centre for Ecology and Hydrology in Edinburgh, and I have an honorary chair at the University of Edinburgh.

Q2 Chair: Thank you all for coming this afternoon. My first question is a fairly broad one. As the air quality seems to be varying from year to year, what is the extent of the UK's air quality problem? It is quite a big question, but who wants to start?

Professor Williams: There are two aspects to this question. One is a legal compliance question and the other is a public health and ecosystem health question. The issues around legal compliance are probably fairly well known; they have been aired quite a lot. We, as the UK, are facing potential infraction proceedings from the European Commission on nitrogen dioxide, so that is that. We can explore that, if you like.

The public health issue is probably more important, in many ways. There are legal limits for pollutants that are known to damage health: NO₂, nitrogen dioxide; particles, PM, PM_{2.5}; ozone and others. These legal limits are not necessarily safe limits in the sense that, if you achieve them, there are no public health impacts. The World Health Organisation guidelines are generally lower than these legal limits and they, by and large anyway, are potentially protective of human health. We are a long way from achieving those in the UK, as are many other countries too. The public health problem is still a fairly large one.

Ecosystem health equally is also an issue. The acid rain problem is by and large solved, although Mark may want to expand on that. The major ecosystem problem that we face is so-called eutrophication, which in layman's terms is an excess of nitrogen. As you will know if you are a gardener, you feed plants with nitrogen, but too much in an ecosystem can be damaging, leading to loss of biodiversity and all sorts of other impacts. That is a pretty rough thumbnail sketch of where we are in the UK.

Professor Wilkinson: If I could just add a comment on the health effects, it is important to take in Martin's comment about limit values and standards. Those do not reflect levels at which it is safe for health. For all major air pollutants that are harmful to health, there is no evidence of any threshold, with the possible exception, but still debated, of ozone. For all the other major pollutants—particle fractions, nitrogen dioxide and so on—the lower the concentrations, the greater the health benefits. As far as we can gather, although we do not have the epidemiological evidence right down to zero, all the way down to zero is the reasonable presumption from where we are at the moment. It means, therefore, that simply trying to hit limit value targets and ensure that we do not exceed them would only achieve part of the substantial burden relating to air pollution as it is at the moment.

Professor Sutton: On the ecosystems aspect, which Martin already alluded to, if we express it in terms of the area of the United Kingdom where ecosystems are at threat of nitrogen deposition, it is 62% of the area. 89% of the special areas of conservation have exceedance over part of their area. That is the scale of the area threat to our ecosystems. In terms of the changes, we have loss of biodiversity, flowering plants going out, algae coming in and colonising, green, gloopy slime on trees—lots of changes.

It is worth adding that, in terms of those legal limits linked to human health effects and air pollutants, we do not really have that with the ecosystems side. There is guidance on working towards the critical loads as a measure of the extent of the problem. To take one example, ammonia concentration, there is not a limit value set for ammonia at present. There is a scientific basis to do so and that is being reviewed in the United Nations

Economic Commission for Europe, but across Europe and the UK, there is not any limit value for that gas.

Q3 Chair: I have a couple of supplementaries. Trends show a significant reduction in many pollutants. Emissions of which pollutants remain too high, and where are the hotspots? Would it be fair to say, certainly on vehicles, we seem to have been paranoid about CO₂, and then we suddenly seem to have changed to nitrogen oxide, or is it unfair to make that comparison?

Professor Williams: No, it is not unfair. The reason that we went after CO₂ originally was because of the climate change threat. It is not fair to say that, at the time, the toxic air pollutants were ignored. We thought the European regulations on vehicles would work. All our projections showed emissions were going to go down because we could see increasingly stringent limits on vehicle emissions coming along. The thinking was: we will go after CO₂ because we have air pollution in the bag and controlled. Subsequently, we find those regulations did not work, and so we now find ourselves in a position with NO_x emissions, oxides and nitrogen way higher than they ought to be and way higher than we thought they were going to be.

Q4 Chair: Were you in the scientific community duped by the regulations? I know it is easy to ask the question, not so easy to get the answer, but why are we where we are?

Professor Williams: We were not duped. Documented reports were produced for Defra back in the 1980s that stated the diesel problem: that diesels were going to emit more particles and NO_x than petrol cars and so on. But we could foresee the regulations coming on stream and we, in genuine good faith, thought that they would work. It was not a question of being duped; it was a question of what in hindsight had been the wrong decisions taken in good faith.

Chair: We are all quite wise in hindsight, are we not?

Q5 Jim Fitzpatrick: On Professor Williams's last answer about anticipating that the regulations would work, did they not work because they were brought in more slowly than was expected, because they were not as effective as expected, or because we did not see the volumes? Why was it that they did not work?

Professor Williams: They did not work largely because the test cycle that cars have to go through in the laboratory before they are allowed to go on the road or allowed to be sold was not aggressive enough to reflect real-world driving. It was a relatively benign drive cycle and, as it turned out, as VW have admitted, it was capable of being cheated.

Q6 Jim Fitzpatrick: In some respects, the Chair's question about whether we were duped is part of it. Whether it was conspiratorial, whether it was for business and profit or whether it was just because they were trying to put the best gloss on it, it did not reflect what was happening when the vehicles hit the road.

Professor Williams: That is right. Arguably, if the test cycle had been aggressive and dynamic enough, it may not have been capable of being cheated. It is a combination of things, if you see what I mean.

Q7 Chair: We are going to deal more with that in a minute. Where are the pollution hotspots in the UK? They are in the inner cities, I imagine, but is it just the inner cities?

Professor Williams: It depends which pollutant you are talking about. Nitrogen dioxide, to take a topical example, is generally highest in London as a city average, but any busy road with a lot of traffic and a particularly high proportion of diesels is going to have a high NO₂ concentration. Defra has documented the zones in the UK where the legal limits are being breached. The WHO guideline for NO₂ is the same as the legal limit, so the health impacts are still substantial from NO₂ in most inner cities or anywhere where there is a big road.

Particle concentrations tend to be smoother in terms of their spatial gradient and so they, by and large, are fairly uniform across the UK, with hotspots in cities. There is a background of PM that comes partly from the continent and partly from us. There is this uniform background, on which are superimposed hotspots where vehicle emissions and local sources arise. It is primarily an urban problem, largely because, when you tot up the health impact across the UK, it is in urban areas where most people live. If you are counting the bodies, as it were, then they are going to be in urban areas, but levels in rural areas are relatively high too.

Ozone tends to be a rural pollutant. It tends to be depressed in urban areas for atmospheric chemical reasons, which we do not have to go into. Suffice it to say that the levels are lower in urban areas, although they can peak in smog episodes and cause problems there too.

Q8 Chair: I suppose atmospheric conditions must make a lot of difference to where the actual pollutant is and whether it rises more quickly.

Professor Williams: Yes. Still, anti-cyclonic high pressure conditions are the classic case for poor dispersion and increased concentrations. These lead to short-period, short-term exposure problems, although a lot of the recent evidence in the last 10 years or so, on PM in particular and increasingly on nitrogen dioxide, relates longer-term annual exposures of NO₂ and PM to impacts on mortality and so on. It is not just the peaks; it is not just those smog episodes in low wind speeds. It is continuous exposure that is an issue.

Professor Wilkinson: You ask where the problems and the hotspots are. It is not altogether appropriate just to pick out hotspots, because the burden from air pollution overall is very large, even at the national average exposure levels. I am sure you know the figures: estimates of about 29,000 excess deaths in the UK; six months' average loss of life expectancy for every person. That is a very appreciable burden.

That is calculated on the basis of particle concentrations, PM_{2.5}, which, as Martin suggests, are relatively homogenous across the country. There is more of a concentration in the south-east, largely because of the air mass coming from the continent, but it is relatively evenly distributed. It is not just an urban problem; it is even in rural areas. Indeed, if you look at the contribution of different places, the air mass blown in usually contributes more of the background concentration than do local sources, so it is a countrywide problem. Yes, of course, it is greater in urban areas than elsewhere, but for particles in particular it is relatively widespread.

On the issue about what other pollutants may contribute to in terms of adverse health effects, there is, as you know and as Martin has mentioned, growing evidence about the adverse effects of nitrogen dioxide, which is something that therefore goes along with largely vehicle emissions, so it is bound to be higher in urban centres. But ozone is elsewhere, and it would not surprise me, if we were having this discussion in five years' time, to be also having quite a debate about the adverse health effects of long-term exposure to ozone as well. The evidence is evolving all the time, and just picking out individual pollutants is not necessarily where we should be for all time.

Professor Sutton: I just want to add this, in terms of the reason why the particles are smooth and the gases are peaky. Essentially, the emissions are as gases, be they NOx from a car or ammonia from a cow. For the gases themselves, there are hotspots. In the case of the hotspots on agriculture and ammonia, it is the livestock rather than the cropping. The fertilisers emit some, but it is only about 20%. It is 80% from the pigs, the poultry, the cattle. Once it gets up into the atmosphere, it slowly mixes and the different compounds form the particles. It takes a few days for that to happen, and that is why it is a rather smooth field. Others in Europe are getting our pollution; we are getting theirs. The big events will often be when there is a pollution event combined with still weather and air coming from the east.

Q9 Chair: Can I ask a facetious question? Why can we not argue in the courts that the pollution came from somebody else and it did not come from us? How do you measure what gets blown in and what is home-grown?

Professor Williams: We can get a pretty good handle on that from a combination of measurements and modelling, so we have a pretty good idea. In a sense, we do argue in the courts precisely on that line. Ozone is the classic example. The majority of the ozone that we measure in the UK is formed from emissions in other countries, and vice versa. The way you regulate that is not to set a legal limit for ozone in the UK, because no Government would sign up to being responsible for somebody else's emissions. What we do is sign up to legal limits on our emissions of the precursors of ozone in the first place, in something called the National Emissions Ceilings Directive. That is something that a Government can be held accountable for and yet is designed to control these trans-boundary flows.

Q10 Jim Fitzpatrick: I just wanted to ask Professor Sutton about his comments on agriculture: 80% from animals, 20% from fertilisers. I seem to remember reading some articles over recent years about trying to calculate exactly the volumes coming from animals, because they are not entirely traceable. Checking vehicles has been proven to be difficult because the manufacturers are saying one thing and real life says something else. Is the data very accurate now in terms of the contribution from livestock?

Professor Sutton: It is a very different make-up, because you have lots of small farms rather than a few big vehicle manufacturers. It is fair to say that it is built up on a wealth of statistics: what is the level of nitrogen excretion from a cow? How much is in manure? How much is in urine compared, in terms of productivity, to milk production, for example? Those numbers are pretty well known. Then scaling it up spatially, the first and main driver is: where are the animals and where is the fertiliser used? That is the big one.

Northern Ireland is an area of intensive milk production. East Anglia is primarily cropping, apart from the pig and poultry hotspots in the middle there.

You see that in the map of the model, and you can then see that the monitoring network picks up those patterns. I would say that is a really good understanding. Where we are more limited is that, while there are already some good practices being done by farmers, as to how much and where they are being done, we do not really have such good information, and certainly not spatially.

Chair: We will be interested in where the good practices are.

Q11 Rishi Sunak: Thank you for being here today. It would be helpful if you could go through the major air pollutants. I do not know if it is possible to rank them, but just say what the major health implications are for us of each of the major air pollutants and, in your minds, which ones are the highest priority and the lowest priority.

Professor Williams: Let us concentrate on health effects first, and Paul will amplify, I am sure. The one for which the evidence is strongest is particulate matter, PM, and in particular—pardon the pun—PM_{2.5}, which is associated largely with premature mortality in terms of cardiorespiratory effects: the heart and lung system. There is really quite strong evidence now from around the world for those effects. That is the pollutant that is primarily responsible for the headline figure of 29,000 premature deaths in the UK. The evidence is getting stronger all the time. PM_{2.5} is made up of a whole complex of different pollutants, compounds and elements, and we do not know right now which of those components are the most harmful, so that is an area of important research.

Next on the list in terms of evidence is probably ozone, which is regulated not with a limit value in the EU but with these emissions ceilings. There is fairly strong evidence for the effects in smog episodes—the short-term peaks—but increasingly, as Paul has suggested, from long-term exposure to baseline ozone. That is a global problem. The global background of ozone is dependent on emissions in China, the US, Europe and pretty much everywhere. The whole policy scene would shift if we were interested in this long-term background effect of ozone. There is evidence now that that is becoming an issue.

On NO₂, nitrogen dioxide, up until a few years ago the evidence for health effects from that was less convincing than it was for PM, largely because the concentrations of NO₂ and PM are very closely correlated. It is very difficult to prise apart the effects of the two, but with more sophisticated statistical analyses, there is now increasing evidence of potentially large effects from NO₂ as well. I use the word “potentially” advisedly. They could be as large as those from PM. Whether or not they are additive is another question and the subject of current research. But those are the three big pollutants that we are concerned about.

Professor Wilkinson: For me, the one that stands out is particles. It is the only one for which the evidence of adverse health effects from long-term exposure is unequivocal. The evidence for that is now based on a wealth of international studies over the last 25 years or so. As Martin said, it is largely cardiorespiratory illnesses, but including lung cancer. In 2013, IARC, the International Agency for Research on Cancer, classified diesel emissions as carcinogenic and, a year later, classified air pollution as a group 1 carcinogen, meaning beyond reasonable doubt. Basically, it is sufficient evidence for

being causal of lung cancer. That evidence relates to long-term exposure. It is important to distinguish between effects of long-term and short-term exposure. For example, in relation to ozone, most of the evidence we have is from short episodes or day-to-day variations, but that really is a measure of exacerbation of disease only. It does not tell us about whether ozone causes new disease onset. You cannot measure that just through day-to-day fluctuation. You need studies that can measure ozone as an annual average or average over a long period.

Those studies are much more important, because they tell us about public health burdens that are much more of relevance. We know that they are not just due to exacerbation or to this phenomenon that sometimes people refer to as harvesting: that only the very frail are affected by short-term peaks, and those people may be having events brought forward in time, but they are not contributing a large additional underlying burden. Based on long-term studies looking at exposure over a long period, you can tell, in terms of new disease onset, these are true additional burdens. For that, it is very clearly particles.

Ozone is largely in relation to short-term exacerbations. There are one or two studies that have provided some evidence about long-term exposure as well, but it is much less well established and still debated. For nitrogen dioxide, in relation to long-term exposure, it is quite a complicated story, for the reason that Martin suggested about the close correlation between nitrogen dioxide and particles. Essentially, there are only a handful of studies in which the effect of particles and nitrogen dioxide have been looked at at the same time, ie in the same population, and in statistical models that contain both of those pollutants and look at how they are associated with the outcome.

When you do that, there is beginning to be evidence that the nitrogen dioxide effect is independent and, in some sense, therefore additive to that of the particle effect. But it is important to realise that, when you put both models in, if you add nitrogen dioxide to a model that has particles in, the particle effects weaken. In other words, it appears that some of what was previously thought of as a particle effect has now been transferred to nitrogen dioxide. That is not necessarily to say that nitrogen dioxide is the causative agent; we do not know. They are so closely correlated that you cannot really make the inference of which is cause and effect. But if you put them both in together, they add up to something that is apparently bigger than particles alone, and if you look at their separate relationships, it appears that nitrogen dioxide has quite a strong relationship, but by weakening the particle relationship, usually.

Together, nonetheless, the weakened particle relationship combined with the adjusted NO₂ relationship adds up to more than you would get from particles alone. It is on that basis that we are beginning to draw the conclusion that long-term exposure to nitrogen dioxide has a bigger impact than particles alone, but the probability is it is not a huge increase. It is a fairly complicated story, but we are unlikely to be looking at doubling. We may be looking at a 20% or 30% increase above estimates based on particles alone. It is of that sort of order, but it is very early days in the evidence.

Professor Sutton: You have covered particles and human health. I will go back to the ecosystems briefly. If we project back 20 years, the big issue was sulphur dioxide from the large combustion plants.

Q12 Rishi Sunak: Sorry, we are going to come on to that. Do you mind holding on to that? My colleague is going to ask next about the impact on the natural environment. To finish off with the impacts on human health, what have been the major changes in scientific research conclusions over the past five or 10 years? Very quickly, what do you think are the priorities, going forward, for further research?

Professor Williams: 10 years ago, we were pretty convinced, about particles anyway. That has just strengthened. The issue on particles is to try to tease out what the harmful components are. That is going to be very difficult, because, as I say, it is a very complex mixture of all sorts of stuff, so you really need to try to go after the important sources and prioritise those. That is still a tricky part of research.

The big change, I guess, on NO₂ is the fact that, as we have just discussed, there is now evidence for its independent effect. The potential size of that effect is a big change—a massive change, in fact. As to ozone, we have known about the impacts of short-term smog episodes in California, Europe and so on for decades. The big issue and the new finding there is the exposure to long-term ozone because, if that is substantiated, as I said earlier, the policy environment changes completely and it becomes a global problem. Then you need to get China, India, Asia, North America, potentially the whole northern hemisphere, on board.

Q13 Rishi Sunak: On this particulate matter point then, as a lay person, could you give me an example of the various different compounds within that that would call for different public policy actions? I am just trying to understand. At the moment, if we think in general they are harmful, we take public policy action x, which impacts industry y, but, with more research, you could separate them out, which would mean that industry or that activity is not contributing. Is that what it boils down to?

Professor Williams: Yes, precisely.

Q14 Rishi Sunak: Give us an example.

Professor Williams: I will give you two extreme examples. One component of the PM mix is soot from diesels and other inefficient combustion systems. It is a local problem. If you had a problem with that in London, you would go after diesels and combustion systems. Another major component of the PM mix are the so-called secondary particles—things formed in the atmosphere from emissions way upstream, maybe 1,000 kilometres upstream: ammonium nitrate, ammonium sulphate, to get chemical about it. The important point is that these are emissions that have come from other countries as well as our own. That is where you need this international agreement. Things like the National Emissions Ceilings Directive are designed to address that part of the particle problem. The policy action is crucially dependent on which of those components are the harmful ones and, if you knew that, then you would go after one hard.

Rishi Sunak: In a particular way.

Professor Wilkinson: If I could emphasis that, we do not know that yet.

Rishi Sunak: I got that.

Professor Wilkinson: We cannot distinguish. For example, in relation to road traffic, there is an assumption that it is all because of the combustion. Actually, a lot of it

might be due to tyre and brake wear and other things not related to the combustion engine, but due to the movement and braking of the car.

Rishi Sunak: That is very interesting.

Professor Wilkinson: Not all of the particle pollution would go away, even if you had an entirely electric vehicle or something. There are still particle sources. We just do not know how important those are, compared to other things.

Rishi Sunak: Thank you. That was incredibly helpful.

Q15 Angela Smith: Apologies for being late. I have a regular meeting at 2 o'clock, so I do apologise. I want to turn to the impact of emissions, particularly nitrogen and ammonia, on the natural environment. We have looked at the written evidence, and this is a huge issue, so I wondered what you think are the major impacts on the natural environment and agriculture of emissions of pollutants.

Professor Sutton: We can divide it into the nitrogen part of the story and the ozone part, which comes back again. On the nitrogen side, we have nitrogen oxides in cities, but once they are dispersed, they come down and contribute to nitrogen deposition, and similarly the ammonia. In terms of effects, it is fair to say that the biggest ecosystem effects you see out there are more from the farms in the hotspots than they are from the roads. One reason for that is simply that the roads are a big long line source and better distributed than the farm, which is often a point source. The other thing is that the ammonia can reach the ground more quickly; it is more soluble. Just because of those physical issues, the ammonia ends up having a bigger impact.

When we look at those areas, as I said earlier, we are seeing losses in biodiversity, plant species disappearing. Some of the most sensitive plant species, on for example special areas of conservation, will be things that have been there because they are used to very little nitrogen. They are the things that could compete in bad farming conditions. 200 years ago, we would have said, "Yes, wipe the nature reserves." We had a different view then. Today, nature areas are protected. The particular challenge will be where there are relic nature areas in agricultural landscapes, because that way you are quite close to sources. That makes management quite a challenge in those areas.

Coming on to the ozone, we have the nitrogen oxides reacting with volatile organic compounds, some of which are from combustion sources, some of which are natural, producing the ozone. That is primarily rated as a crop problem. It is a problem for agriculture, because it means the crops are growing less, producing less yield. It impacts on semi-natural species as well. It is fair to say, on the balance of evidence, that the evidence for nitrogen effects on biodiversity are overwhelming. As to the evidence for sustained effects of ozone on biodiversity, there will be people who say it is there. It is something that we need more evidence on.

Lastly, on interaction between the two, this is a finding from new results we have been doing in a European project called ECLAIR, where we started getting the community of nitrogen researchers working together with the community of ozone researchers. One of the interesting things is, when you have more ozone, you are not seeing the yield response you want for nitrogen. Effectively, that means that the ozone is reducing the nitrogen-use efficiency. It is not going into the crop; it is going elsewhere. That will mean you are exacerbating your water problems with nitrates and exacerbating nitrous

oxide, so you start at this point seeing the nitrogen cycle linking up. Those are the different issues.

Q16 Angela Smith: From what you are saying, there is a need for a lot more research. I hope everybody on this Committee would agree that we want to see a more successful agricultural sector while, at the same time, improving and restoring biodiversity wherever we can. On the basis of what you have said, what do you think the priorities for research should be? If we could possibly square the circle, where does the research need to be?

Professor Sutton: There is more research on the ecosystem effects and the interactions. I mentioned the nitrogen-ozone interaction. The danger is that you could go on forever with interactions; when do you have enough evidence? Clearly, we have evidence of those impacts. When it comes to your question about how we can make sure we have thriving agriculture next door to thriving nature, that is really a big challenge. There are issues there where you are using not just plot experiments but landscape experiments, looking at issues of buffer zones, spatial relationships and things like that. As I said in my evidence, one thing is to think of it as not just a problem for agriculture, but an opportunity for agriculture. I put in there some of those fertiliser values. Across Europe, €18 billion worth of nitrogen pollution goes up into the atmosphere per year. That is the fertiliser value, as compared to the common agricultural policy: let us say €55 billion. This is real stuff that is useful to keep in the farming system. If the farming part of that was €12 million, that is 25% of the CAP going up in smoke off the farm—bad for the environment, bad for the farmer. There really are opportunities there, and there are measures, which we might talk further on, that a farmer can do, where it will be profitable for him to take action.

Q17 Angela Smith: We are looking at integrated strategical approaches and landscape-scale approaches here. Today, we have had the publication in the *Nature Communications* journal of the latest report on biodiversity, which is being run by Reading University and the Centre for Ecology and Hydrology. They have been doing this work since 1970 and it is quite worrying. The Wildlife Trust response to it is to say, “The Government needs to recognise more adequately the value of the natural environment and put it on an equal footing with other demands, such as energy, transport and housing.” Would you agree with that?

Professor Sutton: It is a fair statement. We have tried some difficult things in our research time, and one of those is comparing apples and pears. We know that, in principle, you cannot compare apples and pears, but we will have a shot anyway. We try to value ecosystems and human health and, as much as you convert it into numbers, you always end up with a big number for human health, because people care more about health than they care about the environment. In a sense, that is stating the obvious and stating what you have already said. There are others who just do not accept that equation at all, and say we have a duty to protect nature and you cannot monetise it. We need to commit to protect a certain amount of nature and then meet those goals.

Q18 Angela Smith: Would you agree with a natural capital approach, and that that should be embedded in the work that Government do? Do you think that potentially would have a role to play in achieving some of the outcomes that you have been talking about?

Professor Sutton: It certainly can help. The key starting point is asking what we are going to protect and how much, as society. On the air pollution issue, the Natura 2000 sites, the special areas of conservation, are already designated as protected areas. You could say that is a key resource for natural capital. It is not just within the boundaries of those, but if you can protect those, you are going a long way.

The challenge, though, with Natura 2000 and the Habitats Directive is that it is a sleeping dragon. If it wakes up when you are in an assessment process, it can be very tight, and a developer has to prove their action will be safe with the precautionary principle before they can develop, but very often the dragon sleeps and something that is not core development will happen. Particularly in farming activities, to the point you mention, landscape planning and working out the best ways to work together will often just not be done, so the question would then be: how can one strengthen the mechanisms to do that?

One of the things I mentioned in the evidence that I gave was site nitrogen action plans, the concept Natural England have been working on of having people working together between farmers, combustion sources and nature to come up with what you would do locally.

Q19 Chair: How much research is being carried out into how we can have some intensive farming and what I would consider good food production next door to a nature reserve? It is necessary, because, in the end, it is lovely to have lovely nature, but we also like to eat as well. We have to get the balance right. Are we doing enough work? Should ammonium nitrate be injected into the ground, rather than spread on ground? What sort of work are we doing on this?

Professor Sutton: First off, there are those spatial issues and then the hard-on mitigation actions. We have been doing a lot of work in the Centre for Ecology and Hydrology on those spatial landscape structures so that you can make a contribution, with trees as buffer zones, dispersion and planting them to recapture that nitrogen. It is for doing a job, rather than for biodiversity, in that case. At the end of the day, it is still about the right place for the right things. 100 metres from a nature area is not the right place for an intensive chicken farm. Whatever you do, unless you go for really the most ambitious air scrubbing systems, you are going to be having an impact.

Let us say that you are not sitting next to a nature reserve; you are out there in the mixed countryside and the nearest nature area is a few kilometres away. The number one action that we discussed in the United Nations group I work with was low emission spreading of your manure and fertiliser. The reason that is the number one action is because it is the place where the farmer immediately gets a benefit. Instead of having a muck spreader flinging it everywhere, it is put out in nice, neat rows, through band spreading or even incorporation. That is keeping it in the field and, in many cases, the farmer can invest in a low emission piece of equipment and then see a financial return on that after a few years, like any other business investment.

The next reason I see it as catalytic to changing thinking about manure is that, once you start using your manure as the best fertiliser it can be, you start asking the question, "How can I store my manure better? If I stick it in a slurry bag, for example, get a bit of decomposition, get the ammonium high, it is going to have a better fertiliser value when I

finally spread it.” You are propagating it back through the system until you finally might ask yourself, “How can I make my housing system better so it really gets top quality manure?” The starting point is getting the fertiliser value.

Lastly, I will just make the point about ammonium nitrate with mineral fertiliser. Basically, we have two broad kinds: ammonium nitrate and urea. The ammonium nitrate fertiliser is very low emission, so it is really not the priority for taking action, but there are things you can do. The priority is the urea. It is a bit like manure; it is a high emission substance. But, with urea, you can use a low emission practice: you use a coated pellet or an enzyme inhibitor, incorporate it or wash it in, according to your local situation. There are plenty of ways that can be done.

Q20 Dr Monaghan: Do you think that the regulatory regime implemented by the Environment Agency is leading to sufficient reductions in airborne pollutants, specifically in connection with industrial activities and energy production?

Professor Wilkinson: The short answer I always give is a bit of a glib one really, which is, from a health perspective, I would like to see as much done as quickly as possible. Nothing is fast enough. As we have discussed a bit earlier, there is no threshold; there are very substantial burdens; the more we can bring it down, the better.

The answer may depend a bit on different sectors. I personally like to link the air pollution question to the climate change question, because essentially, as I best see it, the way we are going to crack both and bring about the kind of levels of toxic air pollution change that we need is by linking those two and bringing about the low-carbon transition quickly. We know that, from a climate change perspective, we are behind the curve. We need to accelerate our progress on that. That is going to mean transformative changes in most sectors of the economy.

The plans I have seen in relation to the energy sector and electricity generation are fairly swift and they lead pretty rapidly not to complete decarbonisation, but quite close to it. There are big questions in relation to some of the sources that are used, but that is the sort of ambition that I would like to see in all sectors. The sort of things that are outlined in the document in relation to the transport sector do not quite get to the heart of what I would like to see from a public health perspective. For me, in the transport sector, we ought to be seeking a much more comprehensive strategy that looks at all aspects of our transport system and rapidly accelerates the move away from dependence on petrol and diesel as fuel altogether, so that we are not trying to improve the efficiency of engines and to encourage the movement towards Euro 6 engines, which makes some incremental reduction, but trying to switch away from them as much as we can altogether.

That, of course, is a tall order, but that is also the nature of the ambition that we should be embracing to try to meet our climate change targets. The consequence is that, if you put the two together, not only can you meet your climate change targets, but you will have, at the same time, very largely reduced with a greater rapidity a lot of those air pollution targets, because if you are not burning fossil fuels, the sources are not all entirely removed but are very much reduced at the same time. What does that mean in practice? It means, of course, things such as low emissions zones and clean air zones, but it means trying to convince people and setting up structures that mean people do not use their vehicles as much, so that city centres are places people can gain access more by walking,

cycling and using public transport driven not by petrol and diesel but by cleaner energy carriers.

I am not quite sure how to answer your question. The short answer is that I would like to see it go much further faster. The way I would envisage that happening is simply—not simply; it is a very complicated question—by trying to align in much more detail the climate change and the air pollution objectives, and to move at pace for a low-carbon transition, meaning effectively, as rapidly as we can, eliminating fossil fuels as energy sources wherever we can. In the power generation sector, that is largely the ambition, and it is where we are likely to be heading, but it is not heading quite that way in the other sectors.

Chair: We are getting some very good answers, but could they be a little shorter because we are galloping through time rather?

Professor Williams: Very briefly, you initially started asking about the Environment Agency's regulatory regime. That is fine. We have to have this balance between a competitive industry and a protected environment, clearly. That is done pretty much at European level, with standards for regulation from stationary sources and so on. Paul is right: the key here is that anything the Environment Agency does is done within a whole energy strategy of the UK. As I have said in my written evidence, what is needed is some sort of comprehensive, all-embracing strategy for air quality that takes into account the achievement of that 2050 Climate Change Act target, because, again as I put in my written evidence, if you do that right without using polluting fuels, like biomass in low level sources, there is the opportunity to make the biggest improvement in public health from air pollution since the Clean Air Act 1956. That is what is needed.

Q21 Dr Monaghan: What would your view be on whether the Environment Agency has sufficient resources to enforce the regulatory regime?

Professor Williams: I have not seen any evidence of there being any failures in that respect. In my time in Defra, I have to say that I was never aware of any resource problem in that sense. Whether the climate has changed with the spending review and so forth, who knows? I am not party to the detail of that. The effect on the Environment Agency and other issues for the environment from the spending review would certainly be something to look at.

Q22 Dr Monaghan: All three of you have talked about the various types of pollutants and emphasised the importance of some relative to others. In relation to industrial activities and power generation, is it the same mix of pollutants that we should be worried about, or are there different aspects that we should be taking into account?

Professor Williams: Power generation is a major contributor to emissions of the three pollutants we have talked about: PM, nitrogen dioxide and ozone. It was, 10, 15 or 20 years ago, a major source of sulphur dioxide, but emissions of that pollutant have gone down, not least through action by the Environment Agency, by something like 90% in the last 20 years.

Professor Wilkinson: It is worth adding, though, that the emissions from all sectors contribute substantially. In fact, in terms of the spatial average—that is not necessarily what people get individually as their exposure, because more people live in cities, but if

you look across the country as a whole—the biggest contributor to background levels of particles, for PM 2.5, is agriculture. It is larger even than power generation or transport. Those three sectors, plus housing and housing-related energy sources, are the four big contributors. They are not exactly equal, but they are big pieces of the pie and all need to be addressed.

Professor Sutton: I will come on to the Industrial Emissions Directive, which includes livestock sources. Large pig and poultry farms are part of that, so they will be part of the responsibility of the Environment Agency, but that is only 20% or so of the ammonia sources. There is only so much you can do to reduce emissions by that sector. In many cases, you even hear stories of, let us say, a chicken farmer complaining, “Why do I have to do something when there is a cattle farmer next door to me who is not part of that regime?” They are working on what they can, but it is limited in its extent at present.

Q23 Dr Monaghan: That is very helpful. We wanted to ask about the fact that, despite significant decreases in emissions within the agricultural sector in terms of greenhouse gases, the evidence suggests that that particular sector has reached something of a plateau. Is agriculture the forgotten sector, do you feel?

Professor Williams: Yes. To quote some statistics at you, since 1990, SO₂ emissions, largely from the power generation industry, have gone down 89%. NO_x emissions, largely from transport and power generation, have gone down 64%. Agricultural emissions of ammonia have gone down 21%. There is still a lot to do. Coming back to this question of a healthy agricultural sector, the Netherlands and Denmark have made significant reductions in their ammonia emissions and they still have a thriving agriculture sector.

Professor Sutton: In this decade, 2010 to 2020—I looked at the numbers—we are down for a 1% emission increase. That is our commitment. We have projected forward not much commitment, in fact no commitment at present, compared to 2010. In the Netherlands and Denmark, they took a very different approach. They went out and regulated their farmers. Many of them complained, but they are still going. Interestingly, they did several things, not just reducing emissions and requiring them to use low emission manure spreading. The various things they did changed the thinking; it was also a process of developing their agriculture sector.

For example, on-farm nutrient budgeting is required, which is getting all the farmers thinking about that. There is certain work to be done, but there is a reward as well, and there is training for the farmer in that process. One has seen the sector changing in those countries, in parallel with this, over the years. The other thing is that it means those countries are now the ones who are ready to sell their kit abroad, so by leading they get themselves opportunities there.

Q24 Chair: Do they not in the Netherlands, though, move the manure around a lot from the livestock sectors to other sectors? Perhaps there is scope for that here.

Professor Sutton: Yes, definitely. We are seeing that in several places across Europe now. One of the main drivers there is the Nitrates Directive, which says you cannot put more than 170 kilograms per hectare per year of manure nitrogen on the field.

The Netherlands, for example, is an area where they are importing grain from all over Europe, feeding the livestock and ending up with animals and manure. The animals you sell; the manure you wonder what to do with. You may have so much of it you cannot do much other than export it.

One thing that is developing is this whole nutrient recycling and reuse market. I was recently in the Po valley, where they are doing this. They are doing it in Brittany as well. Someone will take your manure at a small price; they will de-gas the ammonia and put it together with sulphuric acid to make ammonium sulphate—fresh fertiliser. They will get biogas at the same time. Then you have your processed manure back with a lower nitrogen to go into the field. It is driving an economic market with opportunities.

Q25 Dr Monaghan: What barriers are stopping that sort of process taking place in the UK? Are they policy or are they technical?

Professor Sutton: On that question, they would be technical and issues of awareness and whether you can make the market work. There may be a requirement to invest, to a certain extent, to kick-start these things. In Italy, I was seeing a lot of innovation happening, but also there were people who had invested not knowing they were going to make a profit at the first stage. Those initial investments, to get that thinking going and kick-start those processes, are perhaps critical.

Q26 Angela Smith: I have two quick questions. First of all, on the basis of what has just been said, do you think the Government ought to look again at their agri-tech strategy to take account of the sorts of illustrations you have been giving to us and the story we have heard about in the Netherlands and Denmark? The second point is: given that the Government are in the middle of producing the 25-year food and farming plan, do you think it is essential that that plan should take account of perhaps the need to realign or recalibrate agriculture, not just for the sake of the environment but for the sake of farming itself?

Professor Sutton: If I come first to the issue of the agri-tech strategy, much of that will be beyond my area of expertise, but there are bits that I could comment on. We have often dealt with little parts of the story separately. Nitrates have been in one place; we are here talking about air quality; in another room, it will be greenhouse gas emissions. We hear so much about the low-carbon economy. What about the nitrogen economy? The interesting thing about nitrogen is that it is, through the nitrogen cycle, linking up lots of different things. It is linking air quality, biodiversity, greenhouse gas, water quality, etc. When it comes to this issue of overcoming barriers to change, if policies were to hit farmers with a bit of air quality, a bit of ammonia, a bit of N₂O, a bit of nitrates, it is not what they want to hear. That nitrogen cycle business is automatically a foundation in the science on which to consolidate.

One of the things we are doing in working with the United Nations Environment Programme is developing a science policy support system internationally: the International Nitrogen Management System. That is not policy, but it is developing the science community to be ready to help policy makers in due course, so that we bring the water people and the air people together. That particularly applies to agriculture. Take those nitrogen oxide emissions, which we were calling pollution just now. Actually, that is

fertiliser value. In the world, \$40 billion a year worth of NO_x is going up into the atmosphere as fertiliser value.

I have a question to stimulate industry. Could new technologies that do not destroy that NO_x—which is what current technologies do: convert it back to pure nitrogen, wash it out and scrub it—by giving you an extra euro or so per kilogram, end up enabling you in 20 years' time to go further than the current technologies allow? That is something on agriculture, but also something on the combustion.

Q27 Jim Fitzpatrick: Good afternoon, gentlemen. Can we go back to transport and perhaps look at this a little more closely? I will ask a general question, just to scene-set. There is quite a lot happening out there: the ClientEarth challenge to Defra; the High Court ruling. They have to produce the plan. The consultation is running at the moment. The Volkswagen revelations may compromise the consultation. There are the clean air zones and the suggestion from the chartered institute that clean air zones are just passing the buck to local government and they are voluntary. Where is Defra sitting at the moment? Do they have to revisit the consultation? Do they have to beef up the regulation in respect of transport, or do we have to wait for their answer to the Supreme Court and then have another look again from January? I know it is a very broad question, but perhaps, if you can scene-set for us, it would lead us on to the next few questions.

Professor Williams: The process is: the consultation period ended on 6 November. Defra will now reflect on that within Government and get cross-Government agreement to a response, which has to go to the Commission by 31 December. The Commission will then look at it and respond. What Defra does with the consultation responses, the final product and then the subsequent Commission response will determine whether the Commission deems it acceptable or not. If not, there will be another round and a potential ramping up of the infraction pressure.

Q28 Jim Fitzpatrick: Do you have any other comments?

Professor Sutton: Not exactly to yours, but I wanted to come back to the question, “Is there a VW story in agriculture?”, as somebody asked me. There was, actually, in the Netherlands. We mentioned that the Netherlands had achieved 40% to 60% reduction in their emissions since 1990. They thought they had achieved 70%, but they have still done pretty well. What were some of the reasons why they did not achieve as much as they thought they had achieved? One of those was a situation where they had required them to be using low emission housing, but many of them had not turned on the air filters. The solution to that is that they are now doing this remote auto-metering. Just like everybody has their electric meter, they will have their metering systems as to whether those housing systems are turned on. Where there is a loophole, someone will try to find it.

Jim Fitzpatrick: I was asking about the clean air zones, which was one of the proposals from Defra, and whether that is just ducking responsibility for producing stronger national regulation by asking local authorities to designate a selection of potential clean air zones and saying, “Let local government get on with it.” The impression I am getting is that

everything is on hold until the time of the response to the Supreme Court and the Commission's response to Defra's conclusions from the consultation.

Professor Williams: It is inevitably on hold, but let us assume that the plan was not changed and it went through as written. My personal view on that is that, first, it is a welcome step forward to have this framework of clean air zones, but in terms of making it work, it seems to me that there is not enough strength in the proposal. There seems to be no sanction, no obvious method whereby Defra will ensure, first, that those clean air zones are set up; secondly, that they are big enough; and, thirdly, that they are done in time. A crucial part of this whole case is the "as soon as possible" achievement of the NO₂ limit values, so timing is crucial. Timing of the effectiveness of those CAZs is crucial.

The key part of the modelling that did that calculation is based on some sort of expert judgment of how quickly the establishment of those clean air zones might turn over the vehicle fleet. As a scientist, that seemed to me to be rather shaky. There was very little evidence presented on the robustness of that calculation. In my personal view, there must be some doubt about, first, how quickly those clean air zones can be set up, because we have local government machinery and committees to go through, etc; and then, secondly, how quickly their establishment is going to turn over the fleet in time to meet compliance by 2020, as stated. It is only five years away.

Professor Wilkinson: I share that scepticism. As Martin said, it is a welcome suggestion and a plan, but I am not sure whether it will achieve what it is meant to achieve. More than that, it lacks the central substance of what I would like to see as a much bolder strategy for how you align air pollution with other environmental objectives in the greenhouse gas emission area, which means the strategy is for not only trying to clean up—make our engines more efficient and a bit cleaner—but trying to change the whole mode of vehicle use we have altogether.

Professor Williams: In fairness to Defra, they have this immediate short-term problem, which they have addressed, but as I have said in my written evidence, it is too narrow to have any significant effect on public health. It needs a wider look. I refer you to my written evidence on that.

Q29 Rishi Sunak: I wanted to talk about some of the alternative fuel technologies. There is a range, everything from hydro cells to electric cars to LPG, etc. I would love to get your thoughts on which of these technologies is, in your minds, first, most likely to be technically feasible and secondly, preferable for environmental reasons.

Professor Williams: Ultimately, on this topic of alignment with the Climate Change Act target, electric vehicles are the way to go, assuming you can generate the electricity in a low-carbon way. To be fair, the Government are doing quite a lot in terms of encouraging take-up of these things. That is the ultimate long-term aim. In the short term, what people may not realise with all the media hype on the VW thing, of course, is that a Euro 6 petrol car is going to emit way less NO_x than a Euro 6 diesel, even if a Euro 6 diesel complies with the real-world emission limits.

In the short term, it is about petrol cars, petrol hybrids particularly, combining the benefits for climate change and air pollution, and other technologies, even, in the bus and heavy duty sector. Electric buses, electric taxis—why not? Compressed natural gas for

buses, for example, is another big benefit. There is some question mark over the emission performance of diesel hybrid buses and trucks. We need to look carefully at those. They may not be as good a solution as people think.

Professor Wilkinson: I support that. Electric is the energy of choice. In hindsight, it was probably not a very wise decision to pursue a decade-long development strategy for diesel, because of the air pollution impacts that Martin referred to. For understandable reasons, it was trying to pursue a climate target, essentially, but, as it turned out, and probably predictably, it was never quite as efficient in terms of toxic air pollutants as petrol. It means that the solution therefore should not just be about trying to make those incremental changes. Of course, in the short term, we are trying to meet these compliances now, but overall, there needs to be a strategy of moving away from it altogether, and so electric vehicles and, in the short term, hybrids are the solution.

Q30 Chair: When it comes to moving heavy good around, it mainly seems to be diesel lorries. I do not think anybody is really suggesting a petrol lorry at the moment, or even a hybrid lorry, and they put blue into the diesel. Is there more that we can do with the diesel fuel itself, not only with lorries but with cars? I made this point before. You quite rightly say we have had a taxation system that has encouraged people almost to go down the diesel route. You are not going to wipe those diesel cars, and you are certainly not going to wipe diesel lorries or diesel trains, where they are not electrified. What do we do about diesel itself? Can we actually do something about the fuel?

Professor Williams: There are various additives that you can use, but the best way of controlling emissions from diesel is after-treatment, which is going on: diesel particulate filters and so-called selective catalytic reduction in the tailpipe. It is a fairly cumbersome tailpipe arrangement, but it is reasonably effective in terms of previous generations of diesel. Nonetheless, I come back to the point that even a diesel with those after-treatment devices in is still likely to emit more than a petrol equivalent. I agree with you in terms of the heavy goods and heavy duty stuff. For trucks, sure, for all sorts of operational and performance reasons, diesel is probably still going to be there, but not necessarily for buses. There are solutions for buses. There are electric buses; there are a few hydrogen buses running around London already. You can do things with the bus sector that you could not with trucks.

Professor Wilkinson: You can have more electric trains. Not that much of the network is electrified at the moment.

Q31 Chair: On a specific minor point, you add this blue to the diesel in a lorry. What does that do to the emissions? Why can that not be added to the diesel that we buy or added in the fuel in the car?

Professor Williams: The blue does not actually go into the fuel; it is part of the catalytic treatment to remove the NOx. The diesel that goes into the engine in the first place is standard diesel that has not been mucked about with. The blue gets injected into the catalyst to remove the NOx.

Q32 Chair: The engine of the diesel car, or the catalytic converter, would have to be altered in order for this blue to work in a car. Is that right?

Professor Williams: Passenger cars are using that now. The bigger diesel cars use the same system.

Q33 Chair: Okay, so there is scope for that. How much does that reduce the pollution?

Professor Williams: When it works effectively, it can take maybe 90% of the NO_x out. That is quite substantial but—again, I come back—it still does not get it down to the level of a Euro 6 petrol car.

Q34 Chair: No, but it still gives you a position on which to improve in the meantime, because we are not living in utopia. If you have a 2014 or 2015 diesel car, you are not going to scrap that car. You have paid £20,000 to £40,000 for your car; you are not going to scrap it. This is the realistic world. Why should the Government not be pushing for more of the blue type technology to be in those cars, or even to be fitted now? Should we perhaps give incentives? I do not know. I am just asking you the question.

Professor Williams: You may not want to scrap that car, but you may want to trade it in for a petrol one.

Q35 Chair: But somebody else will buy it. It is not going to be scrapped; that is the point I am making. In an ideal world, everybody changes from diesel to petrol, but that will not happen.

Professor Williams: That was a marginally facetious comment, Chairman. I apologise.

Chair: I know. I am quite happy for you to make it.

Professor Williams: You are quite right. The nub of your question was this big population of dirty air diesels that are still around and what we do about them. Scrappage schemes have been mooted but, by and large, at the scale that would be needed to improve things, they are not going to be big enough. It is going to be far too expensive to do that. All you can do is what Defra suggested—things like clean air zones and potentially other fiscal measures to discourage and reduce their use and limit it to areas where they are not going to make as big an impact on public health.

Q36 Dr Monaghan: Back to this idea of blue, you said something is injected into the exhaust. Did I pick that up right?

Professor Williams: Yes.

Q37 Dr Monaghan: What is the chemical that is injected in, and is that a total-loss system?

Professor Williams: It is urea.

Q38 Dr Monaghan: Presumably, the vehicle has a septic tank where it carries this solution.

Professor Williams: Yes, that is right. That is why this system is used only in the larger diesel cars, because there is physically not a great deal of room to put one in a small diesel car.

Professor Wilkinson: The assumption also is that people are going to be less inclined to go through the faff of having to put in urea as well as fill up with diesel.

Professor Sutton: It is worth briefly adding, in case it was not obvious, that that urea is the same compound that is coming out of farming as emissions. We are choosing to add it into engines. The hope is that, stoichiometrically, the NO_x and the reduced nitrogen from the urea will react and produce pure nitrogen, and there will be no problem. But, actually, that is a mechanism where we are paying for valuable nitrogen to go into that pollution reduction system, so, for me, it still comes back to the need for investment in the next big-wave generation of how to reduce emissions from these things.

Chair: We can put the exhaust pipe into the soil, then, and that will work, will it? I am being facetious now.

Q39 Ms Ritchie: I just have a supplementary. How financially viable are your propositions in terms of reducing emissions, both for the consumer and for others?

Professor Williams: Which propositions did you have in mind?

Ms Ritchie: The ones you have just been talking about.

Professor Wilkinson: Are you talking about blue?

Ms Ritchie: Yes.

Professor Williams: While it is not legally required, in that the directive does not actually specify the technology, it specifies the emission limits, and the most practicable way of achieving those emission limits is by using this blue combined with the catalytic reduction system. That is out there. The manufacturers are doing that.

Q40 Chair: But not for cars, is it?

Professor Williams: No, they have been doing it for trucks for three or four years now, but the new Euro 6 diesel cars, the bigger ones, have that system in them already.

Q41 Chair: What is stopping us bringing that for more cars, then, with smaller engines?

Professor Williams: All new cars are likely to have it, depending on the size. There are two ways of addressing that Euro 6 NO_x limit. One is through that blue-fuelled catalytic system, but there are other low NO_x catalysts that do not need urea. There is a different system that is used, by and large, on the smaller cars. It is out there now; it is being used.

Q42 Chair: Should we use a stick on people and say, “You have to have that, or else your car will be charged £200 or £300 a year tax”?

Dr Monaghan: Presumably there is a choice for the vehicle owner as to whether they fill up that second tank or not. The vehicle, I suspect, will run just as well without it.

Professor Williams: There are on-board diagnostics that warn drivers to fill up. I think I am right—although I am not a detailed expert on this—that if you leave it too long, then the system will shut your engine down.

Chair: It shuts the tractors down as well, does it not? It is interesting. We are going to do a lot more in another session on this, but we are all very interested in it, so thank you.

Q43 Jim Fitzpatrick: Professor Wilkinson mentioned earlier on that we have been talking about mitigating and minimising the impact, when we should be changing altogether—a model shift—and trying to encourage people to walk, cycle, use public transport. Are we doing enough of that as a society? Are Government doing enough to encourage behavioural change?

Chair: I am not going to cycle from Devon, Jim, whatever happens.

Professor Wilkinson: You might take the train. The very clear answer to me is, no, we are not. The paradox is that a lot of the strategies for trying to encourage people to be more active in their travel patterns would make cities pleasanter places to live, because it would cut down congestion in centres; it would open up spaces more. There would be pleasanter spaces for us to use.

The reason I would give a very unequivocal answer that we should be doing more on that is, whatever you think about the air pollution impact on health, they would be dwarfed, as far as we can estimate, by the physical activity benefits if people were more active. They would likely be at least 10 times greater from people being more physically active, if they could walk or cycle on a regular basis, because they have bearing all sorts of health outcomes: cardiovascular diseases, diabetes, obesity, some cancers, even some forms of dementia and mental health. It is a complicated thing, because it means you have to have a fairly extensive strategy for public health infrastructure—some cities are fairly well served already; London is relatively well served—but it means also banning or limiting entry of private motor vehicles, which is not always easy to do. But I would say we are not doing nearly enough.

Q44 Jim Fitzpatrick: To move on to shipping, I do not want to parochialise this, but, as a simple example, London is building a cruise terminal at the moment. EU regulations do not require shore-to-ship energy supply, so the planning committee turned down the community request for this, and these cruise ships will be sitting in the middle of the Thames, in the middle of London, using their diesel engines to generate power as long as they are in port. There is compliance with the regulation, but some argue very strongly—and common sense would suggest appropriately—that the regulations are somewhere behind the time, even though the clean zones require ships to use the much cleaner fuel, rather than the bunker fuel that they use when they are at sea. With increased shipping in London and elsewhere—the Thames has seen a 150% increase in river traffic in the last few years—are the regulations behind the times, both in terms of ports as well as our coastal shipping?

Professor Williams: The shipping regulations are moving on a pretty long timescale. The strongest case for taking action on shipping in London is clearly on NO₂, nitrogen dioxide. Clean fuel will not help that. There have been big reductions in the sulphur content of marine fuels, to the extent that we can see changes in sulphur dioxide concentrations on the south coast of the UK, but that is not going to help any on NO₂. In

my view, you could certainly consider a case for requiring ship-to-shore electricity charging or whatever.

Back to the vehicle technology, the same SCR—selective catalytic reduction—technology is used in some ships as is used in cars. You could mount a case that says, “Given London’s problem with NO₂, if the ship does not have SCR, then it has to have ship-to-shore energy. If it has SCR then, okay, maybe we will consider something else.” Ports have done this in the past, regardless of EU regulation. Ten or more years ago, the port of Gothenburg had a requirement that ships docking there had to have SCR fitted. The NO_x controls on ships do not bite for a decade or more. I would need to locate the precise date, but they are a long way off.

Chair: Thank you, professors, very much for your evidence. We have had a very good afternoon, and we are going to take some more evidence now. It is most appreciated. I think we have dealt with the other questions. If you want to add anything after today’s session or to what you have given in your answers, please feel free to do so. We appreciate your frankness and openness. Thank you very much.

Examination of Witnesses

Witnesses: **Simon Birkett**, Clean Air in London, and **Alan Andrews**, Lawyer, Health and Environment, and Clean Air Project Leader, ClientEarth, gave evidence.

Q45 Chair: Thank you very much for coming to our second evidence session this afternoon. If you would like to introduce yourself first of all; then we will kick straight off.

Simon Birkett: I am Simon Birkett, founder and director of Clean Air in London. I have been campaigning on air pollution for about 10 years. I also sit on the United Nations Environment Programme’s high-level intergovernmental and stakeholder advisory group for its five-yearly report on the global environment.

Alan Andrews: I am Alan Andrews. I am a solicitor and lawyer with ClientEarth. We have been working on air quality for the past six years. Our most high-profile work has been the ongoing case against the Secretary of State for Environment, Food and Rural Affairs, which culminated in this year’s Supreme Court order, but I also work at the Brussels level on the National Emissions Ceilings Directive, a key vote on which is to take place next week. I will be happy to answer questions on that.

Q46 Chair: Thank you very much. My first one is reasonably straightforward. Emissions of most pollutants are on a downward trend, but your groups are campaigning vigorously for further action. What is the extent, in your view, of the UK’s air quality problems?

Simon Birkett: If we think in terms of one atmosphere, we have the greenhouse gases and local air pollution. As we heard in the previous sessions, I would split local air pollution into particles, which are really regulated as a lump, all of them together, and then the gases, where it is really only the nitrogen dioxide molecule or gas that is regulated for health and legal purposes. China, India and Eastern Europe have terrible problems with particles, but Dr David Carslaw from King’s College London said that many roads in

central London will tend to have the highest levels of nitrogen dioxide in the whole world, and that is basically a diesel problem and is something that we should be very ashamed about. Defra's report for last year is that 38 out of 43 UK zones exceeded the legal limit—which is aligned with the World Health Organisation guideline—for nitrogen dioxide. For particles, levels are much higher than the World Health Organisation guideline.

Alan Andrews: The only thing I would add is that, from a human health and a legal point of view, what matters are the concentrations of pollutants in the outdoor air that we breathe on a daily basis. We have brought our case because the levels of one pollutant, nitrogen dioxide, are well above the legal limits. It is also worth remembering that those legal limits should be seen as the bare minimum required to protect human health. In some cases, particularly for particulate matter, the legal limits are far less stringent than those recommended by the WHO guidelines.

Q47 Chair: In some ways, you have answered this part of the question, but where are the major hotspots for pollution across the UK?

Professor Williams: For nitrogen dioxide, it is really the urban areas. It is a very local pollutant. For example, about 82%—this is the Mayor's estimate—of the nitrogen dioxide in London is generated within London, so it is a city problem around the UK. For particles, because it is everything together, about three quarters of the particles in London come from outside it. Of course, we are also exporting our own.

Q48 Chair: Have you looked a great deal at the difference between levels in the rural and urban areas? Have you made those comparisons, or is it the urban areas you have particularly concentrated on?

Simon Birkett: I work London and up, but very much UK as well. For England as a whole, the population-weighted average for fine particles—so across the whole population, across the whole of England—for human-made or PM2.5, we are talking about 11 or 12 micrograms per cubic metre, relative to the World Health Organisation guideline of 10. In London, it is more like 13 or 14. But I would emphasise that Defra has doubled its own estimate of the non-human-made contribution, so when I probed them about the fact that this human-made contribution seemed to have gone down, they said the reason this other bit had doubled was just because it was not explained by their model. We are probably talking about 25% over the WHO guideline on average across the country, and probably 50% above it in London.

Alan Andrews: It is worth stressing that, while the nitrogen dioxide problem is largely an urban problem, it is not confined to the big cities—the Londons, Birminghams, Manchesters and so on. We are seeing significant breaches of those legal limits even in fairly small towns, at busy road junctions in very small towns and even in villages. The other point is that, as Simon mentioned, the particle problem is far more widespread. It is not as localised. That emphasises the need for action at the EU level to tackle the emissions at source, which contribute to the overall levels of PM2.5.

Q49 Chair: These are the particles that, for want of a better expression, are moving around, floating around basically, blown in and blown out?

Alan Andrews: That is right. Prevailing winds take them over to mainland Europe the majority of the time, but when we have an easterly air flow, we see the pollution blowing in from mainland Europe and contributing to these smog episodes. A recent Defra study showed that over 50% of the PM2.5 mass originated outside the UK, and that figure would probably be a lot higher during these periodic pollution episodes.

Simon Birkett: It is also worth saying that, when we have an ozone episode, it is in the country. It is East Anglia or Charlton Mackrell or somewhere like that, in the summer, in July and August.

Q50 Dr Monaghan: To what extent do you think the policies of the UK Government have taken into account the health and environmental impacts of air pollution?

Simon Birkett: If I can start, there is no joined-up thinking at all in Government. This problem goes back to at least September 1990. The reason I brought all these is not to read them to you, but to show you. This is the 1990 report. Although Labour has taken the rap for diesel, in fact the evidence is that the problem goes back to September 1990. It has been successive Governments since then. A point I would add to the previous session is that even when it was clear that emissions standards were not working, successive Governments ploughed on pursuing CO₂ in denial of that.

I will give you some specific examples of failures. We have got DECC encouraging biomass burning in cities. We have local generation, combined heat and power plants, being encouraged within cities. We have a massive auction, which closes today, for power and they are talking about 1.5 gigawatts of diesel farms, including some of those in urban areas. Within hospitals, the Department of Health's air filter standard is no different to the standard to keep dust out of factories. The Department for Transport says it is not illegal to remove a factory-fitted diesel particle filter, but it is then illegal to drive on the road without it, which is obviously idiocy. You have Defra's NO₂ plans, which we have talked about before, and the Treasury's benefit-in-kind taxation, encouraging people to buy diesel vehicles.

We have no joined-up thinking and, at the moment, Defra is acting as a letterbox and a clearing house for legal action from ClientEarth or infraction action from Europe. Rory Stewart is being a good leader but, as a Department, it is an important signal that Oliver Letwin has now been given the job of trying to join this up. That is a very worthwhile step, but will he do something?

Alan Andrews: I will not add to the list of examples that Simon gave, but there very clearly is a lack of joined-up thinking here. It certainly seems that other Government Departments are more than happy to let Defra carry the can, but it is worth emphasising that the Supreme Court order binds the Government as a whole. It is addressed to the Secretary of State but covers the full central Government. We need to see a co-ordinated response, and so far we have just not seen that at all.

Q51 Dr Monaghan: The list is clearly extensive and covers a number of complex issues and problems, I suspect. What more do you feel can be done to heighten public awareness of all of those impacts?

Simon Birkett: It is what I refer to as building public understanding, which is a combination of awareness, information, knowledge, education. It is when people get it. A large part of the problem is that, across successive Governments, whenever I have stood up on TV or radio or something like that, there is a standard Defra paragraph press release that goes out, which used to say, “Air pollution is better than it was. We have plans in place to deal with it and we are concerned about it” or something. Now they change it to say “as soon as possible”. I am not a cricketer, but in cricketing terms, they play a dead bat to it and try to take the momentum out of the story every time.

We are not helped by the fact that the BBC, for example, on its weather forecasts on its website—it does not really give them on the news—for 330 days a year says “pollution low”. That is not the annual or the ongoing risk; it is just that major pollution episodes are low. People see that; it is totally misleading. On the Met Office forecast, you see these green maps for the whole country, apart from a few days a year. The Met Office maps do not forecast urban roadside air pollution, so they are completely misleading. They do not give a picture of nitrogen dioxide where people live and work. It is more that if the Government stopped doing things that were wet blankets working against this story, that would be a good start. The *Evening Standard* did a fabulous job. When it was going at this issue every day, everyone across London was talking about it. That is the sort of exercise we need here.

Alan Andrews: That is right. It is quite interesting that one of the times we saw a big growth in public awareness was when we had the so-called Saharan dust storms in 2014. Unfortunately, the Government’s response was in some ways misleading. They were more than happy to blame it on this Saharan dust that they really could not control. What we need is some real honesty in communicating with the public, explaining the health impacts very clearly. The policy solutions, which in some cases might not be popular—people will not want to be told that there are restrictions on where they can drive their cars—need to go hand in hand with awareness-raising. The very least they can do is give people adequate warnings when there are these high-pollution episodes.

We would like to see a more proactive approach. A national awareness-raising campaign is one idea that has been mooted, but has been refused by Defra. We would like to see a step up in minimum obligations, in terms of warning people, but also a more proactive approach of going out there and explaining the health impacts.

Simon Birkett: Can I add to that?

Chair: Could you keep your answer short?

Simon Birkett: It will be very brief. A survey that we did of 100 MPs, twice, showed that MPs ranked air pollution as the fourth or fifth of five public health risks, when it is actually the second. I heard, unfortunately, at lunchtime today that Matthew Pennycook, who has done a lot of work trying to set up an all-party parliamentary group, has not been able to find a single organisation to support it. There is a lot of work we could do within Parliament too.

Q52 Dr Monaghan: In terms of improving the level of honesty that you have talked about and perhaps challenging that dead-bat approach, are there any particular areas of research that you would like to see developed to inform public opinion in this area?

Simon Birkett: I do not think we need more research. The evidence is there. What we need is action. This is well known to be the biggest public health risk after smoking, although not sufficiently well known. The World Health Organisation says it is by far the biggest environmental risk. It is there: we do not need more evidence; we need action.

Alan Andrews: I quite agree. We are used to seeing pollen counts and UV warnings on the weather forecast. Why are we not just as used to seeing air pollution warnings? That is the level we need to aspire to.

*Sitting suspended for a Division in the House.
On resuming—*

Q53 Ms Ritchie: You are very welcome back. What will be the impact of Defra's current policies on air pollution?

Alan Andrews: The problem is that we do not really know, because Defra has not provided the supporting information. When the draft plans were published, we were all expecting there to be a detailed technical report, showing all the various assumptions it had used and what the health and economic impacts would be, but it did not publish that. We are still waiting to see that. We expect it with the final plans, which are due at the end of this year.

Q54 Ms Ritchie: Have you been pursuing Defra in relation to this, to obtain ideas or updates?

Alan Andrews: We have made the point that we want to see the evidence, but it has not been forthcoming. We will have to wait until 31 December, which is very disappointing.

Q55 Ms Ritchie: Based on the answer you have given me and on some of the knowledge you have, what areas of Defra's 2007 air quality strategy need updating?

Simon Birkett: I think it was Professor Williams who led the work on that in 2007. It was a very good strategy, identifying lots of low-hanging fruit, such as shipping, agriculture and so on, but little or nothing was done on those things. What we need now is a new strategy to update that 2007 work, something that really addresses one atmosphere: the whole picture of the greenhouse gases and the local air pollution. That is what we need, because otherwise we get these frankly idiotic policies from DECC, DFT and HMT, which basically say, "This diesel generator stuff is technology-neutral." It may be power-neutral, but it is not neutral in terms of killing people; it is not neutral in terms of emissions. It is complete idiocy, so we need a one-atmosphere strategy across Government.

Q56 Chair: That has to go well beyond Defra, does it not? That has to be very much a Government strategy. You are saying at the moment that it is not joined up enough across Government.

Simon Birkett: That is absolutely right. I do not know if you would add anything to that, Alan.

Alan Andrews: To go back to the earlier question, although we do not have the evidence base, the reason it has not been published is probably that Defra knows the draft plans it has published will have virtually no impact on human health. They do not commit the Government to taking any new measures, other than coming up with this national framework of clean air zones, and leave it to local authorities to do all the heavy lifting at a time when they are facing swingeing cuts to their budgets.

Q57 Ms Ritchie: Are there any additional measures that an updated strategy should contain other than what you have already been saying to us?

Simon Birkett: Basically, because this is the biggest environmental health risk and the biggest public health risk after smoking, we need to throw everything at it, including the kitchen sink. Every sector needs to play its part. We need a root-and-branch review and it has to be led across Government.

Q58 Ms Ritchie: As a follow-up to that, how effective are Defra's arrangements in ensuring that other Government Departments and local authorities take adequate action and are equipped to take that action?

Simon Birkett: They are totally ineffective. I have produced my list of—whatever it is—1.5 gigawatts of power generation going to the diesel sector today. This is just absolute lunacy. It is about the dirtiest possible way of generating power. Defra is ineffective at limiting some of the stupid things done by other Departments.

Q59 Ms Ritchie: What needs to be done, then?

Simon Birkett: Something joined up, I would have thought, to get Oliver Letwin to really have a grip on this. That is what it needs across Government.

Q60 Ms Ritchie: Do you think that local authorities' effectiveness is constrained by limited resources, limited power or lack of political will?

Alan Andrews: All those factors will prevent the adoption of clean air zones or any other effective measure at the local authority level. To give you one example, Defra's plans did some loose cost estimates around the introduction of clean air zones and estimated that the implementation costs to local authorities would be something like £24 million. At the same time, they are offering only £500,000 to local authorities to pay for air quality measures. There is a huge gulf, at the moment, between the resources needed at the local authority level and what the Treasury is making available to them.

Q61 Ms Ritchie: In that respect, what priority do Departments other than Defra put on air quality?

Alan Andrews: Very little, if any.

Q62 Ms Ritchie: Obviously they should do more. What more could be done?

Simon Birkett: DECC ought to be looking at all emissions, so at PM, particles; at NO_x, oxides of nitrogen; and at CO₂. DFT should be looking at the whole picture of one atmosphere, not just CO₂. There is a myopic focus within these Government Departments on CO₂. They do not seem to care about anything else, and that is deeply troubling.

Q63 Ms Ritchie: How can this be done if Defra has the overall responsibility for air quality or pollution—all of these issues? What should Government do to ensure that more concrete action is taken to address this very important issue?

Alan Andrews: The point earlier about having Defra and all the other responsible—

Ms Ritchie: Overarching?

Alan Andrews: Yes. Whether it is the Cabinet Office or some other body that has oversight over all the relevant Government Departments to ensure coherence and that everyone is pulling in the same direction, that could be valuable. Also, the NO₂ plans and the national air quality strategy, which we think is needed, need to very clearly delineate responsibility for who is doing what and by when.

Q64 Ms Ritchie: Overarching in terms of policy formation, policy development, policy implementation and operational implementation—are you saying one Department takes responsibility for all those things?

Simon Birkett: Not one Department. We have seen that this just has not worked with one Department. They end up getting kicked around by other Departments or ignored. This has to be led by the Cabinet Office, the Prime Minister or the Prime Minister's office. It really needs to be done from the very top.

Q65 Ms Ritchie: You are saying that one Department should be leading this, with all other Departments feeding in to ensure that that happens.

Simon Birkett: We have seen one Department, Defra, trying to do it. If you gave it to DFT or DECC, I do not think they would do it. This has to be done across the whole of Government, and probably the only body placed to do that, or with the resources to do that, is the Cabinet Office.

Q66 Ms Ritchie: Given your experience, how hopeful are you of that happening?

Simon Birkett: When I started 10 years ago, there was very little interest in this subject. It was all on climate. Everyone thought this problem would go away. Now there

are hundreds of organisations involved in this issue. It has rocketed up the agenda. There is a world of change happening. People who ignore this do so at their peril. I think they will be steamrollered as this issue gains further momentum.

Q67 Angela Smith: The Environmental Audit Committee came up with a series of recommendations on this issue. I tend to find that recommendations on air quality are all too often like motherhood and apple pie. One can get quite cynical about ever meeting or delivering a strategy. My main concern is that, if the new plans put a greater responsibility on local authorities, with their constrained resources, then we will effectively be letting the Government off the hook. Do you think that, fundamentally, central Government will still be responsible to the European Union, even if they try to largely offload the responsibility for delivering these plans to local authorities?

Alan Andrews: I should say first that we will not let them off the hook.

Angela Smith: No, I am sure you will not.

Alan Andrews: If we do not see a major change in approach, we have been quite open that we will go back to court to demand better plans. The European Commission is waiting in the wings and will similarly escalate legal action if it is not convinced that these plans are up to the mark. To directly answer your question, the Commission infringement action will be brought against central Government. Any infraction fine would be paid by central Government. Of course, there are mechanisms by which central Government could make local authorities feel the pain, whether directly, by passing a fine down through the Localism Act, or by less direct means. The important thing to note is that their biggest worry should be ClientEarth and the Supreme Court order for now, because that is the most immediate means by which we will hold central Government to account. The Commission infringement action is a more distant, albeit equally real, threat.

Q68 Angela Smith: It is interesting, because Defra, in the face of huge potential fines for its failures in terms of sewage in the River Thames, has acted in the end and we will get the Thames tideway tunnel, because the cost of providing the tunnel is less, effectively, than the daily fines for breaching sewage or pollution levels in the River Thames.

Chair: You are cynical, aren't you?

Angela Smith: I am.

Jim Fitzpatrick: It is going to be paid for by the consumer.

Angela Smith: Yes, it is. The point is that the balance between the cost of doing something and the cost of doing nothing has made it imperative that the Government act. They have been very honest about that, Neil, to be fair. At what point do you think the balance between the cost of doing nothing and the cost of doing something becomes favourable and forces the Government to do something effective?

Simon Birkett: The evidence for taking action, the health and natural environment effects, has been overwhelming for many years. The work supporting the 2007 air quality strategy said that transport and power generation measures had benefits 20 times the cost impact.

I would separate infraction action and the UK courts. Alan is leading on the work to enforce these laws in the UK system. Infraction action happens in five stages, with the fifth stage being fines. For nitrogen dioxide, we have had the first written warning. I expect that we would have the second stage of infraction action possibly as soon as February or March next year, unless Alan is very actively back in the Supreme Court. The Mayor of London estimated that infraction fines at that fifth stage could be £300 million per annum per pollutant, for each of nitrogen dioxide and particles.

If I were to guess, the Defra NO₂ consultation looks like plans for others; it looks as if they are trying to find a mechanism to pass on any fines that come in through that, saying, “We have clean air zones. It was the local authority’s fault for not doing it. Here is the fine”.

Angela Smith: Hence my first question.

Alan Andrews: That will not wash with the Commission at all. There is a long line of European case law that says, regardless of what national measures and arrangements you have for implementing EU law, ultimately central Government will carry the can.

Q69 Angela Smith: It is important to know that and have that on the record. Let us not forget that it is not just London, of course. I have lived by junction 34 of the M1 in Sheffield for long enough, and that is one of the real hotspots in all of this. Moving on very quickly to look at infrastructure, particularly transport infrastructure, and not just the construction of it but the maintenance of it, is it your view that the Government need to think again and be a little more robust in calculating air quality costs?

The point I make about maintenance is this: if you close down a bridge to paint it and you use a low-quality paint with very low levels of VOCs, you will be painting that bridge again much sooner than if you had used high-solvent paint. That effectively means that you are rearranging your traffic routes significantly and repeatedly over a period, thereby reducing air quality, not improving it, in the long term. There are ways of maintaining transport infrastructure that can help deal with air quality issues. Do you think that the Government do enough to think robustly about these issues?

Simon Birkett: The Eddington committee, many years ago, said that most of the investment should not go into grand projects such as HS2 or new runways; it should go into fixing bottlenecks, and that that was the most efficient way of sorting out the transport system. We need to be doing two things in big-picture terms. Next year is the 60th anniversary of the Clean Air Act, so we need to have this one-atmosphere re-energisation of policy and strategy, but we need to be doing two things. We need to be hammering down on the dangerous things, which are diesel in cities, agriculture, shipping, and coal emissions, and we need to be actively pushing up the other side of the seesaw, which is encouraging active travel on a massive scale. That is the way to do this cheaply.

Q70 Angela Smith: But we are going to build HS2. Will HS2 have a role to play in improving air quality? Do the Government think laterally and broadly enough about these issues?

Alan Andrews: No. They tend to take rather a tick-box approach to assessment of air quality, in infrastructure projects and various other policy areas that we have discussed. There needs to be more robustness in how we assess the health impacts of air pollution. We have heard about the growing evidence of the direct effects of nitrogen dioxide. When that is factored into cost-benefit analysis, the numbers will start looking very different, because at the moment we apply only the indirect health impact of nitrogen dioxide, from where it condenses to form particles.

Q71 Chair: Just to throw a spanner in the works, let us take HS2. It may or may not reduce pollution, but the pollution that will be caused by building it will be enormous. It is fascinating what we choose to go for, is it not? Surely, if you want no pollution, you shut everything down, do you not? There has to be a solution in which we at least have development.

Simon Birkett: There are issues with some developments. Heathrow is a very good example, where it bumped up against these limits. I could talk more about that, but it is because diesel has been encouraged for 25 years that we are bumping up against these health guidelines and limits now. We are not talking about stopping development and banning diesel everywhere in the country. This is about, where people are exposed to this problem, addressing the big sources of it as cheaply as possible. Farming, shipping and coal-fired power stations are the cheapest ways to tackle it outside cities. This is about tackling the problem as cheaply as possible. I do not think anyone would say that spending £55 billion on HS2 was going to be a cost-effective way to tackle the UK's air pollution problem.

Chair: It was possibly a slightly unfair question.

Q72 Rebecca Pow: First, on the transport point, the Chancellor is setting up his new National Infrastructure Commission to push forward development projects, and I can understand why that is. How important do you think it is to have an environmental expert on that commission?

Simon Birkett: It is absolutely vital. To give you a sense of that, the legal opinion that Clean Air in London commissioned from Robert McCracken QC said that the Davies Commission made some at best ambiguous remarks about the relevance of the air quality directive. He went on to say—and I will just read the punch line—that, if he said what we think he said, the commission misdirected itself on the law. That is a really dumb thing to do, if you are then the Government that follow on, thinking that you can take that at face value. You need people who understand these issues involved in these commissions up front, so that you do not end up years later finding there is a QC opinion that says you probably misdirected yourself on the law.

Q73 Rebecca Pow: That is interesting. I wanted it on the record, because it is something I have asked the Prime Minister himself, and he is going to look into it. I think you will find that the Environmental Audit Committee is looking this afternoon into the very issue of cross-departmental sustainability. It is very interesting how these two Committees connect. They are being led to believe by Mr Letwin that everything is being dealt with satisfactorily within all these different Departments—DECC, Defra, Transport, whatever—and they have

the Natural Capital Committee reporting back shortly. What you say suggests that that situation is not working in all these Departments. Do you think we should have an overarching, for example, Minister for Sustainability who deals with all these things: water pollution, air pollution, soil? Would that be a way of sorting it out?

Simon Birkett: Frankly, I am quite alarmed if Oliver Letwin thinks this is already being done well across Departments. I gave half a dozen examples earlier on.

Chair: That is the official line.

Simon Birkett: That is not being done. We need a champion for one atmosphere who says, "I am going to sort out CO₂ and these local air pollution problems".

Q74 Rebecca Pow: He may be coming up with that when the Natural Capital Committee reports back. That may be a significant turning point. Do you think it will be?

Simon Birkett: I do not. This is a really big challenge. It is linked to what is going on in Paris at the moment and everything else. We need to throw everything at it, including the kitchen sink. Frankly, I have been too busy to go to the natural environment hearings that Defra has had. It is not a priority on my radar screen, because it does not seem that important. There are many other more important things happening. We really need someone, as you say, who will take a lead on this across Government. That is the only way we will get some proper progress.

Q75 Rebecca Pow: How urgent is it?

Simon Birkett: It was urgent 25 years ago. We have over 1,000 schools near busy roads in London. It is affecting everyone every day. It cannot be much more urgent than that.

Alan Andrews: Just to take it back to the Supreme Court order from April this year, it ordered immediate action to solve this public health problem. It demanded a plan to achieve compliance in the shortest time possible. Yet we have Government plans which, on a very optimistic assumption, are projecting breaches in 2025. It is of the utmost importance that we get a grip on this problem as soon as possible.

Q76 Jim Fitzpatrick: We had a brief chat in the interval, gentlemen. I was going to ask about Defra's role, but you have very clearly indicated that this is a Government problem. Oliver Letwin and the Cabinet Office coming as reinforcements, the cavalry, was hopefully a good sign that the Government were starting to take it more seriously. Notwithstanding all of that, is there anything Defra can do separately, in the meantime, until we see what the response is to the Supreme Court, the consultation and Oliver Letwin's comments from the Environmental Audit Committee?

Alan Andrews: There is no reason they have to wait at all. They were ordered to take immediate action. Surely the air quality plan will contain all the details of that, but there is nothing to stop them getting cracking right away.

Q77 Jim Fitzpatrick: You said yourself, Mr Andrews, and the professors said earlier on, that what we really need is a revisitation of the Clean Air Act of the 1950s; we need a national strategy. Defra is one of the smallest Government Departments; it has one of the smallest budgets. It does not have the profile of some of the other Departments. The Cabinet Office coming in would almost seem to be good news, because Government have got that there needs to be a whole-Government response. The question is: yes, it would be great if Defra could get out there, get on the charger and lead the way, but that is not likely to happen, is it?

Simon Birkett: It is not likely to happen currently. One of the exciting opportunities for this Committee is to light a fire under them, frankly—

Jim Fitzpatrick: A non-emitting fire.

Simon Birkett—so that they are prepared to provide the answers to the Cabinet Office, because there is a lot of expertise within Defra. Let me cite two things, though. Probably the most important single thing for the next five years, apart from the nitrogen dioxide plans, the one-atmosphere strategy and public understanding, is what Defra is going to say at the Council of Ministers on 16 December about the National Emission Ceilings Directive. What are they going to say next week? That really does matter. That is within Defra's control.

I would be pleased if you would press them on that, because that is about hammering down on all these sources of emissions. Are we going to have, as we need, binding legal limits for pollutants by sectors across Europe in 2020, 2025 and 2030? At the moment, we have had the UK lobbying to weaken these laws, saying they do not want binding targets for 2025. They are trying to get methane and ammonia excluded. It really is a shocking state of affairs. This is how we deal with the problem at its source, and that is absolutely vital.

We have the European Parliament's environment committee voting next Monday, 14 December, on the real-world driving emissions. Hopefully, it will decide that it wants the European Parliament to veto the weakening of diesel standards that occurred a month or two ago. If it passes that next week, then it will go to the European Parliament plenary in January. There are some really big things happening that are absolutely within Defra's control and we need them to get on with it.

Alan Andrews: Just to expand on that point, I think there is a little bit of doublespeak. On the one hand, Defra is complaining that it cannot achieve compliance because of problems with the EU regulations, but at the same time, it is not doing anything to push for action at the EU level. As Simon says, next week, there are two crucial votes in the Council. It is imperative that the UK pushes for tough new action to introduce effective, fit-for-purpose regulations governing diesel emissions from diesel cars and also, as Simon says, the NEC directive, which is setting targets for pollutants from all sectors. The current proposals from the Commission are not great, but they take us half the way forward and would halve the number of premature deaths happening in the future. But we are not seeing any evidence that Defra is pushing for tough new targets.

Q78 Chair: I am a little sceptical about all this. I spent 10 years in the European Parliament, where we saw a drive toward diesel cars. We had all the big German manufacturers and the

manufacturers across Europe, not just Volkswagen, pushing diesel like mad. We were obsessed with CO₂ emissions. Now, all of a sudden, we are obsessed with nitrogen oxide. While the Government are in the dock, and I accept that, as are previous Governments, both Conservative and Labour in between—all guilty—so is most of Europe. What I am intrigued by is whether the scientific advice has changed. Are we going to go madly driving toward nitrogen oxide, so carbon dioxide does not matter so much, and then, a little way down the road, are we going to turn?

I am not being funny, but it is quite simple for you guys to come in and say, “Right, Government, you have got this all wrong.” It is quite easy to say that, but how do we get it all right, and how do we know the scientific advice we are getting now is right and that they will not change it further down the road?

Simon Birkett: In 1990, we knew that, if we did not deal with exhaust emissions, there would still be a diesel problem. There was a great quote in one of John Vidal’s articles recently from a senior civil servant, who said—to be totally reductionist—they were talking about killing people today rather than saving lives tomorrow. Many years ago, they knew that focusing on CO₂ probably would kill people sooner rather than later. What I would add to the previous session you have had this afternoon is that the evidence that these engine emission standards were not working was around 10 years ago, but still, even today, the Government are ploughing on, encouraging CO₂ efficient fuel, which is diesel.

This is not new science. This is a recognition that action should have been taken. This problem has got much worse, rather than much better, and it needs to be addressed as a whole. We cannot have one technology trying to tackle one carbon dioxide molecule or something else. We need to look in the round.

Alan Andrews: I would echo those comments. While there is clearly a legal imperative to address the NO₂ problem, the Government need to see this as an opportunity to achieve the NO₂ limits as soon as possible and use that as a springboard toward a much more holistic approach, not only to air quality but to climate change mitigation as well. For example, clean air zones could be designed in such a way that they deliver multiple benefits, not just for human health but also for climate change mitigation. Accelerate the uptake of electric vehicles; accelerate the decarbonisation of the transport sector. It all needs to be part of a much more holistic response, so we are not picking on one pollutant at a time.

Q79 Rebecca Pow: Talking about clean fuels, which do you think is the best road to go down?

Simon Birkett: We need to look first at lifestyle changes and shutting or banning the inexcusable activities, for example the removal of factory-fitted diesel particle filters. We ought to do those things automatically. On technology, we need to do two things in parallel: short-term and long-term action. In the short term, if through labelling we told people what the CO₂, NO_x and particle emissions of their cars were, people would start making sensible, informed decisions, at no cost to the consumer, about what to buy, so we can do that. In the short term, let us get people driving smaller petrol vehicles—ideally electric or hybrid, but let us get them into petrol vehicles.

In the long term, there ideally ought to be the infrastructure for rapid-charging electric vehicles. For example, in the previous session there was a discussion about the large vehicles. I sat in a seminar with the Freight Transport Association two or three years ago and said, “We are assuming we are going to be using compressed natural gas in 2020.” We need to realise that a lot of these changes are going on already. Hydrogen, I think, is far too expensive. LPG has very high particle numbers; that is not the answer.

Chair: A few years ago, it was.

Simon Birkett: It was for CO₂. I do not think it was ever the answer for—

Q80 Chair: It was not long ago that they were pushing LPG. This is the point. You have biomethane down here. It will not be five minutes’ time before that will be wrong.

Simon Birkett: I do not accept that, because a technology-neutral approach is not setting loose standards for diesel and tight standards for petrol. A technology-neutral approach is saying, “We will limit the amount of particle, gas or carbon dioxide that comes out of the exhaust pipe.” We do not care how you achieve that, but we are not going to set loose standards for diesel and tough standards for petrol, which is where we are at the moment.

Q81 Rebecca Pow: Do you think we might need incentives? For example, loads of people went down the diesel road because a tax was weighed and it came into the lowest particulate emission level, or so we were told as buyers. That is why a lot of people transferred, me included, and I feel deeply, deeply deceived. I only did it very recently, just before the scandal hit. People transferred to diesel because of that incentive. Do you think we should do that with the electric cars and the gas cars?

Simon Birkett: We do not have to change every vehicle across the whole country. We are talking about protecting people where they live and work. We do not have to generate enough electricity for every car to be electric. This is about where the problem areas are. I was very pleased to hear, speaking to my MP, Mark Field, on Monday night, that he had just bought a Prius, a petrol-electric hybrid. We can encourage people to walk, cycle and use public transport, and not use diesel vehicles. Frankly, if the Mayor removed the 25-foot turning circle requirement on taxis, we would not have 22,000 diesel taxis running around the city. There are a lot of things we could do to cut the red tape that works against it.

Rebecca Pow: There was an example of the conversion of a cab in Parliament today. For £1,500, you can convert to gas, apparently. It could be possible.

Q82 Chair: That is probably LPG, is it not?

Simon Birkett: I have flagged my concerns about LPG. LPG is not as clean as compressed natural gas.

Chair: If it is compressed natural gas, it is probably cleaner, is it?

Simon Birkett: Yes.

Chair: What does it say?

Rebecca Pow: Liquefied petroleum gas.

Simon Birkett: That is LPG, and that is not as good as CNG by any means.

Q83 Chair: Sorry to labour this point, but, if you compare a diesel car with a petrol car, it will usually do 1.5 times as many miles with that particular fuel. Therefore, you have to average that out as well. That is what was concentrated on in the past. We concentrated on CO₂, and diesels are always going to be better on CO₂, because they do not use as much fuel. A lot of your solutions are fine, perhaps, for the city. What bus are a lot of my constituents going to get on? First, there is no bus, and, secondly, if it does come, it is not going in the direction you want it to go. I am being facetious, but they will use cars, and I think that is the issue.

Simon Birkett: I do not think there is a problem with using diesel vehicles in the countryside and between cities. Ideally there would be something else, but that is not the problem. We do not want them driving down the Embankment, Park Lane or Grosvenor Place. These reports all show the focus on CO₂ fuel efficiency going back to 1990. We need this one-atmosphere thinking, so that people recognise it is not just about one molecule, one gas within this stuff coming out of exhausts and chimneys. We need to look at this problem properly.

Alan Andrews: I accept it is wise to be sceptical about clean air zones, but they focus the solutions on where the problem is, in the bigger, more polluted urban areas. It is fine to be using diesel vehicles out in the countryside, where there is not a major air pollution problem, where you do not have dense populations breathing in the pollution.

Q84 Chair: You have these clean air zones, which I think mainly affect lorries. Should the Government consider bringing in clean air zones as far as cars are concerned as well?

Simon Birkett: Germany has about 70 low emission zones across the country and has done for five years. Berlin went in before 2010, I think.

Q85 Chair: I cannot believe they are banning diesel cars.

Simon Birkett: Yes, that is exactly what they did. These low emission zones in Germany all restrict diesel cars. In 2010, Berlin basically said, unless you had a Euro 4 diesel car, which is 2008 vintage, or an abatement filter fitted, you were not allowed into the central 30% of the city. When people say low emission zones do not work—and I have heard some people say that—they are being really unhelpful and, frankly, wrong.

If you look at the spectrum of low emission zones, the 100% low emission zone is what they are doing in Rome, Madrid and other places, where they are pedestrianising the worst places. Oxford Street ought to be pedestrianised. You cannot have all these diesel buses and taxis mixing with all these people. These low emission zones exist widely across Europe. We have one. The Mayor is proposing bringing in, from 2020, something he calls his ultra-low emission zone, which is not really ultra-low emission, but that is what he calls it. There is a very wide view across London that it is too small, too weak, too late. In typical Mayor fashion, he originally said he was going to ban vehicles, and, by

the end of it, after several backwards steps, he said, “Provided cars pay £12.50 a day, they can come in as diesel cars.” We need something that is bigger, stronger and sooner.

Alan Andrews: I have just a short answer on that point. The Supreme Court order requires the plans to contain measures to achieve compliance in the shortest time possible. The current proposals would not include cars within most of the clean air zones. That is clearly not achieving compliance in the shortest time possible. Yes, cars need to be addressed within the framework of clean air zones.

Simon Birkett: They are in Germany, for example.

Alan Andrews: There is one slight problem, in that, with nitrogen dioxide, there is not currently a viable retrofit option, as there was for diesel particulate filters, which were used in the German low emission zones. That is a challenge for industry, and Government should be working very closely with industry to see if they can come forward with a viable option, because we have this problem of a rump.

Q86 Chair: Just to correct Simon, I do not think they have banned diesel cars in Germany, by the sound of it. They have just said they have to have the right diesel engine and the right fittings. It could be argued now as to whether that is indeed working and they are to the level that was specified, I suspect.

Simon Birkett: They banned the older diesel vehicles; that is absolutely correct. Thank you for that clarification, Chairman.

Alan Andrews: The crucial point is that it is a model based on banning vehicles unless they meet the standard, rather than charge-based, as envisaged by Defra.

Chair: I see. Yes, that is quite different. I understand.

Q87 Jim Fitzpatrick: You will have heard me ask the professors this same question, gentlemen, about shipping. Many of us are big supporters of using the Thames for tourism; for commuting; for commercial vehicles especially, to get lorries off the road; for refuse, recycling and the rest of it. The question is: are the regulations behind where shipping is, given the increased volumes we have seen and the fact that we want to see much more of it? Professor Williams very helpfully said that Gothenburg had taken steps to say that, if the cruise ships did not have SCR, they would not be able to use the port, but not all vessels have the best technology or the best equipment. Do you have any comments on shipping as a mode and the regulations for metropolitan use or use around the coast?

Alan Andrews: I am not an expert at all when it comes to shipping policy. One comment I would make is that the concept of clean air zones needs to be a lot broader than looking at just road transport. It needs to look at all major emission sources, including non-road machinery, such as construction equipment, shipping and all major NO_x and other pollution sources. Within a clear air zone, you could have requirements that all ships use the best available techniques and technologies.

Simon Birkett: There is the CO₂ problem, and then there are the sulphur oxides and oxides of nitrogen problems from shipping. My understanding is that NO_x emissions from shipping within Europe could exceed those from all its road transport emissions by

about 2020 or 2025, so shipping needs to be tackled for its NO_x emissions. There is a sulphur emission control area up the east coast of the UK on the North Sea. There is nothing on the west coast for sulphur. There is no oxides of nitrogen emission control area, or NECA, on the east or west of the UK. Within London, it is complete madness to have a cruise terminal being approved in Greenwich with no onshore power to that. My understanding is that one of these ships would be equivalent to several hundred HGVs chugging away down there.

We really do need onshore power. This is not new or surprising. The US has been using onshore electric power plugged into ships for many years. The Environmental Protection Agency has made grants for it in the States. It is not as if we have to reinvent the wheel.

Q88 Rebecca Pow: You can almost give me a yes/no answer to this. Am I right in thinking that aeroplane pollution was removed from our calculations of overall air pollution for some time?

Simon Birkett: If I can disclose an interest, my late father-in-law was Lord Marshall, the Chairman of British Airways. He and I agreed that air pollution laws needed to be complied with around Heathrow. My understanding is that aircraft emissions, in terms of local pollutants, are excluded above the landing and take-off cycle, which is, I think, 1,000 metres. At Heathrow, the modelling shows that it is a road transport problem and a local diesel problem. You could build a third runway at Heathrow, but before taking that decision, you would have to ban diesel vehicles for many miles around Heathrow, including the M4 and the M25. That is why it is a pretty tall order to comply with the Air Quality Directive and the McCracken opinion.

Chair: I had better declare an interest at this stage, because I drive up and down the M4 and I do not particularly want it closed. Thank you, gentlemen, very much. We have gained a lot from your evidence. What we have gained from your evidence and the professors' as well is that it has to be very much a cross-departmental, cross-Government effort. Defra is in the dock, but so is everybody else. We have to make sure that we get Government to act.