

AIR QUALITY INFORMATION SYSTEM REVIEW

Final report and recommendations



Prepared for: Department for Environment, Food and Rural Affairs; and UK Health Security Agency

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This is a report from the Air Quality Information System review (AQIS) to the Department for Environment, Food and Rural Affairs and UK Health Security Agency. The information contained within this report provides a summary of the AQIS Review and recommendations resulting from the review, independent of government policy.

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Executive Summary

In 2021 the Department for Environment, Food and Rural Affairs (Defra) and the UK Health Security Agency (UKHSA) launched the Air Quality Information System (AQIS) review as part of the government's commitment to improve the provision of air quality information to the public following the inquest into the death of Ella Adoo-Kissi-Debrah.

The AQIS review was led by an external multi-disciplinary steering group tasked with examining the strengths and limitations of the information and related communication systems that are used to engage with the public on issues related to air pollution and health in the United Kingdom, and ultimately to make a series of recommendations for improvement.

Insights from the steering group on current air quality information provision

The initial phase of the project was dedicated to assessing the strengths and weaknesses of existing information provision and considering the evidence the steering group would need in order to make informed recommendations for improvements.

The steering group drafted an interim statement on the effectiveness of the existing AQIS. This was generally positive about the UK's technical capabilities for providing air quality information – highlighting the UK's national atmospheric emissions inventory, extensive monitoring networks and advanced modelling capabilities – but concluded these capabilities were not being exploited to their fullest potential.

The steering group highlighted a number of issues impeding public awareness and understanding of air quality themed around the accessibility, appropriateness and impact of the information provided. Principally, they noted a lack of evidence that the public is aware of existing air quality information sources. Those who could find information may be faced with prohibitively technical language and information that assumes a high degree of scientific literacy. Furthermore, air quality health advice did not reflect the most up-to-date clinical advice, and existing alerting systems fail to provide accessible data or advice on longer-term exposure.

Programme of work

Defra and UKHSA, with guidance from the steering group, developed a programme of work covering the breadth of evidence needed to make recommendations for an improved information system.

Research was split across 5 workstreams.

- Workstream 1 – aimed to understand who needs to know about air quality and what they need to know

- Workstream 2 – queried the accuracy and precision of the air quality data and models that underpins the Daily Air Quality Index (DAQI) and forecasts
- Workstream 3 – considered how to use data to tell a meaningful story
- Workstream 4 – focused on effecting behaviour change
- Workstream 5 – explored how to reach target audiences

Evidence, addressing these themes, was compiled from Defra and UKHSA commissioned and/or undertaken research projects and ongoing projects by relevant stakeholders in these areas. The Committee on the Medical Effects of Air Pollutants (COMEAP) also established a sub-group to answer specific questions identified by the steering group. Defra’s Air Quality Expert Group (AQEG) also hosted an air quality modelling roundtable.

Key findings from the AQIS review evidence

Who needs to know about air quality and what they need to know

A rapid review of the epidemiological evidence regarding susceptibility of specific subpopulations to air pollution concluded that no immediate changes or additions are need to the groups currently defined as “at risk” in the DAQI. However, it did find some evidence that individuals with obesity or metabolic syndrome/diabetes may also be at higher risk of the effects of air pollution and there may be value in signposting to information about this. A separate review found that higher patterns of air pollution exposure may be experienced by individuals belonging to lower socioeconomic status groups and persons belonging to ethnic minorities, indicating a need for improved local and community level awareness raising and engagement.

Assessment of the literature on health effects of physical activity in air pollution suggested that the current advice regarding air pollution and physical exertion should be updated to focus on reducing personal exposure rather than discouraging physical activity. Additionally, new evidence examining the delay between short-term exposure and onset of health effects suggests that at risk groups should be advised to monitor symptoms for at least a week after exposure to elevated levels of air pollution.

Accuracy and precision of air quality data and models

The modelled and measured data on which UK air quality information is based was found to give a sufficiently accurate and precise representation of real-world air quality conditions. However, increased spatial granularity and temporal resolution of air quality data and forecasts may help to improve relevance for behaviour modification.

Tell a meaningful story with data

The evaluation of the DAQI concluded that most people who viewed the DAQI found the purple, red, amber, green ratings easy to understand and generally users interpreted the information correctly. However, the use of green to indicate a low short-term exposure risk, combined with a lack of information about longer-term air pollution trends, may contribute to a misunderstanding of the public health burden of

long-term exposure. Therefore, it is recommended that a long-term statement should be displayed alongside the DAQI to help viewers to understand the difference between long-term and short-term risks of exposure to air pollution.

Effecting behaviour change

Research found little evidence of individuals altering behaviour as a result of accessing air quality information. Those at risk due to underlying medical conditions, whilst demonstrating a motivation to act on health advice, were rarely directed towards advice as part of managing their condition – this group expressed a strong desire for more information or signposting from their health care providers.

Qualitative research with the general public indicated that outside of at-risk groups, few people felt that the risk from exposure to poor air quality was directly relevant to them, and compared to other environmental issues air quality has limited social relevance with little shared understanding of the importance of the issue. However, participants were receptive to learning more and agreed that building information about air pollution into social spaces has the potential to increase the visibility of the topic and signal its importance, creating new social norms and expectations around air quality behaviours.

To maximise impact information should be seen to come from trusted and credible sources – people considered the Met Office to be a particularly credible source, whilst the NHS and health care professionals are trusted to give sound health advice.

Expanding reach

Some of the groups of people most impacted by air pollution are often unheard and may be difficult to reach through traditional channels – therefore whilst expanding the use of existing channels to communicate air quality information presents significant opportunities, any future strategy for public engagement around air quality should incorporate interventions focused at individual, national and community level. Interventions should involve individuals in decision making and empower people who feel affected by air pollution to speak out.

Young people were identified as particularly relevant in raising the profile of air quality as a social issue. Findings from the AQIS qualitative research panel suggested lessons about air quality could be embedded in primary and secondary school education to foster enthusiasm in pupils and harness the significant influence young people have on their friends, parents and grandparents.

Theory of change and recommendations

A theory of change (ToC) process was developed to provide a structured way of reaching consensus on the AQIS review recommendations, providing assurance on how and why the delivery of the AQIS recommendations are expected to achieve any anticipated benefits by illustrating the clear causal chain from recommendations to intended outcomes.

The ToC process resulted in a longlist of 32 recommendations, which have been rationalised into the final set of 11 AQIS recommendations.

Summary of recommendations

Theme	Recommendation
Principles	<p>1. Air quality information providers should take an outcome-based approach to communicating air quality information, risk and potential action.</p> <p>2. Air quality information should use accessible language and be recognisable; developed with a consistent tone, message and advice. This information should be readily accessible and proactively disseminated across existing channels, where appropriate.</p> <p>3. Any co-benefits of taking action should be communicated alongside the possible health benefits.</p>
Communications	<p>4. Develop and implement a communications strategy to raise public awareness of air pollution, including the actions the government and other public bodies are taking, and the actions individuals can take to protect their health and reduce their contributions.</p>
Education	<p>5. Work with the relevant professional health bodies and regulators to upskill health care professionals on the health impacts of air pollution, enabling health care professionals to provide appropriate actionable health advice to the public and susceptible groups.</p> <p>6. The teaching of air quality information in schools should be strengthened.</p> <p>7. Review currently available air quality toolkits that can be utilised by organisations to communicate air quality information. Suitable existing material should be promoted and where appropriate new resources should be created.</p>
Indices and Advice	<p>8. Update the Daily Air Quality Index (DAQI) and associated advice in line with the latest evidence.</p> <p>9. Develop a long-term air quality statement suitable for the public.</p> <p>10. Review, update and expand the existing alerts system.</p>
Review and Evaluation	<p>11. Air quality information provided by government should continue to develop in line with advice from expert groups. As part of implementing any changes to the AQIS an evaluation should be undertaken.</p>

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Background

Purpose of the review

As part of the Government's response to the Coroner's Prevention of Future Deaths (PFD)¹² report recommendations following the tragic death of Ella Adoo-Kissi-Debrah, the Department for Environment, Food and Rural Affairs (Defra) and the UK Health Security Agency (UKHSA) initiated a project in 2021 to review the provision of information and related communication systems that are used to engage with the public on issues related to air pollution and health in the United Kingdom. The review was agreed as a priority for Defra, the Department of Health and Social Care (DHSC), UKHSA and the chairs of the Air Quality Expert Group (AQEG) and the Committee on the Medical Effects of Air Pollutants (COMEAP). The Air Quality Information System (AQIS) review takes a comprehensive view of the air quality information system. The following types of information are therefore encompassed:

- Information systems that describe current and past measured concentrations of pollution; for example, those derived from monitoring networks.
- Information systems that generate short-range predictive forecasts and warnings on future air quality episodes, principally derived from models and targeted at the public and specifically at-risk groups.
- More general air quality information, for example generic information about the health or environmental effects of air pollution, or sources of emissions.
- Advice for the public and at-risk groups on how to reduce their exposure and contribution to air pollution.

Steering group

The AQIS review took a holistic view of the effectiveness and value of air quality information for the public. To achieve this Defra and UKHSA facilitated the formation of the AQIS steering group, consisting of multi-disciplinary experts spanning air quality science, health science, behavioural science and digital communications, as well as lay representation, representation from health charities and members from local and central government.

The role of the steering group was to provide direction and oversight to the review, and ultimately to propose a series of actionable and evidence-based

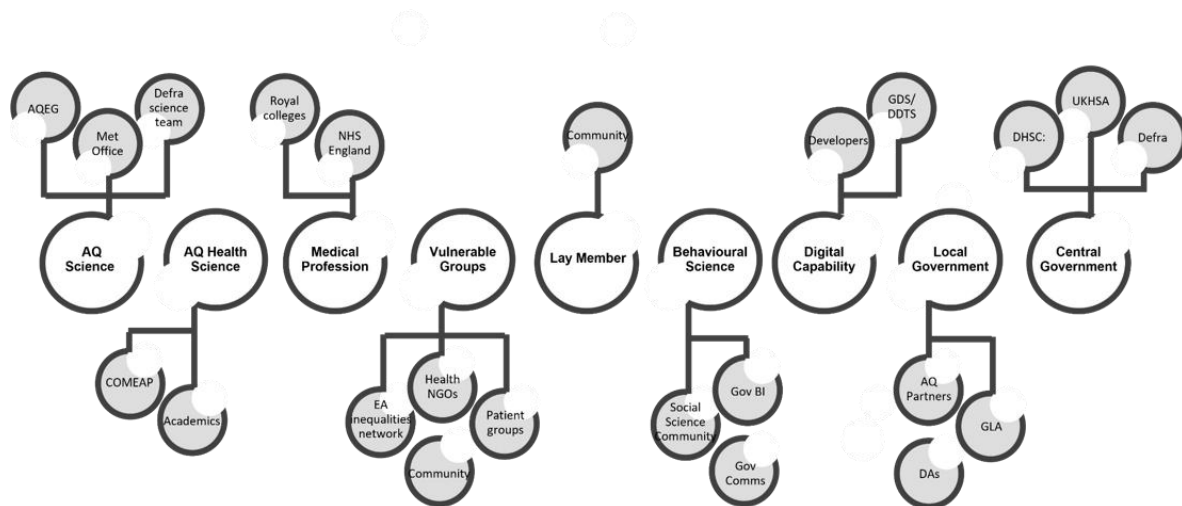
¹ Courts and Tribunals Judiciary. 2021. 'Prevention of Future Deaths: Ella Kissi-Debrah' <https://www.judiciary.uk/prevention-of-future-death-reports/ella-kissi-debrah/>

² Government Legal Department. 2021. Inquest touching the death of Ella Adoo Kissi-Debrah: Response to Regulation 28 Report <https://www.judiciary.uk/wp-content/uploads/2021/04/2021-0113-Response-from-Central-Government-Departments-DEFRA-DFT-and-DHSC-Redacted.pdf>

recommendations for changes that could be made to improve the government's provision of air quality information.

The organisational structure of the review used subject-matter and sectoral specialists and their networks as a conduit for dialogue and input from other communities. This is shown in schematic form in Figure 1.

Figure 1: Membership of the Steering group and wider evidence networks.



Introduction

This report summarises the AQIS review process, the evidence commissioned as part of this review and the AQIS Theory of Change (ToC). It provides a series of recommendations which have been developed in consideration of the evidence collected and reviewed.

This report is not intended to provide detailed information for all the work commissioned, evidence reviewed and discussions that took place. The reports commissioned as part of this review (published alongside this report) and the ToC contain recommendations, some of which are reflected in this report. However, when making improvements to the air quality information system, these should also be considered.

Insights from the steering group on current air quality information provision

The early meetings of the steering group focused on identifying existing baseline capabilities for providing air quality information to the public, and the strengths and weaknesses of the existing system. Later meetings identified potential areas of opportunity and helped guide the secretariat in commissioning further work, both in-house and external.

1. Technical capabilities of air pollution models and monitoring data

The steering group found that there is substantial existing technical capability for providing air pollution information. For example, a short review by the Air Quality Expert Group (AQEG) reported that the UK had a world-leading atmospheric emissions inventory that provides a level of information and granularity on sources of pollution that goes well beyond what is required to meet regulatory reporting needs.

The UK has an extensive national network of around 200 air quality measurement sites (the Automatic Urban and Rural Network, AURN), operated to high standards, that provide publicly available data in close to real-time. This is supplemented by local authority monitoring and some research data, although real-time and public accessibility of that data is patchier. Notably data from NO₂ diffusion tube networks and research supersites is often only released to the public many months after the measurements were made.

The combination of emissions inventory and monitoring data allows Defra to produce annual estimates of ambient air pollution concentrations at 1 x 1 km resolution for the whole of the UK. In some cities estimates of air pollution are made at higher resolutions than this, for example using the ADMS-Urban model which operates at the metre scale.

The technical capability to model air quality and produce short-range (0 – 5 day) forecasts was also considered to be advanced. Whilst models can always be refined and improved further, the skill and resolution of existing systems were deemed likely sufficient to reliably provide advice in advance of the onset of severe air pollution episodes. Current models can provide forecasts of high air pollution events accurately at the county-to-regional scale but not individual hotspots within those counties. Air pollution forecasts are now being produced as ancillary data products of several operational weather forecasting models; for example, the Met Office, European Centre for Medium-range Weather Forecasting (ECMWF) and NASA. Operational weather forecasts, and by extension air quality forecasts, therefore have very high levels of redundancy and robustness against system failures. The embedding of fine scale 'street-level' modelling of pollution is also well-advanced with this capability moving from research applications into more routine operational use.

In combination, the steering group considered that there was a significant existing capability to generate data (past, present, and future) on air quality in the UK. However, this was not in many cases being exploited to its fullest potential by users outside of the research community.

Whilst sustained investment in both monitoring and modelling is vital to support air quality information systems at the cutting edge of what is possible, a key conclusion from the early phase of the review was that providing better information to the public is not substantially constrained by any fundamental technical limitations, either in measurement or modelling. Whilst this indicates a positive starting position for a

national AQIS, the optimal access and use of such data resources is a separate matter and is less well-developed.

2. Problems with existing information system

Beyond underpinning technical and scientific capabilities, the steering group identified a range of issues that related to current **accessibility**, **appropriateness**, and **impact** of information for the public on air quality. Key review messages are identified below:

a) Accessibility

- Whilst a range of telephone and mobile air quality alert systems already exist in the UK, anecdotally steering group members and their networks reported a low level of subscribers for these services amongst their constituents.
- Members identified that there is often a poor user experience with alert systems, and that whilst information is often made publicly accessible, finding that information could be difficult and the format not always accessible to non-specialists.
- Services that require opt-ins and sign-ups may create unintentional barriers to engagement with target groups.
- Existing air quality information sources tend to be directed at users with higher levels of data skills and scientific knowledge.
- There is a lack of relevant channels to communicate with seldom heard from groups such as those who are digitally excluded or groups lacking English language skills.
- Scientific literacy on air pollution, its causes and health effects were considered to be poor, with limited coverage of the topic in the school curricula, and educational provision rarely extending beyond primary education.
- The steering group provided anecdotal examples of where low participation in the use of alerting services could be attributed to a lack of awareness and signposting from health professionals. Such information sources may be helpful to those managing underlying health conditions where air pollution is an aggravating factor.

b) Appropriateness

- Defra's daily air pollution forecasts are typically county-to-regional in geographic scope and lack street or postcode-level details that may help support direct behavioural adjustments; for example, providing guidance on the avoidance of hotspots in cities or by roads.
- Since the last Daily Air Quality Index (DAQI) review, scientific evidence has increased, and clinical advice/management has been updated and there is a need to update current health advice which accompanies the alerts.

- The health advice provided alongside air pollution warnings is often too general. For example, blanket advice to avoid outdoor exercise may dissuade people from exercising at all, or prompt unnecessarily caution against exercise during periods of the day when pollution may actually be low. This may cause harms in the long term.
- Different sources of information can result in a lack of consistency in data or messaging between providers of air quality information. Persistent disagreements between forecasts, or inaccurate forecasts may damage public trust. Media reporting of severe air pollution episodes typically defaults to the worst-case forecast.
- Current alerting systems do not communicate the accumulation of risks that occur when air pollution stay high over any days. At present air pollution is presented as a short-term hazard, similar to severe weather episodes with little emphasis being placed on providing data and advice about longer-term, for example annual, exposure.
- Current information systems that focus on very high-air pollution episodes and related health advice put the onus on at-risk individuals to change behaviour. There is little to no public communication or messaging related to changed behaviours that would lead to reduction in polluting activities and emissions.

c) Impact

- There is a lack of evidence on the extent to which individuals change their behaviour in response to current alerting systems, including those receiving alerts directly (for example, on their phones), or less targeted forecasting of air pollution levels (for example, through weather apps). In part this may be because data sources are promoted generically and do not require/request any feedback from users. There may be value in more targeted delivery in the future with an emphasis on evaluating behavioural change impact on the user.
- Central and local government may not necessarily be viewed by some sections of the public as the most appropriate or trusted messenger for air pollution alerts. For example, vulnerable groups to air pollution exposure with underlying health conditions are considered more likely to respond to information provided through their health practitioner, with this information seen as specific and tailored to their needs. Wider promotion and dissemination to the population is unlikely to have the same impact on those that may benefit most from receiving and acting on information provided.
- There is not always consistency in messaging between different information providers. This can relate to a previous point made around short-term alert messages and long-term pollution annual trends. It does not translate that if an area has few or no alerts that air quality is good on a long-term basis. Annual averages in this case could indeed be high. Without a general understanding of air quality information and the difference between long and short-term exposure and how they impact

health, specific alerts and messages may not be understood and considered to be confusing and/or contradictory.

- No matter how scientifically advanced the underlying information systems may be, overly technical and unrelatable information will reduce engagement and impact.

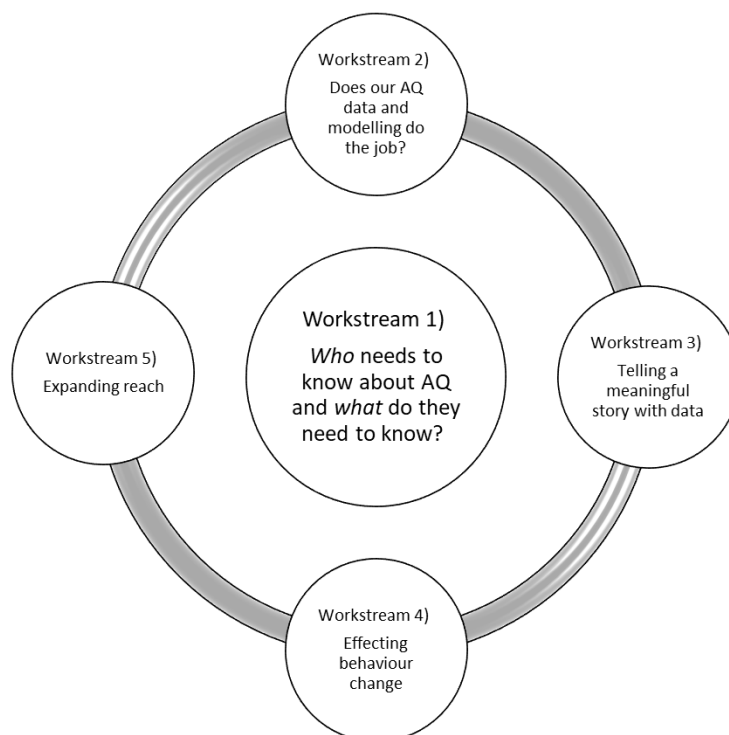
Programme of work

Having established the current baseline capability and principles for future development, the review identified a number of priority areas for further development. These were the two distinct but interrelated elements of the air quality information system:

- The provision of air quality alerts: messages/advice triggered by specific poor air quality conditions and targeted at specific at-risk groups;
- Development of wider air quality information: general messaging and public/professional awareness including information to promote actions and behaviour change for emissions reduction.

Defra and UKHSA developed a work programme that was guided and shaped with input from the steering group. This programme of work was delivered in five streams of activities, summarised in Figure 2. Taken in its totality the steering group considered that this this would cover the breadth of evidence and advice needed when considering the design of a future information system.

Figure 2: AQIS programme of work.



Workstreams

The programme of work for the review was divided into five workstreams, each comprising a series of high-level research questions. To ensure that these research questions were adequately addressed, existing evidence was reviewed and where gaps were identified further work was commissioned. The focus and purpose of each workstream is summarised below:

Workstream 1: Who needs to know about air quality, and what do they need to know? Workstream 1 focussed on the *what, who and why*, and formed the basis for providing much of the underpinning evidence for the rest of the review. Evidence collected in this workstream looked at *who* needs to know about air quality (and *why* specific groups may need targeting), *what* information and advice needs to be provided to people (during and outside of air pollution episodes) and aimed to provide an understanding of which behaviours the information should be aiming to influence to maximise health and wellbeing outcomes.

Workstream 2: Does our air quality data and modelling do the job? Workstream 2 focussed on providing an understanding on how accurate and precise the data that underpins existing air quality systems, such as the DAQI and air quality forecast are; asking whether the current information system provide the public with a sufficiently accurate represent of real-world air quality conditions?

Workstream 3: Telling a Meaningful Story with Data. Workstream 3 focussed on providing evidence to improve our understanding of when (and under what conditions) target audiences need to be provided with air quality information and how to present data so it is interpreted as intended. This workstream was conditional on knowing what your “data story” should be aiming to achieve and who it should be targeted at (workstream 1) and being confident the data inputs are sufficiently accurate, reliable and relevant (workstream 2).

Workstream 4: How to Effect Behaviour Change. This workstream took a user centred approach and gathered insights from different target audiences in order to understand how messaging content and framing affects impact. Behaviour change considered both protective behaviours and emission reducing behaviours.

Workstream 5: Expanding Reach. This workstream focussed on dissemination and gathered insights from different target audiences, gatekeepers and stakeholders to understand how best to reach different groups.

Key findings from the AQIS review evidence

Awareness and understanding of air quality

Awareness of air quality and associated concerns about health impact has been increasing in recent years, but research commissioned and reviewed as part of this review indicates that overall, it is not an issue that is the top of people’s minds.

Defra run the Survey of Attitudes Toward the Environment³ once a year. This is a nationally representative survey investigating the public's attitudes toward environmental issues, including air quality. When asked which environmental factors were most important to their health and wellbeing more than half of respondents ranked 'the quality of the air they breathe' (61%) as 'most important'. Whilst just under nine in ten (86%) people reported at least some concern about air quality when thinking about their health and wellbeing.

Whilst general awareness of air quality has been increasing it does not appear that this has resulted in an increased understanding. As part of the AQIS review, qualitative research was commissioned⁴ to explore how the public can be supported to reduce their exposure and contribution to air pollution. The panel recruited for the qualitative research covered 5 groups, reflecting the general public and those identified as at-risk due to age or health conditions. Comparing with previous studies, it appears that public opinion on the importance of air pollution has not developed significantly in around ten years. The findings from research conducted for this review suggest that this is due to the complexity of the topic, with many inter-related factors that made it difficult for people to engage with at a personal level. People often think about air pollution as an intangible and widespread issue, over which they had very limited individual control or influence.

Specifically, there was a general lack of a clear understanding about what air quality is and what contributes to or reduces it. Generally, people are unaware of different air pollutants (e.g., particulate matter, nitrous oxides) and how different industries and/or activities contribute to air pollution. The major sources of air pollution were assumed to be transport, industrial emissions and energy generation, although the exact reasons how and why these contribute to air pollution were unclear to most.

When asked, understanding of the physical effects of air pollution were better understood than the concept and sources of air pollution. The qualitative research found that people associated the term 'air pollution', with concepts such as breathing, respiratory conditions, asthma and disease. Participants broadly recognised the key groups that are more at risk from the health impacts of air pollution, which they listed as people with lung conditions, children, pregnant and frail people.

Those who were more 'at risk' in relation to air pollution had higher awareness of air quality as an issue and voiced concerns about the immediate and longer-term impacts of air pollution on themselves and their families. This was particularly the case for some older people, those with cardiovascular disease and COPD and carers of young children/pregnant women.

The majority of participants in the qualitative research did not think that air quality was important and/or relevant to them and few were aware of the availability of daily air quality readings. As a result, most participants had not actively sought air quality information, whether at a national or local level. Most participants tended to feel that

³ Survey on Attitudes to the Environment: <https://sciencesearch.defra.gov.uk/ProjectDetails?ProjectId=20907>

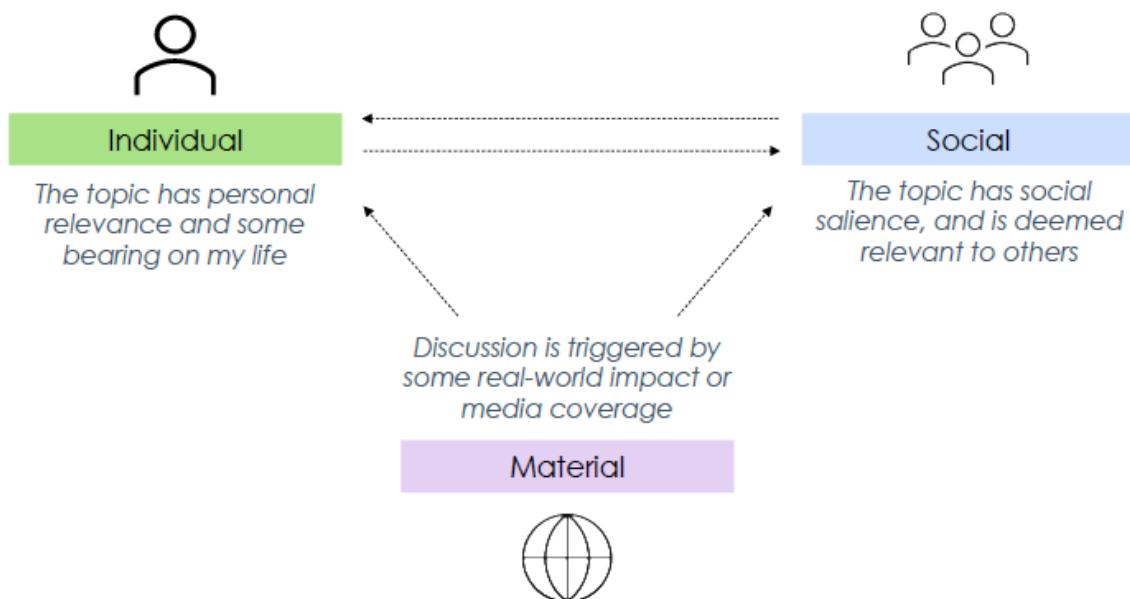
⁴ Defra, Verian (2024) Air quality qualitative research panel

air quality information lacked relevance to them (due to a low perceived level of risk and having other, more pressing concerns, such as the cost of living, and the relative intangibility of the topic), so some participants questioned whether seeking air quality information would benefit them.

A Social Network Mapping study commissioned for the review⁵ found that because people generally felt that air quality was not relevant to them, few people were discussing it within their social networks or groups. This may limit the chance that someone could unintentionally find out more about air quality.

Compared to other environmental issues, discussing air quality was found to be infrequent. Discussion of wider environmental issues were more common (although still relatively infrequent) and was driven by a combination of individual, social and material factors, see Figure 3. At a basic level, this meant that the topic needed to feel meaningful to a particular individual and that individual also needed to believe it would be seen as a relevant topic by others for it to be deemed a worthwhile topic of conversation. With these conditions fulfilled, discussions could then be prompted by some kind of material prompt in the form of real-world impacts of media coverage. Many participants felt that air quality lacked relevance at the individual and social level, as well as having a lack of material cues.

Figure 3: Factors driving discussion of environmental issues.



Communication opportunities

Social norming

Despite low levels of awareness, research commission for the AQIS review shows that people were keen to know more, particularly regarding the extent of the impact of air pollution on their health. Participants in the qualitative panel felt that accessible, daily forecast information would help to raise the profile of air quality as

⁵ Defra, Verian (2024) Air Quality Information System Review: Leveraging social networks

an issue. They also believed that it could prompt people to think about how they may respond to minimise their exposure to air pollution. This clearly highlighted that the current daily forecast published by Defra is not having the desired impact.

Availability and access to air quality information has evolved significantly over the past two decades, from early reports of smog in newspapers to the increasing proliferation of apps, websites, social media platforms, and personal sensors that provide real-time air quality information. In parallel, the way people source air quality information has transformed, with a noticeable shift from the use of traditional media outlets such as newspapers and television to the Internet and social media⁶.

Expanding the use of existing channels to communicate air quality information presents a significant opportunity. Research participants suggest the use of weather apps, news channels⁷ and in public spaces such as bus stops or doctors' surgeries⁸. This would minimise any burden on users, as they would not need to actively seek out sources of air quality information; it would also help to normalise the provision of that information.

Digital channels

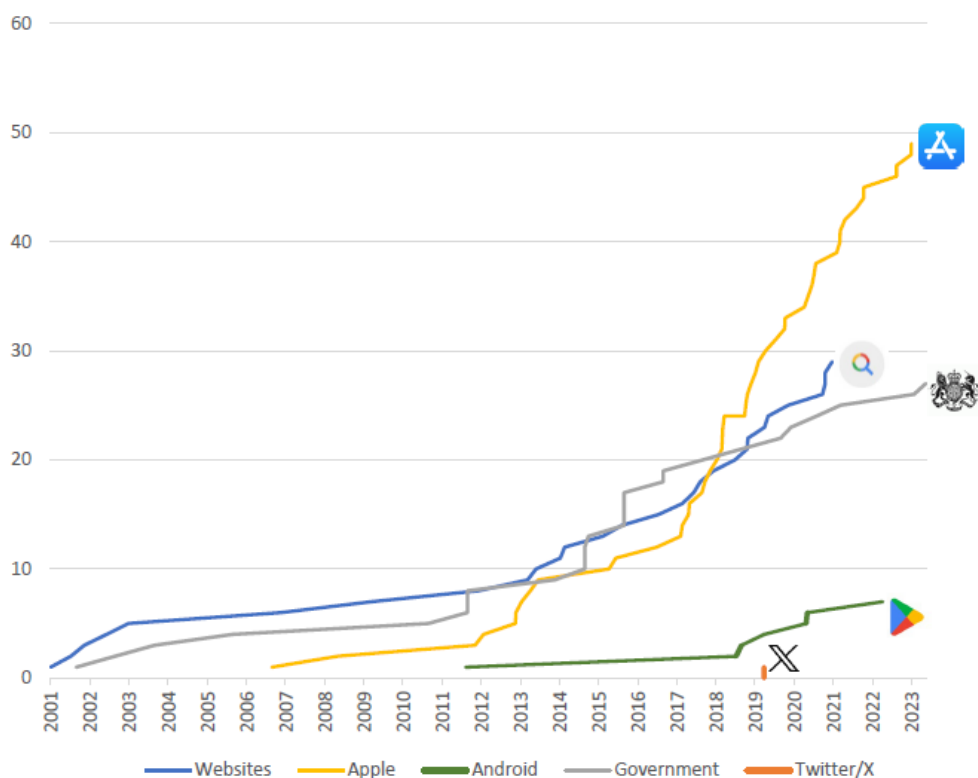
The digital air quality information landscape in the UK has increased in size and become more complex over the past 20 years (Figure 4), including a substantial increase in the number of applications and private companies entering the space. Defra needs to ensure consistent attribution and branding across platforms using Application Programming Interfaces (API), to ensure that data sources and messages are recognisable.

⁶ Defra, Imperial College London (2023) UK Digital Air Quality Information Landscape Review

⁷ Defra, Verian (2024) Air quality qualitative research panel

⁸ Defra, Verian (2024) Air Quality Information System Review: Leveraging social networks

Figure 4: Unique air quality channels launch dates by platform.



The current dominant delivery platform are mobile apps. The number of air pollution app launches overtook the number of website-based AQ channel launches in 2018⁹.

Given the evolving diversity within the AQ landscape since the last update of the Daily Air Quality Index (DAQI), Defra should consider implementing an engagement strategy with key providers in the space. This may include collaborating with channels that are weather-focused, which demonstrated the greatest number of users. Adopting a collaborative approach could help support the rollout of an updated DAQI, ensuring that the information remains relevant and accessible to the public.

Messengers

In research conducted for this review participants consistently agreed that it is important for messages to be delivered by sources perceived as credible. The Met Office was seen as a particularly credible messenger, as it was perceived to be competent, unbiased and scientific. Some participants likened air pollution information to information that the Met Office currently delivers about pollen counts and UV levels. Only some participants were aware it already provides information about air quality, but most were open to it making this information more prominent at times when air pollution is high.

The NHS and other healthcare organisations were also perceived as credible. At present healthcare providers (HCPs) are not typically discussing air quality, even

⁹ Defra, Imperial College London (2023) UK Digital Air Quality Information Landscape Review

with those at particular risk, and there was a strong desire amongst those receiving care for more information or signposting. Participants, in the research conducted for this review, consistently suggested that GPs and pharmacists could play an important role in raising awareness about air quality, especially for the general population and older people. These participants proposed that GPs and pharmacists, through general appointments and via NHS Health Checks, could start to normalise conversations around air quality. Participants felt that HCPs could ask questions such as: 'Do you have a wood burner in your home?', 'What times of the day do you exercise?' or 'Do you tend to cycle on busy roads?' to prompt patients to think about exposure to air pollution and consider making lifestyle changes in response.

Beyond check-ups, participants felt that in certain circumstances HCPs should proactively offer air quality information and advice. For example, participants with respiratory and cardiovascular conditions wanted to know about the effects of air pollution and why they are at a higher risk of experiencing the negative impacts. Asthma reviews and consultant appointments could present ideal opportunities for sharing this information and supporting discussions about how to mitigate symptoms, and manage patients' conditions in the future (e.g., what to avoid and when, and when reliance on medication or inhalers may increase). For those who display new symptoms, such as a persistent cough, participants suggested that HCPs could ask questions about exposure to air pollution; during seasonal times of high air pollution, pharmacists could offer information to people purchasing antihistamines and display information about how to limit exposure to air pollution.

Views on the government as a messenger were more mixed: although trust in politicians was universally low, there was more trust for some information from government departments.

Personal connections such as, friends and family, religious leaders and influencers, were seen by participants as having a key role in passing on information produced by experts. Whilst these personal connections were not deemed to have expertise, participants felt that information passed on by them would have individual and social relevance, which would mean they would be more likely to engage with it than if the information had been passed on by an expert.

Educational opportunities

Education was recognised as an important channel for the dissemination of messages, so that air quality is embedded into everyday thinking. The role of pre-schools and primary schools, where teachers act as role models was highlighted, Air quality should be integrated into everyday activities, making learning fun and engaging was suggested. For secondary schools, incorporating air quality into the curriculum across various subjects was recommended. Science could cover the chemistry and biology of air pollution, geography could address environmental aspects, and, Personal, Social, Health, and Economic education (PSHE) could focus on social responsibility. Participants agreed that there is a need to find ways to make

air pollution an everyday concern for young people, so that it reaches and influences them and does not just become a topic learnt about in school.

Young people were perceived as having significant influence on their parents and grandparents and so participants felt that this influence should be harnessed across communities. It was recognised that young people could encourage their parents and grandparents to think differently about environmental concerns in a way that older people may not consider. Young people tend to be more positive, energetic and passionate than older people and frequently bring solution-focused approaches to environmental subjects. Therefore, young people's involvement in decision-making and the creation of campaigns and information around air quality should be encouraged by organisations across society.

To maximise its effectiveness, a strategy for public engagement around air quality should incorporate a combination of interventions focused at the individual and social levels, as each has the potential to support the other. Interventions aimed at raising the social salience of the topic, will build the perceived relevance of the topic of air quality as a relevant subject for discussion. This in turn has the potential to help empower individuals who do feel affected by air pollution to speak about the topic, further building social salience and creating a positive feedback loop.

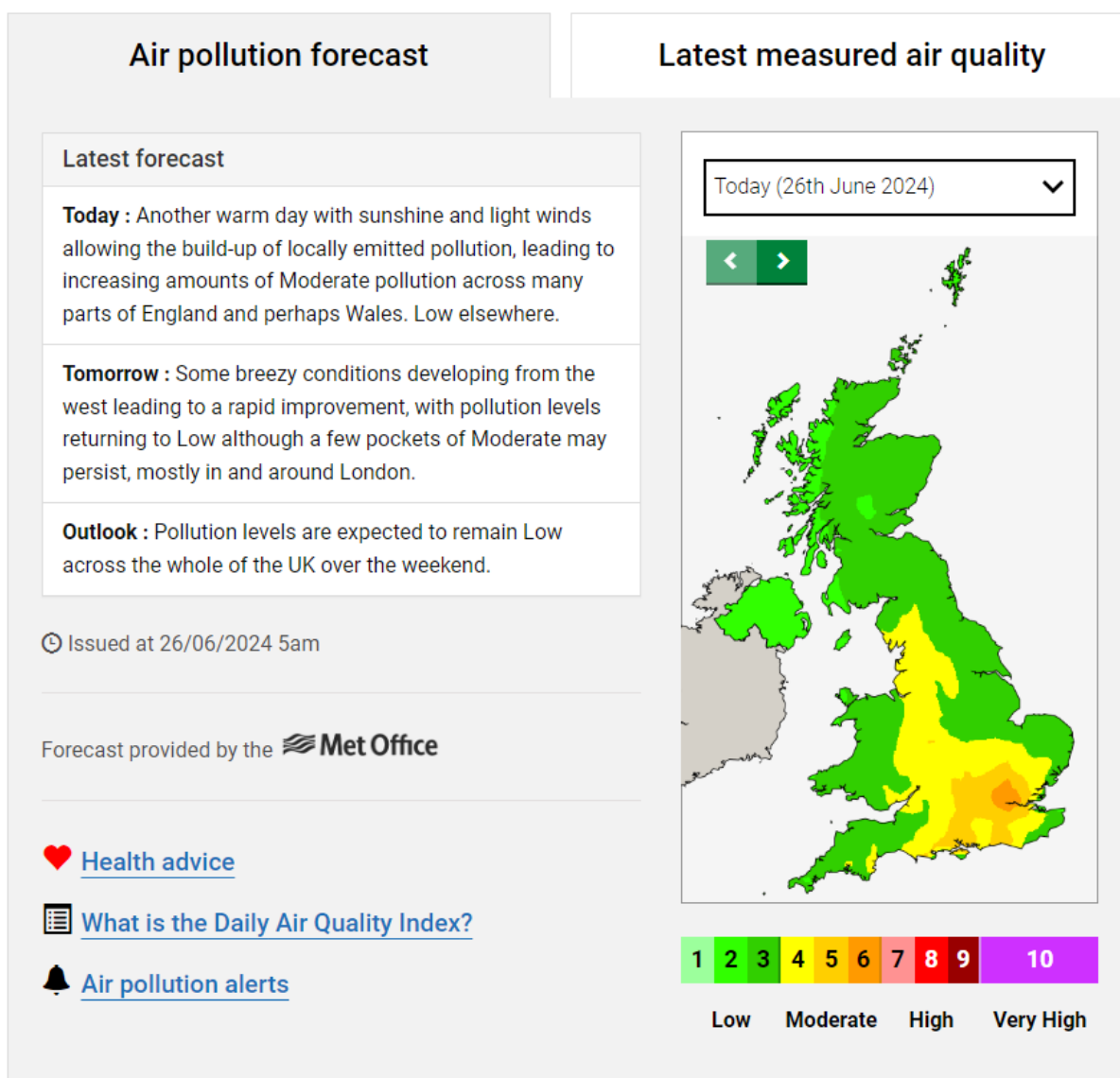
Daily Air Quality Index

The Daily Air Quality Index (DAQI) is the main way that the government informs the public about short-term fluctuations in air pollution levels and provides health advice, with the intention of influencing people's behaviours to alleviate pollution-related acute health episodes (Figure 5).

A research study was commissioned as part of this review to assess the appropriateness and effectiveness of the DAQI for achieving its aims¹⁰. This study evaluated a number of core research questions and concluded that the DAQI is seen to be an appropriate tool for communicating short-term air pollution information, but it is currently ineffective at meeting its aims.

¹⁰ Defra, Ricardo (2024) Evaluation of the Daily Air Quality Index

Figure 5: UK AIR home page with DAQI forecast.



The modelled and measured data on which the DAQI is based generally gives sufficiently accurate and precise representation of real-world air quality conditions at a UK regional level. However, increased granularity of data may help improve relevance for behaviour modification. It was deemed that the current DAQI cut-points remained largely in line with other similar services but that there was merit in conducting further research into this, particularly considering EU and WHO guidelines.

There is evidence that the current recommended actions and health advice provided by the DAQI are no longer fully aligned with the actions to protect health that individuals should take during episodes of elevated air pollution. This is discussed in more detail later in this report.

Awareness and usage of the DAQI service remains low, with very few people accessing it directly. A larger proportion of people are likely being reached through accessing air quality information from third-party applications that use or build upon the DAQI (although this proportion is still low). A greater percentage of people

particularly susceptible to increased short-term levels of air pollution do seem to access the DAQI more frequently.

Across a number of studies, when presented with the DAQI people generally understood the purple, red, amber and green (PRAG) ratings, finding it intuitive to understand.

People and especially those in susceptible groups, appear to be responsive to receiving air quality notifications and willing to enact the associated advice. However, this is contradicted by the finding that there is little evidence that accessing the DAQI results in behaviour change to protect health.

A number of improvements were identified including to the presentation and dissemination of the DAQI to improve accessibility and awareness. These included reviewing and potentially expanding the communication channels of the DAQI (utilising for example social media platforms and third-party services) and making minor adjustments to the visual display of the DAQI information, by including scores (1-10) in addition to the colour-coding.

For the public to be receptive to air quality information such as the DAQI, the awareness of air quality as an issue needs to be increased. Multiple research projects suggest an educational campaign is required to raise public awareness alongside making air pollution information more accessible to the public.

Which groups are most at risk from periods of high air pollution?

Evidence was identified to help understand whether the health advice given as part of the DAQI or wider AQIS should be tailored to an individual's needs depending on their susceptibility to air pollution. This included the commissioning of a review of the literature to identify the epidemiological and experimental evidence bases for increased susceptibility of individuals with metabolic disorders, specific subtypes of asthma and older/younger people (as well as a short commentary on pregnant people)¹¹. COMEAP looked at the evidence for susceptibility of different groups to adverse health effects from short- and long-term exposures to air pollutants using both the review commissioned for AQIS and other evidence¹².

The conclusions were that no additions or changes were needed to groups presently acknowledged as definitely "at-risk" in the DAQI. The present "at-risk" groups are defined as children with asthma, older people and those with respiratory and cardiovascular conditions, where available evidence indicates that they are more likely to be susceptible to the adverse health effects of short-term exposure to air pollution.

Further research is required to establish whether more nuanced recommendations can be made for those who are potentially at risk of the adverse effects of air pollutants. For example, there is evidence that individuals with obesity or metabolic

¹¹ Defra, Imperial College London (2023) Identifying and defining "At Risk" groups to better target air quality information: Evidence assessment for diabetes, obesity, subtypes of asthma and life-stage

¹² COMEAP (2024) Working Paper 01: Susceptibility of population groups to air pollution

syndrome/diabetes may also be at higher risk of the effects of air pollution than non-obese healthy individuals. However, the evidence is not strong enough to include these groups in “at-risk” groups for DAQI advice at present. COMEAP suggested there may be value in providing further information on this subject on the DAQI website, for individuals who are interested or who wish to gain further insight into the evidence that is available.

A further scoping review of scientific literature was undertaken to identify whether some groups and communities are more likely to experience disproportionately higher exposures to air pollution¹³. The groups considered included people with protected characteristics and those who belong to an inclusion health group¹⁴. It also included people who, because of their activities or where they live or work, spend their time in areas with higher outdoor air pollution.

The scoping review identified evidence that exposure to air pollution was often higher than average for those belonging to lower socioeconomic status (SES) groups (defined by income, education, occupation or residence) and to persons belonging to ethnic minorities. People who commute can also be exposed to higher levels of air pollution, but this is dependent on method of commuting, the length of the commute and the location. This evidence highlights the need for local level and community engagement across the agencies that interact with high exposure risk groups to increase awareness of where and how people are exposed to pollution.

What advice is it relevant and appropriate to give for short term episodes of elevated air pollution?

It is important to ensure that any advice which accompanies the DAQI is still clinically appropriate and avoids potential unintended health consequences, for example by discouraging people from taking regular physical activity. The current health advice encourages individuals to consider changing their behaviour to avoid the likelihood of experiencing adverse health effects, focusing on the level of physical activity/exertion, particularly outdoors. Depending on the pollution band, people are advised to “consider reducing”, “reduce” or “avoid” strenuous physical exertion.

A review was undertaken to identify the literature on the health effects while performing physical activity in air pollution to feed into the discussion of the Steering Group¹⁵. COMEAP also considered whether the advice regarding physical activity in the DAQI is still appropriate¹⁶.

The available evidence indicated that, for most people, the long-term benefits of regular physical activity outweigh the possible risks of experiencing adverse

¹³ Defra, Air Quality Consultants (2023) Quick scoping review to understanding the groups at increased risk from adverse effects of air pollution due to their exposure and activities undertaken

¹⁴ Inclusion health is an umbrella term used to describe people who are socially excluded, who typically experience multiple overlapping risk factors for poor health, such as poverty, violence and complex trauma (available at <https://tinyurl.com/mryr5esu>).

¹⁵ UKHSA, University of Leicester (2023) Physical Activity and exposure to air pollution

¹⁶ COMEAP (2024) Working Paper 04: Physical activity and exposure to air pollution

symptoms from undertaking physical activity during short-term periods of elevated air pollution.

COMEAP's recommendation was that the DAQI advice should focus on reducing personal exposure to air pollution, particularly when levels are elevated, rather than discouraging physical activity.

People should be encouraged to monitor their symptoms on the day of physical activity and following days, and to respond in accordance with their clinician's advice. For those who regularly achieve more than the minimum recommended amount of physical activity per week, advice could focus on the timing, intensity and location of the activity.

UKHSA has been undertaking a project to develop and test updated health messages for the DAQI targeted at people with asthma. Following a rapid evidence review, to identify and collate the existing advice, and holding focus groups with respiratory clinicians it was found that the current messages were not in keeping with the most up to date clinical advice. UKHSA has developed updated messages in collaboration with clinicians and tested them with the public as part of the AQIS project. Participants welcomed information created in collaboration with respiratory and clinical experts. They commented that the advice given was realistic and that the actions suggested were easy to understand and follow. If provided alongside the DAQI, they felt that this would help to strengthen understanding of the link between air pollution and respiratory conditions.

Furthermore, the health advice specifically focuses on the day of the air pollution episode, to alert "at-risk" groups to periods of elevated pollution that may have an immediate effect upon their health, and to provide informed advice to reduce exposure and the risk of health effects.

COMEAP additionally reviewed the evidence of the lag between short-term exposures to elevated levels of air pollution and the onset of subsequent adverse health effects¹⁷. The review found that there could be persistent effects extending beyond 24 hours post-exposure (up to 5 days) for a range of cardiovascular endpoints. For respiratory diseases, morbidity effects were reported for at least one week after exposure. For some mortality studies (respiratory and cardiovascular) there was evidence for longer lag periods.

COMEAP's recommendation was that the advice accompanying the DAQI should encourage individuals in 'at risk' groups (older people, children with asthma and those with known respiratory and cardiovascular conditions) to monitor symptoms for at least a week after exposure to elevated levels of air pollution. The advice should also reflect the need to ensure they are adhering to their pre-arranged care plan (for example asthma management plan) in accordance with their clinician's advice, contacting their healthcare professional if necessary.

¹⁷ COMEAP (2024) Working Paper 02: Lag structures for short-term exposures to air pollution for health outcomes

Developing a long-term air pollution tool

The findings from stakeholder engagement work, showed that there were concerns about how the current DAQI displays information and how these forecasts are interpreted by the public. In particular, stakeholders were concerned that the current map used on UK-AIR often displays air quality as green, and could lead to a lack of understanding, among the public, of the public health burden of long-term exposure to air pollution.

COMEAP proposed the concept of a long-term air quality statement (LTAQS), to help address this¹⁸. This additional AQ information tool would provide a different perspective to the DAQI and focusing on the impacts of longer-term exposure to air quality. COMEAP suggested that annual concentrations of key pollutants in comparison with legislative limits and other standards or guidelines was the most appropriate basis for an information system, together with signposting advice on how to reduce emissions of air pollutants. To ensure the LTAQS provided a holistic picture, it was suggested that information about indoor air pollution should also be provided, for example, information on sources of indoor air pollution and factors that can affect indoor air pollution concentrations.

The COMEAP sub-group provided a draft proof of concept version of a potential LTAQS (Figure 6), where a postcode could be used to find local air quality information for a property, to be tested by the qualitative panel¹⁹.

¹⁸ COMEAP (2024) Working Paper 03: Long-term air quality statement

¹⁹ Defra, Verian (2024) Air Quality Information System Review: Leveraging social networks

Figure 6: Illustrative example for a Long-term Air Quality Statement.

Annual Air Pollution Statement			
Address: 1, Example Street, Example Town, XX1 1XX (note: data are made up)			
Outdoor air pollution (green shows compliance, red shows non-compliance, orange shows compliance with UK legislation but not WHO Guidelines)			
Annual PM _{2.5} concentration	6.8 µg/m ³ (2023)	WHO Guideline: 5 µg/m ³ ✘	England target: 10 µg/m ³ ✓
Annual NO ₂ concentration	6.0 µg/m ³ (2023)	WHO Guideline: 10 µg/m ³ ✓	England target: 40 µg/m ³ ✓
Number of exceedances of 200µg/m ³ NO ₂ as 1 hour mean in 1 year	12 (2023)	Not applicable	England target: Up to 18 ✓
Peak season (summer) ozone concentration	48 µg/m ³ (2023)	WHO Guideline: 60 µg/m ³ ✓	Not applicable
Number of exceedances of 100µg/m ³ ozone as 8 hour mean in 1 year	6 (2023)	Not applicable	England target: Up to 10 ✓
Are other air pollutants present at levels above legislation or WHO guidelines?	No		
Indoor air pollution Levels of pollution indoors vary greatly from house to house, reflecting personal behaviour, building design, use of ventilation, maintenance of heating systems, etc. National data on indoor concentrations are not available. However, the following questions help to consider whether you have possible air pollutant problems indoors.			
Does your house have mould?	No		
Do you smoke indoors?	No		
Do you have any open fires burning solid fuels?	No		
Do you use a cooker hood?	No (link to info)		
Have you replaced filters on ventilation equipment?	No (link to info)		
Is your boiler and any other heaters regularly maintained?	Yes		
For houses in radon control areas, are controls fitted and working?	Yes		
Other questions (add as appropriate)			
Notes: Source of data: Brief text Why did pollution at my house go up last year? Brief text			
Further information WHO Guidelines, UK targets: Link to websites Health impacts of air pollution: Link to website Short term exposure data: Link to DAQI website Local Authority Air Quality Information website: Link to LA website UK action on air quality: Link to website			

The findings from this testing found that participants were interested in some form of localised air quality information, but overall, they found the example overwhelming and difficult to understand, due to the amount of technical detail. Although the ‘red, amber, green’ system helped participants to understand whether levels were relatively higher or lower, this did not overcome reservations about the information. Participants therefore suggested that where this type of information is given, multiple layers of information aimed at different levels of understanding could be provided, which people could choose to access, depending on how interested they are in air quality, and what they intend to use the LTAQS for.

The qualitative panel were also positive about the indoor air quality information that was provided with the statement, as it was set out as a questionnaire that participants could answer easily, results highlighting their answers with the ‘red, amber, green’ system to show areas of concern and giving actionable suggestions of what the sources of indoor air pollution were and how to improve indoor air quality in their homes. However, participants felt that the statement could be improved by, once more, providing links to further information, especially regarding background information about what affects indoor air quality and the details of particular pollutants.

Theory of change

A theory of change (ToC) is a model of how a policy is expected to achieve its desired outcomes and benefits, it does this with consideration to external factors and other policies. As part of the AQIS review a ToC²⁰ was developed to provide a structured way of reaching consensus on the AQIS review recommendations, providing assurance on how and why the delivery of the AQIS recommendations are expected to achieve any anticipated benefits by illustrating the clear causal chain from recommendations to intended outcomes. The AQIS ToC was created using guidance from the Defra Theory of Change Toolkit²¹.

As part of the theory of change the review steering group and invited experts developed a problem statement:

Air pollution is a threat to both individual health and the environment.

Adverse health effects are more prominent in vulnerable populations; however everyone is exposed to air pollution, and it damages human health over both the short and long term – driving poor health outcomes, diminishing quality of life and increasing pressure on and costs to the health service.

Reducing the threat from air pollution requires widescale and multi-level behaviour change with buy in from the general public, government, local decision makers, business and industry, however currently many people including the public, at risk groups and decision makers have a poor understanding of the cause and effects of air pollution. People are unsure what actions they can take to avoid exposure to harmful level of pollutants, what they can do to improve air quality, or why air pollution is relevant to them.

Conversely individuals are unaware of the benefits that cleaner air can afford individuals and society. If air pollution is of low relevance to even those it directly and acutely affects, then communication and interventions will fall on deaf ears. Addressing the problem requires a shift in the narrative to break the feedback loop of poor understanding, insufficient support of air quality policies and a lack of political appetite for change.

In response to the problem statement a vision of what the future AQIS should look like was developed:

In an improved future, air quality information is made easy.

²⁰ Defra (2024) Air Quality Information Systems Review Theory of Change

²¹ <https://randd.defra.gov.uk/ProjectDetails?ProjectId=20910>

It is simply explained, readily accessible and presented as a coherent story – with clear links to the issues that people already care about and the benefits of cleaner air.

The information provided is seen as credible and trustworthy and supports a population-wide understanding of air quality harms. Members of the public, influencers and messengers (such as health professionals and educators) decision makers, and business and industry feel informed about the practical actions people can take over the short and long term to reduce their exposure to air pollution and are empowered to take and promote action to reduce pollution.

As awareness and engagement increase across communities, social attitudes and behaviours begin to shift – driving air quality up the political agenda and ultimately driving towards a vision of cleaner air for all.

The ToC process was then used to identify activities that would close the gap between the current AQIS and the ambition for AQIS as set out by the vision statement. This meant identifying the necessary inputs, activities and capabilities that would need to be developed. This process was supported by the evidence from research projects commissioned by the review.

The ToC process led to the development of 32 recommendations in 8 different categories:

- Overarching principles
- Health
- Communication Strategy
- Education
- Normalisation/Empowerment
- Business and Industry
- New Technology
- Operational Guidance.

The AQIS ToC process and recommendations informed the final set of 11 recommendations from this review.

Recommendations

Principles

1. Air quality information providers should take an outcome-based approach to communicating air quality information, risk and potential action.

- Providers should consider the intended outcomes of air quality information, this could include behaviour change, national and local government action and raising awareness.

- Air quality information should be developed with a wide range of experts including academic, health, communication and charity stakeholders, to provide practical and actionable advice to protect health through reduced exposure and to reduce personal contributions.

2. Air quality information should use accessible language and be recognisable; developed with a consistent tone, message and advice. This information should be readily accessible and proactively disseminated across existing channels, where appropriate.

This information should:

- be easy to share across networks
- be presented in a variety of formats and languages to broaden reach for example using symbols and images
- improve understanding of pollutants in general as well as their health impacts

3. Any co-benefits²² of taking action should be communicated alongside the possible health benefits.

This should include:

- additional benefits to health for both the public and susceptible groups
- environmental benefits for example carbon emission reduction
- links to exercise, nature recovery and wellbeing
- benefits of improving indoor air quality
- communications of actions and benefits taken by government, public bodies and industry that address air quality
- reducing the burden on NHS services

Communications

4. Develop and implement a communications strategy to raise public awareness of air pollution, including the actions the government and other public bodies are taking, and the actions individuals can take to protect their health and reduce their contributions.

This should be a multi-year strategy that builds a narrative over time and should include:

²² A co-benefit is a positive effect of a policy or action to address a specific objective that contributes towards other objectives as defined by IPPC (available at <https://www.ipcc.ch/assessment-report/ar5/>)

- a variety of materials that are suitable for a range of scales including national and local
- communications tailored for susceptible groups and their carers
- communications tailored to reach lesser-reached groups, including non-digital audiences
- communications for particular settings (e.g. schools) and locations, especially areas that experience high levels of air pollution
- working with user groups to create communications, e.g. NGOs, community groups, youth groups and local authorities
- the use of existing channels for public health and environmental information, for example public health TV, radio advertisements, and TV weather reports
- the use of social media platforms
- using research findings to maximise impact

Education

5. Work with the relevant professional health bodies and regulators to upskill health care professionals on the health impacts of air pollution, enabling health care professionals to provide appropriate actionable health advice to the public and susceptible groups.

This should include:

- working with the Academy of Medical Royal Colleges and its members and universities and their medical schools to update their curriculums, guidance and continuing professional development
- working with National Health Service bodies
- promoting air pollution exposure as a key consideration on personal asthma care plans to drive this forward within specific susceptible groups
- health advice should be framed as encouraging activity with adjustments, rather than avoiding exercise, if situated in areas of high pollution
- working with health bodies to review and consider including air quality data on patient records and air pollution on annual medical reviews

6. The teaching of air quality information in schools should be strengthened.

Air quality information could be incorporated into several areas of school curricula.

This should include:

- the sources and impacts of air pollution

- links to greenhouse gases, exercise, nature and wellbeing
- practical actions to improve air quality and to protect health

7. Review currently available air quality toolkits that can be utilised by organisations to communicate air quality information. Suitable existing material should be promoted and where appropriate new resources should be created.

- Toolkits should be identified or developed for a range of different stakeholders including but not limited to local authorities, schools, community groups and youth groups.
- New resources should be created with user groups, and be created and/or endorsed by trusted messengers.

Indices & Advice

8. Update the Daily Air Quality Index (DAQI) and associated advice in line with the latest evidence.

This should include:

- improving the understanding of the risks associated with short-term exposure to air pollution
- updating the DAQI advice to reflect the evidence gathered and reviewed by the Air Quality Information System (AQIS) review, including the DAQI evaluation, Social Network Mapping, Qualitative Panel, the World Health Organization (WHO) 2024 report on personal interventions and statement from the Committee on the Medical Effects of Air Pollutants (COMEAP)
- review the existing DAQI cut points to establish if they are still appropriate and in light of the latest published evidence, including the WHO air quality guidelines
- continuing to give separate behavioural advice to children with asthma, older people and those with respiratory and cardiovascular conditions
- the inclusion of information on current evidence about other medical conditions and air pollution
- recent data should be accessible alongside the current DAQI readings
- information on long term risk should be displayed alongside the DAQI
- updates made to the DAQI being reviewed, tested and evaluated regularly to ensure that the information provided is being well understood and utilised by the public, equipping them to take protective action

9. Develop a long-term air quality statement suitable for the public.

A long-term air quality (e.g. annual average concentrations) statement should be developed to provide the general public with information on the risks of exposure to air pollution over a longer timescale than the DAQI (daily concentrations), this should be accompanied by appropriate health advice and behaviour change guidance on how to reduce individual contributions.

- This long-term statement should be displayed alongside the DAQI to enable viewers to understand longer-term and shorter-term risks.
- Clear distinction should be made between the longer-term statement and the DAQI, this distinction should be explained.
- This statement should be developed with expert groups, and specifically consider appropriate cut points, health advice and advice to reduce contributions to air pollution.
- Health advice should consider that some people have more agency to reduce their exposure than others. Advice to reduce contributions should ensure there are options for those on lower incomes, without access to cars, living rurally, or who have restricted mobility.
- User testing and message testing should be used to ensure the efficacy of the long-term statement.

10. Review, update and expand the existing alerts system.

The current alert system should be revised to ensure it is appropriate and effective. The alert system should be expanded to cover a wider range of pollutants, and cascade alerts to a range of settings including but not limited to health care practitioners and settings, local authorities including the directors of public health, care settings and schools.

- These changes should refresh the current public facing alert system in line with the DAQI evaluation and user testing.
- Any future changes to the DAQI cut points should be reflected in the alert system.
- Trigger points for alerts should be directly related to the DAQI bandings and consideration should be given issuing alerts at the moderate banding level and above.
- Health advice for individuals to monitor their symptoms for several days following exposure to high air pollution should be added.
- Engage with and learn from other similar alerts systems including, the Greater London Authority air quality alert system the national alert systems for heat and cold waves, and air pollution systems abroad.

Review & Evaluation

11. Air quality information provided by government should continue to develop in line with advice from expert groups. As part of implementing any changes to the AQIS an evaluation should be undertaken.

Air quality information should continue to develop with consideration of emerging evidence and advice.

This should include:

- considering the commission of future research to fill emerging gaps
- a regular review of the effectiveness of the air quality information system in meeting its aims
- effective utilisation of relevant international research, ensuring that efforts are not unnecessarily duplicated
- ensuring that future research takes account of societal and international change

Concluding statement

An improved air quality information system should be seeking to achieve communication that is fit for purpose, and accessible to all. Such a system should explain why air pollution is considered a hazard and who is most at risk from harm. A key requirement for Defra and UKHSA to consider in next steps is that future alert systems should not put sole onus for change on the most vulnerable and should add emphasis to reaching the public more widely to change polluting behaviours. The steering group agree that advice provided during air pollution episodes should support the public to take action to reduce their exposure, but also provide advice on ways the public can reduce their contribution to air pollution. The second of these two aims would be new and go beyond existing strategies that aim to provide alerts prior to and during an elevated pollution event. Taken in combination such an approach should support:

- Increased public awareness of the major sources of air pollution and the day-to-day actions people can take to reduce air pollution emissions.
- Increased awareness of the harmful health effects arising from air pollution and the activities people can take to reduce that exposure.
- Greater awareness of where to access real-time air quality information, forecasts, and historical data of relevance to their local environment.

- Improved public confidence in source of information that are provided on air pollution more generally, through increased transparency on how such data is generated, quality assured and independently validated.
- Provision of advice and information that the public find engaging and where individuals have both the agency and motivation to take action.