



Australian Government
Bureau of Meteorology

National Air Quality Data Service: Business Requirements Study



Contributing to the Australian Government National Plan for Environmental Information initiative

National Air Quality Data Service: Business Requirements Study
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Executive summary

To monitor air quality and support compliance requirements, Australian State and Territory agencies maintain sophisticated air quality monitoring capabilities that measure, for example, the concentrations of key pollutants including particulates, nitrogen dioxide, ozone, carbon monoxide and sulphur dioxide. There is, however, no single point of access to nationally-consistent air quality data to support, policy, planning, reporting, research and community exposure awareness.

To address national requirements, in 2006 the Bureau of Meteorology (the Bureau) developed a National Air Quality Database (NAQDB) for the then Department of the Environment and Heritage. This database was designed to deliver consistent national data to support specific national reporting requirements (e.g. *State of the Air in Australia 1999-2008* (Department of Sustainability, Environment, Water, Populations and Communities, 2010)). The database developed at the time remains intact although it has not been maintained. The lessons learnt in aggregating air quality data for the NAQDB will be important for the development of any future national service.

More recently, under the auspices of the National Plan for Environmental Information initiative, the Bureau has been working towards the development of an operational National Air Quality Data Service (NAQDS). An NAQDS would address a suite of emerging air quality information needs and priorities. To better understand the needs and priorities for a national air quality data service, the Bureau completed this NAQDS Business Requirements Study. Through consultation with a number of Commonwealth and State and Territory stakeholders, the Bureau has documented their drivers and business interests in a national air quality data service.

Commonwealth stakeholders with the greatest interest in nationally consistent air quality data include the Department of the Environment and the Department of Infrastructure and Regional Development. Their needs include designing air quality improvement policy instruments and assessing their efficacy, supporting more effective decision-making around national infrastructure planning (ports, rail, airports and roads), improving the quality, frequency and efficiency of statutory reporting responsibilities (including the State of the Environment reporting), and supporting priorities and work-packages under the emerging National Clean Air Agreement with nationally consistent data.

1 Introduction

1.1 Background

Air pollution in Australia is a significant cause of morbidity and mortality in the population, with health costs estimated to be in the billions of dollars every year (Begg et al., 2007). In Australia, regular long-term air quality monitoring is undertaken primarily by State and Territory agencies such as the environmental protection authorities. They maintain sophisticated air quality monitoring capabilities measuring key pollutants as specified in the National Environment Protection (Ambient Air Quality) Measure (scew.gov.au/nepms/ambient-air-quality) including particulates, nitrogen dioxide, ozone, sulphur dioxide, carbon monoxide and lead. Sources of air pollution include motor vehicles, domestic wood combustion, commercial, industrial and mining activities, wind-blown dust, and smoke from house fires, bushfires and fuel reduction burns.

Each jurisdiction participating in the Ambient Air Quality National Environment Protection Measure (NEPM) prepares an annual compliance report which assesses the results of monitoring against the requirements of the NEPM. Beyond the NEPM reporting, other specific national reporting of air quality includes the national State of the Environment report (e.g. State of the Environment 2011 Committee, 2011) which is produced every five years and the, State of Australian Cities report (e.g. Department of Infrastructure and Transport, 2013) which is produced annually.

Many of the agencies engaged in monitoring air quality in Australia also publish the data on their websites. There is, however, no single point of public access for nationally-consistent air quality data, and the access to State and Territory data is variable.

1.2 Bureau of Meteorology: previous work

In 2006-08 the Bureau of Meteorology (the Bureau) developed a National Air Quality Database (NAQDB) for the then Department of the Environment and Heritage and the National Environment Protection Service Corporation (acting on behalf of the States and Territories). This database was designed to deliver consistent national data to support selected national reporting requirements (e.g. State of the Air in Australia 1999-2008 (Department of Sustainability, Environment, Water, Populations and Communities, 2010)). The database developed at the time remains intact although it has not been maintained.

Under the auspices of the National Plan for Environmental Information initiative, the Bureau has been exploring options to develop a National Air Quality Data Service (NAQDS), leveraging earlier work conducted around the development of a National Air Quality Database, but using a more modern

information storage and access paradigm, based on the constructs of the Reference Architecture of the National Environmental Information Infrastructure (Bureau of Meteorology, 2014b).

In early 2014, the Bureau undertook an NAQDS Data Feasibility Study with States and Territories to better understand the feasibility of developing a national service (Bureau of Meteorology, 2014a). This focused on improving the understanding of data availability, licensing and the practicality of data provision. The feasibility study affirmed that the air quality data captured across Australia are comprehensive, use standardised procedures and lend themselves to compilation at a national level.

1.3 What is an NAQDS?

The vision for an NAQDS is one in which data would continue to be maintained and curated at-source, for example with the respective EPA, but readily compiled and accessed through a single national service point. By applying consistent data and information technology standards, air quality data could be made readily discoverable and nationally interoperable to support multiple uses.

The NAQDS would be similar to the Bureau's existing systems for weather and climate monitoring—providing public access to national air quality data and ultimately value-added services.

1.4 This study

This report presents the findings from the business requirements study examining drivers from a range of stakeholders to inform any future development of an NAQDS.

2 Method

This study commenced in February 2015 and involved consultation with stakeholders representing Australian Government, State and Territory governments, non-government organisations, and research organisations and academia that rely on air quality data to support their businesses. Neither environmental consultants nor the public were included in this study, but would be included in any functional requirements specification process. Consultation occurred through presentations and briefings at forums and meetings. The study did not examine detailed system needs such as those that would be captured through a functional and non-functional requirements process, as this would occur at a later stage with a smaller cohort of stakeholders.

2.1 Process

The components of the Business Requirements Study were structured around a framework aiming to capture and consolidate stakeholder business requirements and resultant benefits for nationally consistent air quality information:

1. Build on the stakeholder cohort and the findings from the 2014 NAQDS Data Feasibility Study (Bureau of Meteorology, 2014a).
2. Identify stakeholders through existing networks and initial executive-level engagement.
3. Using a semi-structured interview process, interview stakeholders to gain an understanding of their drivers for and possible benefits from a national service.
4. Document and review findings and present back to respondents to ensure veracity.
5. Analyse and consolidate results into the Business Requirements Study.

2.2 Interviews

Prior to interview, each stakeholder was given a questionnaire with a list of proposed questions and background information. This provided an opportunity to seek information and consult with colleagues ahead of the interview. Some interviews were held face-to-face, while others were conducted via conference calls. The interview questionnaire was used to guide the discussions. At the end of each interview, the information was summarised in a consistent format that articulated the drivers, expected benefits and any ancillary issues. The resulting interview summary document was provided to each participant for review and feedback prior to inclusion into the final report. Summaries of these interviews are presented in section 3.

2.3 Stakeholders

Stakeholder interviews for this study focused on organisations that have a current or future interest in accessing air quality data on a national—rather than regional—level. Contacts were identified through the previous Data Feasibility Study and other collaborative activities, as well as new contacts brokered through executive briefings. Table 1 provides the list of stakeholder organisations and business areas with an interest in air quality information. The outcomes of the interviews are presented in the following section 3.

Table 1 List of key stakeholders

	Organisation	Business area (where applicable)
Australian Government	Department of the Environment	<ul style="list-style-type: none"> • State of the Environment • National Pollutant Inventory • Air Quality Section • National Environmental Science Programme
	Department of Infrastructure and Regional Development	<ul style="list-style-type: none"> • Department of Infrastructure, Transport and Regional Economics, Policy and Research • Regional Economic Policy, Policy and Research
	Department of Health	<ul style="list-style-type: none"> • Chemical and Environmental Health Policy Section
	Australian Bureau of Statistics	<ul style="list-style-type: none"> • Centre of Environment Statistics
	CSIRO	<ul style="list-style-type: none"> • Oceans and Atmosphere
State and Territory	NSW Department of Health	
	South Australian Department of Health	
	Tasmanian Department of Health and Human Services	
	Northern Territory Department of Health	
	Western Australian Department of Health	
	NSW OEH	
	Tasmanian EPA	
	Queensland EHP	
	Victorian EPA	
Research	University of Newcastle	<ul style="list-style-type: none"> • School of Environmental and Life Sciences
	Queensland University of Technology	<ul style="list-style-type: none"> • International Laboratory for Air Quality and Health

3 Study findings

Through a series of semi-structured interviews an understanding of the drivers and benefits for national air quality data provided from an operational NAQDS were identified. Table 2 gives an overview of the drivers and benefits for each stakeholder. Although drivers and benefits are shown by stakeholder, there is overlap in benefits—for example in regard to improving the quality, timeliness and efficiency of national reporting by Australian Government agencies.

Table 2 Overview of drivers and benefits

Driver	Benefit
<p>State of the Environment Report</p> <p><i>Department of the Environment</i></p>	<p>Improve access to air quality data to reduce the time required to collect air quality data to support the production of the Atmosphere chapter of the State of the Environment Report which is currently produced every five years. At present this is a relatively cumbersome and costly process.</p>
	<p>Enable the department to efficiently support the core objectives of the emerging Essential Environmental Measures programme.</p>
	<p>Allow users of State of the Environment Report to re-use the data underpinning the report.</p>
<p>National Clean Air Agreement</p> <p><i>Department of the Environment</i></p>	<p>Provide data to support the development of practical, effective and efficient policy settings to ensure Australia is well positioned to respond to emerging air quality issues.</p>
	<p>Provide efficient access to data for the monitoring of national variations in air quality and assess the risk of worsening of air pollution in Australia by policy makers. This will allow more frequent and effective risk assessments to be undertaken.</p>
	<p>Provide efficient access to data by policy makers regarding emerging air pollution trends by identifying air quality issues and providing information to design the most appropriate management interventions.</p>

Driver	Benefit
	<p>Engender a culture of collective action to also support other work packages under the National Clean Air Agreement.</p> <p>Ensure a continued and strengthened cooperative approach to air quality management across all levels of government, through more accessible national air quality data.</p> <p>Improve knowledge and supporting education objectives regarding the state of the air in different parts of Australia by making up-to-date and reliable air quality information easily accessible.</p>
<p>State of the Air in Australian</p> <p><i>Department of the Environment</i></p>	<p>Enable 'on-demand' preparation of the State of the Air in Australia reports (or similar products), which assess air quality against the pollutants specified in the national ambient air quality standards in the National Environment Protection Measure (NEPM).</p> <p>Provide easy access to national data in standard format that has undergone a similar quality assurance process to enable more accurate comparisons nationally.</p>
<p>National Environmental Protection Measures: Air Pollution</p> <p><i>States and Territories</i></p>	<p>Provide more efficient national reporting, with nationally consistent air quality information, and consequently the ability to report more frequently if required.</p> <p>Reduce the effort required to report on NEPM pollutants by the States and Territories, as the data would already be available nationally.</p>
<p>State of Australian Cities Report</p> <p><i>Department of Infrastructure and Regional Development</i></p>	<p>Reduce the time to collect and analyse data for the State of Australia's Cities Report pertaining to urban air quality. This would reduce publication lead time.</p> <p>Improve the accuracy of the Habitat City Prosperity Index (air quality information that underpins the Environmental Sustainability parameter) through improved access to comprehensive, quality data.</p>

Driver	Benefit
<p>Support policy decisions and management of grant programmes</p> <p><i>Department of Infrastructure and Regional Development</i></p>	<p>Reduce resource requirements associated with gathering and analysing data to support, improve or refute large transport or infrastructure proposals.</p> <p>Support the efficient administration of grant programmes to more effectively consider environmental health impacts of decisions (e.g. road corridors).</p> <p>Improve policy decisions by providing a nationally consistent evidence base for policy activities (e.g. road and rail planning).</p>
<p>National environmental ‘surveillance’ monitoring capability: Urban air quality</p> <p><i>Bureau of Meteorology</i></p>	<p>Fill a gap in Australia's environmental surveillance monitoring capability, which currently only monitors changes in meteorological parameters (e.g. temperature, pressure and rainfall).</p> <p>Support the Bureau's ability to offer value-added services such as air quality forecasts.</p>
<p>States and Territories: Environmental reporting</p> <p><i>State and Territory Environmental Protection Authorities and Environment Departments (Air quality data custodians)</i></p>	<p>Increase collaboration between State and Territory EPAs to produce, verify and publish data to the same standards.</p> <p>Improve efficiency of EPA staff—enabling external requests for data and information from other departments, media, organisations, researchers or the public to be accessed directly from a national system. Data queries could be serviced by accessing information from a central location.</p> <p>Reduce jurisdictional national reporting requirements if reports can be generated from NAQDS data.</p> <p>Support development of coordinated smoke management strategies by State and Territory agencies, to support better analysis and predictions that allow early forewarning to communities of approaching smoke or other hazards—if data were available in near-real time.</p>

Driver	Benefit
<p>Human health impacts</p> <p><i>Federal, State and Territory health departments, non-government organisations (including the Clean Air Society of Australia and New Zealand, and the Asthma Society)</i></p>	<p>Support more effective research and analysis by drawing from comprehensive, nationally-comparable air quality data. This would lead to improved knowledge about health impacts associated with air quality, and could assist in monitoring mitigation strategies.</p>
	<p>Provide a flexible capacity to protect the health of individuals and communities from emerging environmental conditions, through easy access to national air quality data.</p>
	<p>Simplify national monitoring, assessment and management of environmental conditions (such as smoke, dust and industrial pollution) that impacts or may impact on public and environmental health.</p>
<p>Research</p> <p><i>CSIRO, Queensland University of Technology</i></p>	<p>Open up new research possibilities by providing easy access to nationally comparable air quality data. Currently large data-acquisition activities inhibit more comprehensive or expansive research activities at national scales.</p>
	<p>Provide research organisations with a readily accessible source of reliable, consolidated, national air quality data. This is an essential input to improve the rigour of studies and calibration of forecasting models across Australia.</p>
	<p>Reduce the effort required to collect nationally comparable data. This will lower the cost of collating the information for research organisations leading to better research outcomes.</p>
<p>Future reporting</p> <p><i>Australian Bureau of Statistics</i></p>	<p>Fill a gap in the current national reporting suite delivered by the Australian Bureau of Statistics, through the development of an experimental air quality account. This could provide the ability to integrate air quality data with social and economic data.</p>
	<p>Provide information to improve understanding of the link between environment protection expenditure and resultant changes to quality of air.</p>

Driver	Benefit
	Improve our understanding of how certain actions, currently undertaken by agencies to protect the environment, affect air quality (monitor effectiveness).
Community awareness <i>Public</i>	Support the public to make informed personal decisions through situational awareness tools focused on air quality status across Australia (historical, current and forecasts).
	Provide easy access to air quality information to enable visitors to Australia to make more informed decisions about travel behaviour.
	Improve community understanding of air quality issues to assist in the discussions around decision-making for public infrastructure projects. For example supporting information around the construction of new freeways.

3.1 Summary

The results in Table 2 highlight the breadth of benefits from the development of an NAQDS. In addition to these, emergent benefits would also arise. For example, national data may enable the development of new monitoring methods using satellite-borne remote sensing technologies—leading to an ability to monitor beyond urban areas.

As anticipated, drivers and benefits for State and Territory organisations are not as strong, as they already have access to timely, quality-assured air quality information, or collect this information themselves. Their benefits and drivers primarily focus on improving their ability to deliver to national drivers (e.g. NEPM reporting) and reducing their need to directly publish data to the public and other users. There is, however, some evidence that cross-border air quality issues such as bushfire smoke are becoming more significant and will demand a more integrated national approach.

The primary drivers and major benefits for national data come from Australian Government agencies and the research sector, which typically deliver research products to these stakeholders through specialist analyses and data products. Benefits primarily relate to improved efficiencies in national-scale environmental and human health reporting, and ultimately an improved frequency of reporting. These would allow the development of more effective policy and programme responses—e.g. national air quality policy and national transportation planning.

In regard to the major benefits, there is evidence of duplication in data acquisition and analysis between the major national environmental reporting programmes; such as State of the Environment, State of the Cities, Progress in Australia's Regions and NEPM. These programmes would jointly benefit from more effective access to nationally consistent air quality data, aggregated at a single point and available to multiple users. The burden on data custodians to supply to multiple users would be decreased.

4 Conclusions

Air quality remains one of the more pressing environmental health concerns confronting policy makers. There is, however, a paucity of nationally consistent data to support reporting, policy development and research. Owing to the emerging policy agenda around the National Clean Air Agreement, the revision of the Air Quality NEPM and improved understanding of the impacts of poor air quality exposure on human health, renewed emphasis has been placed on the importance of access to nationally consistent air quality data.

The NAQDS Business Requirements Study has highlighted that, although there is not one primary stakeholder requiring nationally consistent air quality data, an operational NAQDS would serve multiple needs and lead to major efficiencies and improvements in service provision. The following high-level conclusions can be made:

- Australian Government stakeholders with the greatest interest in nationally consistent air quality data include the Department of the Environment and the Department of Infrastructure and Regional Development.
- Nationally consistent air quality data would:
 - feed into the design of policy and assessing its efficacy;
 - support more effective decision-making around major infrastructure grant programmes (transport-related);
 - improve the quality, frequency and efficiency of statutory reporting responsibilities such as the State of the Environment (State of the Environment 2011 Committee, 2011), State of the Air (Department of Sustainability, Environment, Water, Populations and Communities, 2010), and State of Australian Cities (Department of Infrastructure and Transport, 2013);
 - provide ongoing support to the National Environment Protection Measure (Ambient Air Quality) reporting; and
 - support new requirements under the emerging National Clean Air Agreement.
- Indirectly, the research sector would be a major beneficiary of nationally consistent air quality data—given its critical role in responding to government needs at both a national and State/Territory level through specific research studies, and the consequent need to compile data for each study in isolation.

- States and Territories would use an NAQDS primarily to streamline NEPM reporting requirements, but some benefit could be realised by reducing their data publishing burden through one system.
- A review of other countries' national air quality systems (Bureau of Meteorology, 2015) indicates that the provision of nationally consistent air quality data affords a range of new opportunities and benefits not necessarily articulated in our interviews, such as national air quality alerts and forecasts.

The Business Requirements Study has captured and documented the drivers and benefits that would emerge from the provision of nationally consistent air quality data through an NAQDS. Table 3 provides a summary of these drivers and benefits, linked to key stakeholders and summarised by a benefit category (environmental intelligence, policy, reporting, compliance and research).

In addition to the benefits identified through this study, our review of other countries' experiences with aggregating air quality data indicates that other benefits are likely to emerge. These benefits could include the development of application-based situational awareness tools for the public (e.g. asthma health warnings), development of new national monitoring technologies based on synoptic remote sensing (enabling daily monitoring in non-urban areas) and more effectively coupling air quality information with other national measures such as social and economic data to support more integrated policy development.

Table 3 Summary of stakeholders and drivers

Stakeholder	Driver	Environmental Intelligence	Policy	Reporting	Compliance	Research
Department of the Environment	National State of the Environment Reporting; Clean Air Agreement; National Environmental Protection Measures; Essential Environmental Measures Programme; National Pollutant Inventory; National Environmental Science Program	●	●	●		●
Department of Infrastructure and Regional Development	States of the Cities; Cities Yearbook; transport infrastructure planning policy development (roads and rail); urban infrastructure development compliance monitoring		●	●	●	
Bureau of Meteorology	Air quality forecasting					●
Australian Bureau of Statistics	Environmental Accounts; Essential Statistical Assets; Waste Accounts			●		
State and Territory environment departments—e.g. EPAs, NSW Office of Environment and Heritage	National urban air quality benchmarking; improved NEPM reporting (national consistency); driving ICT improvements (data delivery)	●	●	●	●	●
Federal, State and Territory health departments	Epidemiological studies on human health and mortality; Health policy; supporting education programmes (air quality and human health); hospital visitation rates (planning)	●	●			●
National Research Infrastructure—e.g. CSIRO, universities	Enabler for national-scale air quality research; reducing data acquisition costs; supporting new research applications (forecasting, bushfire smoke impacts)					●
* Non-government organisations—e.g. Clean Air Society of Australia and New Zealand, Asthma Society.	Improving awareness of air quality impacts on human health; policy development	●	●			
* Community (public)	Situational awareness (for respiratory illnesses); travel planning; international tourism and promotion (international competitiveness)	●				

* Not interviewed but evidence garnered from published material

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 - National Environmental Science Program Section
- Australian Government Department of Infrastructure and Regional Development
- Australian Government Department of Health
- Australian Bureau of Statistics: Centre of Environmental Statistics
- CSIRO: Oceans and Atmosphere
- South Australian Department of Health: Public Health and Clinical Systems Branch
- Northern Territory Department of Health: Environmental Health Branch
- New South Wales Department of Health: Environmental Health Branch
- Tasmanian Department of Health and Human Services: Environmental Health Branch
- Western Australia Department of Health: Public Health and Clinical Services Division
- NSW Office of Environment and Heritage
- Queensland Department of Environment and Heritage Protection
- Victorian Environment Protection Authority
- Tasmanian Environment Protection Authority
- Northern Territory Environment Protection Authority
- University of Newcastle: School of Environmental and Life Sciences
- Queensland University of Technology: International Laboratory for Air Quality and Health

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