



**Sustainable  
Communities  
and Waste**

National Environmental Science Program

**Report on Sustainable  
Communities and Waste  
(SCaW) Hub, Impact Priority 4  
Air Quality (IP4) stakeholder  
workshop held on 9 Dec 2021**

Amanda Wheeler, Melita  
Keywood, Fay Johnston, Penny  
Jones, Donna Green, Sharon  
Campbell, Bin Jalaludin.

## Citation

Wheeler, Amanda; Keywood, Melita; Johnston, Fay; Jones, Penny; Green, Donna; Campbell, Sharon; Jalaludin, Bin. Report on SCaW IP4 stakeholder workshop held on 9 Dec 2021. Melbourne: CSIRO; 2022. csiro: EP2022-2303. <https://doi.org/10.25919/kw52-6e06>. Prepared for the Australian Government Department of Climate Change, Energy, the Environment and Water.

## Copyright

© Commonwealth Scientific and Industrial Research Organisation 2023. To the extent permitted by law, all rights are reserved and no part of this publication covered by copyright may be reproduced or copied in any form or by any means except with the written permission of CSIRO.

## Important disclaimer

CSIRO advises that the information contained in this publication comprises general statements based on scientific research. The reader is advised and needs to be aware that such information may be incomplete or unable to be used in any specific situation. No reliance or actions must therefore be made on that information without seeking prior expert professional, scientific and technical advice. To the extent permitted by law, CSIRO (including its employees and consultants) excludes all liability to any person for any consequences, including but not limited to all losses, damages, costs, expenses and any other compensation, arising directly or indirectly from using this publication (in part or in whole) and any information or material contained in it. CSIRO is committed to providing web accessible content wherever possible. If you are having difficulties with accessing this document please contact [csiro.au/contact](https://csiro.au/contact).

## Acknowledgements

The Sustainable Communities and Waste Hub acknowledges all Aboriginal and Torres Strait Islander Traditional Custodians of Country and recognises their continuing connection to land, sea, culture, and community. We pay our respects to Elders past, present and emerging.

This project is supported with funding from the Australian Government's National Environmental Science Program.

The authors would like to thank the participants of the survey and the workshop for their contributions.

Document ID: EP2022-2303



# **Report on Sustainable Communities and Waste (SCaW) Hub, Impact Priority 4 Air Quality (IP4) stakeholder workshop held on 9 Dec 2021**

**Amanda Wheeler, Melita Keywood, Fay Johnston, Penny Jones, Donna  
Green, Sharon Campbell, Bin Jalaludin**

**July 2022**

## Contents

1	Pre-workshop survey findings .....	5
2	Workshop Structure .....	7
3	Workshop Responses .....	9
3.1	Priorities: Are the top topics identified in the survey the right issues for the Hub to focus on? .....	9
3.2	Priorities: Are there any issues that are a priority to you that are missing? .....	12
3.3	Gaps: What projects/data has been collected previously relating to these areas? .....	12
3.4	Gaps: What relevant projects are currently underway? What is their focus, timing for results, where are they operating? .....	14
3.5	Gaps: What are the upcoming policy, programs and management activities that could be informed by research? .....	16
3.6	Gaps: Where do we still have data gaps/ future needs that will strengthen management and decision making? .....	16
3.7	Research needs: What research in these gaps would be most useful to you/your organisation? .....	17
3.8	Research needs: Is there scope to leverage off existing activities to progress addressing these gaps? .....	18
3.9	Research Needs: What else is needed to address these gaps? .....	18
4	Summary .....	19
5	Appendix .....	20

# 1 Pre-workshop survey findings

Impact Priority 4 Air Quality (IP4) hosted a 3-hour workshop which included both Sustainable Communities and Waste (SCaW) Hub (the Hub) members and stakeholders to discuss priorities and planning for IP4 across the duration of the NESP lifespan.

A wide variety of stakeholders and researchers identified by the IP4 team were invited to the workshop via an email from Dr Melita Keywood (CSIRO). Together with the workshop invitation, we circulated a survey to elicit key topics of interest. Stakeholders invited to participate in the workshop and survey included members from the following organizations:

- ACT Health,
- DPIE NSW,
- Newcastle University,
- City of Newcastle,
- NSW Health,
- University of Wollongong,
- UNSW,
- NT EPA,
- NT Health,
- City of Darwin,
- CSIRO,
- Asthma Foundation,
- QLD DES,
- Brisbane City Council,
- QLD Dept Health,
- Sunshine Coast Council,
- Noosa Shire Council,
- QUT,
- SA EPA,
- EPA Vic,
- Vic DoT,
- University of Melbourne,
- Monash University,
- City of Ballarat,
- Tas EPA,
- Tas Dept Health,

- City of Launceston,
- Brighton Council (Tas),
- Local Govt Assoc of Tasmania,
- Tas Aboriginal Organisation,
- Tas Aboriginal Centre,
- City of Hobart,
- WA Dep Health,
- City of Freemantle,
- City of Perth,
- Gondwana Link,
- WALGA, WA DoT,
- WA Health,
- WA DEWR,
- UWA,
- Curtin University,
- ISA,
- Minderoo Foundation,
- CAR,
- CASANZ,
- AFAC AQFx Working Group,
- Natural Hazards Research Australia.

In total 80 individuals completed the survey and 45 individuals representing 28 organisations attended the workshop.

The survey was used both to design the workshop structure and to evaluate future air quality research needs. The survey asked participants to rank a list of 12 pre-determined topics from the most important to the least important, see Appendix A for a copy of the survey. These topics were compiled from information gathered from the SCaW Hub State Round Tables that took place in 2021, the call for NESP2 SCaW Hub proposals from DAWE and the proposal submitted by the UNSW-led consortium to host the SCaW Hub. Table 1 depicts the results, ranking the 12 topics from most to least frequently prioritised. In conjunction with DAWE's priorities, the results from this survey will be used to inform priorities for the Hub's research.

**Table 1: Survey Results – Proportion of respondents who selected ‘Most Important’ (n= 80)**

Topic	Proportion of respondents who selected ‘Most Important’
Health impacts from planned and unplanned fire smoke	67%
Changing climate and emissions reduction	58%
National air quality forecasting system	54%
Health productivity and economic impacts	54%
Optimise air pollution policy and regulation	54%
Improve public understanding of air quality information	53%
Exposure to wood heater smoke	49%
Optimise local urban planning for waste management and air pollution	49%
Develop tools for local and state governments to obtain, interpret and apply air quality information from low-cost sensor network data	49%
Emissions estimates and inventories	46%
Evaluate interventions and new technologies	44%
Exposure to dust and dust storms	24%

## 2 Workshop Structure

The 12 survey topics were used as the basis for the workshop discussions. For facilitation purposes the 12 topics were grouped into three themes:

- (i) Exposure,
- (ii) Planning, Information and Policy and
- (iii) Emissions and Forecasting.

Table 2 shows how the 12 topics were grouped into these larger categories, with four topics allocated into each of the three overarching themes.

**Table 2: Survey Topics and Workshop Themes**

Exposure	Planning, Information & Policy	Emissions & Forecasting



1) Measure and reduce exposure to wood heater smoke	1) Improve public understanding of current and forecasted air quality information and optimise communication strategies	1) Update and improve emission estimates and inventories
2) Measure, manage and reduce the health impacts from planned and unplanned landscape fire smoke	2) Optimise air pollution policy and regulation	2) Develop a national air quality forecasting system potentially including pollen forecasting
3) Measure and reduce exposure to dust and dust storms	3) Develop tools for local and state governments to obtain, interpret and apply air quality information from low-cost sensor network data and related research	3) Evaluate how a changing climate and emissions reduction measures will impact sources of air pollution and secondary pollutant formation
4) Evaluate interventions and new technologies such as HEPA filters and clean air shelters to reduce risk from air pollution, with a focus on vulnerable populations	4) Optimise local urban planning for waste management and air pollution impacts	4) Evaluate health, productivity and economic impacts of exposure to air pollution

All workshop attendees were grouped into one of the three themes shown in Table 2 and each group was asked to respond to the following questions over three 30-minute sessions

## Session 1: Understanding priorities

- Are the top topics identified in the survey the right issues for the Hub to focus on?
- Are there any issues that are a priority to you that are missing?

## Session 2: Understanding knowledge gaps

- What projects/data has been collected previously relating to these areas?
- What relevant projects are currently underway? What is their focus, timing for results, where are they operating?
- What are the upcoming policy, programs and management activities that could be informed by research?
- Where do we still have data gaps/ future needs that will strengthen management and decision making?

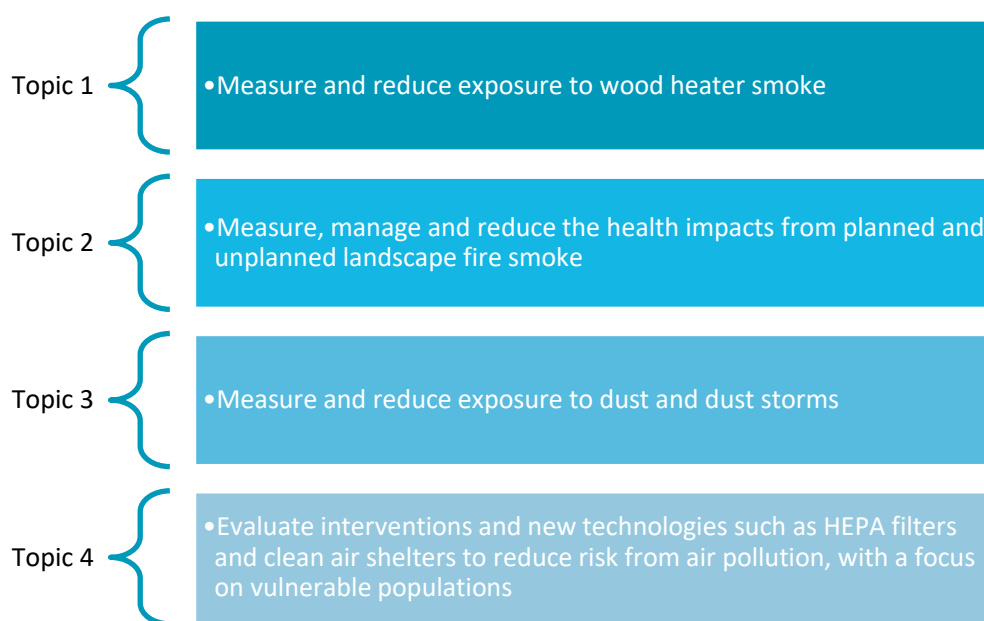
## Session 3: Research needs

- What research in these gaps would be most useful to you/your organisation?
- Is there scope to leverage off existing activities to progress addressing these gaps?
- What else is needed to address these gaps?
- The following workshop results have been grouped by the breakout room questions and, where relevant, include responses from each of the three group themes.

### 3 Workshop Responses

#### 3.1 Priorities: Are the top topics identified in the survey the right issues for the Hub to focus on?

##### Exposure theme



The Exposure group acknowledged that research into the Topics 1 and 2 should be prioritised in order to improve understanding of any consequent health effects of smoke and to establish effective interventions as required in Topic 4 around landscape fires and woodstove emissions. They also asked, how much smoke from wood heaters is reasonable?

Topic 3 raised questions around silica exposures, especially for WA. In addition, concerns were raised around how a national move to the use of electric vehicles would potentially result in increased roadside dust emissions from brake wear and tyre degradation. It is known that electric vehicles are heavier than current vehicles and thus generate more dust emissions.

Questions were raised by this group around how emerging technologies, such as low emission woodstoves, could be used to mitigate exposures to air pollutants (aligning with

topic 4, interventions). The group were keen to assess how these, and other technologies, could be incorporated into the built environment. This was felt to be especially pertinent given the increasing number of high-density developments being planned along main roads.



There was general agreement that all of the topics identified for this theme were important.

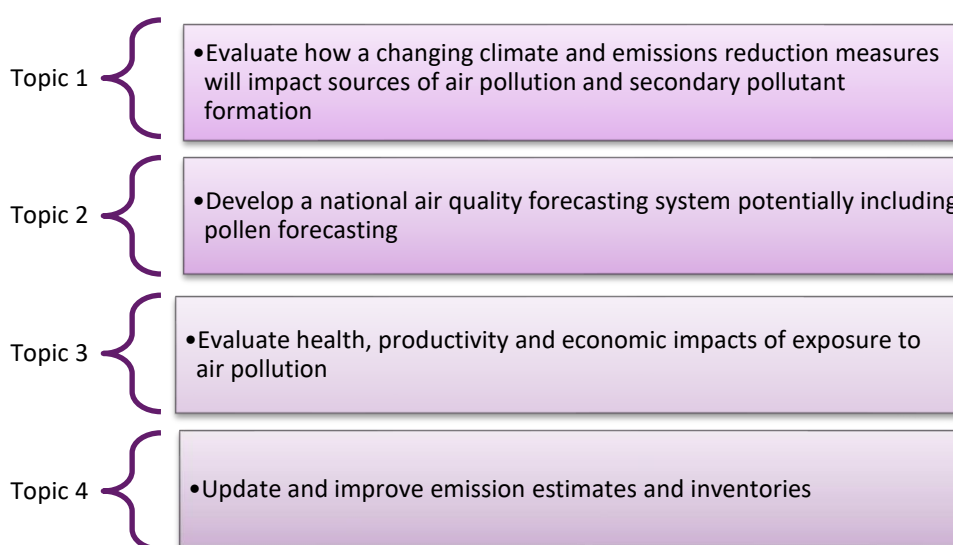
Topic 1- The group acknowledged that significant progress has been made around nationally consistent messaging and communication to improve public understanding of air quality information. However, the group also acknowledged that this is an evolving issue. There is a lack of data and evidence related to messaging and behavioural change and research into these gaps should continue if behavioural change is to be a successful outcome as the science evolves.

Topic 2-The group emphasised that all topics proposed by the IP4 team recognised the importance of ensuring that **any future research in the Hub contributed to current and future air pollution policy and regulation** – this should be a key end goal.

Topic 3 -The group’s discussion focused on the challenges low-cost sensors represent. These included keeping up with the changing technology, using / accessing the data, how to improve the data quality, and how to use the technology for identification of localised air quality issues.

Topic 4 -The group felt that local conditions and neighbourhood planning were not accounting for the potential impacts of emissions from waste management facility chimneys or from accidental fires resulting from waste storage at facilities.

## Emissions and Forecasting theme:



Topic 1- The group highlighted that only limited research activities are currently underway on this topic, and participants felt that there was a need for more fundamental knowledge development. This topic has good linkage opportunities with work in the NESP Climate Systems hub as well as ACCESS-NRI. In addition, ozone generation will change with changing vehicle fleet as it is NO<sub>x</sub> dependant, the group felt that this should be tracked and managed.

Topic 2 – The group **raised concerns around the use of sensor networks and their consistency. This has been a recurring concern raised throughout the workshop.** Following on from the discussion around how a sensor network might be used to support air quality forecasting (and other activities), questions were raised regarding funding for such sensors and management of data quality. The use of dynamic emissions as inputs to forecasting, and the need for a consistent pollen monitoring network were also raised as important gaps related to this topic: there was a view that pollen forecasts would be valuable but not possible without a pollen monitoring system.

Topic 3 – The group felt there is a great need to develop Australian based data for risk ratios.

Topic 4 -The group discussed a range of needs in order to address this topic. Current limitations that should be addressed under this topic included emission flux measurements, shipping emissions inventory, impacts of a hydrogen economy on local and regional air quality, pollen measures, and the need for emission validation of diffuse sources. The group also raised the need to develop consistent methodologies for emissions modelling/estimation that extend the National Pollutant Inventory (NPI).

The group also raised that the recently funded HEAL network should be engaged to ensure any research activities can leverage both HEAL and the NESP funding and research opportunities for greater impact.

### **3.2 Priorities: Are there any issues that are a priority to you that are missing?**

#### **Exposure theme:**

Health impacts of non-regulated air pollutants including ultrafine particles and black carbon.

Implementation of green zones e.g. types of plants and their resulting pollens

#### **Planning, Information and Policy theme:**

Indoor air quality. This was raised as a concern, given the increasing need to use homes or public buildings as safe havens during air pollution events. At this time, it was felt that there was little systematic information or data collection on indoor air quality levels, enforcement of building codes was also deemed to be lacking.

Green zones should be incorporated into any future city planning.

#### **Emissions and Forecasting theme:**

Impacts of the transition to a hydrogen economy on local and regional air quality was raised as a missing priority.

The issue of funding and quality certification for low-cost sensors was also raised.

### **3.3 Gaps: What projects/data has been collected previously relating to these areas?**

#### **Exposure theme:**

Professor Johnston's research group at University of Tasmania (UTAS) has conducted a range of activities related to landscape fire smoke. Any future research should seek to advance their science further.

A study of the use of HEPA filters to reduce staff exposures to Covid-19 was successfully conducted at Royal Melbourne Hospital<sup>1</sup>.

There have been several epidemiological studies investigating the Australian context for traffic-related emissions and health.

### Planning, Information and Policy theme:

Topic 1 - wood heater health impact assessment that was conducted by the UTAS team in Tasmania<sup>2</sup>. Wood heater emission control work has been conducted in New Zealand and could be used as a basis for Australian research on this issue<sup>3</sup>. Asthma Australia has also conducted a consumer survey of over 25,000 users on the health impacts of wood heaters which could be leveraged going forward<sup>4</sup>.

Topic 2 could leverage the work conducted by the LGA in Armidale, NSW which has assessed wood heater emissions on local air quality<sup>5</sup>. Queensland's regional air quality data reporting is well developed and could be used as an example for other states. They also raised the use of the AirRater smartphone app as a method to disseminate air quality data - <https://airrater.org/>

Topics 3 and 4 -the Burn Brighter campaign run in Tasmania to reduce wood heater emissions and the Launceston wood heater buy back scheme evaluation<sup>6,7</sup>.

### Emissions and Forecasting theme:

Topic 1 Projects related to secondary aerosol formation resulting from biomass burning

Topic 2 -a number of projects related to current air quality forecasting were identified. Pollen-related activities incorporating forecasting include the Victorian Thunderstorm

---

<sup>1</sup> Use of portable air cleaners to reduce aerosol transmission on a hospital COVID-19 ward. C Marshall, K Buising, R Schofield, L Irving, M Keywood, A Stevens, et al. *Infection, Disease & Health* 26, S4

<sup>2</sup> Health impacts of ambient biomass smoke in Tasmania, Australia. N Borchers-Arriagada, AJ Palmer, DMJS Bowman, GJ Williamson. *International journal of environmental research and public health* 17 (9), 3264

<sup>3</sup> <https://www.car-cre.org.au/funding-intiatives> (Johnston)

<sup>4</sup> <https://asthma.org.au/what-we-do/current-projects/air-smart/>

<sup>5</sup> The effects on mortality and the associated financial costs of wood heater pollution in a regional Australian city. DL Robinson, JA Horsley, FH Johnston, GG Morgan. *Medical Journal of Australia* 215 (6), 269-272

<sup>6</sup> Community-wide distribution of a catalytic device to reduce winter ambient fine particulate matter from residential wood combustion: A field study. O Johnston, F Johnston, J Todd, G Williamson. *Plos one* 11 (11), e0166677

<sup>7</sup> Evaluation of interventions to reduce air pollution from biomass smoke on mortality in Launceston, Australia: retrospective analysis of daily mortality, 1994-2007. FH Johnston, IC Hanigan, SB Henderson, GG Morgan. *BMJ* 346

Asthma Monitoring system<sup>8</sup> and AusPollen<sup>9</sup>. The University of Melbourne are conducting the pollen forecasting for both of the above projects using machine learning; and are also conducting machine learning forecasting for a range of other air pollutants. In terms of smoke forecasting, the group identified a number of projects including the NSW Air Quality Forecasting Framework (AQFF), and NSW planned hazard reduction burns being shared with the National Smoke forecasting system being operated by CSIRO and BoM. In addition, DPIE and UNSW have investigated meteorological influences and the impact on burn timing<sup>10</sup>. The City of Perth Citizen Science monitoring program was raised as a potentially useful data source.

Topic 3- University of Melbourne research that has used basic risk ratios to calculate health implications associated with air pollution as well as work that has estimated economic costs of emissions. NSW DPIE work on the health benefits of clean energy programs<sup>11</sup>. The group also noted the need to leverage past work on health, productivity and economic impacts performed by the previous CAUL NESP Hub and the Centre for Air pollution, energy and health Research (CAR).

Topic 4 -existing research at both the jurisdictional level and in academia, that have evaluated emissions, both from vehicles and shipping. These included the MUMBA campaign (measurements of urban, marine and biogenic air),<sup>12</sup> and a formaldehyde project by the University of Melbourne and University of Wollongong. The ability to use the Open NEM for electricity distribution data for inventory calculation was also raised<sup>13</sup>. A CSIRO project modelling air quality from biogenic emissions was also noted; as were a number of PhD projects at QUT on aspects of vehicle and ship emissions.

### **3.4 Gaps: What relevant projects are currently underway? What is their focus, timing for results, where are they operating?**

A range of projects are underway that the theme group attendees were able to provide details for, along with information on relevant contacts. Suggestions are to keep these projects in mind as new research projects are developed to ensure that the existing research can be leveraged.

Some overlap was identified between themes with regards to low emissions woodheaters and the Dept of Transport road / urban plans.

#### **Exposure:**

---

<sup>8</sup> <https://www.health.vic.gov.au/environmental-health/epidemic-thunderstorm-asthma-risk-forecast>

<sup>9</sup> <https://auspollen.edu.au/>

<sup>10</sup> Di Virgilio, D.; Hart, M.A.; Jiang, N. Meteorological controls on atmospheric particulate pollution during hazard reduction burns. *Atmos. Chem. Phys.* **2018**, *18*, 6585–6599

<sup>11</sup> <https://www.mdpi.com/1996-1073/14/22/7622/pdf>

<sup>12</sup> <https://essd.copernicus.org/articles/9/349/2017/>

<sup>13</sup> <https://www.climatecollege.unimelb.edu.au/open-nem-australian-electricity-market-data-live>

UNSW will be investigating the local spatial scales of woodheater emissions - <https://www.car-cre.org.au/funding-initiatives> (Cowie)

Bushfire vs planned burns health impacts (Bush Fire CRC project 2022)

A number of HEPA filter intervention studies were identified by the group, these included the COVID-19, classroom and planned burn studies being led by various NESP partners.

### Planning, Information and Policy:

Asthma Australia will be piloting AirSmart in 2022 to increase education around air quality - <https://asthma.org.au/what-we-do/current-projects/air-smart/>

A new CRE has been established 'Healthy Housing' which is establishing a network for all housing related researchers - <https://www.healthyhousing-cre.org/>

Air quality forecasting systems rollout - <https://research.csiro.au/aqfx/smoke-observation-network/>

Trials for burning hardwood in low emission woodheaters -<https://www.car-cre.org.au/funding-initiatives> (Johnston)

Dept of Transport are funding research on reducing exposures to road emissions in Victoria and the evaluations of green spaces / transport corridors in Melbourne. They are also supporting research to assess ways to encourage active transport to schools.

### Emissions and Forecasting:

National Air Pollution Emissions Inventory (NAPAI) work under the National Air Technical Advisory Group<sup>14</sup>.

Inner West Melbourne PM2.5 source apportionment study being run by EPA Victoria - <https://www.epa.vic.gov.au/for-community/current-projects-issues/preventing-pollution-brooklyn>

Upcoming research that may be undertaken under the HEAL network - <https://www.anu.edu.au/news/all-news/heal-network-to-tackle-health-impacts-of-climate-change>

NSW black carbon monitoring network<sup>15</sup>

Predicted bush fire progressions are going to be shared with the National Smoke Forecasting system (NSW RFS)

Commonwealth and NSW are undertaking an evaluation into a national approach for managing Non Road Diesel Engine Emissions, report is due early 2022.

UNSW PhD student (Ms Charlotte Waudby) is looking at thunderstorm asthma, meteorology and health effects in Melbourne and Sydney. Should be published in 2022<sup>16</sup>.

---

<sup>14</sup> <https://www.awe.gov.au/environment/protection/air-quality/national-clean-air-agreement/national-air-technical-advisory-group>

<sup>15</sup> <https://www.epa.nsw.gov.au/~media/EPA/Corporate%20Site/resources/air/Monitoring-Air-Quality-in-NSW.ashx>

<sup>16</sup> <https://www.ccrc.unsw.edu.au/ccrc-team/students/charlotte-waudby>



Air in Alice is a research project being led by Supriya Mathews (Menzies) to place low-cost sensors in Alice Springs in 2022 (overlap with exposure) -

<https://www.nationaltribune.com.au/citizen-scientists-to-help-in-important-national-research-projects/>

CSIRO will be developing a system to downscale climate runs suitable for CTM due in June 2022.

City of Perth, WA have been using low-cost sensors for air quality monitoring (overlap with exposure). (<https://public.eagle.io/public/dash/cylif9q00axiwhb>)

As part of the TERN network, there is a group adding school weather and air quality sensors to schools. They have currently published the quality-controlled data. ([www.SWAQ.org.au/explore](http://www.SWAQ.org.au/explore))

### **3.5 Gaps: What are the upcoming policy, programs and management activities that could be informed by research?**

All themes recognised that any projects should address policy and the link to climate change. Recommendations were that air pollution projects should be pathways to policy change. Other suggestions were to identify roadmaps that could lead to phasing out of emitters. It was also noted that the review of the AAQ NEPM is scheduled for 2025 which is within the NESP lifespan.

### **3.6 Gaps: Where do we still have data gaps/ future needs that will strengthen management and decision making?**

#### **Exposure:**

Some overlap with data gaps identified by the Planning, Information and Policy theme were noted, especially related to wood heaters and land management for planned burns. Again, education around the health effects of poor air quality were noted as lacking.

Indoor air quality was also noted as a gap.

Continuous monitoring of pollen and the lack of secure funding were noted as being required to contextualise any associated health burdens.

Concerns were raised over the lack of information available related to long-term exposures to poor air quality episodes.

#### **Planning, Information and Policy:**

Issues related to LGA's ability to manage smoke emissions from wood heaters, fire pits and backyard burning was identified.

Recommendations were made around urban design and the lack of information available to deter planning of schools and childcare facilities close to roads.

Geospatial gaps were noted as being a data gap as many researchers are now relying on national-level high resolution GIS data for research activities.

Science communications around the health effects of poor air quality required education of the public.

Housing and air transfer data are lacking for the Australian context. Suggestion is to link to OzSage work.

### Emissions and Forecasting:

As with the Exposure theme group, this theme noted the lack of pollen data.

Recommendations were made to conduct additional air quality monitoring outside of urban areas and to include Ultrafine Particles and Black Carbon emission measurements.

There is a lack of understanding related to air emissions from waste – these were noted as nano / micro plastics, PFAS, PFOS and heavy metals<sup>17</sup>.

Additional gaps were noted related to the tracking of lightning as the predominant source of bushfire ignitions.

### 3.7 Research needs: What research in these gaps would be most useful to you/your organisation?

An overarching concern raised across the workshop was around how to **change public perceptions around air quality** – how do we make people care about this problem?

Across the various stakeholders, it was clear that **smoke was a problem**. Questions around informing the public of risk, what interventions work, woodheater inventories, and the ability to forecast smoke were all identified.

**How best to use low-cost sensors** to understand local emissions and to provide evidence for action was raised by several organisations as a gap.

A number of actions related to climate change / behaviour change were identified and how best to evaluate their impacts. Suggestions included identifying what it would take financially to incentivise switching mode of transport along with moving from combustion engines to electric.

The **burning of waste** in remote communities was raised as a concern in relation to the emissions and health impacts that this activity caused.

Indoor air quality issues will gain in significance so understanding **how best to minimise exposures** in these locations was considered to be needed. This included the **use of safe havens and HEPA cleaners**.

To improve forecasting, there is a need to **improve real-time emissions monitoring of sources** that include traffic, dust and smoke.

---

<sup>17</sup> <https://iopscience.iop.org/article/10.1088/1748-9326/abae9f>

The relationship between greening of urban areas to reduce heat island effects and the selection of greencover to optimise the amount of biological emissions is currently lacking.

### **3.8 Research needs: Is there scope to leverage off existing activities to progress addressing these gaps?**

A number of low-cost sensor programs were identified in different states which could offer the opportunity to develop a program for the effective use of the sensors.

#### **Exposure:**

It was noted that Australia has not got a program to evaluate HEPA filter effectiveness. Some research has been established with the University of Melbourne around testing filters for COVID-19 removal.

Some councils are embarking on Smart Cities projects, specifically using low-cost sensors. Engagement with ongoing projects could be used to establish how best to use these sensors.

#### **Planning, Information and Policy:**

The CSIRO Living Labs offer several opportunities to leverage existing studies that utilise low-cost sensors. There is also opportunity to translate their existing data to health impacts and symptom reporting.

#### **Emissions and Forecasting:**

NSW has an existing Black Carbon monitoring network.

Queensland DES has already downscaled CMIP 6 models to 10km resolution nationally. NARClm is downscaling CMIP 6 to 4 km resolution (due end of 2022).

Strong link with NATAG workplan to have a nationally consistent air emissions inventory.

Costs of CO<sub>2</sub> capture at emission source e.g. CO<sub>2</sub> capture plus waste to energy incinerator.

WHO guidelines will be indicative when the 2025 review of 2025 NEPM occurs.

### **3.9 Research Needs: What else is needed to address these gaps?**

Suggestions were made at several points that a road map was needed to track how change to policy could be implemented in the longer term.

The useful rollout of low-cost sensors by local governments and how best to share that data was a consistent gap across all themes.

## 4 Summary

It was clear from the range of discussions held at the workshop, along with the survey results, that the 12 topics identified by the Hub were relevant and important to address. This was supported by a wide range of stakeholders and academic researchers.

A large number of ongoing and planned research was identified which should be leveraged to ensure continuity of the science rather than replication. Any new research that is supported by the hub should ensure that it can directly impact policy. The recommendation is that the hub ensures ongoing engagement for co-design opportunities as the program progresses.

Research questions or needs that were noted repeatedly across the themes included:

- i) Smoke emissions from landscape fires, bushfires, wood heaters and backyard firepits. The actions recommended for further investigation includes the need to encourage behaviour change, the evaluation of new technology and the efficacy of interventions to reduce exposures and consequent health impact.
- ii) The use of low-cost sensor networks to understand local air quality issues. Many stakeholders were either trying to set these networks up or were struggling to evaluate their usefulness.
- iii) Emissions and forecasting data for evaluating the introduction of new technology. Climate change actions and improved management of air quality will rely on new technology. The ability to model scenarios and their potential economic benefits was identified as being key to targeting appropriate activities.

### Word cloud from this report



## **5 Appendix**

### **Appendix A: IP4 Survey circulated to stakeholders and academic researchers**



