

International Sampler Comparison Group (ISCG)

Report of activities 2024

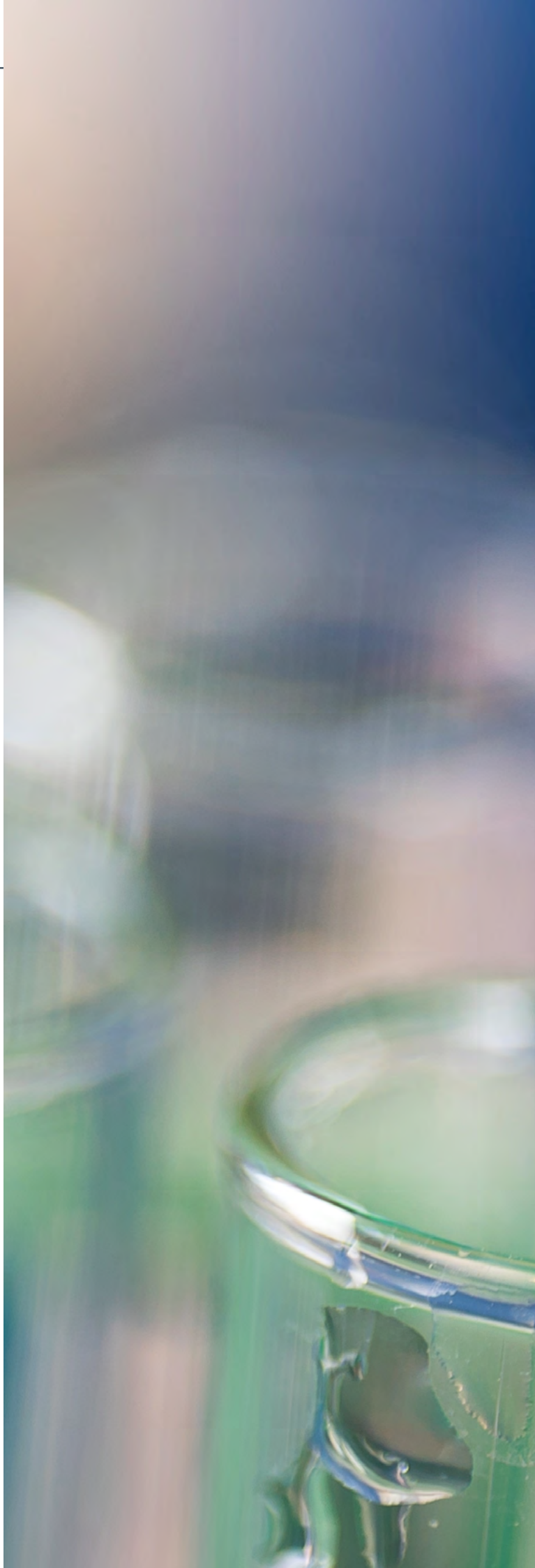


INTERNATIONAL
SAMPLER COMPARISON
GROUP

About the International Sampler Comparison Group (ISCG)

The ISCG coordinates and communicates research to progress the science of occupational aerosol sampling. This report presents a summary of the ISCG activities during 2024.

<https://www.ecu.edu.au/research/dust>



CONTENTS

1. WHAT ARE THE AIMS OF THE ISCG REPORT?	3
2. WHO ARE THE ISCG?	3
3. FUNDING FOR ISCG ACTIVITIES	3
4. ENGAGEMENT ACTIVITIES	3
4.1 ISCG meetings.....	3
4.2 Industry engagements	3
4.3 Engagement with other stakeholders	3
5. ONGOING WORK PROGRAMMES.....	5
5.1 Commentary with recommendations for sampling practice for aerosols	5
5.2 Valorisation of sampler performance data by means of a sampler selection tool	5
5.3 Optimising laboratory testing protocols.....	6
6. ANCILLARY WORK PROGRAMMES	6
6.1 Performance of commonly used respirable and inhalable aerosol samplers	6
6.2 Sequential analytical procedure for evaluating Chromium (III) and Chromium (VI) speciation and their differential solubilities from air samples	6
6.3 Ongoing studies	7
6.4 Future studies.....	7
7. ISCG WEBSITE	7
8. FURTHER DISSEMINATION AND ENGAGEMENT ACTIVITIES IN 2025	7

1. WHAT ARE THE AIMS OF THE ISCG REPORT?

- Describe the terms of reference of the International Sampler Comparison Group (ISCG) and composition of the group.
- Summarise the engagement activities of the ISCG during the calendar year 2024, these including meetings and conference presentations.
- Summarise ISCG programmes of work either completed or ongoing during the calendar year 2024.
- Summarise ancillary programmes of work not funded by ISCG but aligned with the ISCG activities.
- Summarise the planned ISCG activities for the following calendar year (2025).

[A report outlining the activities of the ISCG during 2019-2023 is also available.](#)

2. WHO ARE THE ISCG?

The ISCG are a group of International experts who have agreed to:

- Develop a research plan (short / medium / long-term) for future laboratory and workplace-based studies, which will allow the assessment of the performance of aerosol sampling heads.
- Identify external funding support to allow for elements of the research plan to be funded.
- Where funds for research activities are made available through the ISCG, act as a steering committee for that project.
- Engage and involve other stakeholders who are interested in the activities of the ISCG.
- Communicate findings from ISCG's work openly (e.g., via publications, workshops, conference presentations etc) so that the wider community can benefit from the learning.

The core ISCG members are detailed in Table 1 (listed in alphabetical order).

Table 1: Core ISCG members

Name	Organisation
Pieter Bertier	Belgian Center for Occupational Hygiene (BeCOH), Belgium
Marcus Cattani	Edith Cowan University (ECU), Australia
Karen Galea	Institute of Occupational Medicine (IOM), UK
Martin Harper	Independent, USA
Darrah Kaye Sleeth	University of Utah, USA
Steven Verpaele	Nickel Institute, Belgium

3. FUNDING FOR ISCG ACTIVITIES

The core ISCG activities are funded by various associations, these including the Nickel Institute (NI), the Cobalt Institute (CI) and the International Copper Association (ICA). However, in order for the ISCG activities to continue, additional financial support is essential. The ISCG is happy to discuss opportunities with potential sponsors to enable mutually beneficial work programmes to move forward.

Members of the ISCG are involved in other, ancillary programmes of work, funded by other organisations, which are summarised in this report for completeness.

4. ENGAGEMENT ACTIVITIES

4.1 ISCG MEETINGS

- Monthly on-line video conferencing meetings of the core ISCG group throughout the year.
- In-person / hybrid meeting of core ISCG group and guests, April 2024, Salt Lake City, USA.

4.2 INDUSTRY ENGAGEMENTS

- 19th September 2024 - Meeting with industry stakeholders (Copper Alliance).
- 19th November 2024 – Meeting with The Particle Platform group at CEFIC – Introducing ISCG for future cooperation within this Particle Platform

4.3 ENGAGEMENT WITH OTHER STAKEHOLDERS

- 28th February 2024 - Chamber of Minerals and Energy (WA), Health and Hygiene Working Group
 - Marcus Cattani and Benjamin Walsh “*Dust exposure research*”
- 3rd March 2024 - International Institute for Welding IIW Committee-VIII on Health, Safety and Environment meeting, Wels, Austria
 - Steven Verpaele, presentation ISCG activities
- 15th April 2024 - XII Congress of Toxicology in Developing Countries, Santiago, Chile
 - Steven Verpaele, presentation on exposure assessment for aerosols – ISCG activities included
- 15th to 17th April 2024 - AusIMM International Mine Health and Safety Conference 2024, Perth, Western Australia
 - Benjamin Walsh (Australian Researcher) “*Conventional and Real time sampler comparison study*”
- 24 April 2024 - OSHA Technical Center, 8660 Sandy Parkway, Sandy, UT
 - Meeting ISCG team with OSHA Technical Center director and staff on corporation on sampler testing, specifically regarding the PPI sampler

- 16th May 2024 - Flemish occupational physician association (VUSA) and Belgian occupational hygiene association (BSOH) congress, Leuven, Belgium
 - Steven Verpaele, presentation on metals and metalloids exposure assessment – ISCG activities included
- 9th-13th June 2024 - International Occupational Hygiene Association, 13th Scientific Conference, Dublin
 - Benjamin Walsh (Australian Researcher) “*Conventional and Real time sampler comparison study*”
- 8th August 2024 - Indonesian Industrial Hygiene Association (IIHA) annual conference, Surabaya, Indonesia
 - Steven Verpaele, Nickel Institute stakeholder meeting regarding the Industrial Hygiene Business plan activities - ISCG activities included
 - Steven Verpaele – PDC - Exposure assessment framework for aerosols and their elemental composition
- November 2024 - AIHA Aerosol Technology Committee meeting
 - Darrah Sleeth, presentation on the ISCG activities
- 2nd-4th December 2024 - Australian Institute of Occupational Hygienists 2024 Conference, Perth, Western Australia
 - Steven Verpaele “*The sense and nonsense of gravimetric analysis in workplace measurements*”
 - Benjamin Walsh (Australian Researcher) “*Real time versus conventional sampler comparison study*”
 - Steven Verpaele – CES - Exposure assessment framework for aerosols and their elemental composition

5. ONGOING ISCG WORK PROGRAMMES

5.1 COMMENTARY WITH RECOMMENDATIONS FOR SAMPLING PRACTICE FOR AEROSOLS

Contracted to – Martin Harper, Independent Consultant

- Commenced – August 2023
- Due for completion – 2025
- Estimated cost - £10,500 (excluding any open access publication fees)
- Funded by: NI, Ci and ICA

This Commentary publication will provide consensus recommendations for sampling practice with respect to aerosols. This will be based on the following available information:

- recently published compendia of research
- previously published research, not included in i)
- unpublished research
- previously published guidelines

This Commentary will begin with an introduction to aerosol sampler developments and how they have been linked to our understanding of the behaviour of aerosols in the environment and through the process of inhalation, but, in addition, will include how developments have been influenced by practical considerations, including cost and ease of use. The Commentary will then report on each currently available sampling device, describing first the laboratory and field research involving each and then discussing how the results of those studies may be reconciled, taking into account environmental conditions. Gaps in our knowledge will be highlighted along with the contribution of those gaps to our level of uncertainty. The Commentary will conclude with guidance for sampler selection, taking into specific environmental conditions, and how best any recommended product(s) should be used.

This publication will be completed and submitted to a peer-reviewed journal in 2nd quarter 2025.

5.2 VALORISATION OF SAMPLER PERFORMANCE DATA BY MEANS OF A SAMPLER SELECTION TOOL

- Contracted to - BeCOH
- Commenced end 2024
- Due for completion – One year project
- Estimated cost – € 63,500
- Funded by: NI, Ci and ICA

Previous work of the ISGC has shown that many industrial hygiene (IH) professionals do not read sampler validation studies in scientific literature. Their perception is that all samplers on the market must have been validated and that workplace specific sampler validation is not required. Sampler selection is therefore all too often based on availability and tradition. Many IH professionals also rely on the laboratories they work with for sampler selection advice. Yet, analytical experts in labs are not always sampling experts.

Hence, there is a need for a ‘quick and easy’ sampler selection guide. This should preferably be a tool that is always and everywhere accessible. It should provide the user information on sampler performance at different levels: from very basic level “I don’t care, just tell me what to use” to specialist level, for example “I need the references for the bias map of sampler X”. The tool needs to be a dynamic source of information, meaning that it should always reflect the most recent insights and not be a snapshot of the state-of-the-art, like a review paper. This tool will help in generating the awareness that not all samplers perform equally at all workplaces.

This project will commence following completion of the short commentary (as the outputs of that programme of work feed into this).

5.3 OPTIMISING LABORATORY TESTING PROTOCOLS

- Contracted to – University of Utah
- Commenced - Jan 2025
- Due for completion – early 2026 (one year contract)
- Estimated cost - £41,790 University of Utah

The overall objective of the project is to continue to optimise the laboratory testing protocols while making more direct connections between the lab and field work. First, we will identify the priority areas for further study regarding protocols for laboratory sampler comparison studies of both inhalable and respirable samplers based on many additional discussions that have occurred since the original workshop. Separate proposals will be developed to conduct those studies as part of future work. Next, we will seek to validate the use of the WAM by performing a series of wind tunnel tests using that device. This will help provide a clearer understanding of differences between lab and field work.

The deliverables will be as follows:

- Task 1: List of priority concerns regarding laboratory protocols for performance testing of inhalable and respirable air samplers.
- Task 2: Dataset that provides sampler variability data using the WAM inside the wind tunnel for both inhalable and respirable samplers at different particle sizes and wind speeds.

6. ANCILLARY WORK PROGRAMMES

6.1 PERFORMANCE OF COMMONLY USED RESPIRABLE AND INHALABLE AEROSOL SAMPLERS

This was funded by Worksafe BC.

“Does the performance of commonly used respirable and inhalable aerosol samplers enable adequate collection of workplace metals to meet occupational exposure limits?”

Grant recipient: Darrah Sleeth, University of Utah

Collaborators:

- Martin Harper, University of Florida (Zefon International)
- Steven Verpaele, NI
- Pieter Bertier, BeCOH

Project overview:

- Laboratory and field comparisons of samplers for both inhalable/total and respirable fractions
- Laboratory study conducted in wind tunnel at University of Utah using inert particles and gravimetry
- Field comparisons used the “Workplace Atmosphere Multisampler” (WAM) device that allowed 12 different samplers to sample the same atmosphere
- Sampling was conducted at 3 locations in Europe and one in North America, one of the European locations involved two different situations

- Pb/Zn/Cd, Mn/Fe, Co, Ni, Cu/Fe using chemical analysis

Key findings:

- Laboratory tests resulted in respirable sampler rankings that were somewhat different from field-based rankings
- No sampler was considered to be a true reference method, and the lab had problems isokinetic samplers
- In the field, respirable data from the multi-fraction sampler (Disposable Inhalable Sampler (DIS) with foam insert) consistently gave the highest respirable results
- In the field, the multi-fraction sampler analysed for the inhalable fraction gave identical results to the same sampler (DIS) used without foam
- DIS gave similar results to the IOM in the lab when tested for inhalable fraction, but much higher results in the field because wall deposits were not accounted for in the IOM

[The final project report is available from WorkSafe BC website.](#)

6.2 SEQUENTIAL ANALYTICAL PROCEDURE FOR EVALUATING CHROMIUM (III) AND CHROMIUM (VI) SPECIATION AND THEIR DIFFERENTIAL SOLUBILITIES FROM AIR SAMPLES

This is funded by Worksafe BC.

“Developing a sequential analytical procedure for evaluating Chromium (III) and Chromium (VI) speciation and their differential solubilities from air samples”

Grant recipient: Hossein Kazemian, Northern Analytical Lab Services (NALS) at University of Northern British Columbia (UNBC), Canada

PhD student: Mya Schouwenburg

Collaborators:

- Martin Harper, (Zefon International)/University of Florida
- Steven Verpaele, NI

Project overview:

- Evaluation of a specially cleaned PVC “Disposable Inhalable Sampler” (DIS) from Zefon/Environmental Express for:
- Soluble hexavalent chromium
- Soluble trivalent chromium
- Total chromium using microwave digestion procedure (without hydrofluoric or perchloric acids) developed under this project
- IC-ICP-MS method, laboratory studies include background, LOD/LOQ, and recovery with and without the presence of Fe(II)
- Project was intended to validate use of monoisotopic Cr standards per EPA 6800 to correct for interspecies conversion but this could not be accomplished in the time available

Final report submitted to WorkSafe BC in 2024.

6.3 ONGOING STUDIES

“Comparison of conventional samplers and real time detection systems (medium and low cost) for measuring particulates and their elemental composition”

Grant recipient: A/Prof Marcus Cattani, Edith Cowan University, Australia

Collaborators:

- Steven Verpaele, NI
- Pieter Bertier, BeCOH

Additional funding has been obtained from Rio Tinto, and, Fortescue. In-kind support has been received from GCG.

Project overview:

- In 2022 the Nickel Institute donated a Workplace Aerosol Multi-sampler to ECU, and, a research group at ECU was established.
- A sampling strategy to compare a statistically significant series of real time and conventional samples taken in the field was established, using the IOM and Higgins-Dewell Cyclone as standards.
- The ISCG funding was used to hire a full-time research technician for one year to conduct the field work
- Fortescue hosted the WAM and the Technician in 2024, and this will continue in 2025
- Samples have been submitted to a laboratory in Perth, Western Australia for analysis.

The first series of samples has been collected on an iron ore mine site in Western Australia

Preliminary findings indicate:

- Inhalable dust concentrations ranged from 0.22 mg/m³ to 95.05 mg/m³ (IOM sample head), and, respirable dust concentrations ranged 0.1 mg/m³ to 1.33 mg/m³ Casella Cyclone.
- In comparison to the standard the AMS520 with the Dorr-Oliver cyclone had the highest respirable dust confidence (intraclass correlation).
- In comparison to the standard the DIS (Zefon Filter/plug) had the lowest confidence (intraclass correlation).

6.4 FUTURE STUDIES

“Validation of Phase-Specific Analysis and Samplers for Nickel-Containing Workplace Aerosols”

Funding through Nickel Institute, ISCG and other to identify

PhD student: Steven Verpaele (Nickel Institute)

Collaborators:

- Marcus Cattani, ECU
- Pieter Bertier, BeCOH;
- Matthew Leybourne, Queens University

Aims and Objectives

- Evaluation of the disposable respirable multi-fraction aerosol sampler (DRS) at higher flowrate than nominal to determine if it can be used at a higher flowrate
- Develop a semi-automated extraction cell for wet chemical metal speciation
- Validate the semi-automated extraction cell with known metal reference materials for comparison with the conventional methods
- Evaluate the usefulness of the semi-automated extraction cell for metal speciation analysis of real workplace samples taken with the multi-fraction aerosol sampler (DRS).

7. ISCG WEBSITE

ISCG has a website to further facilitate dissemination of the ISCG activities, <https://www.ecu.edu.au/research/dust>. This is hosted by ECU.

Presently details of the ISCG aims, core group composition, publications and an overview of some of the ongoing activities are included. The content of the website will continue to evolve and be updated periodically to reflect ISCG continued work.

A new “Register of research” has been added to the website and will be communicated in 2025 to enable researchers to share their research websites and contact details.

8. FURTHER DISSEMINATION AND ENGAGEMENT ACTIVITIES IN 2025

- Monthly on-line video conferencing meetings of the core ISCG group will take place throughout 2025.
- Members of the ISCG will present on the group's activities at the AIHA Connect conference, 19-21st May 2025, Kansas City, USA
- An in-person ISCG meeting will take place at Loen, Norway, on the 14th June 2025. A meeting with STAMI representatives will take place in Oslo on 13th June and the ISCG will present at the AirMon conference commencing 15th June 2025 in Loen. The aims and objectives of the STAMI meeting are to view their laboratories and to allow in-person discussions with interested stakeholders. The ISCG meeting will allow for more involved strategic and funding discussions to take place. It's hoped that ISCG will have a symposium session at the AirMon conference, showcasing several of the current projects and promoting the aims and objectives of the group.
- ISCG will seek to present outputs of the projects at other, appropriate forum during 2025.
- ISCG will continue to engage with authoritative organisations (e.g., HSE, NIOSH, IFA, IRSST, INRS) with the goal of harmonising proposals and protocols on aerosol sampling.



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