

Module 2: Air pollution impact on workers



What will you learn in this module?



What is air pollution and why does it matter?



What is occupational exposure, and its impacts?



How do we estimate health impacts of occupation exposure?



What further research is needed?

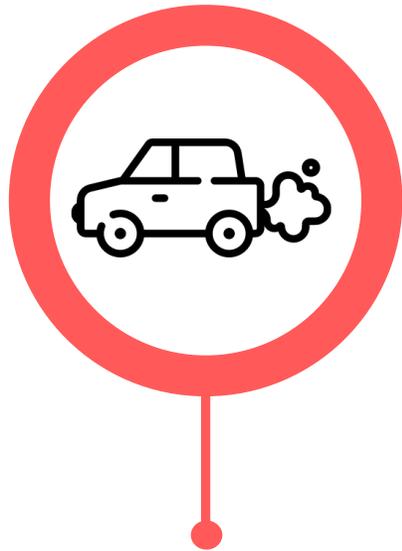


**What is air
pollution and
why does it
matter?**



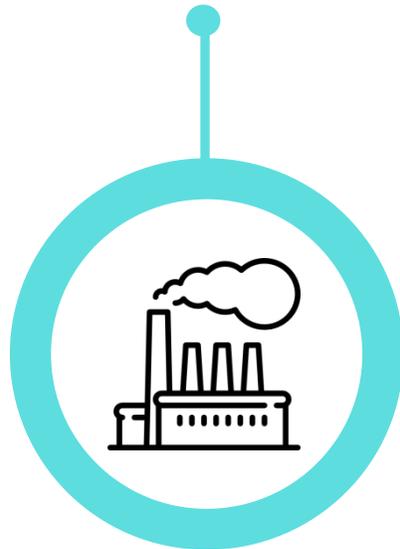
What is air pollution?

Key sources of PM2.5:

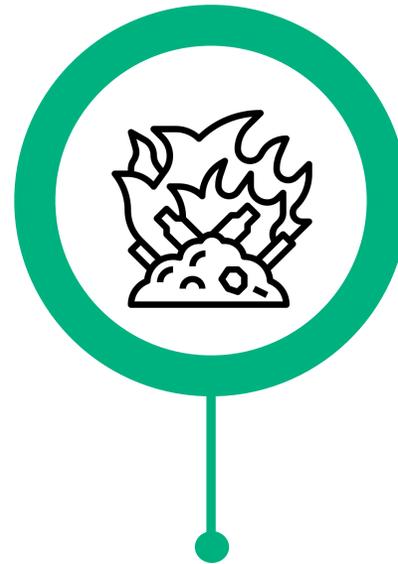


Road transportation

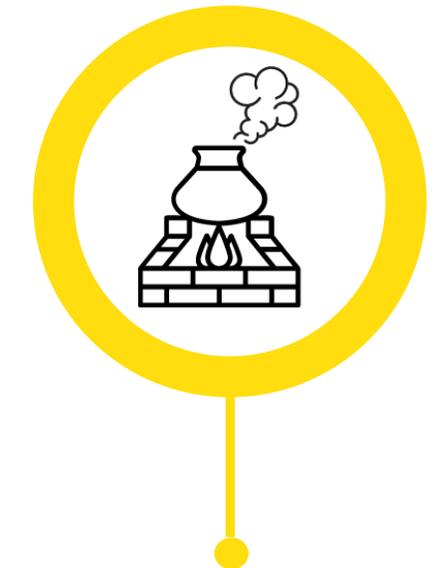
Fossil fuel consumption in industry



Waste burning

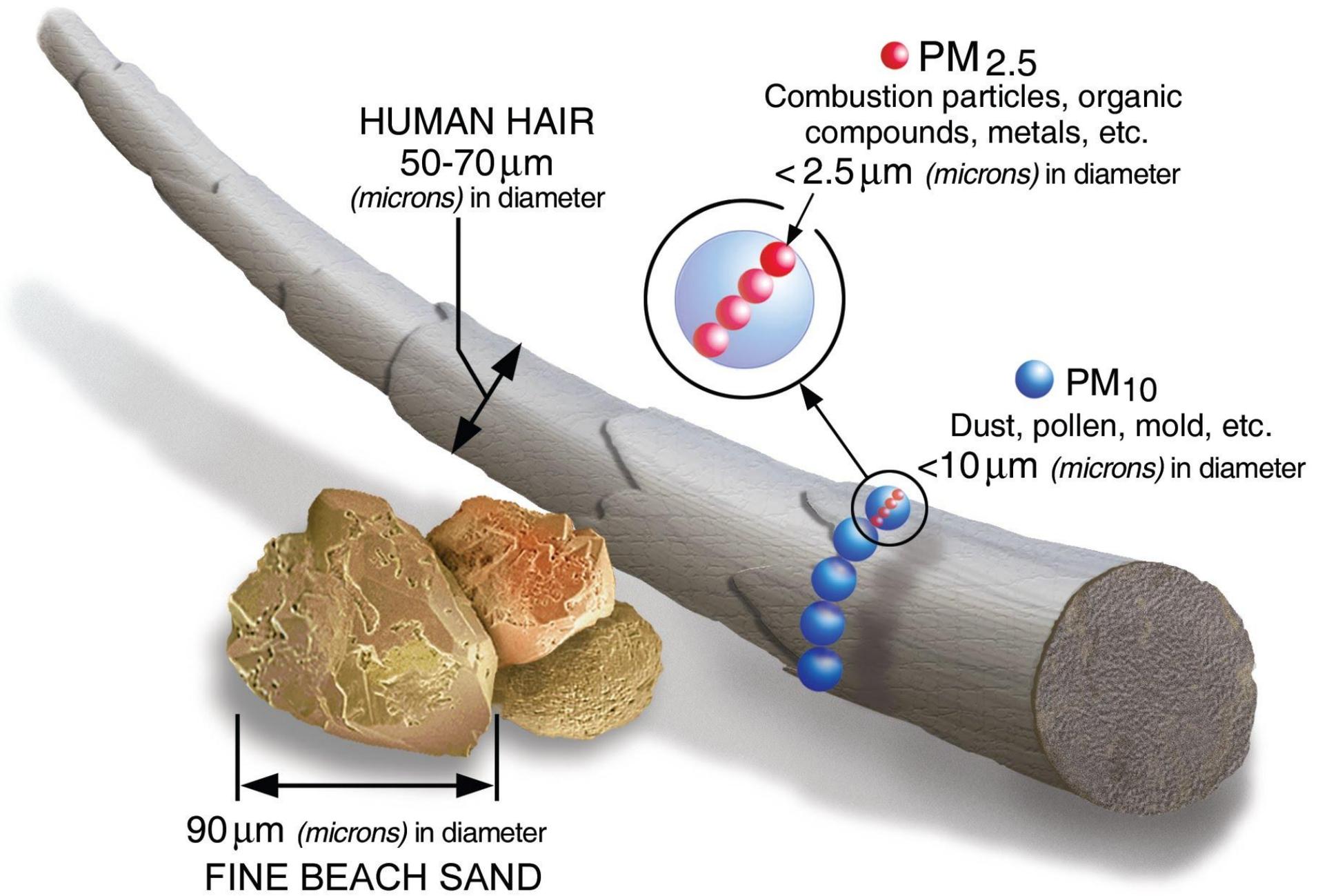


Agricultural crop residue burning



Residential cooking





HUMAN HAIR
50-70 μm
(microns) in diameter

90 μm (microns) in diameter
FINE BEACH SAND

PM_{2.5}
Combustion particles, organic
compounds, metals, etc.
< 2.5 μm (microns) in diameter

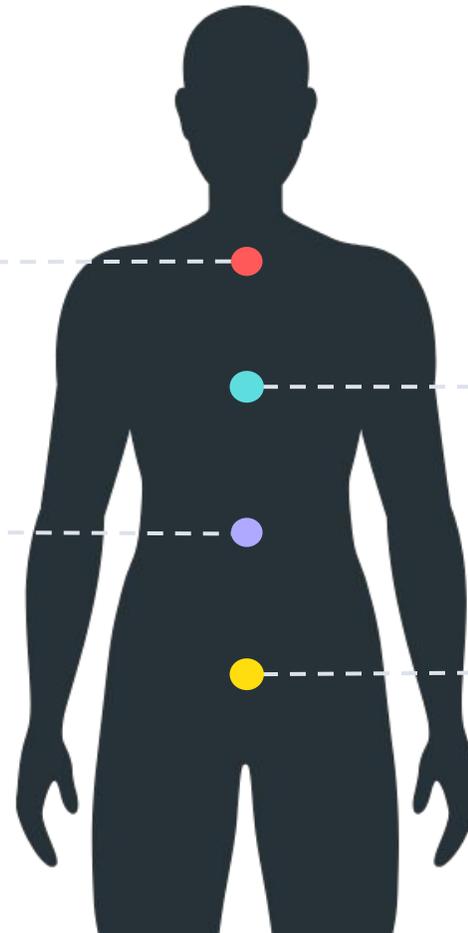
PM₁₀
Dust, pollen, mold, etc.
< 10 μm (microns) in diameter



Why does it matter?

- Exposure to air pollution has been linked to various health impacts.
- According to the WHO, air pollution contributes to around 6.9 million premature deaths in 2016.

- Respiratory infections**
- Air pollution can cause inflammation of the respiratory system
- Lung cancer**
- Air pollution can cause inflammation which can lead to the activation of cancerous mutations.



Stroke

- Air pollution can impact the cardiovascular system increasing the risk of heart attack or stroke

Diabetes

- Air pollution inhibits the body's ability to respond to insulin



**What is
occupational
exposure and its
impacts?**



How are people exposed to air pollution?



Ambient exposure

- The exposure people face due to air pollution in the outside air.
- Sources of ambient air pollution can be both natural (e.g desert dust or sea salt) or anthropogenic (emissions from biomass burning, vehicle emissions etc.)

- The key source is traditional biomass cook stoves.
- A large proportion of the health burden from household air pollution is shouldered by women and children as they typically spend most of their time indoors.

Household exposure



Occupational exposure

- The exposure of people to harmful air pollutants and other toxic substances due to their work
- Covers both formal and informal occupations





Office workers

- Reduced exposure to ambient air pollution
- Possible 'office syndrome' due to lack of ventilation and high CO2



Textile workers

- High levels of formaldehyde, carbon monoxide, carbon dioxide, and PM are dangerous contaminants prevalent in their working place



Streetfood workers

- Limited proper equipment for protection
- Exposed to PM and black carbon



Traffic police

- Spend their time exposed to harmful emissions from traffic pollution



Construction workers

- Frequent exposure to dust, fumes and gases emitted by vehicles and machinery

Examples of occupational exposure to air pollution



The impacts of occupational exposure

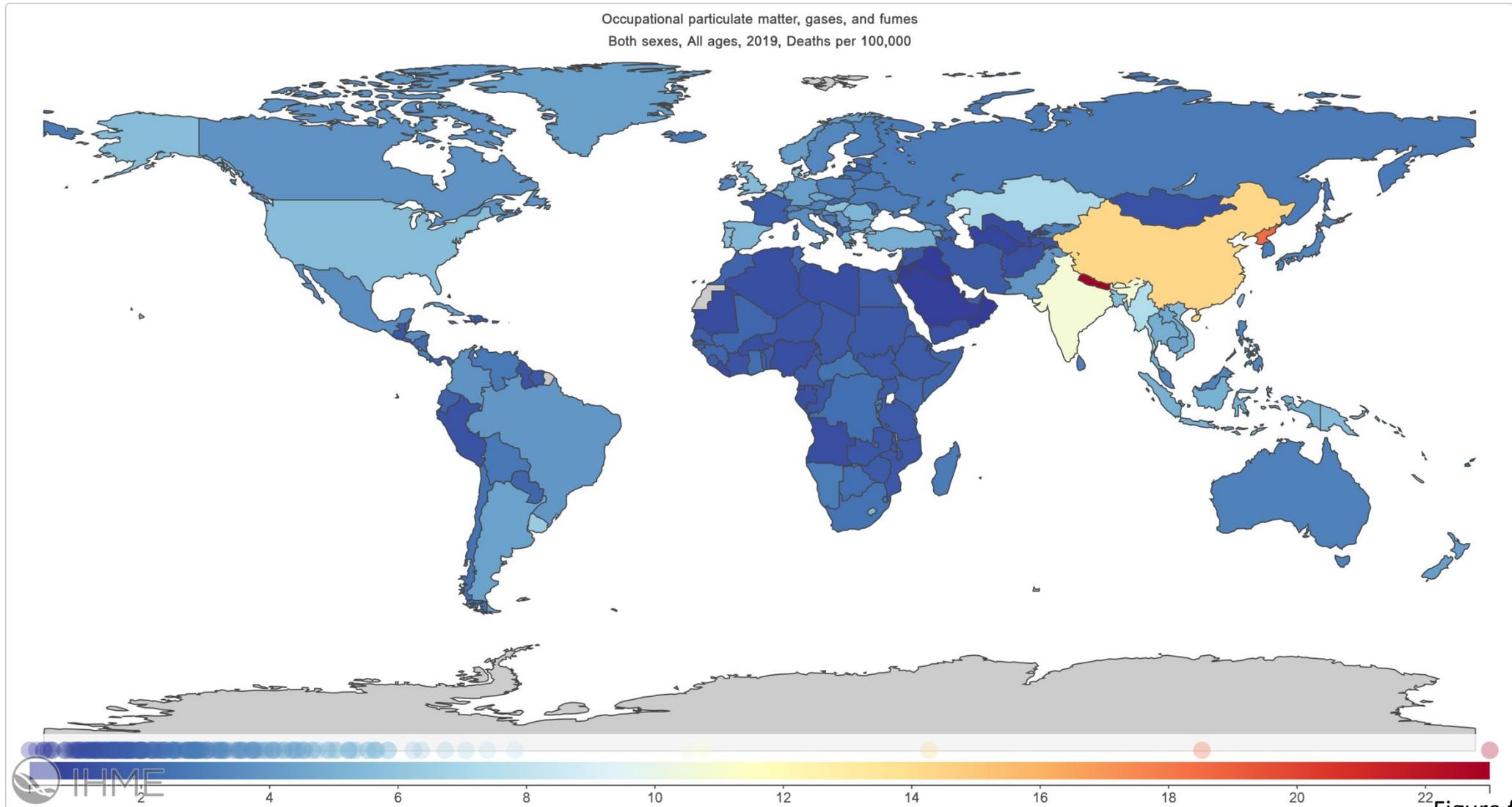
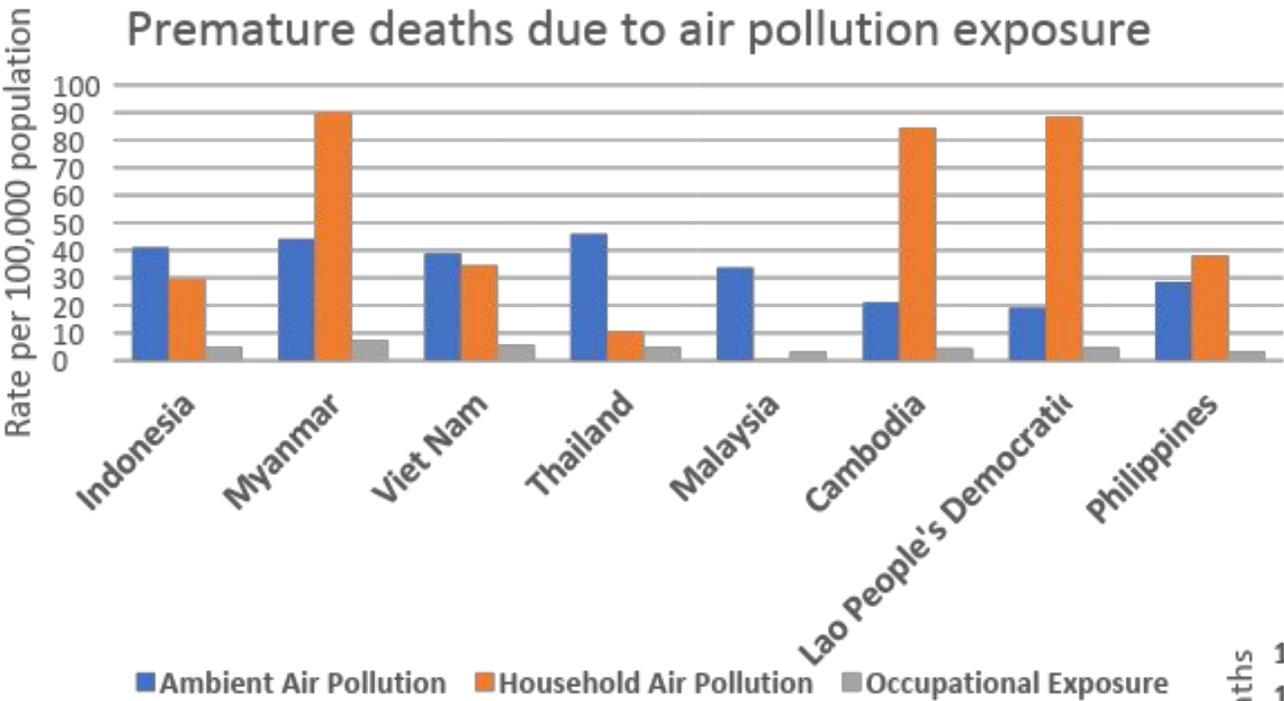
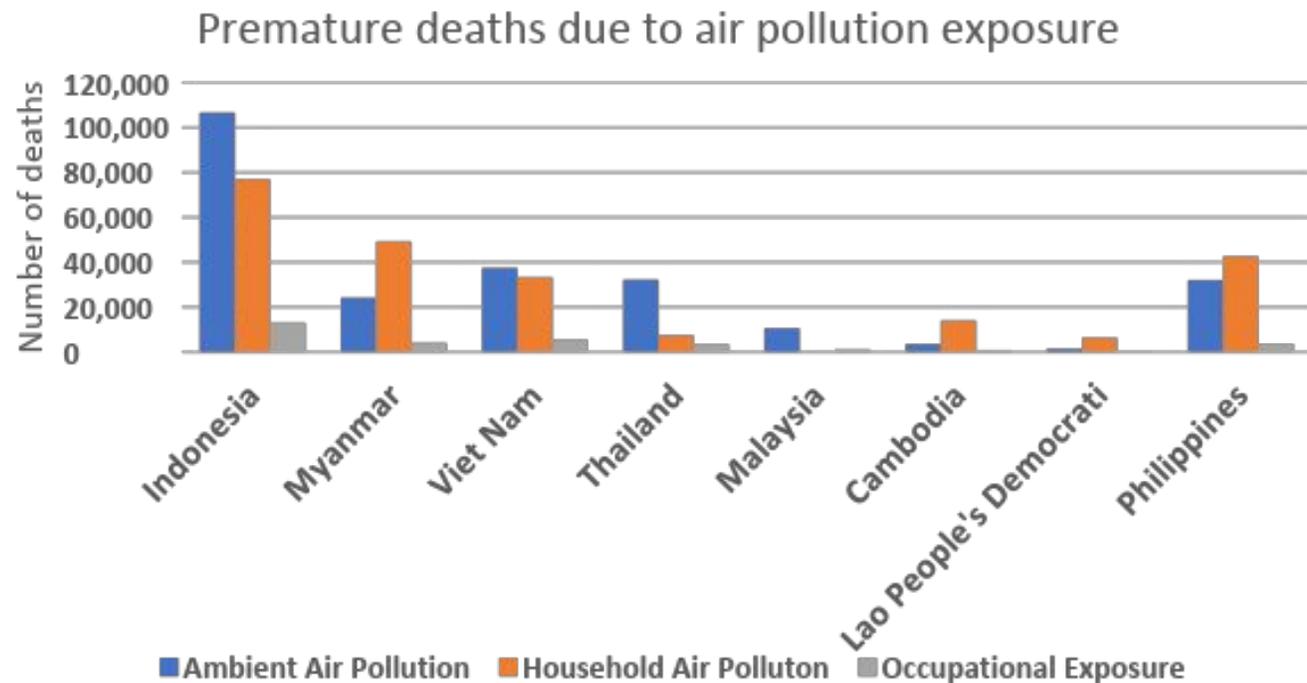


Figure from GBD data



Premature deaths due to air pollution in Southeast Asia



How do we estimate health impacts of occupational health?



Step 1:

- Determine the number of people working in each sector.

Proportion of the population engaged in different occupations x the economically active population

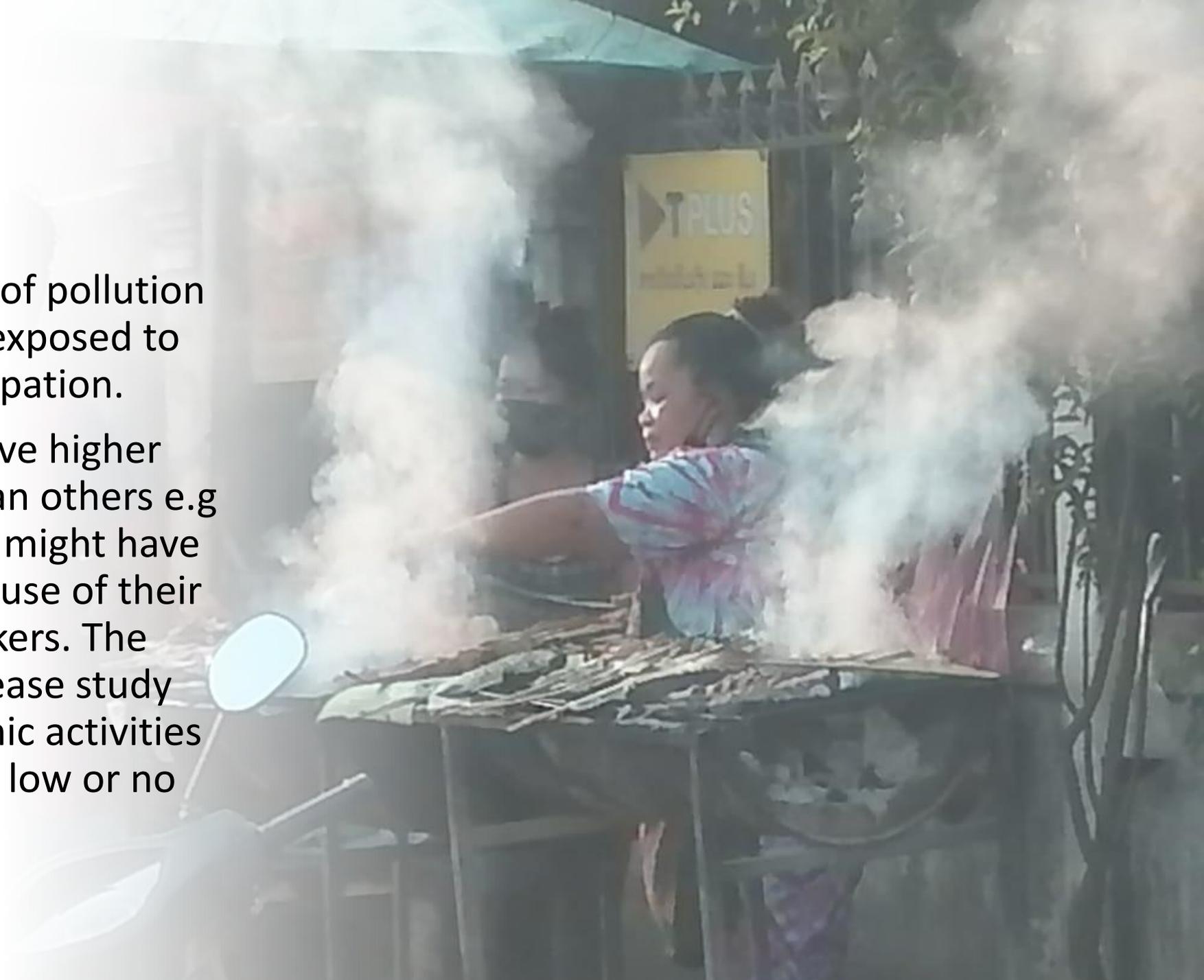


ILO Economic Activity classifications



Step 2:

- Understand the level of pollution to which a worker is exposed to because of their occupation.
- Some occupations have higher levels of exposure than others e.g construction workers might have higher exposure because of their work than office workers. The Global Burden of Disease study has classified economic activities as having either high, low or no exposure



Step 3:

- The exposure rate and the population exposed is then used to estimate the number of premature deaths.

Number of premature
deaths due to risk

Population exposed

$$\Delta Mort = y_0 \left(\frac{RR - 1}{RR} \right) Pop$$

Baseline
mortality

Relative Risk



**What further
research is
needed?**



Gaps in current estimates/research of the health burden of occupational exposure



Available data is concentrated in certain regions. Many countries in Southeast Asia region are *data scarce* because of a lack of capacity to monitor air quality.



Certain economic activities/occupations are often more studied than others particularly in *informal workers* who are also often not protected by policies.

- Informal labour not included
- Limited types of professions studied



Only considers increased risk of cardiovascular disease not any other diseases associated with air pollution e.g. *stroke, lung cancer, diabetes, respiratory infection* which are associated with ambient particulate matter and household air pollution exposure



What is needed to reduce occupational exposure?



Improve understanding and empower workers

- **Quantitative studies** to estimate total air pollutant emissions from different types of work and the exposure in each occupation group will allow for better estimates of health burdens, leading to better informed policy and **empowerment of workers** to take action
- **Qualitative studies** to understand the perceptions of air pollution for different groups and what policies are in place to understand key issues facing workers



Estimate exposure for informal workers

- Better understand the contribution of the **informal sector**
- Estimate the exposure and associated health impacts for **informal workers**



Policies to reduce occupational exposure

- Promotion of personal protective equipment (PPE) wearing to reduce exposure
- Better ventilation to reduce exposure
- Improve/enhance technology to reduce emissions



Key messages



A person's job can significantly impact their exposure to air pollution with consequences for their health.



This occupational exposure is often additional to other sources of exposure to air pollution such as ambient and household. Certain groups of people will have higher exposure to occupational air pollution due to their jobs but also may be more likely to have higher air pollution exposure from other sources due to their socioeconomic status.



Key messages



There are various ways that we can assess and mitigate occupational air pollution exposure. This can provide evidence which will help to inform policy.



Policy is often limited in the informal sector in particular, and often workers in these sectors have limited rights – these sectors are also often a major source of ambient air pollution and are a significant policy gap when it comes to air pollution mitigation.

Relevant resources

SEI work on air pollution and gender:

- Furszyfer Del Rio, D. D., et al. 2020. [“Do we need better behaved cooks? Reviewing behavioural change strategies for improving the sustainability and effectiveness of cookstove programs.”](#) *Energy Research & Social Science* 70(2020).
- Johnson, O., Lambe, F. and Ochieng, C. A. 2016. [What's Health Got to Do With It? Testing Marketing Messages for Clean Cookstoves in Cambodia and Kenya.](#) Working Paper 2016-04. Stockholm: Stockholm Environment Institute (SEI).
- Kumar, P. et al. 2022. [“In-kitchen aerosol exposure in twelve cities across the globe.”](#) *Environment International* 162(2022).
- Malley, C.S., et al. 2017. [Preterm birth associated with maternal fine particulate matter exposure: A global, regional and national assessment.](#) *Environment International* 101(2017): 173-182
- Nakarmi, A.M., et al. 2020. [“Mitigating the impacts of air pollutants in Nepal and climate co-benefits: a scenario-based approach.”](#) *Air Qual Atmos Health* 13 (2020): 361-370.
- Strambo C., Segnestam L., and Jahović, B. 2021. [Air pollution in Bosnia and Herzegovina: a gender equality, social equity and poverty reduction lens.](#) Discussion Brief. Stockholm: Stockholm Environment Institute (SEI).
- West, S.E., et al. 2021. [Using a co-created transdisciplinary approach to explore the complexity of air pollution in informal settlements.](#) *Humanities and Social Sciences Communications* 8(285).



Relevant resources

Podcasts:

- SEI Asia podcast: [Air pollution and its impacts on the health of workers in Cambodia](#)