

Workers' Safety and Health in a Changing Climate: Proceedings from the National Strategic Workshop at the All India Institute of Hygiene and Public Health, Kolkata

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Abstract

The Strategic Workshop on “Workers’ Safety and Health in a Changing Climate,” convened by the All India Institute of Hygiene and Public Health (AIIHPPH), Ministry of Health and Family Welfare, in collaboration with the National Centre for Disease Control (NCDC) and the National Programme on Climate Change and Human Health (NPCCHH), was held in October 2025 at Kolkata. The Strategic Workshop on “Workers’ Safety and Health in a Changing Climate” aimed to foster multisectoral dialog and collaboration to address the growing impact of climate change on occupational health, safety, and productivity, thereby contributing to sustainable development. Convened under the leadership of AIIHPPH, NCDC, and NPCCHH, the 2-day workshop brought together senior policymakers, researchers, academicians, and industry leaders from diverse sectors. Discussions were structured around five major, interconnected themes: 1) Protecting Workers from Extreme Weather Events (Heat), 2) Occupational and Environmental Air Pollution, 3) Chemical Exposures in a Changing Climate, 4) Technology for Climate-Resilient Workplaces, and 5) Psychosocial Well-being of Workers. Key recommendations from the deliberations were consolidated after discussions into actionable points, emphasizing the need for an integrated, technology-enabled, and equity-focused approach. Actionable steps included integrating health surveillance with climate data (e.g., WBGT/IMD forecasts), developing a National Chemical Exposure Surveillance Network, adopting AI/IoT-based predictive safety tools, and institutionalizing psychosocial care. The workshop reaffirmed a commitment to the vision of “Health for All, Safe Work for All,” urging interministerial convergence (Health, Labor, Environment) and supportive partnerships—especially with Micro, Small, and Medium Enterprises (MSMEs)—to ensure a climate-resilient workforce.

Keywords: Air pollution, climate change, heat stress, integrated surveillance, occupational health, psychosocial wellbeing, technology

INTRODUCTION

The Strategic Workshop on “Workers’ Safety and Health in a Changing Climate” was convened with the objective of fostering dialog and collaboration among experts, policymakers, researchers, and practitioners from diverse sectors—health, labor, environment, and industries. Recognizing that the health and safety of workers form the cornerstone of sustainable development, the workshop sought to address one of the most pressing challenges of our time: the growing impact of climate change on occupational health and productivity.

Organized under the leadership of the All India Institute of Hygiene and Public Health (AIIHPPH), Ministry of Health and Family Welfare, Government of India, with the National Centre for Disease Control (NCDC) and the National Programme on Climate Change and Human Health (NPCCHH), this initiative marked a crucial step in advancing national priorities on

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climate-resilient health systems. By bringing together key stakeholders from ministries, research institutions, academia, industries, technical institutes, voluntary associations, and development partners, the workshop created a platform for cross-sectoral learning and evidence-based policy dialog.

The deliberations underscored the need to integrate climate considerations within occupational health frameworks, ranging from surveillance and risk assessment to preventive technologies and psychological resilience. A strong emphasis was placed on the role of industries as partners in progress, with discussions highlighting the importance of supportive engagement rather than enforcement-driven approaches. Participants and dignitaries emphasized that ministries and academic institutions must proactively handhold industries, particularly small and medium enterprises, in building climate-resilient and safe work environments through technical guidance, capacity-building, and accessible compliance frameworks.

Through this workshop, AIIHPH reaffirmed its commitment to the Ministry's vision of "*Health for All, Safe Work for All*,"^[1] by linking climate resilience with occupation and safeguard the health and dignity of workers—the true drivers of India's growth story.

WORKSHOP PROCEEDINGS

Day 1

Date: October 10, 2025

The first day of the 2-day Strategic Workshop on *Workers' Safety and Health in Changing Climate* commenced at the Bidhan Nagar Campus of AIIHPH with the traditional Rigvedic invocation "Move together, speak together, let your minds be in harmony." The event brought together a distinguished group of experts, policymakers, academicians, and practitioners to deliberate on the emerging occupational health challenges posed by climate change.

Inaugural session

The day began with registration and welcome of dignitaries by Dr. Harikrishna BN, Public Health Specialist, followed by felicitation of guests and watering of the plant as a symbol of sustainable growth.

Dr. Monalisha Sahu, Associate Professor and Head, Department of Occupational Health, AIIHPH, delivered the Introductory Address, setting the context of the workshop and highlighting its alignment with the National Programme on Climate Change and Human Health (NPCCHH).

The Welcome Address was given by Dr. Debashis Dutt, Dean, Director-Professor and Head, Department of Public Health Administration, emphasizing AIIHPH's seven-decade legacy in advancing occupational health in India.

Dr. Manas Kumar Kundu, Director, AIIHPH, delivered the Inaugural Address, reaffirming the Institute's commitment to cross-sectoral collaboration, and urged the development

of field-level frameworks linking occupational health to sustainable industry practices.

Mr. Ashis Kumar Shit, Chief Inspector of Factories, Government of West Bengal, in his Guest of Honour Address, stressed the importance of developing context-specific strategies to protect vulnerable worker populations and encouraged fostering stronger partnerships between government, industry, and academia. He emphasized that regulatory systems must adapt to regional and sectoral realities, particularly in high-risk occupations, to ensure effective implementation of occupational health and safety (OHS) measures.^[2]

Dr. Shyam Pingle, Vice President, International Commission on Occupational Health (ICOH), highlighted that proactive engagement between regulatory authorities and industries can create a culture of prevention rather than reaction, ensuring that occupational health standards evolve in step with emerging climate-related risks. Dr. Pingle also underlined the need for continued dialog, international collaborations, and sharing of best practices to strengthen India's leadership in climate and occupational health.

Keynote address

The *Keynote Address* was delivered virtually by Prof. (Dr.) Ranjan Das, Director, NCDC, on "*Scaling NPCCHH Lessons: Translating National Frameworks to Worker Safety*." He elaborated on the need to operationalize NPCCHH at the workplace level and to create district-level occupational health surveillance nodes. Dr. Das emphasized the importance of integrating climate-sensitive occupational health indicators within existing health information systems and building the capacity of frontline health workers for timely risk communication. He also highlighted the value of cross-ministerial collaboration and public-private partnerships to ensure the sustainability and scalability of climate-resilient worker safety interventions.

The inaugural session concluded with a ceremonial tree plantation by planting a tree named 'Chaya' symbolizing resilience and growth, marking a collective commitment toward a sustainable and safer environment.

TECHNICAL SESSION I: WORKERS' HEALTH AND SAFETY IN CHANGING CLIMATE – SETTING THE CONTEXT

The first technical session was led by Dr. Monalisha Sahu, Associate Professor and Head, Department of Occupational Health, AIIH and PH, Kolkata. Dr. Sahu set the stage for the day's discussions by providing an overview of the complex and evolving relationship between climate change and workers' health. She emphasized that rising ambient temperatures, altered rainfall patterns, and increased air pollution levels are significantly affecting the productivity, safety, and wellbeing of workers across both organized and unorganized sectors. A major focus of her address was the protection of workers in the unorganized sector, who form the majority of India's workforce yet remain outside formal occupational health

frameworks. She highlighted the importance of leveraging national platforms such as the e-Shram portal^[3] to integrate workers' demographic and occupational data with health and climate vulnerability information. Such integration, she noted, could support evidence-based policymaking and enable targeted interventions for climate resilience among informal and migrant workers. She also highlighted AIIH and PH's recent initiatives and priority research areas, including heat-related illnesses, air pollution, climate-related mental health concerns, and nutrition. She emphasized the importance of evidence-based, community-embedded responses strengthened by technological innovations and the integration of AI and machine learning.

TECHNICAL SESSION II: PROTECTING WORKERS FROM EXTREME WEATHER EVENTS (EMPHASIS ON HEAT)

This session was moderated jointly by Dr. Aniket Chowdhury, Assistant Director, NCDC, and Dr. Arkaprabha Sau, Deputy Director (Medical), Regional Labour Institute, Kolkata. In their opening remarks, the moderators emphasized the growing concern of heat-related illnesses among outdoor and industrial workers in the context of increasing global temperatures. They underlined the need for surveillance systems, early warning mechanisms, and workplace-level preparedness to mitigate heat stress risks.

The session featured three expert speakers and was followed by an open discussion chaired by Prof. (Dr.) Nandakishore Alva N, Director Professor and Dean, ESI-PGIMSR, Joka, and Dr. T. Rajgopal, Adjunct Faculty, Public Health Foundation of India (PHFI) and Former Vice President, Global Medical and Occupational Health, Unilever.

Dr. Debashis Dutt, Director-Professor and Dean, AIIH and PH, deliberated on "*Occupational Heat Stress Surveillance: Field Gaps and Evidence*." He discussed field data from various industrial sectors and pointed out the limited awareness and reporting mechanisms for heat-related disorders. He stressed the need to integrate *Heat Stress Indices and Wet Bulb Globe Temperature (WBGT)* monitoring into regular workplace assessments. Dr. Dutt called for national guidelines and cross-sectoral coordination between public health departments and industries for adaptive planning.

Dr. H. R. Biswas, Scientist F and Head, Regional Meteorological Centre, IMD, Kolkata, spoke on "*From Forecast to Field: Leveraging IMD Alerts for Worker Safety*." He demonstrated how real-time weather forecasts and heatwave alerts from IMD could be effectively utilized by industries to plan shifts, ensure adequate hydration, and reduce exposure to extreme heat. Dr. Biswas also mentioned the potential of *IMD's Heat Action Plans*^[4,5] as a tool to strengthen occupational preparedness and worker protection at the district level.

Dr. Shubhendu Mudgal, Health and Safety Expert, World Bank, presented on "*Global Models for Climate-Resilient Workplaces*." Drawing from international best practices, he

highlighted successful interventions from Southeast Asia and Latin America, such as heat acclimatization protocols, workplace cooling innovations, and employee heat awareness programs like ILO Just transition model and ADB Climate Risk Management. He underscored the value of data-driven decision-making and stressed the importance of including small and medium enterprises (SMEs) in climate adaptation efforts.

Discussions focused on developing heat-health early warning systems, district-level heat index mapping, and the inclusion of heat-related indicators within NPCCHH reporting. The need for integrating IMD alerts into workplace-level response plans was strongly supported.

During the open discussion, Prof. (Dr.) Alva emphasized the need to translate surveillance data into actionable policy frameworks and capacity-building modules for factory medical officers; he also mentioned about ESIC's Factory Adoption Program and how it can be useful for climate resilience. Dr. T. Rajgopal added that corporate entities should integrate climate resilience into their sustainability and ESG (Environmental, Social, and Governance) commitments. Participants from academia and industries actively shared their field experiences, making the session highly interactive and solution-oriented.

TECHNICAL SESSION III: OCCUPATIONAL AND ENVIRONMENTAL AIR POLLUTION – DOUBLE BURDEN ON WORKERS

The final session of the day addressed the overlapping challenges of occupational and environmental air pollution and its compounded impact on worker health. It was moderated by Dr. Aniket Chowdhury (Assistant Director, NCDC) and Dr. S. K. Sadhukhan, Director-Professor and Head, Department of Epidemiology, AIIH and PH.

The session was chaired by a distinguished panel comprising Dr. Shyam Pingle, Vice President, International Commission on Occupational Health (ICOH), and Dr. Debashis Dutt, Dean, AIIH and PH. In their opening remarks, the chairpersons collectively emphasized that workers today face a "double exposure"—environmental air pollution due to urban emissions and occupational air pollutants from industrial processes. They advocated for unified monitoring frameworks and integrated health impact assessments to capture this cumulative burden.

The speakers provided a multidisciplinary perspective:

Dr. Deepanjan Majumdar, Senior Principal Scientist and Head, NEERI, presented on "*Urban Hotspots: Integrating Ambient and Workplace AQ Data*." He discussed NEERI's recent findings on air quality monitoring in industrial clusters and the potential of real-time sensors to detect particulate matter exposure among workers. Importantly, he emphasized the development and field application of low-cost air quality sensors that can be deployed in small- and medium-scale enterprises and informal sector workplaces. These tools, he

noted, can democratize data collection, enhance awareness, and guide local mitigation efforts^[6] even in resource-limited settings.

Dr. T. Rajgopal, Adjunct Faculty, PHFI, presented “*Translating Data to Action: An Occupational Physician’s Perspective.*” Drawing from his rich industry experience, he illustrated how occupational physicians can convert environmental and health surveillance data into practical preventive measures, such as engineering controls, rotation schedules, and employee awareness programs. He emphasized that empowering factory health personnel with analytical skills can bridge the gap between research and real-world action.

Dr. Sandeep Thacker, Consultant on Climate Change and Human Health, UNICEF, spoke on “*Air Pollution Exposure among Workers in Informal and MSME Sectors.*” He highlighted the neglected yet significant exposure of informal sector workers—such as waste recyclers, street vendors, and construction laborers—to both ambient and occupational pollutants. He stressed the need for inclusive policies, portable protective devices, and targeted outreach programs to safeguard this vulnerable workforce.

In their closing remarks, the chairpersons applauded the integration of scientific research, occupational medicine, and policy perspectives within the session. Dr. Pingle emphasized the need for research-driven air quality management strategies and highlighted international collaborations under ICOH for advancing cleaner and safer workplaces. Dr. Dutt concluded the session by underlining AIIH and PH’s commitment to advancing occupational and environmental health research to address the evolving challenges of climate change.

Day 2

Date: October 11, 2025

The second day of the workshop was devoted to exploring sectoral risks, emerging technologies, and psychosocial dimensions of worker safety in the context of a changing climate. The sessions focused on practical innovations, industry experiences, and interdisciplinary discussions aimed at building climate-resilient occupational health systems across India’s diverse work environments. The sessions drew participation from experts across ICMR, NCDC, AIIMS, ESI, UNICEF, and industry representatives, reflecting the multidisciplinary spirit of the event.

TECHNICAL SESSION IV: CHEMICAL EXPOSURES IN A CHANGING CLIMATE – MINING, MANUFACTURING, AND AGRICULTURE RISKS

The day began with a technical session addressing the intersection of climate variability and chemical hazards across major sectors such as mining, manufacturing, and agriculture. The session was moderated by Dr. C. S. Taklikar (Professor and Head, Department of Health Promotion and Education, AIIH and PH) and Dr. Barun Kumar Sikdar (Ex-Industrial Health

and Safety Specialist, Department of Labour, Government of West Bengal).

The session was chaired by Dr. Santasabuj Das, Director and Scientist G, ICMR-NIRBI, Kolkata, and Dr. Subhashish Sau, Associate Professor and Head, Department of Physiology, University of Kalyani. In their opening remarks, the chairpersons underlined the importance of adapting chemical safety frameworks to account for the dynamic effects of climate change. They emphasized that rising temperatures, humidity, and extreme weather events can alter chemical stability, dust dispersion, and worker exposure levels—posing new challenges for occupational health systems.

Dr. Karthik Thokala, Medical Superintendent, Coal India Ltd., opened the presentations with insights from the mining sector. His talk, “*Mining Sector Chemical and Dust Exposure: Field Realities and Innovations in Worker Protection,*” focused on the compounded effects of heat and particulate exposure in open-cast mines. He highlighted innovative mitigation approaches such as smart helmets, personal cooling devices, and microclimate-controlled shelters that enhance worker safety and comfort.

Next, Dr. Arnab Sen, Station-in-Charge and Head, ICAR-IVRI Eastern Zone, discussed “*Climate Change and Its Effect on Spillover Diseases from Livestock.*” He elaborated on how climatic shifts are transforming pathogen–host dynamics, leading to increased zoonotic transmission risks for agricultural and animal-handling workers. He advocated for a One Health-based surveillance model integrating human, animal, and environmental health systems.^[7]

Mr. Sanjib Kumar Jana, General Manager (EHS), IVL Dhunseri Petrochem Industries Pvt. Ltd., spoke on “*Occupational Health in Petrochemical Industries: New Challenges in a Climate-Stressed Environment.*” He shared how variations in ambient temperature and humidity affect chemical volatility and worker exposure patterns. He proposed developing climate-adaptive SOPs, emergency preparedness plans, and retraining programs to enhance worker protection.

Following these sectoral presentations, Dr. Meera Dhuria, Joint Director and Head, Biochemistry and Toxicology, NCDC, delivered an important address on “*Chemical Emergency Preparedness and Its Capacity Building.*” She emphasized the need for robust chemical incident response systems and cross-sectoral coordination between health, industry, and disaster management agencies. Dr. Dhuria highlighted NCDC’s initiatives under the NPCCHH framework for strengthening laboratory capacity, rapid response teams, and training modules to enhance readiness for chemical emergencies.^[8] She stressed that preparedness at the district and workplace levels must be integrated into broader climate resilience planning, ensuring both prevention and rapid containment of toxic exposures.

In their closing observations, Dr. Das and Dr. Sau commended the diversity of perspectives and the inclusion of both preventive and emergency preparedness dimensions. They

reiterated that climate-integrated chemical risk management, supported by sector-specific toxicological research and capacity-building initiatives, is essential for safeguarding worker health in a rapidly changing environment.

Dr. Das commended the sectoral diversity of insights and underscored the importance of adaptive toxicology research. Prof. Sau emphasized that climate resilience in industrial safety must evolve beyond compliance toward anticipatory risk management through science-policy collaboration.

TECHNICAL SESSION V: TECH FOR CLIMATE-RESILIENT WORKPLACES – SCALABLE TOOLS AND INDUSTRY PILOTS

The session highlighted innovations in digital and technological tools aimed at enhancing occupational health and safety in climate-stressed environments. It was moderated by Dr. A. K. Mallick (Director-Professor, Department of MCH, AIIH and PH) and Dr. R. K. Tiwary (Head, Department of Statistics, AIIH and PH). The moderators emphasized that technology, when integrated with surveillance and policy frameworks, can empower both organized and unorganized sectors to implement effective climate-resilient interventions.

The session was chaired by Dr. R. P. Bhawe, Director in Charge and Head of Office, Regional Labour Institute (RLI), Kolkata, and Dr. Ashok Puranik, Director, AIIMS Guwahati. In their opening remarks, the chairpersons highlighted those scalable, low-cost innovations and predictive tools are crucial for preventing occupational hazards in the context of climate variability. They stressed that digital integration and intersectoral coordination are key to strengthening workplace health surveillance.

Dr. Arkaprabha Sau, Deputy Director (Medical), RLI, Kolkata – “*Integrating Environmental and Health Surveillance Using IoT and Machine Learning.*” Dr. Sau presented strategies for linking environmental exposures with worker health data in real time using IoT-based sensors. He demonstrated how low-cost, portable devices can track temperature, humidity, and air quality while simultaneously recording physiological parameters such as heart rate and core body temperature. These systems enable predictive alerts for heat stress or toxic exposure and support field-level preventive interventions.

Dr. Himank Agrawal, Scientific Officer, IIT Indore – “*AI-Driven Worker Surveillance and Predictive Safety Analytics.*” Dr. Agrawal discussed the application of machine learning models to anticipate workplace hazards, including heat stress, chemical exposures, and ergonomic risks. He emphasized the use of predictive analytics to guide shift scheduling, personal protective equipment allocation, and emergency response preparedness, highlighting the ethical considerations of data privacy and transparency.

Dr. Priyanka Roy, Deputy Director (Medical)/Deputy Chief Inspector of Factories, Department of Labour, West Bengal – “*Technical Advances in Pneumoconiosis Diagnosis*

and Management.”: Dr. Roy shared updates on AI-assisted digital radiography and portable diagnostic tools that facilitate early detection of pneumoconiosis in industrial and mining settings. She emphasized linking diagnostic data with national health portals such as e-Shram to enhance surveillance and compensation mechanisms, particularly for workers in small and medium enterprises.

In their closing remarks, Dr. Bhawe and Dr. Puranik lauded the multidisciplinary approach combining technology, policy, and ethical oversight. They emphasized that while digital and AI tools provide powerful surveillance capabilities, capacity building, training, and field validation remain critical to ensure equitable and effective implementation. Dr. Bhawe highlighted that these innovations should complement, not replace, human oversight, ensuring that safety interventions are practical and context-sensitive.

TECHNICAL SESSION VI: PSYCHOSOCIAL WELL-BEING OF WORKERS AMIDST CLIMATE CHANGE – SPECIAL EMPHASIS ON VULNERABLE POPULATIONS

This session addressed the critical yet often overlooked psychosocial aspects of worker health in the context of climate change, with focus on vulnerable populations. It was moderated by Dr. Nandini Bhattacharya, Officer-In-Charge, RHU and TC, Singur, and Dr. Bobby Paul, Professor and Head, Department of PSM, AIIH and PH. The moderators highlighted that climate-induced stressors such as job insecurity, extreme weather events, and environmental hazards can have profound impacts on both mental and physical health, particularly among workers in informal sectors.

The session was chaired by Dr. Amit Kumar Chakraborty, Scientist G, ICMR-ICAM/ICMR-NIRBI, and Dr. Indrani Bhattacharyya, Chief Executive Officer, Child in Need Institute (CINI). In their opening remarks, the chairpersons emphasized that occupational health frameworks must go beyond physical protection and incorporate psychosocial wellbeing and social resilience. They also highlighted the need for multisectoral collaboration to safeguard workers facing compounded vulnerabilities due to climate and occupational hazards.

Dr. Vandana Bhatia, Health Specialist, UNICEF, presented on “Climate Change and Lead Poisoning: A Dual Threat to Child Health.” She elaborated on how climate change intensifies environmental lead exposure, disproportionately affecting children of working parents, and advocated for integrating child health considerations into occupational health strategies. Ms. Monalisa Datta, Environment Specialist, CINI, spoke on “At the Margins of Climate Change: Safeguarding Well-Being of Vulnerable Populations,” highlighting the heightened vulnerabilities of marginalized workers, particularly women and informal laborers. Dr. Payel Mazumder, Industrial Psychologist, St. Xavier’s University, discussed “Psychological Safety in the Age of Climate Change: Protecting Workers

Beyond the Physical Hazards,” emphasizing the importance of mental health programs, peer support networks, and supervisory training to ensure a psychologically safe work environment.

During the open discussion, participants explored practical strategies for supporting mental wellbeing, including the use of AI-based forums and digital platforms to provide real-time counseling and peer support. The conversation also touched on integrating these tools into broader occupational health and climate resilience frameworks and the importance of capacity building for effective adoption.

In their concluding remarks, Dr. Chakraborty and Dr. Bhattacharyya reiterated the importance of holistic occupational health approaches that include both physical and psychosocial protection, emphasizing that safeguarding the wellbeing of vulnerable workers requires preventive, responsive, and evidence-based interventions that address the complex interplay of climate, work, and social factors.

The final session of the workshop focused on summarizing the scientific and technical deliberations of the 2-day event.

Chaired by Dr. Manas Kundu, Director, AIIH and PH, Dr. Debashis Dutt, Director-Professor and Dean, AIIH and PH, Dr. Shyam Pingle, Vice President, ICOH, and Dr. T. Rajgopal, Adjunct Faculty, PHFI, the session provided an overview of key discussions and emerging insights across all technical sessions. The moderators, including Dr. Monalisha Sahu, Dr. Aniket Chowdhury, Dr. Arkaprabha Sau, and Dr. Sandeep Thacker, highlighted major takeaways such as the integration of climate-resilient occupational health strategies, the use of innovative technologies and AI for surveillance, psychosocial support for vulnerable workers, and the importance of capacity building for chemical and environmental hazard preparedness. The session concluded with reflections from the chairpersons, emphasizing the need for evidence-based interventions, intersectoral collaboration, and the translation of workshop learnings into actionable policies and workplace practices. The key deliberations and recommendations from the sessions are compiled in Table 1, and the resulting conceptual framework is depicted in Figure 1.

Table 1: Key recommendations and discussion points from each of the sessions convened during the strategic workshop

Sessions	Key recommendations	Discussion points
Protecting Workers from Extreme Weather Events (Heat)	<ul style="list-style-type: none"> Educate employers and workers on HRIs; enforce engineering, administrative, and PPE controls Use IMD APIs for localized heat alerts; integrate risk awareness in workplace safety Link HRI surveillance with IHIP and WBGT; mandate reporting through PSUs Integrate heat indices in NPCCHH; establish district heat-monitoring units Train HCWs in HRI management; equip facilities with heat-stroke rooms Implementing Water Rest Shade program 	<ul style="list-style-type: none"> HRI surveillance remains poor, especially in unorganized sectors Shift needed from temperature-based to health-specific alerts for workers, need for validating wearable technology for real-time worker risk assessment Fragmented health–environment data impede comprehensive management
Occupational and Environmental Air Pollution	<ul style="list-style-type: none"> Develop affordable personal exposure sensors Map and model pollutant sources in high-risk zones Create IMD–Health–Labour coordination for early warnings Include occupational exposure in National Clean Air dashboards 	<ul style="list-style-type: none"> Workers, especially women, face a triple burden—occupational, environmental, and indoor pollution Behavior change following awareness programs remains limited Address wage loss for workers during extreme weather events
Chemical Exposures in a Changing Climate	<ul style="list-style-type: none"> Operationalize NDMA–NCDC chemical emergency modules Mandate biomonitoring and periodic health exams Conduct research on climate impact on chemical toxicity Ensure antidote availability near factories and agricultural fields Capacity building on chemical emergency preparedness in a changing climate 	<ul style="list-style-type: none"> Heat increases absorption and toxicity of chemicals Climate shifts may accelerate parasite incubation and epidemics Rainfall-related soil degradation increases pesticide dependence. Need for portable, low-cost pesticide sensors
Technological Advancements for Climate Resilience	<ul style="list-style-type: none"> Develop AI-based integrated occupational surveillance Integrate personal and environmental data for predictive modeling Pilot digital twin systems for health validation. Improve data quality, sensor usability, and infrastructure and sustainability 	<ul style="list-style-type: none"> Data and validation gaps persist in R&D Sustained political will and infrastructure are key to adoption
Psychosocial Well-being of Workers	<ul style="list-style-type: none"> Implement workplace peer-support (‘Buddy’) systems Integrate psycho-social care in disaster plans Design gender-sensitive programs for women workers Train responders for psychological first aid to detect and manage distress early 	<ul style="list-style-type: none"> Psycho-social health neglected, especially in informal sectors Climate stress increases anxiety, depression, and insecurity. New mental health issues: climate anxiety and solastalgia

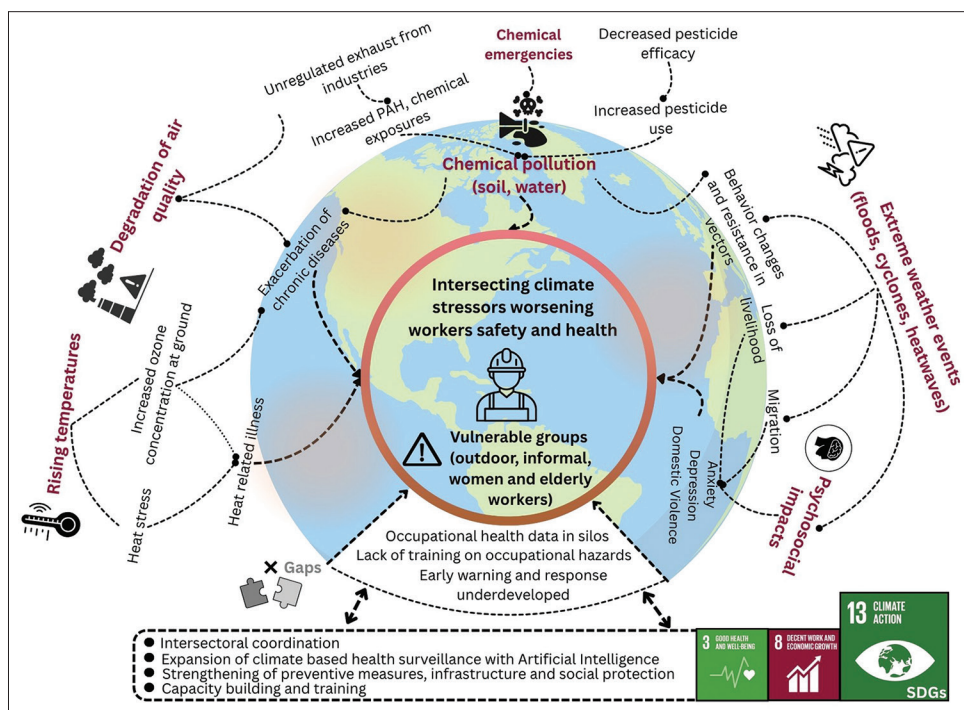


Figure 1: Conceptual framework depicting intersecting climate stressors worsening workers' safety and health

CONCLUSION

The 2-day Strategic Workshop on “*Workers' Safety and Health in a Changing Climate*” reaffirmed the national commitment of the Ministry of Health and Family Welfare (MoHFW) and the National Centre for Disease Control (NCDC) to integrate occupational health within India's climate-change and public-health agenda. The deliberations underscored that climate-induced hazards—heat stress, chemical exposure, air pollution, and psychosocial strain—are now emerging determinants of worker morbidity and productivity.

The workshop provided a unified platform for policymakers, researchers, industry leaders, and technical experts from DGHS institutions, NCDC, NPCCHH, ICMR, NDMA, IMD, and AIIHPH to identify gaps and co-develop actionable pathways for climate-resilient occupational health. The discussions resulted in consensus on developing a National Framework for Climate-Resilient Worker Safety and Health that will:

- Strengthen district-level climate and occupational health surveillance units under NPCCHH;
- Integrate heat, air, and chemical exposure data into national health information systems;
- Promote adoption of AI-based and IoT-enabled technologies for early warning and predictive risk management; and
- Institutionalize psychosocial wellbeing within occupational-health programs.

The workshop emphasized that achieving resilience requires interministerial convergence between MoHFW, MoLE, and MoEFCC, along with continuous capacity building of state and institutional partners. AIIHPH, as the oldest

occupational-health institution in the country, and NCDC, as the national coordinating body for climate and health, jointly committed to advancing this collaborative agenda through research, policy support, and training.

The outcomes of this workshop will inform future strategic plans under the NPCCHH and serve as a foundation for developing climate-resilient occupational-health policies and interventions across sectors, ensuring that the health and dignity of every worker remain at the heart of India's sustainable development goals.

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We extend our sincere gratitude to all the distinguished speakers representing the International Commission on Occupational Health (ICOH), Public Health Foundation of India (PHFI), National Environmental Engineering Research Institute (NEERI), United Nations International Children's Emergency Fund (UNICEF), India Meteorological Department (IMD), World Bank, Indian Council of Agricultural Research – Indian Veterinary Research Institute (ICAR-IVRI), Indian Institute of Technology (IIT), and Child in Need Institute (CINI), whose insightful contributions enriched the deliberations of the workshop.

We also express our deep appreciation to the enthusiastic participants whose active engagement added immense value

to the discussions. Finally, we gratefully acknowledge the contributions of all the departments of AIIHPH for their constant input, collaboration, and active participation across the various sessions of the workshop.

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Nil.

Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. World Health Organization. Promoting healthy, safe and resilient workplaces for all. Geneva: World Health Organization; 2025. Available from: <https://www.who.int/activities/promoting-healthy-safe-and-resilient-workplaces-for-all>. [Last accessed on 2025 Nov 10].
2. Government of India, Ministry of Labour and Employment. The Occupational Safety, Health and Working Conditions Code, 2020. New Delhi: Government of India; 2020.
3. Ministry of Labour and Employment, Government of India. e-Shram Portal. New Delhi: Ministry of Labour and Employment. Available from: <https://eshram.gov.in/>. [Last accessed on 2025 Nov 10].
4. Press Information Bureau, Government of India. Heat Action Plans (HAPs). Delhi: Press Information Bureau; 2023. Available from: <https://www.pib.gov.in/PressReleaseIframePage.aspx?PRID=1982978>. [Last accessed on 2025 Nov 10].
5. National Disaster Management Authority (NDMA). SOPs for developing a Climate Adaptive and Inclusive Heat Action Plan focused on vulnerable communities. Delhi: NDMA; 2024. Available from: <https://ndma.gov.in/sites/default/files/NL-May24/images/article2.pdf>. [Last accessed on 2025 Nov 10].
6. Council of Scientific and Industrial Research (CSIR). Newsletter 11 To 15 October 2023. Local Area Management Plan. New Delhi: CSIR; 2023. Available from: <https://www.csir.res.in/sites/default/files/2023-11/11%20To%2015%20October%202023.pdf>. [Last accessed on 2025 Nov 10].
7. Singh S, Sharma P, Pal N, Sarma DK, Tiwari R, Kumar M. Holistic One health surveillance framework: Synergizing environmental, animal, and human determinants for enhanced infectious disease management. *ACS Infect Dis* 2024;10:808-26.
8. Ministry of Health and Family Welfare, Government of India. Union Health Secretary Launches Training Modules on Public Health Management of Chemical Emergencies. New Delhi: Ministry of Health and Family Welfare; 2025. Available from: <https://www.mohfw.gov.in/?q=en/press-info/9456>. [Last accessed on 2025 Nov 10].