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Control of Welding Fumes in Informal Sector Street Welding Operations

1. Introduction

This report was prepared for Workplace Health Without Borders (WHWB), an international non-profit organization dedicated to promoting global occupational health by engaging industrial hygienists and other occupational health (OH) professionals to build prevention capacity and address hazards in under-served areas. The topic of investigation is the control of welding fumes in street welding operations, with particular attention to informal sector settings in low- and middle-income countries.

The report was commissioned against the backdrop of a significant and well-documented disparity in occupational health coverage. The International Labor Organization (ILO) estimates that the informal sector accounts for approximately 60% of the world's workforce globally and up to 90% in developing countries. Workers in the informal economy lack the health and safety information, institutional oversight, and protective infrastructure available to many workers in the formal sector. Welding is among the most hazardous trades practiced informally, yet it remains among the least studied in truly informal, public-space settings.

Since published studies focused specifically on roadside or sidewalk welding are limited in number, the scope of this review was expanded to include all informal and small-scale sector welding. Evidence from roadside-specific studies is highlighted where available, and findings from adjacent informal-sector settings — including garage-based, workshop-based welding operations — are used to build a coherent picture of the problem.

The report addresses two main research questions:

- What does the literature provide about the magnitude of informal sector welding as a hazard, including the numbers of workers involved, the types of exposures, and injury to which they are subject?
- What possibilities exist for improving hazard controls in informal welding settings, and what role could WHWB and occupational health professionals play in supporting those improvements?

The hazards not a purely technical question about fume composition. In many of the settings described in the literature, welding is conducted in open public areas — on sidewalks, in garages, at roadsides — where oversight is non-existent, training is inconsistent, inspection is limited, and occupational health resources are largely absent.

In these environments, the hazard may extend beyond the welder to include nearby vendors, customers, pedestrians, and residents. This report therefore treats informal street welding as both an occupational health issue and, in certain settings, a broader community public health concern.

2. Findings

2.1 The Scale and Structure of Informal Sector Welding

Informal welding is a geographically widespread and economically significant trade. The reviewed literature documents informal and small-scale welding operations in Uganda, Tanzania, India, Ethiopia, Nigeria, Nepal, South Africa, Ghana, and Indonesia. Although local conditions vary, a common structural pattern emerges: welding is routinely performed in small, unregulated environments where employer accountability is weak, regulatory inspection is infrequent, occupational training is informal or absent, and workers bear the cost of their own protection, often without adequate resources to do so effectively.

The ILO frames this structural vulnerability clearly: in sub-Saharan Africa, where a large share of the reviewed studies is located, an estimated 71.9% of non-agricultural employment is informal. Studies from Tanzania explicitly situate informal welding within this broader economic reality, noting that the sector is not a marginal backwater but a mainstream form of employment for a significant share of the working-age population (Magoha et al., 2024). In the absence of formal employment relationships, workers in informal welding have no employer-funded health and safety programs, no workers' compensation systems, and little practical recourse when they are injured or become ill.

The workforce in these settings tends to be young and male. Studies from Uganda, Ghana, and South Africa describe workforces made up predominantly of men, many with informal or apprenticeship-based training. The Ghanaian garage study identified that most welders at the Sunyani garages had ten years of experience or fewer, and many were relatively young (Adu et al., 2025). This matters because both inexperience and precarious labor status are associated with higher injury rates. The Ugandan injury study identified that being a casual laborer with informal training and working longer hours were all associated with significantly higher injury likelihood, while greater work experience was protective (Itiakorit et al., 2021).

On the specific question of roadside and sidewalk welding, the published literature is thin. The Rivers State, Nigeria, study is among the few that focuses explicitly on hazard-control needs among roadside welders (Ekenedo & Precious, 2016). The Dar es Salaam small-scale industries study, which includes welders among other informal trades, describes working conditions on and adjacent to public streets (Msamanga et al., 2004).

2.2 Welding Fume Hazards: Exposure and Composition

Welding fumes are not a single uniform hazard. The fume generated by welding is a complex mixture of fine metallic particulates and gases whose composition varies with the welding process, the base metal, the electrode or filler material, and the presence of surface coatings. In informal settings, where process control is minimal and materials may be mixed or recycled, the fume mixture is particularly difficult to predict.

The strongest direct evidence on fume composition from informal-sector welding comes from a study in Bandung City, Indonesia. Nastiti et al. (2012) collected breathing-zone air samples from 30 mild steel manual metal arc welders and 17 non-welders in small-scale informal workshops. Using instrumental neutron activation analysis, the study identified a fume profile that included iron, manganese, chromium, zinc, cobalt, and other trace elements, in addition to elevated respirable particulate matter. Crucially, the authors framed informal small-scale welding not only as a worker-level occupational hazard but as a measurable contributor to urban air pollution; a framing directly relevant to sidewalk and roadside settings where bystanders may be exposed.

The Nigerian study by Fikayo et al. (2023) adds direct monitoring data from a small-scale arc welding context in Ikenne, Nigeria. Among 142 welders and 142 age-matched controls, workplace air monitoring identified that chromium, nickel, manganese, carbon monoxide, and nitrogen dioxide each exceeded their recommended exposure values. Spirometry results indicated that welders had significantly lower Forced Expiratory Volume in One Second (FEV1) and FEV1/Forced Vital Capacity (FVC) ratios than controls, measurably reduced lung function, alongside a higher prevalence of respiratory symptoms including cough, phlegm, chest tightness, and breathlessness. This study is methodologically stronger than most in the reviewed set since it combines air monitoring results, biological outcome measurement (spirometry), and symptom assessment.

The Ethiopian study by Badima et al. (2024) provides another direct exposure measurement in a small-scale enterprise context. Among 226 welders and 217 controls in Akaki Kality Sub-City, Addis Ababa, the study measured welding fume exposure directly and identified that welders had a significantly higher prevalence of chronic respiratory symptoms than controls. Although the specific fume concentrations are not detailed in the source summary, the study is notable for combining direct exposure assessment with respiratory health outcomes in a setting closely aligned with the informal enterprises of concern to this review.

Beyond respiratory hazards, manganese in welding fume has received sustained research attention because of its potential to cause neurological impairment at relatively low exposure levels. Mehrifar et al. (2020) compared 38 male welders exposed to shielded metal arc welding fumes with 27 administrative controls in an Iranian metal-construction setting, using breathing-zone air monitoring, blood manganese measurement, and standardized neurobehavioral and neurocognitive tests. The study identified that manganese inhalation was associated with neurobehavioral and neurocognitive impairment among exposed welders. Bowler et al. (2007) similarly reported dose-effect relationships between manganese exposure and neurological, neuropsychological, and pulmonary outcomes among confined-space bridge welders, with measurable effects at levels encountered in occupational welding.

A literature review by Flynn and Susi (2009) synthesized the broader manganese-and-neurology evidence base, noting that manganese exposure from welding can cause manganism — a clinical neurological syndrome — and identifying numerous probable or possible cases of occupational manganism among welding-exposed workers. The authors also noted that the specific link between welding and Parkinson's disease remains epidemiologically contested. Nonetheless, the neurological dimension of welding-fume hazards extends the risk picture well beyond the acute irritation or respiratory symptoms that are most visible in informal settings.

Biomonitoring studies further extend the exposure picture by examining internal metal burden rather than air concentrations alone. Ellingsen et al. (2006) conducted a cross-sectional study comparing 96 welders with 96 controls and also examined 27 former welders diagnosed with manganism, combining workplace air measurements with whole-blood and urine element analysis. The study reported measurable manganese and iron concentrations in the breathing zones of welders and documented corresponding elevations in biological markers. A separate biomonitoring study identified that whole-blood iron, manganese, chromium, and lead were all higher in welders than in non-welders in an automotive-parts manufacturing setting (Romashov & Olkhovskiy, 2015). Taken together, these studies indicate that airborne fume exposure can translate into measurable internal metal burden in welding workers, though the clinical significance varies by metal, exposure level, and individual susceptibility.

2.3 Injury and Morbidity Among Informal Welders

The injury burden documented in the reviewed literature is high and consistent across settings. In the most striking quantitative finding, a cross-sectional study of 327 welders in small-scale metal workshops in Wakiso District, Uganda, reported that 87.8% of respondents had experienced a self-reported occupational injury. Cuts and burns were reported by 84.3% of injured workers, and eye injuries by 62.7% (Itiakorit et al., 2021). These figures place informal welding among the most injury-prone occupations studied in the literature. Importantly, the study identified structural predictors of injury: casual labor status, informal training, and longer working hours all significantly increased injury likelihood, while greater work experience was protective.

In southern India, a cross-sectional study compared 150 welders in unorganized welding units in Vellore with 150 non-welder controls. Welders had significantly higher rates of skin burns, redness, hyperpigmentation, itching, eye injuries, and sensorineural hearing loss than controls. The study also reported hypertension in 12.6% of welders compared with 0.7% of non-welders — a striking differential that, while requiring cautious interpretation in a cross-sectional design, points to possible cardiovascular effects associated with chronic welding exposure. Critically, none of the welders in that study reportedly used appropriate PPE (Alexander et al., 2016).

The picture from Tanzania and South Africa reinforces these findings. In a cross-sectional study of 219 adult informal welders across 70 welding sites in Mwanza City, Tanzania, 11.4% reported on-site government inspection,37% had adequate knowledge of occupational safety practices, and an extraordinary 93.6% showed poor adherence to OSH guidelines (Magoha et al., 2024). In Pretoria West, South Africa, a mixed-methods study of 40 informal welders identified that workers operated in hazardous environments with limited regulatory oversight, were often unaware of relevant safety legislation, and used PPE inconsistently (Mashimbyi et al., 2025).

The Dar es Salaam study, which examined 310 male workers across multiple informal trades including welding, reported very high self-reported exposure to hazardous agents — dust, fumes, noise, and sunlight — and low rates of PPE use (Msamanga et al., 2004). The Nepal qualitative study adds depth to these statistics by documenting the lived experience of informal welders: workers described eye burns, electrical shocks, and a pervasive sense of working without adequate institutional support or recourse (Koirala et al., 2025).

The pattern across studies is consistent. Informal welding is associated with high rates of acute injury (particularly eye and burn injuries), significant morbidity (respiratory, dermatological, auditory, and possibly cardiovascular), and a structural environment in which protection is weak, oversight is minimal, and workers bear the burden of hazardous conditions largely alone.

2.4 PPE, Training, and the Knowledge-Practice Gap

A persistent and cross-cutting theme in the informal welding literature is the gap between what workers know about protection and what they actually do. This gap is not reducible to ignorance, and it cannot be closed simply by providing information.

The evidence is clearest in the Ugandan PPE study by Nalugya et al. (2022), a cross-sectional assessment of 329 welders in small-scale metal workshops in Nansana Municipality. The study identified that 61.4% of welders had high PPE knowledge — meaning that a majority understood what protective equipment was available and why it mattered. Yet only 31.3% had a positive attitude toward PPE use, and 37.1% demonstrated good PPE-related practices in observed behavior. Formal training was associated with better knowledge, but knowledge did not reliably translate into consistent protective practice. The implication is direct: PPE programs focused only on awareness and education are unlikely to produce adequate and sustained protective behavior in informal settings.

The Tanzanian study by Magoha et al. (2024) reaches a similar structural conclusion. With 37% of workers demonstrating adequate knowledge and 93.6% showing poor adherence to OSH guidelines, the problem is not only individual non-compliance but a systemic absence of the conditions that make consistent safety practice possible — inspection, training reinforcement, accessible equipment, and organizational support. The South African and Indian studies reinforce this: in both Pretoria West and Vellore, limited regulatory oversight and poor PPE use co-occurred in ways that suggest they are not independent phenomena but mutually reinforcing features of informal work (Mashimbyi et al., 2025; Alexander et al., 2016).

The Ghanaian garage study by Adu et al. (2025) offers an encouraging counterpoint. It identified that eye PPE use was associated with fewer self-reported eye problems among welders. This is modest evidence as the study is cross-sectional and relies on self-report, but it suggests that even simple, available, and individually adoptable protective measures can reduce harm when actually used. The implication for intervention is that eye protection, which is relatively low-cost and individually deployable, may be one of the highest-leverage targets for practical improvement in informal welding settings.

2.5 Street and Roadside Welding as a Distinct Setting

Sidewalk, roadside, and garage-adjacent welding present a control problem that is qualitatively different from fixed indoor workshop welding. These operations occur in open, mobile, and public environments with little infrastructure, no fixed ventilation, weak separation from pedestrian flow, and limited capacity for engineering controls. The welder's "workplace" in these settings is defined by where they position or locate their equipment on a given day.

The Rivers State, Nigeria, study by Ekenedo and Precious (2016) is one of the few in the literature to focus directly on the hazard-control needs of roadside welders rather than simply documenting injuries or symptoms. The study found that roadside welders in Rivers East Senatorial District operated with weak access to hazard control resources and that feasible controls in their settings were constrained by the mobile and informal nature of the work. It is descriptive rather than experimental, but it establishes that roadside welding is a distinct subtype of informal welding that requires control strategies adapted to its specific constraints.

The Dar es Salaam study by Msamanga et al. (2004), covering informal trades including welding in an urban Tanzanian setting, provides contextual evidence for the types of hazards present in public-space work. WHWB members have directly observed welding on a sidewalk in Dar es Salaam, affirming that street-level welding is not a theoretical construct but an observable practice in settings where the organization seeks to intervene.

In public-space settings, the boundaries of who is "at risk" are not confined to the welder. The Bandung study by Nastiti et al. (2012) explicitly frames small-scale informal welding as a source of urban air pollution, suggesting that fume emissions affect surrounding communities, not just the worker at the arc. OSHA guidance, written for regulated workplaces, requires that adjacent persons be protected from welding rays by noncombustible or flameproof screens or shields — an obligation that, if applied to public-space welding, would imply a duty of protection toward nearby vendors, pedestrians, and residents (OSHA, n.d.). This regulatory logic does not automatically apply in informal settings, but it underscores why street welding is appropriately framed as a community health issue and not only a worker health issue.

2.6 Evidence Gaps and Limitations of the Literature

The reviewed literature provides sufficient evidence to establish that informal sector welding is a high-hazard occupation with a large and under protected workforce. However, it has important limitations that affect the strength of specific recommendations.

Direct exposure monitoring studies are considerably fewer than symptom surveys, PPE assessments, and injury prevalence studies. Of the reviewed sources, only a small number — the Bandung, Nigerian, and Ethiopian studies — measured airborne contaminants directly in informal or small-scale settings. Studies combining air monitoring with biological outcome measurement (such as spirometry) are rarer still.

Evidence specific to roadside or sidewalk welding is particularly sparse. The Rivers State study is directly focused on roadside welders but does not include exposure monitoring.

Most other studies are set in fixed or semi-fixed informal workshops rather than truly mobile, public-space operations. The effectiveness of specific control measures has not been evaluated in roadside conditions.

Most studies are cross-sectional in design, which limits causal inference and cannot capture long-term health trajectories. Several studies rely on self-reported injury and PPE use, which are subject to recall and social desirability bias. One biomonitoring study (Bainin et al., 2022, Ghana) appeared internally inconsistent in its reported lead findings, suggesting that individual studies should be read carefully rather than accepted at face value.

These gaps do not undermine the core finding: that informal welding workers face serious, measurable, and largely unaddressed hazards, but they do require that some recommendations be framed as evidence-informed inference rather than as proven best practice in roadside environments.

3. Recommendations

3.1 Practical Control Strategies for Highly Informal Settings

The standard hierarchy of controls — elimination, substitution, engineering controls, administrative controls, and PPE — provides a useful framework, but it cannot be applied mechanically to sidewalk and roadside welding. The most effective engineering control on paper (local exhaust ventilation, LEV) may be among the least feasible first-line options in a public-space setting. LEV systems require a fixed installation or a carefully positioned mobile unit, consistent worker cooperation in hood placement, and a power source. In outdoor welding, LEV effectiveness is further compromised since ambient airflow disperses fumes before they can be captured. The UK Health and Safety Executive (HSE) explicitly states that LEV cannot be relied upon to effectively capture welding fume outdoors, and that outdoor welding requires suitable respiratory protective equipment (RPE) instead (HSE, n.d.).

Acknowledging these constraints does not mean that engineering controls are irrelevant. The Zaidi et al. (2004) study from India demonstrated that a low-cost, locally manufactured portable LEV unit could meaningfully reduce welder exposure in small workshop settings — suggesting that adapted engineering solutions are possible where a fixed work location exists. CPWR evaluations of commercially available portable LEV systems (Meeker, 2014) similarly demonstrate that source capture can be effective under tested conditions. These options deserve attention in semi-fixed informal workshops, even if they are not the first-line solution for truly mobile sidewalk operations.

For roadside and sidewalk settings, the most realistic near-term controls are those that are simple, low-cost, individually deployable, and compatible with mobile work. Based on the reviewed evidence and the guidance of OSHA and HSE, the following practical measures are most relevant:

- Work area positioning: Welders should choose the most open and well-ventilated location available within their immediate environment, avoiding semi-enclosed corners, doorways, and areas where fume can accumulate. Keeping active welding away from the densest areas of pedestrian traffic reduces exposure to bystanders and is consistent with the framing of street welding as a community hazard.

- Shields and curtains for arc protection: OSHA requires that adjacent persons be protected from welding rays by noncombustible or flameproof screens or shields, or by appropriate eye protection. HSE describes welding curtains and screens as practical measures for protecting passers-by and nearby workers from arc light. In a roadside setting, portable, low-cost screens or curtains — which need not be sophisticated — could help define a safer work perimeter and reduce arc flash exposure to bystanders. These should be clearly communicated as arc and spark controls, not as fume controls: they do not remove welding fume. OSHA also specifies that when screens are used, they must not seriously restrict ventilation (OSHA, n.d.).
- Eye and face protection: The Ghanaian study identified that eye PPE use was associated with fewer self-reported eye problems (Adu et al., 2025). Locally made or locally available welding shields and goggles represent the most accessible and individually deployable form of protection. Eye protection is arguably the single highest-leverage PPE target in informal welding because eye injuries are among the most common acute harms and because appropriate eye protection is feasible even in mobile settings.
- Respiratory protection: Where LEV is not feasible, RPE is the primary means of reducing inhaled fume. HSE explicitly recommends RPE for outdoor welding where LEV cannot work (HSE, n.d.). In informal settings, the challenge is not only selecting appropriate respirators but ensuring that workers can access, afford, maintain, and correctly use them. Half-face respirators with appropriate particulate filters (P100 class or equivalent) provide meaningful protection, but comfort, fit, and sustained availability are practical constraints.
- Minimizing combustibles and trip hazards: Roadside operations require organizing cords, materials, and combustibles to reduce the risk of electrical shock, fire, and physical injury — hazards that are compounded by the uncontrolled nature of public work environments.

3.2 A Community-Based Public Health Approach

Since informal street welding takes place in public space, and since fume emissions from small-scale welding are measurably a source of urban air pollution, the hazard is not confined to the welder alone (Nastiti et al., 2012). Nearby vendors, residents, and pedestrians are potentially exposed to arc radiation and fume. Under these conditions, a prevention strategy limited to individual workers — without engaging the surrounding community and relevant public institutions — is structurally incomplete.

A community-based public health campaign offers a complementary approach that is particularly suited to the informal street welding context. Such a campaign would not replace occupational health interventions but would extend their reach into the public space where the hazard actually occurs. The most useful version of this approach would emphasize:

- Practical risk communication for the local community: Clear, accessible messaging about the hazards of welding fume and arc flash to nearby residents, vendors, and pedestrians — and what simple steps (staying clear of active welding, avoiding prolonged proximity) can reduce bystander exposure.
- Visible demonstration of safer work practices: Short, repeated field demonstrations for welders on how to set up a safer temporary work area — including positioning, screening, and PPE use — are likely to be more effective than classroom-based instruction in informal settings. The knowledge-practice gap documented across the literature (Nalugya et al., 2022; Magoha et al., 2024) suggests that practical, visible, on-site modeling of safer behavior is a more effective educational strategy than awareness alone.
- Engagement of local public health departments and universities: Local public health authorities and universities represent institutional anchors for community-based campaigns. They can provide legitimacy, local knowledge, logistical support, and the capacity to conduct ongoing monitoring and evaluation. Several studies have noted the near-absence of government inspection in informal welding settings (Magoha et al., 2024; Itiakorit et al., 2021); engaging health departments in community-based surveillance is one realistic pathway toward greater institutional presence.
- Media and peer outreach: The Darasakazini Organization's work in Tanzania (described in Section 3.4 below) demonstrates that media sensitization — including radio and television outreach — can extend community awareness beyond the immediate intervention site. Community health workers and peer educators within welder networks offer a complementary channel.

This community-based recommendation is evidence-informed rather than directly proven in the informal welding literature. The reviewed studies do not include a formal evaluation of a community health campaign in a roadside welding setting. However, the structural logic that a hazard occurring in public space requires a public-space response, is well-supported by the evidence reviewed.

3.3 The Role of Occupational Health Professionals

The literature makes clear that informal welding workers operate in a space that formal occupational health has largely not reached. The evidence base documents weak inspection, limited training, inadequate monitoring, and no systematic exposure assessment in most of the settings reviewed. Occupational health professionals, including industrial hygienists, occupational physicians, and OH nurses, could make several concrete contributions:

- Exposure assessment in field conditions: Conduct breathing-zone and area air monitoring in roadside and informal workshop settings to characterize actual exposures and identify the highest-priority hazards in specific locations.

- Adapting low-cost control technologies: Design, test, and evaluate locally manufacturable or locally purchasable control technologies — including portable screens, locally made welding shields, and affordable respirators — for effectiveness and feasibility in highly informal conditions.
- Training development: Design brief, task-based training modules that can be delivered in the field, emphasizing practical protective behaviors rather than abstract regulatory knowledge.
- Partnership with local universities and NGOs: Support and build the capacity of local organizations — including those already working in this space — to sustain prevention activities beyond any single project.
- Evaluation: Design simple before-and-after assessments or observational studies to determine whether interventions actually reduce exposure, injury, and symptom burden over time.

3.4 Organizations Currently Working on This Issue

Two organizations deserve particular mention as active examples of on-the-ground occupational health work with informal welders in sub-Saharan Africa.

Workplace Health Without Borders (WHWB)

WHWB is the commissioning organization for this report and is itself a key actor in this space. The organization's mission: engaging industrial hygienists and other OH professionals to address hazards in under-served areas, positions them well to support practical interventions in informal welding settings. This report is intended to inform WHWB's strategic thinking about whether and how to develop focused initiatives in this area.

Darasakazini Organization (Tanzania)

A particularly relevant local actor is the Darasakazini Organization, an NGO registered in Tanzania (registration number ooNGO/R/3133) and located in Bunda District, Mara Region. Founded on April 22, 2022, by Executive Director Mzee Ahmed, the organization's mission is to promote and raise awareness of occupational safety and health issues and to improve working conditions in informal sectors. As of its most recent reporting, Darasakazini had reached more than 200 workers through OSH training, workplace risk assessments, environmental monitoring, media and community sensitization campaigns, and distribution of PPE including respirators, face shields, and gloves.

Directly relevant to the subject of this report, Darasakazini implemented a dedicated welding fumes project in 2023 at the Dar es Salaam Small Industries Cooperative Society (DASICO) in Kariakoo Gerezani, Dar es Salaam. The project, funded at USD 3,500 by the American Industrial Hygiene Association (AIHA), involved 30 small-scale welders and 11 workshop leaders. It included training on welding fume hazards and control measures, environmental monitoring of gas concentrations and particulate matter at 11 welding locations, distribution of face shields and double-filter respirators, and media sensitization through Global TV and Radio. The project reportedly improved knowledge and risk perception among welders and encouraged safer workplace practices.

The Darasakazini Organization represents a model of locally-led, community-embedded occupational health intervention in exactly the kind of setting that this review addresses. Its existing relationships with both local communities and international partners — including WHWB-UK and AIHA — make it a natural potential collaborator for any future WHWB initiatives in Tanzania. The organization's work also demonstrates that community-based media outreach (radio and television) is a practically feasible component of a public health campaign for informal welders, extending awareness beyond direct program beneficiaries.

4. Internet Resources for Further Research

The following table provides online resources that WHWB and its members can consult for further independent research on the topics covered in this report.

Resource / Title	Organization / Source	Type	Relevance to Topic
Controlling the Risks from Welding	Health and Safety Executive (HSE, UK)	Guidance page	Comprehensive practical guidance on welding fume control, LEV, RPE, and screens/curtains; explicitly addresses outdoor welding limitations.
General Requirements for Welding, Cutting, and Brazing (29 CFR 1910.252)	OSHA (US)	Regulatory guidance	Covers screening requirements to protect persons adjacent to welding; relevant to public-space and community exposure questions.
Transparent Welding Curtains Interpretation	OSHA (US)	Interpretation letter	Clarifies the role and limitations of welding curtains and screens, including requirements that they not restrict ventilation.
Women and Men in the	International Labour Organization (ILO)	Statistical report	Provides global and regional data on the

Resource / Title	Organization / Source	Type	Relevance to Topic
Informal Economy: A Statistical Picture			size of the informal economy, including the 60–90% informal employment figures referenced in this report.
CPWR Welding Fume LEV Evaluation Reports (Lincoln Electric X-Tractor; Eurovac II)	CPWR – Center for Construction Research and Training	Technical field-evaluation reports	Evaluations of commercially available portable LEV systems; useful for understanding the performance and limitations of source-capture controls in field conditions.
AIHA International Affairs — Grant Programs	American Industrial Hygiene Association (AIHA)	Organization/funding page	Information on AIHA's international grant programs, which funded the Darasakazini welding fumes project in Tanzania; relevant for identifying funding mechanisms.
Darasakazini Organization (Tanzania)	Darasakazini Organization / Mzee Ahmed, Executive Director (ahmedmzee07@gmail.com)	NGO — local partner organization	Tanzanian NGO with direct experience conducting welding fume interventions, environmental monitoring, and community health campaigns with informal welders in Dar es Salaam.
WHO Global Plan of Action on Workers' Health 2008–2017 (and successor frameworks)	World Health Organization (WHO)	Policy document	International policy framework for occupational health in underserved settings; useful for framing advocacy or partnership discussions.

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