BRIEF

Health Impact Assessment of a Small-Scale Mining and Milling Operation in Bubi District, Zimbabwe[1]

August 2025

Key Messages

Health Impact Assessment (HIA) is a vital tool to integrate health, environment, and mining policies for sustainable development. This HIA examined the Small-Scale Mining and the Milling Operation in Bubi District, Zimbabwe. Artisanal and small-scale mining (ASM) and custom milling in Bubi District expose miners and communities to high risks of accidents, respiratory diseases, and chemical poisoning. An estimated 35% of miners suffer accidents, while 19% develop silicosis and a tuberculosis prevalence of up to 40%. Poor mining practices and management of custom milling effluent of mercury, cyanide, and heavy metals threaten the Mbembesi River, a water source for the downstream community and domestic animals. By examining potential health impacts, the HIA identifies options to maximize health benefits and prevent health risks.

The projected health impacts found in the HIA and outlined in this brief raised a number of recommendations, including for: frequent inspection of mining sites and stronger regulatory enforcement; safer technologies; awareness campaigns to mitigate potential health impacts, as reinforced by the Public Health Act, Environmental Management Act, and Mines and Minerals Act; enclosed milling systems and automated controls to minimize dust and noise exposure for workers; and stricter requirements for waste discharge.

By systematically evaluating the potential health effects of mining projects and related environmental changes, HIA helps ensure that decision-making protects public health, promotes environmental stewardship, and supports economic growth in a balanced and responsible manner. A policy requiring Environmental Impact Assessments (EIAs) and HIAs should be applied and enforced in all ASM operations as a condition for licensing.

The policy context

ASM is a critical livelihood source in Zimbabwe, contributing significantly to gold production. However, it is often poorly regulated, exposing workers and surrounding communities to serious health hazards. The Gold More Custom Milling Plant, a small-scale gold mining and custom milling operation located in Bubi District, Matabeleland North Province has been operational since 2018. It requires annual renewal of its Custom Milling Certificate, contingent upon compliance with the Zimbabwe Public Health Act 2018, the Environmental Management Act, and other mining-specific health and safety regulations. This HIA assesses the health risks associated with the mining and milling activities, especially as the annual renewal deadline approaches on December 31, 2025.

Artisanal small scale mining Source: UNDP, 2024

[1] This policy brief was produced by Lyman Mlambo, University of Zimbabwe, Paul Matshona, Zimbabwe School of Mines, Pemberai Sithole, Gwanda State University, Perez Livias Moyo, National University of Science and Technology, Zimbabwe, with review from Dr Carlos Dora, and technical input from Dr Rene Loewenson, Training and Research Support Centre (TARSC) in EQUINET and copy edit by V Kernohan. It was sponsored, in part, by the *African Extractivism and the Green Transition* (AEGT) research partnership and by TARSC in the Regional Network for Equity in Health in East and Southern Africa (EQUINET. www.equinetafrica.org).

AEGT is funded by a Partnership Grant (File # 895-2023-1011) awarded by the Social Sciences and Humanities Research Council of Canada. For more information about AEGT's research and knowledge mobilization initiatives, please visit https://www.aegt.ca/.

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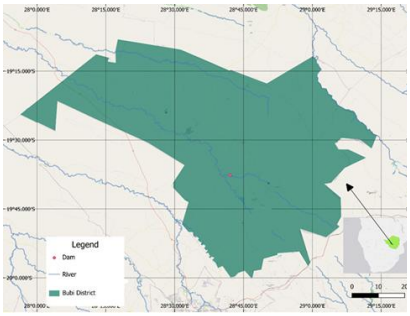
The Health Impact Assessment

HIA identifies potential positive and negative health impacts to take into account in policy and planning, maximising benefits, preventing costly risks and protecting vulnerable people. This concurrent HIA assessed risks and impacts as the project operates, enabling early identification of health risks and supporting timely policy and management interventions.

The HIA was implemented during a regional EQUINET training programme. It used an internationally recognised five-stage method: This included screening to identify feasibility, the causal pathways and focus of the HIA; scoping to identify the sources and forms of evidence; a profiling and assessment stage to identify the direction, magnitude, severity and likelihood of health impacts, and on this basis the significance of the health impacts assessed; and setting of recommendations for significant impacts; and steps to report and communicate the HIA and propose areas for monitoring the impacts and implementation of the recommendations.

From the screening and scoping stages, the HIA focused on four Elements of the Gold More's Custom mining and milling operation in Bubi district (see adjacent map):

a. Mining methods and safety.
b. Milling processes and standards.
c. Waste discharge and management, and
d. Transportation activities.



Bubi district, Zimbabwe. Source: Paul Matshona, 2025

As a desk-based assessment, the HIA triangulated data from academic literature, government reports, reports from the mining sector, non-government organisations and media. Though specific quantitative data for Bubi was limited, the analysis extrapolated evidence from studies on similar ASM operations across Zimbabwe. While the reliance on secondary data was a limitation, careful triangulation and peer review of evidence gives reasonable confidence in the findings.

A causal pathway was developed that linked the four key elements assessed with social determinants of health (SDH), viz: the factors affecting health and the routes of exposure to them and health outcomes. The causal links were derived from national and international evidence.

The causal pathway, shown adjacent, informed the HIA analysis.

The profiling and assessment stage explored the potential impact of the activities on the determinants and health outcomes for the four key areas assessed.

For example, inadequate dust control leads to poor working conditions (SDH), resulting in respiratory illnesses such as silicosis (health outcome) in mill workers.

Key element	Key SDH	Exposure/ Risk Pathways	Health Outcomes	Who is affected
Mining methods and safety,	Unsafe mining practices, health and sanitation regulations, mining management and safety regulations	Occupational hazards including accidents, injuries, dust, (silica, PM), noise, toxic chemicals; social hazards from increased employment income including alcohol use, interpersonal and sexual violence, social tensions.	Respiratory diseases (silicosis, pneumoconiosis), hearing loss, musculoskeletal disorders, occupational injuries, violence-related injuries, mental health issues, increased STDs	Mine workers, Nearby and downstream communities vulnerable groups (women children and the elderly)
Milling process and standards	Inadequate dust and chemical control, poor hygiene	Air-borne particulates, mercury and cyanide; noise pollution; infectious disease risk; and social hazards indicated under element 1	Respiratory illness, chemical poisoning, hearing loss, skin diseases, infectious diseases; violence-related injuries, mental health issues, increased STDs	Mill workers, nearby residents, downstream communities, vulnerable groups (women, children and the elderly)
Waste management and tailings	Environmental regulations, improper disposal, tailing dam failures, contamination of soil, surface and underground water	Heavy metals, chemicals, vector breeding sites, structural hazards	Chronic heavy metal poisoning, gastrointestinal diseases, vector-borne diseases (malaria, dengue), injuries	Mining communities, waste handlers, downstream communities, ecosystem
Transportation activities	PPE availability, insecure storage of chemicals in transit, condition of roads, unsafe driving practices	Airborne particulates, mercury, cyanide, diesel/petrol spills, noise pollution, infectious disease risk	Respiratory diseases, chemical poisoning, hearing loss, skin diseases, infectious diseases, acute injuries	Transport workers, other mine workers, residents, downstream communities

The causal pathway linking the elements to health impacts developed in the HIA

Findings of the HIA on health impacts

The HIA pointed to impacts for the pathways for each of the four areas of health impact assessed. It found significant negative health impacts across all operational elements. The most severe and significant impacts are summarized below.

The mining pit, Bubi Source: Mukasiri Sibanda, 2019

Firstly, in relation to **mining methods and safety:** Over 200 miners are involved in using machinery and equipment to excavate bulk materials such as rock boulders and soils at the surface and underground. This involves also the use of explosives to loosen the material for excavation. The health impacts include increased morbidity and mortality due to accidents, injuries, and occupational diseases, with ASM studies indicating a 35% accident prevalence, 19% silicosis, and 40% tuberculosis prevalence. Unsafe mining practices drive high injury and disease rates, with 237 fatalities in 2023, representing a 96% increase over 2021. With increased production demands, the severity and likelihood of injury make this a high priority area of impact.

The milling process, Bubi Source: Mining Zimbabwe, 2021

Secondly, in relation to the **milling processes and standards:** The process involves crushing, grinding and concentration of the mined material to extract the gold. Ten workers use machinery and equipment, and apply chemicals such as mercury and cyanide. The health risks from these processes include mercury and cyanide poisoning of workers and communities, respiratory illnesses from dust; and hearing loss from noise. Given the inadequate dust control and poor hygiene at the milling site, the 10 mill workers and 74 000 people in the Membesi river basin community are affected by these medium to highly significant impacts.

Thirdly, the **waste discharge and management** involve disposal of waste from mining and milling processes in tailing facilities. This waste includes waste rocks, heavy metals, discharge from mills and water laden with heavy metals and chemicals. Poor waste management leads to contamination of the Mbembesi river threatening the health of 74 000 people, including due to heavy metal poisoning, cholera, malaria and diarrhoea. These health impacts are highly significant, given their long-term effects and the frequency of the environmental causes in the sector.

Finally, in **transportation activities:** Drivers and security assistants transport people, ore, explosives, chemicals and other materials between the mining and milling sites and external markets. The health risks include chemical spills, accidents, and air pollution. While these risks have a lower likelihood, if the incidents do occur the health impacts are severe.

The HIA indicates that the most affected groups are miners, mill workers, local and downstream communities and vulnerable groups, including women, children, and elderly people.

Recommendations from the HIA

Based on the findings, various actions are recommended to mitigate the most significant health impacts, improve compliance with the Public Health Act and to address health in the mining, milling, waste management and transportation activities. Implementing the recommendations will enhance the possibility of license renewal.

As high priority, immediate actions, the HIA recommends that:

- The Ministry of Mines and Mining Development (MMMD) conducts immediate, frequent, and unannounced inspections of all mining sites supplying the mill; enforces the mandatory use of personal protective equipment (PPE) and penalizes non-compliance to reduce accidents and injuries.

- The mill operator, under the immediate guidance and monitoring of the MMMD's Metallurgy Department, installs enclosed milling systems and automated controls to minimize dust and noise exposure for workers.
- The Ministry of Health and Child Care, in partnership with Environment Management Agency (EMA) and non-state organisations launches health promotion campaigns for miners on the risks and prevention of dust inhalation, the importance of sanitation to prevent cholera, and the risks of harmful sexual behaviours.

As medium-to-long term actions, the HIA recommends that:

- The MMMD, EMA, and Ministry of Water (via Zimbabwe National Water) prescribes and enforces stricter requirements for waste discharge; including implementing tailings dam detoxification protocols and establishing a programme for regular, public monitoring of water quality in the Mbembesi River.
- The government (led by the MMMD and EMA) develops and enforces a policy requiring Environmental Impact Assessments (EIAs) and HIAs for all ASM operations as a condition for licensing, promoting a holistic, preventative approach.
- The government through Parliament, and with MMMD and EMA, integrates and strengthens compliance with HIA in formal ASM frameworks.

Implementation of these recommendations will have significant positive effects beyond the Bubi operations. Enforcing safety and environmental standards can set a precedent for the entire ASM sector in Zimbabwe. Successful awareness campaigns can improve general health literacy in mining communities. Integrating HIA into the licensing process can institutionalize health considerations in economic development, aligning with national goals and with the UN Sustainable Development Goals (SDGs 3, 6, and 11).

The HIA proposes monitoring of the recommendations and key areas of health impact, including silicosis prevalence among miners (>10% triggers action), mercury levels in the Mbembesi River (>0.001 mg/L WHO limit triggers public alerts and mill suspension), and the quarterly rate of mining accidents (>25% triggers safety retraining and fines). Local communities and advocacy groups should have the role and power to report violations and participate in water quality monitoring to ensure transparency.

References

1. Chanda-Kapata P. (2020). Public Health and Mining in East and Southern Africa. EQUINET, Harare
2. Chirisa I, Mudzonga E. (2022). Accidents, injuries, and safety in ASM in Zimbabwe. Delve Database. Online at https://www.delvedatabase.org/resources/accidents-injuries-and-safety-among-artisanal-and-small-scale-gold-miners-in-zimbabwe
3. Loewenson R, Simpson S, Dora C et al. (2025). EQUINET Training Manual: Capacity building on Health Impact Assessment. 2nd edition, EQUINET, Harare
4. Matambo R. (2025) Artisanal mining in Zimbabwe: A complex narrative of balancing economic gains and social strife. ACCORD. Online at: https://www.accord.org.za/conflict-trends/artisanal-mining-in-zimbabwe-a-complex-narrative-of-balancing-economic-gains-and-social-strife/
5. Médecins Sans Frontières (2024). 'Bringing Healthcare to Artisanal Miners in Zimbabwe'. MSF. Online at: https://www.msf.org/bringing-healthcare-artisanal-miners-zimbabwe
6. Mining Zimbabwe. (2021). Occupational Health and Safety in the ASM Sector. Online at: https://miningzimbabwe.com/occupational-health-and-safety-in-the-asm-sector/
7. Moyo D, Zishiri C, Ncube R, et al. (2021) Tuberculosis and Silicosis Burden in Artisanal and Small-Scale Gold Miners in a Large Occupational Health Outreach Programme in Zimbabwe. Int Jo Env Res and Public Health. 20;18(21):11031. doi: 10.3390/ijerph182111031. PMID: 34769551; PMCID: PMC8583466.
8. Moyo D, Kavenga F, Ncube RT, et al. (2023). Knowledge, Attitudes, and Practices of Artisanal and Small-Scale Miners regarding Tuberculosis, Human Immunodeficiency Virus, and Silicosis in Zimbabwe. Int Jo Env Res and Public Health, 20;23:7116. https://doi.org/10.3390/ijerph20237116
9. Ncube-Phiri S, Ncube A, Mucherera B, Ncube M. (2015) 'Artisanal small-scale mining: Potential ecological disaster in Mzingwane District, Zimbabwe', Jàmbá: Jo Disaster Risk Studies, 7:1, doi: 10.4102/jamba.v7i1.158
10. Singo J, Moyo D, Isunju JB, Bose-O'Reilly S,et al. (2022). Health and Safety Risk Mitigation among Artisanal and Small-Scale Gold Miners in Zimbabwe. Int Jo Env Res and Public Health, 19;21:14352. https://doi.org/10.3390/ijerph192114352
11. WHO (2023). Health Impact Assessment tools and methods. WHO, Geneva
12. Zinyuke R. (2025). Cholera stalks artisanal miners along Mazowe River. The Herald. July 5. Online at https://www.heraldonline.co.zw/cholera-stalks-artisanal-miners-along-mazowe-river/