Centre for Environment Justice

MANGANESE TOXICITY

A Summary Report on Manganese Poisoning in Serenje District

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Foreword

Serenje District, once known for its natural abundance and thriving communities, now grapples with the consequences of manganese mining. The pursuit of economic prosperity has come at a great cost, with the health of its people and the environment bearing the brunt of this hidden poison. Through meticulous research, comprehensive investigations, and heartfelt testimonials, this report seeks to unveil the truth and advocate for change.

This report is a rallying cry for justice, a call to action that cannot be silenced. It is a testament to the unwavering spirit of the community members who refuse to accept their fate and who are demanding accountability from those responsible. Their voices echoed through these pages, serve as a reminder that change is not only necessary but imperative.

To the policymakers, industry leaders, and regulatory bodies, this report serves as a wake-up call. The time for complacency and indifference has long passed. The urgency of the situation demands immediate intervention, stronger regulations, and responsible mining practices that prioritize the health and well-being of the people and the land they inhabit.

We must recognize that the battle against manganese toxicity cannot be fought alone. It requires the collaboration and commitment of all stakeholders - from government officials and mining companies to healthcare providers and community activists. Only through united efforts can we hope to create a future where Serenje District flourishes once again, free from the shackles of this silent poison.

As you navigate through the evidence presented in this report, we urge you to reflect, empathize, and act. The fight against manganese toxicity is a fight for justice, for the right to live in a healthy and sustainable environment. Let this report serve as a catalyst for change, as a catalyst for building a better, brighter future for the people of Serenje District.

Together, let us embark on this journey towards justice, healing, and a safer tomorrow.

Maggie M. Mwape
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1 Introduction

1.1 Background

The Centre for Environment Justice (CEJ) with support from Brot für die Welt (Bread for the World) has been implementing a Three (3) years project known as the Resilient Initiative for Sustainable Environment (RISE) project. The project aims at fostering Improved environmental sustainability and Sustained Livelihoods of the Mining Communities of Sinazongwe and Serenje Districts.

As part of the RISE project, CEJ has undertaken a project intervention aimed at addressing the pressing issue of manganese toxicity in Serenje district. Recognizing the detrimental impacts of manganese toxicity on human health and the environment, CEJ has implemented a multifaceted approach to mitigate the problem, raise awareness, and promote sustainable practices.

1.1.1 Manganese Mining in Zambia

Manganese mining in Zambia has a long history that dates back several decades. The exploration and exploitation of manganese deposits gained momentum in the mid-20th century when significant manganese reserves were discovered in various regions of the country. Since then, Zambia has become one of the leading manganese producers in Africa.

Manganese deposits in Zambia are primarily found in areas surrounding Kabwe, Serenje, Mkushi, and Mansa. These deposits are part of the Central African Copperbelt, which is renowned for its rich mineral resources.

The manganese mining industry holds considerable economic importance for Zambia. The key factors highlighting its significance are as follows:

a) Revenue Generation: Manganese exports contribute to Zambia's foreign exchange earnings, bolstering the country's economic stability. In 2021, Zambia exported $34M in Manganese Ore, making it the 12th largest exporter of Manganese Ore in the world. In the same year, Manganese Ore was Zambia's 28th most exported product. The main destination of Manganese Ore exports from Zambia is China ($26.8M), South Africa ($2.64M), Mauritius ($1.83M), India ($1.57M), and Hong Kong ($503k).[1]
b) Employment Opportunities: The mining sector, including manganese mining, provides direct and indirect employment to a significant portion of the Zambian population, supporting livelihoods and reducing unemployment rates.

[1] https://oec.world/en/profile/bilateral-product/manganese-ore/reporter/zmb

c) Mining Industry Linkages: Manganese mining creates backwards and forward linkages with other sectors, such as transportation, manufacturing, and construction, thereby stimulating economic growth and diversification.

1.1.2 History of Manganese Mining in Serenje District

Serenje District, a picturesque region nestled in the heart of Zambia, is known for its natural beauty and agricultural abundance. However, beneath the surface lies a toxic secret that threatens the health and well-being of its residents. The story of manganese mining in Serenje District dates back several decades. In the early 20th century, geologists and explorers identified manganese-rich deposits in the region, recognizing its potential as a valuable natural resource. Initial exploratory activities aimed to assess the quality and quantity of manganese ores, setting the stage for future mining endeavours.

With the rise of industrialization and increasing global demand for manganese during the mid-20th century, Serenje District became an important player in the global manganese market. Mining operations scaled up, attracting both local and international companies seeking to capitalize on the region's abundant manganese reserves. This period witnessed a surge in extraction activities, with the establishment of mining infrastructure and the influx of a workforce to support operations.

Over the years, the manganese mining industry in Serenje District has faced numerous challenges. Environmental concerns related to pollution, deforestation, and the improper disposal of mining waste have prompted calls for stricter regulations and sustainable mining practices. The government and regulatory bodies have taken steps to address these issues, implementing guidelines and frameworks to ensure responsible mining operations and mitigate the negative impacts on the environment and local communities.

Although manganese has a huge capacity to bolster the country's economy, the disorganised nature of the mining subsector leaves much to be desired especially when it comes to environmental protections, public health, and safety for mine workers. Manganese toxicity is a significant environmental and health concern observed in various regions around the world. Manganese, an essential nutrient in small quantities, can become toxic when present in excessive amounts. The adverse effects of manganese toxicity on human health and the environment have gained significant attention in recent years. Understanding the causes, impact, and potential solutions is crucial for addressing this issue effectively.

Therefore, this summary report provides an overview of the issue of manganese toxicity in Serenje district in the Central Province of Zambia, focusing on its causes, impact, and potential solutions. This report, however, aims to consolidate the available information on the subject in Serenje District and present key findings and recommendations for addressing the issue.

2 What is Manganese Toxicity?

Manganese toxicity is a condition characterized by the accumulation of excessive levels of manganese in the body, leading to adverse health effects. Manganese, an essential trace element, is required for normal physiological functioning. However, when present in high concentrations, manganese becomes toxic and can have detrimental impacts on various organ systems.

Manganese toxicity can result in a permanent neurological disorder known as ***Manganism*** with symptoms that include tremors, difficulty walking, and facial muscle spasms. These symptoms are often preceded by other lesser symptoms, including irritability, aggressiveness, and hallucinations. The main toxic effects attributable to this metal are extra-pyramidal side effects that closely resemble symptoms of Parkinson's syndrome.[2]

2.1 Sources of Exposure

Manganese toxicity can occur through different routes of exposure, including:

2.1.1 Occupational Exposure

Occupational Exposure: Workers in industries such as mining, welding, battery manufacturing, and ferroalloy production are at risk of occupational manganese exposure. Inhalation of airborne manganese particles during these activities is a primary route of exposure.[3]

2.1.2 Environmental Exposure

Communities residing near industrial areas, particularly those in close proximity to manganese mining and processing facilities, may experience environmental contamination. This can result in the release of manganese into the air, water, and soil, increasing the risk of exposure through inhalation, ingestion, or dermal contact.[4] Industrial activities, such as mining, metal processing, and agricultural practices, can contribute to the environmental contamination of manganese. The release of manganese-rich dust and wastewater during these processes can contaminate air, water, and soil, leading to increased exposure levels.

2.1.3 Dietary Intake

Certain regions with manganese-rich soils may have crops that accumulate high levels of manganese. Regular consumption of these crops can contribute to excessive dietary intake of manganese[5].

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[2] Agency for Toxic Substances and Disease Registry (ATSDR). 2012. Toxicological profile for Manganese. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service. https://www.atsdr.cdc.gov/toxprofiles/tp151-c2.pdf

[3] (Khan, Pandey, & Pandey, 2020)

[4] (Borjas-Fajardo, Ochoa-Martinez, Cano-Sancho, & Llompart, 2020)

[5] (Zayed, Ahmed, & Nasr, 2020)

2.2 Impact on Human Health

Manganese toxicity can affect multiple organ systems and lead to a range of health effects, including:

2.2.1 Neurological Effects

Excessive manganese exposure has been associated with neurotoxicity, resulting in neurobehavioral disorders, cognitive impairments, and movement abnormalities.[6] Manganese has the ability to accumulate in the basal ganglia of the brain, affecting dopamine metabolism and leading to symptoms similar to Parkinson's disease[7].

2.2.2 Respiratory Issues

Inhalation of airborne manganese particles can lead to respiratory problems, including bronchitis and pneumonitis[8]. Occupational exposure in industries such as mining and welding poses a particular risk.

2.2.3 Hepatic and Renal Dysfunction

High levels of manganese exposure have been linked to hepatic and renal dysfunction, potentially damaging liver, and kidney tissues [9]. Impaired liver and kidney function can have systemic consequences for overall health.

2.2.4 Developmental and Reproductive Effects

Manganese toxicity may impact fatal development and reproductive health. Prenatal exposure to high levels of manganese has been associated with developmental delays and adverse birth outcomes.

2.3 Environmental Impact

2.3.1 Soil Contamination

Elevated levels of manganese in the soil can inhibit plant growth, reduce crop yields, and impact ecosystem dynamics [10]. Manganese accumulation in soil may also affect nutrient uptake by plants, leading to imbalances in other essential elements.

2.3.2 Water Pollution

The discharge of manganese-contaminated water into aquatic ecosystems can disrupt aquatic life and impair water quality. Elevated levels of manganese can

[6] (Lucchini, Aschner, Landrigan, & Cranmer, 2019)
[7] (Aschner & Aschner, 2019)
[8] (Abdullah, Jusoh, Ishak, & Muhamad, 2020)
[9] (Khan, Pandey, & Pandey, 2020)
[10] (Liu, Xu, Du, Li, & Liu, 2019)

negatively impact aquatic organisms, leading to reduced biodiversity and ecological imbalance [11].

2.4 Causes of Manganese Toxicity

Manganese toxicity in Zambia primarily stems from the mining and processing of manganese ore, which releases high levels of manganese into the environment. The key causes identified include:

2.4.1 Mining Activities

Large-scale and illegal small-scale mining operations lead to the release of manganese-rich dust and particulate matter, contaminating air, water, and soil in surrounding areas.

2.4.2 Ore Processing and Waste Disposal

Inadequate waste management practices during ore processing contribute to the release of manganese into water bodies and soil, further exacerbating toxicity levels.

2.5 Vulnerable Populations

Certain groups may be more susceptible to the adverse effects of manganese toxicity, including:

2.5.1 Children

Children, due to their developing nervous systems and higher metabolic rates, are more vulnerable to the neurotoxic effects of manganese.

2.5.2 Elderly Individuals

Ageing individuals may have decreased manganese clearance mechanisms, making them more prone to manganese accumulation and associated health effects.

[11] (Vega-Rodríguez, Rodríguez-Seijo, Vidal-Liñán, & Moreda-Piñeiro, 2021)

3 CEJ's Intervention in Serenje District

This section provides an overview of the key components of the CEJ's project intervention. In this section of the report, we delve into the alarming issue of manganese toxicity, unearthing the untold stories, uncovering the causes, and shedding light on the devastating consequences for both human health and the environment.

3.1 Investigative Journalism

CEJ initiated a comprehensive investigative journalism to gather crucial data on the extent and impact of manganese toxicity in Serenje District. This investigation involved conducting key informant interviews with the victims, mine site visitations, and community consultations. The data collected serves as a foundation for evidence-based decision-making and designing appropriate interventions.

3.1.1 The Hidden Danger

While Serenje District boasts rich manganese deposits, the very resource that promises economic prosperity has become a silent menace. Local residents, largely unaware of the dangers lurking in their midst, are unwittingly exposed to high levels of manganese through various channels, including occupational activities, environmental contamination, and dietary intake.

3.1.2 Health Crisis Unveiled

Through extensive interviews and medical investigations, we encountered numerous individuals whose lives have been irrevocably affected by manganese toxicity. From neurological disorders and respiratory ailments to liver and kidney dysfunction, the toll on human health is alarmingly evident. Our investigations reveal a lack of access to healthcare services and limited awareness among residents about the link between their symptoms and manganese exposure.

3.1.2.1 Mine Workers at Southern Africa Ferro Alloys Limited (SAFAL) Suffer Manganese Toxicity

During the investigation, CEJ found out that a permanent brain-damaging health condition with symptoms similar to Parkinson's disease had hit about 28 workers at an Indian-owned manganese processing company known as Southern Africa Ferro Alloys Limited (SAFAL), in Serenje, central Zambia. However, what was striking is that even after government was informed of the situation the company was still operating and no punitive actions were taken against the company.

3.1.3 Environmental Devastation

As we ventured into Serenje's mining areas, we discovered a landscape scarred by unregulated mining practices. Manganese-rich dust fills the air, while nearby water sources are tainted with toxic runoffs, endangering aquatic ecosystems and agricultural lands. The consequences are far-reaching, with reduced crop yields, soil contamination, and a disrupted ecological balance that threatens the region's long-term sustainability.

3.1.4 Regulatory Failures

Our investigation uncovered a startling lack of oversight and enforcement in the mining sector. Despite existing regulations and guidelines, unscrupulous actors exploit loopholes, sidestepping their responsibilities for mine safety and pollution control. Local communities bear the brunt of this negligence, left to suffer the consequences while mining companies profit.

3.1.5 The Call for Justice

In the face of this crisis, CEJ facilitated several news articles aimed at fostering governments intervention in the issue of manganese toxicity in Serenje district and demand accountability from mining companies in the district. CEJ working tirelessly to raise awareness, provide support to affected individuals, and lobby for stricter regulations. CEJ continues to fight for justice, thereby insisting that the health and well-being of Serenje's residents especially the affected mine workers must take precedence over profit.

3.1.5.1 Governments Reaction to CEJ Whistleblowing on Manganese Toxicity

Following a thorough investigative research on manganese poisoning in Serenje district and the subsequent news articles, government responded through a report from the Acting Minister of Health Hon. Brenda Tambatamba, MP who said that the government of the republic of Zambia was aware of an outbreak of a strange disease in Kanona Ward in Serenje District and Chitambo Ward in Chitambo District in Central Province.

Addressing Parliament, Ms Tambatamba said on 20th September 2022, Government through the Ministry of Health responded to an alert concerning employees of the Southern Africa Ferro Alloys Limited - SAFAL who presented the loss of balance, tremors, impaired speech, uncomfortable drooling or dropping saliva from the mouth and decreased movements.

She said Ministry of Health records indicated that 28 people had shown the above symptoms but no mortality had been associated to the disease.

Ms Tambatamba said Occupational Health and Safety Institute - OHSI was notified, and blood samples taken from 281 employees to determine the cause of the problem.

The cabinet minister said results revealed that 271, which was 96.4% of the employees, had blood levels of manganese above the normal level. The results showed in the ranges of 0.116 to 0.623 parts per million. The average was 0.244 parts per million. The normal range is 0.005 parts per million to 0.02 parts per million.

Ms Tambatamba said a Joint Inspection Team had been constituted consisting of staff from the Ministry of Health, the Ministry of Labour and Social Security, Ministry of Mines and Minerals Development, Zambia Environmental Management Agency - ZEMA, Mine Safety Department and the Occupational Health and Safety Institute - SILICOSIS and Mines Safety Department to urgently undertake full investigation of the risk assessment at SAFAL.

Members of the public will be informed of the outcome of the investigation and appropriate actions to be taken. Further, this Joint Investigations Team will extend the exercise to all manganese processing plants to ensure compliance to all relevant laws. The Joint Investigations Team will ensure that all non-compliant facilities and made to be compliant to the protection of human health and environment.

The Acting Minister of Health warned all manganese processing plants in the country to put in place measures to ensure that they were fully compliant to all relevant laws before the law enforcement wings visit them.

3.2 Community Engagement and Capacity Building

CEJ recognizes the importance of community engagement in addressing manganese toxicity effectively. The project intervention involves conducting community awareness campaigns, workshops, and training sessions to educate local communities about the risks associated with manganese toxicity and preventive measures. Capacity building initiatives are designed to empower community members with knowledge and skills to protect themselves and advocate for sustainable mining practices and environmental protection.

3.3 Advocacy and Policy Influence

CEJ actively engages with relevant stakeholders, including government bodies, mining companies, and regulatory agencies, to advocate for stronger regulations and policies to address manganese toxicity. By highlighting the findings from the investigative journalism and raising awareness of the issue, CEJ aims to influence policy decisions and encourage the adoption of sustainable mining practices that minimize manganese contamination and protect public health and the environment.

3.4 Stakeholder Collaboration

Recognizing the need for collaboration among various stakeholders, CEJ fosters partnerships with local communities, civil society organizations, academic institutions, and other relevant entities. By bringing together diverse expertise and resources, CEJ aims to create a collaborative platform for knowledge-sharing, innovative solutions, and collective action in combating manganese toxicity.

3.5 Monitoring and Evaluation

To ensure the effectiveness of the project intervention, CEJ implements a robust monitoring and evaluation framework. This framework involves regular monitoring of environmental indicators, health data, and policy developments related to manganese toxicity. By tracking the progress of the intervention, CEJ can identify strengths, challenges, and areas for improvement, thereby enhancing the overall impact of the project.

4 Current Efforts and Challenges

Addressing manganese toxicity requires collaborative efforts from various stakeholders, including governments, industries, and scientific communities. Current initiatives to mitigate manganese toxicity include:

4.1 Regulations and Guidelines

Governments have implemented regulations and guidelines to control manganese emissions and limit exposure in occupational settings.

4.2 Research and Awareness

Scientists are conducting research to understand the mechanisms of manganese toxicity better, while awareness campaigns are raising public and professional knowledge about the risks and preventive measures.

Despite these efforts, challenges remain, such as limited data on the long-term effects of manganese toxicity, inadequate monitoring systems, and the need for improved mitigation strategies.

4.3 Sustainable Solutions and Best Practices

The CEJ seeks to promote sustainable solutions and best practices for mitigating manganese toxicity. This includes advocating for responsible mining practices, improving waste management systems, and supporting research on remediation techniques. By disseminating information about sustainable approaches, the CEJ aims to facilitate the adoption of practices that minimize manganese contamination and promote the well-being of both communities and ecosystems.

5 Recommendations

The following are some of the critical recommendations for mitigating manganese toxicity in Zambia.

I. Strengthen Regulatory Framework

The Zambian government should enhance the regulatory framework governing manganese mining and processing activities. This includes strict enforcement of existing regulations, periodic monitoring, and regular audits of mining operations to ensure compliance with environmental standards and occupational health and safety regulations.

II. Promote Sustainable Mining Practices

Mining companies should adopt sustainable practices that minimize the release of manganese-rich dust and wastewater into the environment. Implementing advanced technologies and best practices for dust control, waste management, and water treatment can significantly reduce the environmental impact and potential health risks associated with manganese mining.

III. Enhance Occupational Health and Safety

Mining companies should prioritize the safety and well-being of workers by providing comprehensive training programs on occupational health hazards, including manganese toxicity. Strict adherence to personal protective equipment (PPE) protocols and regular health check-ups for workers exposed to manganese should be implemented to detect and address any early signs of toxicity.

IV. Community Awareness and Education

Raising awareness among local communities about the risks of manganese toxicity is crucial. Community engagement programs should be developed to educate residents about the sources of exposure, potential health effects, and preventive measures. Information should be provided in local languages and accessible formats to ensure maximum understanding and participation.

V. Access to Healthcare and Monitoring

Improving access to healthcare services, especially in areas affected by manganese mining, is essential. Establishing healthcare facilities equipped to diagnose and treat manganese-related health conditions can help identify and manage cases of toxicity in a timely manner. Additionally, implementing a systematic health monitoring program for individuals living in proximity to mining areas can provide valuable data on exposure levels and facilitate early intervention.

VI. Environmental Remediation and Rehabilitation

Efforts should be made to rehabilitate and remediate areas affected by manganese contamination. Soil remediation techniques, such as phytoremediation and soil washing, can help restore contaminated lands. Implementing proper waste management practices, including the safe disposal and treatment of mining waste, is also crucial to prevent further environmental degradation.

VII. Research and Monitoring

Continued research on the impacts of manganese toxicity and its long-term effects is essential. Investing in scientific studies and monitoring programs can provide valuable insights into exposure levels, health outcomes, and environmental changes. This data can inform evidence-based decision-making and the development of targeted interventions.

VIII. Multi-Stakeholder Collaboration

Collaboration among government agencies, mining companies, civil society organizations, and local communities is vital for effective mitigation of manganese toxicity. Establishing platforms for dialogue and cooperation can facilitate the exchange of knowledge, resources, and expertise to collectively address the issue.

IX. Strengthen Public-Private Partnerships

Encouraging public-private partnerships can drive innovation, promote sustainable practices, and support community development initiatives. By leveraging the expertise and resources of both sectors, comprehensive solutions to manganese toxicity can be developed and implemented more effectively.

X. Long-term Monitoring and Evaluation

Implementing a robust monitoring and evaluation framework is crucial to assess the effectiveness of mitigation measures and ensure their long-term sustainability. Regular monitoring of environmental indicators, health data, and compliance with regulations will help identify areas of improvement and guide future interventions.

By implementing these recommendations, Zambia can take significant strides towards mitigating manganese toxicity, safeguarding public health, and protecting the environment. A comprehensive and collaborative approach is crucial to ensure a sustainable future for affected communities and the mining industry.

6 Conclusion

The project intervention by the Centre for Environment Justice on manganese toxicity demonstrates a comprehensive and proactive approach to addressing this critical issue. Through research, community engagement, advocacy, stakeholder collaboration, and monitoring, the CEJ strives to make a tangible difference in mitigating the impacts of manganese toxicity. By working towards sustainable solutions and raising awareness, the CEJ is contributing to the protection of human health and the environment in affected regions and fostering a future where manganese mining is conducted responsibly and in harmony with the well-being of communities and ecosystems.

The history of manganese mining in Serenje District is a tale of economic growth, social changes, and environmental challenges. As the region continues to grapple with the impact of mining activities, there is a collective aspiration to learn from the past and pave the way for a sustainable future. By promoting responsible mining practices, fostering community engagement, and prioritizing environmental stewardship, Serenje District can chart a path towards a balanced and equitable approach to manganese extraction that benefits both present and future generations.

As we conclude our investigation into the manganese toxicity crisis in Serenje District, urgent action is needed to protect the health of the community and safeguard the environment. The voices of those affected must be amplified, and the responsible authorities held accountable for their failures. It is our hope that this exposé will ignite a sense of urgency, prompting swift intervention and measures to address this silent poison. The time to act is now, to ensure a safer and healthier future for the people of Serenje District.

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