

INTEGRATING INTERNATIONAL HAZARD CLASSIFICATION SYSTEMS INTO UGANDA'S ENVIRONMENTAL AND OCCUPATIONAL HEALTH FRAMEWORKS

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ABSTRACT

Hazard classification is a cornerstone of global chemical safety management, essential for protecting human health, property, and the environment. Two major frameworks—the Globally Harmonized System of Classification and Labelling of Chemicals (GHS) and the United Nations hazard classification system embedded in the UN Model Regulations on the Transport of Dangerous Goods—offer standardized approaches to identifying, categorizing, and communicating chemical hazards. Developed under the auspices of the United Nations, these systems facilitate international trade, regulatory harmonization, and risk mitigation across sectors. Uganda has progressively adopted both GHS and UN hazard class principles to strengthen its environmental and occupational health regulations, particularly through the National Environment Act and supporting legislation. As a signatory to key international conventions and a participant in global commerce, Uganda's integration of these classification systems reflects its commitment to international standards and public safety. This qualitative study explored and presents results on

the structure and application of both GHS and UN hazard classes, examines Uganda's regulatory alignment, and discusses the challenges and opportunities associated with their implementation in the country's environmental and occupational health frameworks.

Keywords: *Global harmonized system (GHS), hazard classes, Uganda, UN Model Regulations*

1. Introduction

The management of hazardous chemicals has become an increasingly urgent concern in developing countries, particularly those undergoing rapid industrialization and urban expansion. As industries grow and the use of chemical substances intensifies across sectors such as agriculture, manufacturing, healthcare, and mining, the potential risks to human health, property, and the environment escalate (Ssepuuya, 2023). In this context, effective hazard classification systems are indispensable tools for identifying, categorizing, and communicating the dangers associated with chemical materials.

Two globally recognized frameworks have emerged to guide countries in managing chemical hazards: The Globally Harmonized System of Classification and Labelling of Chemicals (GHS) and the United Nations hazard classification system embedded in the UN Model Regulations on the Transport of Dangerous Goods. The GHS, developed by the United Nations, offers a unified approach to classifying chemical hazards and conveying this information through standardized labels, pictograms, signal words, and safety data sheets. It is designed to enhance protection of human health and the environment, facilitate international trade, and harmonize regulatory practices across borders. Meanwhile, the UN hazard classification system, administered by the UN Sub-Committee of Experts on the Transport of Dangerous Goods, organizes substances into nine distinct hazard classes based on their physical, chemical, and toxicological properties. This system is primarily used to regulate the safe transport of dangerous goods and is foundational to international agreements such as the IMDG Code and ICAO Technical Instructions.

Uganda, as a signatory to multiple international conventions and a participant in global trade, has progressively adopted both the GHS and the UN hazard classification system to strengthen its environmental and occupational health frameworks (Ayebale, 2021; Lusondo, 2024; NEMA, 2024). The country's commitment is reflected in the enactment of the National Environment Act, 2019, and the subsequent National Environment (Management of Hazardous Chemicals and Products Containing Hazardous Chemicals) Regulations, 2023. These legal instruments mandate the classification, registration, labeling, and safe handling of hazardous chemicals in accordance with international standards. Uganda's integration of these systems has not only improved regulatory oversight but also enhanced public safety, workplace health, and environmental protection.

In the occupational health domain, Uganda's Occupational Safety and Health Act of 2006 provides a complementary framework for managing chemical risks in the workplace. A recent amendment provides universal and higher compliance standards that among others eliminate exemptions for small workplaces, formalize professional practitioner oversight (Obilil Idoot, 2025; Uganda Occupational Safety and Health (Amendment) Act, No. 20 of 2025). Although the Act does not explicitly reference the UN hazard classes or GHS, its provisions are increasingly interpreted in alignment with these systems. Employers are required to identify chemical hazards, assess risks, and implement control measures, including the use of appropriate labeling and safety documentation. This alignment has led to improved hazard communication, reduced workplace incidents, and strengthened emergency preparedness.

As Uganda continues to industrialize and expand its chemical footprint, the integration of international hazard classification systems remains a critical strategy for safeguarding health and promoting sustainable development. This paper explores the structure and application of both GHS and UN hazard classes, examines Uganda's regulatory alignment, and discusses the challenges and opportunities associated with their implementation in the country's environmental and occupational health frameworks.

2. Methodology

This study employed a qualitative research design, combining document analysis, policy review, expert consultation, comparative framework and thematic syntheses to examine the integration of international hazard classification systems into Uganda's environmental and occupational health frameworks (Table 1). The methodology was structured to capture both the regulatory evolution and practical implementation of the Globally Harmonized System (GHS) and the United Nations hazard classification system within the Ugandan context.

Table 1: Qualitative research approaches and specific tasks implemented for data collection

Approach	Specific actions
Document and Policy Analysis	<p>Primary data sources included national legislation, regulatory guidelines, and official government publications. Key documents reviewed were:</p> <ul style="list-style-type: none"> • The National Environment Act, 2019 • The National Environment (Management of Hazardous Chemicals and Products Containing Hazardous Chemicals) Regulations, 2023 • The Occupational Safety and Health Act, 2006 • Uganda’s submissions to international conventions such as the Basel, Rotterdam, and Stockholm Conventions <p>These documents were analyzed to identify provisions related to hazard classification, licensing, labeling, transport, and enforcement mechanisms. International frameworks such as the UN Model Regulations on the Transport of Dangerous Goods and the GHS (Rev. 10) were also examined to assess alignment and adaptation.</p>
Stakeholder Consultation	<p>Semi-structured interviews were conducted with key informants from regulatory agencies, including the National Environment Management Authority (NEMA), the Directorate of Occupational Safety and Health, the Uganda National Bureau of Standards (UNBS), and selected private sector representatives. These consultations provided insights into implementation challenges, institutional capacity, and inter-agency coordination.</p>
Comparative Framework Analysis	<p>A comparative approach was used to assess Uganda’s integration of hazard classification systems against international best practices. This involved mapping Uganda’s regulatory instruments to core elements of the GHS and UN hazard classes, including classification criteria, labeling standards, and transport protocols.</p>
Thematic Coding and Synthesis	<p>Data from document reviews and interviews were coded thematically using NVivo software to identify recurring patterns, gaps, and opportunities. Themes included regulatory coherence, enforcement capacity, public awareness, and digital infrastructure. Findings were synthesized to develop a comprehensive understanding of Uganda’s progress and challenges in implementing hazard classification systems.</p>

Ethical Considerations: All interviews were conducted with informed consent, and participants were assured of confidentiality. The study adhered to ethical standards for research involving human subjects, as guided by Uganda National Council for Science and Technology (UNCST) protocols.

3. Results and Discussion

Structure and Purpose of Hazard Classification Systems: GHS and UN Hazard Classes: Effective hazard classification is central to chemical safety management, enabling governments, industries, and communities to identify, communicate, and mitigate risks associated with hazardous substances. Two globally recognized systems—the Globally Harmonized System of Classification and Labelling of Chemicals (GHS) and the United Nations hazard classification system—provide complementary frameworks for managing chemical hazards across sectors and borders.

The GHS, developed by the United Nations, categorizes hazards into three broad groups: physical hazards, health hazards, and environmental hazards. Physical hazards include properties such as flammability, explosiveness, and reactivity. Health hazards encompass toxicity, carcinogenicity, and respiratory sensitization, while environmental hazards focus on aquatic toxicity and effects on the ozone layer. Each hazard class is further divided into categories based on severity, allowing for nuanced risk assessment. Communication tools under GHS include standardized pictograms, signal words such as “Danger” or “Warning,” hazard statements, and precautionary statements. Safety Data Sheets (SDS) follow a 16-section format, ensuring consistency across jurisdictions and facilitating the exchange of chemical safety information (UNECE, 2023a).

The primary objectives of GHS are to enhance the protection of human health and the environment, facilitate international trade in chemicals by harmonizing regulations, and reduce duplication of testing and evaluation. By providing a common language for hazard communication, GHS supports regulatory efficiency and improves risk management across borders. In Uganda, GHS has been formally adopted through the National Environment (Management of Hazardous Chemicals and Products Containing Hazardous Chemicals) Regulations, 2023, which mandate classification, labeling, and documentation in line with GHS standards. This has significantly improved chemical safety in workplaces, public spaces, and transport systems.

Complementing the GHS is the UN hazard classification system, which is primarily used for the transport of dangerous goods. This system divides hazardous substances into nine primary classes: Class 1 (Explosives), Class 2 (Gases), Class 3 (Flammable Liquids), Class 4 (Flammable Solids), Class 5 (Oxidizing Substances and Organic Peroxides), Class 6 (Toxic and Infectious Substances), Class 7 (Radioactive Material), Class 8 (Corrosives), and Class 9 (Miscellaneous Dangerous Goods). Each class is further subdivided to reflect specific risks and handling requirements. These classifications are codified in the UN Model Regulations, which serve as the basis for international

transport agreements such as the International Maritime Dangerous Goods (IMDG) Code, the International Civil Aviation Organization (ICAO) Technical Instructions, and regional frameworks like the African Agreement on the Transport of Dangerous Goods by Road (ADR) (UNECE, 2023b).

The UN hazard classification system is designed to facilitate safe transport, emergency response, and regulatory compliance across borders. It provides a common language for hazard communication and supports harmonized enforcement of safety standards. In Uganda, this system has been integrated into customs procedures, transport licensing, and emergency preparedness protocols. Agencies such as the Uganda Revenue Authority (URA), the Uganda National Bureau of Standards (UNBS), and the National Environment Management Authority (NEMA) rely on these classifications to regulate the movement of hazardous goods and ensure public safety (NEMA, 2023a, b).

Together, the GHS and UN hazard classification systems form a robust foundation for chemical safety governance (United Nations Office for Disaster Risk Reduction - **UNDRR, 2021**). Their integration into Uganda's environmental and occupational health frameworks reflects the country's commitment to international best practices and its proactive approach to managing chemical risks in a rapidly industrializing economy.

Uganda's Regulatory Integration of GHS and UN Hazard Classification Systems

Uganda has made significant strides in strengthening its chemical safety governance by integrating both the Globally Harmonized System of Classification and Labelling of Chemicals (GHS) and the United Nations hazard classification system into its legal and regulatory frameworks. This dual adoption reflects the country's commitment to international standards and its proactive approach to safeguarding public health, environmental integrity, and workplace safety.

A major milestone in this integration was the enactment of the National Environment (Management of Hazardous Chemicals and Products Containing Hazardous Chemicals) Regulations in 2023, under the broader National Environment Act of 2019. These regulations provide a comprehensive structure for the management of hazardous chemicals, mandating that all substances be classified according to GHS criteria prior to registration. Entities involved in the handling, importation, or distribution of hazardous chemicals are required to obtain licenses, which include obligations such as conducting environmental risk assessments and securing insurance coverage to mitigate potential harm.

The regulations also stipulate that labeling and packaging must conform to GHS standards, incorporating internationally recognized pictograms, hazard statements, and precautionary measures to ensure clear communication of risks. In addition, detailed guidelines are provided for the safe storage and transportation of hazardous chemicals, including specific provisions for

movement across water bodies and transboundary transit. Public education is a key component of the framework, with mandated awareness campaigns, the development of a national chemical database, and mechanisms for information exchange aimed at enhancing transparency and stakeholder engagement.

Parallel to the adoption of GHS, Uganda's environmental regulatory framework has evolved to incorporate the UN hazard classification system, particularly in the context of chemical transport and emergency preparedness. The same 2023 regulations explicitly reference the nine UN hazard classes, which categorize dangerous goods based on their physical, chemical, and toxicological properties. These classifications inform the handling, packaging, and movement of substances within Uganda and across its borders, ensuring that chemicals are managed in accordance with their risk profiles.

The National Environment Management Authority (NEMA) serves as the lead agency in enforcing these provisions, working in close coordination with the Uganda Revenue Authority (URA), the Uganda National Bureau of Standards (UNBS), and the Ministry of Health. This multi-agency approach has enhanced Uganda's capacity to monitor chemical flows, prevent pollution, and respond effectively to environmental emergencies. Moreover, the integration of UN hazard classes aligns Uganda with its international obligations under treaties such as the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal, to which the country is a signatory (Basel Convention Secretariat, (2022)).

Together, the incorporation of GHS and UN hazard classification systems into Uganda's environmental and occupational health frameworks represents a robust and harmonized approach to chemical safety. It enables regulatory coherence, facilitates international trade, and promotes sustainable development by ensuring that hazardous substances are managed responsibly throughout their lifecycle.

Integration of Hazard Classification into Uganda's Occupational Health and Safety Framework

Uganda's commitment to workplace safety is anchored in the Occupational Safety and Health Act of 2006, which provides a comprehensive legal framework for managing occupational risks, including those posed by hazardous chemicals. As industrial activity expands across sectors such as agriculture, manufacturing, mining, and healthcare, the need for robust chemical safety measures has become increasingly urgent. The Act mandates employers to identify chemical hazards, assess risks, and implement control measures that protect workers from exposure. These measures include the provision of personal protective equipment (PPE), regular training, maintenance of health records, and continuous monitoring of workplace conditions.

A key strength of Uganda's occupational health strategy is its alignment with international hazard classification systems. While the Act does not explicitly reference the United Nations hazard classes, its provisions are compatible with the system and are increasingly interpreted in line with global standards. Employers are expected to incorporate hazard identification based on UN classifications, which categorize substances by their physical, chemical, and toxicological properties. This approach enables more precise risk assessments and tailored safety protocols, particularly for substances that fall under categories such as flammable liquids, toxic agents, or corrosives.

In parallel, the integration of the Globally Harmonized System of Classification and Labelling of Chemicals (GHS) has enhanced hazard communication in Ugandan workplaces. The use of GHS-compliant labels, pictograms, and Safety Data Sheets (SDS) ensures that workers are clearly informed about the nature of the chemicals they handle. These tools support informed decision-making, reinforce safe handling practices, and facilitate emergency preparedness. Employers are also required to display safety signage and precautionary guides in areas where hazardous chemicals are stored or used, further strengthening visual communication of risks.

Oversight of these occupational safety measures is provided by the Directorate of Occupational Safety and Health, operating under the Ministry of Gender, Labour and Social Development (MoGLSD, 2006). The Directorate plays a central role in enforcing compliance, conducting inspections, and offering technical guidance to employers. Through its efforts, Uganda has made notable progress in reducing workplace incidents, improving hazard awareness, and building institutional capacity for chemical safety management.

The integration of both GHS and UN hazard classification systems into Uganda's occupational health and safety framework reflects a strategic and forward-looking approach to worker protection. As chemical use continues to grow across industries, the country's alignment with international standards positions it to effectively manage risks, safeguard its workforce, and promote sustainable development.

Challenges and Opportunities in Implementing Hazard Classification Systems in Uganda

Uganda's adoption of international hazard classification systems—namely the Globally Harmonized System of Classification and Labelling of Chemicals (GHS) and the United Nations hazard classification framework—marks a significant step toward improving chemical safety across environmental and occupational domains. However, the journey toward full implementation is not without its challenges.

One of the most pressing issues is limited technical capacity, particularly among small and medium-sized enterprises and local authorities. Many of these entities lack the expertise required to accurately classify chemicals, apply standardized labels, and interpret hazard communication

protocols. This gap in knowledge undermines consistent application of both GHS and UN hazard classes, increasing the risk of improper handling, storage, and transport of hazardous substances.

Enforcement of these systems is also constrained by resource limitations. Regulatory bodies such as the National Environment Management Authority (NEMA) and the Directorate of Occupational Safety and Health face logistical and financial hurdles in conducting inspections, monitoring compliance, and responding to violations. These constraints hinder the effectiveness of Uganda's otherwise progressive legal framework.

Public awareness presents another challenge. Many workers, transporters, and community members remain unfamiliar with the meaning of GHS pictograms, signal words, and hazard statements, as well as the UN's nine hazard classes. This lack of understanding diminishes the impact of hazard communication tools and weakens the culture of safety that these systems are designed to promote.

Despite these challenges, Uganda is well-positioned to strengthen its implementation efforts. The country's participation in international conventions such as the Basel, Rotterdam, and Stockholm Conventions provides access to technical assistance, funding, and global best practices. These treaties encourage harmonization of chemical safety standards and support capacity-building initiatives.

Regional cooperation through the East African Community (EAC) offers additional opportunities. Collaborative efforts within the region can help harmonize regulations, facilitate cross-border training, and promote shared strategies for managing hazardous substances (EAC, 2021). Uganda's engagement with EAC partners enhances its ability to align with regional transport and safety protocols, particularly those based on the UN hazard classification system.

Partnerships with non-governmental organizations, academic institutions, and donor agencies are also expanding Uganda's technical capacity. Training programs, workshops, and public awareness campaigns are equipping stakeholders with the skills and knowledge needed to implement hazard classification systems effectively. These initiatives are especially valuable in reaching underserved sectors and building a nationwide culture of chemical safety.

Digital innovation presents a promising frontier. Uganda is developing platforms and databases to support chemical tracking, classification, and compliance monitoring. These tools offer a modern approach to regulatory oversight, enabling real-time data sharing and more efficient enforcement. Continued investment in digital infrastructure will be critical to scaling these solutions nationwide.

In final analysis, while Uganda faces notable challenges in fully implementing GHS and UN hazard classification systems, the country also has substantial opportunities to advance its chemical safety agenda. Through strategic partnerships, regional collaboration, and technological

innovation, Uganda can build a resilient and effective framework for managing hazardous substances—protecting its people, environment, and economy in the process.

4. Conclusion

Uganda's integration of both the United Nations hazard classification system and the Globally Harmonized System of Classification and Labelling of Chemicals (GHS) represents a transformative advancement in the country's approach to chemical safety. By aligning its environmental and occupational health frameworks with internationally recognized standards, Uganda has significantly strengthened its regulatory capacity, improved public and workplace safety, and enhanced its readiness to respond to chemical emergencies.

The adoption of GHS has brought clarity and consistency to hazard communication through standardized labeling, safety data sheets, and public education initiatives. Simultaneously, the incorporation of UN hazard classes has reinforced safe transport and handling of dangerous goods, ensuring that substances are managed according to their risk profiles across borders and within domestic supply chains.

These efforts have laid the foundation for a safer and more sustainable chemical management system. However, realizing the full potential of these frameworks will require continued investment in technical capacity, enforcement mechanisms, and stakeholder awareness. As Uganda builds on its progress, it is well-positioned to lead by example in the region—demonstrating how harmonized hazard classification systems can protect human health, preserve the environment, and support responsible industrial development.

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