Terms of Reference (ToR)

Research and Analysis of the Composition and Environmental Impact of Ore Dressing Agent Comprising Sodium Isocyanate for ASGM in Suriname and Developing Sustainable Environmental Regulations

1. Background

Suriname's Artisanal and Small-Scale Gold Mining sector (ASGM) is a crucial component of its economy. To promote sustainable and efficient mining practices, there is a growing interest in exploring chemical products such as with the use of sodium isocyanate. Sodium isocyanate in combination with certain conditioning agents, is presented as an alternative to traditional chemical agents such as mercury and sodium cyanide used in gold extraction processes. A thorough analysis is necessary to evaluate their effectiveness, environmental impact, safety, and potential for adoption in Suriname. Considering potential adoption is essential for establishing environmental regulations in the gold mining industry for several reasons:

- **Protection of Water Resources**: ASGM often involves the use of toxic chemicals like mercury and sodium cyanide. Improper handling and disposal can contaminate soil, air and rivers and groundwater, which are critical sources of drinking water and livelihood for local communities.

- **Protection of Soil Resources**: Toxic chemicals like mercury and sodium cyanide in ASGM severely contaminate soil, disrupting ecosystems, reducing fertility, and hindering agriculture and reforestation. Contaminated soil also leaches pollutants into water bodies, worsening environmental degradation and threatening local livelihoods and their health.

- **Protection of Air Quality:** ASGM releases harmful chemicals, like vaporized mercury and cyanide fumes, into the air, posing serious health risks and polluting distant ecosystems. Prolonged exposure leads to respiratory and neurological issues, underscoring the need for strict monitoring and controls.

- **Preservation of Ecosystems**: Suriname's rainforest is one of the most biodiverse regions in the world. Pollution from mining activities can destroy habitats, harm wildlife, and disrupt delicate ecosystems both on land and in water. Aquatic ecosystems, including rivers and wetlands, are particularly vulnerable to contamination from mining runoff,

which can impact water quality, aquatic species, and the communities relying on these resources. Similarly, terrestrial habitats face degradation through deforestation and habitat fragmentation, further threatening biodiversity and ecological balance.

- **Improvement in Public Health and Safety**: Chemical exposure in ASGM poses significant health and safety risks. Hazardous substances like mercury can cause severe health issues, particularly for vulnerable groups such as the elderly, children and pregnant women. Unsafe transport, handling, use, storage, and disposal further lead to poisoning incidents, environmental contamination, and long-term health crises. The absence of protective equipment and training increases accidents and injuries, highlighting the need for measures to ensure public health and safer working conditions.

- **Sustainable Development**: Unregulated chemical usage in the mining sector can lead to short-term profits but long-term environmental degradation. Implementing regulations ensures sustainable industry operation, balancing economic benefits with environmental and social responsibilities.

- **Global Environmental Commitments**: Suriname is a signatory to international agreements like the **Minamata Convention on Mercury**, which seeks to reduce mercury pollution. Enforcing regulations aligns with these commitments will enhance the country's global standing.

- **Conflict Prevention**: Mining operations frequently intrude on the territories of indigenous and tribal communities, disrupting their lands and ways of life. The resulting pollution and environmental degradation often spark social tensions and unrest. Establishing clear regulations is essential to ensure accountability and provide mechanisms for conflict resolution.

- **Economic Impacts**: Environmental degradation can damage other key sectors, such as agriculture and tourism. Regulations ensure that mining activities do not undermine these economic pillars.

By addressing these issues, Suriname can protect its natural resources, promote public health, and achieve a sustainable balance between economic growth and environmental conservation.

2. Objectives of the Assignment

The primary objective of the research is to analyze the composition and chemistry of commercially traded ore dressing agents whose active constituent is sodium isocyanate, known in Suriname by their trade names Jin Chan and Sandioss, to establish stringent environmental regulations that will be included in any environmental permit and regulation of the import of abovementioned ore dressing agents, if approved for use in the ASGM sector.

Scope of Work

1. Map the diverse chemicals used for ore dressing in the ASGM and Large Scale Mining in Suriname. Loaction: In the districts of Brokopondo, Sipaliwini and Marowijne. The identified sites are: Sarakreek, Snesi kondre and Roma East
2. Analyze the chemical composition of the sodium isocyanate-based ore dressing agent commercially available in Suriname, establishing their composition, and evaluate their technical performance in gold extraction.
3. Evaluate the environmental impacts (e.g., on water, soil, air, and biodiversity) as well as the health and safety implications of the material, including its toxicity levels and compliance with regulatory standards, to assess its feasibility for use in small-, medium-, and large-scale gold mining operations in Suriname.
4. Provide recommendations for potential adoption, including proposing evidence-based guidelines (regulations) for safe transport, storage, use and disposal in gold mining.

3. Activities

The consultancy firm will undertake the following tasks:

1. Desktop research
    a. Gather, review and summarise existing data on sodium isocyanate-based ore dressing agent, particularly its chemical composition, use, estimated amount of use per day, efficacy, and case studies of application in mining using internationally validated sources.
2. Fieldwork and Sampling
    a. Conduct site visits to ASGM operations in Suriname to determine the different chemical usage. In the districts of Brokopondo, Sipaliwini and Marowijne. The identified sites are: Sarakreek, Snesi kondre and Roma East

b. Test the sodium isocyanate-based ore dressing agent commercially available in Suriname i.e. Jin Chan and Sandioss under controlled and real-world mining conditions.

3. Stakeholder Engagement
    a. Conduct interviews with miners, environmental regulators, NGOs focused on environmental issues, relevant institutions, experts, and local authorities or community representatives. This includes engaging with district commissioners and tribal authorities to assess the application and use of Jin Chan and Sandioss in gold mining.
    b. Understand local perceptions, challenges, and opportunities for adoption of sodium isocyanate-based ore dressing agent as an alternative to mercury use in gold mining.
4. Comparative Analysis
    a. Compare Jin Chan and Sandioss to traditional chemicals in terms of efficiency, cost, and direct and indirect environmental and health impact.
5. Regulatory and Environmental Assessment
    a. Review the legal framework and environmental policies in Suriname related to chemical use in mining.
    b. Highlight compliance challenges or adjustments needed for the introduction of sodium isocyanate-based ore dressing agent.
    c. Establish monitoring, compliance and enforcement mechanisms to ensure adherence to regulations.
6. Reporting and Recommendations
    a. Provide a detailed report summarizing findings.
    b. Offer actionable recommendations for stakeholders, including technical guidelines and policy recommendations.

4. Results of output

1. **Mapping the Diverse Chemical Usage in the Gold Mining Industry**
    a. A comprehensive inventory of chemicals currently used in ASGM, categorized by type, purpose, and processes (e.g., cyanidation, flotation, amalgamation).
    b. Identification of key suppliers / importers, common practices, and variations in usage across small- and large-scale mining operations.
    c. A comparison of chemical usage trends within Suriname and global benchmarks.
2. **Evaluate the Technical Performance of the sodium isocyanate-based ore dressing agents Jin Chan and Sandioss in Gold Extraction**
    a. Detailed data on the efficiency and recovery rates of Jin Chan and Sandioss compared to traditional methods (e.g., cyanide-based extraction).
    b. Analysis of the conditions (e.g., ore type, operational scale) under which these products perform optimally.
    c. Documentation of laboratory and field test results showcasing scalability and reproducibility.
3. **Assess Environmental, Health and Safety Impacts, Including Toxicity Levels and Regulatory Compliance**
    a. Toxicological profiling of sodium isocyanate-based ore dressing agents, with an emphasis on their impacts on human health, air quality, aquatic ecosystems, and soil health.
    b. Assessment of regulatory compliance with Suriname's environmental and health and safety standards and international benchmarks.
    c. Identification of potential hazards and mitigation strategies in transport, storage, handling, and disposal.
4. **Analyse Environmental Feasibility for Use in Small-, Medium- and Large-Scale Gold Mining Operations in Suriname**
    a. Evaluation of the adaptability of the sodium isocyanate-based ore dressing agents Jin Chan and Sandioss in varied mining environments, including alluvial and hard-rock mining operations.
    b. Examination of environmental benefits, such as reduced waste generation and contamination risks, compared to current practices.

5. **Provide Recommendations for Potential Adoption, Including Proposing Guidelines (Regulations) for Safe Use and Disposal**
    a. A clear roadmap for integrating sodium isocyanate-based ore dressing agents into Suriname's Artisanal and Small-Scale Gold Mining sector (ASGM), with considerations for cost, scalability, and sustainability.
    b. Development of best practice guidelines and regulations for the safe handling, use, and disposal of these chemicals.
    c. Policy recommendations to support regulatory approval and adoption, emphasizing long-term environmental and economic benefits.

5. Deliverables

The consultancy firm is expected to deliver the following:

1. Inception Report (within 2 weeks): Detailed methodology, work plan including timeline, list of stakeholders and stakeholder engagement strategy and quick scan into Suriname's Artisanal and Small-Scale Gold Mining sector (ASGM).
2. Interim Report (mid-term): Preliminary findings, including initial test results and stakeholder feedback.
3. Final Report (end of assignment): Comprehensive findings, comparative analysis, and actionable recommendations.
4. Set of guidelines and regulations for safe transport, storage, use and disposal and additional policy recommendations (end of assignment).
5. Presentation (end of assignment): Key findings and recommendations delivered to relevant stakeholders.

6. Duration of the Assignment

The assignment is expected to last no longer than 4 months, starting from the signing of the contract.

7. Qualifications and Experience

To address the scope of work effectively, the team of experts required for this consultancy should reflect a multidisciplinary approach to ensure all facets of the assignment are thoroughly examined. Below is a description of the required team composition, qualifications, expertise and skills:

Team Composition and Expertise

1. **Chemical Engineer (MSc Level)**
    - **Role:** Evaluate the chemical composition, performance, and technical feasibility of sodium isocyanate-based agents in gold extraction processes.
    - **Qualifications:**
        - Master's degree (MSc) or higher in Chemical Engineering or a related field.
        - Proven expertise in chemical applications in mining, including research and testing.
        - Strong analytical skills for interpreting laboratory and field test results.
    - **Experience:**
        - Familiarity with industrial chemical processing and safety standards.
        - Proficiency in conducting controlled experiments and scaling applications to real-world settings.
2. **Environmental Scientist (MSc/PhD Level)**
    - **Role:** Assess environmental impacts, including effects on water, soil, air, and biodiversity, and propose mitigation strategies.
    - **Qualifications:**
        - MSc or PhD in Environmental Science, Environmental Engineering, or a related discipline.
        - Expertise in toxicological profiling and environmental compliance standards.
    - **Experience:**
        - Demonstrated experience with environmental impact assessments and sustainable development practices.
        - Strong understanding of international environmental frameworks, such as the Minamata Convention on Mercury.
3. **Mining Sector Specialist (MSc Level)**
    - **Role:** Provide insights into the practical application of sodium isocyanate-based agents in the ASGM sector and evaluate efficiency compared to traditional methods.
    - **Qualifications:**
        - MSc in Mining Engineering or a related field.
        - Strong understanding of Suriname's ASGM sector, including operational dynamics and challenges.
    - **Experience:**
        - Familiarity with local and international mining practices and regulatory standards.

        - Demonstrated ability to bridge technical findings with policy recommendations.
4. **Regulatory/Legal Expert (MSc Level)**
    - **Role:** Review Suriname's regulatory framework and develop evidence-based guidelines for safe chemical transport, handling, use, storage, and disposal.
    - **Qualifications:**
        - MSc in Environmental Policy, Law, or a related field.
        - Expertise in developing and implementing regulatory compliance frameworks.
    - **Experience:**
        - Familiarity with Suriname's environmental regulations and international benchmarks.
        - Proven track record in drafting actionable regulatory policies.

Key Qualities Across Team Members:

- Strong analytical and reporting skills to synthesize findings into comprehensive reports.
- Proven ability to work collaboratively within interdisciplinary teams.
- Exceptional communication skills to engage effectively with diverse stakeholders, including government agencies, NGOs, and local communities.

8. Budget and Payment Terms

Proposals should include a detailed budget, specifying costs for personnel, travel, materials, organizing the final presentation and other expenses. Payment will be made in tranches based on deliverables:

- 20% upon submission and approval of the Inception Report.
- 40% upon submission and approval of the Interim Report.
- 40% upon submission and approval of the Final Report and delivery of the Presentation.

9. Submission of Proposals

All proposals must be submitted to the email address: info-EMSAGS@nimos.org, with the subject reading as follows***: Application for*** **Research and Analysis of Ore Dressing**

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