Supported by:

EMSAGS
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TERMS OF REFERENCE

Ambient Air Quality Measurements and Analysis of Mercury Vapour Around a Cluster of Gold-Buying Shops in Paramaribo-Noord

Client: National Environmental Authority (NMA)

Duty Station: Paramaribo – Suriname

Duration: 45–60 working days

Expected Start: April 2026

A. BACKGROUND AND CONTEXT

Mercury vapour released from gold-buying shops during amalgam heating can disperse rapidly into ambient air. **Given the presence of approximately 30 gold-buying shops within a 10 km radius, the risk is not limited to localized plumes but includes a potential cumulative "urban dome" effect, leading to chronically elevated background levels throughout the district.**

Human exposure to airborne mercury is associated with neurological, developmental, cardiovascular, and respiratory risks, particularly for vulnerable groups such as children, pregnant women, and the elderly. The National Environmental Authority (NMA) is responsible for monitoring and enforcing environmental standards related to air quality.

This TOR supports NMA's commitment to

- Minamata Convention on Mercury (Annex F & G)
- WHO Air Quality Guidelines

- ATSDR Minimal Risk Levels
- EPA and NIOSH mercury vapour monitoring recommendations
- BAT/BEP (Best Available Techniques / Best Environmental Practices) for Artisanal and Small-Scale Gold Mining (ASGM) sectors.

This study aims to establish scientifically defensible, spatially representative, and meteorologically corrected ambient mercury vapour concentrations surrounding gold-buying facilities **and within the broader affected urban airshed.**

B. OBJECTIVES OF THE ASSIGNMENT

The objective is to measure, analyse and interpret ambient mercury vapour concentrations near gold-buying shops in Suriname in order to:

1. Quantify ambient mercury vapour levels at varying distances from gold-buying shops.
2. **Assess the cumulative impact of the cluster of 30 shops on the regional ambient air quality (aggregate exposure).**
3. Determine spatial dispersion patterns through GIS-based mapping.
4. Integrate meteorological data to evaluate atmospheric transport conditions.
5. Compare measured concentrations with WHO, EPA, ATSDR and regional standards.
6. **Identify "hotspots" near sensitive receptors (schools, clinics, residential complexes) located within the 10 km radius.**
7. Provide actionable, evidence-based policy and enforcement recommendations for the NMA.

C. SCOPE OF WORK

The consultant shall undertake the following tasks:

1. Site Selection & Cluster Analysis

The consultant shall develop a *Site Selection Justification Report* including:

- **A preliminary GIS inventory mapping all ~30 known gold shops in the 10 km radius.**
- Selection of Minimum 5–7 "Sentinel" gold-buying shops for *active* monitoring, representing:
  - Different shop sizes and operational scales.
  - Varying ventilation/outdoor conditions (chimney height vs. open burning).
  - **High-density clusters vs. isolated shops.**
- Identification of background/reference sites at least **2–5 km upwind** from the gold-shop cluster to establish a true baseline (avoiding the urban heat island/pollution dome effect).
- **Identification of "Sensitive Receptors" (schools, elderly homes) within the downwind path of the major clusters.**

2. Ambient Air Quality Monitoring

The monitoring strategy shall employ a hybrid approach using both Active (Real-time) and Passive (Diffusive) sampling to cover the large 10km area effectively.

a. Active Sampling (High Resolution)

Measurements at each selected *sentinel* shop must occur at the following distances:

- 0–10 m (impact zone)
- 25 m (nearby community)

- 50–100 m (outer exposure zone)
- **Measurements must include vertical profiling where possible (e.g., ground level vs. second floor) to account for chimney plume overpass.**

b. Passive Sampling (Spatial Coverage) – NEW REQUIREMENT

To capture the cumulative impact of 30 shops over the 10 km radius, the consultant shall deploy a network of Passive Diffusive Samplers (e.g., MerPAS or equivalent) for a period of 14–30 days.

- Grid-based deployment or transect deployment across the Paramaribo-Noord district.
- Placement at sensitive receptors (schools/hospitals).
- This data will provide the Time-Weighted Average (TWA) necessary for chronic risk assessment.

c. Temporal Requirements (Active Sampling)

Ambient measurements shall include:

- Continuous 24-hour logging.
- Conducted over minimum 3 separate days.
- Coverage of peak (burning hours) and non-peak mercury emission periods.
- Sampling frequency: Minimum logging frequency 1 second to 1 minute (for active analyzers).

d. Measurement Methods

The consultant shall use:

- **Active:** Direct-reading, high-sensitivity mercury vapor analyzers (Lumex RA-915M, Jerome J505 or equivalent) capable of sub-μg/m³ detection.

- **Passive:** Diffusive samplers analyzed by an accredited laboratory (CVAFS detection method).
- **Calibration:** Calibration and verification mandatory before and after each sampling session.

3. Meteorological Data Collection

The following meteorological parameters must be collected continuously:

- Wind speed & Wind direction.
- Ambient temperature & Relative humidity.
- **Solar radiation (to assess atmospheric stability classes).**
- Meteorological data shall be obtained via a portable weather station (preferred) aligned with measurements.

4. QA/QC, Calibration & Data Validation

The consultant shall implement a *Quality Assurance and Quality Control (QA/QC) Plan*, including:

- Instrument calibration certificates (NIST-traceable).
- **Co-location studies (running passive samplers next to active analyzers for validation).**
- Field and instrument blanks.
- **Chain of Custody (COC) protocols for passive samplers sent to laboratories.**
- Outlier handling using IQR method.
- Mandatory reporting in **ng/m³ (nanograms per cubic meter)** for precision.

5. Data Analysis

a. Statistical Analysis

- Mean, median, SD, percentiles (95th/98th percentile for acute peaks).
- **Calculation of "Background Enrichment Factors" (how much higher the cluster area is compared to rural background).**

b. Spatial Analysis

- Distance-decay models.
- **Interpolated Isopleth Maps (Heatmaps) covering the full 10 km radius based on passive sampling data.**

c. Meteorology-Integrated Analysis

- Wind-rose diagrams.
- **Pollution Rose (merging concentration data with wind vectors to pinpoint dominant sources).**

6. Community Health & Environmental Risk Assessment

The consultant shall apply a health-risk screening approach including:

- Estimation of exposure concentrations (EC).
- Hazard Quotient (HQ = EC / Reference Value).
- **Calculation of Cumulative Cancer Risk and Non-Cancer Hazard Indices (if applicable references exist, otherwise focus on neurological/developmental thresholds).**
- **Specific risk section for "Sensitive Receptors" identified in the site selection phase.**

7. Occupational Health & Safety (OHS) for the Consultant – NEW SECTION

Due to the nature of the sector, the consultant must submit a Health & Safety Plan that includes:

- PPE protocols for field staff (respirators with mercury-specific cartridges during peak burning events).
- Conflict resolution/de-escalation protocols when measuring near informal or semi-legal operations.

D. EXPECTED OUTPUT & DELIVERABLES

1. Site Selection & Cluster Inventory Report.
2. Ambient Sampling Work Plan + QA/QC Plan.
3. Health & Safety Plan.
4. Ambient Air Measurement Reports (**Active & Passive results**).
5. Meteorological Dataset.
6. Background Location Comparison Report.
7. Validated Master Dataset (.xlsx + .csv).
8. GIS-based Ambient Exposure Map (**District-wide Heatmap**).
9. Community Health Risk Assessment Report.
10. Final Integrated Technical Report (full analysis + recommendations).

E. DELIVERABLES AND PAYMENT SCHEDULE

Deliverable	Payment (%)	Timeline
1. Site Selection & Cluster Inventory Report, Ambient Sampling Work Plan + QA/QC Plan, and Health & Safety Plan.	20%	Week 2
2. Ambient Air Measurement Reports (Active &	30%	Week 7

Passive results), Meteorological Dataset, and Background Location Comparison Report.		
3. Validated Master Dataset (.xlsx + .csv), GIS-based Ambient Exposure Map (District-wide Heatmap), and Community Health Risk Assessment Report.	30%	Week 10
4. Final Integrated Technical Report (full analysis + recommendations).	20%	Week 12

F. CONTRACT DURATION

45–60 working days, including all fieldwork, lab analysis turnaround time (for passive samplers), QA/QC and reporting.

G. REQUIRED EXPERTISE

The consultant/team must have:

- Master's degree in environmental science, Atmospheric Science, Chemistry or Toxicology.
- Documented experience in mercury vapour ambient air monitoring (**specifically using both active and passive methodologies**).
- Experience with **Source Apportionment** and dispersion characteristics of heavy metals.
- Competence in GIS mapping and meteorological analysis.
- Demonstrated project experience in urban exposure assessments.

H. SELECTION CRITERIA

Proposals will be evaluated based on the following:

- **Relevant Experience (30%):** Documented experience in mercury vapour monitoring using both active and passive methodologies and demonstrated project experience in urban exposure assessments.
- **Technical Methodology and Approach (20%):** Quality of the proposed hybrid sampling strategy, QA/QC plan, and the integration of meteorological data.
- **Academic Qualifications & Team Composition (20%):** Verification of required Master's degrees in relevant scientific fields and competence in GIS mapping and toxicological risk assessment.
- **Financial Proposal (30%):** Cost-effectiveness of the all-inclusive fee.

I. APPLICATION PROPOSAL

The Consultant must submit:

1. Technical Proposal

- Indicating the consultant's understanding of the TOR and a description of how he/she proposes to carry out the tasks and achieve the deliverables;
- Statement of why the consultant considers her/him suitable for this consultancy;
- CV's of the consultant indicating all past experience, as well as the contact details of the consultant and at least three (3) professional references.

2. Financial Proposal

- Applicants are instructed to submit their financial proposals in Suriname Dollars (SRD) for this consultancy. Selected candidate who submitted a US Dollar quotation will be paid in SRD at the prevailing UNORE rate at time of payment. (Reference: https://treasury.un.org/operationalrates/OperationalRates.php#S)

- Financial proposals must indicate an all-inclusive daily fee. This fee must consider professional fees, communications, consumables, specialized equipment rentals (analyzers/passive samplers), lab analysis fees, insurance, and any other relevant expenses.

J. Submission and Opening of Proposals

All proposals must be submitted to the email address: **info-EMSAGS@nimos.org** , with the subject reading as follows **:"Application for Ambient Air Quality Measurements and Analysis of Mercury Vapour Around a Cluster of Gold-Buying Shops in Paramaribo Noord**".

- Submission Deadline: Friday, April 17, 2026, 15:00h Suriname Time.
- Please ensure that the Application letter, CVs, Technical Proposal, and Financial Proposal are submitted as **SEPARATE FILES** in one email.
- Any proposal that arrives after the deadline for submission shall not be considered.