









**Ministry of Environment and Energy**

Republic of Maldives

**Terms of Reference**

**Consultancy Services for Laboratory Analysis of Potential PCB containing oil samples**

**1. BACKGROUND**

The Government of the Republic of Maldives has received funding from United Nations Industrial Development Organization (UNIDO) for the “Implementation of an environmentally sound management of municipal and hazardous solid waste to reduce emissions from unintentional POPs and PCBs”.

Polychlorinated biphenyls (PCBs) are a class of synthetic organic chemicals popular in the past for their use in electrical equipment. Even though its properties such as inertness and longevity made it favorable in the commercial industry, in 1979 production of PCBs were banned due to their toxicity to the environment and human health. PCBs are one of the most widespread persistent environmental pollutants and were classified as Persistent Organic Pollutant in 2001 by the “Stockholm Convention on Persistent Organic Pollutants (POPs). All parties including the Maldives who have ratified the convention are mandated to eliminate Polychlorinated Biphenyls (PCBs) containing liquids and PCB contaminated equipment by 2025.

The National Implementation Plan was developed and published this year under the obligations as party to the Stockholm convention on Persistent Organic Pollutants. The main objective of the study is to protect human health and the environment from POPs. According to the National Implementation Plan (NIP) there are 18 potential PCB containing equipment in Maldives. These include 15 electrical transformers and 3 circuit breakers. The total volume of PCB contaminated oil from all 18 equipment is estimated to be 6100 liters. Hence the objective of this project is to gather analytical data to implement the action plans identified in the National Implementation Plan (NIP).

The Government of the Republic of Maldives intends to apply part of the proceeds of this project for consultancy services for laboratory analysis of transformer oil and circuit breaker oil samples from two main regions that have been identified to potentially contain PCB contaminated transformers. All 15 transformers and 3 circuit breakers were found within two of the cities in the south of Maldives; Addu City and Fuvahmulah City.

Human exposure to PCBs occurs mostly in the individuals working in power sector/ factories with use of PCBs or PCB containing equipment. Occupational exposure to PCBs can result in a broad spectrum of health related risks such as elevated serum lipid levels, increased level of some serum enzyme and possible damage to liver and respiratory problems.

The Government of the Maldives is now seeking the consultancy services for laboratory analysis to test the PCB samples taken from these two cities where the equipment is located.

## **2. OVERALL OBJECTIVE**

The overall objective of the assignment is to analyze the oil samples of potentially PCB contaminated equipment, to confirm the presence of PCB in the samples and to determine the concentration levels of PCB in the oil. A total of 1 liter samples will be collected from each of the 5 pieces of equipment identified in the NIP.

Aim of this assignment is to confirm the presence of PCB in transformer oil through chemical analysis to further improve the national PCB inventory for national reporting purpose as well as obtaining detailed information on existing PCB contaminated equipment for planned elimination of PCBs for 2025 target.

## **3. SCOPE OF WORKS**

Preliminary qualitative assessment of PCB containing equipment showed presence of 18 pieces of potentially PCB containing equipment in the Maldives

As part of this assignment PCB samples will be obtained from 5 of the potential PCB containing equipment identified by the PCB qualitative assessment.

Samples have been collected by a team from the Ministry. Sampling had been carried out according to IEC 60475:2010, Method of Sampling Liquid Dielectrics. Precautions for sample collection will be taken by the team in accordance to the IEC 60475:2010, Method of Sampling Liquid Dielectrics

The successful bidder is required to undertake a primary screening by using a non-specific method for chlorine detection using ion specific electrode or screening test kits. Since PCBs contain chlorine the aim of this is to determine whether any chlorine-based compounds are detected in the samples. Though a negative result for chlorine confirms the absence of any PCB congeners in the samples. A positive result for chlorine only confirms the presence of chlorine in the sample and is an indication of probable PCB contamination in the equipment. This helps us narrow down samples for secondary testing. Only samples that are tested positive for chlorine will undergo secondary testing.

Further secondary testing should be conducted on a maximum of 9 samples. If the number of chlorine containing samples exceed 9, ministry will reserve the right to determine the samples that would undergo further screening based on the locations the samples were taken from. Secondary testing should follow IEC 61619:1997- Insulating Liquids - Contamination by polychlorinated biphenyl (PCBs)-Method of determination by capillary column gas chromatography.

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### **a. Laboratory Analysis**

All the samples collected and handed over to the consultancy firm are required to undergo Rapid Oil characterization (ROC) methods or any internationally accepted method using either:

1. Colorimetric method for determination of PCBs with test kits – ROC method 1
- (or)
2. Electrochemical method for the determination of PCB content with ion specific electrode acc. to US EPA SW-846 method 9079 – ROC method 2

Out of the 5 samples, the samples that are will be tested using Advanced Chemical Fingerprinting (ACF) methods.

Advance Chemical Fingerprinting (ACF) methods should follow IEC 61619:1997 Contamination by polychlorinated biphenyl (PCBs)-Method of determination by capillary column gas chromatography.

Upon quantitative analysis, samples need to be classified according to the obtained results as:

“Not contaminated with PCB” (<50 ppm PCB) or

“Contaminated with PCB” (>50 ppm PCB)

### **b. Assessment of results of investigation**

Results of laboratory analyses should be presented and processed as follows:

- Original of laboratory protocols, including the chain of custody forms
- Tables of results of laboratory analysis indicating presence of PCBs where applicable along with concentration of PCBs in the sample measured in ppm, including the chromatograms.

Additional works related to shipping and laboratory works includes:

- Obtain necessary permits to bring the sample in the country in which the laboratory is located.
  - Share the permit documents with the client for ease of delivery.
  - Informing the client once the sampled have been safely collected/received by the laboratory.
  - Preparation of an analysis report of the samples.
  - Share both hardcopies and soft copies of the results of the laboratory tests including analysis report to the client.
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#### 4. DELIVERABLES

The deliverables and indicative time schedule is as follows:

- Packing and shipping safety guidelines.
- Handling of all Export permits from Maldives to the country where the laboratory is located. A record of the shipment export receipt its tracking number etc need to be indicated to the Ministry.
- Handling of all Import permits for the country in which the laboratory is located (or) Letter from relevant government agency informing that permits are not required for import of samples for similar works. A record of receipt of exported samples to the laboratory need to be indicated to the Ministry.
- Initial results of the samples after primary screening of the samples
- Detailed analysis report of the results.

#### 5. PAYMENT

Payment will be in accordance with the schedule specified below;

DESCRIPTION	ALLOCATION	REQUIREMENT
Receipt of oil samples by the laboratory	15%	Export from origin country and Import permits for the country in which the laboratory is located. Records of Customs clearance reports and receipt of samples to the laboratory need to be submitted to the client.
Primary assessment of oil samples	35%	Primary assessment conducted using Rapid Oil Characterization Method and results emailed to client.
Completion of all remaining works	50%	Receipt of results Advanced Chemical Fingerprinting (ACF) methods and final assessment of results of investigation by the Client

#### 6. REPORTING

Completion of each deliverable should be informed and communicated with the Project Management Unit, Ministry of Environment and Energy, Republic of Maldives. All communications, reports and documents submitted should be in English

#### 7. SUBMISSION REQUIREMENTS

The following documents shall be submitted for the bids to be considered sufficiently responsive.

1. company profile
  2. company /Laboratory accreditation certificate
  3. Accreditation for the international standards stipulated in section 11 of this TOR
  4. List of related laboratory analysis completed by the company/laboratory within the past 3 years along with valid official reference letters
  5. Cost breakdown of major activities. The total cost shall be clearly indicated.
  6. GST Registration Certificate if applicable
  7. Duration of completion of all deliverables
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## 8. EVALUATION CRITERIA

Category		Total Marks
1. Profile of the Laboratory /Company		30
2. Number of similar analysis undertaken		20
3. Price of Quotation	The Party with lowest financial proposal will get 50%. Other parties will be scored by [(lowest price/proposed price) x 50]	50
<b>TOTAL</b>		<b>100%</b>

## 9. CONTRACT DURATION

The contract duration will be based on the duration stated in the quotations submitted. The maximum duration allowed for the assignment is **45 days**.

## 10. SERVICES AND FACILITIES PROVIDED BY THE CLIENT

Any works that need to be conducted at the sampling site will be conducted by the Client; Ministry of Environment and Energy with the support from the stakeholders involved. This work includes:

- Communications and permits from the companies that have equipment possibly contaminated with PCB.
  - Collection of sample of transformer and circuit breaker oil from all 5 pieces of equipment.
  - Initiating the chain of custody procedure: filling the chain of custody forms to trace the possession of each sample from the moment of collection to the laboratory of destination, demonstrating that none of the samples have been tampered with or Contaminated during collection, transit, storage or analyses.
  - Obtaining permits to ship samples to address specified by the contractor.
  - Shipping the samples according to international safety guidelines
- Any additional information required by the laboratory can be requested by email to the project PMU.

## 11. Laboratory or testing facility requirements

The laboratory for PCB oil analysis should be accredited to perform analytical tests in accordance with the technical standards issued by International Electro technical Commission. It should have a multidisciplinary approach in diagnostics based on integrated chemical and electrical measurements, performed by specialized experts. The laboratory should have a proven track record of successful participation in international Round Robin Tests (RRT) and Proficiency Tests (PT Schemes) for determination of PCBs content in oils and for different oil analyses.

Chemical Laboratory for testing insulating oil should have accreditation for the following international standards:

- ISO/IEC 17025:2005: General requirements for the competence of testing and
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calibration laboratories

- IEC 61619:1997 Contamination by polychlorinated biphenyl (PCBs)-Method of determination by capillary column gas chromatography
- US EPA SW-846 method 9079.

The laboratory should be an experienced entity in screening and analysis methods for PCB contaminated equipment for enforcement agencies, state bodies, as well as transformer maintenance and repair utilities.

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