**TERMS OF REFERENCE (TOR)**

**of**

**Environmental Quality Monitoring During Operational Phase by 3rd Party**

**(May 2026 – April 2031)**

**Environmental Quality Monitoring During Operational Phase by 3rd Party (May 2026 – April 2031)**

1. **BACKGROUND**

Hongsa Power Company Limited (hereinafter referred as the “Employer”) pleased to announce herewith Term of Reference (TOR) to inquire for the potential Company (hereinafter referred as the “Bidder”) regarding to service on the environmental quality monitoring, performing for the planning, field sampling, laboratory, data analysis, result interpretation, reporting and be the part of Employer environmental quality monitoring team (The 3rd party monitoring unit).

**1.1 PROJECT DESCRIPTION**

The Project located in Hongsa, Xayaboury Province, northwestern region of Lao PDR, approximately 34 km northeast from the Thai - Lao border at the HouayKhon Checkpoint, ChaloemPrakiat District, and Nan Province, Thailand. It is about 67 km2 Concession Area granted by the Government of Lao. The area is a relatively flat valley floor at about 500 m MSL, surrounded by rough hills rising to over 900 m in elevation. The valley floor area is triangular, narrow in the east and wide in the west. Streams and small rivers flow into the valley, the largest of which is the Nam Luok. The Nam Ken is joined by the Nam Luok at the northern edge of the valley and flows through a narrow valley to the Mekong River.

|  |  |
| --- | --- |
| The Project comprises:**(A)** The Power Plant Project encompasses the development of an 1,878 MW (626 MW x 3 units) coal-fired power plant project commonly referred as the Hongsa Power Plant to be located in the Hongsa District, Xayaboury Province, northwestern Lao PDR, including all of the project facilities related thereto under the Power Concession Agreement. It is proposed that ash produced by the power plant be transported to the dumping area approximately 1 km northwest of the power complex. Water supply for the power plant will be supplied by a 45.0 million m3,0.9 and 2 km2 of reservoir created by erecting a dam on the Nam Luok (4 km. upstream of Muang Hongsa) and Nam Ken (9 km downstream of Muang Hongsa), respectively. A double circuit 500 kV transmission line will be built over a length of approx. 67 km to a point along the Thai/Laos border to deliver power to the EGAT power grid. | D:\003-GIS\Map\Project Overview\Overview_5.jpg**(B)** The Coal Mining Project encompasses the survey, exploration, prospecting, evaluation, mining, refining (treatment & processing), exploitation, and transportation of Coal in and from the Coal Mining Area as defined in the Mining Concession Agreement including expansion area by the conveyor, the design, construction, completion, operation and maintenance of the Coal Mining Project, the supply and delivery of Coal to the Project, and all other ancillary activities related thereto to be carried out under the Mining Concession Agreement. |
| **(C)** The Limestone Quarry Project encompasses developing, financing, owning, operating and extracting limestone for use by the Project to produce power for desulphurization process for Project’s Power Plant, under the Mining Concession Agreement. The limestone quarry is located 35 km far from the Power Plant and Mining area. |  C:\Users\Pasit Chaisorn\Desktop\HPC Project Overview Rev3_Page1.jpg |

**1.2 STANDARDS AND REGULATIONS**

The reference standards and regulations used in this project are divided into 2 sections i.e. (reference standards and regulations as APPENDIX A)

* + 1. **The standards for the monitoring at Hongsa and Nguen Districts, Xayaboury Province, Lao PDR**
		- The governing standards and obligations between the Government of Lao PDR and Hongsa Power Company Limited addressed on the Concession Agreement, Annex I/Q - Company’s Social and Environmental Obligations.
		- National Environmental Standard of Lao PDR.
		- Agreement on the protection of the drinking water and water supply quality, Department of Health and Environment Ministry of Public Health, Lao PDR (March 2014).
		- International Finance Corporation (IFC) Environmental, Health and Safety Guidelines: General EHS Guidelines, April 30, 2007.
		1. **The standards for the monitoring at Nan Province, Thailand**
		- ประกาศคณะกรรมการสิ่งแวดล้อมแห่งชาติ ฉบับที่ 24 (พ.ศ. 2547) เรื่องกำหนดมาตรฐานคุณภาพอากาศในบรรยากาศโดยทั่วไป ประกาศในราชกิจานุเบกษา ฉบับทั่วไป เล่ม 121 ตอนพิเศษ 104ง ลงวันที่ 22 กันยายน พ.ศ. 2547
		- ประกาศคณะกรรมการสิ่งแวดล้อมแห่งชาติ ฉบับที่ 33 (พ.ศ. 2552) เรื่อง กำหนดมาตรฐานค่าก๊าซไนโตรเจนไดออกไซด์ในบรรยากาศโดยทั่วไป ประกาศ ณ วันที่ 17 มิถุนายน พ.ศ. 2552
		- ประกาศคณะกรรมการสิ่งแวดล้อมแห่งชาติ เรื่อง กำหนดมาตรฐานฝุ่นละอองขนาดไม่เกิน 2.5 ไมครอน ในบรรยากาศโดยทั่วไป ประกาศ ณ วันที่ 23 มิถุนายน พ.ศ. 2565
		- มาตรฐานคุณภาพน้ำในแหล่งน้ำผิวดิน ประกาศคณะกรรมการสิ่งแวดล้อมแห่งชาติ ฉบับที่ 8 (พ.ศ. 2537) ออกตามความในพระราชบัญญัติส่งเสริมและรักษาคุณภาพสิ่งแวดล้อมแห่งชาติ พ.ศ. 2535 (ประเภทที่ 2, 3 และ 4)
		- มาตรฐานน้ำดิบของการประปาส่วนภูมิภาค (อ้างอิงจาก WHO guideline, 2550)
		- มาตรฐานคุณภาพน้ำประปา การประปาส่วนภูมิภาค เอกสารแนบท้ายคำสั่ง กปภ. ที่ 197/2565 ลงวันที่ 9 มีนาคม 2565 ตามคำแนะนำขององค์การอนามัยโลก (WHO) ฉบับที่ 4 ปี ค.ศ. 2011 ภาคผนวกที่ 1 ปี ค.ศ. 2017
		- เกณฑ์มาตรฐานปริมาณปรอทในเนื้อปลาและผลิตภัณฑ์ประมง ตามประกาศกระทรวงสาธารณสุข ฉบับที่ 98 (2529) และฉบับที่ 273 (2546)
1. **OBJECTIVE**

The objective of this implementation is to conduct for the environmental quality monitoring during the operational phase around the Project’s concession area and relevant communities according to the scope of Operational Phase Environmental Management and Monitoring Plan (OPEMMP) to monitor the environmental impacts possibly caused by the Project’s activities, including the preparation of measures to mitigate and prevent environmental impacts during May 2026 – April 2031.

Environmental quality monitoring will be included in significant and potential environmental concerns e.g. air quality, noise level, vibration level, surface water quality, groundwater quality, aquatic flora, aquatic fauna, biological condition, water supply quality, drinking water quality, discharge water quality and cover for the Project’s locations. Moreover, the monitoring results shall be summarized and compared with relevant standards and regulations, then official report to relevant the Government of Lao PDR and Government of Thailand.

1. **OPERATIONNAL PLAN AND COMPLETION DATE**

The environmental quality monitoring schedule is as follows.

1. The monitoring plan, immigration request and related documents must be submitted at least 2 weeks prior to field monitoring.
2. Field monitoring must be completed by the 2nd week of the last month of each quarter (March, June, September and December).
3. Field sampling reports (all tasks) must be submitted within 2 weeks (14 days) after field monitoring is completed.
4. Analysis reports (all tasks) must be submitted within 3 weeks (21 days) after field monitoring is completed.
5. The 1st draft report (all tasks) must be submitted within 6 weeks (42 days) after field monitoring is completed.
6. All reports must be reviewed and revised within 4 weeks after the 1st draft reports are submitted.
7. All reports will be delivered to Hongsa within 11 weeks (77 days) after field monitoring is completed.

**Table 1** Environmental quality measurement implementation schedule

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | January | February | March | April | May | June | July | August | September | October | November | December |
| W1 | W2 | W3 | W4 | W1 | W2 | W3 | W4 | W1 | W2 | W3 | W4 | W1 | W2 | W3 | W4 | W1 | W2 | W3 | W4 | W1 | W2 | W3 | W4 | W1 | W2 | W3 | W4 | W1 | W2 | W3 | W4 | W1 | W2 | W3 | W4 | W1 | W2 | W3 | W4 | W1 | W2 | W3 | W4 | W1 | W2 | W3 | W4 |
| 1. Submit the monitoring plan and related documents
 |  |  |  |  |  | Q1 |  |  |  |  |  |  |  |  |  |  |  | Q2 |  |  |  |  |  |  |  |  |  |  |  | Q3 |  |  |  |  |  |  |  |  |  |  |  | Q4 |  |  |  |  |  |  |
| 1. Conduct field monitoring
 |  |  |  |  |  |  |  |  | Q1 | Q1 |  |  |  |  |  |  |  |  |  |  | Q2 | Q2 |  |  |  |  |  |  |  |  |  |  | Q3 | Q3 |  |  |  |  |  |  |  |  |  |  | Q4 | Q4 |  |  |
| 1. Submit field sampling reports
 |  |  |  |  |  |  |  |  |  |  |  | Q1 |  |  |  |  |  |  |  |  |  |  |  | Q2 |  |  |  |  |  |  |  |  |  |  |  | Q3 |  |  |  |  |  |  |  |  |  |  |  | Q4 |
| 1. Submit analysis reports
 | Q4 |  |  |  |  |  |  |  |  |  |  |  | Q1 |  |  |  |  |  |  |  |  |  |  |  | Q2 |  |  |  |  |  |  |  |  |  |  |  | Q3 |  |  |  |  |  |  |  |  |  |  |  |
| 1. Submit 1st draft reports
 |  |  |  | Q4 |  |  |  |  |  |  |  |  |  |  |  | Q1 |  |  |  |  |  |  |  |  |  |  |  | Q2 |  |  |  |  |  |  |  |  |  |  |  | Q3 |  |  |  |  |  |  |  |  |
| 1. Review and revise all reports
 |  |  |  |  | Q4 | Q4 | Q4 | Q4 |  |  |  |  |  |  |  |  | Q1 | Q1 | Q1 | Q1 |  |  |  |  |  |  |  |  | Q2 | Q2 | Q2 | Q2 |  |  |  |  |  |  |  |  | Q3 | Q3 | Q3 | Q3 |  |  |  |  |
| 1. Delivery all reports to the Hongsa Office
 |  |  |  |  |  |  |  |  | Q4 |  |  |  |  |  |  |  |  |  |  |  | Q1 |  |  |  |  |  |  |  |  |  |  |  | Q2 |  |  |  |  |  |  |  |  |  |  |  | Q3 |  |  |  |

1. **SITE PERMIT REQUISITION**

Documents for Site Permit Requisition (HPC document forms) must be submitted at least 3 weeks before working on the premises included.

* Site Permit Requisition (SPR)
* Job Safety Analysis (JSA)
* Medical certificate (validate in 1 year)
* Environmental Mitigation Measures related to approved OPEMMP of HPC.

\*\*\*Operator EMP as HPC’s template is required to submit after 90 days after 1st SPR is approved.

1. **REPORTING**
2. **Field sampling report**
* Table of contents
* Station name, actual coordinates (UTM), parameters and monitoring or sampling date.
* Overview map of sampling/monitoring stations.
* Site observation and surrounding environment table.
* A 100 meters radius map around monitoring point.
* Picture of sample collection, preservation and appearance.
* Picture of surrounding environment in the north, south, east and west directions
* Actual surrounding conditions around the measurement point and specific activities that may affect measurement results.
* Chain of Custody
* Problems and obstacles encountered during field monitoring (if any).
1. **Analysis report**
* Table of contents
* Standard method of determination.
* Methods of sample collection and sample preservation.
* Summary table of analysis results, applicable standards and Limit of Quantitation (LOQ) or Limit of Detection.
* Appendix: Analysis report signed by authorized person.
1. **Summary report**
* The summary report for the Environmental quality monitoring in Lao PDR is prepared in English and Lao languages.
* The summary report for the Environmental quality monitoring in Nan Province is prepared in Thai language.

**Content of report**

* **Table of contents**
* **Introduction**
* Background of the project
* Objective of Environmental quality monitoring
* **Standards and Regulations**
* Standard method of determination, Limit of Quantitative
* Sampling method and sample preservation methods
* Quality Assurance/ Quality Control (QA/QC)
* **Ambient air quality monitoring**
	+ Station name, actual coordinates (UTM), parameters and monitoring or sampling date
	+ Overview map of monitoring stations.
	+ Site observation and surrounding environment table (same format as field sampling report).
	+ Results and discussion: summarized monitoring results compared with the applicable standards and possible causes of exceeding standard results.
	+ Monitoring results table (show sample name, parameters, unit, results, applicable standards).
	+ Monitoring results graph for each parameter (present period).
	+ Compare the monitoring results with the previous period and the same period last year with the comparison graph for each parameter.
* **Ambient noise level monitoring**
	+ Station name, actual coordinates (UTM), parameters and monitoring or sampling date
	+ Overview map of monitoring stations.
	+ Site observation and surrounding environment table (same format as field sampling report).
	+ Results and discussion: summarized monitoring results compared with the applicable standards and possible causes of exceeding standard results.
	+ Monitoring results table (show sample name, parameters, unit, results, applicable standards).
	+ Monitoring results graph for each parameter (present period).
	+ Compare the monitoring results with the previous period and the same period last year with the comparison graph for each parameter.
* **Vibration level monitoring**
	+ Station name, actual coordinates (UTM), parameters and monitoring or sampling date
	+ Overview map of monitoring stations.
	+ Site observation and surrounding environment table (same format as field sampling report).
	+ Results and discussion: summarized monitoring results compared with the applicable standards and possible causes of exceeding standard results.
	+ Monitoring results table (show sample name, parameters, unit, results, applicable standards).
* **Surface water quality monitoring (stream and dam)**
	+ Station name, actual coordinates (UTM), parameters and monitoring or sampling date
	+ Overview map of monitoring stations.
	+ Site observation and surrounding environment table (same format as field sampling report).
	+ Results and discussion: summarized monitoring results compared with the applicable standards and possible causes of exceeding standard results.
	+ Monitoring results table (show sample name, parameters, unit, results, applicable standards, Limit of Quantitation).
	+ Monitoring results graph for each parameter (present period).
	+ Compare the monitoring results with the previous period and the same period last year with the comparison graph for each parameter.
* **Groundwater quality monitoring**
	+ Station name, actual coordinates (UTM), parameters and monitoring or sampling date
	+ Overview map of monitoring stations.
	+ Site observation and surrounding environment table (same format as field sampling report).
	+ Results and discussion: summarized monitoring results compared with the applicable standards and possible causes of exceeding standard results.
	+ Monitoring results table (show sample name, parameters, unit, results, applicable standards, Limit of Quantitation).
	+ Monitoring results graph for each parameter (present period).
	+ Compare the monitoring results with the previous period and the same period last year with the comparison graph for each parameter.
* **Aquatic ecology monitoring**
	+ Station name, actual coordinates (UTM), parameters and monitoring or sampling date
	+ Overview map of monitoring stations.
	+ Site observation and surrounding environment table (same format as field sampling report).
	+ Results and discussion
	+ Monitoring results table (show sample name, parameters, unit, results)
	+ Monitoring results graph for each parameter (present period)
	+ Compare the monitoring results with the previous period and the same period last year with the comparison graph.
* **Drinking water quality monitoring**
	+ Station name, actual coordinates (UTM), parameters and monitoring or sampling date
	+ Overview map of monitoring stations.
	+ Site observation and surrounding environment table (same format as field sampling report).
	+ Results and discussion: summarized monitoring results compared with the applicable standards and possible causes of exceeding standard results.
	+ Monitoring results table (show sample name, parameters, unit, results, applicable standards, Limit of Quantitation).
	+ Monitoring results graph for each parameter (present period).
	+ Compare the monitoring results with the previous period and the same period last year with the comparison graph for each parameter.
* **Water supply monitoring**
	+ Station name, actual coordinates (UTM), parameters and monitoring or sampling date
	+ Overview map of monitoring stations.
	+ Site observation and surrounding environment table (same format as field sampling report).
	+ Results and discussion: summarized monitoring results compared with the applicable standards and possible causes of exceeding standard results.
	+ Monitoring results table (show sample name, parameters, unit, results, applicable standards, Limit of Quantitation).
	+ Monitoring results graph for each parameter (present period).
	+ Compare the monitoring results with the previous period and the same period last year with the comparison graph for each parameter.
* **Discharge water quality monitoring**
	+ Station name, actual coordinates (UTM), parameters and monitoring or sampling date
	+ Overview map of monitoring stations.
	+ Site observation and surrounding environment table (same format as field sampling report).
	+ Results and discussion: summarized monitoring results compared with the applicable standards and possible causes of exceeding standard results.
	+ Monitoring results table (show sample name, parameters, unit, results, applicable standards, Limit of Quantitation).
	+ Monitoring results graph for each parameter (present period).
	+ Compare the monitoring results with the previous period and the same period last year with the comparison graph for each parameter.
1. **Executive summary report**

Executive summary report for the Environmental quality monitoring in Lao PDR (Task1).

The Bidder shall submit reports and relevant documents in the formats specified as table below.

**Table 2** Reporting format and number of reports delivered

| **No.** | **Report** | **Language** | **Reporting format** |
| --- | --- | --- | --- |
| **PDF** | **MS word** | **MS Excel** | **Presentation****(MS PowerPoint)** | **Hard copy report** |
| **Task 1 Overall Project (Hongsa and Nguen District, Xayaboury Province, Lao PDR)** |
| 1 | Field sampling report | ENG | P | P | - | - | 1 Set |
| 2 | Analysis report | ENG | P | P | - | - | 1 Set |
| 3 | Analysis result + Graph | ENG | - | - | P | - | - |
| 4 | Summary report | ENG + LAO | P | P | - | P(Eng) | 9 Set |
| 5 | Executive summary report | ENG + LAO | P | P | - | - |
| **Task 2 Transboundary (Nan Province, Thailand)** |
| 1 | Field sampling report | Thai | P | P | - | - | 1 Set |
| 2 | Analysis report | Thai | P | - | P | - | 1 Set |
| 3 | Analysis result + Graph | ENG | - | - | P | - | - |
| 4 | Summary report | Thai | P | P | - | P | 7 Set |
| Additional **(Ban Namsib – Hongsa District, Xayaboury Province, Lao PDR) (Air quality, Mercury in fish tissue and sediment)** |
| 1 | Analysis report  | ENG | P | - | P | - | 1 Set |

Remark : For reports in PDF, MS Word, MS Excel, MS PowerPoint formats, send via email.

1. **REPORT DELIVERY ADDRESS**
2. Hongsa Power Company Limited

3/37-38 Worawichai Road, Naiwiang Sub-District, Muang District, Nan Province 55000

1. Hongsa Power Company Limited

NNN Building 4th Floor/Room No. D5, Boulichan Road, Phonsinouan Village, Sisattanark District, Vientiane Capital, Lao PDR

1. **SCOPE OF WORK**

The Bidder shall carry out and complete Environmental Quality Monitoring by 3rd Party during Operational Phase in compliance with OPEMMP (Operational Phase Environmental Management and Monitoring Plan) requirements. The scope of work is to be undertaken by the Bidder, which represents it has full knowledge and understanding of its duties and obligations. The Bidder shall perform the services promptly as follows:

1. Employer’s Safety, Health, and Environmental regulations e.g. PPE (Personal Protective Equipment), First Aid Kit, cleanliness and others that are required by HPC.
2. Thailand and Laos immigrations, shipping, tax, insurance, and other relevant processes including all fees to support the processes.
3. Power supply (electricity or generator or battery), security and land rental fees for ambient air/ noise/ vibration monitoring in community and boundary areas according to Table 3.

**Table 3** Electrical source for measuring equipment and land rental fees.

| **Location**  | **Station** | **Task** | **Frequency\*****(Time/year)** | **Power supply** | **Security and land rental fees****(THB/time)** |
| --- | --- | --- | --- | --- | --- |
| **Electricity** | **Generator** |
| Hongsa District | 1. Hongsa primary school
 | 1 | 2 | P |  | 1,500 |
| 1. Ban Simongkol temple
 | 1 | 2 | P |  | 1,500 |
| 1. Ban Nam Sib
 | 1 | 1 | P |  | 1,500 |
| 1. CPE Camp
 | 1 | 1 | P |  | - |
| 1. CA. Boundary Ban Champa
 | 1 | 1 |  | P | - |
| 1. CA. Boundary Simongkol
 | 1 | 1 |  | P | - |
| Nguen District | 1. Ban Bimi primary school
 | 1 | 2 | P |  | 1,500 |
| 1. Ban Kang primary school
 | 1 | 2 | P |  | 1,500 |
| 1. Muang Nguen (Center stadium)
 | 1 | 2 | P |  | 1,500 |
| 1. Limestone Quarry (CA. Boundary)
 | 1 | 1 | P |  | - |
| MCA Expansion | 1. Ban Kiew Ngew primary school
 | 1 | 2 | P |  | 1,500 |
| 1. Ban Bo Luang primary school
 | 1 | 2 | P |  | 1,500 |
| Nan Province | 1. โรงเรียนมัธยมพระราชทานเฉลิมพระเกียรติ ต.ห้วยโก๋น

อ.เฉลิมพระเกียรติ จ.น่าน | 2 | 2 | P |  | 3,000 |
| 1. โรงเรียนบ้านสบมาง ต.ภูฟ้า

อ.บ่อเกลือ จ.น่าน | 2 | 2 | P |  | 3,000 |
| 1. วัดศรีพันต้น อ.เมือง จ.น่าน
 | 2 | 2 | P |  | 3,000 |

\* *Measured for 3 consecutive days.*

1. Boat for collecting samples at the following monitoring station.
2. Upstream of Nam Louk Dam
3. Mid-stream of Nam Ken Dam
4. อ่างเก็บน้ำห้วยปูซ้อ ต.ห้วยโก๋น อ.เฉลิมพระเกียรติ จ.น่าน
5. Vehicle for staff traveling and equipment mobilization/ demobilization, accommodation, food, drinks and other consumable fees.
6. The bidder shall present the work procedure for field monitoring 1 time prior to the first operation.
7. The Bidder shall perform for all environmental quality monitoring consisting of 3 tasks i.e.
	1. **Task 1**: The monitoring for Overall Project in Lao PDR (Power Plant, Lignite Mining, Limestone Quarry, Expansion of Lignite Mine Concession Area and Community Areas in Hongsa and Nguen District, Xayaboury Province, Lao PDR).
	2. **Task 2**: The monitoring for Transboundary (Nan Province, Thailand).
	3. **Additional analysis (exclude in main report of Task 1)** in Hongsa, Lao PDR (Air quality at Ban Namsib, Mercury in fish tissue and sediment).

1. **METHOD OF DETERMINATION**

Methods of determination and required Limit of Quantitation (LOQ) or Limit of Detection are as follows.

**Table 4** Method of determination and required Limit of Quantitation (LOQ) or Limit of Detection

| **Parameters** | **Method of Determination** | **Desired Limit of Quantitation****(LOQ)** | **Unit** | **Remark** |
| --- | --- | --- | --- | --- |
| **Ambient air quality and Meteorological condition** |
| Total suspended particulate (TSP) | Gravimetric High-Volume Method  | ≤1 | µg/m3 | 72 Consecutive hours |
| Particulate matter less than 10 µm (PM10) | Beta Ray Attenuation, Gravimetric High Volume Method, Tapered Element Oscillating Microbalance, Light Scattering or Dichotomous Air Sampler | ≤1 | µg/m3 |
| Sulphur dioxide (SO2) | UV Fluorescence Method or Pararosaniline Method | ≤1 | µg/m3 |
| Nitrogen dioxide (NO2) | Chemiluminescence or Cavity Attenuated Phase Shift Spectroscopy | ≤1 | µg/m3 |
| Particulate matter less than 2.5 µm (PM2.5) | Beta Ray Attenuation, Gravimetric Low Volume Method, Tapered Element Oscillating Microbalance, Light Scattering or Dichotomous Air Sampler | ≤1 | µg/m3 |
| Arsenic (As) in PM10 | Hydride Generation Atomic Absorption Spectrometric Method | ≤0.0002 | µg/m3 |
| Cadmium (Cd) in PM10 | Atomic Absorption Spectrophotometric or Inductively Coupled Plasma Spectroscopy | ≤0.02 | µg/m3 |
| Lead (Pb) in PM10 | Atomic Absorption Spectrophotometric or Inductively Coupled Plasma Spectroscopy | ≤0.07 | µg/m3 |
| Mercury (Hg) in PM10 | Cold-Vapor Atomic Absorption Spectrometric Method | ≤0.0002 | µg/m3 |
| Wind speed (WS) | Cup Anemometer | - | m/s |
| Wind direction (WD) | Wind vane | - | m/s |
| **Noise level**  |
| 1. Day Average Sound Level (LAd)
2. Night Average Sound Level (LAn)
3. 24 Hours A-Weight Equivalent Continuous Sound Level (LAeq 24 hours)
4. 8 Hours A-Weight Equivalent Continuous Sound Level (LAeq 8 hours)
5. 1 Hour A-Weight Equivalent Continuous Sound Level (LAeq 1 hour)
6. Percentile 90 Sound Level (LA90)
7. Maximum Sound Level (LAmax)
8. Minimum Sound Level (LAmin)
 | International Organization for Standardization (ISO1996) for noise level measurement | - | dB(A) | 72 Consecutive hours |
| **Vibration level**  |
| 1. Peak particle velocity (Transverse, Vertical, Longitudinal)
2. Displacement (Transverse, Vertical, Longitudinal)
3. Frequency
 | International Organization for Standardization(ISO4866) for vibration level measurement | - | mm/smmHz | 72 Consecutive hours |
| **Water Quality, Sediment and Fish tissue** |
| Aldrin | Liquid-Liquid Extraction Gas Chromatographic Method | ≤0.1 | µg/L | LOQ or LOD |
| Alkalinity | Titrimetric Method | ≤1.0 | mg/L as CaCO3 |  |
| Alpha-BHC | Liquid-Liquid Extraction Gas Chromatographic Method | ≤0.02 | µg/L | LOQ or LOD |
| Aluminium (Al) | AAS or ICP | ≤0.05 | mg/L |  |
| Ammonia - Nitrogen (NH3 - N) | Phenate Method | ≤0.01 | mg/L as N |  |
| Arsenic (As) | Hydride Generation Atomic Absorption Spectrometric Method | ≤0.001 | mg/L |  |
| Biochemical Oxygen Demand (BOD) | 5 Day BOD test, Azide Modification | ≤0.1 | mg/L |  |
| Depth | Depth Meter | - | meter or centimeter |  |
| Cadmium (Cd) | AAS or ICP | ≤0.001 | mg/L |  |
| Calcium (Ca) | AAS or ICP | ≤0.05 | mg/L |  |
| Chemical Oxygen Demand (COD) | Open Reflux, Colorimetric Method | ≤5 | mg/L |  |
| Chloride (Cl-) | Argentometric or Mercuric Nitrate Method | - | mg/L |  |
| Chromium (Cr) | AAS or ICP | ≤0.01 | mg/L |  |
| Chromium hexavalent (Cr6+) | Extraction and Direct Air Acetylene Flame Method | ≤0.01 | mg/L |  |
| Colour | Visual Comparison Method | - | Pt - Co |  |
| Conductivity | Electrical Conductivity Method | ≤1.0 | µS/cm |  |
| Copper (Cu) | AAS or ICP | ≤0.01 | mg/L |  |
| Cyanide | Colorimetric Method (Pyridine-Barbituric Acid Reagent) | ≤0.005 | mg/L |  |
| DDT | Liquid-Liquid Extraction Gas Chromatographic Method | ≤0.1 | µg/L |  |
| Dieldrin | Liquid-Liquid Extraction Gas Chromatographic Method | ≤0.1 | µg/L | LOQ or LOD |
| Dissolved Nitrogen (Ammonia + Nitrate) | Filtration, Distillation, Nesslerization, Cadmium Reduction & Calculation Method | ≤1.0 | mg/L |  |
| Dissolved Oxygen (DO)  | Membrane Electrode Method (DO Meter) | ≤0.1 | mg/L |  |
| Dissolved Phosphorus  | Filtration and Acid Digestion & Ascorbic Method | ≤0.01 | mg/L |  |
| E. coli Bacteria | Membrane Filter Technique Method | <1 | CFU/100 mL |  |
| Eldrin | Liquid-Liquid Extraction Gas Chromatographic Method | ≤0.1 | µg/L | LOQ or LOD |
| Fat, Oil & Grease (FOG) | Soxhlet Extraction Method | ≤3 | mg/L |  |
| Fecal Coliform Bacteria (FCB) | Multiple Tube Fermentation Technique | <1 | MPN/100 mL |  |
| Fecal Coliform Bacteria (FCB) | Membrane Filter Technique Method | <1 | CFU/100 mL |  |
| Flow rate | Flow meter | - | m/s |  |
| Free Residual Chlorine  | DPD Colorimetric Method | ≤0.1 | mg/L |  |
| Heptachlor | Liquid-Liquid Extraction Gas Chromatographic Method | ≤0.1 | µg/L | LOQ or LOD |
| Hydrogen Sulfide (H2S) | Methylene Blue Method (SM 2012:4500-S2-D) | ≤0.01 | mg/L |  |
| Iron (Fe) | AAS or ICP | ≤0.01 | mg/L |  |
| Lead (Pb) | AAS or ICP | ≤0.002 | mg/L |  |
| Magnesium (Mg) | AAS or ICP | ≤0.01 | mg/L |  |
| Manganese (Mn) | AAS or ICP | ≤0.01 | mg/L |  |
| Mercury in water | Cold-Vapor Atomic Absorption Spectrometric Method | ≤0.0001 | mg/L |  |
| Mercury in Fish tissue | Cold-Vapor Atomic Absorption Spectrometric Method | ≤0.05 | mg/kg (wet weight) | LOQ or LOD |
| Mercury in Sediment | Cold-Vapor Atomic Absorption Spectrometric Method | ≤0.10 | mg/kg (dry weight) | LOQ or LOD |
| Nickel (Ni) | AAS or ICP | ≤0.01 | mg/L |  |
| Nitrate  | Cadmium Reduction Method | ≤0.01 | mg/L as N  |  |
| ≤0.05 | mg/L as NO3 |
| Pesticide : Carbamate Group | Liquid-Liquid Extraction Gas Chromatographic Method | ≤0.1 | µg/L |  |
| Pesticide : Organochlorine Group  | Liquid-Liquid Extraction Gas Chromatographic Method | ≤0.1 | µg/L |  |
| Pesticide : Organophosphate Group | Liquid-Liquid Extraction Gas Chromatographic Method | ≤0.1 | µg/L |  |
| pH | Electrometric Method (pH Meter) | - | - | Resolution = 0.01 |
| Phenols | Chloroform Extraction Method | ≤0.001 | mg/L |  |
| Phosphate (PO43-) | Colorimetric Method | ≤0.01 | mg/L |  |
| Potassium (K) | AAS or ICP | ≤0.01 | mg/L |  |
| Sodium (Na) | AAS or ICP | ≤0.05 | mg/L |  |
| Sulfide (S2-) | Iodometric Method | ≤1.0 | mg/L |  |
| Sulphate (SO42-) | Turbidimetric Method | ≤1.0 | mg/L |  |
| Temperature | Thermometer | - | ˚C | Resolution = 0.1 |
| Total Coliform Bacteria (TCB) | Multiple Tube Fermentation Technique | <1 | MPN/100 mL |  |
| Total Coliform Bacteria (TCB) | Membrane Filter Technique Method | <1 | CFU /100 mL |  |
| Total Dissolved Solids (TDS) | Dried at 180 ˚C | ≤50 | mg/L |  |
| Total Hardness | EDTA Titrimetric Method | ≤5 | mg/L as CaCO3 |  |
| Total Kjeldahl Nitrogen (TKN) | Kjeldahl Method | ≤1.0 | mg/L |  |
| Total N (Ammonia + Nitrate) | Distillation, Nesslerization, Cadmium Reduction and Calculation Method | ≤1.0 | mg/L |  |
| Total Organic Carbon (TOC) | High-Temperature Combustion Method | ≤0.05 | mg/L |  |
| Total Organochlorine Pesticide | Liquid-Liquid Extraction Gas Chromatographic Method | ≤0.01 | mg/L |  |
| Total Phosphorus | Acid Digestion & Ascorbic Method | ≤0.01 | mg/L |  |
| Standard Plate Count | Standard Plate Count Method | <1 | Colonies/cm3 |  |
| Total Solids (TS) | Dried at 103 -105 ˚C | ≤50 | mg/L |  |
| Total Suspended Solids (TSS) | Dried at 180 ˚C | ≤50 | mg/L |  |
| Transparency | Secchi Disk | - | cm |  |
| Turbidity | Nephelometric Method | 0.02 | NTU |  |
| Zinc (Zn) | AAS or ICP | ≤0.01 | mg/L |  |

1. **MONITORING STATION AND MONITORING PARAMETER**

The bidder shall conduct all field monitoring and collect samples as per the specified monitoring stations and parameters. The coordinates of the monitoring station use actual values ​​measured on the field monitoring date. The monitoring stations and parameters of all tasks classified by the Environmental aspects are as follows.

\*\*\*In case of the owner is required to change or update the monitoring station or location, the owner will be informed to bidder in advance for further agreement. However, the number of station and parameters are not changed from the TOR.

**Task 1 : Overall Project**

**Table 5** Ambient air quality monitoring stations, monitoring parameters and implementation period for task 1 (Overall project)

| **Station**  | **Period** | **Parameter** |
| --- | --- | --- |
| **1st**  | **2nd**  | **3rd**  | **4th**  |
| **Hongsa District, Lao PDR** | 1. Total Suspended Particulate (TSP)
2. Particulate Matter less than 10 µm (PM10)
 |
| 1. HS-A-001
 | Hongsa primary school  | P |  |  | P |
| 1. HS-A-002
 | Ban Han Market | P |  |  | P |
| 1. HS-A-003
 | Power Plant area | P |  |  | P |
| 1. HS-A-005
 | Ban Simongkol temple  | P |  |  | P |
| 1. HS-A-006
 | AQMS Ban Han | P | P | P | P | 1. Particulate Matter less than 2.5 µm (PM2.5)
 |
| 1. HS-A-007
 | AQMS Ban Champa | P | P | P | P |
| 1. HS-A-008
 | AQMS Ban Simongkol | P | P | P | P |
| 1. HS-A-010
 | CPE Camp | P |  |  |  | 1. Particulate Matter less than 10 µm (PM10)
2. Wind Speed (WS) + Wind Direction (WD)
 |
| 1. HS-A-011
 | Ban Champa (CA. Boundary) | P |  |  |  |
| 1. HS-A-012
 | Ban Simongkol (CA. Boundary) | P |  |  |  |
| **Nguen District, Lao PDR** | 1. Total Suspended Particulate (TSP)
2. Particulate Matter less than 10 µm (PM10)
3. Sulphur Dioxide (SO2)
4. Nitrogen Dioxide (NO2)
5. Wind Speed (WS) + Wind Direction (WD)
 |
| 1. NG-A-001
 | Ban Bimi Community  | P |  | P |  |
| 1. NG-A-002
 | Ban Kang Community  | P |  | P |  |
| 1. NG-A-003
 | Muang Nguen  | P |  | P |  |
| 1. NG-A-004
 | Limestone Quarry (CA. Boundary) | P |  |  |  | 1. Particulate Matter less than 10 µm (PM10)
2. Wind Speed (WS) + Wind Direction (WD)
 |
| **Expansion of Lignite Mine Concession Area (MCA)** | 1. Total Suspended Particulate (TSP)
2. Particulate Matter less than 10 µm (PM10)
3. Particulate Matter less than 2.5 µm (PM2.5)
4. Sulphur Dioxide (SO2)
5. Nitrogen Dioxide (NO2)
6. Wind Speed (WS) + Wind Direction (WD)
 |
| 1. MCA-A-001
 | Ban Kiew Ngew Primary School | P |  | P |  |
| 1. MCA-A-002
 | Ban Bo Luang Primary School | P |  | P |  |

**Table 6** Ambient noise monitoring stations, monitoring parameters and implementation period for task 1 (Overall project)

| **Station**  | **Period** | **Parameter** |
| --- | --- | --- |
| **1st**  | **2nd**  | **3rd**  | **4th**  |
| **Hongsa District, Lao PDR** | 1. Day Average Sound Level (LAd)
2. Night Average Sound Level (LAn)
3. 24 Hours A-Weight Equivalent Continuous Sound Level (LAeq 24 hours)
4. 8 Hours A-Weight Equivalent Continuous Sound Level (LAeq 8 hours)
5. 1 Hour A-Weight Equivalent Continuous Sound Level (LAeq 1 hour)
6. Percentile 90 Sound Level (LA90)
7. Maximum Sound Level (LAmax)
8. Minimum Sound Level (LAmin)
 |
| 1. HS-NS-001
 | Project Noise Boundary Ban Han |  | P |  | P |
| 1. HS-NS-002
 | Project Noise Boundary Ban Champa |  | P |  | P |
| 1. HS-NS-003
 | Project Noise Boundary Ban Simongkol |  | P |  | P |
| 1. HS-NS-004
 | Ban Han Market |  | P |  | P |
| 1. HS-NS-005
 | Ban Simongkol Temple |  | P |  | P |
| 1. HS-NS-006
 | Ban Champa |  | P |  | P |
| **Nguen District, Lao PDR** |
| 1. NG-NS-001
 | Ban Bimi (CA. Boundary) |  | P |  | P |
| 1. NG-NS-002
 | Limestone Quarry |  | P |  | P |
| 1. NG-NS-003
 | Ban Kang Primary School |  | P |  | P |
| **Expansion of Lignite Mine Concession Area (MCA)** |
| 1. MCA-NS-001
 | Ban Kiew Ngew Primary School | P |  | P |  |
| 1. MCA-NS-002
 | Ban Bo Luang Primary School | P |  | P |  |

**Table 7** Vibration level monitoring stations, monitoring parameters and implementation period for task 1 (Overall project)

| **Station**  | **Period** | **Parameter** |
| --- | --- | --- |
| **1st**  | **2nd**  | **3rd**  | **4th**  |
| **Hongsa District, Lao PDR** | 1. Peak particle velocity
2. Displacement
3. Frequency
 |
| 1. HS-VB-001
 | Ban Simongkol Community | P |  | P |  |
| **Nguen District, Lao PDR** |
| 1. NG-VB-001
 | Ban Bimi Primary School |  | P |  | P |
| 1. NG- VB-002
 | Ban Kang Primary School |  | P |  | P |
| **Expansion of Lignite Mine Concession Area (MCA)** |
| 1. MCA-VB-001
 | Ban Kiew Ngew Primary School | P |  | P |  |
| 1. MCA-VB-002
 | Ban Pangbong Primary School | P |  | P |  |

**Table 8** Surface water (stream) quality monitoring stations, monitoring parameters and implementation period for task 1 (Overall project)

| **Station**  | **Period** | **Parameter** |
| --- | --- | --- |
| **1st**  | **2nd**  | **3rd**  | **4th**  |
| **Hongsa District, Lao PDR** | 1. Water level
2. Temperature
3. Flow Rate \*
4. pH
5. Turbidity
6. Total Suspended Solids (TSS)
7. Total Solids (TS)
8. Conductivity
9. Dissolved Oxygen (DO)
10. Biochemical Oxygen Demand (BOD)
11. Chemical Oxygen Demand (COD)
12. Fat, Oil & Grease (FOG)
13. Total Dissolved Solids (TDS)
14. Total Hardness
15. Alkalinity
16. Nitrate - Nitrogen (NO3 - N)
17. Ammonia - Nitrogen (NH3 - N)
18. Sulphate (SO42-)
19. Phosphate (PO43-)
20. Lead (Pb)
21. Zinc (Zn)
22. Iron (Fe)
23. Chromium (Cr)
24. Aluminium (Al)
25. Copper (Cu)
26. Nickel (Ni)
27. Cadmium (Cd)
28. Mercury (Hg)
29. Arsenic (As)
30. Manganese (Mn)
31. Total Coliform Bacteria (TCB)
32. Fecal Coliform Bacteria (FCB)
33. Phenols
 |
| 1. HS-SW-001
 | Downstream of Ban Phonchan - Nam Kham inlet 8 | P | P | P |  |
| 1. HS-SW-005
 | Upstream of Mine development area - Nam Le Diversion inlet 7 | P | P | P |  |
| 1. HS-SW-007 \*
 | Upstream of Nam Louk Dam (Upper part of Nam Louk Dam: (NL-01) | P | P | P |  |
| 1. HS-SW-008
 | Downstream of Nam Louk Dam (NL-05) | P | P | P |  |
| 1. HS-SW-009
 | Upstream of conference at Nam Ken | P | P | P |  |
| 1. HS-SW-010
 | Upstream of Nam Ken Dam-Ban Simongkol | P | P | P |  |
| 1. HS-SW-012
 | Upstream of Nam Ken Dam (NK-04) | P | P | P |  |
| 1. HS-SW-013 \*
 | Mid-stream of Nam Ken Dam (Mid-part of Nam Ken Dam: NK-02) | P | P | P |  |
| 1. HS-SW-014
 | Downstream of Nam Ken Dam (NK-05) | P | P | P |  |
| 1. HS-SW-015
 | Upstream of RAP area-Ban Napoung | P | P | P |  |
| 1. HS-SW-016
 | Downstream of RAP area-Ban Thankham | P | P | P |  |
| 1. HS-SW-017
 | Upstream of Diversion | P | P | P |  |
| 1. HS-SW-018
 | Upstream of Ban Phonchan-Nam Kham | P | P | P |  |
| 1. HS-SW-024
 | End of Diversion | P | P | P |  |
| 1. HS-SW-025
 | Surface water near landfill | P | P | P |  |
| **Nguen District, Lao PDR** |
| 1. NG-SW-001
 | Mid-stream of quarry development area (Nam Yang at Ban Don mun) | P | P | P |  |
| 1. NG-SW-002
 | Downstream of quarry development area (Nam Yang at Ban Bimi) | P | P | P |  |
| 1. NG-SW-003
 | Upstream of quarry development area (Nam Yang at Ban Kang) | P | P | P |  |
| **Expansion of Lignite Mine Concession Area (MCA)** |
| 1. MCA-SW-001
 | Surface water ITH Camp | P |  | P |  |
| 1. MCA-SW-002
 | Surface water SQ Camp | P |  | P |  |
| 1. MCA-SW-003
 | Huay Kating Ban Kiew Ngew  | P |  | P |  |
| 1. MCA-SW-004
 | Upstream Huay Kating Ban Pangbong | P |  | P |  |
| 1. MCA-SW-005
 | Downstream Huay Kating Ban Pangbong | P |  | P |  |

**Note** : \* Measurement of flow rate except at stations HS-SW-007 and HS-SW-013

**Table 9** Surface water (Dam) quality monitoring stations, monitoring parameters and implementation period for task 1 (Overall project)

| **Station**  | **Period** | **Parameter** |
| --- | --- | --- |
| **1st**  | **2nd**  | **3rd**  | **4th**  |
| 1. HS-SW-007
 | Upstream of Nam Louk Dam (NL-01) | P | P | P |  | 1. Total Organic Carbon (TOC)
2. Total Phosphorus
3. Dissolved phosphorus
4. Hydrogen Sulfide (H2S)
 |
| 1. HS-SW-020
 | Mid-part of Nam Louk Dam (NL-02) | P | P | P |  | 1. Total Phosphorus
2. Dissolved phosphorus
3. Total Nitrogen
4. Dissolved Nitrogen
5. Hydrogen Sulfide (H2S)
6. Phytoplankton biomass
 |
| 1. HS-SW-021
 | Lower-part of Nam Louk Dam (NL-03) | P | P | P |  | 1. pH
2. Total Hardness
3. Manganese
4. Nitrate – Nitrogen
5. Ammonia – Nitrogen
6. Chromium
7. Arsenic
8. Lead
9. Zinc
10. Sulphate
11. Nickel
12. Copper
13. Phenols
14. Total Coliform Bacteria
15. Fecal Coliform Bacteria
16. Total Nitrogen
17. Dissolved Nitrogen
18. Chromium hexavalent (Cr6+ )
19. Hydrogen Sulfide (H2S)
20. Phytoplankton biomass
 |
| 1. HS-SW-008
 | Downstream of Nam Louk Dam (NL-05) | P | P | P |  | 1. Chromium hexavalent (Cr6+ )
2. Hydrogen Sulfide (H2S)
 |
| 1. HS-SW-023
 | Upper-part of Nam Ken Dam (NK-01) | P | P | P |  | 1. Hydrogen Sulfide (H2S)
 |
| 1. HS-SW-013
 | Mid-stream of Nam Ken Dam (NK-02) | P | P | P |  | 1. Total Phosphorus
2. Dissolved phosphorus
3. Total Nitrogen
4. Dissolved Nitrogen
5. Hydrogen Sulfide (H2S)
6. Phytoplankton biomass
 |
| 1. HS-SW-022
 | Lower-part of Nam Ken Dam (NK-03) | P | P | P |  | 1. Total Nitrogen
2. Dissolved Nitrogen
3. Hydrogen Sulfide (H2S)
4. Phytoplankton biomass
 |
| 1. HS-SW-012
 | Upstream of Nam Ken Dam (NK-04) | P | P | P |  | 1. Total Organic Carbon (TOC)
2. Total Phosphorus
3. Dissolved phosphorus
 |
| 1. HS-SW-014
 | Downstream of Nam Ken Dam (NK-05) | P | P | P |  | 1. Chromium hexavalent (Cr6+ )
2. Hydrogen Sulfide (H2S)
 |

**Table 10** Pesticide in surface water monitoring stations, monitoring parameters and implementation period for task 1 (Overall project)

| **Station**  | **Period** | **Parameter** |
| --- | --- | --- |
| **1st**  | **2nd**  | **3rd**  | **4th**  |
| 1. HS-SW-001
 | Downstream of Ban Phonchan - Nam Kham inlet 8 |  | P |  |  | 1. Carbamate Group
2. Organophosphate Group
3. Organochlorine Group
 |
| 1. HS-SW-005
 | Upstream of Mine development area - Nam Le Diversion inlet 7 |  | P |  |  |
| 1. HS-SW-008
 | Downstream of Nam Louk Dam (NL-05) |  | P |  |  |
| 1. HS-SW-009
 | Upstream of conference at Nam Ken |  | P |  |  |
| 1. HS-SW-010
 | Upstream of Nam Ken Dam-Ban Simongkol |  | P |  |  |
| 1. HS-SW-012
 | Upstream of Nam Ken Dam (NK-04) |  | P |  |  |
| 1. HS-SW-015
 | Upstream of RAP area-Ban Napoung |  | P |  |  |
| 1. HS-SW-016
 | Downstream of RAP area-Ban Thankham |  | P |  |  |
| 1. HS-SW-018
 | Upstream of Ban Phonchan-Nam Kham |  | P |  |  |

**Table 11** Aquatic flora/fauna/Fish identification monitoringstations, monitoring parameters and implementation period for task 1 (Overall project)

| **Station**  | **Period** | **Parameter** |
| --- | --- | --- |
| **1st**  | **2nd**  | **3rd**  | **4th**  |
| **Hongsa District, Lao PDR** | 1. Phytoplankton
2. Zooplankton
3. Fish organism
* *Sex*
* *Size*
* *Body weight*
* *Species*
* *Gonad condition*
1. Aquatic flora
2. Aquatic fauna
 |
| 1. HS-SW-001
 | Downstream of Ban Phonchan-Nam Kham inlet 8 | P |  | P |  |
| 1. HS-SW-005
 | Upstream of Mine development area - Nam Le Diversion inlet 7 | P |  | P |  |
| 1. HS-SW-008
 | Downstream of Nam Louk Dam (NL-05) | P |  | P |  |
| 1. HS-SW-009
 | Upstream of conference at Nam Ken | P |  | P |  |
| 1. HS-SW-010
 | Upstream of Nam Ken Dam-Ban Simongkol | P |  | P |  |
| 1. HS-SW-012
 | Upstream of Nam Ken Dam (NK-04) | P |  | P |  |
| 1. HS-SW-015
 | Upstream of RAP area-Ban Napoung | P |  | P |  |
| 1. HS-SW-016
 | Downstream of RAP area-Ban Thankham | P |  | P |  |
| 1. HS-SW-018
 | Upstream of Ban Phonchan-Nam Kham | P |  | P |  |
| **Nguen District, Lao PDR** |
| 1. NG-SW-002
 | Downstream of quarry development area (Nam Yang at Ban Bimi) | P |  | P |  |
| 1. NG-SW-003
 | Upstream of quarry development area (Nam Yang at Ban Kang) | P |  | P |  |
| **Expansion of Lignite Mine Concession Area (MCA)** |
| 1. MCA-SW-001
 | Surface water ITH Camp | P |  | P |  |
| 1. MCA-SW-002
 | Surface water SQ Camp | P |  | P |  |
| 1. MCA-SW-003
 | Huay Kating Ban Kiew Ngew  | P |  | P |  |
| 1. MCA-SW-004
 | Upstream Huay Kating Ban Pangbong | P |  | P |  |
| 1. MCA-SW-005
 | Downstream Huay Kating Ban Pangbong | P |  | P |  |

**Table 12** Ground water quality monitoring stations, monitoring parameters and implementation period for task 1 (Overall project)

| **Station**  | **Period** | **Parameter** |
| --- | --- | --- |
| **1st**  | **2nd**  | **3rd**  | **4th**  |
| **Shallow well** | 1. Bore depth
2. Temperature
3. pH
4. Turbidity
5. Conductivity
6. Total Suspended Solids (TSS)
7. Total Dissolved Solids (TDS)
8. Sodium (Na)
9. Total Hardness
10. Calcium (Ca)
11. Magnesium (Mg)
12. Iron (Fe)
13. Manganese (Mn)
14. Nitrate - Nitrogen (NO3 - N)
15. Cadmium (Cd)
16. Chromium (Cr)
17. Arsenic (As)
18. Lead (Pb)
19. Zinc (Zn)
20. Mercury (Hg)
21. Nickel (Ni)
22. Copper (Cu)
23. Sulfate (SO42-)
24. Alkalinity
25. Potassium (K)
26. Fat, Oil & Grease (FOG)
27. Total Coliform Bacteria (TCB)
28. Fecal Coliform Bacteria (FCB)
29. Total Plate Count
30. E. coli Bacteria
 |
| 1. HS-GW-002
 | Shallow well Ban Simongkol | P | P | P |  |
| 1. HS-GW-003
 | Shallow well Ban Han | P | P | P |  |
| 1. HS-GW-009
 | Shallow well Ban Champa | P | P | P |  |
| **Piezometer** | 1. Bore depth
2. Temperature
3. pH
4. Turbidity
5. Conductivity
6. Total Suspended Solids (TSS)
7. Total Dissolved Solids (TDS)
8. Sodium (Na)
9. Total Hardness
10. Calcium (Ca)
11. Magnesium (Mg)
12. Iron (Fe)
13. Manganese (Mn)
14. Nitrate - Nitrogen (NO3 - N)
15. Cadmium (Cd)
16. Chromium (Cr)
17. Arsenic (As)
18. Lead (Pb)
19. Zinc (Zn)
20. Mercury (Hg)
21. Nickel (Ni)
22. Copper (Cu)
23. Sulfate (SO42-)
24. Alkalinity
25. Potassium (K)
 |
| 1. HS-PZ-001O
 | PZE 001O | P | P | P |  |
| 1. HS-PZ-1130G
 | HS 1130G | P | P | P |  |
| 1. HS-PZ-013
 | PZE 013 | P | P | P |  |
| 1. HS-PZ-043
 | PZE 043 | P | P | P |  |
| 1. HS-PZ-069
 | PZE 069 | P | P | P |  |
| 1. HS-PZ-051
 | PZE 051 | P | P | P |  |
| 1. HS-PZ-060
 | PZE 060 | P | P | P |  |
| 1. HS-PZ-136
 | PZE 136 | P | P | P |  |
| **Ash Pond** |
| 1. HS-ASH-001
 | Deep Well | P | P | P |  |
| 1. HS-ASH-002
 | Shallow Well | P | P | P |  |
| 1. HS-ASH-003
 | Deep Well | P | P | P |  |
| 1. HS-ASH-004
 | Shallow Well | P | P | P |  |
| 1. HS-ASH-005
 | Deep Well | P | P | P |  |
| 1. HS-ASH-006
 | Shallow Well | P | P | P |  |
| **Monitoring well** | 1. Bore depth
2. Colour
3. Temperature
4. pH
5. Turbidity
6. Conductivity
7. Total Suspended Solids (TSS)
8. Total Dissolved Solids (TDS)
9. Total Solids (TS)
10. Sodium (Na)
11. Total Hardness
12. Calcium (Ca)
13. Magnesium (Mg)
14. Iron (Fe)
15. Manganese (Mn)
16. Nitrate - Nitrogen (NO3 - N)
17. Phosphate (PO43-)
18. Cadmium (Cd)
19. Chromium (Cr)
20. Arsenic (As)
21. Lead (Pb)
22. Zinc (Zn)
23. Mercury (Hg)
24. Nickel (Ni)
25. Copper (Cu)
26. Sulfate (SO42-)
27. Alkalinity
28. Potassium (K)
29. Chloride (Cl)
30. Total Coliform Bacteria (TCB)
31. Fecal Coliform Bacteria (FCB)
32. Chromium hexavalent (Cr6+)
 |
| 1. HS-GW-010
 | Emergency pond monitoring well | P |  | P |  |
| 1. HS-GW-011
 | Landfill monitoring well 3 | P |  | P |  |

**Table 13** Discharge water quality monitoring stations, monitoring parameters and implementation period for task 1 (Overall project)

| **Station** | **Period** | **Parameter** |
| --- | --- | --- |
| **1st** | **2nd** | **3rd** | **4th** |
| **Power Plant Area** | 1. pH
2. Flow rate
3. Turbidity
4. Temperature
5. Dissolved Oxygen (DO)
6. Conductivity
7. Biochemical Oxygen Demand (BOD)
8. Chemical Oxygen Demand (COD)
9. Total Suspended Solids (TSS)
10. Total Dissolved Solids (TDS)
11. Total Kjeldahl Nitrogen (TKN)
12. Sulfide
13. FAT, Oil & Grease (FOG)
14. Total Hardness
15. Alkalinity
16. Nitrate-Nitrogen (NO3 - N)
17. Phosphate (PO43-)
18. Cadmium (Cd)
19. Chromium (Cr)
20. Copper (Cu)
21. Total Iron (Fe)
22. Nickel (Ni)
23. Lead (Pb)
24. Zinc (Zn)
25. Arsenic (As)
26. Mercury (Hg)
27. Chromium hexavalent (Cr6+)
28. Phenols
29. Total Residual Chlorine
 |
| 1. HS-PP-EF-01
 | Power Plant Discharge Compliance Point | P | P | P | P |
| **Lignite Mining Area** | 1. pH
2. Flow rate
3. Turbidity
4. Temperature
5. Dissolved Oxygen (DO)
6. Conductivity
7. Biochemical Oxygen Demand (BOD)
8. Chemical Oxygen Demand (COD)
9. Total Suspended Solids (TSS)
10. Total Dissolved Solids (TDS)
11. FAT, Oil & Grease (FOG)
12. Alkalinity
13. Nitrate-Nitrogen (NO3 - N)
14. Total Phosphorus (P)
15. Phenol
16. Copper (Cu)
17. Total Iron (Fe)
18. Nickel (Ni)
19. Zinc (Zn)
20. Mercury (Hg)
21. Arsenic (As)
22. Chromium hexavalent (Cr6+)
23. Chromium (Cr)
24. Lead (Pb)
 |
| 1. HS-MN-EF-01
 | South Settling Pond 8 | P | P | P | P |
| 1. HS-MN-EF-02
 | Wetland Pond 6 | P | P | P | P |
| 1. HS-MN-EF-03
 | West Lake Spillway | P | P | P | P |
| **Expansion of Lignite Mine Concession Area (MCA)** |
| 1. MCA-MN-EF-01
 | MCA Expansion Setting Pond 3 | P | P | P | P |

**Table 14** Drinking water and water supply quality monitoring stations, monitoring parameters and implementation period for task 1 (Overall project)

| **Station**  | **Period** | **Parameter** |
| --- | --- | --- |
| **1st**  | **2nd**  | **3rd**  | **4th**  |
| **Drinking water** | 1. Temperature
2. Colour
3. pH
4. Turbidity
5. Conductivity
6. Total Dissolved Solids (TDS)
7. Total Hardness
8. Iron (Fe)
9. Manganese (Mn)
10. Nitrate (as NO3)
11. Cadmium (Cd)
12. Arsenic (As)
13. Lead (Pb)
14. Zinc (Zn)
15. Mercury (Hg)
16. Sulfate (SO42-)
17. Copper (Cu)
18. Total Coliform Bacteria (TCB)
19. Fecal Coliform Bacteria (FCB)
20. E. coli Bacteria
 |
| 1. HS-DKW-001
 | Drinking water Phonchan accommodation building 1 | P |  | P |  |
| 1. HS-DKW-002
 | Drinking water Phonchan accommodation building 2 | P |  | P |  |
| 1. HS-DKW-003
 | Drinking water Phonchan accommodation building 3 | P |  | P |  |
| 1. HS-DKW-004
 | Drinking water Phonchan accommodation building 4 | P |  | P |  |
| 1. HS-DKW-005
 | Drinking water Phonchan accommodation building 5 | P |  | P |  |
| 1. HS-DKW-006
 | Drinking water Na Nong Kham accommodation building 6 | P |  | P |  |
| 1. HS-DKW-007
 | Drinking water Na Nong Kham accommodation building 11 | P |  | P |  |
| 1. HS-DKW-008
 | Ice Machine Phonchan canteen | P |  | P |  |
| 1. HS-DKW-009
 | Ice Machine Na Nong Kham accommodation canteen | P |  | P |  |
| 1. HS-DKW-010
 | Ice Machine Na Nong Kham accommodation | P |  | P |  |
| 1. HS-DKW-011
 | Drinking water by Local supplier | P |  | P |  |
| **Water supply** | 1. Temperature
2. Colour
3. pH
4. Turbidity
5. Conductivity
6. Total Dissolved Solids (TDS)
7. Total Hardness
8. Iron (Fe)
9. Manganese (Mn)
10. Nitrate (as NO3)
11. Cadmium (Cd)
12. Arsenic (As)
13. Lead (Pb)
14. Zinc (Zn)
15. Mercury (Hg)
16. Sulfate (SO42-)
17. Copper (Cu)
18. Aluminum (Al)
19. Sodium (Na)
20. Total Coliform Bacteria (TCB)
21. Fecal Coliform Bacteria (FCB)
22. E. coli Bacteria
23. Free Residual Chlorine
 |
| 1. HS-WSP-001
 | Water supply Phonchan accommodation | P |  | P |  |
| 1. HS-WSP-002
 | Water supply Mining Office | P |  | P |  |

**Task 2 : Transboundary (Nan Province, Thailand)**

**Table 15** Ambient air quality monitoring stations, monitoring parameters and implementation period for task 2 (Nan Province, Thailand)

| **Station**  | **Period** | **Parameter** |
| --- | --- | --- |
| **1st**  | **2nd**  | **3rd**  | **4th**  |
| 1. NAN-A-01
 | โรงเรียนมัธยมพระราชทานเฉลิมพระเกียรติ ต.ห้วยโก๋น อ.เฉลิมพระเกียรติ จ.น่าน | P |  |  | P | 1. Total Suspended Particulate (TSP)
2. Particulate Matter less than 10 µm (PM10)
3. Particulate Matter less than 2.5 µm (PM2.5)
4. Sulphur Dioxide (SO2)
5. Nitrogen Dioxide (NO2)
6. Arsenic (As) in PM10
7. Cadmium (Cd) in PM10
8. Lead (Pb) in PM10
9. Mercury (Hg) in PM10
10. Wind Speed (WS) + Wind Direction (WD)
 |
| 1. NAN-A-02
 | โรงเรียนบ้านสบมาง ต.ภูฟ้า อ.บ่อเกลือ จ.น่าน | P |  |  | P |
| 1. NAN-A-03
 | วัดศรีพันต้น อ.เมือง จ.น่าน | P |  |  | P |

**Table 16** Surface water, sediment, fish tissue and water supply monitoring stations, monitoring parameters and implementation period for 2 (Nan Province, Thailand)

| **Station**  | **Period** | **Parameter** |
| --- | --- | --- |
| **1st**  | **2nd**  | **3rd**  | **4th**  |
| **Surface water** |
| 1. NAN-SW-01
 | อ่างเก็บน้ำห้วยโก๋น ต.ห้วยโก๋น อ.เฉลิมพระเกียรติ จ.น่าน |  |  | P |  | 1. Transparency
2. Temperature
3. pH
4. Dissolved Oxygen (DO)
5. Biochemical Oxygen Demand (BOD)
6. Chemical Oxygen Demand (COD)
7. Turbidity
8. Conductivity
9. Total Suspended Solids (TSS)
10. Total Dissolved Solids (TDS)
11. Total Hardness
12. Alkalinity
13. Aluminium (Al)
14. Iron (Fe)
15. Manganese (Mn)
16. Nitrate - Nitrogen (NO3 - N)
17. Ammonia - Nitrogen (NH3 - N)
18. Phosphate (PO43-)
19. Cadmium (Cd)
20. Chromium (Cr)
21. Arsenic (As)
22. Lead (Pb)
23. Zinc (Zn)
24. Mercury (Hg)
25. Sulphate (SO42-)
26. Nickel (Ni)
27. Copper (Cu)
28. Phenols
29. Oil & Grease (FOG)
30. Total Coliform Bacteria (TCB)
31. Fecal Coliform Bacteria (FCB)
32. Cyanide
33. Total Organochlorine Pesticide
34. DDT
35. Alpha-BHC
36. Dieldrin
37. Aldrin
38. Heptachlor
39. Eldrin
 |
| 1. NAN-SW-02
 | น้ำรี (ต้นเน้ำ) ต.ขุนน่าน อ.เฉลิมพระเกียรติ จ.น่าน |  |  | P |  |
| 1. NAN-SW-03
 | น้ำรี (ท้ายน้ำ) ต.ขุนน่าน อ.เฉลิมพระเกียรติ จ.น่าน |  |  | P |  |
| 1. NAN-SW-04
 | ช้าง (ต้นน้ำ) ต.ขุนน่าน อ.เฉลิมพระเกียรติ จ.น่าน |  |  | P |  |
| 1. NAN-SW-05
 | น้ำช้าง (ท้ายน้ำ) ต.ขุนน่าน อ.เฉลิมพระเกียรติ จ.น่าน |  |  | P |  |
| **Sediment and fish tissue** |
| 1. NAN-SW-06
 | ห้วยน้ำรี บ้านน้ำรีพัฒนา ต.ขุนน่าน อ.เฉลิมพระเกียรติ จ.น่าน |  |  | P |  | 1. Mercury in sediment (ปรอทในดินตะกอนท้องน้ำ)
2. Mercury in fish tissue (ปรอทในเนื้อปลา)
 |
| 1. NAN-SW-07
 | ห้วยน้ำช้าง บ้านน้ำช้างพัฒนา ต.ขุนน่าน อ.เฉลิมพระเกียรติ จ.น่าน |  |  | P |  |
| 1. NAN-SW-08
 | อ่างเก็บน้ำห้วยโก๋น ต.ห้วยโก๋น อ.เฉลิมพระเกียรติ จ.น่าน |  |  | P |  |
| 1. NAN-SW-09
 | คลองหมูเน่า ต.ห้วยโก๋น อ.เฉลิมพระเกียรติ จ.น่าน |  |  | P |  |
| 1. NAN-SW-10
 | ห้วยน้ำรี บ้านกิ่วจันทร์ ต. ขุนน่าน อ.เฉลิมพระเกียรติ จ.น่าน |  |  | P |  |
| **Water supply** |
| 1. NAN-WS-01
 | อ่างเก็บน้ำประปา อบต.ห้วยโก๋น อ.เฉลิมพระเกียรติ จ.น่าน |  |  | P |  | 1. Temperature
2. Colour
3. pH
4. Turbidity
5. Conductivity
6. Total Dissolved Solids (TDS)
7. Total Hardness
8. Aluminium (Al)
9. Iron (Fe)
10. Manganese (Mn)
11. Nitrate (as NO3)
12. Cadmium (Cd)
13. Arsenic (As)
14. Lead (Pb)
15. Zinc (Zn)
16. Mercury (Hg)
17. Sulphate (SO42-)
18. Copper (Cu)
19. Total Coliform Bacteria (TCB)
20. Fecal Coliform Bacteria (FCB)
21. E.coli Bacteria
 |
| 1. NAN-WS-02
 | อ่างเก็บน้ำประปาหมู่บ้านน้ำรีพัฒนา ต.ขุนน่าน อ.เฉลิมพระเกียรติ จ.น่าน |  |  | P |  |

**Table 17** Additional analysis in Hongsa, Lao PDR

| **Station**  | **Period** | **Parameter** |
| --- | --- | --- |
| **1st**  | **2nd**  | **3rd**  | **4th**  |
| **Ambient air quality** |
| 1. Ban Namsib
 |  |  | P |  | 1. Total Suspended Particulate (TSP)
2. Particulate Matter less than 10 µm (PM10)
3. Particulate Matter less than 2.5 µm (PM2.5)
4. Sulphur Dioxide (SO2)
5. Nitrogen Dioxide (NO2)
6. Arsenic (As) in PM10
7. Cadmium (Cd) in PM10
8. Lead (Pb) in PM10
9. Mercury (Hg) in PM10
10. Wind Speed (WS) + Wind Direction (WD)
 |
| **Mercury (Hg) contamination** |
| 1. Downstream of Nam Louk Dam ( HS-SW-008)
2. Upstream of Conference at Nam Ken (HS-SW-009)
3. Downstream of Nam Ken Dam (HS-SW-014)
4. Upstream of RAP area - Ban Napoung (HS-SW-015)
5. Upstream of Ban Phonchan-Nam Kham (HS-SW-018)
 |  |  | P |  | 1. Mercury in fish tissue
2. Mercury in sediment
 |

1. **THE BIDDER’S OBLIGATION**
2. **Labor**
3. The Bidder shall be responsible for supply and provision labor, either its own employees or subcontractor, sufficient for perform and accomplish the Work itself. The Bidder shall ensure that its labor is suitably skilled, qualified, and experienced for the Work.
4. Employer’s Safety, Health, and Environmental regulations e.g. PPE, First Aid Kit, cleanliness.
5. The Bidder shall be solely and exclusively liable and responsible for any and all such Bidder’s liabilities and obligations in relation to such labor.
6. The Bidder shall be responsible for labor compliance with any applicable laws and regulation at its own costs and expenses.
7. The Bidder shall be responsible for ensuring compliance with any laws and regulations in relation to health, safety, and environment, any standard which HPC obtains such as ISO including HPC’s rules and regulation related thereto. The Bidder shall ensure that working conditions and the working environment at the Site complies with all such rules and regulations.
8. At the request of HPC, the Bidder will promptly replace any members of its staff or any other of its representatives who are unacceptable to HPC and replace them with someone satisfactory to HPC.
9. In event that the Parties agree to appoint the key personnel according to the conditions and requirements stated in TOR to perform the Work hereunder, such person shall not be changed or replaced until the Bidder receives a written consent from HPC.
10. In any event, the Bidder shall promptly provide to HPC any document or information related to its labor such as work experience, organization chart, personal information, etc.
11. **Material, Equipment, Tools, and Utilities**
12. Unless agreed otherwise by HPC, the Bidder shall be solely responsible for providing all utilities for the completion of the Work itself.
13. The Bidder shall ensure that all materials supplied or used by it are of good quality, free of defects, free and clear of any lines are suitable for the purposes for which they are intended, and conform to any agreed, good, and suitable standards and specifications as well as applicable law.
14. Ownership of and any intellectual property right in any plans and specifications of the Work and any other material in relation thereto shall be and remain with HPC. The Bidder will keep confidential, safe and secure and only use for the purposes of the Work only. On request, the Bidder will return any and all copies to HPC and will not take any further copies without the prior written consent of HPC.
15. The Bidder shall remove from the Site any materials, plant, equipment rubbish, garbage or other things that do not comply with the requirements of the Contract upon request of HPC or upon the completion of the Work (as the case may be). The Bidder shall comply promptly with any such requests of HPC at its cost and expense.
16. Each of the materials shall become HPC’s property when it is delivered to the Site and already paid for such material.
17. **Work**
18. The Bidder is bound to allow HPC to inspect the Work during its progress.
19. The Bidder cannot have part, or all of the Work carried out by its subcontractor except receiving the written consent from HPC. However, in case that HPC allows to do so, the Bidder shall remain liable for any act or fault of the subcontractor.
20. The Bidder shall be deemed to have informed itself as to the correctness and sufficiency of the necessary information and factors in connection with performing the Work including, but not limited to, the applicable standards of performance to which the Bidder must adhere, the time frame for successfully completing the Work and at the cost specified in the Contract. The Bidder shall keep HPC informed of all material matters relating to the Work and shall promptly notify HPC of any matter that may or will change the scope, cost and/or timing of the Work.
21. In case that the Bidder consider that the information, documents and/or other particulars made available to it by HPC are not sufficient to enable the Bidder to perform the Work in the manner and to the standard required, it shall promptly advise HPC of the nature of the deficiency. HPC will provide such further information, documents and/or other particulars as are reasonably necessary in the circumstances. When the Work is complete and/or HPC requests for such information or documents, the Bidder shall promptly return to HPC all information received, including any memos and notes and soft copy thereof.
22. **SITE VISIT**
	1. If the Bidder need to visit and examine the site and service area as provided in this clause and shall obtain for itself all the information that it thinks necessary for the Bid and Contract. Any costs of visiting the Site shall be borne by the Bidder.
	2. The Bidder and any of its personnel or agents may enter upon the Site for the purpose of inspection, but upon the condition that the Bidder hereby releases and indemnifies the Company and its personnel or agents from and against all liability to the Bidder, its personnel or agents, and any other person for personal injury (whether fatal or otherwise), loss of or damage to property and any other loss, damage, costs and expenses of whatever kind and however caused which may happen during or in consequence of the permit to enter hereby granted.
	3. The bidder who do not attend TOR explanation, HPC shall not consider its proposal.
23. **BIDDER’S QUALIFICATION**

The Bidder must have experience and qualifications as follows:

* 1. The bidder shall have experience in Environmental monitoring work at least 5 years.
	2. The bidder shall have relevant academic qualifications in the field of environmental monitoring and science.
	3. The bidder shall provide a sufficient number of qualified specialists to perform the work under this TOR according to Table 18.
	4. The bidder must be able to analyze all required parameters (subcontractors can be used) and the method of determination and the proposed Limit of Quantitation (LOQ) must meet the requirement in Table 4 or must not exceed the applicable control standard for each parameter as Appendix A at least 90% of the requested parameters.
	5. The bidder must not be bankrupt or liquidated.
	6. Never breach of contract or work with HPC or HPC’s Bidder.
	7. The bidder shall not have mutual benefits with other bidders submitting proposals to the Employer or not being an offender fair competition in this tender.
	8. The Bidder and its assigned Experts shall have no business, financial, personal, or other interest in HPC activities, the project or any activities related thereto.
	9. The bidder shall be able to work both in Lao PDR and Thailand.
	10. The bidder shall own or contract with an analytical laboratory which is complied with standard method.
	11. The bidder shall own or contract with an analytical laboratory which is complied with standard method or ISO 17025: 2017 certification.
	12. The minimum number of specialists that the Bidder shall provide to conduct field monitoring according to Table 19.

**Table 18** Qualification of key person

| **Position** | **Number of persons** | **Graduate / Certificate/ Experience** |
| --- | --- | --- |
| Project manager/ Project’s coordinator | 1 | * Bachelor’s or Master’s degree in Environmental engineering, Environmental science, Environmental management or closely related fields, or equivalent experience.
* At least 5 years of Environmental monitoring and management.
* Good writing and reading for English and Lao language.
 |
| Technical specialist | 1 (at least) | * Bachelor’s or Master’s degree in Environmental engineering, Environmental science, Environmental management
* At least 3 years of Environmental monitoring and management
* Good writing, reading and understanding for English, Lao and Thai language.
 |
| Specialist for Environmental monitoring (leading monitoring team) | 1(At least 1 person for each field monitoring team in Lao and Thailand) | * Bachelor’s degree in Environmental engineering, Environmental science, Environmental management or closely related fields, or equivalent experience.
* At least 3 years of field environmental monitoring for wastewater, water, noise, vibration, air quality and related parameters.
 |
| Field staff for environmental monitoring  | Refer to Table 19 | * Bachelor’s degree in Environmental engineering, Environmental science, Environmental management or closely related fields, or equivalent experience
* At least 1 year of field environmental monitoring for wastewater, water, noise, vibration, air quality and related parameters.
 |
| Specialist for Environmental laboratory analysis | 1 | * Bachelor’s degree in Chemistry science, Environmental science or closely related fields, or equivalent experience.
* At least 3 years of Environmental laboratory analysis and certified person for laboratory analysis.
 |

**Table 19** Minimum number of field monitoring staff to support monitoring task

|  |  |
| --- | --- |
|  | **Minimum number of field operators** |
| **Period 1**(Summer) | **Period 2**(Early wet) | **Period 3**(Wet) | **Period 4**(Winter) |
| Task 1 | Overall project (Hongsa and Nguen District, Lao PDR) | 6 | 4 | 6 | 4 |
| Task 2 | Transboundary (Nan Province, Thailand) | 3 | - | 3 | 3 |

1. **SECURITY AND WARRANTY**

Any and all Security shall be issued from a reliable and reputable bank or financial situation acceptable to HPC in its respective standard form in order to ensure and secure the due execution, proper performance and fulfillment of obligations under each contract with the minimum conditions and requirements as follows:

* 1. **BID BOND**

N/A

* 1. **ADVANCE PAYMENT BOND**

N/A

* 1. **PERFORMANCE BOND**

N/A

* 1. **PERFORMANCE RETENTION MONEY**

HPC shall deduct and retain any amount due or become due, at least ten percent (10%) of each payment payable to the Bidder until such a retained amount is equivalent to ten (10) percent of the initial contract price as the security for the performance of the Bidder in substitution of the Performance Bond.

The Performance Security Money shall be returned, without any interest, to the Bidder within thirty (30) days after the issuance of the take-over certificate.

* 1. **WARRANTY**

N/A

1. **PAYMENT**
	1. **Term of payment:** Credit 30 days after receiving all tasks of Environmental monitoring report for each monitoring period.
	2. **Payment condition**
2. If an invoice is submitted to HPC on the 1st – 15th of any month, the payment of such invoice will be paid on the 10th of the following month.

In this regard, when there is the case that such submitted invoice is incorrect or the work performed or goods procured is not in compliance with the requirements provided under the Agreement, the Bidder could be entitled to receive the payment on the same due date only on the conditions that such invoice is revised to the Employer’s satisfaction or the work has been performed or the goods has been procured in compliance with the requirements thereof; and that the revised invoice is re-submitted to the Employer within the date of 15 of such month.

1. If an invoice is submitted to HPC on the 16th – 31st of any month, the payment of such invoice will be paid on the 25th of the following month.

In this regard, when there is the case that such submitted invoice is incorrect or the work performed or goods procured is not in compliance with the requirements provided under the Agreement, the Bidder could be entitled to receive the payment on the same due date only on the conditions that such invoice is revised to the Employer’s satisfaction or the work has been performed or the goods has been procured in compliance with the requirements thereof; and that the revised invoice is re-submitted to the Employer within the end of such month.

1. **BIDDING’S DOCUMENT**
* Part I: General and Technical documents
* Part II: Commercial document

The Bidder shall submit the following documents with quotation, or other related documents:

* 1. **GENERAL AND TECHNICAL PROPOSAL**
		1. Company profile (Past performance and experience). (Required)
		2. Project Organization chart (Position and responsibility) for supporting to this work with key personal’s CV (Management Team and Senior Staffs) (Required)
		3. Manpower planning (Required)
		4. Project schedule plan (Required)
		5. Equipment planned and list (Required)
		6. Copy of Tax Certificate (Required)
		7. Copy of company affidavit (Required)
		8. Power of Attorney (Required)
		9. Proposed method of determination and Limit of Quantitation (LOQ) (Required)
		10. Certification ISO17025: 2017 for analytical laboratory (Required)
		11. Certification ISO 9001, ISO 14001: 2015, ISO 45001: 2018 (if any).
		12. Safety, Occupational Health and Environmental Practice related plan/work procedure. (if any)
	2. **COMMERCIAL PROPOSAL**

Shall be breakdown based on appropriate assumption and composed with.

* + 1. Total contract price in Thai Baht
		2. For local bidder, the service agreement shall be made in LAK currency, and exchange rate shall be applied with the 1st business day of each year.
		3. Operation cost and others;
* Analysis cost for each parameter
* Reporting cost
* Insurance, immigration, customs fee, monitoring equipment transportation
* Electricity, fuel, security and land rental fees for ambient air monitoring
* Overhead of staff, accommodation, transportation
* Other Cost (if any)
	+ 1. Price shall include all applicable tax (Exclude 10% VAT) regarding service work.
1. **SUBMISSION OF PROPOSAL**

Bidder’s proposal shall be submitted to HPC in 2 sealed envelopes, each envelope shall contain separate proposals specified as below.

1. Sealed envelopes 1 - contain completed filled part 1 General and Technical Proposal.
2. Sealed envelopes 2 - contain of completed filled part 2 Commercial Proposal.

The bidder shall submit the Proposal to the HPC office at the address specified in clause 31 that no later than 05.00 p.m. local time on the date of June 20th , 2025for further selection and any presentation of submitted proposal is required which will be conducted at by VDO conference or MS-Team Meeting. The all expenses would be responsible by own Bidder’s Company.

1. **VALIDITY OF PROPOSAL**

The proposal shall remain valid for a period of 60 days from the date of the submission of the proposal.

1. **ACCEPTANCE AND REJECTION OF PROPOSAL**

The HPC reserves the right, at its sole discretion, to accept the Proposal, which in its judgment is the most responsive and best Proposal, to reject any and all Proposals, and to waive minor irregularities and informalities in any Proposal submitted.

The HPC will reject any Proposal which, in his judgment, is non-responsive. The HPC will not be bound to award a contract to the Supplier who has submitted a Proposal indicating the lowest price but will take into account all evaluating factors and other factors such as compliance with the TOR Documents, technical and financial qualification, and capability of the Supplier to execute the Works promptly and vigorously in such manner as to secure delivery and/or completion within the time specified.

1. **ACCEPTANCE OF WORK**
	1. **Part of Work**

The Bidder shall report in writing to HPC for the progress of the Work, or the delivery of the material in the form of a progress report, or delivery report, contents of which will be set out by the HPC, before the inspection time. HPC shall nominate its personnel to check, evaluate, and approve such parts of Work or the delivered material.

Then, if HPC’s nominated person does not find any defect and damage of the part of the Work, or the delivered material meets the quantity and requirement under the Contract, then, HPC shall provide the Certificate of Inspection to the Bidder as evidence. However, in case that defect, or damage is found, or the delivered material are not met the quantity or requirement as agreed under the Contract, the Certificate of Inspection shall be provided after such damage or defect is remedied as evaluated by HPC.

* 1. **Whole of Work**

In case of the final part of the Work is complete, or the Work is checked and inspected only single time, this condition shall be applied. The whole Work shall be taken over by HPC conditional upon the issuance of the Taking-Over Certificate. Such a certificate shall be issued conditional upon the whole Work is complete and passed all tests as required under the Contract, and the Bidder accomplishes all conditions as further stated in the TOR. Provided that the Bidder must inform HPC for the final inspection in advance at least fourteen (14) days.

In case that HPC reject the Work, HPC will give the reason and specify the Work to be done by the Bidder to fulfill the obligation under the Contract.

1. **LIQUIDATED DAMAGES:**
2. **DELAY LIQUIDATED DAMAGES:**

Where any part of the Work is not complete within the scheduled completion Date (clause 3), the bidder hereby agrees to pay HPC the delay liquidated damages in daily rate in an amount of zero-point one (0.1) percent of the total contract price for each day of delay. The maximum of such liquidated damages under the Contract shall not exceed than ten (10) percent of the total contract price.

* 1. **OTHER**
	2. In the event that the amount of Bidder’s personnel to perform its obligations under this Agreement doesn’t meet the requirements as substance provided in Annex III, the Bidder agrees to be deducted the monthly services fees payable to the Bidder by the Employer at the rate two times of daily rate basis of each personnel by each person.
	3. In the event that the Bidder doesn’t perform in compliance with terms of this Agreement, the Employer shall be entitled to impose liquidated damages in daily rate of zero-point one (0.1) percent of the monthly services fee calculated day by day, provided that the total amount of liquidated damages shall not exceed a maximum amount of ten (10) percent of the total contract price.
	4. In the event that the Bidder doesn’t perform in compliance with rules and/or regulations of the Employer, the Employer is entitled but not obligated to verbally instruct the Bidder to rectify such non-compliance performance. Provided that the Bidder doesn’t rectify its performance as instructed by the Employer, the Employer shall be entitled to deliver notice of instruction for such rectification within seven (7) days after receiving such notice, unless the Bidder doesn’t perform in compliance with this sub-clause, the Bidder shall be imposed liquidated damages subject to sub-clause b)
1. **SET-OFF**

HPC shall be entitled to set off against any sum payable by HPC to the Bidder:

* 1. any debt or other money due from the Bidder to HPC; and
	2. any claims for money which HPC may have against the Bidder whether for damages (including liquidated damages) or otherwise.
1. **TAX**
	1. Where the bidder is a corporate or individual of the Lao PDR, HPC shall, in accordance with the applicable taxation law, withhold all applicable taxes at the ruling rate from all payments to the Bidder, remit the amount withheld to the applicable tax office for the Bidder’s account and forward the appropriate receipt to the Bidder.
	2. Where the Bidder is not a corporate or individual of the country of HPC, the following provisions shall apply:
2. If the Bidder have a permanent establishment in the Lao PDR for the performance of the Work, and can provide a tax certificate of domicile (or like), which is valid at the dates of the duration of the Contract, from the applicable tax office for the purpose for claiming exemption from the applicable withholding tax or reduction of the applicable withholding tax rate based on the prevailing tax treaty, HPC shall, in accordance with the applicable taxation law of the country of HPC, withhold all applicable taxes at the ruling rate from all payments to the Bidder, remit the amount withheld to the applicable tax office for the Bidder’s account and forward the appropriate receipt to the Bidder.

If the Bidder claims for either exemption from the withholding tax or reduction of the withholding tax rate based on the prevailing tax treaty, a valid certificate of domicile shall be sent to HPC prior to payment.

1. The withholding tax may not apply to the Bidder who represents and warrants that it does not have a permanent establishment in Lao PDR for the performance of the Work. Notwithstanding, the Bidder shall indemnify HPC for any damages, penalties, charges, fines, costs, and expenses (including legal fees) suffered by HPC as a result of neither deducting nor withholding applicable taxes by HPC in reliance of the Bidder’s representation and warranty hereinabove.
2. The bidder shall be responsible and liable for the payment of all taxes imposed on it in relation to the performance of Work under the Contract including the withholding tax for the income tax payable to its employees and the Bidder shall indemnify HPC for any claims or loss made from such failure.
3. **ADDITIONAL WORK**

In the case of additional Environmental quality monitoring are requested, the unit price of service fee shall be based on the service fee specified in this Agreement.

1. **VISA AND WORK PERMIT**

The bidder shall be responsible for its employee's visa and work permit. All of the cost shall be borne by the bidder.

1. **IMPORT/EXPORT MATERIALS, VEHICLE AND OTHER EQUIPMENT**

The bidder shall be responsible for importing and exporting materials, vehicles, and other equipment for working, including any sample which shall be sent to be analyzed in any country, and the analyzed sample which shall be sent back to HPC. All of the cost shall be borne by the bidder.

1. **FORCE MAJEURE**

Neither Party shall be liable for any failure to perform its obligations under the Contract to the extent that such failure is caused by Force Majeure; provided that such affected Party must inform other Party in writing within seven (7) days from the date that the affected Party becomes aware or should become aware of such Force Majeure. If the affected Party fails to do so, no extension of time in connection with such Force Majeure shall be allowed.

For avoidance of doubt, in no event shall the Bidder’s delay or failure to perform in accordance with the Contract in which is caused by foreseeable event on the date of the submission of the proposal, including epidemic or disaster, will be claimable as impracticable performance and deemed as force majeure. The Bidder shall use, at its own cost and expense, all reasonable efforts to remedy its inability to perform and to resume full performance hereunder as soon as practicable.

If the Force Majeure continues for a period of thirty (30) consecutive days or more, then either Party may terminate the Contract upon giving the other Party written notice of termination. The termination shall be without prejudice to the accrued rights of the Parties.

1. **CONFIDENTIALITY**

The Bidder shall keep confidential all documents, drawings and other information supplied by HPC as marked ‘Confidentiality’ and shall not disclose such information or items to a third party except as may be required by law or for the proper execution of the Work. Where it is necessary for the Bidder to provide such items to a third party the Bidder shall, prior to supply of the items, ensure that the third party has entered into a non-disclosure agreement with the Bidder in respect of the items. The Bidder shall not disclose any information or provision in this Contract to any third party without prior written approval of HPC. This condition shall survive the termination or expiration of the Contract.

1. **IDEMNIFICATION**

Each Party agrees to indemnify and hold harmless the other Party, its officer, agents, subcontractors, Bidders, employees, successors and assigns against any and all claims, losses, damages, liabilities, penalties, expenses, legal fees, and costs of any kind or amount whatsoever, which result from or arise out of any act or omission of the indemnifying party, its officer, agents, subcontractors, Bidders, employees, successors and assigns that occurs in connection with this Contract including bodily injury, sickness, disease or death, of any person whatsoever arising out of or in the course of or by reason of the design, execution and completion of the Work and the remedying of any defects, unless attributable to any negligence, willful act or breach of the Contract by HPC. This condition shall survive the termination of this Contract.

1. **CLAIM**

Subject to clause 26 (**FORCE MAJEURE**) , if each Party considers itself to be entitled to any additional payment, or extension of time, or obligation hereunder or in connection with this Contract, such Party shall give a written notice to the other Party describing the event, circumstance giving the rise of the claim as soon as possible; however, no later than fourteen (14) days after the affected Party became aware, or should have become aware of any event. It is expressly stated here that HPC shall have a right to request the Bidder to provide the complete and thorough details of such claims.

If the affected Party fails to do so, no additional payment or extension of time shall be allowed, and the other Party shall be discharged from all liability in connection with such claim.

1. **ASSIGNMENT AND SUBCONTRACTING**

None of the rights and/or obligations accrued hereunder may be assigned, sub-contracted or otherwise divested by the Bidder without HPC's prior written consent. Any such consent shall not relieve the Bidder from any liability or obligation under the Contract and the Bidder shall be responsible for the acts, defaults and negligence of its subcontractors, agents, representatives or workmen as fully as if they were the acts, defaults or negligence of the Bidder itself.

1. **AUTHORIZED CONTACT OF HPC**

**To: Khun Phannipa Kiatbumrung (Division Manager Procurement)**

**Address 1:** Hongsa Power Company Limited

NNN Building 4th Floor/Room No. D5, Boulichan Road,

Phonsinouan Village, Sisattanark District, Vientiane Capital, Lao PDR.

**Address 2**: Hongsa Power Company Limited

Phonchan Office, Hongsa District, Xayaboury Province, Lao PDR.

**Address 3:** Hongsa Power Company Limited

3/37-38 Worrawichai Rd., Naiwieng Sub-district, Mueang District, Nan Province, 55000 Thailand

Telephone Number: +856-20-5244 1809

Tel: +856(0)74266121-4 EXT. 1131

E-mail address : Phannipa\_K@hongsapower.com

**Appendix A: Reference standards and regulations**

1. **THE STANDARDS APPLICABLE FOR ENVIRONMENTAL QUALITY MONITORING IN LAO PDR (TASK 1)**
2. **The applicable standards for ambient air monitoring**

|  |  |  |
| --- | --- | --- |
| **Parameters** | **Standard** | **Unit** |
| **Average1 hr.** | **Average24 hr.** |
| **1/** | **2/** | **1/** | **2/** |
| Total suspended particulate (TSP) | - | - | - | ≤330 | µg/m3 |
| Particulate matter less than 10 µm (PM10) | - | - | ≤300 | ≤120 | µg/m3 |
| Sulphur dioxide (SO2) | ≤780 | ≤780(0.13 ppm) | ≤300 | ≤130(0.05 ppm) | µg/m3 |
| Nitrogen dioxide (NO2) | ≤320 | ≤320(0.11 ppm) | - | - | µg/m3 |
| Particulate matter less than 2.5 µm (PM2.5) | - | - | - | ≤50 | µg/m3 |
| Wind Speed (WS) & Wind Direction (WD) | - | - | - | - | m/s |

**Standards refer to:**

1/ *The Governing Standards and Obligations between the Government of Lao PDR and Hongsa Power Company Limited addressed on the Concession Agreement, Annex I-Company’s Social and Environmental Obligations (from first day of year 6 (2016) to end of Concession Period).*

*2/ The Ambient Air Quality Standard, National Environmental Standards of Lao PDR No.0832/MNRN (7 Feb 2017).*

1. **The applicable standards for noise level monitoring**

|  |  |  |
| --- | --- | --- |
| **Parameters** | **Standard** | **Unit** |
| 1/ | 2/ | 3/ |
| Day Average Sound Level (LAd) | ≤70 | - | ≤55 | dB(A) |
| Night Average Sound Level (LAn) | ≤70 | - | ≤45 | dB(A) |
| 24 Hours A-Weight Equivalent Continuous Sound Level (LAeq 24 hours) | - | ≤70 | - | dB(A) |
| 8 Hours A-Weight Equivalent Continuous Sound Level (LAeq 8 hours) | - | - | - | dB(A) |
| 1 Hour A-Weight Equivalent Continuous Sound Level (LAeq 1 hour) | - | - | - | dB(A) |
| Percentile 90 Sound Level (LA90) | - | - | - | dB(A) |
| Maximum Sound Level (LAmax) | - | ≤115 | - | dB(A) |

**Standards refer to:**

1. ***Ambient noise level monitoring at project boundary***

***1/*** *The Governing Standards and Obligations between the Government of Lao PDR and Hongsa Power Company Limited addressed on the Concession Agreement, Annex I-Company’s Social and Environmental Obligations for LAd and LAn at Project Noise Boundary.*

***2/*** *The Noise Standard, National Environmental Standards of Lao PDR No.0832/MNRN (7 Feb 2017)*

1. ***Ambient noise level monitoring at community area***

***3/*** *Environmental, Health and Safety (EHS) Guidelines, International Finance Corporation (IFC), World Bank Group, (2017).*

1. **The applicable standards for vibration level monitoring**

|  |  |  |
| --- | --- | --- |
| **Parameters** | **Standard** | **Unit** |
| Velocity | ≤50.8 | mm/s |
| Displacement | ≤0.20 | mm |
| Frequency | - | Hz |

**Standards refer to** *The Vibration Standard, National Environmental Standards of Lao PDR No.0832/MNRN (7 Feb 2017).*

1. **The applicable standards for surface water monitoring**

| **Parameter** | **Standard** | **Unit** |
| --- | --- | --- |
| **1/** | **2/** |
| pH | 5 – 9 | 5 – 9 | - |
| Dissolved Oxygen (DO) | ≥6.0 | ≥2.0 | mg/L |
| Biochemical Oxygen Demand (BOD) | ≤1.5 | - | mg/L |
| Chemical Oxygen Demand (COD) | ≤5.0 | 10 - 12 | mg/L |
| Conductivity | - | ≤4,000 | µS/cm |
| Total Suspended Solids (TSS) | - | ≤60 | mg/L |
| Manganese (Mn) | ≤1.0 | ≤1.0 | mg/L |
| Nitrate - Nitrogen (NO3 - N) | ≤5.0 | ≤5.0 | mg/L as N |
| Ammonia - Nitrogen (NH3 - N) | ≤0.2 | ≤0.5 | mg/L as N |
| Phosphate (PO43-) | - | ≤2.0 | mg/L |
| Cadmium (Cd) | ≤0.005 | ≤0.003 | mg/L |
| Arsenic (As) | ≤0.01 | ≤0.01 | mg/L |
| Lead (Pb) | ≤0.05 | ≤0.01 | mg/L |
| Zinc (Zn) | ≤1.0 | ≤1.0 | mg/L |
| Mercury (Hg) | ≤0.002 | ≤0.001 | mg/L |
| Sulphate (SO42-) | ≤500 | - | mg/L |
| Nickel (Ni) | ≤0.1 | ≤0.1 | mg/L |
| Copper (Cu) | ≤0.1 | ≤1.5 | mg/L |
| Phenols | ≤0.005 | ≤0.005 | mg/L |
| Chromium Hexavalent (Cr+6) | ≤0.05 | ≤0.05 | mg/L |
| Fat, Oil & Grease (FOG) | - | - | mg/L |
| Total Coliform Bacteria (TCB) | ≤5,000 | - | MPN/100 mL |
| Fecal Coliform Bacteria (FCB) | ≤1,000 | - | MPN/100 mL |
| Organochlorine Pesticide | - | ≤0.05 | mg/L |
| Dichlorodiphenyltrichloroethane (DDT) | - | ≤1.0 | µg/L |
| alpha-Benzene hexachloride (α-BHC) | - | ≤0.02 | µg/L |
| Dieldrin | - | ≤0.1 | µg/L |
| Aldrin | - | ≤0.1 | µg/L |
| Heptachlor and Heptachlor Epoxide | - | ≤0.2 | µg/L |
| Endrin | - | None | µg/L |

**Standards refer to:**

1/ *The Governing Standards and Obligations between the Government of Lao PDR and Hongsa Power Company Limited addressed on the Concession Agreement, Annex I-Company’s Social and Environmental Obligations.*

*2/ The Surface Water Standard (Type 4), National Environmental Standards of Lao PDR No.0832/MNRN (7 Feb 2017).*

1. **The applicable standards for ground water monitoring**

| **Parameter** | **Standard** | **Unit** |
| --- | --- | --- |
| **1/** | **2/** |
| pH | 6.5 - 9.0 | - | - |
| Turbidity | ≤20 | - | NTU |
| Total Suspended Solids (TSS) | ≤1200 | - | mg/L |
| Total Hardness | ≤500 | - | mg/L as CaCO3 |
| Iron (Fe) | ≤1.0 | - | mg/L |
| Manganese (Mn) | ≤0.5 | ≤0.5 | mg/L |
| Nitrate (as NO3) | ≤45 | - | mg/L |
| Cadmium (Cd) | ≤0.003 | ≤0.003 | mg/L |
| Arsenic (As) | ≤0.01 | ≤0.01 | mg/L |
| Lead (Pb) | ≤0.01 | ≤0.01 | mg/L |
| Zinc (Zn) | ≤15.0 | ≤5 | mg/L |
| Mercury (Hg) | ≤0.001 | ≤0.001 | mg/L |
| Nikel (Ni) | - | ≤0.02 | mg/L |
| Copper (Cu) | ≤1.5 | ≤1.5 | mg/L |
| Sulphate (SO42-) | ≤250 | - | mg/L |
| Chromium hexavalent (Cr6+) | - | ≤0.05 | mg/L |
| Total Coliform Bacteria (TCB) | ≤2.2 | - | MPN/100 mL |
| Fecal Coliform Bacteria (FCB) | NONE | - | MPN/100 mL |
| Total Plate Count | ≤500 | - | CFU/100 mL |
| E. coli Bacteria | NONE | - | MPN/100 mL |

***Standards refer to****;*

*1/ The Groundwater Standard for* ***Drinking Purposes****, National Environmental Standards of Lao PDR No.0832/MNRN (7 Feb 2017).*

*2/ The Groundwater Standard, National Environmental Standards of Lao PDR No.0832/MNRN (7 Feb 2017).*

1. **The applicable standards for drinking water and water supply monitoring**

| **Parameter** | **Standard 1/** | **Unit** |
| --- | --- | --- |
| **Drinking water** | **Water supply** |
| Temperature | 25 - 35 | 25 - 35 | ˚C |
| pH | 6.5 - 8.5 | 6.5 - 8.5 | - |
| Turbidity  | ≤5 3/ | ≤10 | NTU |
| Conductivity | ≤1,000 | ≤1,000 | µS/cm |
| Total Dissolved Solids (TDS) | ≤600 | ≤600 | mg/L |
| Total Hardness | ≤300 | ≤300 | mg/L as CaCO3 |
| Iron (Fe) | ≤1.0 | ≤1.0 | mg/L |
| Manganese (Mn) | ≤0.5 | ≤0.5 | mg/L |
| Nitrate (as NO3) | ≤45 | ≤45 | mg/L |
| Aluminum (Al) | - | ≤0.2 2/ | mg/L |
| Cadmium (Cd) | ≤0.003 | ≤0.003 | mg/L |
| Arsenic (As) | ≤0.05 | ≤0.05 | mg/L |
| Lead (Pb) | ≤0.01 | ≤0.01 | mg/L |
| Sodium (Na) | ≤250 2/ | ≤250 2/ | mg/L |
| Zinc (Zn) | ≤15 | ≤15 | mg/L |
| Mercury (Hg) | ≤0.001 | ≤0.001 | mg/L |
| Sulphate (SO42-) | ≤250 | ≤250 | mg/L |
| Copper (Cu) | ≤2 | ≤2 | mg/L |
| Total Coliform Bacteria (TCB) | ≤2 | ≤2 | CFU/100 mL |
| Fecal Coliform Bacteria (FCB) | NONE | NONE | CFU/100 mL |
| E. coli Bacteria  | NONE | NONE | CFU/100 mL |
| Free Residual Chlorine  | - | 0.1 – 2.0 2/ | mg/L |

Standards refer to:

*1/ The Drinking Water Standard, National Environmental Standards of Lao PDR No.0832/MNRN (7 Feb 2017).*

*2/ Agreement on the protection of the drinking water and water supply quality, Department of Health and Environment Ministry of Public Health, Lao PDR (March 2014)*

*3/ The Drinking Water Standard, National Environmental Standards of Lao PDR No.0832/MNRN (7 Feb 2017) specified the standard value of Turbidity standard allowed by MoM for improvement standards of HPC, April 2019.*

1. **The applicable standards for Power plant discharge monitoring**

| **Parameter** | **Standard** | **Unit** |
| --- | --- | --- |
| pH | 6 – 9 1/ | - |
| Temperature | ≤3 degrees differential 1/ | ˚C |
| Biochemical Oxygen Demand (BOD) | ≤30 2/ | mg/L |
| Chemical Oxygen Demand (COD) | ≤120 2/ | mg/L |
| Total Suspended Solids (TSS) | ≤50 1/ | mg/L |
| Total Dissolved Solids (TDS) | ≤2500 2/ | mg/L |
| Total Kjeldahl Nitrogen (TKN) | ≤100 2/ | mg/L |
| FAT, Oil & Grease (FOG) | ≤10 1/ | mg/L |
| Cadmium (Cd) | ≤0.1 1/ | mg/L |
| Copper (Cu) | ≤0.5 1/ | mg/L |
| Iron (Fe) | ≤1.0 1/ | mg/L |
| Nickel (Ni) | ≤1.0 2/ | mg/L |
| Phenols | ≤1.0 2/ | mg/L |
| Zinc (Zn) | ≤1.0 1/ | mg/L |
| Mercury (Hg) | ≤0.005 1/ | mg/L |
| Arsenic (As) | ≤0.5 1/ | mg/L |
| Chromium hexavalent (Cr6+) | ≤0.25 2/ | mg/L |
| Lead (Pb) | ≤0.5 1/ | mg/L |
| Total Residual Chlorine | ≤0.2 1/ | mg/L |

***Standards refer to:***

*1/ The Governing Standards and Obligations between the Government of Lao PDR and Hongsa Power Company Limited addressed on the Concession Agreement, Annex I-Company’s Social and Environmental Obligations (Annex I-2 effluent discharge (Page I-72,73)).*

*2/ The General industrial Wastewater Discharges Standard, National Environmental Standards of Lao PDR No.0832/MNRN (7 Feb 2017).*

1. **The applicable standards for Mine discharge monitoring**

| **Parameter** | **Standard** | **Unit** |
| --- | --- | --- |
| pH | 6 – 9 | - |
| Temperature | <3 degrees differential | ˚C |
| Total Suspended Solids (TSS) | ≤50\* | mg/L |
| FAT, Oil & Grease (FOG) | ≤10 | mg/L |
| Chemical Oxygen Demand (COD) | ≤150 | mg/L |
| Biological oxygen demand (BOD) | ≤50 | mg/L |
| Copper (Cu) | ≤0.3 | mg/L |
| Total Iron (Fe) | ≤2.0 | mg/L |
| Nickel (Ni) | ≤0.5 | mg/L |
| Phenols | ≤0.5 | mg/L |
| Zinc (Zn) | ≤0.5 | mg/L |
| Mercury (Hg) | ≤0.002 | mg/L |
| Arsenic (As) | ≤0.1 | mg/L |
| Chromium hexavalent (Cr6+) | ≤0.1 | mg/L |
| Lead (Pb) | ≤0.2 | mg/L |

***Standards refer to****; Annex Q Company’s Integrated Environmental and Social Obligation: Hongsa Lignite Mine, Limestone Mine and Thermal Power Plant and Ancillary Facilities / Operational Phase Environmental and Monitoring plan (OPEMMP*).

\* TSS standard: The load from each individual effluent parameter does not result in an ambient water quality downstream the discharge point that is higher than 75% of the ambient water quality standard during the rainy season and within the ambient water quality standard during the dry season.

1. **THE STANDARDS APPLICABLE FOR ENVIRONMENTAL QUALITY MONITORING IN NAN PROVINCE, Thailand (TASK 2)**
2. **The applicable standards for ambient air monitoring**

| **Parameters** | **Standard** | **Unit** |
| --- | --- | --- |
| ค่าเฉลี่ยฝุ่นละอองรวม ในเวลา 24 ชั่วโมง (TSP) **1/** | ≤330 | µg/m3 |
| ค่าเฉลี่ยฝุ่นละอองขนาดไม่เกิน 10 ไมครอน ในเวลา 24 ชั่วโมง (PM10) **1/** | ≤120 | µg/m3 |
| ค่าเฉลี่ยฝุ่นละอองขนาดไม่เกิน 2.5 ไมครอน ในเวลา 24 ชั่วโมง (PM2.5) 3/ | ≤37.5 | µg/m3 |
| ค่าเฉลี่ยก๊าซซัลเฟอร์ไดออกไซด์ ในเวลา 24 ชั่วโมง (SO2) **1/** | ≤300(0.12 ppm) | µg/m3 |
| ค่าเฉลี่ยก๊าซไนโตรเจนไดออกไซด์ ในเวลา 1 ชั่วโมง (NO2) **2/** | ≤320(0.17 ppm) | µg/m3 |

**1/** มาตรฐานคุณภาพอากาศในบรรยากาศโดยทั่วไป ตามประกาศคณะกรรมการสิ่งแวดล้อมแห่งชาติ ฉบับที่ 24 (พ.ศ. 2547) ประกาศในราชกิจจานุเบกษา ฉบับประกาศทั่วไป เล่ม 121 ตอนพิเศษ 104ง วันที่ 22 กันยายน 2547

2/ ประกาศคณะกรรมการสิ่งแวดล้อมแห่งชาติ ฉบับที่ 33 (พ.ศ. 2552) เรื่อง กำหนดมาตรฐานค่าก๊าซไนโตรเจนไดออกไซด์ในบรรยากาศโดยทั่วไป ประกาศ ณ วันที่ 17 มิถุนายน พ.ศ. 2552

**3/** ประกาศคณะกรรมการสิ่งแวดล้อมแห่งชาติ เรื่อง กำหนดมาตรฐานฝุ่นละอองขนาดไม่เกิน 2.5 ไมครอน ในบรรยากาศโดยทั่วไป ประกาศ ณ วันที่ 23 มิถุนายน พ.ศ. 2565

1. **The applicable standards for surface water monitoring**

| ดัชนีชี้วัด | แหล่งน้ำประเภท 2 | แหล่งน้ำประเภท 3 | แหล่งน้ำประเภท 4 | หน่วย |
| --- | --- | --- | --- | --- |
| ความเป็นกรด - ด่าง (pH) | 5.0 - 9.0 | - |
| ออกซิเจนละลาย (Dissolved Oxygen, DO) | ≥6.0 | ≥4.0 | ≥2.0 | mg/L |
| บีโอดี (Biochemical Oxygen Demand, BOD) | ≤1.5 | ≤2.0 | ≤4.0 | mg/L |
| แบคทีเรียกลุ่มโคลิฟอร์มทั้งหมด (Total Coliform Bacteria, TCB) | ≤5,000 | ≤20,000 | - | MPN/100 mL |
| แบคทีเรียกลุ่มฟีคอลโคลิฟอร์ม (Fecal Coliform Bacteria, FCB) | ≤1,000 | ≤4,000 | - | MPN/100 mL |
| ไนเตรต - ไนโตรเจน (Nitrate – Nitrogen) | ≤5.0 | mg/L as N |
| แอมโมเนีย - ไนโตรเจน (Ammonia – Nitrogen) | ≤0.5 | mg/L as N |
| ฟีนอล (Phenols) | ≤0.005 | mg/L |
| ทองแดง (Copper, Cu) | ≤0.1 | mg/L |
| นิคเกิล (Nickle, Ni) | ≤0.1 | mg/L |
| แมงกานีส (Manganese, Mn) | ≤1.0 | mg/L |
| สังกะสี (Zinc, Zn) | ≤1.0 | mg/L |
| แคดเมียม (Cadmium, Cd) กรณีที่ความกระด้างในรูป CaCO3 ไม่เกิน 100 mg/L | ≤0.005 | mg/L |
| แคดเมียม (Cadmium, Cd) กรณีที่ความกระด้างในรูป CaCO3 เกิน 100 mg/L | ≤0.05 |
| โครเมียมเฮ็กซาวาเล้นท์ (Chromium Hexavalent, Cr6+) | ≤0.05 | mg/L |
| ตะกั่ว (Lead, Pb) | ≤0.05 | mg/L |
| ปรอท (Mercury, Hg) | ≤0.002 | mg/L |
| สารหนู (Arsenic, As) | ≤0.01 | mg/L |
| ไซยาไนด์ (Cyanide) | ≤0.005 | mg/L |
| สารฆ่าศัตรูพืชและสัตว์ที่มีคลอรีนทั้งหมด (Total Organochlorine Pesticide) | ≤0.05 | mg/L |
| ดีดีที (DDT) | ≤1.0 | µg/L |
| บีเอชซีชนิดแอลฟา (Alpa-BHC) | ≤0.02 | µg/L |
| ดิลดริน (Dieldrin) | ≤0.1 | µg/L |
| อัลดริน (Aldrin) | ≤0.1 | µg/L |
| เฮปตาคลอร์ (Heptachlor) | ≤0.2 | µg/L |

มาตรฐานคุณภาพน้ำในแหล่งน้ำผิวดิน ประกาศคณะกรรมการสิ่งแวดล้อมแห่งชาติ ฉบับที่ 8 (พ.ศ. 2537) ออกตามความในพระราชบัญญัติส่งเสริมและรักษาคุณภาพสิ่งแวดล้อมแห่งชาติ พ.ศ. 2535

1. **The applicable standards for sediment and fish tissue**

| **Parameter** | **Standard** | **Unit** |
| --- | --- | --- |
| ปรอท (Hg) ในเนื้อปลา **1/** | ≤0.5 | mg/kg (wet weight) |
| ปรอท (Hg) ในดินตะกอนในแหล่งน้ำผิวดิน **2/** | ≤0.200 | mg/kg (dry weight) |

**1/** เกณฑ์มาตรฐานปริมาณปรอทในเนื้อปลาและผลิตภัณฑ์ประมง ตามประกาศกระทรวงสาธารณสุข ฉบับที่ 98 (2529) และฉบับที่ 273 (2546)

**2/** มาตรฐานคุณภาพดินตะกอนในแหล่งน้ำผิวดินเพื่อปกป้องสัตว์หน้าดิน ตามประกาศคณะกรรมการสิ่งแวดล้อมแห่งชาติ พ.ศ. 2565

1. **The applicable standards for water supply monitoring**

| **Parameter** | **Standard** | **Unit** |
| --- | --- | --- |
| สี (Colour) | ≤15 | Pt-Co |
| ความขุ่น (Turbidity) | ≤5 | NTU |
| ความเป็นกรด - ด่าง (pH) | 6.5 - 8.5 | - |
| ของแข็งที่ละลายได้ทั้งหมด (Total Dissolved Solid, TDS) | ≤1000 | mg/L |
| เหล็ก (Iron, Fe) | ≤0.3 | mg/L |
| แมงกานีส (Manganese, Mn) | ≤0.1 | mg/L |
| ทองแดง (Copper, Cu) | ≤2.0 | mg/L |
| สังกะสี (Zinc, Zn) | ≤3.0 | mg/L |
| ความกระด้างทั้งหมด (Total Hardness) | ≤300 | mg/L as CaCO3 |
| ซัลเฟส (Sulphate) | ≤250 | mg/L |
| ไนเตรตในรูปไนเตรต (Nitrate as NO3) | ≤50 | mg/L |
| โคลิฟอร์มแบคทีเรีทั้งหมด (Total Coliform Bacteria, TCB) | ไม่พบ | CFU/100 mL |
| อี โคไล (E.coli) | ไม่พบ | CFU/100 mL |
| ปรอท (Mercury, Hg) | ≤0.001 | mg/L |
| ตะกั่ว (Lead, Pb) | ≤0.01 | mg/L |
| แคดเมี่ยม (Cadmium, Cd) | ≤0.003 | mg/L |

มาตรฐานคุณภาพน้ำประปา การประปาส่วนภูมิภาค เอกสารแนบท้ายคำสั่ง กปภ. ที่ 197/2565 ลงวันที่ 9 มีนาคม 2565 ตามคำแนะนำขององค์การอนามัยโลก (WHO) ฉบับที่ 4 ปี ค.ศ. 2011 ภาคผนวกที่ 1 ปี ค.ศ. 2017