AES-VCM MONG DUONG POWER CO. LTD.

MONG DUONG 2 BOT THERMAL POWER PLANT

---***---

ENVIRONMENTAL MONITORING REPORT FOR MONG DUONG 2 BOT THERMAL POWER PLANT

JUNE - 2016

HA NOI, JUNE – 2016

AES-VCM MONG DUONG POWER CO. LTD.

MONG DUONG 2 BOT THERMAL POWER PLANT

___***___

ENVIRONMENTAL MONITORING REPORT FOR MONG DUONG 2 BOT THERMAL POWER PLANT

JUNE - 2016

Invested by:

AES-VCM MONG DUONG POWER PLANT CO., LTD.

Implemented by:

BACH KHOA ENVIRONMENTAL AMICABLE TECHNOLOGY, JSC. (BKEST)

M.S.D.N: 0103772256 C.T.C.P
CÔNG TY CỔ PHẦN CÔNG NGHỆ THÂN THIỆN MÔI TRƯỜNG BÁCH KHOA
Q. HAI BÀ TRƯNG - T.P HÀ NỘI

GIÁM ĐỐC

Tạ Văn Sơn

HA NOI, JUNE - 2016

CONTENTS

TABLES iii
GENERAL INTRODUCTION ON MONG DUONG 2 BOT THERMAL POWER PLANT ..4
CHAPTER I. PLAN OF ENVIRONMENTAL MONITORING PROGRAM IN MONG DUONG 2 THERMAL POWER PLANT IN 2016 7
I.1. The purpose of monirtoring program 7
I.2. Environmental monitoring parameters and frequency in 2016 7
I.3. Monitoring positions 9
I.4. Environmental monitoring method and equipment/instruments 9
CHAPTER II. RESULTS AND ASSESSMENT 12
II.1. Water environment 12
II.1.1. Wastewater 12
CHAPTER III. CONCLUSION AND RECOMMENDATION 14
III.1. Conclusion 14
III.2. Recommendation 14
APPENDIX 16
APPENDIX 1. APPLICATION OF QA/QC PROGRAM FOR ENVIRONMETAL MONITORING IN MONG DUONG 2 THERMAL POWER PLANT 17
Applying QA / QC program for environmental monitoring Mong Duong 2 phase operation in April 2016 17
1. QA/QC in the design of environmental monitoring program 17
2. QA/QC on field monitoring 18
3. Quality assurance and quality control (QA/QC) in laboratory 21
APPENDIX 2. IMAGES OF MONITORING ACTIVITIES ON FIELD 28
APPENDIX 3. MAP OF SAMPLING AREAS 29
APPENDIX 4: THE MONITORING RESULTS 30

FIGURES

Figure 1.1. Mong Duong 2 Thermal Power Plant location 5
Figure 2.1. The chart of Temperature in cooling water.....13
Figure 4.1. QA/QC in lab (ISO/IEC 17025:2005) 22
Figure 4.2. Sampling water in Mong Duong 2 thermal power plant.....28
Figure 4.3. Map of sampling areas 29

TABLES

Table 1.1. The categories of Mong Duong 2 Thermal Power Plant are used together with Mong Duong 1 Thermal Power Plant in Mong Duong Electricity Power Centre ..6
Table 1.2. Environmental parameters and frequency 8
Table 1.3. The coordinates of monitoring points in Mong Duong 2 Thermal Power Plant 9
Table 1.4. Method for measurement, sampling and preservation 10
Table 1.5. Analytical methods in the Laboratory 10
Table 2.1. The points of water sampling 16th environmental monitoring 12
Table 4.1. Summary of quality assurance activities in the design of environmental monitoring program in Mong Duong 2 Power Plant 17
Table 4.2. The current status of quality assurance and quality control activities on field (Mong Duong 2 Thermal Power Plant) 19
Table 4.3. The current status of quality assurance and quality control activities at the laboratory 23
Table 4.4. On-field blank samples (water) 26
Table 4.5. % RPD of QC duplicate samples (Water) 26

GENERAL INTRODUCTION

ON MONG DUONG 2 BOT THERMAL POWER PLANT

Mong Duong 2 Thermal Power Plant is one of two thermal power plant projects. It locates in Mong Duong Electricity Power Centre and has construction site that locates near No. 18A national route. The distance from Mong Duong thermal power plant to Ha Long city is about 50 km and to Cam Pha commune about 18 km in the North East. Mong Duong Electricity Power Centre locates in zone 3, Mong Duong ward, Cam Pha commune, Quang Ninh province. This position lies near Mong Duong estuary and along Luong Gac (Gac Channel). This is an advantage for not only transporting materials by waterway to construction site but also installing cooling water system for two factories. Along South East coast of Electricity Power Centre is range of low mountain. In Luong Gac, there is coal port and chemical store belong Bai Tu Long Coal Company. The plant has total capacity about 1240MW (including two sets of machinery with average capacity is 620MW) with total investment about 2 billion USD. Construction stage was started since September 15th, 2011 and is scheduled supplying commercial electricity for each set of machinery.

- No. 1 set of machinery was operated on March 4th, 2016 with capacity 620MW.
- No.2 set of machinery was operated on April 22nd, 2016 with capacity 620MW. Total capacity is 1240MW.

Area of plant is 81.822 ha. Plant is built in zone 3, Mong Duong ward, Cam Pha commune, Quang Ninh province. Boundary of plant: by the East: beside Binh Minh port; by the South: beside rivulet; by the West: beside Mong Duong 1 thermal power plant; by the North: beside the road which leads to plant and Mon Duong river. The location to build project has many advantages in transferring material by waterway, constructing, investigating, exploiting, and operating plant.

The location of Mong Duong Electricity Power Centre including Mong Duong 2 thermal power plant project and general plan of Centre is shown in **Figure 1.1**

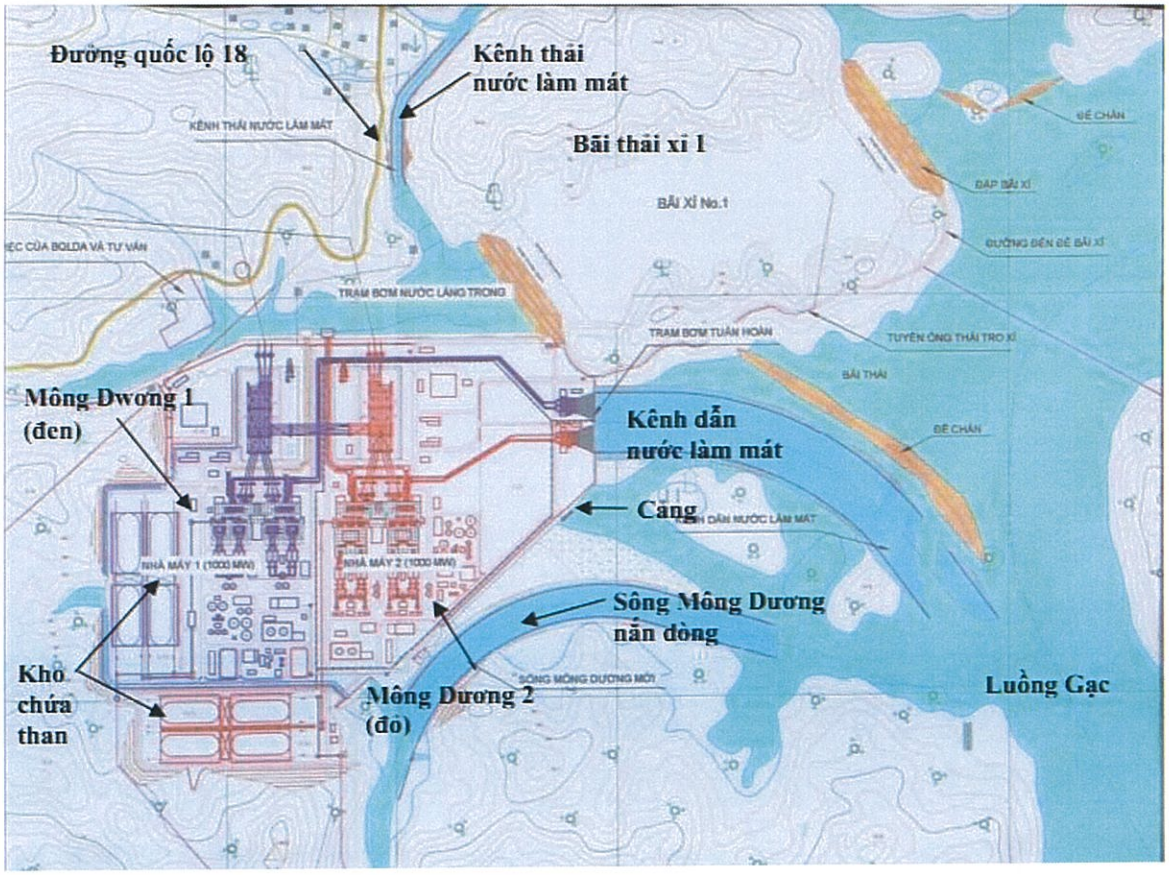


Figure 1.1. Mong Duong 2 Thermal Power Plant location

Mong Duong 2 Thermal Power Plant project is built after Mong Duong Electricity Power Centre completing infrastructures (leveling platform, converting flow of Mong Duong river, completing water collection system, water discharge system to cool, ash dumps…). The works within project include:

+ Infrastructure of thermal power plant: including generator, primary transformer and ancillary works;

+ The operator, warehouse, workshop;

+ Piping, cooling pump system of general channel from Luong Gac river to Electricity Power Centre.

+ Sewage piping system from plant to Luong Gac canal

+ Channel discharges cooling water into general discharge system of Electricity Power Centre

+ Piping system leads oil from oil receiving point;

+ Slag treating system includes pump station and pump system, which leads slag to general slag, discharged pool of Electricity Power Centre

+ Coal warehouse (about 15 days);

+ Construction treats wastewater;

+ Private road;

+ Fire preventing and fighting system;

+ Temperatureorary and fixed accommodation;

+ The drainage system within plant.

+ Port that receive oil and limestone

+ Slag landfill

The categories used together with Mong Duong 1 Thermal Power Plant are shown in the following table:

Table 1.1. The categories of Mong Duong 2 Thermal Power Plant are used together with Mong Duong 1 Thermal Power Plant in Mong Duong Electricity Power Centre

No.	Categories	Description
1	All area of centre	Mong Duong 2 plant account for 50%
2	Coal receiving region	Using conveyer to transport coal in centre
3	Cooling water supplying channel	This construction is built by EVN. Connection point is pump station in the East of project
4	Cooling water discharging channel	This construction is built by EVN. It locates in the North of project
5	Fresh water supplying system	This construction is built in the North - West by EVN.
6	500 KV connection line	This construction is built by EVN. Mong Duong 2 connection structure inside the distribution station
7	110 KV power supply line for testing in factory	This construction is built by EVN. Mong Duong 2 connected at self-substation to the point inside the
8	Road	At primary road of Mong Duong 2.
9	FO oil and limestone receiving port	Only used by Mong Duong 2. Area is 0.57 ha
Source: AES-VCM Mong Duong Power Co. Ltd., October, 2014		

All general categories of construction are completed and put in use.

CHAPTER I. PLAN OF ENVIRONMENTAL MONITORING PROGRAM IN MONG DUONG 2 THERMAL POWER PLANT IN 2016

The environmental monitoring program in April is the 16th monitoring time in operation stage of plant. The main purpose is to show the judge about environment status of plant during operation stage. Environmental monitoring program are performed to make report on periodic environment quality of Mong Duong 2 Thermal Power Plant. This program ensures environmental management object of Mong Duong 2 Thermal Power Plant project to meet the requirements of national environmental protection laws and AES company during operation stage. The detailed objects are shown as following parts:

I.1. The purpose of monirtoring program

The purpose of monitoring program is to evaluate the environmental quality, to examine the pollution level of each environmental component and to collect continuous data to serve environmental management works for Mong Duong 2 Thermal Power Plant and Mong Duong Electricity Power Centre.

In detail:

- ✓ Components, polluted sources, concentration/contents/intensity of pollutants
- ✓ The impact of environmental agents/pollutants
- ✓ Forecasting changes in the levels and effects of these agents
- ✓ Information to managers, namely management board of Mong Duong thermal power plant to take measures in order to mitigate or prevent the harmful effects of environmental pollution caused by the operation of the plant

Besides, this environmental monitoring program is also followed the requirements of approved EIA report of Mong Duong 2 Thermal Power Plant (2007), wastewater discharge permit No 1494/GP-BTNMT (21st July 2014) and permit for completing environmental protecting construction No 42/GXN-TCMT (21st April 2015).

I.2. Environmental monitoring parameters and frequency in 2016

All the environmental monitoring parameters are selected typically for each environmental component.

For Mong Duong 2 Thermal Power Plant, monitoring parameters selecting for second monitoring time are strictly complied with EIA report and based on the fact operating stage of the factory.

Main monitoring parameters and frequency are seen in table below:

Table 1.2. Environmental parameters and frequency

No	Item	Term of work	Location	Frequency requirement			Monitoring parameters	Reference Standard	Final frequency	Sampling Quantity
				ADB EIA	MONRE EIA	Permit				
1	Water environment	Cooling water	CW1, CW2, CW3				Temperature, pH; TSS; EC; NH_4^+; NO_3^-; DO; BOD_5; Total N&P; Heavy metals (As, Cr, Cd, Cu, Pb, Zn, Ni, Hg, Fe, Mn, Se..), total oil & grease, Coliform	QCVN40:2011/BTNMT		03 samples
		Industrial waste water (WW1)	From the discharge point into the coolant channels		-		Temperature; pH; Colour; COD; BOD_5; TSS; As,Hg; Pb, Cd, Cr^{3+}, Cr^{6+} , Cu, Zn, Ni, Mn, Fe, Oil & grease, F^-, S^{2-}; Nutrients (N&P), ; Residual chlorine, amoni and coliform.	QCVN40:2011/BTNMT		01 sample

I.3. Monitoring positions

All the environmental monitoring positions are selected by the fact situation of the plant and are followed by the proposed program from EIA report that is approved in permit No 803/QĐ-BTNMT (22nd May 2007), demand of monitoring in operating period is built in Social and Environment Management System - SEMS, wastewater discharge permit No 1494/GP-BTNMT (21st July 2014) and permit for completing environmental protecting construction No 42/GXN-TCMT (21st April 2015).

The survey was conducted before sampling to examine the monitoring points by GPS-Silva-21802-901, Sweden. The coordinates are listed as in **Table 1.3** follows:

Table 1.3. The coordinates of monitoring points in Mong Duong 2 Thermal Power Plant

Environmental Aspect	No	Location	X	Y
I. WATER ENVIRONMENT				
Cooling water	CW1	Intake point of cooling water	21°04'32.6"N	107°21'18.5"E
	CW2	Discharge point into the cooling water channel	21°04'28.3"N	107°20'57.1"E
	CW3	Discharge point to common Mong Duong Power complex channel	21°04'42.4"N	107°21'03.1"E
Industrial waste water	WW1	Discharge point into the Cooling water channel	21°04'31.1"N	107°21'04.4"E

I.4. Environmental monitoring method and equipment/instruments

Main environmental monitoring methods are:

- ✓ Surveying, collecting data, sampling, on-field measurement;
- ✓ Sampling, preservation and measurement on-field and laboratory in compliance with current Vietnamese standards, circulars and regulations;
- ✓ Data processing and evaluation, statistical method in comparison to QCVN/TCVN

Methods for measurements, sampling and preservation; equipment/instruments are as in **Table 1.4 and Table 1.5**

Table 1.4. Method for measurement, sampling and preservation

No	Environmental components	Name/ number of sampling and measurement methods	Equipment / LOD
WASTEWATER		TCVN 6663-1:2011, TCVN 5999:1995, TCVN 6663-3:2008	
1	Temperature	TCVN 4557:1988	From 0 - 80°C
2	pH	TCVN 6492:2011	From 0 – 14

Table 1.5. Analytical methods in the Laboratory

No	Environmental components	Name/ number of analytical methods	MDL/LOD
WASTEWATER			
1	Colour	TCVN 6185: 2008	5 Pt -Co
2	BOD_5 (20^OC)	TCVN 6001–1:2008	2 mg/L
3	COD	SMEWW 5220 C:2012	2 mg/L
4	Total suspended solid (TSS)	TCVN 6625 : 2000	2 mg/L
5	TDS	SOP-TDS	0 - 1.999 mg/L
5	Asen (As)	EPA 200.8	1.26 µg/L
6	Mercury (Hg)	EPA 200.8	0.72 µg/L
7	Lead (Pb)	EPA 200.8	0.72 µg/L
8	Cadimi (Cd)	EPA 200.8 TCVN 6193:1996	0.6 µg/L 0.006 mg/L
9	Chrome VI (Cr^{6+})	TCVN 7939:2008	2.3 µg/L
10	Chrome III (Cr^{3+})	SMEWW 3125:2012 + SMEWW 3500Cr.B:2012	0,01 µg/L
11	Copper (Cu)	EPA 200.8 TCVN 6193:1996	9.15 µg/L 0.013 mg/L
12	Zinc (Zn)	EPA 200.8 TCVN 6193:1996	1.59 µg/L 0.014 mg/L
13	Nikel (Ni)	EPA 200.8 TCVN 6193:1996	3.21 µg/L 0.022 mg/L

14	Mangan (Mn)	EPA 200.8	3.87 µg/L
15	Iron (Fe)	EPA 200.8	5.31 µg/L
16	Mineral Oil & Grease	EPA 1664	0.3mg/L
17	Florua (F-)	SMEWW 4500D.F-2012	0,1mg/L
18	Sulfide (calculated by H_2S)	SMEWW 4500-S^{2-} D:2012	0.03 mg/L
19	Total Nitrogen	TCVN 6638:2000	3 mg/L
20	Total phosphorus	TCVN 6202: 2008	0.017 mg/L, 0.05 – 4mg/l
21	Residual Chlorine	TCVN 6225 – 3:2011	0.17 mg/L
22	Ammonium (calculated by N)	SMEWW 4500-NH_4^+-F	0.23 mg/L
		TCVN 6179-1:1996	0.3 mg/L
25	Coliform	TCVN 6187-2:1996	3 MPN/100 mL

Notes:

- *TCVN: Viet Nam standards*
- *SOP-CO: Standard Operating Procedure for on-field sampling of CO*
- *MASA: Methods of Air Sampling and Analysis*
- *AS/NZS: Australian/New Zealands Standards*
- *EPA: Environment Protection Agency*
- *SMEWW: Standard Method for The Examination of Water and Waste Water*
- *SVOC: Semivolatile Organic Compounds*
- *VOC: Volatile organic compound*
- *TPH: Total petroleum hydrocarbon*

CHAPTER II. RESULTS AND ASSESSMENT

The 16th Environmental monitoring time in operation time of Mong Duong 2 plant was implemented in the period from 27/06/2016 at 03 cooling water samples and 01 industrial wastewater sample. The monitoring results are shown in the following sections.

II.1. Water environment

Water samples are monitored including wastewater, surface water, coastal water, detailed water sampling locations as **table 2.5** below:

Table 2.1. Water sampling positions in 16th environmental monitoring program

Water environment	Code	Positions	Coordinates	
Industrial waste water	WW1	From discharge point to cooling water chanel	21°04'31.1"N	107°21'04.4"E
Cooling water	CW1	Intake point of cooling water	21°04'32.6"N	107°21'18.5"E
	CW2	Discharge point into the cooling water canal	21°04'28.3"N	107°20'57.1"E
	CW3	Discharge point to common Mong Duong Power complex canal	21°04'42.4"N	107°21'03.1"E

Evaluating the results of environmental monitoring of water as the following sections:

II.1.1. Wastewater

Wastewater of the plant in the 16th monitoring program includes 01 industrial wastewater sample and 03 samples of cooling water.

a. Industrial wastewater

The influent industrial wastewater includes irregular wastewater, regular wastewater and oil contaminated wastewater. The capacity of industrial wastewater treatment system is 110 m^3/h. The sample WW was taken at the discharge point into the cooling water channel. At the monitoring time, the industrial wastewater treatment system operates normally. The detailed monitoring points are below:

WW: From discharge point to cooling water chanel

The result shows that all the parameters of industrial wastewater are lower than QCVN 40:2011/BTNMT column B. Coparing with the **TCW-AES-TKV**: The standard of Mong Duong 2 BOT thermal power plant about permitted limit of industrial wastewater,

all parameter meet allowed standard. This demonstrates that the industrial wastewater treatment system works extremely well.

b. Cooling water

In order to estimate the quality of cooling water supply for plant and also discharging cooling wastewater, cooling water was taken at 03 positions at 03 intake points of cooling water, discharge point into the cooling water channel and discharge point to common Mong Duong power complex channel. The detailed positions:

- CW1: Intake point of cooling water
- CW2: Discharge point into the cooling water channel
- CW3: Discharge point to common Mong Duong Power complex channel

At the monitoring time, the plant operates in normal condition. Capacity of cooling water is about 4,000,000 m^3/ day.night. According to the design of cooling water system as well as the characteristics of the cooling water, two parameters that need to be tightly controlled are temperature and residual chlorine. In addition, the quality of the cooling wastewater is compared with QCVN 40:2011/BTNMT- National technical regulation on industrial wastewater. Due to the characteristics of the cooling water does not contain many polluted factors so the monitoring results therefore also reflect the fact that the monitoring parameters are achieved strictly allowed standard of the plant -GVC-AES-TKV- Standards of BOT Mong Duong 2 thermal power plant of the permitted limit value of cooling water. Monitoring the temperature of the coolants after discharging into the environment is also quite important to ensure that the cooling water does not affect the aquatic environment. Fluctuated temperature in cooling water is as shown below:

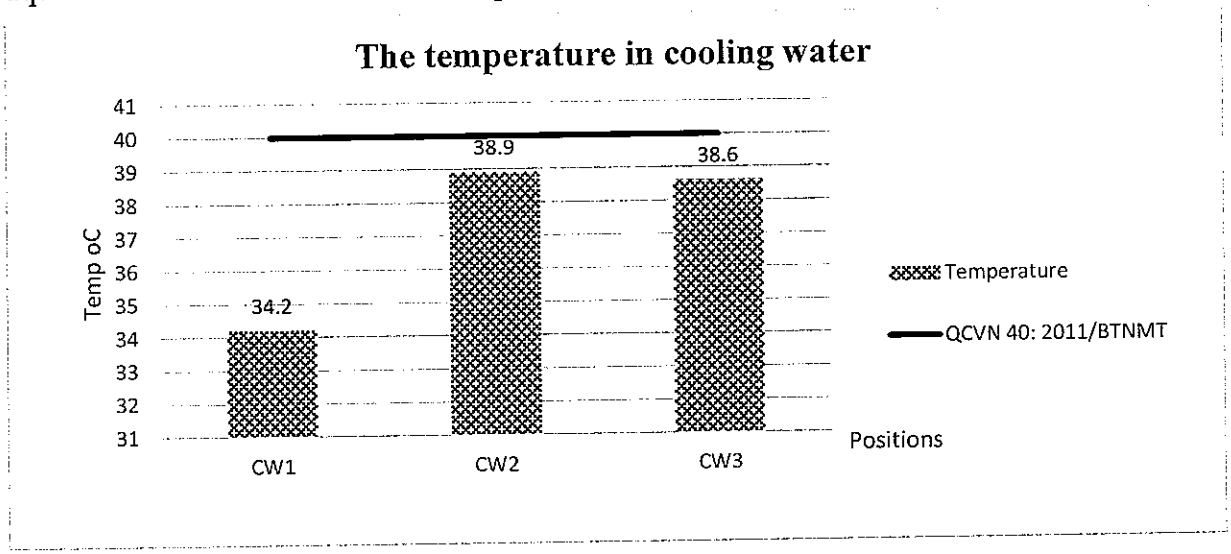


Figure 2.1. The chart of Temperature in cooling water

The temperature in cooling water into the environment has reduced to the air's temperatures roughly, and tend to cool down slowly in the direction of flow.

CHAPTER III. CONCLUSION AND RECOMMENDATION

III.1. Conclusion

The 16th Environmental monitoring program in operation stage of Mong Duong 2 thermal power plant was conducted in June, 2016, the sampling locations were approved according to plan, the environmental monitoring factors includes: waste water, cooling water. Based on the results of environmental monitoring, the assessment of environmental quality in the area of the plant in operation stage as follows:

Wastewater

Wastewater of the plant in the 16th monitoring time includes 01 industrial wastewater sample. In which, parameters of industrial wastewater are smaller than allowed standard (QCVN 40:2011/BTNMT), and TCW-AES-TKV: The standard of Mong Duong 2 BOT thermal power plant about permitted limit of industrial wastewater.

Cooling water

Monitoring results of the cooling water samples shown that all the monitoring parameters are allowed to the standards of QCVN 40: 2011/BTNMT and GVC-standard AES-TKV- Standards of BOT Mong Duong 2 Thermal power plants of the permitted limit value of cooling water.

III.2. Recommendation

Based on the monitoring results of the 16th monitoring time in operation stage in Duong Duong 2 Thermal Power plant, the monitoring team and implementing units may give some recommendations to the management board of Mong Duong 2 thermal plants and the contractor at the plant as follows:

Continue implementation of environmental monitoring activities periodically with the noise component, ambient air, wastewater, surface water, ecological environment according to plan, the roadmap setting out in the region during the operation stage of Mong Duong 2 thermal power plant. This is in order to detect early signs of environmental pollution due to the impact of the plant through each stage or other events affecting the region.

Continue and expand the assessment of the impact of plant's operations to the surrounding residential area. Especially we should focus on evaluating expansion and more detailed assessment of environmental ambient air, surface water area. Study and estimate the impact of 2 plants to people's living. Beside the influence of environment, it is need to assess the social impact on population in Mong Duong 2 thermal power plant area.

Providing updated information on the situation of the environment for the local area and building contractors to have plans for dealing with pollution as well as minimize the polluting activity to the regional environment.

During construction works or auxiliary expansion of mills', contractors should strictly implement measures to reduce air pollution and surface water, coastal, especial attention to the area has signs of contamination.

Disseminating environmental information is to raise people's awareness in the community and region.

APPENDIX

APPENDIX 1. APPLICATION OF QA/QC IN MONITORING PROGRAM

APPENDIX 2. IMAGES OF MONITORING ACTIVITIES ON FIELD

APPENDIX 3. MAP OF SAMPLING AREAS

APPENDIX 4. THE MONITORING RESULTS

APPENDIX 1. APPLICATION OF QA/QC PROGRAM FOR ENVIRONMETAL MONITORING IN MONG DUONG 2 THERMAL POWER PLANT

Applying QA/QC program for environmental monitoring Mong Duong 2 phase operation in June 2016

1. QA/QC in the design of environmental monitoring program

Activities to ensure quality in the design of environmental monitoring program for Mong Duong 2 Thermal Power Plant are summarized in **Table 4.1** follows (compare current status with the requirements of Circular 21/2012/TT-BTNMT on 19/12/2012, Ministry of Natural Resources and Environment guiding the quality assurance and quality control in environmental monitoring).

Table 4.1. Summary of quality assurance activities in the design of environmental monitoring program in Mong Duong 2 Power Plant

No.	Activities	Current status in comparison to the requirements of Circular 21	Note
1	Determine the objectives of monitoring program	+	
2	Design the environmental monitoring program	+	Monitoring in cooling water, waste water in the plant
2.1.	Compliance with environmental protection programs and national strategies	+	
2.2.	To comply with the technical guidance, procedures and regulations for each environmental component	+	QCVN 40:2011/BTNMT of Ministry of Environment and Resources: National Technical Regulation on industrial wastewater. Circular No. 29/2011/TT-BTNMT of Ministry of Natural Resources and Environment: Technical Regulation on environmental monitoring procedures of

			surface water
2.3.	Follow all steps in design environmental monitoring program	+	

Note: (+) full (-) not enough

2. QA/QC on field monitoring

The activities on field can be classified as follows:

- ✓ QA/QC in direct measurement on field (this activity can be operated independently out of other activities);
- ✓ QA/QC in sampling, sample pretreatment, samples preservation;

In this environmental monitoring program for Mong Duong 2 Power Plant, QC samples were carried out include: *On field blank sample (code: QCHT). This is defined as the small sample of handled clean material, which is stored, transported and analyzed in laboratory similar to real samples. These QC samples are used to control contamination in the sampling process.*

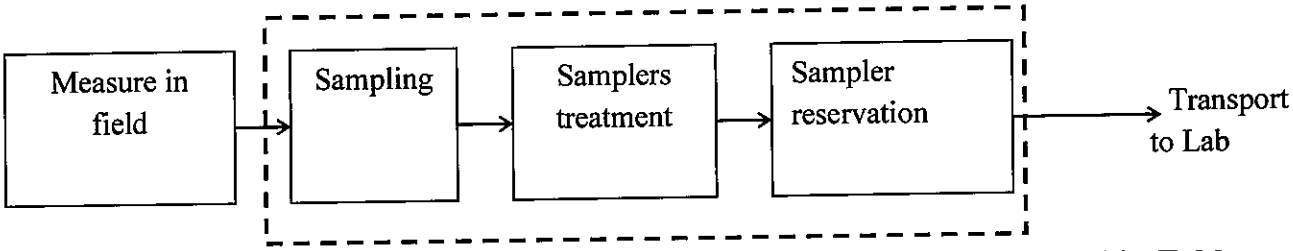
On-field blanks for wastewater are COD and TSS

- ✓ QA/QC in transporting samples to the laboratory

QC sample was choosen transportation blank sample (code: QCVC). QCVC is a small sample of the clean material transporting and researching with true samples in the same environment, the preservation and analysis of laboratory parameters as true sample. This QC sample types are used to control contamination during transporting samples.

Transportation blanks sample for wastewater: COD and TSS

QC sample at the laboratory (code: QCPTN) is replicate analyzed for the same above parameters.



Activities to quality assurance in the field of monitoring are summarized in **Table 4.2** follows:

Table 4.2. The current status of quality assurance and quality control activities on field (Mong Duong 2 Thermal Power Plant)

No.	Activities	Current status in comparison to the requirements of Circular 21	Notes
1	**Environmental Monitoring on field**	+	Followed the plan
1.1.	Determination of environmental parameters	+	Represent for each environmental component, based on proposed report of EIA
1.2.	Analytical method	+	Current Vietnamese standards (TCVN)
1.3.	On-field environmental facilities and equipment	+	Periodically maintenance and calibration
1.4.	Chemicals, standards	+	Prepare before going to the field
1.5.	Personnel	+	Assign members of performing each items
1.6.	Data processing and reporting	+	
1.7.	Quality control	-	Applied QC samples for 02 parameters in wastewater, not for all parameters.
2.	**Sampling, samples pre-treatment and preservation on field**	+	Followed current Vietnamese standards (TCVN)
2.1.	Quality assurance	+	
2.1.1.	Determination of sampling site	+	Representative for the area, followed the

No.	Activities	Current status in comparison to the requirements of Circular 21	Notes
			surveyed results
2.1.2.	Assurance of monitoring parameters	+	Followed the plan
2.1.3.	Assurance of sampling time and frequency	-	Followed the plan, some changes in accordance to train schedule
2.1.4.	Sampling methods, samples pre-treatment and preservation	+	Followed current Vietnamese standards (TCVN)
2.1.5.	Equipment and instruments	+	Periodical maintenance and calibration
2.1.6.	Personnel	+	Group work
2.1.7.	Sample containers	+	Cleaned and sterilized
2.1.8.	Chemicals	+	
2.1.9.	On-field sampling minutes	+	
2.2.	Quality control	-	Applied QC samples for 02 parameters 02 parameters in wastewater samples, not for all parameters
3.	**Sample transportation to laboratory**	+	
3.1.	Quality assurance	+	
3.1.1.	Sample transportation	+	
3.1.2.	Sample delivery	+	Using delivery minute

No.	Activities	Current status in comparison to the requirements of Circular 21	Notes

Notes: **(+) full** **(-) not enough**

3. Quality assurance and quality control (QA/QC) in laboratory

3.1. QA in laboratory

ISO/IEC 17025-2005 gives management requirements and technical requirements for the operation QA/QC laboratory. Here are the management requirements:

1. Organization.
2. Quality system.
3. Document control..
4. Review of requests, proposals and contracts.
5. Subcontracting of tests and calibrations.
6. Procurement services and supplies.
7. Service to customers.
8. Complaints (or suggestions).
9. Control testing and/or calibration mismatch
10. Remedies.
11. Precautions.
12. Control of records.
13. Internal assessment.
14. Review of leadership.

The technical requirements include:

1. General requirements.
2. Personnel.
3. Facilities andenvironmental conditions.
4. Test methods, calibration and approvedmethods.
5. Devices.
6. Traceabilityof measurement.

7. Sampling.
8. Sample managementand calibration.
9. Quality assurancetest resultsand calibration
10. Report the results.

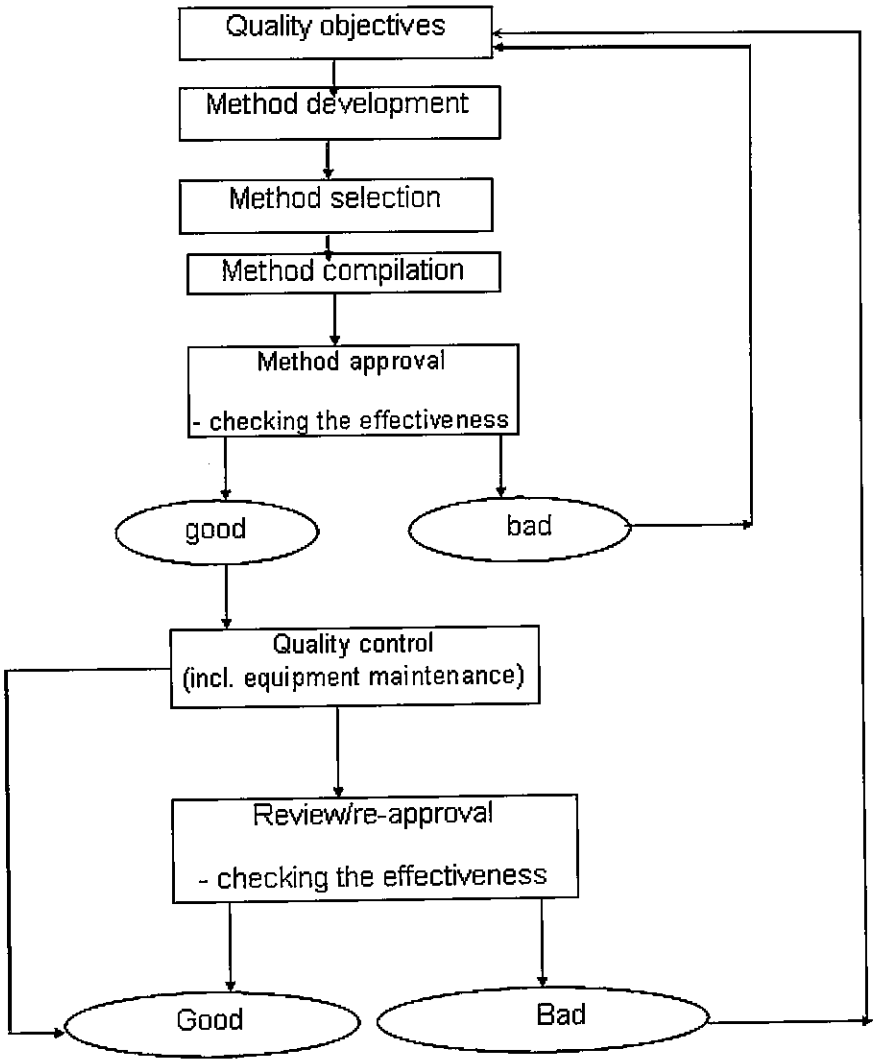


Figure 4.1. QA/QC in lab (ISO/IEC 17025:2005)

Table 4.3. The current status of quality assurance and quality control activities at the laboratory

No	Activities	Current statusin comparison to the requirementsof Circular21	Notes
4.	**QA/QC at the laboratory**	+	According to the laboratory regulations (ISO/IEC 17025 VILAS No 406 of R & D laboratory – Institute for Environmental Science and Technology)
4.1.	Management requirement	+	-as above-
4.1.1.	Determine the laboratory organization, appoint the duty and responsibility for each staff	+	-as above-
4.1.2.	Document system	+	-as above-
4.1.3.	Internal evaluation	+	-as above-
4.1.4.	Periodical review the quality management system and laboratory operation to ensure the effectiveness and continuous	+	-as above-
4.2.	Technical requirement	+	-as above-
4.2.1.	Quality assurance (analytical method, method selection, and method approval)	+	-as above-
	Facilities and equipment (calibration, labelling, maintenance)	+	-as above-
	Inter-laboratory comparison	+	-as above-
	Environmental condition	+	-as above-
	Sample management	+	-as above-
	Data quality assurance	+	-as above-
4.2.2.	Quality control	+	-as above-
	Using QC samples	+	-as above-

No	Activities	Current statusin comparison to the requirementsof Circular21	Notes
	Develop the QC accepted criteria	+	-as above-
5.	**QA/QC in data processing and reporting**	+	-as above-
5.1.	Environmental Monitoring data processing and management	+	Using software issued by Ministry of Natural resources and environment
5.1.1.	Documents related to monitoring process needed to update	+	According to the laboratory regulations (ISO/IEC 17025 VILAS No 406 of R & D laboratory – Institute for Environmental Science and Technology)
5.1.2.	Store all document related to monitoring process	+	Followed the form issued by Ministry of Natural Resources and Environment
5.1.3.	Check, calculate and process all data from the field and/or laboratory	+	According to the laboratory regulations (ISO/IEC 17025 VILAS No 406 of R & D laboratory – Institute for Environmental Science and Technology)
5.2.	Reporting	+	-as above-
5.2.1.	Phase report needed to ensure the accuracy and honest	+	-as above-
5.2.2.	Review the reports	+	-as above-
5.2.3.	Report submitting	+	Submit to client and save the data

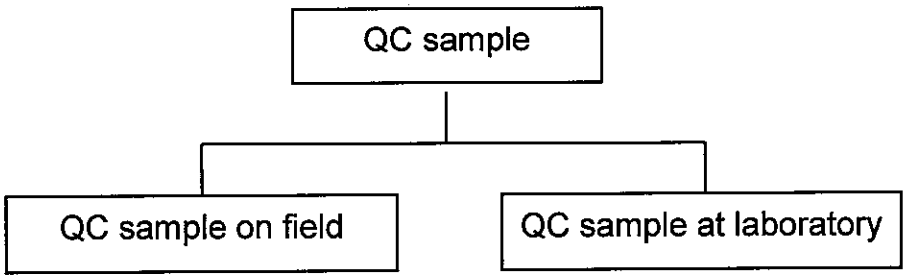
3.2. (QC) in Lab

QC samples include:

- QC sample for equipment

- QC sample for methods: Selected the duplicates at the Lab with the COD and TSS in water.

QC sample types:



In this environmental monitoring program for Mong Duong 2 Thermal Power Plant in June 2016, QC samples (blanks and duplicates) were carried out at all sampling sites with some parameters of wastewater in parallel with true samples.

QC sample on field is included: On-fields blank sample (code: QCHT), transportation blank sample (code: QCVC), applied for 02 parameters of water (*COD and TSS*). The analytical requirement for blank is less than MDL (method detection limit) or LOD (Limit of detection). In case the result is higher than these levels, it is needed to analyze again in order to remove the error cause.

QC sample at the laboratory (code: QCPTN) is replicately analyzed for the same above parameters.

Results were calculated, compared, followed the formula:

RPD: Relative Percent Difference

$$RPD = \frac{|LD1 - LD2|}{[(LD1 + LD2)/2]} \times 100(\%)$$

In which:

- RPD: Relative Percent Difference
- LD1: first analytical result
- LD2: second analytical result (duplicate)

The requirement of dispersion level between duplicate and true samples is not over ±20% (expected quality target of the laboratory).

3.3. QC sample analytical results

3.3.1. On-field blank sample analytical results

The 16th environmental monitoring time conducted with 02 QC samples: On-field blank sample, transportation blank sample of 02 parameters: *COD and TSS.*

Table 4.4. On-field blank samples (water)

Type of sample	Code	COD (mg/l)		TSS (mg/l)	
		% value ≤2	% value ≥2	% value ≤2	% value ≥2
QCHT: on-field blank samples	CW1	100	0	100	0
	WW1	100	0	100	0

3.3.2. Duplicate sample analytical results

Selected QC samples were duplicates in Lab (QCPTN) with parameters of COD and TSS in water. In detail:

Table 4.5. % RPD of QC duplicate samples (Water)

No.	Code	% RPD	
		COD	TSS
1.	CW1	4.082	6.185
2.	WW1	9.221	3.046

QA/QC activity was conducted fully as design in monitoring program; therefore, the above results shown rather good with the expected quality target of the laboratory within RPD ±20% (meet the requirements of the Lab).

3.3.3. Evaluation on completed monitoring data

Completed monitoring data is evaluated by percent of full data in comparison to the expected data in the begin of plan.

Formula using for percent of completed data as bellows:

$$C = \frac{V}{T} \times 100(\%)$$

In which:

- C: % of completed data
- V: number of acceptable samples
- T: total samples in beginning plan

Here C ≥ 95% is acceptable.

In this monitoring program (June 2016) for Mong Duong 2 Thermal Power Plant, there were 01 wastewater samples, 03 cooling water samples.

Therefore:

$$C = \frac{V}{T} \times 100(\%) = \frac{4}{4} \times 100(\%) = 100\ \%$$

C =100% is ensured the completed data in this monitoring program of June 2016.

APPENDIX 2. IMAGES OF MONITORING ACTIVITIES ON FIELD

Figure 4.2. Sampling water in Mong Duong 2 thermal power plant

APPENDIX 3. MAP OF SAMPLING AREAS

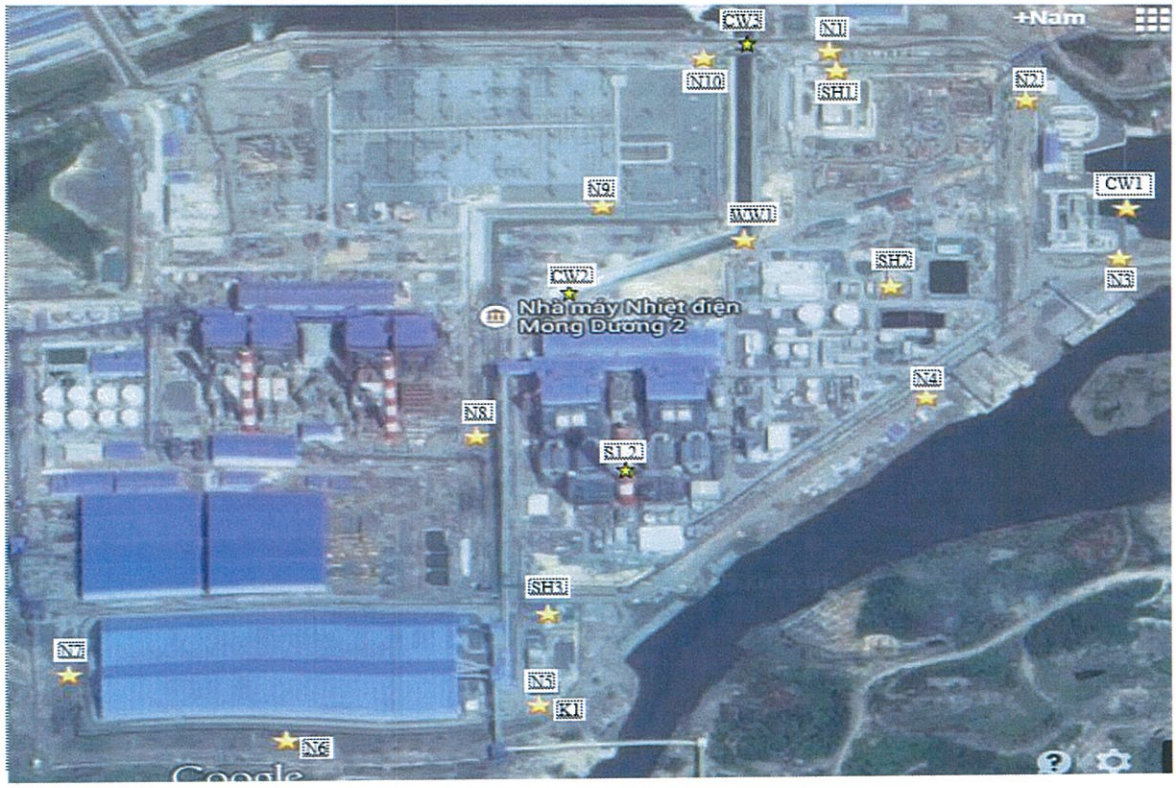


Figure 4.3. Map of sampling areas

APPENDIX 4: THE MONITORING RESULTS

HANOI UNIVERSITY OF SCIENCE AND TECHNOLOGY
SCHOOL OF ENVIRONMENTAL SCIENCE AND TECHNOLOGY
Address: 3rd floor, C10 Building, Hanoi University of Science and Technology - No.1, Dai Co Viet Road, Hanoi
Tel.: (84-4).38681686 E-mail: inest@hust.edu.vn Fax: (84-4).38693551 http://inest.hust.edu.vn

No: 01/102/TTQT-2016-EN

VILAS 406; VIMCERTS 055

ENVIRONMENTAL MONITORING RESULTS

Sampling Site : Mong Duong 2 Thermal Power Plant
Address : Mong Duong ward – Cam Pha city – Quang Ninh province
Sampling Date : June 02nd ÷ 03rd, 2016
Type of Samples : Noise
Number of Samples : 02 Samples x 2 times per day

No	Monitoring positions	Measurement method	QCVN 26:2010/BTNMT			
			6h-21h		21h-6h	
			Leq (dB_A)	Lmax (dB_A)	Leq (dB_A)	Lmax (dB_A)
			70	**-**	**55**	**-**
1	N18	TCVN 7878-2:2010	60	66	53	58
2	N19		54	61	50	56

Note:

- *The result is valid only for samples at the monitoring time.*
- *Symbol (-): unstipulated;*
- ***QCVN 26:2010/BTNMT** - National Technical Regulation on Noise;*
- *Sampling positions* *Coordinates*

N18 – Near residential area, about 1000 m in the North West of plant (near EVN operation office) *21°04'44.8"N 107°20'39.2"E*

N19 – Near residential area, about 500m in the East of plant (near Mong Duong temple) *21°04'28.2"N 107°21'26.6"E*

Ha Noi, June 08th 2016

Centre for industrial environmental monitoring and pollution control
Director

MSc. Ton Thu Giang

School of Environmental Science and Technology

VIỆN TRƯỞNG
PGS.TS. Nghiêm Trung Dũng

HANOI UNIVERSITY OF SCIENCE AND TECHNOLOGY
SCHOOL OF ENVIRONMENTAL SCIENCE AND TECHNOLOGY
Address: 3rd floor, C10 Building, Hanoi University of Science and Technology - No.1, Dai Co Viet Road, Hanoi
Tel.: (84-4).38681686 E-mail: inest@hust.edu.vn Fax: (84-4).38693551 http://inest.hust.edu.vn

No: 02/102/TTQT-2016-EN

VILAS 406; VIMCERTS 055

ENVIRONMENTAL MONITORING RESULTS

Sampling Site : Mong Duong 2 Thermal Power Plant
Address : Mong Duong ward – Cam Pha city – Quang Ninh province
Sampling Date : June 02nd ÷ 03rd, 2016
Type of Samples : Noise
Number of Samples : 10 Samples x 2 times per day

No	Monitoring positions	Measurement method	TCVSLĐ 3733/2002/QĐ-BYT			
			Day time		Night time	
			Leq (dB_A)	Lmax (dB_A)	Leq (dB_A)	Lmax (dB_A)
			85	**115**	**85**	**115**
1	N1	TCVN 7878-2:2010	59	64	51	60
2	N2		60	66	53	62
3	N3		62	69	58	66
4	N4		57	69	53	60
5	N5		60	70	55	65
6	N6		61	69	54	61
7	N7		60	70	50	64
8	N8		75	81	72	78
9	N9		65	75	59	64
10	N10		64	73	60	70

Note:

- *The result is valid only for samples at the monitoring time.*
- ***TCVSLĐ –Standard about hygiene in workplace,*** *based on decision No.3733/2002/QĐ-BYT*
- *Sampling positions*

	Coordinates	
N1: Parking area	*21°04'40.2"N*	*107°21'07.5"E*
N2: Outside plant near with lay-down area	*21°04'38.5"N*	*107°21'14.7"E*
N3: Main access road	*21°04'30.8"N*	*107°21'18.9"E*
N4: Outside plant near with fuel oil tank	*21°04'23.0"N*	*107°21'11.0"E*
N5: Near the east side of the coal warehouse	*21°04'08.3"N*	*107o20'56.4"E*
N6: Near the south side of the coal warehouse	*21°04'06.6"N*	*107°20'46.9"E*
N7: Near the west side of the coal warehouse	*21°04'09.8"N*	*107°20'38.8"E*
N8: Outside plant near with mill plant #2	*21°04'23.8"N*	*107°20'54.1"E*
N9:Outside plant near with cooling water discharging position	*21°04'32.7"N*	*107°20'58.2"E*
N10: Near with outlet #1	*21°04'40.0"N*	*107°21'02.8"E*

Ha Noi, June 08th 2016

Centre for industrial environmental monitoring and pollution control
Director

School of Environmental Science and Technology

VIỆN TRƯỞNG
PGS.TS. Nghiêm Trung Dũng

HANOI UNIVERSITY OF SCIENCE AND TECHNOLOGY
SCHOOL OF ENVIRONMENTAL SCIENCE AND TECHNOLOGY
Address: 3rd floor, C10 Building, Hanoi University of Science and Technology - No.1, Dai Co Viet Road, Hanoi
Tel.: (84-4).38681686 E-mail: inest@hust.edu.vn Fax: (84-4).38693551 http://inest.hust.edu.vn

No: 03/102/TTQT-2016-EN

VILAS 406; VIMCERTS 055

ENVIRONMENTAL MONITORING RESULTS

Sampling Site : Mong Duong 2 Thermal Power Plant
Address : Mong Duong ward – Cam Pha city – Quang Ninh province
Sampling Date : June 02nd, 2016
Type of Samples : Cooling water
Number of Samples : 01 Sample

No	Parameters	Unit	Analytical methods	Results	MDPCL-EHS-SP-02-006	QCVN 40: 2011/BTNMT	
				CW3		$C_{(Column\ B)}$	C_{max}
1	Temperature	°C	SMEWW 2550B:2012	38.1	40	40	40
2	Temperature difference (out-in)	°C	SMEWW 2550B:2012	4.1	8	-	-
3	Residue Chlorine	mg/l	TCVN 6225-3:2011	<0.2	0.2	2	1.62

Note:

- *The result is valid only for samples at the monitoring time. Symbol (-): unstipulated;*
- ***MDPCL-EHS-SP-02-006****: The standard of Mong Duong 2 BOT thermal power plant on permited limit of cooling water*
- ***QCVN 40:2011/BTNMT****- National technical regulation on industrial wastewater; Column B in Table 1 indicates the values of parameters of industrial wastewater (C) when it is discharged into the water sources not serving tap water supply;*
- *C_{max} is the maximum permissible value of a pollution parameter of industrial wastewater being discharged into receiving waters (mg/l). $C_{max}$is calculated as follows:*

$$C_{max} = C \times K_q \times K_f = C \times 0.9 \times 0.9 = C \times 0.81$$

In which:
+ C: is the value of a pollution parameter of industrial wastewater specified in Table 1;
+ K_q: Flow rate coefficient/ volume of wastewater receiving resource K_q = 0.9
+ K_f: is the coefficient of discharged flow rate F >5.000 therefore; K_f=0.9

- *Sampling position:* *Coordinates*
CW3:Discharge point to common Mong Duong Power complex channel *21°04'42.4"N 107°21'03.1"E*

Ha Noi, June 08th 2016

R & D Laboratory **School of Environmental Science and Technology**

Dr. Nguyen Thi Thu Hien

VIỆN TRƯỞNG
PGS.TS. Nghiêm Trung Dũng

HANOI UNIVERSITY OF SCIENCE AND TECHNOLOGY
SCHOOL OF ENVIRONMENTAL SCIENCE AND TECHNOLOGY
Address: 3rd floor, C10 Building, Hanoi University of Science and Technology - No.1, Dai Co Viet Road, Hanoi
Tel.: (84-4).38681686 E-mail: inest@hust.edu.vn Fax: (84-4).38693551 http://inest.hust.edu.vn

No: 04/102/TTQT-2016-EN

VILAS 406; VIMCERTS 055

ENVIRONMENTAL MONITORING RESULTS

Sampling Site : Mong Duong 2 Thermal Power Plant
Address : Mong Duong ward – Cam Pha city – Quang Ninh province
Sampling Date : June 09th ÷ 10th, 2016
Type of Samples : Noise
Number of Samples : 02 Samples x 2 times per day

No	Monitoring positions	Measurement method	QCVN 26:2010/BTNMT			
			6h-21h		21h-6h	
			Leq (dB_A)	Lmax (dB_A)	Leq (dB_A)	Lmax (dB_A)
			70	**-**	**55**	**-**
1	N18	TCVN 7878-2:2010	61	66	53	58
2	N19		53	62	51	56

Note:
- *The result is valid only for samples at the monitoring time.*
- *Symbol (-): unstipulated;*
- ***QCVN 26:2010/BTNMT** - National Technical Regulation on Noise;*
- *Sampling positions* *Coordinates*

N18 – Near residential area, about 1000 m in the North West of plant (near EVN operation office) *21°04'44.8"N 107°20'39.2"E*

N19 – Near residential area, about 500m in the East of plant (near Mong Duong temple) *21°04'28.2"N 107°21'26.6"E*

Ha Noi, June 15th 2016

Centre for industrial environmental monitoring and pollution control
Director

MSc. Ton Thu Giang

School of Environmental Science and Technology

VIỆN TRƯỞNG
PGS.TS. Nghiêm Trung Dũng

HANOI UNIVERSITY OF SCIENCE AND TECHNOLOGY
SCHOOL OF ENVIRONMENTAL SCIENCE AND TECHNOLOGY
Address: 3rd floor, C10 Building, Hanoi University of Science and Technology - No.1, Dai Co Viet Road, Hanoi
Tel.: (84-4).38681686 E-mail: inest@hust.edu.vn Fax: (84-4).38693551 http://inest.hust.edu.vn

No: 05/102/TTQT-2016-EN

VILAS 406; VIMCERTS 055

ENVIRONMENTAL MONITORING RESULTS

Sampling Site : Mong Duong 2 Thermal Power Plant
Address : Mong Duong ward – Cam Pha city – Quang Ninh province
Sampling Date : June 09th ÷ 10th, 2016
Type of Samples : Noise
Number of Samples : 10 Samples x 2 times per day

No	Monitoring positions	Measurement method	TCVSLĐ 3733/2002/QĐ-BYT			
			Day time		Night time	
			Leq (dB_A)	Lmax (dB_A)	Leq (dB_A)	Lmax (dB_A)
			85	**115**	**85**	**115**
1	N1	TCVN 7878-2:2010	57	64	51	60
2	N2		60	66	53	63
3	N3		62	68	58	66
4	N4		57	69	52	60
5	N5		61	70	55	64
6	N6		61	70	54	61
7	N7		60	70	51	62
8	N8		75	80	72	77
9	N9		64	75	59	64
10	N10		64	72	60	68

Note:

- *The result is valid only for samples at the monitoring time.*
- ***TCVSLĐ –Standard about hygiene in workplace,*** *based on decision No.3733/2002/QĐ-BYT*
- *Sampling positions*

	Coordinates	
N1: Parking area	*21°04'40.2"N*	*107°21'07.5"E*
N2: Outside plant near with lay-down area	*21°04'38.5"N*	*107°21'14.7"E*
N3: Main access road	*21°04'30.8"N*	*107°21'18.9"E*
N4: Outside plant near with fuel oil tank	*21°04'23.0"N*	*107°21'11.0"E*
N5: Near the east side of the coal warehouse	*21°04'08.3"N*	*107o20'56.4"E*
N6: Near the south side of the coal warehouse	*21°04'06.6"N*	*107°20'46.9"E*
N7: Near the west side of the coal warehouse	*21°04'09.8"N*	*107°20'38.8"E*
N8: Outside plant near with mill plant #2	*21°04'23.8"N*	*107°20'54.1"E*
N9:Outside plant near with cooling water discharging position	*21°04'32.7"N*	*107°20'58.2"E*
N10: Near with outlet #1	*21°04'40.0"N*	*107°21'02.8"E*

Ha Noi, June 15th 2016

Centre for industrial environmental monitoring and pollution control
Director

School of Environmental Science and Technology

VIỆN TRƯỞNG

HANOI UNIVERSITY OF SCIENCE AND TECHNOLOGY
SCHOOL OF ENVIRONMENTAL SCIENCE AND TECHNOLOGY
Address: 3rd floor, C10 Building, Hanoi University of Science and Technology - No.1, Dai Co Viet Road, Hanoi
Tel.: (84-4).38681686 E-mail: inest@hust.edu.vn Fax: (84-4).38693551 http://inest.hust.edu.vn

VILAS 406; VIMCERTS 055

No: 06/102/TTQT-2016-EN

ENVIRONMENTAL MONITORING RESULTS

Sampling Site : Mong Duong 2 Thermal Power Plant
Address : Mong Duong ward – Cam Pha city – Quang Ninh province
Sampling Date : June 09th, 2016
Type of Samples : Cooling water
Number of Samples : 01 Sample

No	Parameters	Unit	Analytical methods	Results	MDPCL-EHS-SP-02-006	QCVN 40: 2011/BTNMT	
				CW3		$C_{(Column\ B)}$	C_{max}
1	Temperature	°C	SMEWW 2550B:2012	38.5	40	40	40
2	Temperature difference (out-in)	°C	SMEWW 2550B:2012	4.2	8	-	-
3	Residue Chlorine	mg/l	TCVN 6225-3:2011	<0.2	0.2	2	1.62

Note:

- *The result is valid only for samples at the monitoring time. Symbol (-): unstipulated;*
- ***MDPCL-EHS-SP-02-006**: The standard of Mong Duong 2 BOT thermal power plant on permited limit of cooling water*
- ***QCVN 40:2011/BTNMT**- National technical regulation on industrial wastewater; Column B in Table 1 indicates the values of parameters of industrial wastewater (C) when it is discharged into the water sources not serving tap water supply;*
- *C_{max} is the maximum permissible value of a pollution parameter of industrial wastewater being discharged into receiving waters (mg/l). $C_{max}$is calculated as follows:*

$$C_{max} = C \times K_q \times K_f = C \times 0.9 \times 0.9 = C \times 0.81$$

In which:
+ C: is the value of a pollution parameter of industrial wastewater specified in Table 1;
+ K_q: Flow rate coefficient/ volume of wastewater receiving resource K_q = 0.9
+ K_f: is the coefficient of discharged flow rate F >5.000 therefore; K_f=0.9

- *Sampling position:* *Coordinates*

CW3:Discharge point to common Mong Duong Power complex channel *21°04'42.4"N 107°21'03.1"E*

Ha Noi, June 15th 2016

R & D Laboratory

Dr. Nguyen Thi Thu Hien

School of Environmental Science and Technology

VIỆN TRƯỞNG
PGS.TS. Nghiêm Trung Dũng

HANOI UNIVERSITY OF SCIENCE AND TECHNOLOGY
SCHOOL OF ENVIRONMENTAL SCIENCE AND TECHNOLOGY
Address: 3rd floor, C10 Building, Hanoi University of Science and Technology - No.1, Dai Co Viet Road, Hanoi
Tel.: (84-4).38681686 E-mail: inest@hust.edu.vn Fax: (84-4).38693551 http://inest.hust.edu.vn

No: 07/102/TTQT-2016-EN

VILAS 406; VIMCERTS 055

ENVIRONMENTAL MONITORING RESULTS

Sampling Site : Mong Duong 2 Thermal Power Plant
Address : Mong Duong ward – Cam Pha city – Quang Ninh province
Sampling Date : June 16th ÷ 17th, 2016
Type of Samples : Noise
Number of Samples : 02 Samples x 2 times per day

No	Monitoring positions	Measurement method	QCVN 26:2010/BTNMT			
			6h-21h		21h-6h	
			Leq (dB_A)	Lmax (dB_A)	Leq (dB_A)	Lmax (dB_A)
			70	-	55	-
1	N18	TCVN 7878-2:2010	59	64	52	59
2	N19		53	63	50	55

Note:
- *The result is valid only for samples at the monitoring time.*
- *Symbol (-): unstipulated;*
- ***QCVN 26:2010/BTNMT** - National Technical Regulation on Noise;*
- *Sampling positions* *Coordinates*

N18 – Near residential area, about 1000 m in the North West of plant (near EVN operation office) *21°04'44.8"N 107°20'39.2"E*

N19 – Near residential area, about 500m in the East of plant (near Mong Duong temple) *21°04'28.2"N 107°21'26.6"E*

Ha Noi, June 22nd 2016

Centre for industrial environmental monitoring and pollution control
Director

MSc. Ton Thu Giang

School of Environmental Science and Technology

VIỆN TRƯỞNG
PGS.TS. Nghiêm Trung Dũng

HANOI UNIVERSITY OF SCIENCE AND TECHNOLOGY
SCHOOL OF ENVIRONMENTAL SCIENCE AND TECHNOLOGY
Address: 3rd floor, C10 Building, Hanoi University of Science and Technology - No.1, Dai Co Viet Road, Hanoi
Tel.: (84-4).38681686 E-mail: inest@hust.edu.vn Fax: (84-4).38693551 http://inest.hust.edu.vn

No: 08/102/TTQT-2016-EN

VILAS 406; VIMCERTS 055

ENVIRONMENTAL MONITORING RESULTS

Sampling Site : Mong Duong 2 Thermal Power Plant
Address : Mong Duong ward – Cam Pha city – Quang Ninh province
Sampling Date : June 16th ÷ 17th, 2016
Type of Samples : Noise
Number of Samples : 10 Samples x 2 times per day

No	Monitoring positions	Measurement method	TCVSLĐ 3733/2002/QĐ-BYT			
			Day time		Night time	
			Leq (dB_A)	Lmax (dB_A)	Leq (dB_A)	Lmax (dB_A)
			85	115	85	115
1	N1	TCVN 7878-2:2010	59	64	50	61
2	N2		60	67	53	63
3	N3		62	68	57	66
4	N4		58	69	52	61
5	N5		61	71	55	65
6	N6		61	70	54	61
7	N7		62	70	52	62
8	N8		75	81	70	78
9	N9		63	75	59	63
10	N10		64	71	61	67

Note:

- *The result is valid only for samples at the monitoring time.*
- ***TCVSLĐ –Standard about hygiene in workplace,** based on decision No.3733/2002/QĐ-BYT*
- *Sampling positions*

	Coordinates	
N1: Parking area	*21°04'40.2"N*	*107°21'07.5"E*
N2: Outside plant near with lay-down area	*21°04'38.5"N*	*107°21'14.7"E*
N3: Main access road	*21°04'30.8"N*	*107°21'18.9"E*
N4: Outside plant near with fuel oil tank	*21°04'23.0"N*	*107°21'11.0"E*
N5: Near the east side of the coal warehouse	*21°04'08.3"N*	*107o20'56.4"E*
N6: Near the south side of the coal warehouse	*21°04'06.6"N*	*107°20'46.9"E*
N7: Near the west side of the coal warehouse	*21°04'09.8"N*	*107°20'38.8"E*
N8: Outside plant near with mill plant #2	*21°04'23.8"N*	*107°20'54.1"E*
N9:Outside plant near with cooling water discharging position	*21°04'32.7"N*	*107°20'58.2"E*
N10: Near with outlet #1	*21°04'40.0"N*	*107°21'02.8"E*

Ha Noi, June 22nd 2016

Centre for industrial environmental monitoring and pollution control
Director

School of Environmental Science and Technology

VIỆN TRƯỞNG

HANOI UNIVERSITY OF SCIENCE AND TECHNOLOGY
SCHOOL OF ENVIRONMENTAL SCIENCE AND TECHNOLOGY
Address: 3rd floor, C10 Building, Hanoi University of Science and Technology - No.1, Dai Co Viet Road, Hanoi
Tel.: (84-4).38681686 E-mail: inest@hust.edu.vn Fax: (84-4).38693551 http://inest.hust.edu.vn

No: 09/102/TTQT-2016-EN

VILAS 406; VIMCERTS 055

ENVIRONMENTAL MONITORING RESULTS

Sampling Site : Mong Duong 2 Thermal Power Plant
Address : Mong Duong ward – Cam Pha city – Quang Ninh province
Sampling Date : June 16th, 2016
Type of Samples : Cooling water
Number of Samples : 01 Sample

No	Parameters	Unit	Analytical methods	Results	MDPCL-EHS-SP-02-006	QCVN 40: 2011/BTNMT	
				CW3		$C_{(Column\ B)}$	C_{max}
1	Temperature	°C	SMEWW 2550B:2012	38.4	40	40	40
2	Temperature difference (out-in)	°C	SMEWW 2550B:2012	4.0	8	-	-
3	Residue Chlorine	mg/l	TCVN 6225-3:2011	<0.2	0.2	2	1.62

Note:

- *The result is valid only for samples at the monitoring time. Symbol (-): unstipulated;*
- ***MDPCL-EHS-SP-02-006**: The standard of Mong Duong 2 BOT thermal power plant on permited limit of cooling water*
- ***QCVN 40:2011/BTNMT**- National technical regulation on industrial wastewater; Column B in Table 1 indicates the values of parameters of industrial wastewater (C) when it is discharged into the water sources not serving tap water supply;*
- *C_{max} is the maximum permissible value of a pollution parameter of industrial wastewater being discharged into receiving waters (mg/l). $C_{max}$is calculated as follows:*

$$C_{max} = C \times K_q \times K_f = C \times 0.9 \times 0.9 = C \times 0.81$$

In which:
+ C: is the value of a pollution parameter of industrial wastewater specified in Table 1;
+ K_q: Flow rate coefficient/ volume of wastewater receiving resource $K_q = 0.9$
+ K_f: is the coefficient of discharged flow rate F >5.000 therefore; K_f=0.9

- *Sampling position:* *Coordinates*
CW3:Discharge point to common Mong Duong Power complex channel *21°04'42.4"N 107°21'03.1"E*

Ha Noi, June 22nd 2016

R & D Laboratory

Dr. Nguyen Thi Thu Hien

School of Environmental Science and Technology

VIỆN TRƯỞNG
PGS.TS. Nghiêm Trung Dũng

HANOI UNIVERSITY OF SCIENCE AND TECHNOLOGY
SCHOOL OF ENVIRONMENTAL SCIENCE AND TECHNOLOGY
Address: 3rd floor, C10 Building, Hanoi University of Science and Technology - No.1, Dai Co Viet Road, Hanoi
Tel.: (84-4).38681686 E-mail: inest@hust.edu.vn Fax: (84-4).38693551 http://inest.hust.edu.vn

No: 10/102/TTQT-2016-EN

VILAS 406; VIMCERTS 055

ENVIRONMENTAL MONITORING RESULTS

Sampling Site : Mong Duong 2 Thermal Power Plant
Address : Mong Duong ward – Cam Pha city – Quang Ninh province
Sampling Date : June 23rd ÷ 24th, 2016
Type of Samples : Noise
Number of Samples : 02 Samples x 2 times per day

No	Monitoring positions	Measurement method	QCVN 26:2010/BTNMT			
			6h-21h		21h-6h	
			Leq (dBA)	Lmax (dBA)	Leq (dBA)	Lmax (dBA)
			70	-	55	-
1	N18	TCVN 7878-2:2010	58	63	53	60
2	N19		54	61	51	55

Note:
- *The result is valid only for samples at the monitoring time.*
- *Symbol (-): unstipulated;*
- ***QCVN 26:2010/BTNMT** - National Technical Regulation on Noise;*
- *Sampling positions* *Coordinates*

N18 – Near residential area, about 1000 m in the North West of plant (near EVN operation office) *21°04'44.8"N 107°20'39.2"E*

N19 – Near residential area, about 500m in the East of plant (near Mong Duong temple) *21°04'28.2"N 107°21'26.6"E*

Ha Noi, June 29th 2016

Centre for industrial environmental monitoring and pollution control
Director

MSc. Ton Thu Giang

School of Environmental Science and Technology

VIỆN TRƯỞNG
PGS.TS. Nghiêm Trung Dũng

HANOI UNIVERSITY OF SCIENCE AND TECHNOLOGY
SCHOOL OF ENVIRONMENTAL SCIENCE AND TECHNOLOGY
Address: 3rd floor, C10 Building, Hanoi University of Science and Technology - No.1, Dai Co Viet Road, Hanoi
Tel.: (84-4).38681686 E-mail: inest@hust.edu.vn Fax: (84-4).38693551 http://inest.hust.edu.vn

No: 11/102/TTQT-2016-EN

VILAS 406; VIMCERTS 055

ENVIRONMENTAL MONITORING RESULTS

Sampling Site : Mong Duong 2 Thermal Power Plant
Address : Mong Duong ward – Cam Pha city – Quang Ninh province
Sampling Date : June 23rd ÷ 24th, 2016
Type of Samples : Noise
Number of Samples : 10 Samples x 2 times per day

No	Monitoring positions	Measurement method	TCVSLĐ 3733/2002/QĐ-BYT			
			Day time		Night time	
			Leq (dB_A)	Lmax (dB_A)	Leq (dB_A)	Lmax (dB_A)
			85	**115**	**85**	**115**
1	N1	TCVN 7878-2:2010	59	64	51	61
2	N2		61	67	53	63
3	N3		62	68	57	65
4	N4		58	68	52	61
5	N5		61	71	55	65
6	N6		60	70	53	61
7	N7		62	71	52	63
8	N8		75	81	70	77
9	N9		63	75	59	63
10	N10		63	71	60	67

Note:

- *The result is valid only for samples at the monitoring time.*
- ***TCVSLĐ –Standard about hygiene in workplace,*** *based on decision No.3733/2002/QĐ-BYT*
- *Sampling positions*

	Coordinates	
N1: Parking area	*21°04'40.2"N*	*107°21'07.5"E*
N2: Outside plant near with lay-down area	*21°04'38.5"N*	*107°21'14.7"E*
N3: Main access road	*21°04'30.8"N*	*107°21'18.9"E*
N4: Outside plant near with fuel oil tank	*21°04'23.0"N*	*107°21'11.0"E*
N5: Near the east side of the coal warehouse	*21°04'08.3"N*	*107o20'56.4"E*
N6: Near the south side of the coal warehouse	*21°04'06.6"N*	*107°20'46.9"E*
N7: Near the west side of the coal warehouse	*21°04'09.8"N*	*107°20'38.8"E*
N8: Outside plant near with mill plant #2	*21°04'23.8"N*	*107°20'54.1"E*
N9:Outside plant near with cooling water discharging position	*21°04'32.7"N*	*107°20'58.2"E*
N10: Near with outlet #1	*21°04'40.0"N*	*107°21'02.8"E*

Ha Noi, June 29th 2016

Centre for industrial environmental monitoring and pollution control
Director

School of Environmental Science and Technology

VIỆN KHOA HỌC VÀ CÔNG NGHỆ MÔI TRƯỜNG

VIỆN TRƯỞNG

HANOI UNIVERSITY OF SCIENCE AND TECHNOLOGY
SCHOOL OF ENVIRONMENTAL SCIENCE AND TECHNOLOGY
Address: 3rd floor, C10 Building, Hanoi University of Science and Technology - No.1, Dai Co Viet Road, Hanoi
Tel.: (84-4).38681686 E-mail: inest@hust.edu.vn Fax: (84-4).38693551 http://inest.hust.edu.vn

No: 12/102/TTQT-2016-EN

VILAS 406; VIMCERTS 055

ENVIRONMENTAL MONITORING RESULTS

Sampling Site : Mong Duong 2 Thermal Power Plant
Address : Mong Duong ward – Cam Pha city – Quang Ninh province
Sampling Date : June 23rd, 2016
Type of Samples : Cooling water
Number of Samples : 01 Sample

No	Parameters	Unit	Analytical methods	Results	MDPCL-EHS-SP-02-006	QCVN 40: 2011/BTNMT	
				CW3		$C_{(Column\ B)}$	C_{max}
1	Temperature	°C	SMEWW 2550B:2012	38.4	40	40	40
2	Temperature difference (out-in)	°C	SMEWW 2550B:2012	4.2	8	-	-
3	Residue Chlorine	mg/l	TCVN 6225-3:2011	<0.2	0.2	2	1.62

Note:

- *The result is valid only for samples at the monitoring time. Symbol (-): unstipulated;*
- ***MDPCL-EHS-SP-02-006****: The standard of Mong Duong 2 BOT thermal power plant on permited limit of cooling water*
- ***QCVN 40:2011/BTNMT-*** *National technical regulation on industrial wastewater; Column B in Table 1 indicates the values of parameters of industrial wastewater (C) when it is discharged into the water sources not serving tap water supply;*
- C_{max} *is the maximum permissible value of a pollution parameter of industrial wastewater being discharged into receiving waters (mg/l).* C_{max} *is calculated as follows:*

$$C_{max} = C \times K_q \times K_f = C \times 0.9 \times 0.9 = C \times 0.81$$

In which:

+ C: is the value of a pollution parameter of industrial wastewater specified in Table 1;
+ K_q*: Flow rate coefficient/ volume of wastewater receiving resource* $K_q = 0.9$
+ K_f*: is the coefficient of discharged flow rate F >5.000 therefore;* $K_f = 0.9$

- *Sampling position:* *Coordinates*

CW3:Discharge point to common Mong Duong Power complex channel *21°04'42.4"N 107°21'03.1"E*

Ha Noi, June 29th 2016

R & D Laboratory **School of Environmental Science and Technology**

Dr. Nguyen Thi Thu Hien

VIỆN TRƯỞNG
PGS.TS. Nghiêm Trung Dũng

HANOI UNIVERSITY OF SCIENCE AND TECHNOLOGY
SCHOOL OF ENVIRONMENTAL SCIENCE AND TECHNOLOGY

Address: 3rd floor, C10 Building, Hanoi University of Science and Technology - No.1, Dai Co Viet Road, Hanoi
Tel.: (84-4).38681686 E-mail: inest@hust.edu.vn Fax: (84-4).38693551 http://inest.hust.edu.vn

VILAS 406; VIMCERTS 055

o: 01/103/TTQT-2016-EN

ENVIRONMENTAL MONITORING RESULTS

ampling Site : Mong Duong 2 Thermal Power Plant
.ddress : Mong Duong ward – Cam Pha city – Quang Ninh province
ampling Date : June 27th, 2016
ype of Samples : Cooling water
lumber of Samples : 03 samples

No.	Parameters	Unit	Analytical methods	Results			MDPCL-EHS-SP-02-006	QCVN 40: 2011/BTNMT	
				CW1	CW2	CW3		$C_{(Column\ B)}$	C_{max}
1.	Temperature	°C	SMEWW 2550B:2012	34.2	38.9	38.6	40	40	40
2.	Temperature difference (out-in)	°C	SMEWW 2550B:2012	-	4.7	4.4	8	-	-
3.	pH	-	TCVN 6492:2011	7.8	7.7	7.8	6.0-9.0	5.5 – 9.0	5.5 – 9.0
4.	Color(pH=7)	Pt/Co	TCVN 6185:2008	<5	<5	<5	70	150	150
5.	COD	mg/l	SMEWW 5220C:2012	23	23	22	81	150	121.5
6.	BOD_5	mg/l	TCVN 6001-1:2008	12	11	11	40.5	50	40.5
7.	TSS	mg/l	TCVN 6625:2000	20	22	21	50	100	81
8.	TDS	mg/l	SOP-TDS	20,440	20,680	20,700	-	-	-
9.	Arsenic (As)	mg/l	EPA 200.8	0.0205	0.0209	0.0208	0.081	0.1	0.081
10.	Mercury(Hg)	mg/l	EPA 200.8	0.0010	0.0011	0.0011	0.005	0.01	0.0081
11.	Lead (Pb)	mg/l	EPA 200.8	0.0024	0.0026	0.0024	0.405	0.5	0.405
12.	Cadmium (Cd)	mg/l	EPA 200.8	0.0002	0.0002	0.0002	0.0081	0.1	0.081
13.	Chromium III (Cr^{3+})	mg/l	SMEWW 3125B:2012 + SMEWW 3500 Cr. B: 2012	0.010	0.009	0.010	0.5	1	0.81
14.	Chromium VI (Cr^{6+})	mg/l	TCVN 6658:2000	<0.001	<0.001	<0.001	0.081	0.1	0.081
15.	Copper(Cu)	mg/l	EPA 200.8	0.038	0.034	0.036	0.5	2	1.62
16.	Zinc (Zn)	mg/l	EPA 200.8	0.030	0.032	0.030	1.0	3	2.43

No.	Parameters	Unit	Analytical methods	Results			MDPCL-EHS-SP-02-006	QCVN 40: 2011/BTNMT	
				CW1	CW2	CW3		$C_{(Column\ B)}$	C_{max}
17.	Nickel (Ni)	mg/l	EPA 200.8	0.0014	0.0017	0.0016	0.405	0.5	0.405
18.	Manganese (Mn)	mg/l	EPA 200.8	0.020	0.017	0.019	0.81	1	0.81
19.	Iron (Fe)	mg/l	EPA 200.8	0.455	0.460	0.454	1	5	4.05
20.	Total mineral oil & grease	mg/l	SMEWW 5520F:2012	<0.20	<0.20	<0.20	4.05	10	8.1
21.	Fluoride (F^-)	mg/l	SMEWW 4500D.F^-2012	0.127	0.134	0.132	8.1	10	8.1
22.	Sulfide (as H_2S)	mg/l	SMEWW 4500 S^{2-}.D:2012	<0.03	<0.03	<0.03	0.405	0.5	0.405
23.	Total N	mg/l	TCVN 6638:2000	1.37	1.55	1.49	24.3	40	32.4
24.	Total P	mg/l	TCVN 6202:2008	0.077	0.084	0.080	4.86	6	4.86
25.	Residue Chlorine	mg/l	TCVN 6225-3:2011	<0.17	0.48	0.32	0.2	2	1.62
26.	Ammonium (NH_4^+)	mg/l	SMEWW 4500 NH_3.F:2012	0.79	0.82	0.81	8.1	10	8.1
27.	Coliform	MPN/100ml	TCVN 6187-2:1996	520	400	400	5,000	5,000	5,000

Note:

- *The result is valid only for samples at the monitoring time. Symbol (-): unstipulated;*
- *The samples will be destroyed after 5 days from the date of issue of environmental monitoring results unless otherwise agreed with the customer.*
- ***MDPCL-EHS-SP-02-006**: The standard of Mong Duong 2 BOT thermal power plant on permited limit of cooling water*
- ***QCVN 40:2011/BTNMT**- National technical regulation on industrial wastewater; Column B indicates the values of parameters of industrial wastewater (C) when it is discharged into the water sources not serving tap water supply;*
- *C_{max} is the maximum permissible value of a pollution parameter of industrial wastewater being discharged into receiving waters (mg/l). $C_{max}$is calculated as follows:*

$$C_{max} = C \times K_q \times K_f = C \times 0.9 \times 0.9 = 0.81 \times C$$

In which:

+ C: is the value of a pollution parameter of industrial wastewater specified in QCVN 40:2011/BTNMT;

+ K_q: Flow rate coefficient/ volume of wastewater receiving resource $K_q = 0.9$

+ K_f: is the coefficient of discharged flow rate (F >5,000 m^3/24h) therefore; K_f=0.9;

- *Sampling positions:*

CW1: Intake point of cooling water — *Coordinates*

CW2:Discharge point into the cooling water canal — *21°04'15.6"N 107°20'02.4"E*

CW3:Discharge point to common Mong Duong Power complex canal — *21°04'28.3"N 107°20'57.1"E*

21°04'42.4"N 107°21'03.1"E

Ha Noi, July 15th 2016

R & D Laboratory

Dr. Nguyen Thi Thu Hien

School of Environmental Science and Technology

VIỆN TRƯỞNG

PGS.TS. Nghiêm Trung Dũng

HANOI UNIVERSITY OF SCIENCE AND TECHNOLOGY
SCHOOL OF ENVIRONMENTAL SCIENCE AND TECHNOLOGY
Address: 3rd floor, C10 Building, Hanoi University of Science and Technology - No.1, Dai Co Viet Road, Hanoi
Tel.: (84-4).38681686 E-mail: inest@hust.edu.vn Fax: (84-4).38693551 http://inest.hust.edu.vn

No: 02/103/TTQT-2016-EN

VILAS 406; VIMCERTS 055

ENVIRONMENTAL MONITORING RESULTS

Sampling Site : Mong Duong 2 Thermal Power Plant
Address : Mong Duong ward – Cam Pha city – Quang Ninh province
Sampling Date : June 27th, 2016
Type of Samples : Industrial wastewater
Number of Samples : 01 sample

No.	Parameters	Unit	Analytical methods	Results	MDPCL-EHS-SP-02-006	QCVN 40: 2011/BTNMT	
				WW1		$C_{(Column\ B)}$	C_{max}
1.	Temperature	°C	SMEWW 2550B:2012	35.0	40	40	40
2.	pH	-	TCVN 6492:2011	8.2	6.0-9.0	5.5 – 9.0	5.5 – 9.0
3.	Color(pH=7)	Pt/Co	TCVN 6185:2008	23	70	150	150
4.	COD	mg/l	SMEWW 5220C:2012	32	81	150	135
5.	BOD_5	mg/l	TCVN 6001-1:2008	20	40.5	50	45
6.	TSS	mg/l	TCVN 6625:2000	87	50	100	90
7.	TDS	mg/l	SOP-TDS	498	-	-	-
8.	Arsenic (As)	mg/l	EPA 200.8	0.0015	0.081	0.1	0.09
9.	Mercury(Hg)	mg/l	EPA 200.8	0.0030	0.005	0.01	0.009
10.	Lead (Pb)	mg/l	EPA 200.8	0.0012	0.405	0.5	0.45
11.	Cadmium (Cd)	mg/l	EPA 200.8	0.0005	0.0081	0.1	0.09
12.	Chromium III (Cr^{3+})	mg/l	SMEWW 3125B:2012 + SMEWW 3500 Cr. B: 2012	0.016	0.5	1	0.9
13.	Chromium VI (Cr^{6+})	mg/l	TCVN 6658:2000	<0.001	0.081	0.1	0.09
14.	Copper(Cu)	mg/l	EPA 200.8	0.026	0.5	2	1.8
15.	Zinc (Zn)	mg/l	EPA 200.8	0.048	1.0	3	2.7
16.	Nickel (Ni)	mg/l	EPA 200.8	0.0006	0.405	0.5	0.45
17.	Manganese (Mn)	mg/l	EPA 200.8	0.008	0.81	1	0.9
18.	Iron (Fe)	mg/l	EPA 200.8	0.087	1	5	4.5
19.	Total mineral oil & grease	mg/l	SMEWW 5520F:2012	<0.20	4.05	10	9
20.	Fluoride (F^-)	mg/l	SMEWW 4500D.F^-2012	0.095	8.1	10	9
21.	Sulfide (as H_2S)	mg/l	SMEWW 4500	<0.03	0.405	0.5	0.45

No.	Parameters	Unit	Analytical methods	Results	MDPCL-EHS-SP-02-006	QCVN 40: 2011/BTNMT	
				WW1		$C_{(Column\ B)}$	C_{max}
23.	Total P	mg/l	TCVN 6202:2008	0.030	4.86	6	5.4
24.	Residue Chlorine	mg/l	TCVN 6225-3:2011	<0.2	0.2	2	1.8
25.	Ammonium (NH_4^+)	mg/l	SMEWW 4500 NH_3.F:2012	7.89	8.1	10	9
26.	Coliform	MPN/ 100ml	TCVN 6187-2:1996	1,000	5,000	5,000	5,000

Note:

- *The result is valid only for samples at the monitoring time. Symbol (-): unstipulated;*
- *The samples will be destroyed after 5 days from the date of issue of environmental monitoring results unless otherwise agreed with the customer.*
- ***MDPCL-EHS-SP-02-006**: The standard of Mong Duong 2 BOT thermal power plant about permitted limit of industrial wastewater.*
- ***QCVN 40:2011/BTNMT**- National technical regulation on industrial wastewater; Column B indicates the values of parameters of industrial wastewater (C) when it is discharged into the water sources not serving tap water supply;*
- *C_{max} is the maximum permissible value of a pollution parameter of industrial wastewater being discharged into receiving waters (mg/l). C_{max} is calculated as follows:*

$$C_{max} = C \times K_q \times K_f = C \times 1.0 \times 0.9 = 0.9 \times C$$

In which:

+ C: is the value of a pollution parameter of industrial wastewater specified in QCVN 40:2011/BTNMT;

+ K_q: Flow rate coefficient/ volume of wastewater receiving resource. K_q = 1.0

+ K_f: is the coefficient of discharged flow rate K_f=0.9

- *Sampling position:* *Coordinates*

WW1: From discharge point to cooling water chanel *21°04'31.1"N* *107°21'04.4"E*

Ha Noi, July 15th 2016

R & D Laboratory **School of Environmental Science and Technology**

VILAS 406

Dr. Nguyen Thi Thu Hien

VIỆN TRƯỞNG

PGS.TS. Nghiêm Trung Dũng