ANNEX I

Air Quality Supporting Information

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ANNEX I-1

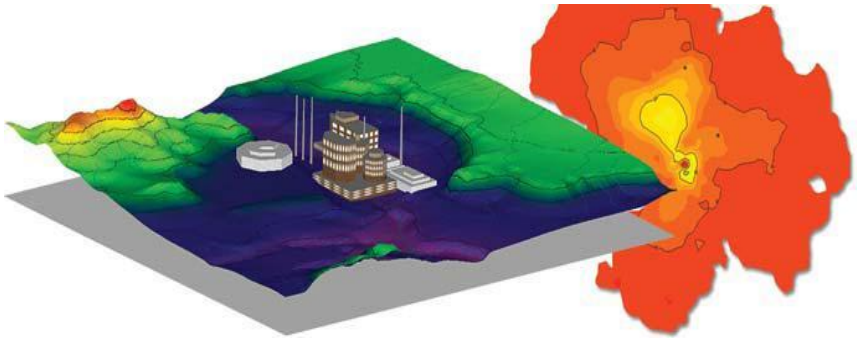
Air Quality Modeling Report

HATTAT ENERJI ve MADEN TICARET A.S.

AMASRA HARD COAL MINE

FIELD B PROJECT

AIR QUALITY ASSESSMENT AND MODELING REPORT



Amasra Bartın / TURKEY

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AERMOD

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ABBREVIATIONS

%	Percent
µg/m³	Microgram/cubic meter
µm	Micrometer
AERMOD	AERMOD Atmospheric Dispersion Modeling System
CO	Carbon monoxide
EU	European Union
GLC	Ground Level Concentration
kg	Kilogram
Kcal	Kilocalorie
kJ	Kilojoule
km	Kilometer
m	meter
m/s	meter/second
mg	Milligram
mg/Nm³	Milligram/normal cubic meter
MoEUP	Turkish Ministry of Environment and Urban Planning
NO	Nitrogen monoxide
NO_2	Nitrogen dioxide
NO_x	Nitrogen oxides
O_2	Oxygen
PM_{10}	Particulate matter with diameter smaller than 10 micrometer
Project	Amasra Hard Coal Mine Field B
RAMAQ	Regulation on the Assessment and Management of Air Quality
RCAPOI	Regulation on the Control of Air Pollution Originating from Industry
RPAQ	Regulation on the Protection of Air Quality
SO_2	Sulfur dioxide
WHO	World Health Organization

1. INTRODUCTION

This report was prepared with the aim of determining the potential air pollution sources, calculating emissions and evaluating environmental effects of emission dispersion on ambient air quality of Amasra Hard Coal Mine Field B (Project).

Air pollutants and their approximate quantities are calculated by emission factors. Contribution to air pollution level and air quality levels in the impact area of the Project are estimated by air quality modeling studies and compared with the pertinent standards. The results of the modeling study were assessed according to the, Regulation on the Control of Air Pollution Originating from Industry (RCAPOI), EU Council Directive 2008/50/EC and WHO Air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulfur dioxide.

The following section briefly explains resulting emissions from the project. Section 3 covers air quality standards and their definitions as stipulated in the Turkish Regulations and international regulations are presented. Methods and emission values used in the modeling study are discussed in Section 4. Results of the modeling study that is carried out according to the RCAPOI instructions and overall assessment of their possible impacts to the air quality of the region are illustrated in Section 5.

2. EMISSIONS AND EMISSION CONTROL

Emission sources of the project can be classified into two categories as stack emissions and non-stack emissions. Non-stack emissions are represent the emissions which occur from especially land preparation and productive activities such as excavation, reclamation of the site, earthworks etc. Only dust emissions will be occur as non-stack emission. Stack emissions are represent the emissions which occur from mining ventilation and it is expected only CO emission will be occur.

In order to calculate dust emissions, emission factors were used. Particulate matter emission factors are taken from Regulation on the Control of Air Pollution Originating from Industry Annex-12 Table 12: Emission Factors Used to Calculate Dust Emissions. Dust emissions emitted from earthwork activities (excavation, loading, transport, etc.) and vehicle movements are calculated by using RCAPOI Annex-12 emission factors which are shown in Table 1.

Table 1.Emission Factors Used to Calculate Dust Emissions

Sources	**Emission Factors kg/ton**	
	Uncontrolled	**Controlled**
Excavating	0.025	0.0125
Loading/Unloading	0.010	0.005
Carrying	0.7	0.35
Storage	5.8 (kg/ha-day)	2.9 (kg/ha-day)

According to these factors, dust emissions are calculated as shown in Table 2.

Table 2.Dust emission calculations for earthwork activities

Area	**Activity**	**Hourly Activity Amount**	**Emission Value (kg/h)**	
			Emission Factors	**Emission (kg/h)**
Shaft-1	Loading	23.74 ton/h	0,005 kg./ton	0,118
	Carrying		0,35 kg / km	0,084
	Unloading		0,005 kg./ton	0,118
Shaft-2	Loading	24.86 ton/h	0,005 kg./ton	0,124
	Carrying		0,35 kg / km	0,728
	Unloading		0,005 kg./ton	0,124
Shaft-3	Loading	20.74 ton/h	0,005 kg./ton	0,104
	Carrying		0,35 kg / km	0,616
	Unloading		0,005 kg./ton	0,104
Mining Dump Area-1	Storage	8.85 ha	2,90 kg/ha.day	1,07
Mining Dump Area - 2	Storage	0.72 ha	2,90 kg/ha.day	0,087
Coal Storage Area-1	Storage	0.64 ha	2,90 kg/ha.day	0,077
Coal Storage Area-2	Storage	1.6 ha	2,90 kg/ha.day	0,193
Quay Construction	Unloading	534.2	0,005 kg./ton	2,67

Area	Activity	Hourly Activity Amount	Emission Value (kg/h)	
			Emission Factors	Emission (kg/h)
	Carrying	ton/h	0,35 kg / km	2,34
Coal Cleaning Area	Excavating	6.30 ton/h	0,0125 kg./ton	0,079
Coal Production	Loading	1.100 ton/h	0,005 kg./ton	5,5
	Unloading		0,005 kg./ton	5,5
	Carrying	750 ton/h	0,35 kg / km	13,12
	Carrying	350 ton/h	0,35 kg / km	24,5
			Total	**59,542**

Stack emissions will be occur from ventilation system and CO emissions will be released. There will be 3 different ventilation fan with independent stack. It is expected that 44 kg/day CO emission will be emitted.

3. AMBIENTAIR QUALITY STANDARDS

Limit values for industrial activities are given in the RCAPOI. Ambient air limit values are provided in Annex-2 Table 2.2 of RCAPOI and similarly to the RAMAQ, these limit values decrease gradually over the years until 2024. RCAPOI Limit Values are shown in Table 3.

Two different categories of air quality standards for the gaseous pollutants and particulate matter are explained below:

"Long Term Limit Value" (LTL) is defined as the value of the arithmetic average of the total measurement results, not to be exceeded at a particular measurement point.
"Short Term Limit Value" (STL) is defined as the value not to be exceeded by 95% of the results when they are sorted with respect to magnitude or the value not to be exceeded by the maximum daily average for any point.

Table 3. Limit Values Stipulated in the RCAPOI

Parameter	Period	Unit	Limit Value [µg/m^3] [Deposition mg/m^{2}day]						
			2014	2015	2016	2017	2018	2019-2023	2024 And later
CO	8 Hour	µg/m^3	16	14	12	10	10	10	10
Particulate Matter (PM 10)	24 hours (not to be exceeded more than 35 times a calendar year)	µg/m^3	100	90	80	70	60	50	50
	Calendar year		60	56	52	48	44	40	40
PM Deposition	STL	mg/m^2 day	390	390	390	390	390	390	390
	LTL		210	210	210	210	210	210	210

European Union directives and World Health Organization also have limit values for air pollution prevention (EU Council Directive 2008/50/EC relating to health based standards and objectives for a number of pollutants in ambient air). WHO defines limit values in "Air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulfur dioxide" document. IFC Guidelines refers to WHO limit values to evaluate emissions. These limit values are shown in Table 4.

Table 4. Limit Values Stipulated in the International Legislation

Parameter	Averaging Period	EU Limit Value (µg/m^3)[1]	WHO Limit Value (µg/m^3)[2]
PM_{10}	24 hours (for the protection of the human health)	50 (not to be exceeded more than 35 times a calendar year)	50
	Calendar year (for the protection of the human health)	40	20
CO	Maximum 8-hour average (for the protection of the human health)	10,000	-

1 Limit Values Stipulated in the "EU Council Directive "2008/50/EC"

2 Limit Values Stipulated in the "WHO Air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulfur dioxide"

4. METHODS USED IN MODELING STUDIES

Modeling studies were carried out for both construction phase dust emissions (PM_{10} and PM deposition) and operation phase NO_X emissions. While the impact area defined in the RCAPOI for the modeling study is an area with a radius of 50 times of the stack height (which makes 2 km x 2 km), an area of 10 km x 10 km covering the required impact area of 4 km x 4 km by the RCAPOI, was used in this modeling study.

4.1. Definition of the Dispersion Model

AERMOD model is one of the most developed computer models estimating hourly, daily and yearly GLC's on the basis of the real time values. Model comprises the calculations of different dispersion models for different sources (point, volume, line) from isolated stacks to fugitive pollutants. Additionally, it considers conditions like aerodynamic waves and turbulence.

AERMOD model works in a network system defined by the user and calculations are made for corner points of each receiving environment segments forming the network. The network system used by AERMOD model can be defined as polar or Cartesian. Additionally, detailed calculations can be made at the discrete receptor points, which can be determined out of the network system. In the dispersion calculations, Planetary boundary layer theory is used. In the model, there is also an option for hilly areas. AERMOD model uses four different data given below:

- Wind direction, wind speed, temperature, mixing height, (depends on user's choice) hourly meteorological data set including wind profile exponential and potential vertical temperature difference.
- Coordinates and heights of each element in the network system defined as receiving environment.
- Data sets including source coordinates based on a starting point determined by the user, source height, diameter, emission rate, temperature and flow rate.

The results of the model are suitable for the preparation of dispersion maps including whole dispersion area. Therefore, the assessment of regional air quality under different scenarios (e.g. different treatment conditions, various pollution sources or varying seasonal conditions) is possible.

The modeling study that estimates gas pollutants and dust concentrations in ambient air by the help of mathematical calculations is comprised of following items:

- "Dispersion Area" for analyzed source is determined.
- A rectangular grid system for the determined dispersion area is prepared with a grid system of 500 m x 500 m and information on latitude, longitude and elevation is obtained. The corners of these grids are nodes.
- Information about the pollutant sources in the dispersion area is obtained.
- Hourly meteorological data of a representative year is obtained.

Hourly, daily and annual average GLC values of pollutants in the ambient air can be estimated by running the model after transferring the information stated in the above steps.

4.2. Meteorological Data Set

Long term meteorological data needed for modeling studies is obtained from the regional meteorological stations. In this study, Bartin Meteorological Station of the Turkish State Meteorological Service is considered as suitable and the meteorological data recorded in this station was used in the modeling study. Since upper air observation values of the region are not measured by this station, these records were obtained Istanbul Meteorological Station.

5. RESULTS OF MODELING STUDIES

5.1. Non-Stack - Ground Level PM_{10} and PM Deposition Concentrations

Modeling studies are carried out for dust parameters for non-stack activities. Ground level concentrations (GLC) of PM_{10} and PM Deposition, determined from the modeling studies are listed in Table 5. PM_{10} Air Pollution Contribution Values (APCV) and Total Pollution.

Table 5. Maximum GLC Values Determined from the Modeling Studies

Parameter	Averaging Period	Maximum GLC Values and Coordinates (µg/m3 for PM10) (mg/m2.day for PM Deposition)	2024National Limit Value (µg/m^3)	EU Limit Values* (µg/m^3)	WHO Limit Values* (µg/m^3)
PM_{10}	*Daily (max.)*	443.61 (444389, 4618526)	50	50	50
	Daily (90.41%)	37.19 (445389, 4620026)	50	50	50
	Yearly	16.59 (444389, 4618526)	40	40	20
PM Deposition	*Monthly*	4.63 (444889, 4619526)	390	-	-
	Yearly	1.85 (444889, 4619526)	210	-	-

Dispersion of PM_{10} and PM deposition GLC values for non stack emissions are shown from Figure 1 through Figure 4.. In accordance with Table 5, daily and yearly GLC values of PM_{10} are 443.61 µg/m^3 and 16.59 µg/m^3. It is allowed on RCAPOI that PM_{10} emissions can exceed limit values more than 35 times during one year period. According to modelling study, project emissions exceed limit value 29 times and it complies with the RCAPOI. Also 35th highest value is calculated as 16.59 and this value lower than the limit values. Monthly and yearly PM Deposition values for earthworks and main construction are 4.63 µg/m^3 and 1.85 µg/m^3, respectively and these values are lower than the limit values to be complied with the RCAPOI.

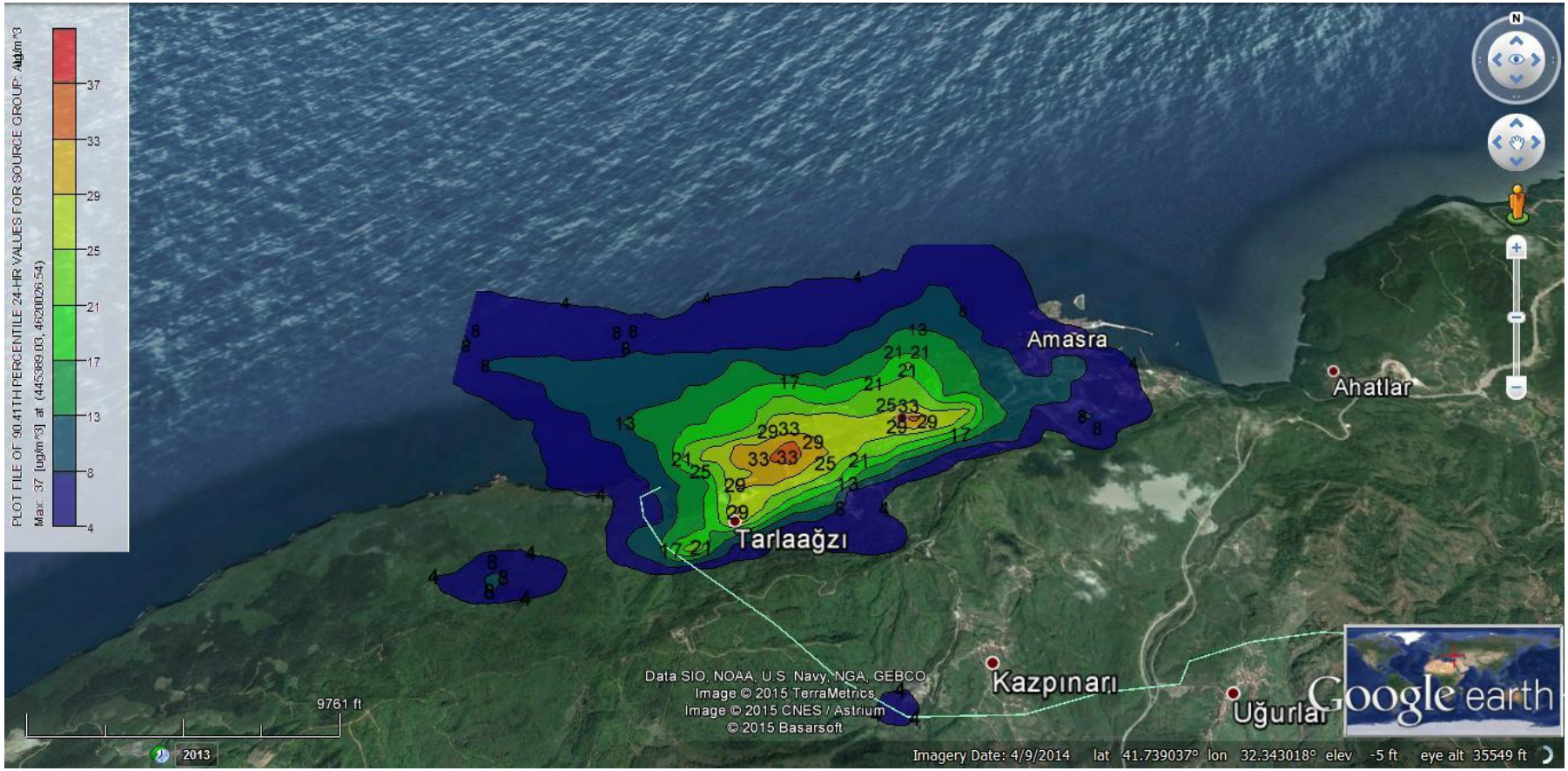

Figure 1. Daily Average %90.41 GLC Dispersion of PM_{10}

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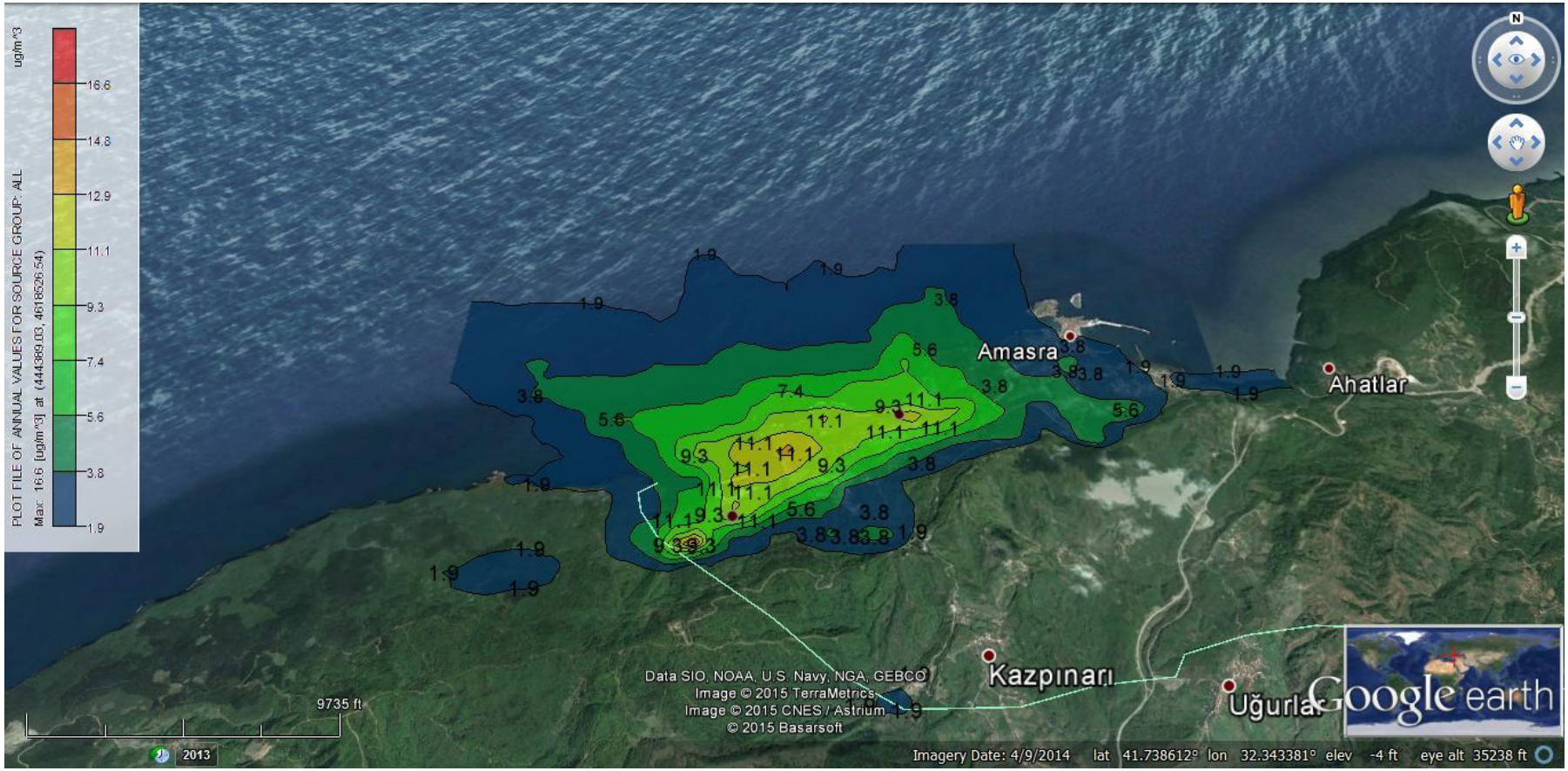

Figure 2. Yearly Average Maximum GLC Dispersion of PM_{10}

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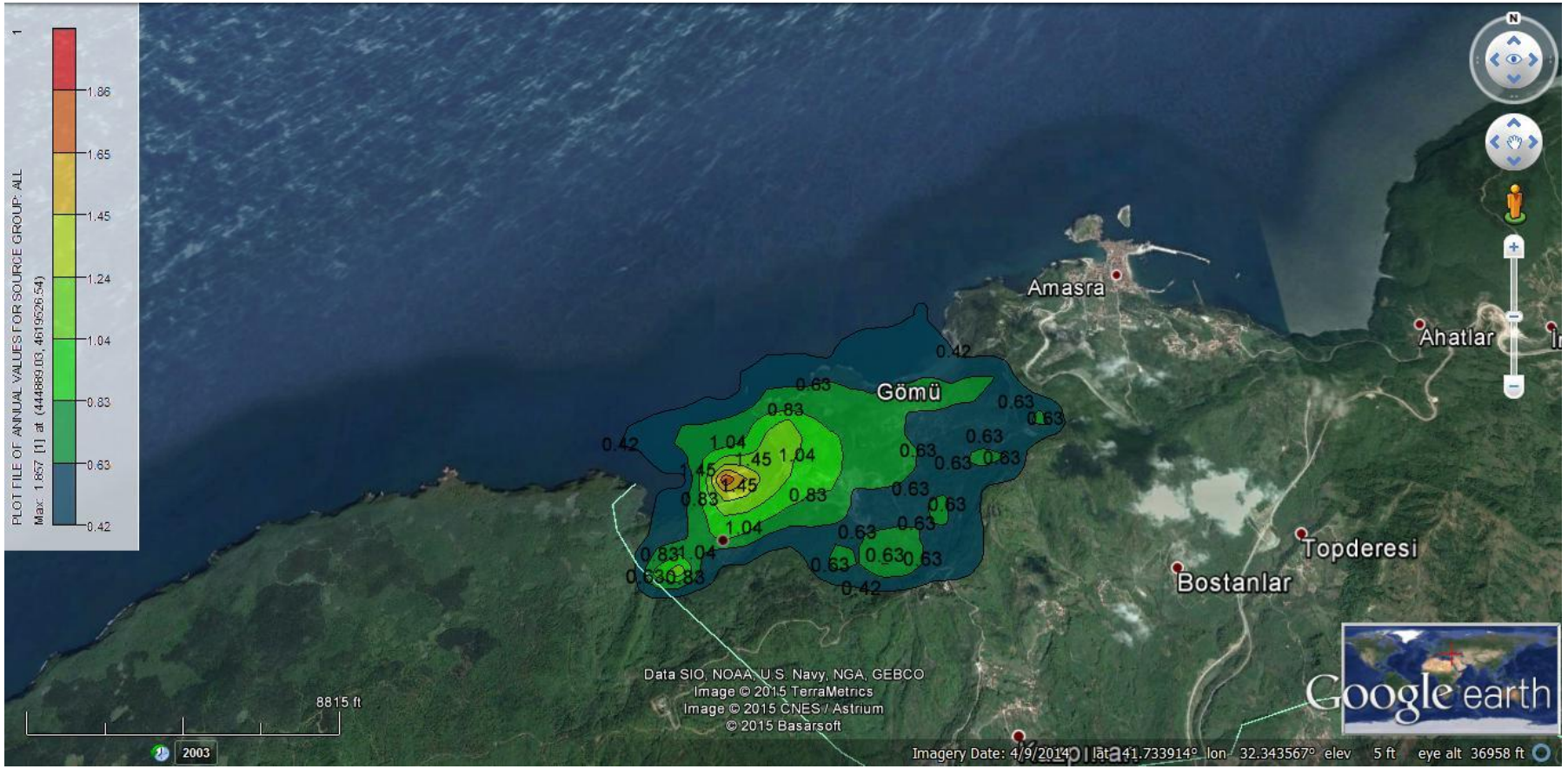

Figure 3. Monthly Average Maximum GLC Dispersion of PM Deposition

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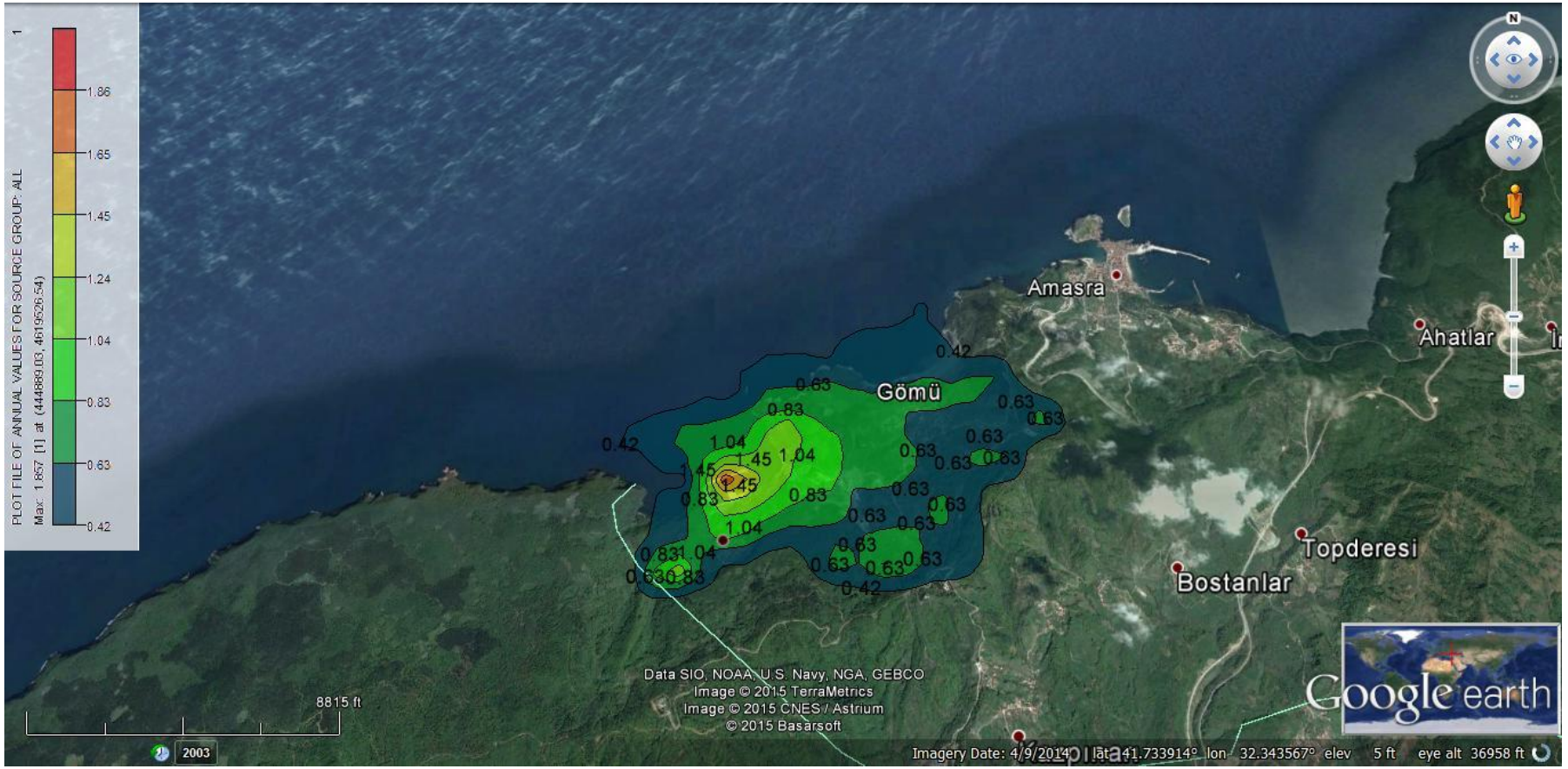

Figure 4. Yearly Average Maximum GLC Dispersion of PM Deposition

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5.2. Stack- Ground Level NO_2 Concentrations

Modeling studies are carried out for CO parameter for stack emissions. GLC's of CO, determined from the modeling studies are listed in Table 6.

In accordance with Table 6, maximum 8-hour average GLC value of CO is 262.82 $\mu g/m^3$ [3]. This value is significantly lower than the associated limits to be complied by the year 2024 which are set forth by the RAMAQ and international limit values.

Table 6. Operation Phase GLC Values Determined from the Modeling Studies

Parameter	Averaging Period	Values ($\mu g/m^3$)	National Limit Values* ($\mu g/m^3$)	EU Limit Values* ($\mu g/m^3$)	WHO Limit Values* ($\mu g/m^3$)
			Year		
			2024		
CO	*8 Hour average*	262.85 (449114, 4622267)	10.000	10.000	-

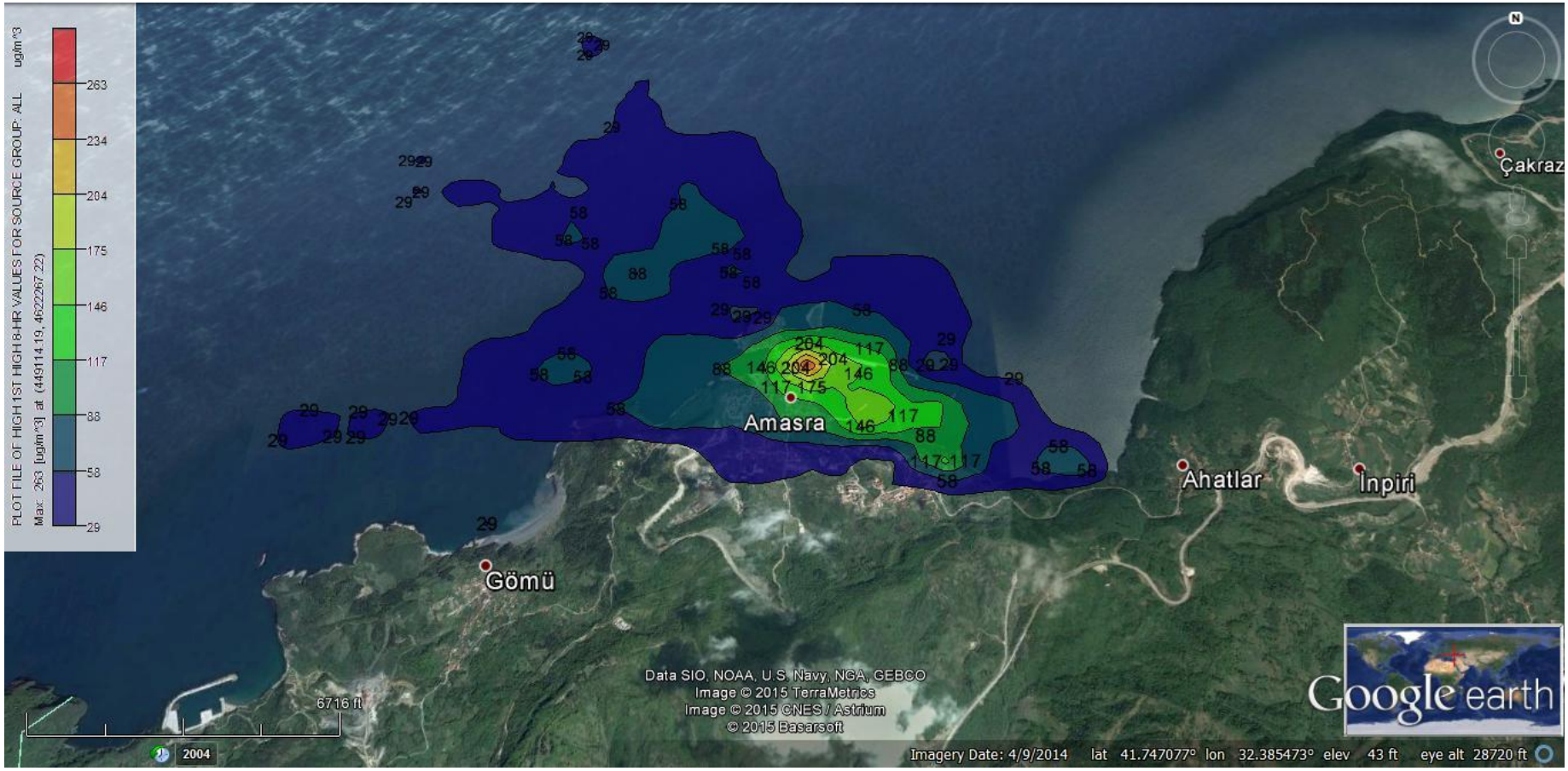

Figure 5. Maximum 8 Hour Average GLC Dispersion of CO Emission

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7. APPROVAL

The air quality modeling study was carried out with the aim of determining the air pollutants and their effects on ambient air quality which emit from Amasra Hard Coal Mine Field B which is planned to establish in Amasra Turkey. Results were assessed according to the Regulation on the Control of Air Pollution Originating from Industry (RCAPOI), EU Council Directive 2008/50/EC and WHO limit values and this report was prepared.

Modeled By	**Prepared By**
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Environmental Engineer	Environmental Engineer

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ANNEX I-2

Layout of the Methane Drainage System

Çizen : Rıdvan ERDOĞAN
Kontrol : Cenk UZUN
Tarih : 16.12.2014

Not: Çizim üzerinden ölçü almayınız.

N

BLACKSEA

1 / 10 000

METHANE DRAINAGE LAYOUT

20"-28" METHANE DRAINAGE PIPES

SHAFT-3

20"-28" METHANE DRAINAGE PIPES

SHAFT-1

EC300 Kömür yer1

Methane Station

-400.74

SCALE: 4/1

20"-28" METHANE DRAINAGE PIPES

EC200 Sağ pano 1

EC200 Sağ pano 2

EC200 Sağ pano 3

250m

AK-13

AK-10 (H)

AK-14

H-11

H-30

H-46

H-53

H-57

H-64

H-73

H-80

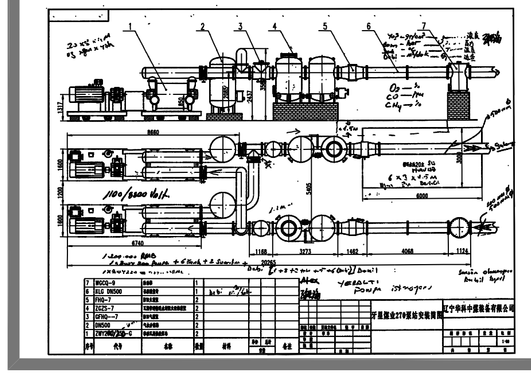
H-82/85

EC400 Sol pano 2

EC400 Sol pano 4

EC400 Sol pano 5

METHANE PUMPS



Appendix-1

SHAFT-3 METHANE STATİON LAYOUT

Ağaçlık Alan

METHANE STATİON

21199

21139

21181

917

21119

918

DN 700
Metan Gazı

DN 500
Metan Gazı

2,5

0,8

3,6

Section / A-A
Scale: 4/1

28

DN 500 Methane pipe

21195

26

DN 700 Methane pipe

Ağaçlık Alan

TRAFO

163

A

A

21117

ORMAN

246

22.25

1057

97

27.74

28.23

32.23

32.85

33.17

34.03

32.46

32.64

25

26

19

N

KLORU-3

32.65

32.90

32.55

33.11

34.14

33.64

32.64

33.21

35.45

34.21

Galeri Ekseni

Aspiratör Binası

Ağaçlık Alan

Appendix-2