



ACWA POWER ELECTRICITY OPERATION AND  
MANAGEMENT INDUSTRY AND TRADE CO.

## **ACWA POWER KIRIKKALE OVERHEAD TRANSMISSION LINE PROJECT**



## **NONTECHNICAL SUMMARY**



**MGS PROJECY CONSULTANCY ENGINEERING TRADE CO.**

ANKARA – JUNE/2014

**PROJECT NAME**

ACWA POWER KIRIKKALE OVERHEAD TRANSMISSION LINE

**PROJECT LOCATION**

Kırıkkale Province, Yahşihan and Merkez Counties, Ankara Province Kalecik, Çubuk, Pursaklar, Keçiören and Yenimahalle Counties

**PROJECT OWNER**

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**NONTECHNICAL SUMMARY****DATE / REVISION****26.06.2014 / 02**

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## ABBREVIATIONS

<b>EBRD</b>	:	European Bank for Reconstruction and Development
<b>OHTL</b>	:	Overhead Transmission Line
<b>SS</b>	:	Substation
<b>NTS</b>	:	Nontechnical Summary
<b>EIA</b>	:	Environmental Impact Assessment
<b>ESIA</b>	:	Environmental and Social Impact Assessment
<b>IFC</b>	:	International Finance Corporation
<b>KEXIM</b>	:	Korean Exim Bank
<b>NGCCPP</b>	:	Natural Gas Combined Cycle Power Plant
<b>TEIAS</b>	:	Turkish Electricity Transmission Company
<b>SEP</b>	:	Stakeholder Engagement Plan

## **SECTION I. INTRODUCTION**

This document is a Non-Technical Summary of the Environmental and Social Impact Assessment (ESIA) study for the “380 kV ACWA Power Kırıkkale Overhead Transmission Line” project which is planned to transmit electricity that will be generated by the ACWA Power Kırıkkale NGCCPP within the boundary of Kırıkkale Province, Yahşihan County, Municipality of Kılıçlar to Bağlum Substation situated in Ankara Province Keçioren District, in compliance with National and International legislation and environmental standards.

The ESIA is an assessment of physical, natural, cultural, social and socioeconomic impacts of the project’s construction and operation phases. This document presents a non-technical summary of the project ESIA.

The overhead transmission lines will be constructed by ACWA Power Electricity Operation and Management Industry and Trade Co. and then transferred to TEİAŞ together with its property rights. In this context, a System Connection Agreement will be signed between TEİAŞ and ACWA Power Electricity Operation and Management Industry and Trade Co.

## SECTION II. PROJECT DESCRIPTION

### Section II.1. Project Definition, Life, Service Purposes, Importance and Necessity

This document is a Non-Technical Study of the Environmental and Social Impact Assessment (ESIA) study for the “380 kV ACWA Power Kırıkkale Overhead Transmission Line” project which is planned to transmit electricity that will be generated by ACWA Power Plant to Bağlum Substation situated in Ankara. The length of 380 kV OHTL is 119 kilometers of which approximately 14.5 kilometers is inside the boundaries of Kırıkkale Province and the remainder, 104.5 kilometers, is situated within the boundaries of Ankara Province.

The overhead transmission lines will be constructed by ACWA Power Electricity Operation and Management Industry and Trade Co. and then transferred to TEİAŞ together with its property rights. In this context, a System Connection Agreement will be signed between TEİAŞ and ACWA Power Electricity Operation and Management Industry and Trade Co. The overhead transmission line route will include the construction of 31 poles, 1 end pole and 310 carrier poles.



**Figure 1. Representative Picture of Overhead Transmission Lines**

Upon completion of the OHTL project, the electricity generated from ACWA Power Kırıkkale Natural gas Combined Conversion Plant will be transmitted to the TEİAŞ network. By connecting into the network the project will play an important role in ensuring an uninterrupted power supply to mainly Kırıkkale and Ankara Provinces..

As stated above, once the project has been commissioned, it will be another step towards providing a countrywide – targeted, more efficient, uninterrupted and continuous power supply. In addition, employment opportunities will also be created to help address unemployment conditions within the region. Assuming that all of the 120 persons planned to be employed in the construction stage would have an average of 4 family members, approximately 480 persons are envisaged to reap the economic benefits due to this Project. Moreover, it is also intended to recruit unskilled labor from the region for employment during infrastructural works of the Project. Consequently, both regional economy and also Turkey economy will see positive economic benefits.

Schematic view of prementioned works is given in Figure 2.

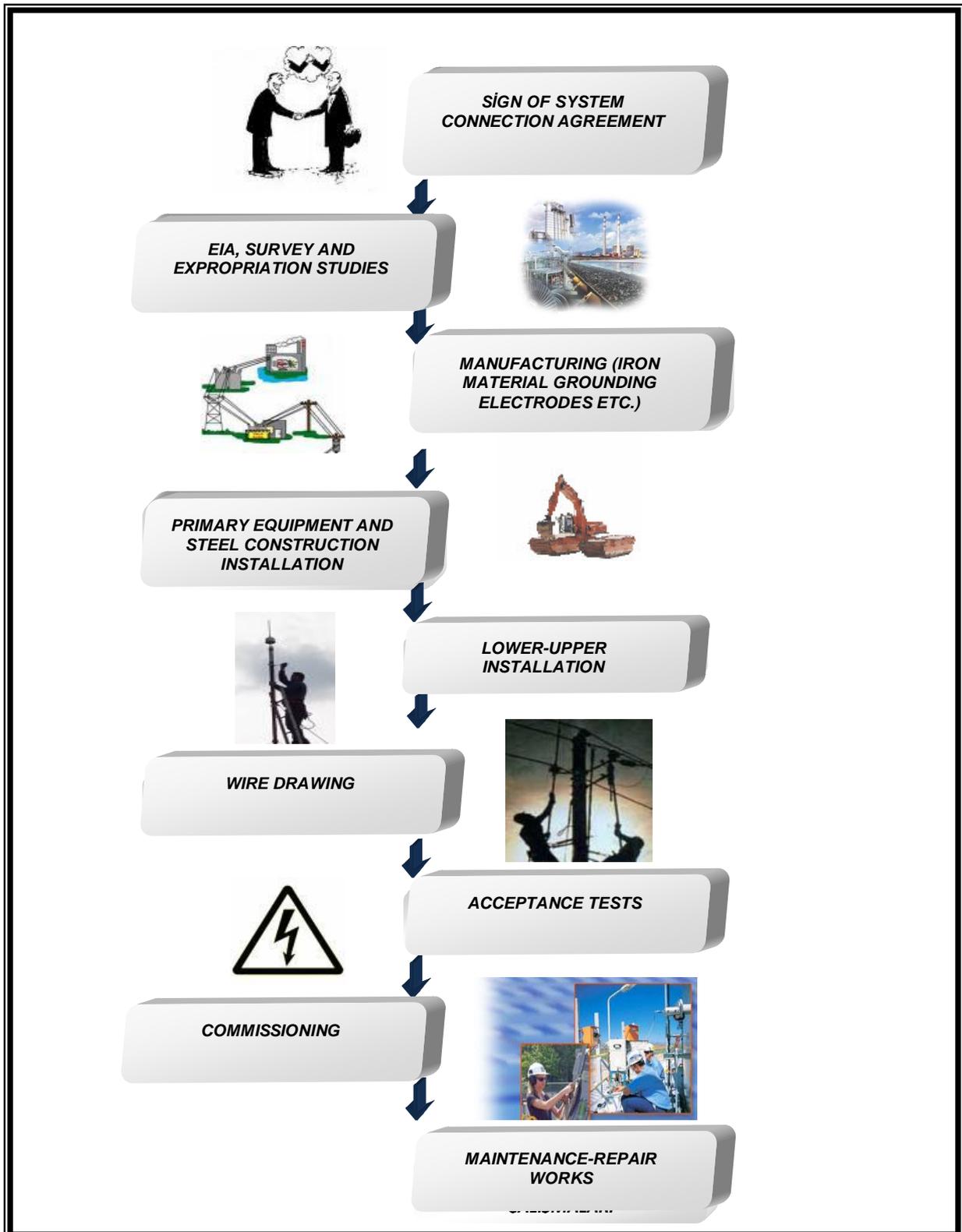


Figure 2. Work Flow Chart

## Section II.2. Project Area

380 kV ACWA Power Kırıkkale Overhead Transmission Line starts from ACWA Power Kırıkkale NGCCPP planned to be constructed within boundaries of Kırıkkale Province, Yahşihan County, Kılıclar Municipality and passes through the Ankara Province, Kalecik, Çubuk, Pursaklar, Yenimahalle Counties and ends up in Bağlum SS situated in Keçiören County.

Yahşihan County of Kırıkkale Province, where the ACWA Power Kırıkkale Natural Gas Combined Cycle Plant Project is planned and The Energy Transmission Line (ETL) starts, has an elevation of 680 m above sea level. The County has a total area of 155 sqkm. The lands in the County are surrounded by Demirlibel, Ardıçlı Hills and Küre and Delikli Mountains. Ankara-Kırıkkale Highway runs through Yahşihan County and serves as the access road for 43 cities. Yahşihan County is located at a distance of 6 km to Kırıkkale city center and 70 km to Ankara Province.

The OHTL route also passes through Kırıkkale Central County, which has an elevation of 700 m above sea level. This County is located on the slope where Çamlıca, Karakaya and Kırıkkale hills in the North of the City reach the plain.

The OHTL route passes through the province of Ankara, through the boundaries of Keçiören, Kalecik, Çubuk, Pursaklar and Yenimahalle counties, which are also within the boundaries of Bağlum SS. Keçiören County of Ankara is one of the central Counties and has an elevation of 850 m above sea level. The County has an area of 759 km<sup>2</sup>. Kalecik County has an elevation of 725 m above sea level and an area of 1,318 km<sup>2</sup>. Çubuk County has an elevation of 1,100 m above sea level and an area of 1248 km<sup>2</sup>. Pursaklar County has an elevation of 1,700 m above sea level and an area of 157 km<sup>2</sup>. Yenimahalle County has an elevation of 894 m above sea level and an area of 295 km<sup>2</sup>.

**Table 1. Some Point Coordinates**

Plot No	Some No	Coordinates	
		Y	X
I30B2	S.1	535138.576	4417315.013
I30B2	S.2	535069.493	4416656.535
I30B2	S.3	535472.976	4416079.004
I30B2	S.4	535850.453	4416000.348
I30B2	S.4/A	537519.072	4416498.033
I30B2	S.5	539172.537	4417367.155
I30B2	S.6	539682.468	4418185.739
I30B2	S.7	540000.545	4426409.273
H30C3	S.8	539138.888	4429785.835
H30C3	S.9	539780.813	4438367.422
H30C3	S.10	539498.119	4439050.170
H30C2	S.11	540148.831	4443389.559
H30C2	S.11/A	539785.642	4444852.209
H30C2	S.12	536511.741	4449188.244
H30C1	S.13	528423.270	4455484.260
H30B4	S.14	524644.668	4456733.248
H30A3	S.15	517100.147	4463181.895

Plot No	Some No	Coordinates	
		Y	X
H30A3	S.16	510859.991	4467373.770
H30A4	S.17	505831.182	4467605.327
H30A4	S.18	502691.819	4465985.261
H30A4	S.19	500556.830	4464400.297
H29B3	S.20	498533.746	4461156.139
H29B3	S.21	496049.383	4456973.602
H29C2	S.22	493026.976	4452375.660
H29C1	S.23	488297.830	4448172.061
H29C1	S.24	486905.931	4445805.194
H29C1	S.25	485075.689	4444436.373
H29C4	S.26	482713.001	4441564.819
H29C4	S.27	481783.948	4437136.183
H29C4	S.28	483229.226	4434298.861
H29C4	S.29	483686.112	4433865.016
H29C4	ND.2	483990.189	4433688.132

A 5 km corridor has been investigated along the OHTL route, 2.5 km from the left and right side of the mid-line considering possible route deviations as part of the environmental impact assessment. The aim has been to identify existing properties that may be affected within this corridor referred to as the EIA Investigation Area, to define potential environmental effects and the required mitigation measures.

The nearest residential areas to the route of the OHTL and their distance from the line have been provided in Table 2 and the nearest sensitive receptors have been provided in Table 3.

**Table 2. Residential Area Centres In the Vicinity of EIH Route and Their Distances to EIH Route**

Province	County	Village	Direction (location as to OHTL)	Distance to Line (m)
Kırıkkale	Yahşihan	Yenişehir District Industrial Site	South, North	180
Kırıkkale	Yahşihan	Hacbalı Village	North, East, West	2500
Kırıkkale	Yahşihan	Mahmutlar Village	West	1000
Ankara	Kalecik	Yukarı Samanlık District within the boundaries of Samanlık Village	West	650
Ankara	Kalecik	Aşağı Samanlık District within the boundaries of Samanlık Village	West	1200
Ankara	Kalecik	Gökdere Village	West	740
Ankara	Kalecik	Gümüşpınar Village	East	1000
Ankara	Kalecik	Keklicek Village	East	1300
Ankara	Kalecik	Hacı Village	Northwest	550
Ankara	Kalecik	Kılıcak Village	Northwest	1100
Ankara	Kalecik	Değirmenkaya Village	Southeast	1050
Ankara	Kalecik	Hasayaz Village	Southwest	830
Ankara	Kalecik	Yeşilöz Village	Northeast	1540
Ankara	Kalecik	Tavşancık Village	Northeast	980
Ankara	Çubuk	Karaali District	West	350

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Ankara	Çubuk	Camili Village	Southwest	1800
Ankara	Çubuk	Oylumiğde Village	Northeast	1870
Ankara	Çubuk	Demirci Village	Northeast	2160
Ankara	Çubuk	Kuyumcu Village	Southwest	980
Ankara	Çubuk	Meşe Yaylası	Northeast	1600
Ankara	Çubuk	Susuz Village	South	1160
Ankara	Çubuk	Kuruca District within the boundaries of Yukarı Çavundur Village	North	1450
Ankara	Çubuk	Çit Village	North	500
Ankara	Çubuk	Sele Village	South	1050
Ankara	Çubuk	Sarıkoz Village	Northwest	1000
Ankara	Çubuk	Yazlıca Village	Southeast	830
Ankara	Çubuk	Saraycık Village	Northwest	2000
Ankara	Çubuk	Karaman Village	Southeast	1200
Ankara	Çubuk	Ovacık Village	Northwest	1600
Ankara	Çubuk	Karaağaç Village	Southeast	2200
Ankara	Çubuk	Sülüklü District within the boundaries of Karaağaç Village	Southeast	850
Ankara	Çubuk	Eğriekin Village	Southeast	1470
Ankara	Çubuk	Yukarı Obruk Village	Northwest	420
Ankara	Çubuk	Aşağı Obruk Village	Southeast	1110
Ankara	Çubuk	Siğirlihacı Village	Southeast	2200
Ankara	Çubuk	Tuğlaköy Village	Northwest	960
Ankara	Çubuk	Kutuören Village	Southeast	2500
Ankara	Pursaklar	Taşkesen District within the boundaries of Gümüşyayla Village	Southeast	1500
Ankara	Pursaklar	Gümüşyayla Village	Northwest	720
Ankara	Pursaklar	Yuva Village	Southeast	630
Ankara	Pursaklar	Sirkeli Yeşilyurt District	Southeast	1700
Ankara	Pursaklar	Yeşilova District	Southeast	2300
Ankara	Keçiören	Çalseki Village	Northwest	1400
Ankara	Pursaklar	Başpınar Location	Southeast	750
Ankara	Yenimahalle	Yakacık Residence	Southwest	1650
Ankara	Keçiören	Bağlum Town	Southeast	2300

**Table 3. The Nearest Sensitive Structures to Some Points and Their Distances to Some Points**

Residential Area	Distance to Some Point (m)	Location as to Some Point	Image
Houses	130	Northeast of S9	
Field Houses within the boundaries of Sirkeli Town	85	South of S25	

Aerial view showing locations of route of overhead transmission line in relation to residential areas has been provided in Figure 3 and site location map has been provided in Figure 4.

Site studies were conducted on 23.10.2012 for the purpose of on-site investigation of the project area according to paragraphs 3 and 9 under the title of “Obligations of institutions/organizations having Certificate of Competence”, Communiqué of Certificate of Competence brought into effect by being published in the Official Gazette numbered 27436 and dated 18.12.2009 for the OHTL Project.



Figure 3. Map of the Project Area showing OHTL Corridor

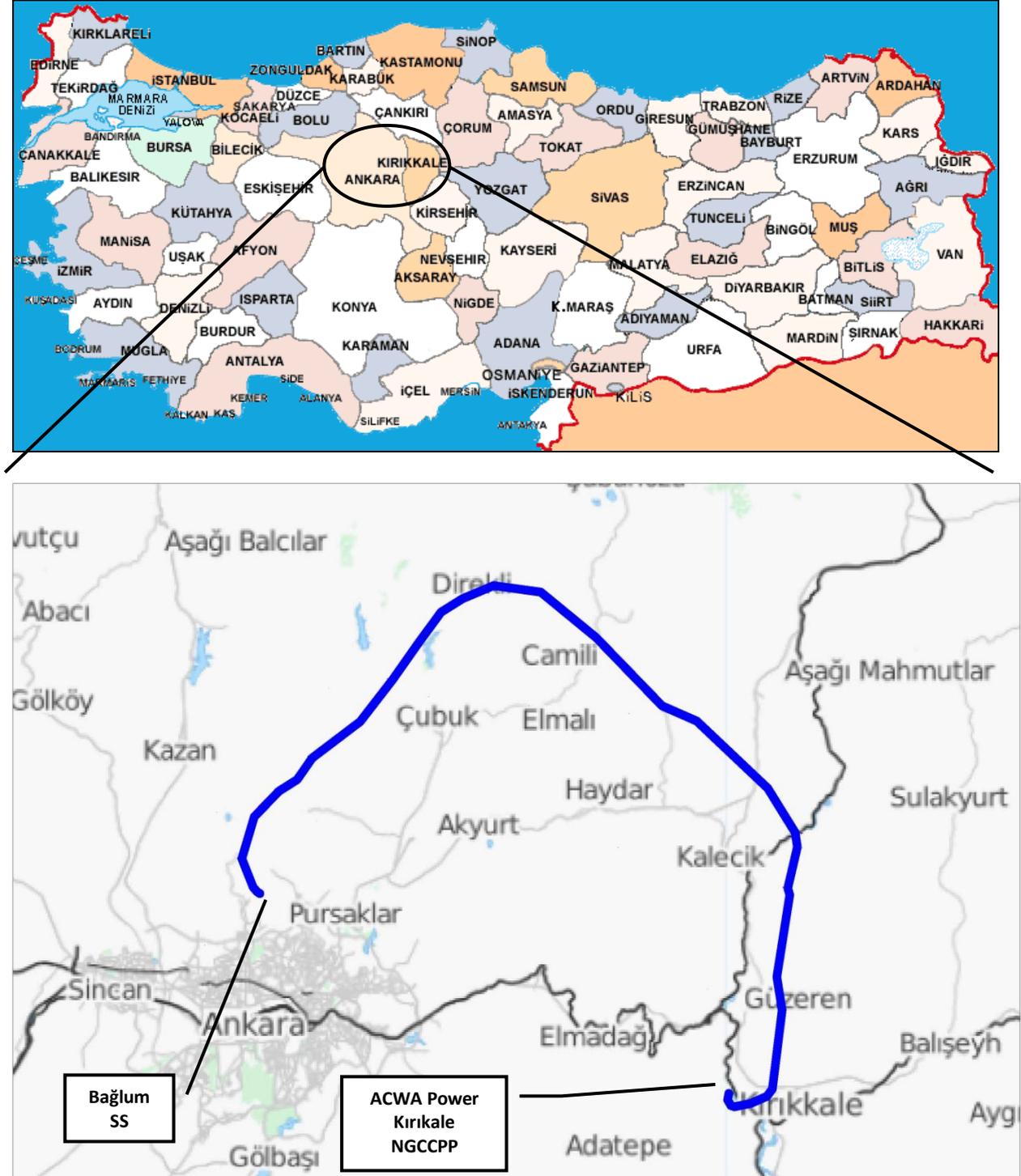


Figure 4. Site Location Map

Expropriation of the private areas where overhead transmission lines pass over should be made through the Expropriation Commission for both property and easement rights in accordance with expropriation plan to be formed during the EIA process. This is pursuant to Expropriation Law numbered 2942 amended with the law numbered 4650 and land values will be paid to rightful holders. Easement right facility will be established within a 50m corridor, 25 m either side of the mid-line within the framework of these studies.

Varying size properties will be expropriated according to the pole type in the places where the pole legs are to be mounted on a concrete base. Since the pole coordinates to be used on the line during this phase are not determined yet, the area to be expropriated for pole legs has not become final.

Since land preparation and construction works become intensive on the areas where primarily poles are to be erected, type of land use will vary on pole locations. No significant or lasting impact will be made in the 50 m corridor due to construction works. However, short term works including wire drawing procedures will be required for the final phase in overhead transmission lines. No significant environmental impact is expected in during construction works.

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### Section II.3. Project Alternatives

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The OHTL routes will be approximately designated on the map with 1/25.000 scale by TEIAŞ General Directorate and connection points are of high importance in this point. (SS, OHTL). The route corridor will then be examined again by considering topographical and geographical conditions of the area.

In this examination, the route has been selected by considering the distance of the OHTL to many sensitive receptors such as the following:

- settlement locations,
- transition route that will shorten the route;
- facility-maintenance-operation possibilities;
- swamp-flood bed-land;
- areas at risk from landslide;
- areas such as forest-orchard-poplar;
- military areas;
- air fields;
- state producing farms;
- private lands;
- communication lines (telephone, e-mail);
- special environmental protected areas;
- highways;
- state railways;
- dams;
- ponds;
- irrigation channels;
- zoning areas;
- mines;and
- coal areas.

TEIAŞ has evaluated options in the determination process of the most appropriate line route, especially considering existing mines throughout the area and not to intersect with them.

In case it is determined that the line passes from the above mentioned areas in the examinations conducted, other alternatives, if any, have been considered. Final form of the route will be designated with the survey conducted again by the contracting firm (survey-distribution) by considering the criteria specified above and will be submitted to TEIAŞ for approval.

In general, in planning phase of overhead transmission line;

- Line route will be designated as alternative over Topographical Map with 1/25.000 Scale,
- Land studies will be commenced over designated route or routes,
- Route will be finalized during land studies and route plan will be planned,
- Prepared Route Plan will be submitted to TEIAŞ.
- Permitting studies (EIA, forest, agriculture etc.) will be commenced by considering route plan approved by TEIAŞ.

Considering the project type, location and purpose, the selected route is the most appropriate alternative for 380 kV ACWA Power Kırıkkale Overhead Transmission Line route.

**SECTION III: EXISTING ENVIRONMENTAL CHARACTERISTICS OF THE PROJECT AREA AND IMPACT AREA**

**Population**

The population data is based on the 2013 date from Turkey address-based population registration system (ADNKS);

The population of Kırıkkale Province in 2013 is 274,658 and 231,831 person reside in the city center and the rest of the population which is 42,827 reside in villages and towns within the districts. The data regarding the district where the Project located is shown in **Table 4**.

**Table 4. Kırıkkale Province Population Data**

County	Province/Town			Village			Total		
	Total	Male	Female	Total	Male	Female	Total	Male	Female
<b>Merkez</b>	187.48	93.128	94.352	8.491	4.488	4.003	195.971	97.616	98.355
<b>Bahşili</b>	5.545	2.778	2.767	1.487	747	740	7.032	3.525	3.507
<b>Balıseyh</b>	2.24	1.137	1.103	4.393	2.226	2.167	6.633	3.363	3.27
<b>Çelebi</b>	1.567	809	758	1.666	838	828	3.233	1.647	1.586
<b>Delice</b>	2.54	1.35	1.19	7.591	3.707	3.884	10.131	5.057	5.074
<b>Karakeçili</b>	4.068	2.06	2.008	303	143	160	4.371	2.203	2.168
<b>Keskin</b>	9.667	4.705	4.962	10.387	5.317	5.07	20.054	10.022	10.032
<b>Sulakyurt</b>	2.417	1.402	1.015	5.356	2.631	2.725	7.773	4.033	3.74
<b>Yahşihan</b>	16.307	8.572	7.735	3.153	1.601	1.552	19.46	10.173	9.287
<b>Toplam</b>	231.831	115.941	115.89	42.827	21.698	21.129	274.658	137.639	137.019

Reference: TUIK, ADNKS., 2013

The population of Ankara Province is 4,965,542 and 4,842,136 person reside in the city center and the rest of the population which is 123,406 reside villages and towns from the district. The data regarding the district where the Project located is shown in **Table 5**.

**Table 5. Ankara Province Population Data**

County	Province/Town			Village			Total		
	Total	Male	Female	Total	Male	Female	Total	Male	Female
<b>Akyurt</b>	26.572	13.534	13.038	629	324	305	27.201	13.858	13.343
<b>Altındağ</b>	363.744	182.916	180.828				363.744	182.916	180.828
<b>Ayaş</b>	8.295	4.331	3.964	4.792	2.32	2.472	13.087	6.651	6.436
<b>Bala</b>	7.542	3.857	3.685	9.855	4.997	4.858	17.397	8.854	8.543
<b>Beypazarı</b>	37.097	18.351	18.746	9.641	4.707	4.934	46.738	23.058	23.68
<b>Çamlıdere</b>	2.764	1.412	1.352	3.975	1.936	2.039	6.739	3.348	3.391
<b>Çankaya</b>	832.075	406.801	425.274				832.075	406.801	425.274
<b>Çubuk</b>	77.958	39.16	38.798	4.656	2.318	2.338	82.614	41.478	41.136
<b>Elmadağ</b>	42.674	21.809	20.865	1.182	576	606	43.856	22.385	21.471
<b>Etimesgut</b>	425.947	215.283	210.664				425.947	215.283	210.664

<b>Evren</b>	1.885	937	948	1.126	540	586	3.011	1.477	1.534
<b>Göbbaşı</b>	109.261	55.432	53.829	1.382	697	685	110.643	56.129	54.514
<b>Güdü</b>	2.591	1.276	1.315	6.065	2.932	3.133	8.656	4.208	4.448
<b>Haymana</b>	8.97	4.857	4.113	22.088	11.058	11.03	31.058	15.915	15.143
<b>Kalecik</b>	8.73	4.426	4.304	4.918	2.394	2.524	13.648	6.82	6.828
<b>Kazan</b>	41.442	21.34	20.102	1.866	945	921	43.308	22.285	21.023
<b>Keçiören</b>	840.809	415.085	425.724				840.809	415.085	425.724
<b>Kızılcahamam</b>	16.504	8.245	8.259	8.131	3.972	4.159	24.635	12.217	12.418
<b>Mamak</b>	559.597	282.464	277.133				559.597	282.464	277.133
<b>Nallıhan</b>	12.125	5.979	6.146	18.174	8.954	9.22	30.299	14.933	15.366
<b>Polatlı</b>	101.012	50.646	50.366	18.337	9.416	8.921	119.349	60.062	59.287
<b>Pursaklar</b>	119.593	60.21	59.383				119.593	60.21	59.383
<b>Sincan</b>	479.454	244.408	235.046				479.454	244.408	235.046
<b>Şereflikoçhisar</b>	28.453	14.48	13.973	6.589	3.207	3.382	35.042	17.687	17.355
<b>Yenimahalle</b>	687.042	335.924	351.118				687.042	335.924	351.118
<b>Toplam</b>	<b>4.842.136</b>	<b>2.413.163</b>	<b>2.428.973</b>	<b>123.406</b>	<b>61.293</b>	<b>62.113</b>	<b>4.965.542</b>	<b>2.474.456</b>	<b>2.491.086</b>

Reference: TÜİK, ADNKS., 2013.

### **Flora-Fauna**

Studies in respect of the flora/fauna of the OHTL project corridor are detailed in the EIA Report in accordance with the requirements for this specific project.

A flora list has been prepared based on the "Flora of Turkey and East Aegean Islands" published by P.H. Davis and Tübitak Plants Data Service" (TUBIVES). Research, publications, and thesis studies conducted in this area, have been reviewed for the purpose of preparing a complete and accurate list of flora. While determining endemic species likely to be present in the Project area and its vicinity, publication called "Turkey Plants Red Book" prepared by Ekim, T and et al., (2000) has been utilized and Turkish meanings of plant species has also been utilized from the book called " Turkish Linguistic Society, 2007" 3rd Edition-Ankara-Turkish Plant Names Dictionary/Turhan BAYTOP.

Latin and Turkish meanings of plant species, endemism conditions, threat categories, phytogeographical areas, habitats in flora list have been indicated whether they are included in Annex-1 list of the Bern Convention.

For fauna analysis of project area and its vicinity; Determination of Protection Measures and Investigation of Systematic and Biological Characteristics of Turkey Vertebra Fauna" of DEMİRİSOY, A. "Environmental Impact Assessment (ÇED)", N. YİĞİT, E. ÇOLAK, (Amfibians, Reptiles, Mamals)" Herpetology -Prof. Dr. Abidin BUDAK, Doç. Dr. Bayram GÖÇME, 2005" Second Edition" and "Rodents of Turkey", Demirsoy A., Yiğit., N., Çolak, E., Sözen, M., Karataş, A., Ankara,2006" has been utilized. Regarding the preparation of the section on the bird species which might live in Project site and impact area, "KIZIROĞLU, İ (2008): Red List of Turkish Birds (Aves)" and "Lecture Notes on Ornithology, YİĞİT, N. et al. Ankara-2008" were used as reference sources.

Latin and Turkish meanings of species, habitats, population density, IUCN categories, endemism conditions, threat categories, phytogeographical areas, habitats in flora list has been indicated whether they are included in annex lists of Central Hunting

Commission Decision of 2012-2013 Hunting Period" where Annex-2 and Annex-3 list of Bern Convention are included.

### **Geological and Hydrogeological Properties**

1/100.000 explorations of Mineral Research and Exploration Institute were used to determine geological characteristics of 380 kV ACWA Power Kırıkkale OHTL.

Stratigraphy of the area that is defined as the study area and that covers the area of the transmission line consists of tectonically related rocks in Triase-Jura Sakarya zone; Young Cretase-Early Eocene sediment rocks in İzmir-Ankara zone and similar rocks in Late Cretase-Early Eocene Kırşehir block.

Cap rock that starts with Mid Eocene transgression discordantly overlies these units.

Cap rocks have a character of foreland basin sediments on base rock. These are alluvial sediment consisting of Mid Eocene Baraklı formation; Çayraz formation; Çavuşlu volcanite; Deliler volcanite; Tohumlar volcanite; Hüseyingazi volcanite; Late Eocene-Oligocene İncik formation; Mid Miocene-Early Pliocene Central Anatolia group sediments; Pliocene Gölbaşı and Karakeçili formation and Quaternary river sediments.

Sakarya zone between pontides and Anatolide-Torid belts is composed of bottom-up tectono- stratigraphically related Karakaya complex consisting of Emir formation; Elmadağ formation, Ortaköy formation and Keçikaya formation and Jura Bayırköy and transitional Akbayır formations that discordantly overly these units.

The unit which is composed of metamorphosed, carboniferous-Permian limestone blocks and Triase pebble stone, sand stone, quartz, silt stone, slate, radiolarite, mudstone, metaspilite, syphilitic basalt and diabase complex was first defined as Karakaya formation by Bingöl et al., (1973).

The study area that covers the route of the project is composed of Karakaya complex, Emir formation, Ortaköy formation, Elmadağ formation and Keçikaya formations.

### **Natural Disaster Condition**

Kırıkkale section of overhead transmission line falls into 2<sup>nd</sup> degree earthquake zone while Ankara section falls into 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> degree earthquake zone which are relatively very low risk areas for earthquakes (See **Figure 11**). Turkey Earthquake Zones are rated based on the values of acceleration values which are given below.

Table 6. Turkey Earthquake Zones

Earthquake Zone	Explanation	Acceleration Value
1st Degree Earthquake Zone	Include tectonic depressions and areas near active fault lines. Here, earthquakes can cause loss of life and property in a great extent.	Higher than 0.40 g
2nd Degree Earthquake Zone	Areas where earthquakes can cause less damage compared to 1st Degree Earthquake Zones.	Between 0.40 g and 0.30 g
3rd Degree Earthquake Zone	Shakes in these areas pass with minimum loss.	Between 0.30 g and 0.20 g
4th Degree Earthquake Zone	Shakes in these areas pass with minimum loss or no loss.	Between 0.20 g and 0.10 g
5th Degree Earthquake Zone	Shakes in these areas occur rarely or are not perceptible	Lower than 0.10 g

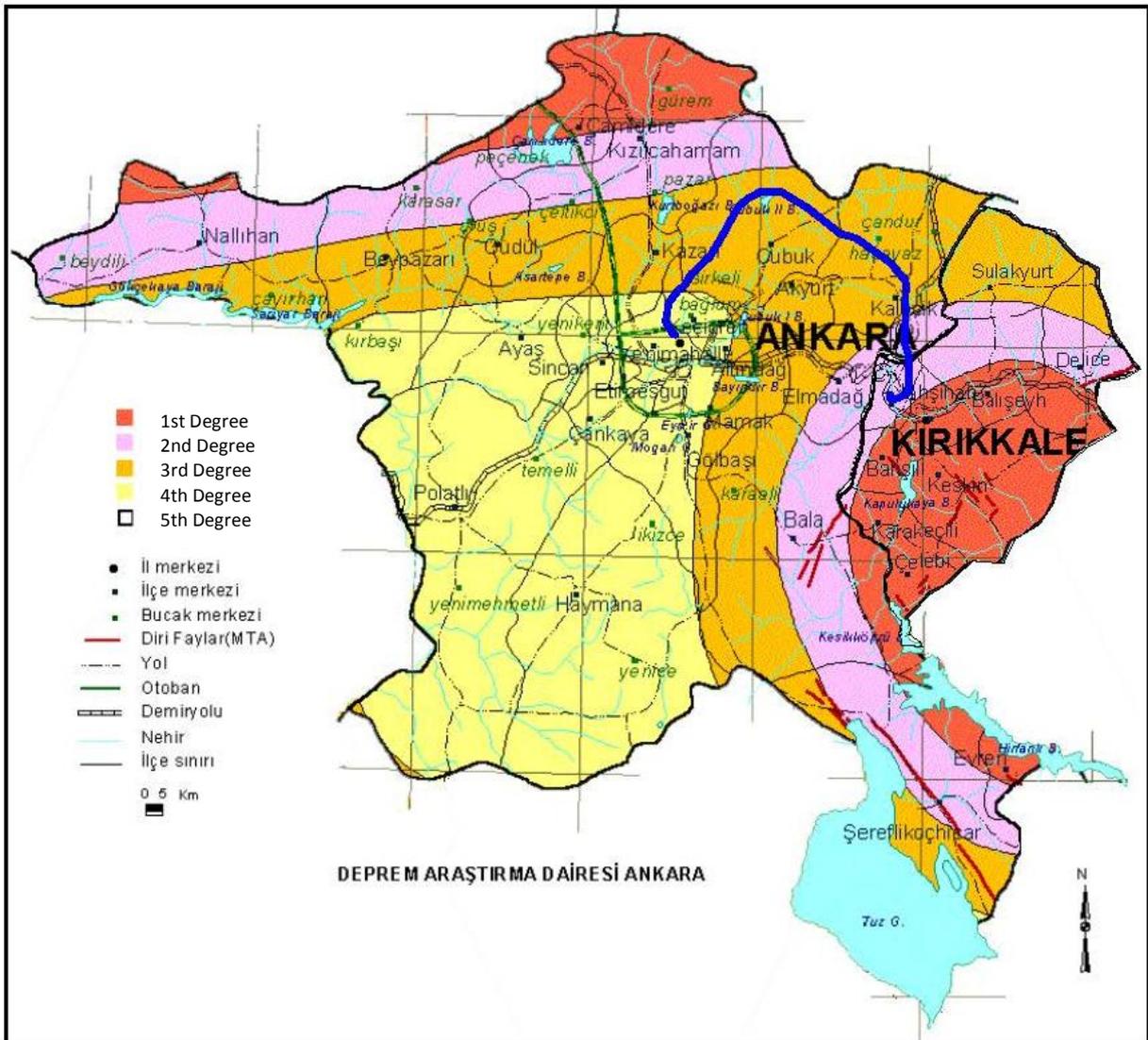


Figure 5. Seismicity Map

In this context, earthquake risk in the Project area is very low.

### **Soil Properties**

Soil types commonly seen along the OHTL route are; brown soils, reddish brown soils, bare rock and debris, colluvial soils and brown forest soils.

### **Water Resources**

The most important surface water resources identified within OHTL route and ESIA Survey Corridor totally in 5 km in width is Kızılırmak River and Çubuk-2 Dam. Kızılırmak River stands at a 300 meter - distance from OHTL starting Pole (S1). There are crossovers planned over the river along the route of OHTL. During Planning studies, guard band defined as the distance of 200 m from right and left hand of the Kızılırmak River has been respected / will be followed. Çubuk-2 Dam stands at a 1000 m from the route and 1400 m to the nearest some pole (S19).

There are no surface waters or natural wetlands at the points where the poles will be erected.

The streams showing seasonal flow across the line are streams of Asmalı, Çırıncağ, Erikli, Büyükçökek, Gürebağları, Köklüce, Tarla, Uzunuyu, Tatlının, Kavaklı, Sondede, Taşlıgeçit, Dolaşan, Yılğın, Kara, Ovazın, Damla, Gürleğen, İncekavak, Kisin, Sudere, İnce, Akyokuş, Katıağaç, Armutlu, Kirliğin, Damlaağaç.

As for the streams showing continuous flow; these are the streams of Kırmı, Taşocağı, Bayamlı, İğdeköy, Kamanlı, Mendek, Bekirin, Tahirinsazak, Kırkelma, Danışman.

### **Air**

Natural gas distribution works in Kirikkale Province have been completed and natural gas is started to be used for heating purposes in residences at the city centre. Some industrial plants as well have switched to using natural gas in processes. Since natural gas is not being used in the entire provincial centre and in industry, domestic and imported coal, fuel oil no. 4 and LPG are currently being used for heating and industrial purposes.

One of the air quality monitoring stations in Turkey established by the Ministry of Environment and Urbanization is located in Kirikkale Province, 12 km away to the closest overhead transmission line route (ES1 pole). Sulphurdioxide (SO<sub>2</sub>) and particular matter (PM) data of the 2011-2012 years of Kirikkale air quality monitoring station is given in Table 7 and the graph in Figure 6.

**Table 7. Kirikkale Air Quality Monitoring Station Data**

Date	Maximum Concentration		Minimum Concentration		Average Concentration	
	PM <sub>10</sub> µg/m <sup>3</sup>	SO <sub>2</sub> µg/m <sup>3</sup>	PM <sub>10</sub> µg/m <sup>3</sup>	SO <sub>2</sub> µg/m <sup>3</sup>	PM <sub>10</sub> µg/m <sup>3</sup>	SO <sub>2</sub> µg/m <sup>3</sup>
01.12.2011-31.12.2011	196	86	28	2	105	25
01.01.2012-31.01.2012	204	24	39	0	86	10
01.02.2012-29.02.2012	-	101	-	9	-	32
01.03.2012-31.03.2012	134	61	11	7	92	20
01.04.2012-30.04.2012	169	35	10	0	64	9

Date	Maximum Concentration		Minimum Concentration		Average Concentration	
	PM <sub>10</sub> µg/m <sup>3</sup>	SO <sub>2</sub> µg/m <sup>3</sup>	PM <sub>10</sub> µg/m <sup>3</sup>	SO <sub>2</sub> µg/m <sup>3</sup>	PM <sub>10</sub> µg/m <sup>3</sup>	SO <sub>2</sub> µg/m <sup>3</sup>
01.05.2012-31.05.2012	83	24	27	0	48	3
01.06.2012-30.06.2012	82	19	31	0	53	1
01.07.2012-31.07.2012	88	3	32	1	54	2
01.08.2012-31.08.2012	85	2	33	0	49	1
01.09.2012-30.09.2012	120	10	39	0	77	2
01.10.2012-31.10.2012	107	9	37	4	66	6
01.11.2012-27.11.2012	120	10	19	5	63	7

Reference: www.havaizleme.gov.tr

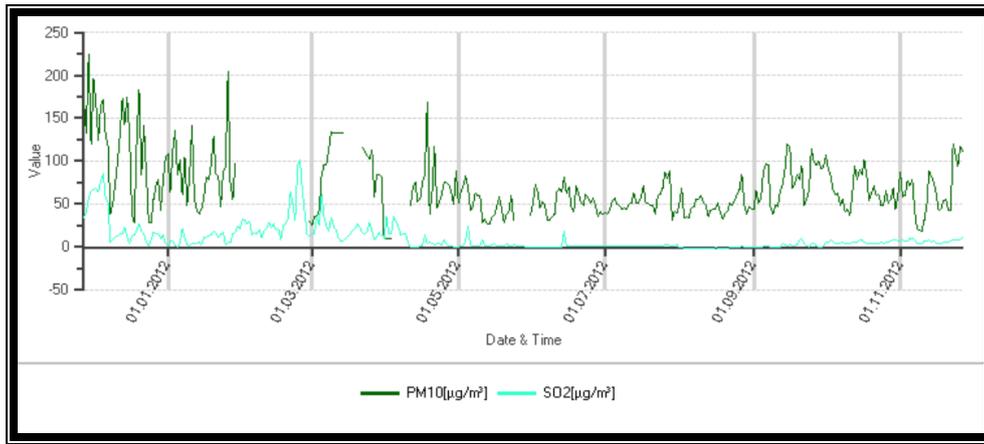


Figure 6. Kirikkale Air Quality Monitoring Station Data Graph

According to Table 8, maximum SO<sub>2</sub> emission is recorded in February-2012 as 101 µg/m<sup>3</sup> and maximum PM<sub>10</sub> emission is recorded in January-2012 as 204 µg/m<sup>3</sup>.

Natural gas usage for domestic heating source is low in Kirikkale Province; instead people prefer to use coal. Irregular urbanization, lack of adequate insulation in buildings and weather conditions rather increase coal usage. This situation can result in short term high PM and SO<sub>2</sub> concentrations.

Another air quality monitoring station in Turkey established by the Ministry of Environment and Urbanization is located in Ankara Province, Dikmen District, 11 km away to the closest overhead transmission line route (S1 pole). Sulphurdioxide (SO<sub>2</sub>), particulate matter (PM) and nitrogenoxide (NO<sub>x</sub>) data of the 2011-2012 years of Ankara-Dikmen air quality monitoring station is given in Table 8 and the graph in Figure 7.

Table 8. Ankara-Dikmen Air Quality Monitoring Station Data

Date	Maximum Concentration			Minimum Concentration			Average Concentration		
	PM <sub>10</sub> µg/m <sup>3</sup>	SO <sub>2</sub> µg/m <sup>3</sup>	NO <sub>x</sub> µg/m <sup>3</sup>	PM <sub>10</sub> µg/m <sup>3</sup>	SO <sub>2</sub> µg/m <sup>3</sup>	NO <sub>x</sub> µg/m <sup>3</sup>	PM <sub>10</sub> µg/m <sup>3</sup>	SO <sub>2</sub> µg/m <sup>3</sup>	NO <sub>x</sub> µg/m <sup>3</sup>
01.12.2011-31.12.2011	180	59	123	22	0	9	80	18	53
01.01.2012-31.01.2012	108	53	74	13	1	8	42	22	41
01.02.2012-29.02.2012	48	47	111	3	10	20	19	30	55
01.03.2012-31.03.2012	135	35	75	6	3	14	62	14	43
01.04.2012-30.04.2012	141	25	73	15	2	7	62	8	32

Date	Maximum Concentration			Minimum Concentration			Average Concentration		
	PM <sub>10</sub> µg/m <sup>3</sup>	SO <sub>2</sub> µg/m <sup>3</sup>	NO <sub>x</sub> µg/m <sup>3</sup>	PM <sub>10</sub> µg/m <sup>3</sup>	SO <sub>2</sub> µg/m <sup>3</sup>	NO <sub>x</sub> µg/m <sup>3</sup>	PM <sub>10</sub> µg/m <sup>3</sup>	SO <sub>2</sub> µg/m <sup>3</sup>	NO <sub>x</sub> µg/m <sup>3</sup>
01.05.2012-31.05.2012	91	19	100	48	10	29	60	13	50
01.06.2012-30.06.2012	254	14	73	37	2	51	125	7	64
01.07.2012-31.07.2012	328	12	-	93	5	-	151	9	-
01.08.2012-31.08.2012	342	14	-	40	5	-	129	10	-
01.09.2012-30.09.2012	308	20	-	24	6	-	143	13	-
01.10.2012-31.10.2012	104	17	-	22	9	-	63	11	-
01.11.2012-27.11.2012	145	16	315	17	8	62	75	11	156

Reference: www.havaizleme.gov.tr

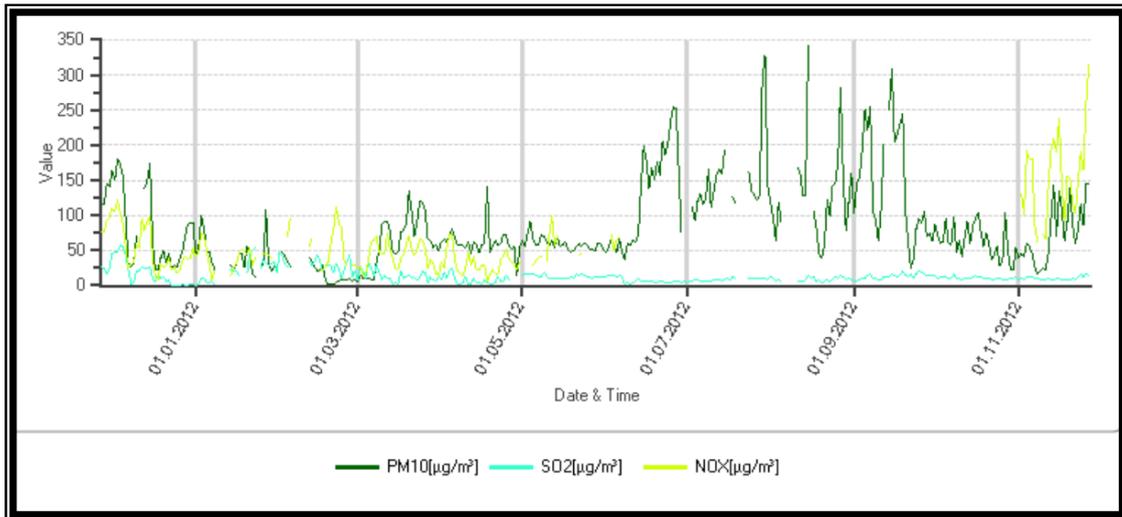


Figure 7. Ankara-Dikmen Air Quality Monitoring Station Data Graph

According to Table 8, maximum SO<sub>2</sub> emission is recorded in December-2011 as 59 µg/m<sup>3</sup>, maximum PM<sub>10</sub> emission is recorded in July-2012 as 342 µg/m<sup>3</sup> and maximum NO<sub>x</sub> emission is recorded in November-2012 as 315 µg/m<sup>3</sup>

The most preferred heating way in Ankara has been natural gas for many years. However, when compared to Kirikkale Province, due to higher traffic load in Ankara, air quality values differ from each other.

### **Meteorology and Climate**

Ankara Province is located in Central Anatolia in which continental climate is present. The region is hot and dry in summers, cold and snowy in winters. Precipitation is seen mainly in springs. Important temperature differences have been found between day and night, summer and winter seasons. The hottest months are July-August, while the coldest month is January. According to the last 30 years observations, average precipitation occurs in January which is the coldest month, (0.3°C; average temperature) compared with July which is the hottest month, (23.6°C) and the annual average temperature is 12°C. Average total annual rainfall is 401 mm and most of the rainy days are in winter and spring. Summer rains are 16% of the annual total precipitation. Average annual relative humidity value is 60.8%.

Continental climate is also present in Kirikkale Province. Since the Province is located between 1280 - 1580 m height above sea level, harsh winter conditions are present. Fall and spring seasons are experienced in short periods, mostly 6 months winter and 6 months summer season is felt. According to the data taken from Kirikkale Meteorology Station; average temperature of the region is 12.5 °C, the highest average temperature is 18.1 °C, the lowest average temperature is 6.7 °C. Average mean rainfall amount for the region is 378.3 mm and the highest amount of monthly rainfall event is recorded in June at 100.6 mm. Yearly average relative humidity is recorded as 63%, yearly average wind speed as 1.8 m/s and the fastest wind is recorded in W (North) direction as 28.1 m/s.

### **Property**

Expropriation of the areas should be made with the capacity of expropriation commission for both property and easement right in accordance with expropriation plan to be formed during EIA process pursuant to Expropriation Law numbered 2942 amended with the law numbered 4650 and land values will be paid to rightful holders by TEİAŞ General Directorate. Easement right facility will be established across the entire 50m corridor as 25 m from either side of the mid-line within the framework of these studies. Properties in sizes varying as to pole type will be expropriated in the places where there is a concrete base for the poles to stand on.

### **Architectural and Archaeological Heritage**

In the project area and vicinity, there are no architectural or archaeological features.

### **Landscape**

As a result of the observations and literature studies in the EIA study area the overhead transmission line route does not impact any area with special landscape designation or protected landscape features.

## SECTION IV. IMPORTANT ENVIRONMENTAL IMPACTS OF THE PROJECT AND MITIGATION MEASURES

### Section IV. 1. Use of Natural Resources

#### Land Use

There is no designated landscape features within the project area.

Since land preparation and construction works become intensive on the areas where primarily poles are to be erected, type of land use will vary on pole locations. No significant impacts will be made in the 50 m corridor during construction works. However, short term works will be performed to the said corridor in wire drawing procedures that are final phase in overhead transmission lines. No important environmental impact is expected in these works to be executed.

Required measures have been taken by complying with the provisions of relevant regulations and the Law Soil Conservation and Land Use" numbered 5403 brought into effect by being published in the Official Gazette numbered 25880 and dated 19/07/2005 prior to construction works in order for agricultural areas within the project corridor to be use for non-agricultural purposes and required permits will be obtained from Kırıkkale Provincial Directorate of Food, Agriculture and Livestock and Ankara Provincial Directorate of Food, Agriculture and Livestock in relation to the areas remaining within the scope of Pasture Law numbered 4342 and with the Law on Conservation and Land Use numbered 5403 within corridor to be expropriated with pole locations.

Since there are no expropriation procedures for forest areas, required permits will be taken from the General Directorate of Forestry as per 17/3 article of Forestry Law numbered 6832 in relation to route passing through forest areas.

#### Water Use

The requirement for potable water for use by 80 personnel to be employed during the construction phase of the project will be met by way of purchasing it from the market and transporting to the work site.

#### **Construction Phase**

Upon assumption that water consumption per person is <sup>1</sup> 150 lt/day,

The number of Persons to be Employed: 120 persons

Daily Water Consumption Volume Per Person: 150 litres/day

Water Volume to be Used:  $120 \times 150 = 18.000 \text{ lt/day} = \mathbf{18 \text{ m}^3/\text{day}}$ .

#### **Operating Phase**

A small team will be assigned for repair-maintenance works in periodic times of year during operating phase of overhead transmission line. However, since maintenance-

<sup>1</sup> Republic of Turkey The Ministry of Environment and Forestry, Guidelines on Waste Water Treatment, 2005,

repair works will last for a short term and water volume to be used by maintenance-repair personnel will be very low, this has not been calculated.

### **Energy Use**

In case of need of electrical energy in construction works of the Project, this will be provided by a mobile generator. Furthermore, fuels such as diesel, machine lubrication etc. for the vehicles to be used during construction will be supplied from fuel stations in the vicinity.

### **Other Uses**

Personnel to be employed in construction of overhead transmission lines will be accommodated in temporary prefabricated structures to be leased in settlement units near to the overhead transmission line; to be established on specific points along the route of the overhead transmission lines. Places of construction sites to be used within the scope of the Project have been determined during EIA process and it will be finalised upon commencement of construction phase. After designating the places of construction sites, their coordinates will be submitted to Kirikkale Provincial Directorate of Environment and Urbanization and Ankara Provincial Directorate of Environment and Urbanization.

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## **Section IV. 2. Description of Environmental Impacts and Mitigation Measures**

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### **Wastewater**

#### **Construction Phase**

The volume of domestic wastewater has been determined as 18 m<sup>3</sup>, based on the conservative assumption that water to be used by personnel to be employed in overhead transmission line will be returned as 100% wastewater. All domestic wastewater will be accumulated in structures to be leased in settlement units near to the overhead transmission line route (with electrical, water, sewer connection); in case of failure of finding suitable housing, they will be accumulated in cesspool whose sealing and impermeability have been proven in buildings of prefabricated construction site to be established on suitable places along overhead transmission line routes and they will be removed periodically by tanker by the Municipality for a fee.

The provisions of Law and Regulation of Water Products numbered 1380 and "Regulation of Water Pollution Control" (amended: Official Gazette numbered 28244 and dated 25/05/2012) effectuated by being published in the Official Gazette numbered 25687 and dated 31/12/2004 during each phase of the said project will be fulfilled and required measures will be undertaken.

A team of few persons will be assigned for repair-maintenance works in periodic times of year during operating phase of overhead transmission line. However, since maintenance-repair works will be short term, liquid waste to be made by personnel of maintenance-repair will not occur.

### **Solid Waste**

#### **Construction Phase**

Domestic solid waste arising from 120 persons to be employed in land preparation and construction phases of the Project has been calculated per person as 1,14 kg/day<sup>2</sup> ;

120 persons x 1,14 kg/day=136.8 kg/days domestic solid waste will be generated.

Domestic solid wastes arising from personnel to be employed during land preparation and construction phase of the project will be handled according to relevant articles specified ( in amended: Official Gazette numbered 25777 and dated 05/04/2005) "Regulation of Solid Waste Control" brought into effect by being published in Official Gazette numbered 20814 and dated 14.03.1991. Wastes formed within this scope will be dumped into garbage containers of relevant municipalities and their safe disposal will be ensured.

### **Dust Emission**

The procedures such as breaking, grinding etc. will not be performed during land preparation and construction phase of the project and dust emission may be caused from excavation procedures to be made for basic hollows of poles. Four hollows will be opened

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<sup>2</sup> TUIK 2010 Municipality Solid Waste Volume Annual Average

for each pole to be erected along route (dimensions of hollows whereby pole legs will settle vary as to type of poles).

Detail relating to the issue and information/calculations will be elaborated in EIA Report. It will be acted in compliance with relevant provisions of Regulation on Industrial Caused Air Pollution Control" numbered 28325 in the Official Gazette and dated 06.06.2012 amended hereof effectuated by being published in the Official Gazette numbered 27277 and dated 3 July 2009 in land preparation and construction phases of overhead transmission line.

### **Exhaust Emission**

Gas emissions such as NO<sub>x</sub>, CO, SO<sub>x</sub>. HC will occur as a result of diesel use as fuel in construction machines during land preparation and construction phase of the project.

Detail relating to the issue and information/calculations will be elaborated in EIA Report. It will be acted in compliance with relevant provisions of Regulation on Industrial Caused Air Pollution Control" numbered 28325 in the Official Gazette and dated 06.06.2012 amended hereof effectuated by being published in the Official Gazette numbered 27277 and dated 3 July 2009 in land preparation and construction phases of overhead transmission line.

### **Noise Emission**

There may be welding noise from equipment to be used in the works such as excavation, construction, installation etc. during land preparation and construction phase of the project as well as corona noise during operating phase.

The said Project is not included in the lists of Annex-1 and Annex-2 of Regulation on Permits and Licenses Required to be Obtained by the Law of Environment. Required measures will be taken for minimizing occurrence of noise by considering "The Requirements For Highway Vehicles" specified in 9th Article and "Requirements for Equipment Used In Open Area in 13th Article" of the said regulation.

The provisions of "Labour Law, Worker Health and Work Safety Bylaw" numbered 1475 as well as Assessment and Management Regulation for Environmental Noise effectuated by being published in the Official Gazette (as amended: Official Gazette numbered 27917 and dated 27.04.2011) effectuated by being published in the Official Gazette numbered 27601 and dated 04.06.2010 in each phase of the said project.

### **Package Wastes**

Packaging wastes likely to occur within the scope of the project will be types of wastes such as cement bags, machine and equipment caps, glass, bottle, metal box etc. Volume of these wastes will change and no conclusive information is given regarding their volumes.

Packaging wastes likely to occur in land preparation and construction phase of the Project will be disposed of in accordance with the provisions of "Regulation on Controlling Packaging Wastes" effectuated by being published in the Official Gazette numbered 28035 and dated 24.08.2011.

### **Excavation Wastes**

Surface stripping and excavation works will be carried out for opening foundation hollows of poles during land preparation and construction phase of overhead transmission line. Some portion of these excavation soils will be laid as backfill material in pole hollows and some portion of it will be laid under poles. (vegetable soil). Thus, excavation waste will not occur during construction phase.

### **Hazardous Waste and Waste Oil**

If possible, maintenance of construction equipments during construction and operation phases including oil change will be performed off-site in authorized services; therefore the possible generation of waste batteries, tires, waste oils and the parts contaminated with waste oils as a source of these transactions will be disposed of with the wastes collected in the related service establishment.

In case of non-availability of the authorized services for oil changes and maintenance procedures of construction machines, maintenance areas will be constituted in the construction site. Generated waste oils and contaminated parts will be collected in impervious containers and delivered to firms licensed by the Ministry

After cooking meals for the personnel to be employed in land preparation and construction phase of the Project, vegetable oil will occur. Volume of these wastes will change and no conclusive information is given regarding their volumes. Vegetable oils will under no circumstances disposed of randomly and will be accumulated in caps and will be returned to recycling facilities having License of Environment according to Regulation on Controlling Vegetable Waste Oils (as amended: Official Gazette numbered 27537 and dated 30.03.2010) effectuated by being published in the Official Gazette numbered 25791 and dated 19.04.2005.

### **Medical Wastes**

Medical wastes occurred during land preparation and construction phase of the Project will not be mixed with other wastes and will be given to relevant municipality by keeping them sealed separate container. The provisions of "Regulation on Controlling Medical Wastes" (as amended: Official Gazette numbered 27537 and dated 30.03.2010) effectuated by being published in the Official Gazette numbered 25883 and dated 22.07.2005 during activities.

### **EMF**

Electromagnetic radiation includes radio waves, micro waves, infrared rays, visible light, ultraviolet rays, x-rays, gama-rays and cosmic rays depending on wave lengths, frequencies and energies.

Primary radiation types are divided into two groups as ionizing radiation and non-ionizing radiation.

Ionizing radiation is an type of ionization where atoms around are directly or indirectly ionized by way of transferring its energy while penetrating through substance.

Radiation arising from base stations having fixed telecommunication devices not having ionizing effect, radio and television transmitters and electrical transmission lines,

substation and electrical home appliances (microwave oven, razors, hair drying machine etc.) is included in electromagnetic radiation group referred as non-ionizing radiation.



Figure 8. Comparison of Radiation Values By Factors Confronted During Daily Life

It is possible to divide effects of electromagnetic waves emitted from overhead transmission lines as "magnetic" and "electrical". Magnetic field is proportional with current passing through cable and electric field is proportional with voltage.

Electrical fields are generated by voltage and they get more powerful when voltage increases. Power of electrical field is measured as Volt/meter(V/m).

Magnetic field is a force to which other load particles applied intermediately by loaded particles. It creates circle and continuous field during current. Size of magnetic field and direction vary as to current intensity. Size of magnetic field is defined as Gauss (G).

Several research studies have been conducted in the issue of effects of electrical field and magnetic field over biological life. In this research, evaluation of effects over human health has been realized in few steps. These steps are fully determination of biological effects, how these effects human health and their frequencies.

Although there are both electrical and magnetic fields around electrical tools and overhead transmission and distribution lines, the recent researches have focused magnetic fields over potential human effects.

Thus, vast majority of studies conducted in relation to electrical and magnetic fields have become intensive in the issue of cancer researches. Some risk factors have been designated as to research results conducted and cancer risks have been revealed as to different effects.

For example, if risk factor is 2, this shows possibility of contracting cancer twice when compared with control group. Proven potential risk factors have been provided below.

**Table 9. Relative Risks Factors Likely to Cause Cancer**

Factor (Cancer Type)	Relative Risk	Reference																														
Smoking (Lung Cancer) *	10 - 40	Wyner and Hoffman, 1982																														
Workers Working with Benzene)2	1.5 -20	Sandier and Collman, 1987																														
Asbestos Professional Contact (Lung Cancer) <sup>z</sup>	2-6	Fraumeni and Blot,1982																														
Prenatal X-rays (Child Cancer)	2.4	Harvey and et al.,1985																														
Environmental Tobacco Smoke- Second Hand	2-3	Fielding and Phenow,1988																														
Hair Paint (Leukaemia)	1.8	Cantor et al., 1988																														
Transmission Lines (Child Cancer)	1.3	Wertheimer and Leeper,1979 Savitz and et																														
Sakarine (Bladder Cancer)	1.5-2.6	IARC,1987																														
Excessive Alcohol (Mouth Cancer)2	1,4-2,3	Tuyns,1982																														
Electric Works (Leukaemia)	1.4-1.9	Savitz and Calle,1987																														
Coffee (Bladder Cancer)	1.3-2.6	Morison and Cole, 1987																														
Chloride Surface Water (Bladder Cancer)	1.3-2.3	Subcommittee on Disinfectants By-																														
<table border="0"> <tr> <td>Relative Risk</td> <td>Coefficient</td> <td></td> </tr> <tr> <td></td> <td><u>Power</u></td> <td></td> </tr> <tr> <td>1,0-1,2</td> <td></td> <td>Never</td> </tr> <tr> <td>1,2-1,5</td> <td></td> <td>Weak</td> </tr> <tr> <td></td> <td>1,5-3,0</td> <td></td> </tr> <tr> <td></td> <td>Moderate</td> <td></td> </tr> <tr> <td></td> <td>3,0-10,0</td> <td></td> </tr> <tr> <td></td> <td>Powerful</td> <td></td> </tr> <tr> <td>10,0 Above</td> <td></td> <td></td> </tr> <tr> <td>Infinite</td> <td></td> <td></td> </tr> </table>	Relative Risk	Coefficient			<u>Power</u>		1,0-1,2		Never	1,2-1,5		Weak		1,5-3,0			Moderate			3,0-10,0			Powerful		10,0 Above			Infinite				<ul style="list-style-type: none"> <li>Relation of Cause-Effect is generally considered to be approved.</li> <li>Alcohol raise mouth cancer risk up to 1,5 in connection with heavy cigarette smoke.</li> </ul>
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**Reference:** Electrical Fields and Magnetic Fields, Volume II, TEAŞ Department of Environment, April 2001

Values in this table are a result of statistical studies and it can be easily inferred from the values in table that potential risk hard to be segregated from one another and effects surpassed or increased other effects.

As a result, adverse effects electrical and magnetic field over human life have not been proven. Magnetic field intensity reveal itself in variable levels in home appliances working with electricity used daily by us.

"Regulation on measures required to be taken in respect with protecting public health and environment from adverse effects of non-ionizing radiation" have become effect by being published in the Official Gazette numbered 27651 and dated 24.07.2010. Definition has been made in a way that 15000 V/m (15kV/m) limit values may not be exceeded for electrical field arising from overhead transmission lines desired in 50 Hz frequency in referred regulation and 2000 mG (200µT) limit values may not be exceeded. "Regulation of Electrical Force Current Installations" effectuated by being published in the Official Gazette numbered 24246 and dated 30 November 2000 has put some limitations to distances of overhead transmission lines to settlement places, roads and facilities and has bound permit installation of lines with these conditions. These distances have been complied during determination of the said project routes.

Limit values specified for electrical and magnetic fields of 50/60 Hz have been provided below with support of United Nations Environmental Program (UNEP) and cooperation of International Radiation Protection Association-International Non-Ionized Radiation Committee (IRPA/INIRC) and World Health Organization (WHO), Environmental Health Department.

**Table 10. Limit Values For The 50/60 Hz – Electrical Magnetic Fields**

Exposure Conditions		Electrical Area (kV/m)	Magnetic Area (Gauss)
Employees	Full day	10	5
	Short period (2days/hour)	30	50
	Organs	-	250
Public	24 hours/day	5	1.05
	Few hours in a day	10	10.05

**Reference:** Zipse,1993

Maximum magnetic field intensity has been determined as 800 mG in another study conducted for 500 kV transmission lines. This value is below 1.000 mG that public can be continuously exposed designated by IRPA/INIRC.

When effects of overhead transmission line to be installed within the framework this project are compared with the values of "Electrical and Magnetic Fields Arising from High Voltage Electrical Transmission Facilities" provided in the table below, it may be stated that it is below the values accepted for magnetic field. Table 11 presents the technical specifications of TEİAŞ.

**Table 11. High Tension – Electricity Transmission Facilities – Induced Electrical and Magnetic Spaces (Just Below Overhead Power Line, Just Above Underground Power Line, Approximate Measurement Range to SS)**

Facility Type	Electrical Area (kV/m)	Magnetic Field (mG)
154 kV EİH	0.3-1	9-14
154 kV Underground Transmission Line	3-4	25-27
154 kV GIS SS	3-5	35-39
154 kV SS	0.1-2	30-140
380 kV OHTL	1-3	35-60
154 kV OHTL	1-6	25-69

**OHTL:** Overhead Transmission Line **SS:** Substation **GIS:** Gas Insulated Compact Type Substation

**Reference:** Electrical Fields and Magnetic Fields, TEAŞ Department of Environment, April 2001

First and sole comprehensive study in respect with identifying electrical field and magnetic field levels arising from high voltage electrical transmission facilities in Turkey was carried out by TEAŞ and TUBITAK National Meteorology Institute in January, 2001(revoked). It is seen that effects 380 kV voltage overhead transmission lines are below international reference standard values according to the results of researches conducted in relation to intensities of electromagnetic fields emitted by overhead transmission lines. Having regard to the foregoing, it is forecast that locals will not be get affected in terms of health from electrical and magnetic fields arising from EİH extended from distance of settlement places to the extent possible.

The provisions of "Working At Powerful Current Facilities" Article 60 and "Accessing Current Installations" Article 59 specified in the Provisions relating to Operating Safety included in 7 Chapter "Electrical Force Current Facilities Regulation" effectuated by being published in the Official Gazette numbered 24246 and dated 30.11.2000 for human health and public within the scope of the said project against all kinds of risky and dangerous approaches will be compiled and measures will be taken.

Members of the public will be prevented access to the facilities, thereby complying with the requirements specified in relevant articles.

All ground works to be made for overhead transmission line will be performed according to "Installation Technical Specification" issued by TEİAŞ General Directorate and measures to be taken for electromagnetic compatibility of control systems and reducing effects of high frequency interventions will be made in compliance with "Regulation on Grounding of Electrical Facilities" numbered 24500 and dated 21/08/2001 of the Ministry of Energy and Natural Resources.

Electrical field cause electrical breaking off air over conductor surface and revealing of loaded particles and this is what called "corona" Corona noise is a crackling noise arising from conductors. Corona noise occurs at dry and wet air but, in light rain, corona noise may be a lot bigger than rain itself. Banded conductor transmission lines create very little corona noise and this noise is impossible to be heard beyond expropriation area.

When electric and magnetic fields consisting of 380 kV voltage overhead transmission lines are compared with both national and international limit values, it is seen that they remain below limit values designated.

Apart from this, while designating final route of line, clearance distances specified in Regulation of Electrical Force Current Installations" will be adhered to. Horizontal and vertical distances included in 44th Article of Electrical Force Current Facility" have been provided in the following tables.

**Table 12. Vertical Distances Required For Safe Approach**

Place where Conductors Pass Through	Vertical Distances (m)
The places where only pedestrians pass, water over which there is no traffic	6
Places such as suitable meadow, fields, pastures etc. for access of vehicles	7
Village and inter-city roads suitable for accessing of vehicles	8
International Highways	9
Water and canals over which there is traffic	6
Non-electric railways	8
Operating Lines	3.5
Electrical Lines	2.5
Structures	5
Tree	3

**Table 13. Horizontal Distances Required For Safe Approach**

AYDEM	Horizontal Distance of Facility to Its Edge
Railway and Highway	All dimensions of pole over-ground is + 2 or over highway and railway expropriation limit (those that is the biggest out of these)
Tree	3
Buildings	4

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### **Section IV. 3. Description of Social Impact and Mitigation Measures**

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#### **Employment**

Due to the Project, positive employment opportunity will also be created under present unemployment conditions within the region. Assuming that every one of 120 persons planned to be employed in stage of construction of said project would have a mean 4 – member family, approximately 480 persons are envisaged to utilize economical benefit due to this Project. Moreover, it also intended to get unskilled labor from the region as to be used during infrastructural works of the Project. Consequently, both regional economy and also Turkey economy will be positively affected.

It is predicted that the mean economical life of overhead transmission line would be more or less 40 years.

The project will most likely provide job opportunities to local people, so the regional economy will be affected positively.

On the other hand some of the necessary materials, equipment and workers needed in the construction and operation phase will most likely be purchased from local sources. The project will also bring economic benefits to the closed by villages and communities such as to restaurants, gas stations, hotels and building apartments, local food market, etc. Meaning that, regional economy will be indirectly affected in a positive way

#### **Property**

As a result of the survey and cadastral archive studies land usage status of the OHTL route, 80 km of the route passes through agricultural land (private property), 37 km forest area and 1 km zoned area.

At every stage of the project, the provisions of Regulation Regarding Soil Pollution Control and Point - Sourced Contaminated Areas taken effect by having been published in the Official Gazette numbered 27605 and dated 8 June 2010 (Amended by O.G. numbered 28323 and dated 14 June 2012) and "Soil Conservation and Land Use Law" numbered 5403 taken effect by having been published in the Official Gazette numbered 25880 and dated 19 July 2005 will be followed and necessary precautions will be taken and concerning the areas within the location of poles and the corridor where expropriation will be effected covered by the scope of Preservation and Land Use Law numbered 4342 and Pasture Law numbered 54034, necessary permissions will be obtained from Kırıkkale Provincial Food, Agriculture and Livestock Management and Ankara Provincial Food, Agriculture and Livestock Management.

Since forest areas have no expropriation procedure, regarding the line which passes through forest areas, as per article 17/3 of Law on Forest no 6831, necessary permissions will be taken from General Directorate of Forests.

Total distance either side of the mid-line during determination of easement areas exhibits variance due to factors of topography, climatic conditions and etc. within the region where such line was planned to pass. In general, this distance gets narrowed at the points where the poles exist and widened between the poles. Amounts of easement and expropriation spaces will be precise following preparation and approval of the expropriation plans.



	SOURCE	POSSIBLE EFFECTS	MEASURES TO BE TAKEN
	the Project.	problems.	Control" effectuated by being published in Official Gazette numbered 20814 and dated 14.03.1991. Wastes formed within this scope will be dumped into garbage containers of relevant municipalities and will be ensured their disposal.
DUST EMISSION	<b>Construction Phase:</b> There will be dust emission from excavation works to be made for digging foundation hollows of poles during land preparation and construction phase of the Project.	Dust emission may temporarily cause soil and water pollution indirectly. Also it will have temporary effect against human health and flora and fauna of environment.	Loading and unloading procedures will be made without scattering during construction works for preventing dust formation. Covers will be placed over vehicles in case of need of transportation procedures.
EXHAUSE EMISSION	Gas emissions such as NOx, CO, SOx. HC will occur as a result of diesel use as fuel in construction machines during land preparation and construction phase of the project.	Exhaust emission may temporarily cause soil and water pollution indirectly. Also it will have temporary effect against human health and flora and fauna of environment.	Maintenance of vehicles to be used for minimizing emissions arising from construction machines will be conducted periodically.
NOISE EMISSION	<b>Construction Phase:</b> Noise will be created arising from operation of construction machines during land preparation and construction phase of the land.  <b>Operating Phase:</b> It is expected that there will be corona noise consisting of overhead transmission line.	There are adverse effects over human health and fauna during construction. Noise levels arising from Electrical Transmission Lines during operating phase are in low level as seen in similar facilities. Thus, it is not expected that adverse effect will be over human health and fauna relating to noise during operating phase.	New and recently-maintained machines will be preferred in selection of construction machines to be used in land preparation and construction phase of the land. Care will be given that as minimum as possible vehicle will be operated at the same time. All works will be conducted in daylight. In this way, it will be ensured that limit values will not be exceeded.
PACKAGING WASTE	Packaging wastes likely to occur within the scope of the project will be types of wastes such as cement paper, machine and equipment caps, glass, bottle, metal box etc.	Unless disposed, it may cause contamination of water sources either both in infrastructure and superstructure, soil pollution.	Packaging wastes created during land preparation and construction phase of the land will be separated according to their categories and those that are re-usable will be given to recycling firms having environmental license and recycling process will be ensured.

	SOURCE	POSSIBLE EFFECTS	MEASURES TO BE TAKEN
HAZARDOUS WASTE/ WASTE OIL	After cooking meals that are requirement of personnel to be employed in land preparation and construction phase of the Project, vegetable oil will occur.	Unless disposed, it may cause contamination of water sources either both in infrastructure and superstructure, soil pollution, fauna and human health.	Vegetable oils will under no circumstances disposed of randomly and will be returned to recycling facilities having License of Environment according to Regulation on Controlling Vegetable Waste Oils (as amended: Official Gazette numbered 27537 and dated 30.03.2010) effectuated by being published in the Official Gazette numbered 25791 and dated 19.04.2005.
	Hazardous waste and waste oil will be generated due to possible maintenance/repair works	Unless disposed, it may cause contamination of water sources either both in infrastructure and superstructure, soil pollution, fauna and human health.	Possible generation of waste batteries, tires, waste oils and the parts contaminated with waste oils as a source of these transactions will be collected in impervious containers and delivered to firms licensed by the Ministry
MEDICAL WASTE	There may be medical waste due to work accidents during land preparation and construction phase of the Project.	Unless disposed, it may cause contamination of water sources either both in infrastructure and superstructure, soil pollution, fauna and human health.	Medical wastes occurred during land preparation and construction phase of the Project will not be mixed with other wastes and will be given to relevant municipality by keeping them sealed separate container. The provisions of "Regulation on Controlling Medical Wastes" (as amended: Official Gazette numbered 27537 and dated 30.03.2010) effectuated by being published in the Official Gazette numbered 25883 and dated 22.07.2005 during activities.
EMA (Electromagnetic Field)	<p><b>Operating Phase:</b></p> <p>It is possible to divide effects of electromagnetic waves emitted from overhead transmission lines as "magnetic" and "electrical".</p>	<p>Several researches have been conducted in the issue of effects of electrical field and magnetic field over biological life. :</p> <p>It is contemplated that there are adverse effects over especially human health in these researches.</p>	<p>Since effects of electro magnetic fields arising from EIH are very low, it is not expected that any adverse effect will be in question for human health or other living beings.</p> <p>Since the project will be projected by considering all kinds of safety measures and distances sufficient and required stipulated by "Regulation on Electrical Force Current Installations" against all kinds of approaches likely to be handled as risky and dangerous for human health and environment, the project will not pose any risk or danger.</p>
FLORA-FAUNA	<p><b>Construction Phase:</b></p> <p>During excavation works, flora species present at the bottom of the poles will be removed locally. In addition there will be noise pollution due to construction works.</p> <p><b>Operation Phase:</b></p> <p>The effect of electromagnetic field of energy transmission lines will be seen on flora-fauna in 2 ways as "magnetic and electric"</p>	<p>Noise pollution may result in migration of mobile fauna species from the Project area</p> <p>According to academic research, adverse electromagnetic effect on floral species due to energy transmission lines are not proved clearly.</p>	<p>After top soil works, removed soil will be laid back to its original form.</p> <p>In case of damage to fauna species, expert staff will be notified immediately and precautions will be taken. For treatment relevant parties will be contacted and necessary process will be implemented. In the construction phase staff will be trained by expert personnel about how to behave and what they should do in such cases</p>
	SOURCE	POSSIBLE EFFECTS	MEASURES TO BE TAKEN

	SOURCE	POSSIBLE EFFECTS	MEASURES TO BE TAKEN
WASTE WATER	<b>Construction Phase:</b> Domestic waste water shall occur due to personnel to be employed	Unless treated, it causes to infrastructure and superstructure water pollution and and soil conservation.	All domestic waste waters shall be accumulated in structures to be leased in settlement units nearby overhead transmission line route (with electrical, water, sewer connection); in case of failure of finding suitable housing, they shall be accumulated in cesspool whose sealing and impermeability have been proven in buildings of prefabricated construction site to be established on suitable places along overhead transmission line routes. and they shall be drawn periodically by municipality and special sector for a fee.
	<b>Operating Phase:</b> There shall not be waste water.		
SOLID WASTE.	Domestic solid waste shall occur arising from personnel to be employed in land preparation and construction phase of the Project.	Unless disposed, it may cause contamination of water sources either both in infrastructure and superstructure, soil pollution, odour problems.	Domestic solid wastes arising from personnel to be employed during land preparation and construction phase of the project shall be handled according to relevant articles specified ( in amended: Official Gazette numbered 25777 and dated05/04/2005) "Regulation of Solid Waste Control" effectuated by being published in Official Gazette numbered 20814 and dated 14.03.1991. Wastes formed within this scope shall be dumped into garbage containers of relevant municipalities and shall be ensured their disposal.
DUST EMISSION	<b>Construction Phase:</b> There shall be dust emission from excavation works to be made for digging foundation hollows of poles during land preparation and construction phase of the Project.	Dust emission may temporarily cause soil and water pollution indirectly. Also it shall have temporary effect against human health and flora and fauna of environment.	Loading and unloading procedures shall be made without scattering during construction works for preventing dust formation. Covers shall be placed over vehicles in case of need of transportation procedures.
EXHAUSE EMISSION	Gas emissions such as NOx, CO, SOx. HC shall occur as a result of diesel use as fuel in construction machines during land preparation and construction phase of the project.	Exhaust emission may temporarily cause soil and water pollution indirectly. Also it shall have temporary effect against human health and flora and fauna of environment.	Maintenance of vehicles to be used for minimizing emissions arising from construction machines shall be conducted periodically.
NOISE EMISSION	<b>Construction Phase:</b> Noise shall be created arising from operation of construction machines during land preparation and construction phase of the land.	There are adverse effects over human health and fauna during construction. Noise levels arising from Electrical Transmission Lines during operating phase are in low level as seen in similar facilities. Thus, it is not expected that adverse effect shall be over human health and fauna relating to noise during operating phase.	New and recently-maintained machines shall be preferred in selection of construction machines to be used in land preparation and construction phase of the land. Care shall be given that as minimum as possible vehicle shall be operated at the same time. All works shall be conducted in daylight. In this way, it shall be ensured that limit values shall not be exceeded.
	<b>Operating Phase:</b> It is expected that there shall be corona noise consisting of overhead transmission line.		

	SOURCE	POSSIBLE EFFECTS	MEASURES TO BE TAKEN
PACKAGING WASTE	Packaging wastes likely to occur within the scope of the project shall be types of wastes such as cement paper, machine and equipment caps, glass, bottle, metal box etc.	Unless disposed, it may cause contamination of water sources either both in infrastructure and superstructure, soil pollution.	Packaging wastes created during land preparation and construction phase of the land shall be separated according to their categories and those that are re-usable shall be given to recycling firms having environmental license and recycling process shall be ensured.
HAZARDOUS WASTE/ OIL	After cooking meals that are requirement of personnel to be employed in land preparation and construction phase of the Project, vegetable oil shall occur.	Unless disposed, it may cause contamination of water sources either both in infrastructure and superstructure, soil pollution, fauna and human health.	Vegetable oils shall under no circumstances disposed of randomly and shall be returned to recycling facilities having License of Environment according to Regulation on Controlling Vegetable Waste Oils (as amended: Official Gazette numbered 27537 and dated 30.03.2010) effectuated by being published in the Official Gazette numbered 25791 and dated 19.04.2005.
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	SOURCE	POSSIBLE EFFECTS	MEASURES TO BE TAKEN
<b>FLORA-FAUNA</b>	<p><b>Construction Phase:</b></p> <p>During excavation works, flora species present at the bottom of the poles will be removed locally. In addition there will be noise pollution due to construction works.</p> <p><b>Operation Phase:</b></p> <p>The effect of electromagnetic field of energy transmission lines will be seen on flora-fauna in 2 ways as "magnetic and electric"</p>	<p>Noise pollution may result in migration of mobile fauna species from the Project area</p> <p>According to academic research, adverse electromagnetic effect on floral species due to energy transmission lines are not proved clearly.</p>	<p>After top soil works, removed soil will be laid back to its original form.</p> <p>In case of damage to fauna species, expert staff will be notified immediately and precautions will be taken. For treatment relevant parties will be contacted and necessary process will be implemented. In the construction phase staff will be trained by expert personnel about how to behave and what they should do in such cases</p>