Initial Environmental Examination

September 2014

TAJ: Wholesale Metering and Transmission Reinforcement Project

Prepared by Fichtner for Barki Tojik of the Republic of Tajikistan and for the Asian Development Bank.

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Abbreviations

A	Ampere
ADB	Asian Development Bank
AH	Affected household(s)
AP	Affected person(s)
asl	above sea level
ASAP	as low as reasonable practicable
BAT	Best Available Technique
CC	Construction Contractor
CIGRE	International Council on large Electric Systems
DIN	Deutsches Institut für Normung (German Industrial Standard)
EC	European Community
EMF	Electric and magnetic fields
EMP	Environmental Management Plan
EMMP	Environmental Management and Monitoring Plan
EN	European Norm
EIA	Environmental Impact Assessment
Ft	feet
G	Giga (10^9)
GDP	Gross Domestic Product
GIS	gas insulated
HIV	Human Immunodeficiency Virus
HPP	Hydropower Plant
HSE	Health, Safety and Environment
HSEMP	Health, Safety and Environment Management Plan
HSEMS	Health, Safety and Environment Management system
Hz	Hertz
IBA	Important Bird Area
ICNIRP	International Commission on Non-Ionising Radiation Protection
IEC	International Electrotechnical Commission
IEE	Initial Environmental Examination
IEEE	Institute of Electrical and Electronics Engineers
INRC	International Non-Ionizing Radiation Committee
IRPA	International Radiation Protection Association
IUCN	International Union for Conservation of Nature
k	kilo (10^3)
kV	kilovolt
kWh	kilowatt hour
LARP	Land Acquisition and Resettlement Plan
µ	micro (10^{-6})
NIR	non-ionizing radiation
OHL	Overhead Line
PCB	Polychlorinated Biphenyls
PCDD	Polychlorinated Dibenzodioxins
PCDF	Polychlorinated Dibenzofurans
PIC	Project Implementation Consultant
PMU	Project Management Unit for Elektro-Energy Sector

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RoW	Right of Way
SCADA	Supervision Control and Data Acquisition System
SF_6	Sulfur Hexafluoride
SS	Substation
STD	Sexually Transmitted Diseases
STI	Sexually Transmitted Infections
T	Tesla
TCDD	Tetrachlorodibenzo-p-dioxin
USD	US Dollar ($)
V	Volt
VDE	Association of German Electricians
WCPA	World Database on Protected Areas
WHO	World Health Organization
WWF	World Wide Fund for Nature

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0. Executive Summary

0.1 Policy, Legal, and Administrative Framework

Environmental Legislative Framework and national Requirements for Environmental Assessment
The principles performing the IEE process are laid down in the Law on Ecological Expertise and in the Procedure on Environmental Impact Assessment of 2013.

Following this law, the company which is developing a project has to prepare an Environmental Impact Assessment (EIA) to the project concerned.

Administrative Framework
The Tajik authority who is responsible for issuing environmental permits for infrastructural projects is the Committee of Environment Protection. In order to implement the Project, the Government of the Republic of Tajikistan set up the 'Project Management Unit for Elektro-Energy Sector' (PMU). Within this PMU the Social Sector and Environmental Monitoring Department has been established. This department is responsible for foreign financed projects.

ADB Requirements for Environmental Assessment
This IEE was carried out in accordance with the relevant ADB guidelines.

0.2 Description of the Project

This document represents the Initial Environmental Examination (IEE) Report on the **ADB** -TA-8547 TAJ: Wholesale Metering and Transmission Reinforcement.

General Description
The project consists of the construction of approximately 95 km of 220 kV OHL between Ayni Substation (Ayni region) and Rudaki Substation (Penjikent region) including construction of additional bays and rerouting of existing connections in both substation.

Location
The Project is planned to be realized in West-Tajikistan.

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Map 0-1: Location of the 220kV OHL, Rudaki Substation and Ayni Substation

General Situation and Scope of Project

The Penjikent region in Tajikistan still suffers from the disconnection from the Central Asian Power System in November 2009. Prior to the disconnection, the Penjikent region was supplied from two 220 kV lines from Uzbekistan. From Penjikent (substation Rudaki) electricity was further transmitted to Ayni region. This electricity was transmitted over 102 km through a 110 kV line.

For the moment, the old 110 kV line is used to supply Penjikent region with electricity from the new constructed Ayni-220 kV Substation. As the demand in Penjikent is higher than the capacity of the line, households and industry in the region suffer from load shedding even in summer time, which is energy surplus period in Tajikistan.

Category of the Project

Based on the rapid environmental assessment, Category B was preliminary assigned to project

According to ADB Safeguard Policy Statement, June 2009 an Initial Environmental Examination (IEE) is required to determine whether significant environmental impacts warranting an EIA are likely.

Project Description

The Project covers the new construction of about 100 km 220kV overhead line, the partly rehabilitation of s/s Rudaki and the connection of the 220 kV line with s/s Rudaki and s/s Ayni.

The rehabilitation measures will require the exchange of old transformers and circuit breakers. Both contain large amounts of oil that has to be

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handled. A possible pollution with PCB has been investigated and could be excluded.

Methodology
During the second week of July, Fichtner's environmental expert conducted a complete field survey from s/s Rudaki along the proposed line to s/s Ayni. During this visit he consulted the local environmental authorities at Penjikent and at Ayni to clarify the location of protected areas that might be affected by the line routing.

An additional survey and consultations were done by the local environmental expert in the third and fourth week of July 2014.

Between 25 and 28 July public consultations were held in the course of the social survey. During these meetings the Project has been introduced to the population and environmental questions have been discussed. In addition during meetings with stakeholders in the region took place.

Proposed Schedule for Implementation
The Feasibility Study will be finished in 2014 and the tender documents will be published in 2015. Start of construction will be earliest in 2016.

0.3 Description of the Environment

Geography and Topography
The project has an altitudinal range from 950 m asl (Penjikent SS) to 1400 m asl (Ayni SS). The Zerafshan valley (in which the OHL will mainly take its course) is quite narrow near Ayni but widens up around Dasthikazy. The surrounding mountains do have steep slopes with high rates of erosion and the risk of landslides.

Geology, Seismology and Soil
Zerafshan Valley is surrounded by folded Paleozoic rocks; the valley itself is filled with Meso-Cenozoic sediments. The type of soil varies depending on the altitude. In the plains and floodplains, gray soil is predominant. This soil is poor in humus, but gives good yields when irrigated and fertilized.

Zerafshan Valley lies in a seismological active region; earthquakes which measure up to 4 on the Richter scale are possible.

Climate
Tajikistan has a continental climate. Heavy rainfalls occur, making the steep slopes on the riverside even more vulnerable to landslides and mudflows.

Water Resources
Zerafshan River has its source at the edge of Pamir. In total, the river length is 781 km, and the total river basin covers 4,000 km^2.

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The groundwater level varies considerably depending on the morphology and season. In floodplains, the water table is close to the surface but where the line corridor is running through mountainous areas the water level is more than some tens of meters below.

Climate Change
Related to the project, the probable events related to climate change may lead to an increased frequency and severity of disasters like landslides, and mudflows affecting the stability of towers.

Biological Resources
Tajikistan features a great diversity of flora. More than 5,000 species of plants are recorded in the country. Grasses, bushes, and shrubs predominate. Most of the line corridor is crossing semi-arid areas with rocky out crops. The vegetation is heavily degraded, bushes and forests are destroyed almost everywhere.

Protected Areas
There are two Nature Refuges (IUCN Category IV) and one Important Bird Area located in the investigation area. They will not be affected by the project.

Land Use
Agriculture is the most important sector of the economy in the valley. With wheat and oats being the most important crops, there are some additional incomes with the growing of apricots, apples, grapes, mulberry and peach. Pastures are poor for cattle.

Socio-economic Conditions
The Penjikent District has 214,000 inhabitants. Penjikent is the capital with 33,000 inhabitants. Ayni District is bigger but with fewer inhabitants (72,000). Almost all of them live in rural areas, where living conditions are primitive.

The poverty rate is estimated to be at 39.6 % and unemployment is a problem. Many able-bodied men look for work abroad (mainly in Russia).
At present, Tajikistan's potential as a tourist site is rather low.

Cultural/Historical Heritage
The territory of Tajikistan has been continuously inhabited since the early Stone Age. It is located on the important historical trade routes of the Silk Road connecting East and West.

There are two important archaeological sites situated near Penjikent (Sarazm and Panjikant), none of them is affected by the project.

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Infrastructure
Ayni has direct connections not only to the capital Dushanbe (including the main airport of Tajikistan) in the south, but also to the eastern and northern parts of the country. Both Penjikent and Ayni have small airports.

0.4 Anticipated Environmental Impacts and Mitigation Measures

During the detailed Design Phase, line routing was done in view of avoiding impacts on settlements, land use, landscape, soil, surface waters and groundwater, flora and fauna, protected areas, cultural and historical sites, and infrastructure (e.g. roads, other OHL) as far as possible. During the construction and operation phases, the Project might mainly cause the following impacts:

During construction:
- land acquisition;
- visual impacts on the landscape;
- soil pollution and erosion;
- pollution of surface water and groundwater;
- damage to vegetation, habitats and protected areas;
- damage to cultural and historical sites;
- waste generation (steel, ceramics, used oil) due to demolition of equipment like old circuit breakers and replacement of two old transformers; domestic waste generation by the workers;
- waste water generation by workers
- contribution to climate change (SF_6 gas);
- air pollution;
- impacts on health and safety (e.g. through works under high voltage, spread of STD/STI/HIV/AIDS);
- noise emissions and vibration;
- impacts on infrastructure and power supply;
- loss of houses and livelihood, involuntary resettlement;
- socio-economic impacts and influx of workers.

Included in operational costs

During operation:
- change of land use;
- visual impacts on the landscape;
- pollution of soil, surface water and groundwater;
- impact on flora during maintenance works;
- electric and magnetic fields;
- contribution to climate change (SF_6 gas);
- socio-economic impacts
- interference with air traffic
- impact of climate change phenomena on the stability of towers
- impact on birds in vicinity of IBA.

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During the design of a proper line corridor, highest priority was laid on the avoidance of settlements and housings. The selected line routing does not require any physical relocation of houses.

Old oil from s/s Rudaki has been tested for a possible contamination and can be declared free of PCB. Consequently, it can be refined and reused without problems.

Possible effects of climate change phenomena like an increase in frequency and severity of mass movements (e.g. landslides, mudflows) affecting the stability of towers are reflected in the design.

Positive Project impacts are the employment of also unskilled workers during construction and a much more reliable power supply for the region of Penjikent.

In summary, from the results of the investigation it can be seen that the Project will have only low environmental and social impacts if the proposed mitigation measures are implemented.

0.5 Analysis of Alternatives

The new 220 kV line route was first supposed to be either parallel to or instead of the existing 110kV. Realization of both was not possible.

Without the Project the Penjikent region will stay isolated from the main transmission grid of Tajikistan and the power supply will not be reliable what impedes industrial development.

0.6 Information Disclosure, Consultation and Participation

Together with the public consultations performed between 25th and 28th of July in the framework of the preparation of the LARP two public meetings were held in the district of Ayni and four at Penjikent. The participants of the meetings were asked for any complaints concerning environmental issues related to the project. No complaints were raised neither because of needed truck movements, nor because of aesthetic issues or because of electric and magnetic fields.

General the problem of clean drinking water was raised and one village complaint about the waste dumping situation. The dirt and smoke from burning waste was described being very annoying some time.

End of July also meetings with stakeholders as municipal administration and environmental departments at Penjikent and Ayuni have been performed.

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0.7 Grievance Redress Mechanism

Great care is taken to prevent grievances. This has been done so far through careful land acquisition design and implementation, by ensuring full AF participation and consultation, and by establishing extensive communication and coordination between the community, the PMU and the local governments also regarding general environmental issues. This notwithstanding, complaints are sometimes unavoidable and a grievance mechanism has been established for the project to allow the APs the opportunity to appeal against any disagreeable decision, practice or activity arising from compensation/ rehabilitation process. Efforts to make APs fully informed of their rights and of the procedures for addressing complaints will continue during civil works.

0.8 Environmental Management Plan

General Environmental Obligations
The Environmental Management Plan (EMP) as stipulated in this IEE Report lists all needed mitigation and monitoring measures necessary to implement the Project in an environment-friendly manner. Monitoring measures and related monitoring parameters, location, measurement, frequency, responsibilities and costs are given for the construction and operation phases of the Project.

Contractor's Health and Safety (H&S) Obligations
Considering the defined H&S targets, the H&S objectives for the Project are:

- Above all 'ZERO ACCIDENT'
- to design overhead lines and substations that are intrinsically safe, a healthy place to work in and have an as low as reasonable practicable impact on the environment;
- to execute the erection, construction and commissioning and to initiate the start-up of the overhead lines and substation operation without health or environment related incidents and to form the basis for a safe operation and maintenance;
- to comply with the applicable laws and regulations.

In order to reach these objectives, the Contractor shall develop, implement and operate an Health and Safety Management Plan (HSMS) and shall determine persons being responsible for all H&S issues on construction site(s). Key tasks to be considered by the contractor are given. The main focus of H&S during construction is the preparation and consideration of a site-specific H&S plan. Minimum requirements with respect to H&S at the construction site are included in the text. The employer shall have the right to extend these H&S requirements in case of the needed actions to fulfill the H&S targets and objectives.

In order to fulfil the health and safety tasks and the environmental requirements given in this EMP the contractor has to set up an overall Health, Safety and Environment Management Plan (HSEMP) and implement a Health, Safety and Environment Management System

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(HSEMS). Such a system includes beside health and safety issues also environmental needs.

Institutional Arrangements and Reporting Needs
The construction contractor is obliged to implement the EMP. Doing so, he shall set up a Health, Safety and Environmental Management Plan (HSEMP) and install a Health, Safety and Environmental Management System (HSEMS) during the entire construction period covering all construction sites and all construction activities (see Section 8.3).

The 'Social Sector and Environmental Monitoring Department' within the PMU as a governmental establishment will be responsible for supervising and monitoring the implementation of the EMP by the CC: For that, the PMU shall perform field visits about twice a month. The PMU is supported by the Project Implementation Consultant (PIC).

The CC will prepare monthly progress reports about the implementation of the EMP. Based on these reports and own field visits the PMU shall prepare monthly Safeguard Monitoring Reports showing the progress of the implementation of the Environmental Management Plan (EMP). The reports shall contain all discrepancies from the EMP and list all HSE relevant incidents and accidents that occur during the implementation of Project.

Based on these reports the Social Sector and Environmental Monitoring Department will prepare semi-annual safeguard performance and monitoring reports and submit them to ADB, to Barqi Tojik and to other relevant national authorities. In doing so, the PMU will be supported by the Project Implementation Consultant (PIC).

In addition, the implementation of the EMP shall be audited twice a year by an independent internationally experienced auditor.

Costs of EMP
The costs of implementation of the mitigation and monitoring measures stipulated in the EMP are **170,500 USD**.

Tender Documents
The Environmental Management Plan presented herewith shall be part of the tender documents to be prepared to the Project.

0.9 Conclusion and Recommendations

During the design of a proper line corridor, highest priority was laid on the avoidance of settlements and housings. The selected line routing does not require any physical relocation of houses.

The borders of the Soy Vota Nature Reserve have been respected in the line routing. To be sure to be outside of the reserve, two towers were moved to the north. The Zerafshansky Nature Reserve is also not affected by the line corridor. Installation of bird spikes and diverters are envisaged in proximity to IBA.

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The old oil resulting from the rehabilitation measures foreseen at s/s Rudaki was analyzed for PCB. Only oil of the circuit breaker OHL 2 contains traces of PCB. The amount of this sample is 8.3 ppm, which is clearly under the threshold value of 50 ppm. In all other samples no PCB was detected (the detection limit of 0.2 ppm was even not reached). All analyzed oil can therefore be considered to be free of PCB. This is consistent to the experience gained in other projects at Tajikistan and other countries of the former Soviet Union. Consequently, the oil can be refined and reused again and no corresponding Management Plan needs to be developed (for more information about PCB and relevant standards in oil see Annex 10.13)

Possible effects of climate change phenomena like an increase in frequency and severity of mass movements (e.g. landslides, mudflows) affecting the stability of towers are reflected in the design.

Positive Project impacts are the employment of also unskilled workers during construction period and a much more reliable power supply for the region of Penjikent. At the moment, this region is only served via an old 110 kV line since the power supply from Uzbekistan is cut off. During construction a long term power shut down is not necessary. Short interruptions (< 8 hours) for connection activities may appear.

To this 220 kV line of the Transmission Reinforcement Project an Environmental Management Plan (EMP) including mitigation and monitoring measures has been developed. This EMP shall be part of the tender documents and the implementation of the EMP shall be supervised by the future Project Implementation Consultant and the PMU and monitored twice a year by an internationally experienced expert.

The overall costs for implementation of the EMP will be **170,500 USD**.

In summary, from the results of the investigation it can be seen that the Project will have only low site-specific environmental and social impacts if the proposed mitigation measures are implemented.

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1. Policy, Legal, and Administrative Framework

1.1 General Provisions

The Republic of Tajikistan is divided into two Provinces (Chatlon and Sughd), one autonomous Province (Gorno-Badakhshan) and the Districts of Republican Subordination. The capital Dushanbe is administered separately.

Tajikistan is a dominant-party system with the People's Democratic Party of Tajikistan being the biggest party. It is a presidential Republic with Emomalii Rahmon being the President since 1994.

The Prime Minister is Kokhir Rasulzoda, the First Deputy Prime Minister is Matlubkhon Davlatov and the two Deputy Prime Ministers are Murodali Alimardon and Ruqiya Qurbanova.

1.2 Environmental Legislative Framework including national Requirements for Environmental Assessment

The most important laws concerning the Environment in Tajikistan are:

- Law on Environmental Protection (2011)
- Law on Ecological Expertise (2012)
- Law on Environmental Impact Assessment (2012)

These laws will be described in the following. For further information about environmental Laws, see Annex 10.1.

Environmental protection in Tajikistan is embedded in the Law on Environmental Protection of 1993 amended in 1997 and superseded by 2011 (№208) Law on Environmental Protection. It defines the legal framework, protected objects, and the role and responsibilities of the Government, the Committee for Environmental Protection (CEP), local authorities, public organizations and citizens. The Act also provides the guarantee of citizens' rights to a healthy and favorable environment and requires the use of a combined system of environmental impact assessment and evaluation of the environmental impact assessment (EIA), in any decision in respect of activities that may have a negative impact on the environment. Under the law, citizens have the right to live in a healthy environment and the right to protection from negative environmental impacts. Citizens have the right to receive environmental information, as well as participate in the development, adoption and implementation of decisions relating to the environmental impacts.

The principles performing the IEE process are laid down in the Law on Ecological Expertise (2003 amended in 2005, 2007, 2008, 2010, superseded in 2012 by the new Law on Ecological Expertise, State environmental review) and in the Governmental Decree ‘course of the Assessment of Environmental Impact’ of 2006 (amended in 2013, now called Procedure on Environmental Impact Assessment, № 252). This

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Resolution approves the list of facilities and activities which require the development of materials necessary for assessment of impact on the environment. National and interstate power lines relates to activities which might have high environmental risk. Since the 220 kV OHL line Ayni- Penjikent relates to national power lines, it is included in this list requiring impact assessment studies.

The Law on Environmental Impact Assessment, new version adopted and signed by the President of the Republic of Tajikistan in 2012 (№ 818) regulates the general procedure for environmental assessments organization and guiding, defines the rights and obligations of the parties, and establishes the rights of citizens to obtain information on environmental hazards and construction activities. The Law defines the principles and procedures for environmental impact assessment, having the purpose of studying the compatibility of proposed actions and projects with the requirements of environmental legislation and standards (norms) and environmental safety of society.

Together with a detailed project description, the EIA study is the basis to go for the environmental permit and has to be submitted to the Committee. As a rule, the Committee prepares an expertise to the project within one month. In preparation of this expertise, all subdivisions that might be involved in the project do participate. With this expertise, the permission is given, is not given or given with requirements and obligations that have to be followed by the company during construction and/or during operation. If the Committee comes to the conclusion that an environmental permit cannot be given because e.g. limit values are exceeded or other environmental aspects are not sufficiently mitigated, the developer can change its design and submit the impact assessment again.

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1.3 Administrative Framework

The Tajik authority who is responsible for issuing environmental permits for infrastructural projects is the Committee of Environment Protection. This committee is directly ranked under the government of the Republic of Tajikistan and has the status of a ministry. The Committee has several subdivisions dealing with nature protection areas, soil, water, hydro-meteorology etc. and has departments in the regions.

In order to implement the Project, the Government of the Republic of Tajikistan set up the 'Project Management Unit for Elektro-Energy Sector' (PMU). Within this PMU the Social Sector and Environmental Monitoring Department has been established. .

In May 2014, the 'Social Sector and Environmental Monitoring Department' within the Project Management Unit (PMU) consisted of 5 persons. This department is responsible for all foreign financed projects except for one World Bank Energy Loss Reduction Project that has created its own PMU.

In 2006, the PMU was restructured and is now directly working under the Government of Tajikistan, supervised by the Ministry of Energy. The 'Social Sector and Environmental Monitoring Department' is equipped with sufficient computers, printers and needed software. The department has no own cars for transportation, but cars from the PMU are available.

The department is in full operation and will be responsible for conducting and/or supervising all necessary works in the field of implementation of the mitigation measures and monitoring actions including of all needed HSE aspects as outlined in this report to the Project. During implementation of the Project this department is supported by international experienced environmental and social experts who will conduct regular construction site audits in order to supervise the implementation of the foreseen mitigation and monitoring measures.

In **Tab. 1-1** below the staff list of the Social Sector and Environmental Monitoring Department within the PMU is given.

Name	Position	Responsible for Project(s)
KARIMOV SIROJIDDIN	Head of the Department	
ASLAMOVA Takhmina	Deputy head of Department, Leading specialist on social and environmental issues	ADB, IDB and KFW financed Projects
DUSTOV AZIZ	Leading specialist on social and environmental issues	ADB, IDB and KFW financed Projects
KHOKIROEVA SHAHLO	Senior specialist on environmental issues	ADB and IDB financed Projects
SHARIPOV KHISRAV	Senior specialist on environmental issues	ADB and IDB financed Projects

Tab. 1-1: Staff of the 'Social Sector and Environmental Monitoring Department' (2014)

1.4 International Agreements

Among others, Tajikistan is part of the Convention on Biological Diversity, the Ramsar Convention on 'Protection of Wetlands', the Montréal Protocol on Substances that Deplete the Ozone Layer, and the UN Conventions on Climate Change and Desertification.

Electric and Magnetic Field:

- ICNIRP recommended 50/60 Hz the Recommendations of the International Non-Ionizing Radiation Committee (ICNIRP) for 50/60 Hz frequencies;
- European Directive 2004/40/EC

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SF_6Handling:

- Recommendations of the International Council on large Electric Systems (CIGRE: SF_6 Task Force: Handling and given Recycling of SF_6 Mixtures) (www.cigre.org);
- DIN EN* 60376 'Specification of technical grade sulfur hexafluoride (SF_6) for use in electrical equipment'
- DIN EN 60480 'Guidelines for the checking and treatment of sulfur hexafluoride (SF_6) taken from electrical equipment and specification for its re-use'
- IEC 62271: High-voltage switchgear and controlgear - Part 303: Use and handling of sulphur hexafluoride (SF_6)

1.5 ADB Requirements for Environmental Assessment

The environmental safeguard policy of the Asian Development Bank (ADB) is grounded in ADB's poverty reduction strategy and long-term strategic framework. The poverty reduction strategy recognizes that environmental sustainability is a prerequisite for economic growth and efforts to reduce poverty. In this context, environmental sustainability is one core issue of ADB's safeguard policy.

ADB requires environmental assessment of all project loans, program loans, sector loans, sector development program loans, financial intermediation loans, and private sector investment operations. Environmental assessment is a process rather than a one-time report, and includes necessary environmental analyses and environmental management planning that take place throughout the project cycle.

ADB screens all proposed projects to determine their potential environmental and social impacts. Depending on the result of this screening, they are classified in one of the following Safeguard Categories:

Category A: A proposed project is likely to have significant adverse environmental impacts that are irreversible, diverse, or unprecedented. These impacts may affect an area larger than the sites or facilities subject to physical works. An environmental impact assessment (EIA), including an environmental management plan (EMP), is required.

Category B: The proposed project's potential adverse environmental impacts are site-specific, few if any of them are irreversible, and in most cases mitigation measures can be designed more readily than for category A projects. An initial environmental examination (IEE), including an EMP, is required.

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Category C: A proposed project is likely to have minimal or no adverse environmental impacts. An EIA or IEE is not required, although environmental implications need to be reviewed.[1]

This IEE was carried out in accordance with the relevant ADB guidelines as there are:

- Safeguard Policy Statement, June 2009, effective since January 2010;
- Environmental Considerations in ADB Operations OM Section F1/OP, October 1, 2013.

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[1] http://www.adb.org/site/safeguards/safeguard-categories

2. Description of the Project

This document represents the Initial Environmental Examination (IEE) Report on the **ADB** -TA-8547 TAJ: Wholesale Metering and Transmission Reinforcement. It was carried out in accordance with the relevant ADB guidelines as discussed in Chapter 1.5.

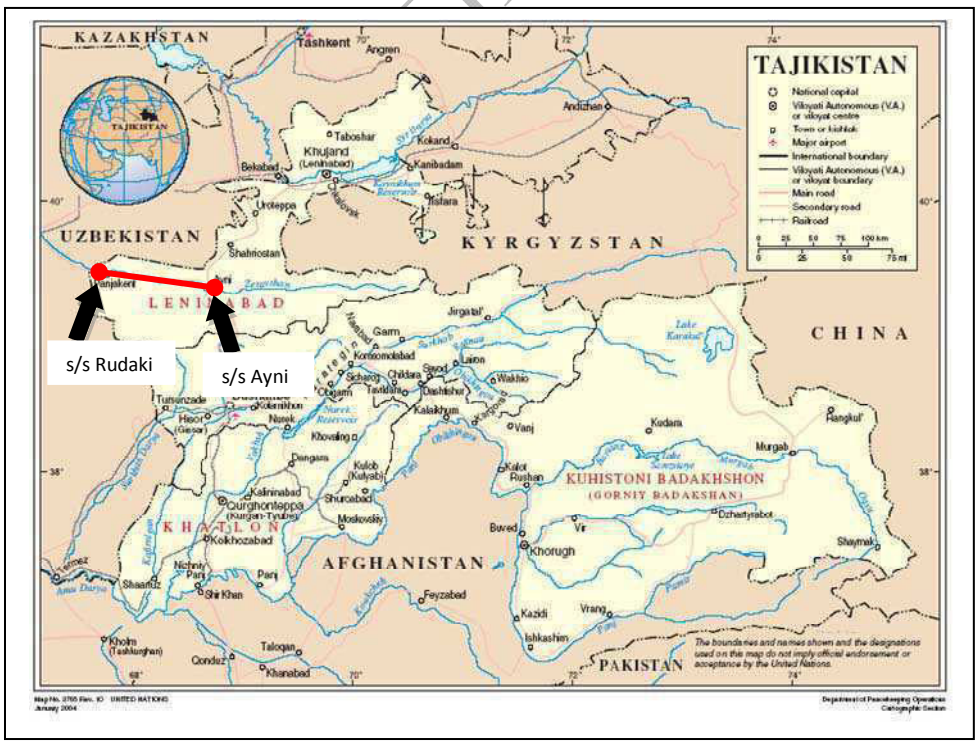
2.1 General Description

Tajikistan has great problems regarding the common condition of the electric supply system, which is characterized by technically obsolete components, instability of voltage, faults of electric power supply, weak capacity of distribution systems, a low payment level, large losses and high dependency on hydrology.

The production, transportation and distribution of electricity are under the state-owned joint-stock company Barqi Tojik, which is currently in the process of organizational restructuring to solve these problems in energy supply. The Wholesale Metering and Transmission Reinforcement Project is intended to contribute to a solution.

The project consists of the construction of approximately 90 km of 220 kV OHL between the substation Ayni 220 kV (Ayni region) and the substation Rudaki (Penjikent region) including construction of additional bays and rerouting of existing connections in both substations.

2.2 Location



Map 2-1: Location of the 220kV OHL, Rudaki Substation and Ayni Substation

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The Project is planned to be realized in West-Tajikistan in the Sughd province. The locations belong to Penjikent District and Ayni District (see Annex 10.2).

2.3 General Situation and Scope of Project

In Tajikistan, 98 % of the electricity is produced by hydropower plants (HPP), which are concentrated on the large rivers. The concentration on hydropower makes the country highly dependent on hydrology and hence natural climatic factors like precipitation and evaporation rates. This is the reason why during wintertime the HPPs do not work at full capacity, generation shortfalls occur and consumers are switched-off from the electric system. At the same time, technical problems and constraints in the transmission grids lead to considerable power losses (currently estimated at around 22 %).

Additionally, some regions still suffer from the disconnection from the Central Asian Power System in November 2009. Prior to the disconnection, the Penjikent region of Tajikistan was supplied with electrical power with two 220 kV lines from Uzbekistan. From Penjikent (substation Rudaki) electricity was further transmitted to Ayni region. This electricity was transmitted over 102 km through a 110 kV line.

For the moment, the old 110 kV line is used to supply the Penjikent region with electricity from the newly constructed substation Ayni 220 kV. As the demand in Penjikent is higher than the capacity of the line, households and industry in the region suffer from load shedding even in summer time, which is energy surplus period in Tajikistan.

2.4 Category of the Project

Based on the rapid environmental assessment, Category B was preliminary assigned to project.[2]

In the ADB 'Safeguard Policy Statement' of June 2009, definitions for the different types of projects are given (see Section 1.5). According to these considerations, projects of Category B are characterized as Projects which "could have some adverse environmental impacts, but of lesser degree or significance than those in Category A".

According to ADB Safeguard Policy Statement, June 2009 an Initial Environmental Examination (IEE) is required to determine whether significant environmental impacts warranting an EIA are likely.

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[2] ADB Project Data Sheet (last update April 2014)

2.5 Project Description

As both of the existing 220 kV OHL's to/from Uzbekistan and ending at the s/s Rudaki are out of operation since many years, Fichtner recommends to rehabilitate the existing 220 kV equipment in the SS Rudaki. One of the two existing OHL's to Uzbekistan will be disconnected and the new 220 kV OHL from Ayni will be connected instead. For that, a new Terminal Tower has to be erected. The rehabilitation works will also contain the two existing 220 kV bays to the existing transformers AT1 and AT2. For bay 3 no rehabilitation works will be necessary except for the installation of the overspan between bus bar 1 and bus bar 2. The other bays will require the removal of the existing equipment and the installation of the following:

- 1 circuit breaker
- 2 disconnecting switches with earthing switch on both sites
- 1 disconnecting switch with earthing switch on one site (bay 2 and 4)
- 3 current transformers
- 3 voltage transformers (bay 1 and 4)
- 3 lightning arresters
- Control, protection and metering equipment for the new OHL bay
- Communication equipment for the new OHL line (OPGW)/bay
- Foundation and steel structure for the new equipment
- Cabling including cable canals
- Leveling and gravelling of the area

The removal of the old equipment includes an exchange of old 63 MVA transformers and circuit breakers. These contain large amounts of oil that has to be handled. A possible pollution with PCB has been investigated and could be excluded.

The new 220 kV OHL line leaving s/s Rudaki will be installed in the corridor defined by the deactivated 220 kV lines to/from Uzbekistan. A line corridor was selected being mostly outside of the residential and mostly out of agricultural used areas. Most of the line runs through mountainous area located parallel to Zerafshan River (see Annex 10.2). The line is not crossing the Zerafshan River and is located at the left banks, in a southern direction of the river.

For the RoW, following guidelines have been respected:

1. As corridor for the 220 kV overhead lines a RoW of 50 m was applied.
2. The ground clearance over roads and over agricultural land is 8 m minimum
3. Distance between outer conductors of two parallel running overhead lines (OHL): (220 kV to 220 kV and 220 kV to 110 kV): minimum the height of the higher tower. Only near substations in congested areas, where different lines will have to be bundled, the minimum distance can be 6 m.

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4. The minimum distance between outer conductor of an OHL and a road is 25 m.

The s/s Ayni 220 kV was commissioned in 2012 and therefore no modernization is needed. It contains all required space provisions for the extension by the proposed 220 kV OHL. The connection between substation and first tower will be by two edge towers.

For the overhead transmission line bay, the same equipment as in the bays in s/s Rudaki will be installed (without the disconnecting switches with earthing switch on both sites). In addition, one coupling between the existing OHL and the new OHL needs to be installed.

2.6 Methodology

During the second week of July, Fichtner's environmental expert conducted a complete field survey from s/s Rudaki along the proposed line to s/s Ayni. During this visit he consulted the local environmental authorities at Penjikent and at Ayni to clarify the location of protected areas that might be affected by the line routing.

An additional survey and consultations were done by the local environmental expert in the third and fourth week of July 2014.

Between 22 and 28 August public consultations were held in the course of the social survey. During these meetings the Project has been introduced to the population and environmental questions have been discussed. In addition during meetings with stakeholders in the region took place.

A list of field surveys and meetings held shown given in Annex 10.4

2.7 Proposed Schedule for Implementation

The Feasibility Study will be finished in 2014 and the tender documents will be published in 2015. Start of construction will be earliest in 2016.

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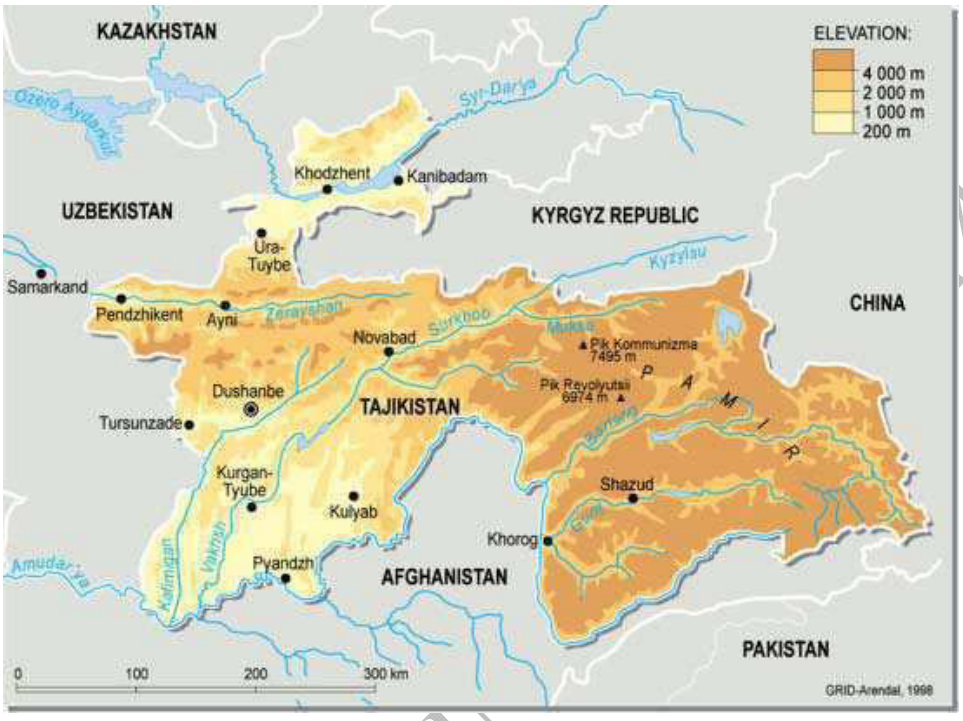
3. Description of the Environment

3.1 Geography and Topography

Tajikistan is a landlocked country with an area of about 140,000 km². It is covered by mountains of the Pamir range, and more than 50 % of the country is located above 3,000 m asl (approx. 10,000 ft).



Map 3-1: Topography of Tajikistan

The project is planned close to the river Zerafshan. Its altitudinal range is from 950 m asl (Penjikent) to 1400 m asl (Ayni).
The Zerafshan valley (in which the OHL will mainly take its course) is quite narrow near Ayni but widens up around Dasthikazy. The surrounding mountains do have steep slopes with high rates of erosion and the risk of landslides.

3.2 Geology, Seismology and Soil

Tajikistan's territory is characterized by mountains formed during the Gerzen and Alpine orogenesis. The country is located in an active seismic belt and hence is exposed to frequent strong earthquakes.

2/3 of Tajikistan's surface is covered by sand, scree, shingle, rock, and permanent snow and ice. Rivers bring rich soil deposits into valleys from the surrounding mountains, creating fertile soils in their vicinity. Soil degradation is a major problem, especially through water erosion on steep cultivated slopes[3]. Other problems are desertification and

[3] http://www.isprs.org/proceedings/XXXVI/7-C50/P78_Seiler_Soil.pdf

increasing levels of soil salinity. Soils (and water) in many areas are polluted by mineral fertilizers and agricultural chemicals.

Zerafshan Valley is surrounded by folded Paleozoic rocks; the valley itself is filled with Meso-Cenozoic sediments. The type of soil varies depending on the altitude. In the plains and floodplains, gray soil is predominant. This soil is poor in humus, but gives good yields when irrigated and fertilized.

Zerafshan Valley lies in a seismological active region; earthquakes which measure up to 4 on the Richter scale are possible.

3.3 Climate

The continental climate of Tajikistan changes with altitude. The annual temperature varies from +17°C and above in the south of the country, to -6°C and lower in the Pamir Mountains. Maximum temperatures can exceed +47°C and fall to -63°C, respectively.

In Penjikent, average maximum temperature varies from 3°C to 18°C, average minimum is -2°C till +10°C. With an average maximum temperature between -5 and +9°C and average minimum from -9 to °C, Ayni is considerably colder. Precipitation in Penjikent varies between zero and 30mm monthly, in Ayni between 3 and 24mm.[4]

Heavy rainfalls occur, making the steep slopes on the riverside even more vulnerable to landslides and mudflows.

Zerafshan Valley is characterized by light winds. The average wind speed is highest in winter, the maximum in January is 6-8 m/s on the passes and 3-5 m/s in the valley.

3.4 Water Resources

3.4.1 Surface Water

Tajikistan is rich in water resources and has a dense river network. Most of Tajikistan's rivers flow from east to west and lead to the Aral Sea. Their maximum spring and summer flow is important for irrigation of agricultural fields on semi-desert areas. Problems occur from severe over-utilization of water for irrigation purposes. Flooding sometimes occurs during spring.

Tajikistan possesses about 1,300 lakes, which can be found mainly in the Pamir region. Other standing water bodies are water reservoirs, which are mainly used for irrigation, electricity generation and fishery.

[4] http://www.worldweatheronline.com

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Zerafshan River has its source at the edge of Pamir Mountains where it originates from a glacier at 2,750 m asl. It flows west throughout Tajikistan till it reaches the border with Uzbekistan after 300 km. In total, the river length is 781 km, and the total river basin covers 4,000 km^2. In the whole catchment it receives 70 tributaries. At the point where it crosses the border to Uzbekistan, the annual river discharge is 5.3 km^3. In Tajikistan, only 0.3 km^3 are used presently (i.e. 8 % of the discharge). In Uzbekistan, the water quality decreases rapidly due to the return of water from irrigation and wastewater from towns[5].

3.4.2 Groundwater

Important groundwater reserves of Tajikistan are mainly located in the quaternary alluvium of the large river valleys (e.g. Syr Darya, Vakhsh) and intermountain depressions. There is a wide range of springs in the country, especially in the Pamir Mountains. Groundwater is used for drinking water supply, industrial processes, and irrigation of lands. The main water consumer is agriculture consuming up to 93 % of the total freshwater intake. Intensive groundwater pollution in Tajikistan is due to infiltration of irrigational wastewater, e.g. along the left bank of Syr Darya River[6].

The groundwater level varies considerably depending on the morphology and season. In floodplains, the water table is close to the surface but where the line corridor is running through mountainous areas the water level is more than some tens of meters below.

3.5 Climate Change

The term climate change refers to long-term alterations in the climatic system. These can be due to natural or anthropogenic causes. Recently, human beings are releasing a large amount of greenhouse gases which change the composition of our atmosphere and reinforce the so called greenhouse effect. Results are amongst others an increasing temperature and a changing pattern of precipitation. However, the impact is very variable depending on the region and a lot of investigation is going on at the moment to develop more detailed and reliable scenarios about future changes.

Concerning precipitation, a decrease of the mean annual rainfall has been reported for Zerafshan Valley for the period 1961-1990 (see Map 4-2). It is assumed that precipitation gets more likely to occur in short, heavy rainfalls in the future. This makes the region even more vulnerable to natural disasters like mudflows.

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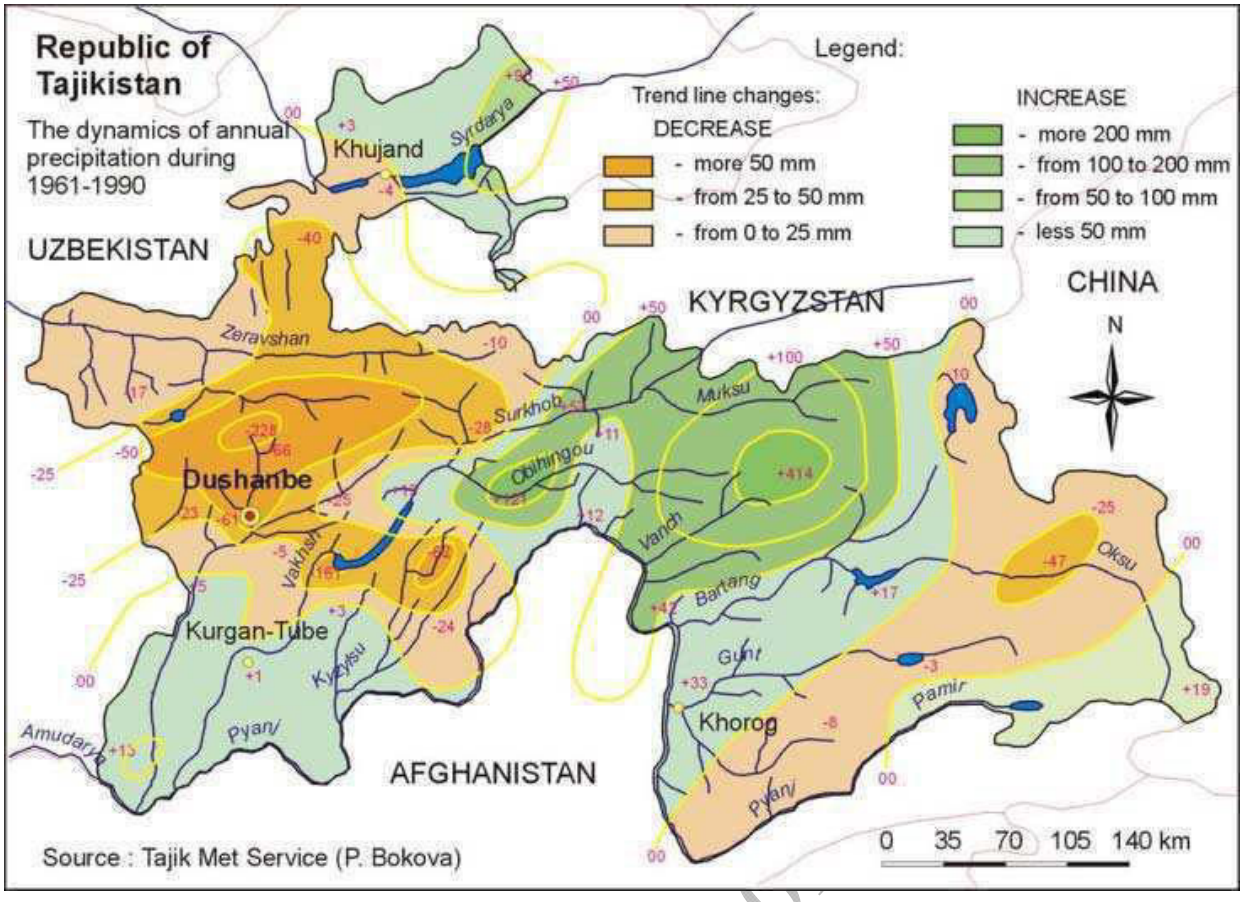
[5] www.fao.org/docrep/V9529E/v9529E06.htm
[6] www.cawater-info.net



Map 3-2: Changes in precipitation pattern in Tajikistan

The increasing temperature generally leads to an increased evaporation, and to a change of water runoff accentuating water stress and droughts. Additionally, the melting of glaciers becomes a problem: the glaciers in Central Asia have melted faster in recent years than ever reported before. Similar to many other rivers in Central Asia, Zerafshan originates from a glacier and is therefore highly dependent on its water balance. The melting of this glacier changes the runoff in the catchment area of Zerafshan drastically. In a short time scale, the melting results in an increased runoff, combined with mudflows, landslides, and land degradation. Once, when the glacier disappeared, an increasing shortage of water will follow.

Related to our project, the probable events described above may lead to an increased frecuency and severity of disasters like landslides, and mudflows affecting the stability of towers.

3.6 Biological Resources

Vegetation and Flora

Tajikistan belongs to two major vegetation zones and has a variety of habitats and ecosystems. Large differences in altitude, topography, climate and soil give rise to different natural environments ranging from deserts in Southern Tajikistan to alpine environments in Pamir.

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Tajikistan features a great diversity of flora. More than 5,000 species of plants are recorded in the country, with two threatened plant species among them. Grasses, bushes, and shrubs predominate.

Fauna

The country's animal life is abundant and diverse. Generally, there are about 80 species of mammals, 360 species of settled and migrating birds, 44 species of reptilians and 49 species of fishes in Tajikistan. According to IUCN (International Union for Conservation of Nature, 2006), threatened species include seven mammal species, nine bird species, one reptile species, three fish species and two invertebrate species[7].

As it can be seen from the photo documentation (see Annex 10.5) most of the line corridor is crossing semi-arid areas. The vegetation is heavily degraded, bushes and forests are destroyed almost everywhere. The still existing forests are limited to regions with little anthropogenic impact. They are light and small, consisting mainly of junipers and shrubs. The other vegetation is sparse and dominated by sagebrush and ferula. With increasing altitude, there are fescue-and alpine steppes.

As a consequence of the degraded environment (in combination to the steep slopes), there are mudslides, flooding and avalanches, causing huge material damage and even loss of life.

3.7 Protected Areas

According to the World Commission on Protected Areas (WCPA), five State Nature Reserves (IUCN Category I), three National Parks (IUCN Category II), a variety of small Nature Monuments (IUCN Category III) and 23 Nature Refuges (Zakazniks, IUCN Category IV) can be found in Tajikistan. In addition, areas under international agreements and programs (e.g. Ramsar Sites according to the Ramsar Convention and Important Bird Areas – IBA- according to BirdLife International) are present in the country. Tajikistan has designed five wetland sites (Ramsar sites) under the Ramsar Convention.

There are two Nature Refuges (IUCN Category IV) and one IBA in the Zerafshan Valley:

- Zerafshansky (Sarezmy) Nature Reserve, 2,300 ha, founded in 1976.
  Objective: Protect the only flood-plain forests in Northern Tajikistan and the habitat of Phasianus colchicus zerafshanicus
- Soy Vota (Saivatinsky, Sayvatin, Say Bota) Nature Reserve, 4,300 ha, founded in 1970
  Objective: botanical reserve to conserve juniper
- IBA Sarazm, 4,280 ha, assessed in 2007, Contained in Zerafshansky Nature Reserve

[7] http://www.encyclopedia.comlnk

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Objective: Protect the habitat of Saker Falcon (*Falco cherrug)*, Yellow-eyed pigeon (*Columba eversmanni*), European Roller (*Coracias garrulus*) and others[8].

According to information of the director of the Forest Department of Ayni (H. Koriev, see Annex 10.4), the Reserve will not be affected by the transmission line. A map of the Soy Vota Nature Reserve has been received and its borders were respected in the routing (see **Map 10-12**). The maps are originated in the mid 60ies of the last century without any update and the exact borders of the area (coordinates) are unknown. To be sure to be outside of the reserve, two towers (60 and 55) were moved to the north, thus the OHL is really outside the protected area.

The same situation applies for the location of Zerafshansky Nature Reserve for which no exact georeferenced maps are available. Following google maps this Reserve is located on the right river bank far away from Rudaki Substation, following birdlife.org it covers the river area also on the left bank, including IBA Sarazm. In any case, this reserve protects an area of Zerafshan River located at the fluvial terrace but substation Rudaki is situated on the upper part of the valley (see Figure 3-1). Consequently, it can reasonably be assumed that Rudaki substation is outside Zerafshansky Nature Reserve and IBA Sarazm.

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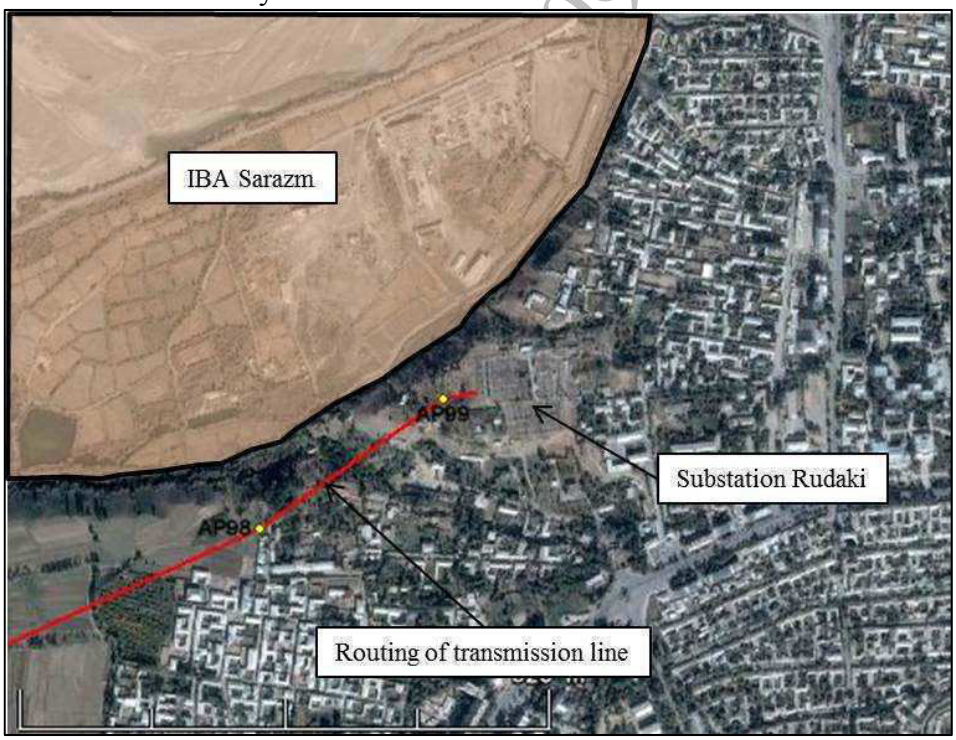

Figure 3-1: Most probable location of Zerafshansky/ IBA Sarazm following the natural topography

[8] birdlife.org

3.8 Land Use

Approximately 1/4 of Tajikistan's land area is under agricultural use with production of cotton, grain, vegetables, potatoes, fruits and wine and rearing of sheep, goats, cattle and yaks. Pastures are the most common agricultural use (21 %). Desert and semi-desert lands are irrigated and show cotton plantations, gardens, and vineyards. In narrow valleys (especially in the north) orchards, fruit trees, mulberry groves, and small cultivated fields can be found. In general the agricultural land use in Tajikistan is strongly dependent on irrigation and fertilization. Particularly cotton requires intense irrigation.

Another important land use is mining. Some fishing is done in the upper Amu Darya River, the Kayrakum Reservoir (fish farming), and the Syr Darya River.

Although land is quite scarce in Zerafshan Valley, agriculture is the most important sector of the economy. In Penjikent district, the conditions for agriculture are quite good. The irrigated land amounts 10,000 ha, another 10,000 ha are dry arable land and 140,000 ha can serve as pasture or hayfield. In Ayni district conditions are not that favourable, only 1,800 ha are irrigated land.

In Soviet times, tobacco has been the most important crop. Since then, the cultivation of tobacco has decreased significantly and the production of cereals, vegetables and potatoes has been growing. With wheat and oats being the most important crops, there are some additional incomes with the growing of apricots, apples, grapes, mulberry and peach. Nevertheless, revenues are quite low due to bad infrastructure and losses of the fresh products on the transport. Pastures are poor for cattle.

3.9 Socio-economic Conditions

3.9.1 Population and Communities

The population of Tajikistan is estimated at almost 8 million. Less than 1/3 live in urban areas due to a general trend toward ruralization[9]. Most people live in small villages (*qishlaq*s).

Living conditions in most rural areas are primitive. Paved roads, modern communications, potable running water, indoor toilets, and modern indoor heating and electrification are still only available in urban areas.

Tajikistan's population is composed of over eighty different ethnic groups. 80 %of the population belongs to the Tajiks, being direct descendants of the Iranian peoples and the largest indigenous group in the country. Other ethnic groups living in the country are Uzbeks (about15 %), a declining Russian population (1.1 %) and several other such as Kyrgyz, Tatars, Ukrainians, Germans, Jews and Armenians. 95 %

[9]http://www.stat.tj

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of the people are Muslim (90 % of Sunni Muslims and 7 % Shi'a Muslims); 5 % belong to other religions[10].

The Penjikent District (3,671 km²) has 214,000 inhabitants. Penjikent is the capital and also the biggest city with 33,000 inhabitants. The rest of the population lives in 14 rural Jaomats. The vast majority of the population is Tajik (70 %) and about 30 % is Uzbek.

Ayni District is bigger (5,159 km^2), but with less people living there (72,000 inhabitants). Almost all of them live in rural areas (8 Jaomats). More than 98 % are Tajik[11].

3.9.2 Economy

Regarding Central Asia and the former Soviet states, Tajikistan is the poorest country. The official estimation for the poverty rate (2013) is at 39.6 %. Nevertheless, some Tajik and international NGOs indicate that the real poverty rate is much higher (more than 70 % in 2010). Most probably, the real number is somewhere in between[12].
After the civil war (1992-1999) the newly-established political stability has led to a growth of the Gross Domestic Product (GDP). Currently (2013) the GDP is about 8.5 billion with a growth of 7 % per year. In 2012, 2.3 million were employed in Tajikistan.

Tajikistan's economy traditionally depends on agriculture. 2/3 of the labour force is still occupied in this field, which accounts for almost 24 % of the GDP. The main crop produced for export is cotton.

In contrast, the industrial sector is poorly developed, providing 14.4 % of the GDP and only around 4 % of total employment. A small number of state-owned enterprises dominate this sector. Industries include mining, chemicals, fertilizers, cement, machine tools, refrigerators, textiles and food processing. Hydropower and aluminium are significant resources with aluminium being the country's most important mineral-based product[13].

At present, Tajikistan's potential as a tourist site is rather low. This fact is for example due to the destruction of most ancient monuments and buildings by numerous earthquakes and the civil war.

The economy in Zerafshan valley depends primarily on cropping, tobacco, small scale gold mining and trade. Especially in Ayni district, agriculture in insufficient to engage all the population and the industry can only provide 2,000 workplaces. Therefore, unemployment is a problem and a high percentage of able-bodied men search (seasonal) work abroad, mainly in Russia and other former Soviet countries. Thus,

[10] http://www.encyclopedia.com
[11] DFID, RosAgroFund, UNDP (2005): Zerafshan Regional Development Initiative. Phase 1: Final Report.
[12] LARP, Draft version August 2014
[13] http://www.encyclopedia.com

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migrant remittances are another important source of income for the population in the valley[14].

3.10 Cultural/Historical Heritage

The territory of Tajikistan has been continuously inhabited since the early Stone Age. It is located on the important historical trade routes of the Silk Road connecting East and West.

There are two important archaeological sites situated near Penjikent:
- Sarazm is one of the oldest settlements in Central Asia and over 5,500 years old. It is considered to be the birthplace of civilization of the Tajik nation and is protected by UNESCO as a World Cultural Heritage. As it lies more than 10 km west of Penjikent, it is not affected by the project.

- Panjikant is a former Sogdian city whose ruins are located in the south of the present-day Penjikent. It has a distance of about 2.8 km through hilly ground from the project site, for which reason it is well protected from construction works.

3.11 Infrastructure

Road A377 goes through Zerafshan Valley and connects Tajikistan with Uzbekistan (Samarqand). Therefore, the road is in close vicinity to the line throughout its course.
Ayni lies at its eastern end and has direct connections not only to the capital Dushanbe in the south, but also to the eastern and northern parts of the country.

The main airport of Tajikistan is Dushanbe International Airport. It has direct connection with Ayni via road M34. Ayni and Penjikent have small airports, the one in Penjikent reopened in July 2014.

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[14] www.tj.undp.org/content/tajikistan/en/home/operations/about_undp/ayni_area_office/

4. Anticipated Environmental Impacts and Mitigation Measures

4.1 General

During the detailed Design Phase, line routing was done in view of avoiding impacts on settlements, land use, landscape, soil, surface waters and groundwater, flora and fauna, protected areas, cultural and historical sites, and infrastructure (e.g. roads, other OHL) as far as possible. During the construction and operation phases, the Project might mainly cause the following impacts:

During construction:

- land acquisition;
- visual impacts on the landscape;
- soil pollution and erosion;
- pollution of surface water and groundwater;
- damage to vegetation, habitats and protected areas;
- damage to cultural and historical sites;
- waste generation (steel, ceramics, used oil[15]) due to demolition of equipment like old circuit breakers and replacement of two old transformers; domestic waste generation by the workers;
- waste water generation by workers
- contribution to climate change (SF_6 gas);
- air pollution;
- impacts on health and safety (e.g. through works under high voltage, spread of STD/STI/HIV/AIDS);
- noise emissions and vibration;
- impacts on infrastructure and power supply;
- loss of houses and livelihood, involuntary resettlement;
- socio-economic impacts and influx of workers.

During operation:

- change of land use;
- visual impacts on the landscape;
- pollution of soil, surface water and groundwater;
- obstacle for birds;
- impact on flora during maintenance works;
- electric and magnetic fields;
- contribution to climate change (SF_6 gas);
- noise emissions;
- fire;
- socio-economic impacts;
- interference with air traffic.

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[15] At 13 May a PCB Investigation Report for Kayrakum, Regar, Baipaza and Rumi was submitted stating that ‚*We are convinced with the answers we received from the operation engineers that PCB has never been applied / used in this substation neither as lubricant nor as coolant*‘ (see Annex).

4.2 Specific findings during field survey

The first aid kit is in a poor condition and should be exchanged. Heart defibrillators are not available at the station.

Fire extinguishers are available but they are in partly bad condition without any sign of monitoring. The extinguishers should be exchanged, increased in numbers and checked regularly.

Rudaki substation is connected to the water network of Penjikent town and drinking water is available.

The toilets are connected to the sewage system but the sanitary situation is not satisfying. 30 people working permanently at the site during daytime and in the morning up to 100 people are assembled at the site. For these people only two toilets are available. This situation should be improved by increasing the number of the toilets. Two showers are available being in an acceptable condition.

The sanitary situation at s/s Ayni is satisfying. However, the batteries are not stored in a separate room as usually done but are located in the control room where people are working. The staff complaint about head ache and breathing problems when the batteries are in use. This is due to sulfuric acid in the batteries emitting sulfur containing gases when working. This is an absolutely unacceptable situation. In order to improve the situation, is proposed to separate the control desk from the remaining control room by a wall.

Below, the potential environmental impacts during the different phases of the Project are described in tabular form (Table 4-2,Table 4-3,Table 4-4). These tables include the proposed mitigation actions to each impact, if necessary.

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4.3 Polychlorinated Biphenyls (PCB) in transformer oil

In order to determine whether old oil from the exchanged equipment of s/s Rudaki is contaminated with PCBs, oil samples have been taken and sent for analyses to a certified laboratory.

Only oil of the circuit breaker OHL 2 contains traces of PCB. The amount of this sample is 8.3 ppm, which is clearly under the threshold value of 50 ppm. It can therefore be considered to be free of PCB. In all other samples no PCB was detected (the detection limit of 0.2 ppm was not reached). This is consistent to the experience gained in other projects at Tajikistan and other countries of the former Soviet Union.

Table 4-1: Results of the Analysis of oil possibly containing PCBs

Name sample	Sampling point	PCB [ppm]
B-2P	Circuit breaker OHL 2 (to Uzbekistan)	8.3
AT-2	Autotransformer 2	-/-
B-1P	Circuit breaker OHL 1 (to Uzbekistan)	-/-
B-1C	Circuit breaker, autotransformer 1	-/-
AT-1	Autotransformer 1	-/-

Consequently, the oil can be refined and reused again and no corresponding Management Plan needs to be developed (for more information about PCB and relevant standards in oil see Annex 10.13)

4.4 Adaptation to Climate Change

The 220 kV OHL has been routed in a close collaboration with the local expert of the Penjikent Electrical Network who have a dedicated local knowledge and experience.

In the initial route definition phase intensive local investigations have been made by the local expert and the Consultant in order to address the risks of landslides and avalanches in the related routing section especially on the first kilometers from Ayni 220 kV substation. For tower locations risky debris banks and other disadvantageous positions have been avoided by using long span section in the routing and by selection of tower positions on the crest of the mountains. Known landslide areas have been identified and avoided by selecting an alternative routing.

In addition, in the following phases of the project the Contractor shall perform a soil analysis and investigation at the final tower positions in order to define the appropriate foundation design. Where necessary the finally selected tower locations which may be exposed to avalanches in the future will be equipped with V - formed avalanche protectors. These protectors are having a mass of 25 t which is equivalent to 10 m²of concrete. The costs of concrete are 120 USD/m². 30 tower locations have been estimated. The related costs of approximately 90,000 USD are already included in the project cost estimate.

In general, the foundations of the towers will be designed for “soft soil” conditions what results in a kind of ‘oversized’ dimensions compared to a normal application in order to carry possible additional forces caused e.g. by landslides.

For the “Checklist for Preliminary Climate Risk Screening”, see Annex 10.7.

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4.5 Design Phase

Table 4-2: Anticipated Environmental Impacts and Mitigation Measures during design phase

Impact of line routing on/Adaptation to	Extent of Impact	Comments	Mitigation Measures
Settlements	■	A proper line routing has been selected.	During design of line routing big efforts have been undertaken to avoid physical relocation of houses and to avoid agricultural land as far as possible
Land acquisition and use	■	Temporary and permanent land acquisition in the RoW and at tower sites, respectively.	Design heights and selective locations of the towers will permit all agricultural activities beneath the transmission line to be continued
Landscape	■	The transmission line will run mainly along the foothills of the surrounding mountains of Zerafshan valley. From the valley, most towers and conductors will therefore be visible.	Mitigation measures are not possible, as the location of the line routing helps to prevent resettlement issues.
Soil and groundwater	■	Soil excavation at tower sites and danger of erosion.	Steep slopes will be avoided for tower erection as far as possible
Surface waters	■	Sediment run-off into surface waters.	Towers shall be erected not closer than 50 m to surface waters to avoid all sediment run-off into these water bodies. Work camps (if foreseen) shall be located down in the valley, but not nearby surface water bodies.
Climate Change	■	Increasing risk of landslides and mudflows, see Annex 10.7	See Section 4.4
Flora and fauna	■	Tower placement on (potential) habitats.	The line routing crosses mainly semi-arid habitats which are found in the whole region. Neither structures of high ecological value nor endangered species will be affected. Cutting of trees will not be necessary. Work camps (if foreseen) shall be located down in the valley.
Protected areas	O	See Section 3.7	

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Impact of line routing on/Adaptation to	Extent of Impact	Comments	Mitigation Measures
Cultural and historical sites.	O	Any close distance (less than 1 km) to mosques and known cultural heritage sites will be avoided. Crossing of graveyards will be avoided	
Infrastructure	O	Foreseen minimal ground clearance of 8 m will be sufficient to avoid negative interference to the traffic in case of road crossings. Crossing of overhead lines (OHL) if any will be done following recommendations of the Institute of Electrical and Electronics Engineers (IEEE). Any close distance to airports will be avoided. The closest distance to an airport is the already existing s/s Rudaki with about 1.2 km. The new OHL keeps a minimum distance of 1.6 km to Penjikent airport.	

Extent of impact:

■■■ = high negative
■■ = medium negative
■ = low negative
O = nil
✦ = locally positive
✦✦ = regionally positive

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4.6 Construction Phase

Table 4-3: Anticipated Environmental Impacts and Mitigation Measures during construction phase

Impact on/of	Extent of impact	Comments	Mitigation Measures
Land acquisition and use	■	The length of the line is about 94 km. A RoW of 50 m is necessary for these 220 kV line what sums up to about 470 ha land required by this RoW. The land size needed for an angle tower is 250 m² and suspension tower is 75 m². 99 angle towers and about 180 suspension towers will be erected what requires about 38,500 m² of land, including 6,900 m² agricultural land. The land needed for construction activities for the towers is in about 11 ha (20x20 m each). Only temporary impacts will occur regarding agricultural use and plantations in the transmission line corridors. All rehabilitation measures at Rudaki substation will be done on existing and already fenced Barqi Tojik properties. In case the CC will install workers camps, land has to be rented temporarily during the construction period.	Selection of line routing has been done in cooperation of technical, environmental and social experts together with the specialists of Barqi Tojik in order to avoid impacts on houses and resettlement activities to the greatest extent possible. Proper compensation for land needed for the erection of towers will be paid. The cultivated land within the construction corridor and for access roads/ tracks will be affected temporarily; compensation will be paid for crop damages and loss of fruit trees. The construction of access roads will be minimized. Work camps (if foreseen) shall be located close to settlement areas. A detailed design of each work camp including infrastructure planning (water and electricity supply, waste management, waste water treatment and disposal) shall be provided by the constructor. Mitigation and compensation of resettlement issues will be described in the LARP as a stand-alone report.

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Impact on/of	Extent of impact	Comments	Mitigation Measures
Soil and erosion	■	Steep slopes have been avoided by the design of the corridor. Excavation works (down to maximum 4 m) and piling will be required at the tower locations. Oil/fuel discharge could lead to soil pollution. The sandy soils are especially sensitive to wind and water erosion.	Removal of topsoil around the tower feet will be minimised. Soil will be stockpiled/ stored according to the single layers and brought back/ refilled after construction in the same order of layers as cut off. Surplus soil materials from excavation shall be used at other locations of the Project as far as possible; disposal of surplus material must be negotiated through local authority approvals. Soil storage sites shall be covered to be secured against wind and water erosion. Replanting of soil will be done when towers are erected in steeper slopes. New access roads not needed anymore after having finished the construction will be rehabilitated and replanted. Soil pollution by e.g. oil/fuel of machines and trucks can be avoided by proper maintenance of all equipment and adequate construction site management. Re-fuelling and maintenance must take place in dedicated areas. Proper training shall be performed regarding re-fuelling and oil changes.
Surface water and groundwater	■	In floodplains, the water table is close to the surface but where the line corridor is running through mountainous areas the water level is more than some tens of meters below. Oil/fuel discharge could lead to pollution of surface waters and groundwater; also soil run-off during construction could pollute surface waters.	Groundwater pollution by e.g. oil/fuel of machines and trucks can be avoided by proper maintenance of all equipment and adequate construction site management. Re-fuelling and maintenance must take place in dedicated areas away from surface waters. Proper training shall be performed regarding re-fuelling and oil changes. The erection of towers at the riverside shall be in the widest distance possible to the river shore line. Construction of towers near the river shall be done during dry season.

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Impact on/of	Extent of impact	Comments	Mitigation Measures
Flora and fauna	■	Tower placement on (potential) habitats. The line routing crosses mainly semi-arid habitats which are found in the whole region. Neither structures of high ecological value nor endangered species will be affected. Cutting of trees will not be necessary.	Work camps (if foreseen) shall be located down in the valley.
Protected areas	O	No protected area will be crossed. Sufficient distance to transmission line corridor is ensured.	
Cultural and historical sites	O	It is not expected to find any historical or cultural sites within the construction corridors, but the presence of hidden soil monuments cannot be fully excluded.	If any remnants are found construction at this site will be stopped immediately and the relevant district office will be informed (Chance Find Procedure).
Air quality	■	Due to the limited time of the construction period, and limited numbers of needed truck movements, the impacts on ambient air quality by machinery and vehicle exhausts will be low. Emissions from machines and transportation will be rapidly dispersed in the air. Some dust generation will take place caused by ground works at mostly small construction sites and vehicles transporting steel and cables to the single pole sites.	Avoid needless truck drives. Machines and vehicles will be checked regularly on the basis of national regulations/ international emission standards to minimize exhausted pollutants. If used closer than 100 m to settlements or single houses construction equipment shall be fitted with emission dampening devices. Generator sets need to fulfil relevant air pollutant emission standards. Trucks transporting sand, gravel and rocks shall be covered with tarpaulins. Stockpiles should be placed at the relevant construction sites and should be covered to avoid dust generation. Water spraying should be done where water reserves are sufficient.
Climate change (SF_6)	O	SF_6, which is a component of transformers, is a very highly effective and persistent greenhouse gas. But, the Project does not contribute measurably to the climate change phenomena during construction.	Careful handling of SF_6 is absolutely necessary considering the relevant guidelines (see Section 10.7).

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Impact on/of	Extent of impact	Comments	Mitigation Measures
Waste	■	Waste will be generated mostly by refurbishment actions in the existing substations. During construction about 200 workers will be employed generating domestic wastes accordingly.	A Waste Management Plan shall be elaborated by the construction contractor as part of the HSE Management plan. Domestic waste generated by workers during construction shall be collected and disposed at the waste landfill site of Penjikent (22 ha). A possible disposal has to be agreed with the city of Penjikent. Old equipment: reuse of parts where possible, however, reuse is restricted due to outdated technique. At the moment, scrap metal processing enterprises can only be found in Dushanbe and Khujand. It is proposed to transport the scrap metal to Dushanbe or Khujand. Normally, the scrap metals will be stocked there and sold by auction. Ceramic wastes are inert and can be used as landfilling material, e.g. for road construction. During replacing old transformers and oil fitted circuit breakers in Rudaki substation old oil has to be handled. It is estimated that about 170-180 t of old oil will accrue. This old oil has been tested for its physical properties and as it does not contain PCBs, it can be reused. In the control building the cable ducts are covered with possibly asbestos containing floor plates. When laying down cables, special care (e.g. breathing masks) shall be taken and considered in the HSEMP to be developed by the CC. In general, principles of waste minimization shall be followed: (1) reduction of waste quantity, (2) recycling as much as possible, (3) proper dumping of remaining waste. Workers shall be trained regarding proper waste handling according to environmental management requirements.
Waste water	■	Only low amounts of waste water will be produced temporarily by workers at the construction sites and/or at work camps, (if such camps are foreseen).	Workers shall be trained regarding proper waste water handling according to environmental management requirements.

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Impact on/of	Extent of impact	Comments	Mitigation Measures
Health and safety	■	The Project increases the risk of work accidents (e.g. due to works under high voltage) and HIV exposure of local women and girls. There is also a potential impact on health and safety of workers due to inadequate sanitary conditions during the construction process.	The construction contractor shall develop an appropriate HSEMP and implement an HSEMS during the construction phase (see Section 8.3). Mobile toilets/ pit latrines and washing facilities shall be installed at the construction sites; they must be managed well to avoid development of disease vectors (mosquitoes). Information campaigns for health and safety of workers will reduce the health risks. A potential negative impact of spreading STD's/ HIV by workers can be mitigated through a health education program and distribution of condoms (see Section 8.3).
Noise and vibration	■	Noise and vibration is limited to the duration of construction activities and will be generated mostly by construction machines during excavation and foundation works. Several machines can lead to cumulative effects. If no electricity is available generators will provide electricity at the construction sites.	Construction works should be avoided at sensitive times (e.g. nighttime, school hours). Generator sets need to fulfil relevant noise emission standards and must be encapsulated if placement is necessary closer than 100 m to settlements or houses. Construction machines shall be fitted with silencers or mufflers and, whenever possible, only machines with low sound power shall be used. Ear protection devices shall be handed out to all workers. Workers are obliged to wear ear protectors where 85 db(A) are exceeded (see World Bank/ IFC General EHS Guideline, 2007). Noise aspects and how and when to protect workers shall be considered within the HSE Management Plan to be set up by the Construction Contractor (CC) (see Section 8.3).
Infrastructure and power supply	■	As the power supply is carried out with the 110 kV, a shutdown will not be necessary during construction works. Short interruptions (< 8 hours) for connection activities may appear.	These short power interruptions shall be done during times of low power demand and announced some days before.
Loss of houses and livelihood Involuntary resettlement	o	Physical relocation could be avoided.	See stand-alone LARP to the Project.

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Impact on/of	Extent of impact	Comments	Mitigation Measures
Socio-economic aspects	■ ✦ ✦✦	Most of the line corridor does not cross agricultural land During construction activities, temporary damages of crops will occur in the transmission line corridors. During construction a maximum of about 200 workers will be employed, especially for civil works unskilled workers will be needed.	Compensation see stand-alone LARP to the Project.
Work camps	■	If work camps are foreseen they are limited in duration and number of permanent workers.	Mitigation measures as proposed regarding health and safety aspects. A detailed design of each work camp including adequate location and infrastructure planning shall be provided by the construction contractor

Extent of impact:

■■■	=	high negative
■■	=	medium negative
■	=	low negative
o	=	nil
✦	=	locally positive
✦✦	=	regionally positive

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4.7 Operation Phase (reflected in the design)

Table 4-4: Anticipated Environmental Impacts and Mitigation Measures during Operation Phase

Impact on/of	Extent of impact	Comments	Mitigation Measures
Land use	■	Agricultural use of all areas that are not permanently expropriated can be continued during the operation phase. Height limitations (i.e. for tree plantation) have to be respected. Minor impacts will occur during maintenance works.	Crop losses during maintenance works have to be compensated separately after occurrence.
Landscape	■	The transmission lines with their towers will contribute to the visual appearance of the landscape. The negative impact is assessed to be low; however, evaluation of visual impacts is always dependent on the observer, which means it is subjective in nature. This type of impact can be assessed differently by different individuals.	Further mitigation actions are not possible. Visual impact has to be accepted.
Air traffic	■	It can't be fully excluded that the OHL will interfere with the air traffic.	An air craft warning system will be installed.
Soil Surface water and groundwater	■	Pollution of soil and water through oil leakage is possible.	At the s/s Rudaki transformers will be fitted with oil pits beneath to collect leaking oil. These oil pits will be connected to the existing drainage system to be able to collect oily waters in case of thunderstorm events. The oily wastewater shall be lead into separate storage tanks for further treatment.

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Impact on/of	Extent of impact	Comments	Mitigation Measures
Fauna (birds)	■	Possible negative impacts could result in the fact that OHLs represent an obstacle for birds. Mostly affected are big and heavy birds bound to surface waters. A bird migration route takes its course along the valley, but stays parallel to the line corridor. No crossing will take place. Wetlands providing habitats for herons or egrets are not present along the line route. The IBA Sarazm is not affected. The protected Zerafshan pheasant dwells in the floodplains year-round and is not a migratory species.	Specific mitigation measures as installation of bird spikes and diverters are envisaged near IBA.
Flora	■	Ecological valuable habitats are not present in the RoW.	Herbicides shall not be used for clearing measures.
Electric and magnetic fields	O for the public ■ at the workplace	From experience of similar projects it can be reasonably assumed that the strength of electric and magnetic fields at the substations will be below the permissible limits at workplaces of 10 kV/m and 500 µT. The same applies along the corridor where the relevant limits are 5 kV /m will not be exceeded even below the conductor. For relevant standards see Annex 10.10 and 10.11	Because state-of-the-art technology is used, specific mitigation actions are not needed (see monitoring measures)
Climate change (SF_6)	■	SF_6 is a strong greenhouse gas but will be used only in small amounts.	In order to minimize SF_6 emissions, the recommendations as given in Section 10.7 shall be followed. The installations will be fitted with gas detectors that indicate immediately any leak from which SF_6 is emitted.
Noise	O	Noise can be generated because of corona effects during periods with high air humidity, which only rarely occur in the Project Area. The corona induced noise during operation is within acceptable limits. Additional noise at substation sites is practically negligible.	Corona effects will be mitigated by using state-of the art conductors with specific correlation of the sub-conductors.

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Impact on/of	Extent of impact	Comments	Mitigation Measures
Fire	O	Sprinkler systems for transformers are not foreseen. Fire walls between transformers will not be erected. Transformers are located with a distance of about 30 m from each other. Within control buildings mobile fire extinguishers are found not to be in a good condition and should be replaced and checked regularly	
Socio-economic aspects	✦ ✦✦	The Project will result in a more reliable power supply in Penjakent region.	

Extent of impact:

■■■	=	high negative
■■	=	medium negative
■	=	low negative
O	=	nil
✦	=	locally positive
✦✦	=	regionally positive

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5. Analysis of Alternatives

An alternative routing for the new transmission line has been discussed. The new 220kV was first supposed to be either parallel to or instead of the existing 110kV. This routing is not possible for following reasons:

The routing instead of the existing OHL is not possible, because this is the only one for energy supply of Penjikent region. To build a new one at the same RoW, it would be necessary to switch it off for a long time period. This is not acceptable.

A parallel routing to the existing 110kV is not possible because the existing line is mostly routed inside the very narrow valley of Zerafshan River. Some parts of it are very prone to landslides; therefore the transmission line should not be too close to its slopes. The valley itself does not allow avoiding built-up areas and according to today's standards it's not admissible anymore to overspan houses.

The finally selected line routing has been chosen as the most feasible corridor from an environmental and social point of view. Physical relocation of houses could be avoided completely. For the detailed routing, see Annex 10.2.

Do nothing scenario:

Without realizing the Project

- Penjikent and surrounding areas will still be supplied from the substation Ayni 220 kV with existing 110 kV line constructed in the 60ies of the last century without redundancy;
- As the peak power demand of Penjikent is currently 75 MW, it surpasses already the maximum rating of the old line, which is 67 MW. Frequent load shedding is the consequence;
- The power demand is predicted to increase to 100 MW in the next 3-5 years mainly due to industrial development; this demand can't be complied with the old line. Therefore, industrial development will be impeded;
- Electricity supply in Penjikent will not be as reliable as with the Project; frequent breakdowns of the electrical system will further exist.

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6. Information Disclosure, Consultation and Participation

Together with the public consultations performed between 25th and 28th of July in the framework of the preparation of the LARP public meetings were held in the district of Ayni and in Penjikent (list of participants see Table 6-1 and Annex 10.6).

Table 6-1: Participants of the public consultations in Ayni and Penjikent region in July 2014

Location	Participants
Zerabad (Dar-Dar, Ayni)	About 20 men in village public meeting place with representative of Jamoat
Urmetan (Ayni)	Four men (land owners) and representative of Jamoat
Serazm (Penjikent)	Five men and nine women with representative of Jamoat
Kushteppa (Kahlifa Hasan, Penjikent)	Six men and 15 women with representative of Jamoat and private farmer's chairperson
Zudhzina (Penjikent)	Seven men and one women plus Jamoat leader and farmer's representative
Gusar (Loikh Sherali, Penjikent)	Five family farm representatives of probably affected area and Jamoat representative
Margedar (Rudaki)	Jamoat leader and prepresentative of farmers

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The project was communicated to people potentially affected by the project. The participants of the meetings were asked for any concern related to environmental issues related to the project. No concerns were raised neither because of needed truck movements, nor because of aesthetic issues or because of electric and magnetic fields.
General the problem of clean drinking water was raised and one village complaint about the waste dumping situation. The dirt and smoke from burning waste was described being very annoying some time.

End of July also meetings with stakeholders have been performed. The Head of Public Utilities and First Deputy Chairman of the City of Penjikent lined out that a waste landfill site (with 22 ha square) is suitable for the disposal of the solid waste generated by the workers and resulting from construction debris (bags, wood debris, and etc.). During the meeting it was agreed that a relevant agreement should be made before start of the construction.

At the present time, according to the Director's Order No. 185/5 as of 5 March 2014 of the 'Hojagii Manziliyu Kommunali'(Public Utilities Service) under the Government of the Republic of Tajikistan, the cost of

1 m³ transportation and placing at the landfill sums up between 56 and 66 TJS.

At the moment, there are no available metal waste processing enterprises in Penjikent and Ayni. It is proposed to transport the metal scrap to Dushanbe or Khujand. As scrap stocked, the bidding can be announced and if there is sufficient quantity the metal scrap can be purchased from the site.

Usually old oil will be refined by Barqi Tojik and reused elsewhere.

Concerning the location of the Zerafshan Conservation Area nearby Penjikent a meeting with the Director of Forestry and with Mr. Inoyatov U.M., Head of Penjikent Rayon Environment Protection Department was held. Following his information, the power transmission line will not touch any part of Zerafshan Nature Reserve.

The accurate location of the Soy Vota conservation area close to Urmetan could not be determined. A meeting was held with the Head of Ayni Rayon Environment Protection Department and Forestry Department concerning this issue. Afterwards, an official letter of the Director of the Forest Department Ayni was issued, stating that the Reserve will not be affected by the transmission line corridor (see Annex 10.4). This was discussed and confirmed at a field visit on 1.9.2014 with representatives of ADB (Nurlan Djenchuraev and Vergel M.Medina) and the director of the Forest Department (M. Koriev, together with Hikmat Dzhunaydovich and Turokulov Nazar).

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Photo 6-1: Meeting with First Deputy Chairman of the City of Penjikent

Photo 6-2: Meeting with the Head of Environment Protection Department at Penjikent

Photo 6-1 Meeting with representatives of the population in a Jamoat of Penjikent Rayon

Photo 6-2 : Interview of concerned farmers in Zerafshan

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7. Grievance Redress Mechanism

Great care is taken to prevent grievances. This has been done so far through careful land acquisition design and implementation, by ensuring full AF participation and consultation, and by establishing extensive communication and coordination between the community, the PMU and the local governments also regarding general environmental issues. This notwithstanding, complaints are sometimes unavoidable and a grievance mechanism has been established for the project to allow the APs the opportunity to appeal against any disagreeable decision, practice or activity arising from compensation/ rehabilitation process. Efforts to make APs fully informed of their rights and of the procedures for addressing complaints will continue during civil works.

Complaints and grievances can be addressed through the following steps and actions (see Figure 7-1):

First Step:
One joint Project Grievance Redress Committee for both concerned *Hukumats* has been established. It includes two members of the affected community (including AP's and non-APs), one representative of each concerned *Jamoat* and one representative of each of the two *Hukumat* Land Councils, to be chaired by one of the two *Hukumat* representatives (to be agreed upon internally by the two *Hukumats*). Grievances must be heard and resolved within 14 days of submission of the complaint.

Second Step:
If the Project Level Grievance Redress Committee is not able to resolve the grievance within a 14-day period, the complaints should be presented via the BT Rayon representative to BT PMU at a central level. The elected representatives of the AF will have the opportunity to mediate by providing their written comments and proposals to the PMU. A final decision will be made by the Director of the PMU after the assessment of the case and a careful preparation of the decision by the PMU resettlement representative.
Grievances must be heard and resolved within 7 days of submission of the complaint.

Third Step:
If no solution is reached within 14 days at BT PMU level, the APs can further submit their case to the appropriate court of law.

According to Tajik law, taking the case to court can be related only to the valuation of the losses and the determination of the level of compensation (payment). The question of the expropriation for the construction of a HVTL itself is not negotiable and a case in court cannot delay construction work.

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While applying the Grievance Redress Mechanism, APs can seek support from the BT PMU resettlement representative who on his part might be assisted by the national and international consultants. The contact addresses/phone numbers will be available at the level of each concerned *Jamoat*.

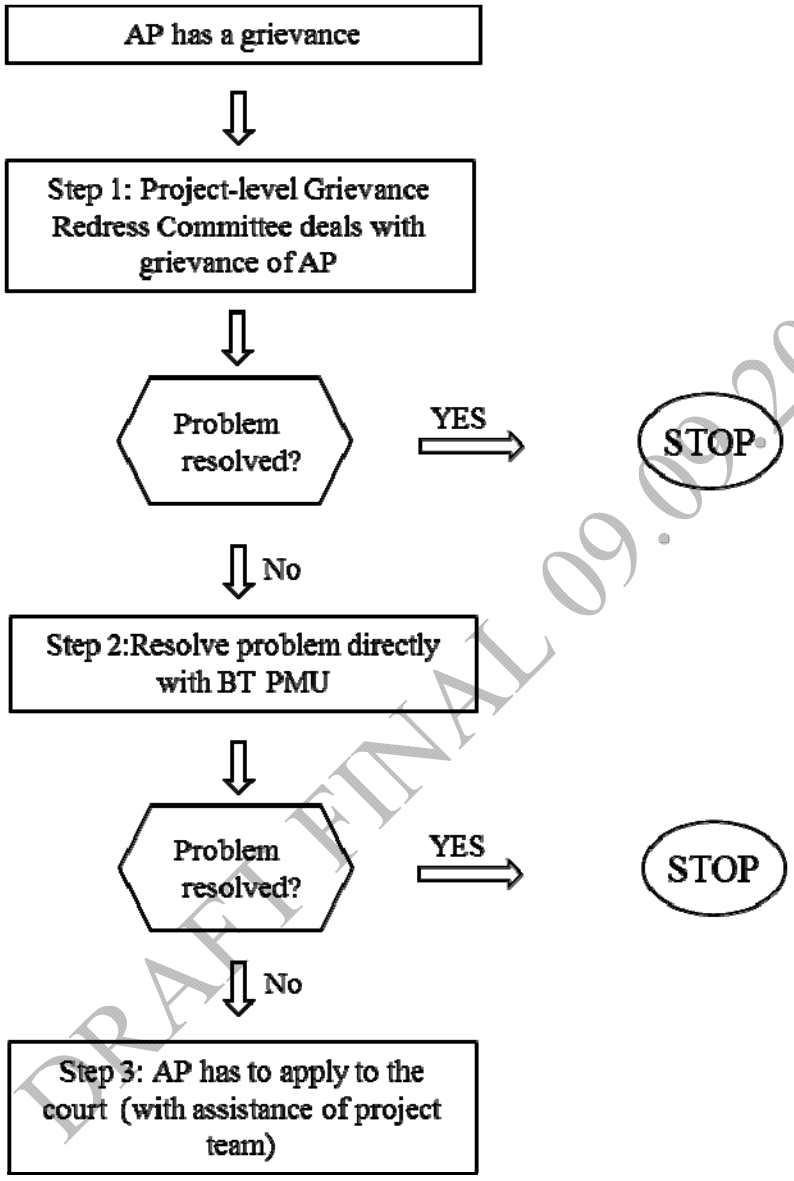

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Figure 7-1: Grievance Mechanism

8. Environmental Management Plan

8.1 Mitigation Measures

8.1.1 Design Phase

Table 8-1: Mitigation Measures during Design Phase

Project Activity	Potential Environmental Impact	Proposed Mitigation Measure	Institutional Responsibility	Cost Estimates
Land acquisition and use	Physical relocation of houses	Selection of line routing has been done in cooperation of technical, environmental and social experts together with the specialists of Barqi Tojik in order to avoid impacts on houses and resettlement activities to the greatest extent possible.	Fichtner/PMU/Barqi Tojik	Included in design
	Prevention of land use activities	Design heights and selective locations of the towers will permit all agricultural activities beneath the transmission line to be continued.	Fichtner/PMU/Barqi Tojik	Included in design
	Landslides and avalanches due to climate change	See Section 4.4	Fichtner/PMU/Barqi Tojik	Included in design (additional construction costs of 90,000USD are already included in construction costs)
	Tower placement on (potential) flora and fauna habitats	The line routing crosses mainly semi-arid habitats which are found in the whole region. Neither structures of high ecological value nor endangered species will be affected. Cutting of trees will not be necessary.	Fichtner/PMU/Barqi Tojik	Included in design

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Project Activity	Potential Environmental Impact	Proposed Mitigation Measure	Institutional Responsibility	Cost Estimates
	Disturbance of protected areas	The new 220 kV OHL will be routed close to the borders of Soy Vota Reserve (created to protect juniper) but will not cross the protected area.	Fichtner/PMU/Barqi Tojik	Included in design
Construction works	Soil excavation and danger of erosion.	Steep slopes will be avoided for tower erection as far as possible	Fichtner/PMU/Barqi Tojik	Included in design
	Sediment run-off into flowing and standing surface waters.	Towers shall be erected not closer than 50 m to surface waters. Rivers and creeks will be over spanned.	Fichtner/PMU/Barqi Tojik	Included in design

8.1.2 Construction Phase

Table 8-2: Mitigation Measures during Construction Phase

Project Activity	Potential Environmental Impact	Proposed Mitigation Measure	Institutional Responsibility	Cost Estimates
Land acquisition and use	Temporary impacts regarding agricultural use and plantations in the transmission line. Crop damages possible. Permanent Impact due to land acquisition for towers.	Appropriate compensation for temporary and permanent land use will be paid. Compensation for crop damages and loss of fruit trees will be paid. The construction of new access roads shall be minimized.	See stand alone Land Acquisition and Resettlement Plan (LARP) to the Project.	See stand alone Land Acquisition and Resettlement Plan (LARP) to the Project.

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Project Activity	Potential Environmental Impact	Proposed Mitigation Measure	Institutional Responsibility	Cost Estimates
General construction works	Noise emission directed to workers	Noise aspects and how and when to protect workers shall be considered within the HSE Management Plan to be set up by the Construction Contractor (CC) (see Section 8.3). E.g. Ear protection devices shall be used where 85 db(A) are exceeded. Respective measurements shall be done by the CC. Construction machines shall be fitted with silencers or mufflers and, whenever possible, only machines with low sound power shall be used	CC	Included in construction costs
	Noise emission directed to the population	Noise aspects and how and when to protect workers shall be considered within the HSE Management Plan to be set up by the Construction Contractor (CC) (see Section 8.3). Construction works should be avoided at sensitive times (e.g. nighttime, school hours). Good management will avoid needless truck movements and truck movements in inhabited areas at sensitive times. Generators must be encapsulated if placement is necessary closer than 100 m to settlements or houses.	CC	Included in construction costs

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Project Activity	Potential Environmental Impact	Proposed Mitigation Measure	Institutional Responsibility	Cost Estimates
General construction works	Spreading of diseases (in the work camp) Increased risk of STD/HIV	The construction contractor shall develop an appropriate HSEMP and implement an HSEMS during the construction phase (see Section 8.3). Mobile toilets/ pit latrines and washing facilities shall be installed at the construction sites; they must be managed well to avoid development of disease vectors (mosquitoes). Health education and distribution of condoms.	CC	Included in construction costs
	Work accidents (e.g. due to works under high voltage)	The construction contractor shall develop an appropriate HSEMP and implement an HSEMS during the construction phase (see Section 8.3). Aim should be zero accidents.	CC	Included in construction costs
	Dust generation	The need for large stockpiles should be minimized. The material shall be placed at the relevant construction sites and shall be covered with tarpaulins. Trucks transporting sand, gravel and rocks shall be covered with tarpaulins. Water spraying should be done where possible to prevent dust generation.	CC	Included in construction costs
	Air pollution through exhaust emissions	Avoid needless truck drives. Machines, generators and vehicles should be checked regularly on the basis of national regulations/ international emission standards to minimize exhausted pollutants. If used closer than 100 m to settlements or single houses construction equipment shall be fitted with emission dampening devices.	CC	Included in construction costs

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Project Activity	Potential Environmental Impact	Proposed Mitigation Measure	Institutional Responsibility	Cost Estimates
	Pollution of surface waters through run-off.	Towers shall be erected not closer than 50 m to surface waters. Rivers and creeks will be over spanned. Construction of towers near the river shall be done during dry season.	CC	Included in construction costs
	Soil excavation and danger of erosion.	Removal of topsoil around the tower feet will be minimized. Replanting of soil will be done when towers are erected in steeper slopes.	CC	Included in construction costs
	Degradation of landscape and soil	Surplus soil materials from excavation shall be used at other locations of the Project as far as possible. It will be stockpiled/ stored according to the single layers and brought back/ refilled after construction in the same order of layers as cut off. Disposal of surplus material must be negotiated through local authority approvals and soil storage sites shall be covered. New access roads not needed anymore after having finished the construction will be rehabilitated and replanted.	CC	Included in construction costs

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Project Activity	Potential Environmental Impact	Proposed Mitigation Measure	Institutional Responsibility	Cost Estimates
General Construction Works	Pollution of soil, surface waters and groundwater	Proper maintenance of all equipment and adequate construction site management. Re-fuelling and maintenance must take place in dedicated areas away from surface waters. Proper training shall be performed regarding re-fuelling and oil changes. At the Rudaki substation transformers will be fitted with oil pits beneath to collect leaking oil. These oil pits will be connected to the existing drainage system. The oily wastewater shall be lead into separate storage tanks for further treatment (see design)	CC	Included in construction costs
Refurbishment of the existing Rudaki substation	Scrap metals	Scrap metal processing enterprises can only be found in Dushanbe and Khujand. It is proposed to transport the scrap metal to Dushanbe or Khujand. Normally, the scrap metals will be stocked there and sold by auction	PMU/Barqi Tojik	Recycling company will pay for the metal
	Ceramic waste	Ceramic wastes are inert and can be used as landfilling material, e.g. for road construction.	CC	Included in the construction costs
	Asbestos	Asbestos containing material will not have to be stored but eventually asbestos containing floor panels (cover plates of the cable ducts inside the control building) have to be moved when opening the ducts. When laying down cables, special care (e.g. breathing masks) shall be taken and considered in the HSEMP to be developed by the CC.		

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Project Activity	Potential Environmental Impact	Proposed Mitigation Measure	Institutional Responsibility	Cost Estimates
	Oil waste	Old oil was analyzed for PCB (see Section 10.13).	Oil testing for PCB was organized by FICHTNER	Included in the design costs
		As the oil is free of PCBs, it will be refined and reused.	PMU/Barqi Tojik	Included in regular operational costs
Connecting of 220 kV line to s/s	Power shut down	Short power interruptions (< 8hrs) shall be done during times of low power demand and announced some days before.	CC PMU/Barqi Tojik	Included in the construction costs
Extension of s/s Rudaki	Health	Substation shall be fitted with an appropriate number of toilets (at least 6 more, separated for men and women)	CC	**15,000 USD**
Connection of OHL to s/s Ayni	Health	The control desk of Ayni shall be separated by a wall to protect the workers from battery vapor	CC PMU/Barqi Tojik	**5,000 USD**
Installation of SF_6 containing circuit breakers	Climate Change	Careful handling of SF_6 is absolutely necessary considering the relevant guidelines (see Section 10.7). The circuit breakers shall be fitted with automatic leak detectors. The CC shall perform a training for Barqi Tojik staff regarding handling of SF_6.	CC and Fichtner for design	Included in the construction costs

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Project Activity	Potential Environmental Impact	Proposed Mitigation Measure	Institutional Responsibility	Cost Estimates
Work camps (if foreseen)	Waste water generation Domestic waste generation Depending on the location: damage to potential habitats, protected areas or agri-cultural land. Accelerated erosion possible.	Work camps (if foreseen) shall be located down in the valley, but not nearby surface water bodies and not on potential habitats, protected areas or agricultural land. Workers shall be trained regarding proper waste water handling according to environmental management requirements. Controlled waste disposal at the nearest village within the existing waste collection and disposal system shall be considered. A detailed design of each work camp including infrastructure planning (water and electricity supply, waste management, waste water treatment and disposal) shall be provided by the constructor.	CC	Included in the construction costs

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8.1.3 Operation Phase (Reflected in the design)

Table 8-3: Mitigation Measures during Operation Phase

Project Activity	Potential Environmental Impact	Proposed Mitigation Measure	Institutional Responsibility	Cost Estimates
Land acquisition and use	Height limitations (i.e. for tree plantations) have to be respected. Minor impacts will occur during maintenance works.	Crop losses during maintenance works have to be compensated properly.	Barqi Tojik	Included in operational costs
Interference with infrastructure	Interference with air traffic	Installation of an air craft warning system	Barqi Tojik	Included in construction costs
Clearing of RoW	Impact on biodiversity	Herbicides shall not be used for clearing measures. Removal of plants only manually	Barqi Tojik	Included in operational costs
Transmssion line design	Impact on biodiversity	Design and installation of bird spikes and diverters near IBA	CC, Fichtner and Barqi Tojik	Included in design costs

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8.2 Monitoring Measures

8.2.1 Construction Phase

Table 8-4: Monitoring Measures during Construction Phase

Monitoring measure	Parameters to be monitored	Location	Measurement	Frequency	Responsibilities	Cost Estimates
Ensure that mitigation and monitoring activities are implemented and executed	All foreseen mitigation and monitoring actions	All construction sites	Through field inspections	Monthly during construction	PMU/ 'Social Sector and Environmental Monitoring Department' Barqi Tojik	Performed by existing PMU/Barqi Tojik staff
				Constantly during construction	PIC	Included in the contract for the Implementation Consultants
			Through audits	Twice a year during construction period = 5 times, performed by an external internationally experienced expert	PMU/ 'Social Sector and Environmental Monitoring Department' Barqi Tojik	**125.000USD**

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8.2.2 Operation Phase

Table 8-5: Monitoring Measures during Operation Phase

Monitoring measure	Parameters to be monitored	Location	Measurement	Frequency	Responsibilities	Cost Estimates
Prevention of soil pollution	Oil leaks at substation sites	At transformer sites	Visual inspection	Regularly	Barqi Tojik	Included in operational costs. Inspections done by staff of Barqi Tojik
Prevention of release of greenhouse gas SF_6	SF_6 leakages	GIS building	Automatic leak detectors	Permanently	Barqi Tojik	Included in operational costs

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8.3 Contractor's Health and Safety (H&S) Obligations

8.3.1 General H&S Targets and Objectives

The Health and Safety (H&S) targets of the Project are:

- zero accidents,
- no hazardous situations to the environment and public;
- no harmful spills to the environment,
- the promotion of welfare and health issues,
- the development of a sound working environment; and
- the integration of the local community.

Considering the defined H&S targets, the H&S objectives for the Project are:

- to design overhead lines and substations that are intrinsically safe, a healthy place to work in and have an as low as reasonable practicable (ASAP) impact on the environment;
- to execute the erection, construction and commissioning and to initiate the start-up of the overhead lines and substation operation without health or environment related incidents and to form the basis for a safe operation and maintenance;
- to comply with the applicable laws and regulations.

8.3.2 H&S Organization

In order to reach the general objectives given above, the Contractor shall develop, implement and operate an Health and Safety Management System (HSEMS). This HSEMS is based on the generally existing H&S policy and goals of the Contractor and on an H& S Management Plan that has to be specifically developed to this Project by the Contractor. This plan shall give all measures how to meet the outlined H&S targets and goals.

The Contractor shall determine persons being responsible for all H&S issues on all construction site(s). These H&S officers in charge shall prepare monthly records of all H&S relevant incidences (e.g. worker's fatal and non-fatal accidents), and keep an employment record giving name, age etc. of employed workers. The H&S officers will be responsible for keeping a high health and safety standard at the construction sites as wearing helmets, providing workers with ear protection devices, ensure that workers are belted during working at height etc. They will also be responsible for regularly teaching of workers in first aid, how to work under high voltage etc. These H&S officers will also take care that all sub-contractors follow this good H&S

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practice at the construction site(s). A monthly report shall be prepared and submitted to the PMU.

Following key tasks shall be considered by the contractor in order to meet the targets and objectives as defined above:

- build up an H&S team with all project team members as part of coordination meeting (s);
- perform H&S training presenting all relevant governing documents and applicable legislative requirements related to H&S;
- implement measures to meet all risk acceptance criteria and H&S objectives defined for the OHL and Substation project,
- implement H&S requirements in all requisitions/ subcontractors,
- implement H&S requirements in all supply contracts,
- set-up and maintain H&S evaluation and decision making system;
- define and implement all H&S permit requirements;
- implement an office safety and clean desk policy;
- prepare an emergency preparedness and response plan.

The main focus of H&S during construction is the preparation and consideration of a site-specific H&S plan to be prepared by the Contractor and to be submitted to the Employer for approval prior to mobilization. This H&S plan shall:

- consider the H&S targets and objectives defined above;
- cater for the full scope of Contractor's work, including what is done by his subcontractor;
- provide all procedures required for performing H&S tasks that are inherently harmful and/or hazardous, e.g. performing excavations and trenching, confined space entry, work at heights, lifting/ hoisting operations, working with hazardous, dangerous or flammable material or goods, working under high voltage etc.

Any deviation to the H&S requirements must be reported in writing to the Employer for approval. The Contractor shall be responsible for promoting H&S awareness among his employees as well as those of his subcontractors, suppliers, visitors, and persons delivering materials and equipment.

8.3.3 Specific H&S Requirements during Construction (Work and Public Safety)

The following requirements are the minimum requirements with respect to H&S at the construction site. The employer shall have the right to extend these H&S requirements in case of the needed actions to fulfill the H&S targets and objectives:

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- Regarding the influx of construction workers, specific attention shall be paid to Sexually Transmitted Diseases (STD)—or Sexually Transmitted Infections (STI) in general and HIV/AIDS in particular. An awareness program shall be developed and communicated to all workers. This program might also include the provision of condoms for all site staff and labor as appropriate and provide an STI and HIV/AIDS screening, diagnosis and counseling.
- The Contractor's approved H&S plan will be the only applicable and valid H&S plan at site outlining and specifying details regarding H&S. Separate subcontractor or supplier's H&S company policies, H&S management systems or H&S plans are not acceptable at site.
- No personnel or employees are allowed to perform works, tasks or operations which they are not specifically trained and certified to perform. All works will be subject to work permits. No works are allowed to perform without an applicable and valid permit to work.
- At arrival of any personnel on site the Contractor shall secure that they have or will get the required training / certification before any works, tasks or operations are assigned.
- The Contractor shall ensure that his own, his subcontractors' and suppliers' personnel at all times follow all site specific H&S rules and requirements whenever they are present on site.
- The Contractor shall ensure that first aid kits including "eye washers" are available at all work locations and that first aid kits are complete at all times. The Contractor shall ensure that at least one defibrillator will be available on each construction site.
- If applicable, the Contractor shall inform himself about the potential presence of poisonous animals and take all required precautions to avoid accidents.
- The Contractor shall ensure that his personnel have passed an elementary first aid training including cardiac arrest treatment.
- The Contractor shall ensure that safety goggles are handed out and worn by all employees or personnel at all times at working places. Hard hat, safety footwear, working gloves and protective outer clothing suitable for the local climate conditions shall be worn at all working locations. Hearing protection shall be worn in all areas with noise levels at or above 80 dB(A).
- All electrical hand tools, extension cables, transportable generators, other non-permanent electrical equipment etc. shall undergo short circuit checks by a certified and registered electrician minimum per every three (3) months, prevailing national or international rules.
- Use of drugs and alcohol are strictly prohibited when working or being present on site. Personnel reporting for work that are under the influence of alcohol and/or drugs shall be denied access to site. In such cases, the Employer expects the Contractor to intervene with appropriate measures according to Contractors' terms of employment in order to prevent recurrence. However, the Employer reserves the right to deny continued access to site to such person(s) without further notice if the site safety and security in any way otherwise is felt threatened.

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In order to fulfil the health and safety tasks and the environmental requirements given in this EMP the contractor has to set up an overall Health, Safety and Environment Management Plan (HSEMP) and implement a Health, Safety and Environment Management System (HSEMS). Such a system includes beside health and safety issues also environmental needs.

8.4 Institutional Arrangements and Reporting Needs

The construction contractor is obliged to implement the EMP. Doing so, he shall set up a Health, Safety and Environmental Management Plan (HSEMP) and install a Health, Safety and Environmental Management System (HSEMS) during the entire construction period covering all construction sites and all construction activities (see Section 8.3).

The 'Social Sector and Environmental Monitoring Department' within the PMU as a governmental establishment will be responsible for supervising and monitoring the implementation of the EMP by the CC: For that, the PMU shall perform field visits about twice a month. The PMU is supported by the Project Implementation Consultant (PIC).

The CC will prepare monthly progress reports about the implementation of the EMP. Based on these reports and own field visits the PMU shall prepare monthly Safeguard Monitoring Reports showing the progress of the implementation of the Environmental Management Plan (EMP). The reports shall contain all discrepancies from the EMP and list all HSE relevant incidents and accidents that occur during the implementation of Project.

Based on these reports the Social Sector and Environmental Monitoring Department will prepare semi-annual safeguard performance and monitoring reports and submit them to ADB, to Barqi Tojik and to other relevant national authorities. In doing so, the PMU will be supported by the Project Implementation Consultant (PIC).

In addition, the implementation of the EMP shall be audited twice a year by an independent internationally experienced auditor.

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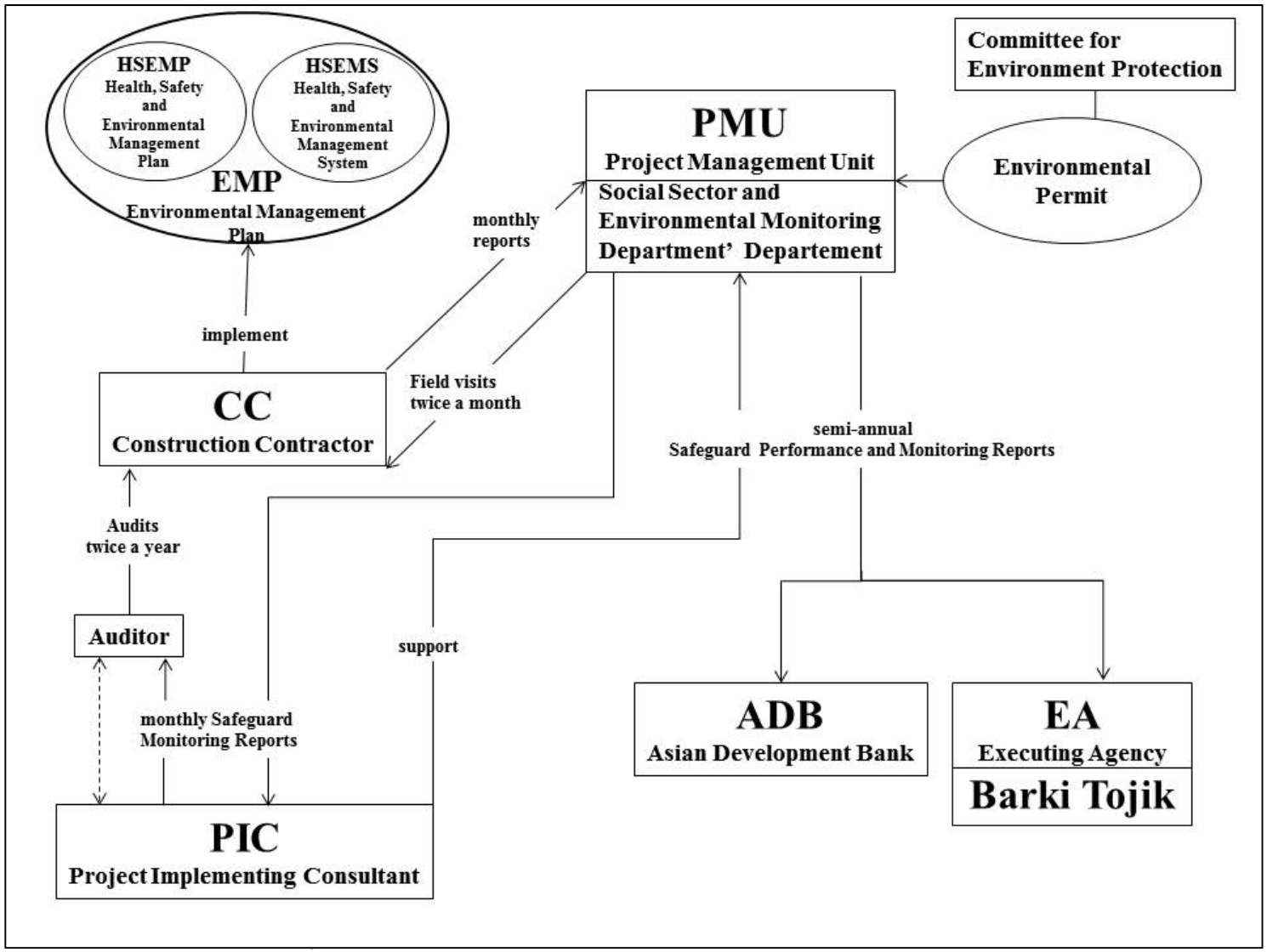

Figure 8-1: Organizational diagram of the project's environmental, health- and safety management system

8.5 Training Requirements

As discussed in Section 1.3 and 8.4 the Government of the Republic of Tajikistan set up the 'Project Management Unit for Elektro-Energy Sector' (PMU) in order to implement the Project. Within this PMU the Social Sector and Environmental Monitoring Department has been established. In other ADB financed Projects training programs for the PMU have been recommended in the IEE concerned.

Specific training needs related to this Project are:

- Risks using SF_6 in circuit breakers and how to handle it (to be done by the construction contractor see Table 8-2);
- Risks arising from PCB contaminated oil, how to measure PCB in oil and how to handle PCB contaminated oil;
- electric and magnetic fields and how to measure.

The costs for a training program covering PCB and EMF issues will sum up to **USD 10,000.**

8.6 Costs of Implementation of the EMP

The costs for mitigation measures being not included in the construction costs sums up to 20,000 USD. The costs for auditing the implementation of the EMP are 125,000 USD, and for training 10,000. From that, the overall costs including 10 % contingency are **170,500 USD**.

The costs for adaptation measures to Climate Change challenges of **90,000 USD** are already included in the construction costs.

The costs for supervising of implementation of EMP by the Project Implementation Consultant (PIC) shall be included in the PIC contract.

For costs resulting from the social analysis see the stand alone report 'Land Acquisition and Resettlement Plan' (LARP).

8.7 Tender Documents

The Environmental Management Plan presented herewith shall be part of the tender documents to be prepared to the Project.

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9. Conclusion and Recommendations

During the design of a proper line corridor, highest priority was laid on the avoidance of settlements and housings. The selected line routing does not require any physical relocation of houses.

The borders of the Soy Vota Nature Reserve have been respected in the line routing. To be sure to be outside of the reserve, two towers were moved to the north. The Zerafshansky Nature Reserve is also not affected by the line corridor. Installation of bird spikes and diverters are envisaged in proximity to IBA.

The old oil resulting from the rehabilitation measures foreseen at s/s Rudaki was analyzed for PCB. Only oil of the circuit breaker OHL 2 contains traces of PCB. The amount of this sample is 8.3 ppm, which is clearly under the threshold value of 50 ppm. In all other samples no PCB was detected (the detection limit of 0.2 ppm was even not reached). All analyzed oil can therefore be considered to be free of PCB. This is consistent to the experience gained in other projects at Tajikistan and other countries of the former Soviet Union. Consequently, the oil can be refined and reused again and no corresponding Management Plan needs to be developed (for more information about PCB and relevant standards in oil see Annex 10.13)

Possible effects of climate change phenomena like an increase in frequency and severity of mass movements (e.g. landslides, mudflows) affecting the stability of towers are reflected in the design.

Positive Project impacts are the employment of also unskilled workers during construction period and a much more reliable power supply for the region of Penjikent. At the moment, this region is only served via an old 110 kV line since the power supply from Uzbekistan is cut off. During construction a long term power shut down is not necessary. Short interruptions (< 8 hours) for connection activities may appear.

To this 220 kV line of the Transmission Reinforcement Project an Environmental Management Plan (EMP) including mitigation and monitoring measures has been developed. This EMP shall be part of the tender documents and the implementation of the EMP shall be supervised by the future Project Implementation Consultant and the PMU and monitored twice a year by an internationally experienced expert.

The overall costs for implementation of the EMP will be **170,500 USD**.

In summary, from the results of the investigation it can be seen that the Project will have only low site-specific environmental and social impacts if the proposed mitigation measures are implemented.

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10. Annexes

10.1 Tajik Environmental Legislation

Specially Protected Natural Areas

This Act was signed by President of the Republic of Tajikistan on 26 December 2011 №786. Present Law on Specially Protected Natural Areas stipulates the legal, institutional and economic frameworks for protected areas, their tasks, mode of operation and zoning.

Depending on the creation purposes, the characteristics of the protection regime and usage, the following categories of protected areas shall be established:

- State natural reserves;
- State parks;
- Nature reserves;
- State zoological parks;
- State nature monuments;
- Ecological and ethnographic zones;
- Arboretums and botanical gardens;
- natural spa, therapeutic and recreational areas.

Specially protected natural areas are the exclusive property of the state, and the state guarantees their effective use in the interests of the people.

The actions directly or indirectly violating the rights of state ownership of the protected areas are prohibited.

For violation of this Act individuals and legal entities shall be liable in accordance with the laws of the Republic of Tajikistan

Environmental Monitoring Law

The given Law No. 707 was signed by the President of the Republic of Tajikistan on 25 March 2011. The Environmental Monitoring Law specifies organizational, legal, economic and social framework for environmental monitoring in the Republic of Tajikistan and governs the relations of the public authorities, local governments of the towns and villages, public organizations and citizens in the sphere.

In accordance with Article 12.

Environmental Monitoring Subjects Duties and Responsibilities, the environmental monitoring subjects in relation to their sites included to the National Register of Environmental Monitoring of the Republic of Tajikistan are obliged to:

– From the own funds initiate and implement local monitoring of the human impact sources on the natural environment;

- Ensure the creation of the material and technical base required for the environmental monitoring;

- Carry out local monitoring using tool and means prescribed by the legislation procedures for the measurements unity ensuring;
- Identify officials responsible for the local environmental monitoring; provide training in accordance with the qualification requirements;
- Submit mandatory data on the local environmental monitoring to the state agency authorized for the environmental monitoring arrangement and implementation and local governments for free and in a timely manner and prescribed scopes.

2. The local environmental monitoring is carried out by the natural resources users or entities engaged by them in accordance with the programs (the regulations) requirements developed and agreed with the state agency authorized for the environmental monitoring arrangement and implementation.

3. The organizations and individual entrepreneurs whose activities are related to the natural resources use or risk of the environment negative impact will arrange and carry out the environmental monitoring as stipulated by the legislation.

Ecological audit

Present Act was signed by President of the Republic of Tajikistan in March 25, 2011 №785. Present Act defines environmental auditing principles and procedures for environmental audit in the Republic of Tajikistan in order to prevent the harmful effects of administrative, economic and other activities on the environment, life and health of the population of the Republic of Tajikistan.

Tasks and purposes of ecological audit:

Basis of the environmental policy strategy of the economic entity;
prioritizing the environmental plannings of business entity, identification of additional opportunities for its implementation;

- verification of compliance with the business entity laws on environmental protection;
- improving the efficiency of the impact of an economic activity on the environment controlling;
- reduction of the emergencies risks related to environmental pollution.

Environmental auditing types

1. Proactive and mandatory types of environmental audit can be established in the Republic of Tajikistan.

2. Proactive environmental audit to be conducted by an environmental audit firm or auditor engaged in entrepreneurial activities without forming a legal entity based on the economic entity resolution.

3. Mandatory environmental audit to be conducted by an environmental audit organization based on the resolution made by state authorities.

4. The procedure for appointment of mandatory environmental audit are determined by the Government of the Republic of Tajikistan.

Following the recommendations of EIA, the effect of this law can be extended to the 220 kV "Ayni - Penjikent" OHL construction project.

Ecological information law

The given Law No. 705 was signed by the President of the Republic of Tajikistan on 25 March 2011 and specifies organizational, legal, economic and social framework for environmental information provision the Republic of Tajikistan and promotes the rights of individuals and legal entities to obtain complete, accurate and timely environmental information and regulates relations in the given sphere.

Present law stipulates the environmental information types and main sources, public environmental information resources formation and maintenance procedures, provision of environmental information to individuals and legal entities, that are non-governmental agencies or other government agencies, including:

1. The general environmental information will be provided to the individuals and legal entities by the environmental information insiders (holders) that are not public authority or other government agency (hereinafter - the Applicant), upon the request and free of charge, unless otherwise provided by Tajik legislation.
2. The general environmental information will be provided to the Applicant by the environmental information insiders within ten days from the Application receipt date.
3. Requirements for the general environmental information application are prescribed by Tajik legislation.
4. The general environmental information will be provided in the format, scope and content specified in the application for the provision of general environmental information, and, in case of insufficient technical resources, the environmental information owner will provide the information in the in the existing format and scope, indicating the relevant reasons.
5. If the owner of the requested general environmental information is a legal entity that is not a public authority or other government agency, then the public authority or other government agency in whose address the Application was received and are competent to meet this application shall request needed information from the environmental information insider within ten days from the Application receipt date, with the written notice to the Applicant.
6. Upon the request from the public authority or other government agency to provide general environmental information referred to in Paragraph 5 of this Article, the environmental information insider shall provide the requested information within ten days from the receipt date or notify the Applicant on refusal in its provision specifying the reasons for such denial within five days upon the receipt request in accordance with the Tajik legislation and international legal acts recognized by Tajikistan.
7. A public authority or other government agency, received the general environmental information in accordance with Part 6 of this Article had, will provide this information to the Applicant within one month from the Application receipt date. In case of the refusal notification receipt from the environmental information insider to provide the environmental information, a public authority or other government agency shall notify the Applicant and specify the reasons for the refusal within five days of the refusal receipt.
8. If compliance with the Application for general environmental information is not a responsibility of the public authority or any other government agency, the Application should be transferred to other public authority or government organization, competent to comply the Application notifying the Applicant within five days from the Application receipt date.

9. In case if the requested environmental information relates to the specialized environmental information type, the environmental information insider shall offer the Applicant to enter into the contract to provide specialized environmental information within five days of Application receipt date.
10. If there are grounds for refusal to provide environmental information stipulated by Tajik legislation and international legal acts recognized by Tajikistan, the environmental information insider notify the Applicant in writing within five days of the refusal to provide environmental information indicating reasons for refusal, explaining the procedures and decision appeal period.

Special Features for Providing Environmental Information to Public Authorities and Government Agencies

1. The general environmental information will be provided to public authorities or other government agencies by the environmental information insider in accordance with the Tajik legislation upon the request, through the information exchange or distribution.
2. The specialized environmental information will be provided to the public authorities free of charge, unless otherwise provided by the Tajik legislation. To other government agencies the specialized environmental information will be provided as per prescribed order and as specified in Article 11 of the given Law Резюме: Following the recommendations of EIA, the effect of this law can be extended to the 220 kV "Ayni - Penjikent" OHL construction project.

Additionally:

Law of RT for «Local government authorities», dated 29.04.2004, no.526

The Act regulates the establishment, powers and activities of local governments:

- defines the powers of local government. Local government agency and the executive of cities and regions is the Chairman of the city (district), being the representative of the President of the Republic of Tajikistan.
- defines the powers of Majlis deputies, which includes the approval of the city budget, local taxes and tax collection, regulation of water consumption, use of land and other natural resources within its powers
- defines the powers of the President of the city (district) that includes the heads of enterprises, organizations and institutions under the jurisdiction of the city, and the responsibility for the activities of sanitary-epidemiological protection of the city inhabitants.
- defines the fees that local public authorities may impose, which may also include payment for the removal of waste and measures for environment protection

Law of RT “On industrial waste and consumption waste”, no. 44 dated 10.05.2002.

The law regulates issues related to waste management. The Act contains the definition of waste types, including consumer waste, recycled materials, municipal solid waste and hazardous waste.

Article 5 defines the powers of the state executive agency for the field of waste management. So, the competent authorities is the State Committee for Environmental Protection under the Government of the Republic of Tajikistan, as determined by its provisions approved by the Government of Tajikistan.

Powers of state executive authorities in the management of MSW defined in Articles 5 and 6 and, in particular, include:

- State control
- Monitoring and supervision of the state of the environment
- Licensing of hazardous waste management
- The development of government regulations on waste management
- Implementation measures in the aftermath of disasters and accidents related to waste management
- Waste inventory management
- Organization of decontamination and waste disposal with the restoration of the damage caused to the environment on their cost
- Creation of economic and social motivations for waste use by individuals and legal persons.

Law of RT "Certain type of activities licensing", no. 37 dated 17.05.2004

According to Article 17 of the Act and Article 8 of the Law of RT "On industrial waste and consumption waste", activities for the hazardous waste management shall be licensed by an authorized state body.

Hazardous waste is defined as a substance having one of the following properties:

- Toxicity;
- Infectious;
- Danger of explosion;
- Flammability;
- The high reactivity.

The authority for licensing activities for the hazardous waste management is the Committee of Nature Protection of the Republic of Tajikistan and its organs. Licensing is carried out in accordance with law and regulation of "Hazardous waste management licensing" dated 6.06.2003. This procedure requires the submission of documentation and cost estimation for each stage. The procedure is performed by above committee, but in certain cases, judgment is required to be provided by state authority on sanitary-epidemiological control.

Law of RT "Organization of sanitary-epidemiological safety of the population", no 49 dated 08.12.2003

This law establishes the legal, institutional and economic framework, the measures related to the provision of sanitary-epidemiological safety of the population. The law defines the regulatory role of the government for ensuring sanitary and epidemiological rules and defines the organization and structure of the sanitary and epidemiological surveillance.

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- Article 21 The law establishes the sanitary and epidemiological requirements for the collection, use, processing, transportation, storage and disposal of industrial and domestic waste

environment for human habitation, flora and fauna, conservation and improvement of the purity of air, the establishment of state control over the use of air in the cities and industrial centers and other settlements points, sources of air pollution, as well as strengthening the rule of law in this relationship for the benefit of present and future generations
Question for the distance between the transmission lines and the airport shall be sent to the construction staff, as this issue is not related to the environment issues. This issue is also absent in the civil codes and regulations “RUSSIAN FEDERATION AERODROMES SNIP 32-03-96 Official Edition, MINISTRY OF CONSTRUCTION OF THE RUSSIAN FEDERATION (RUSSIA, Ministry of Construction)”, used by the Tajik pilots, this issue is not shown in article "Environment protection measures".

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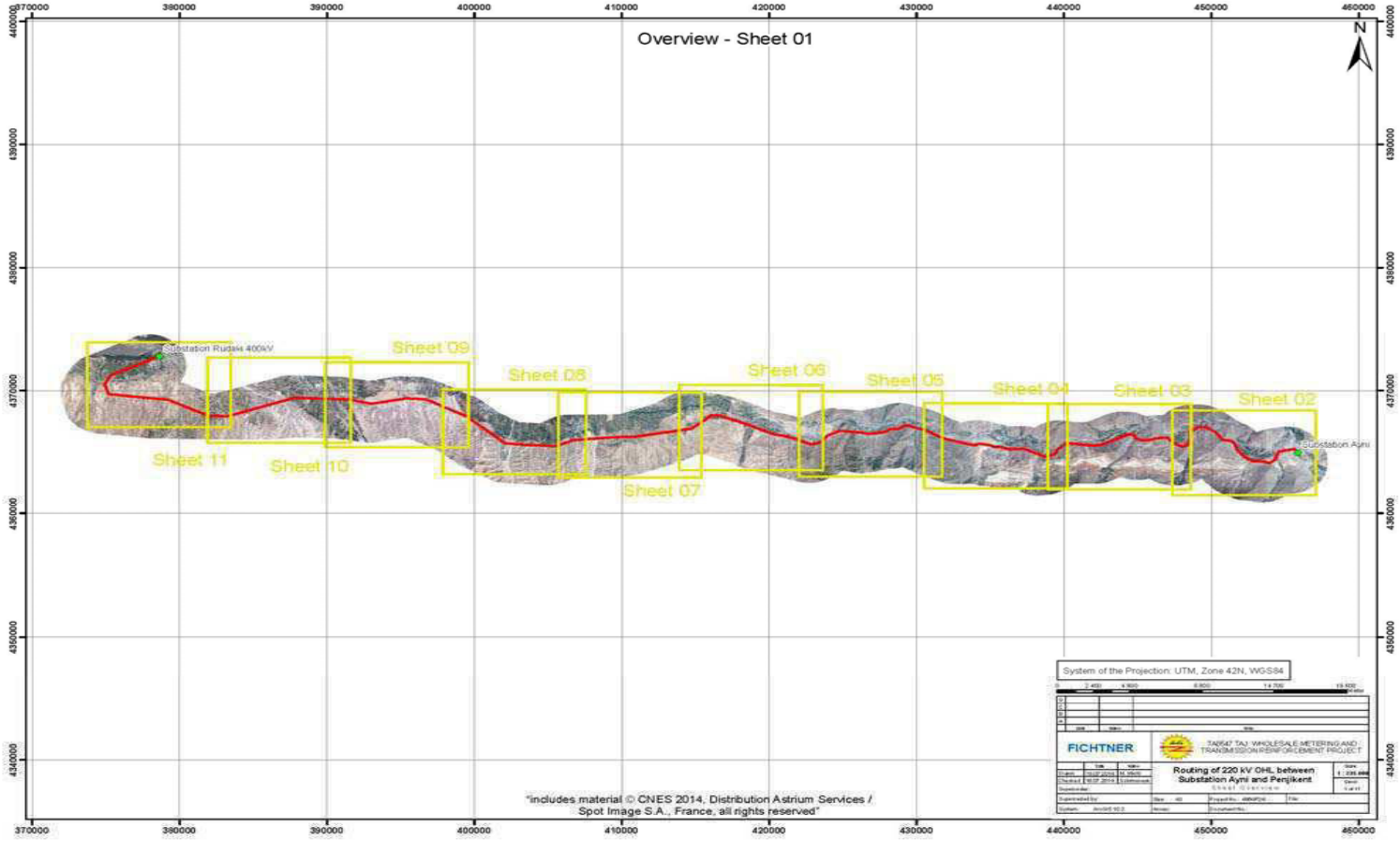
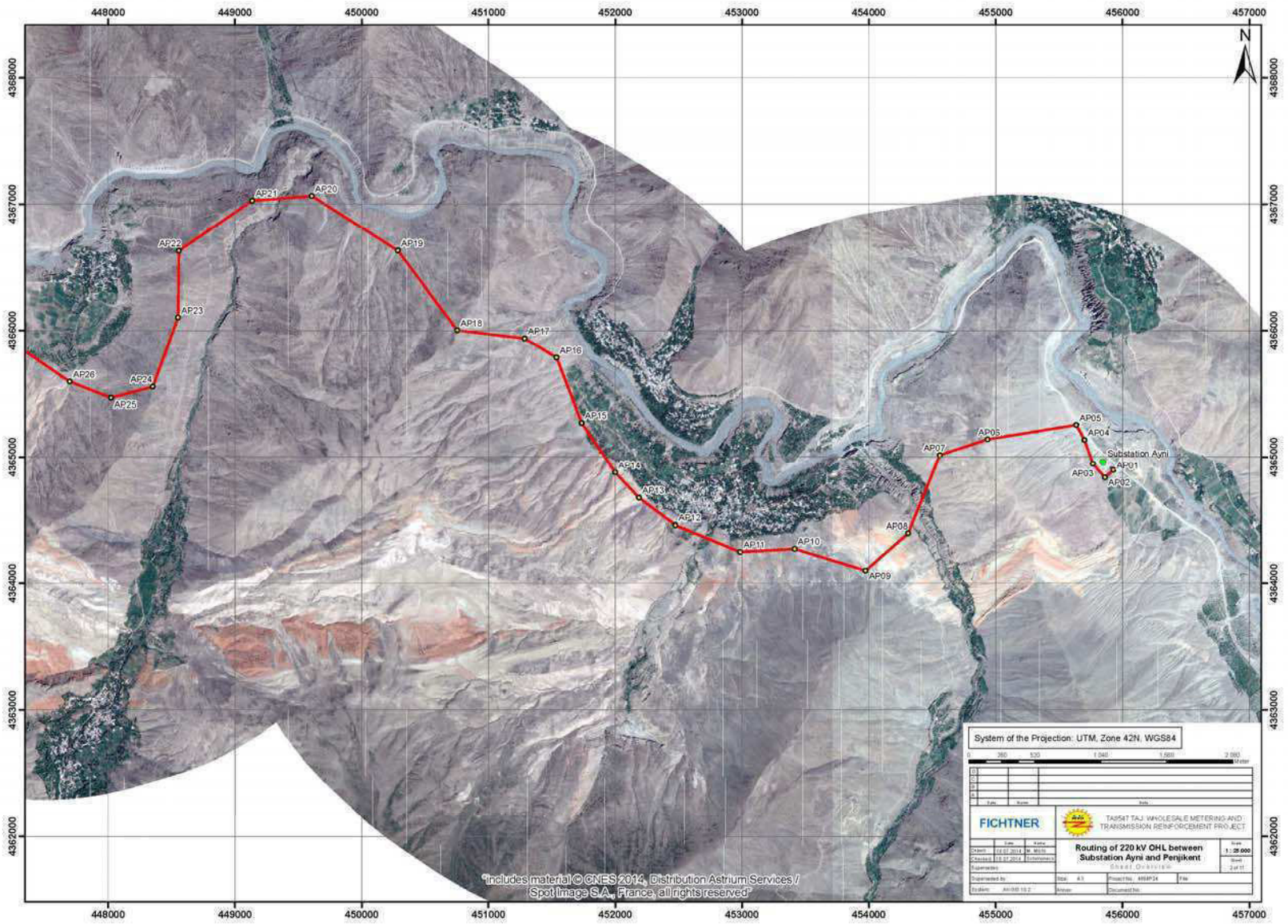
10.2 Maps

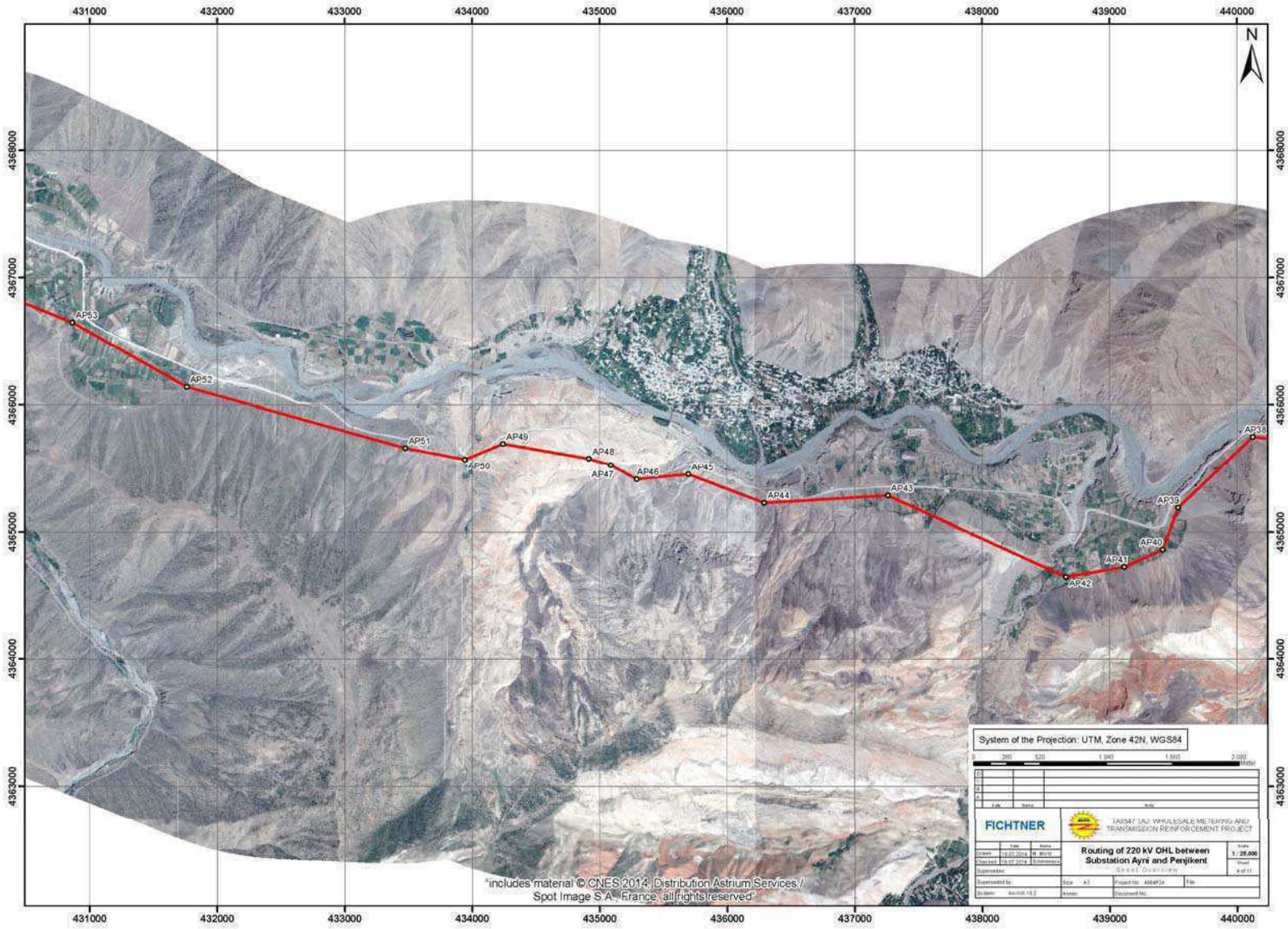


Map 10-1: Overview of line routing of the proposed 220 kV line between s/s Ayni and Penjikent (sheet 02-11)

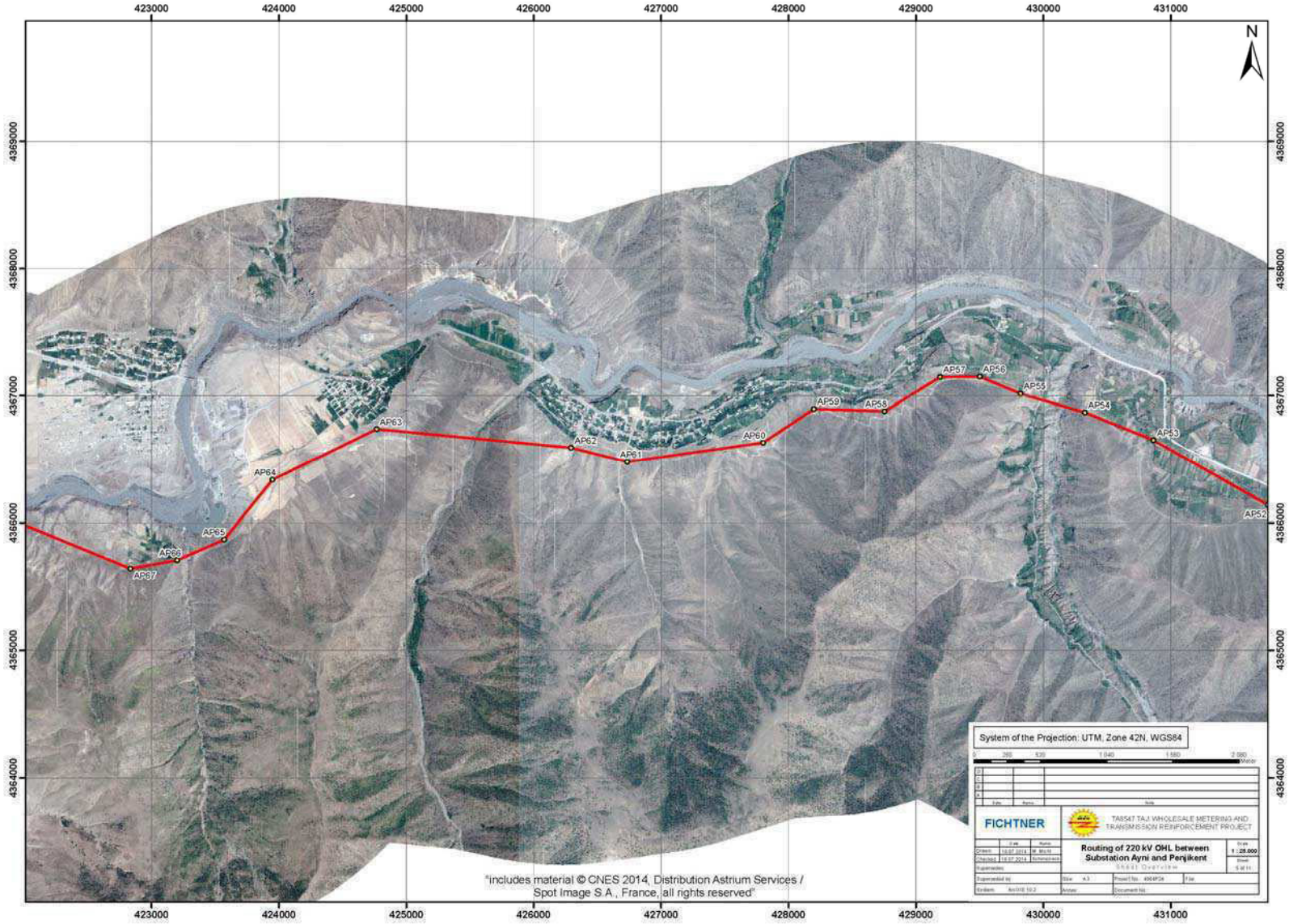


Map 10-2: Line routing sheet 2

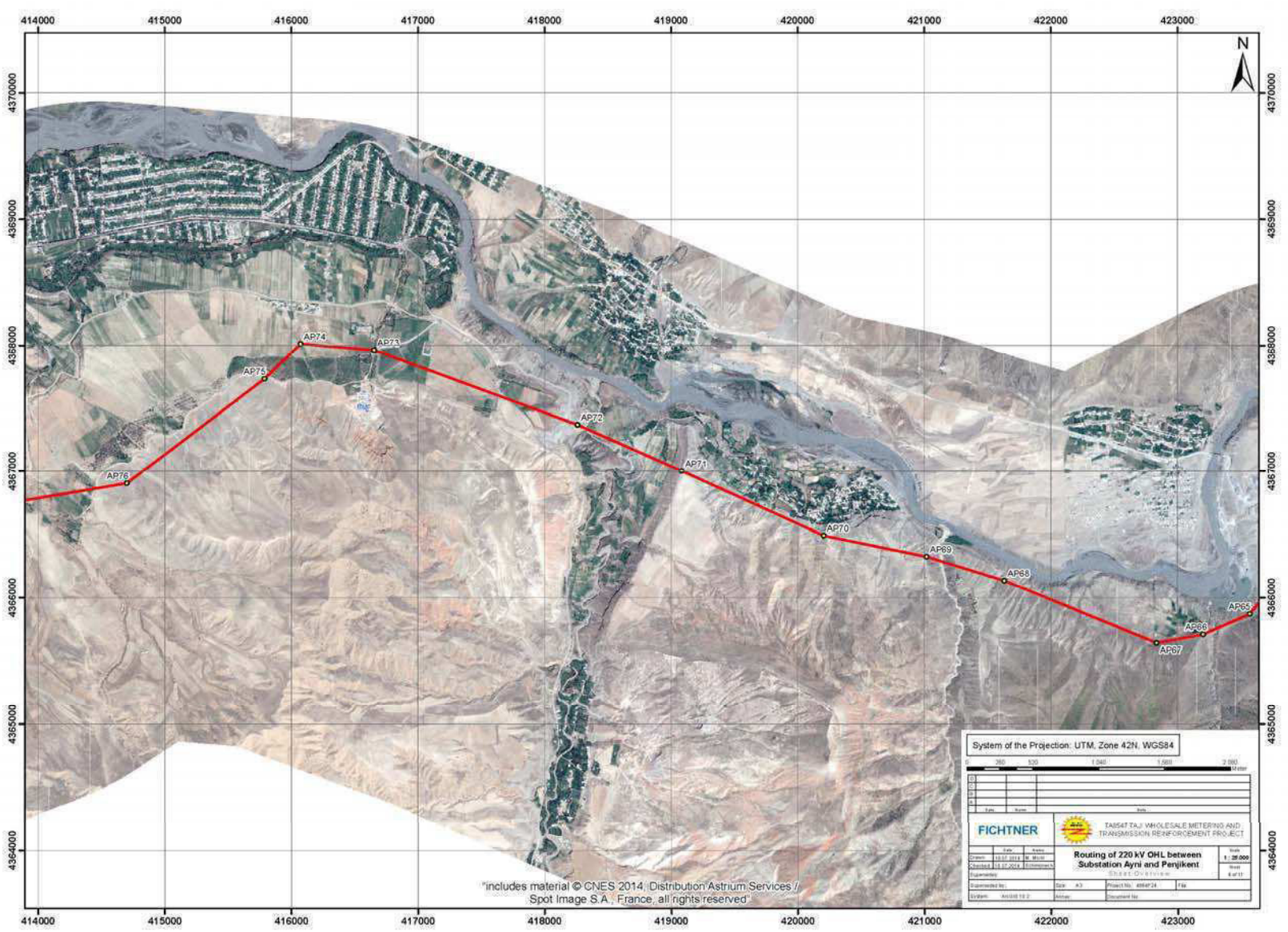
Map 10-3: Line routing sheet 3



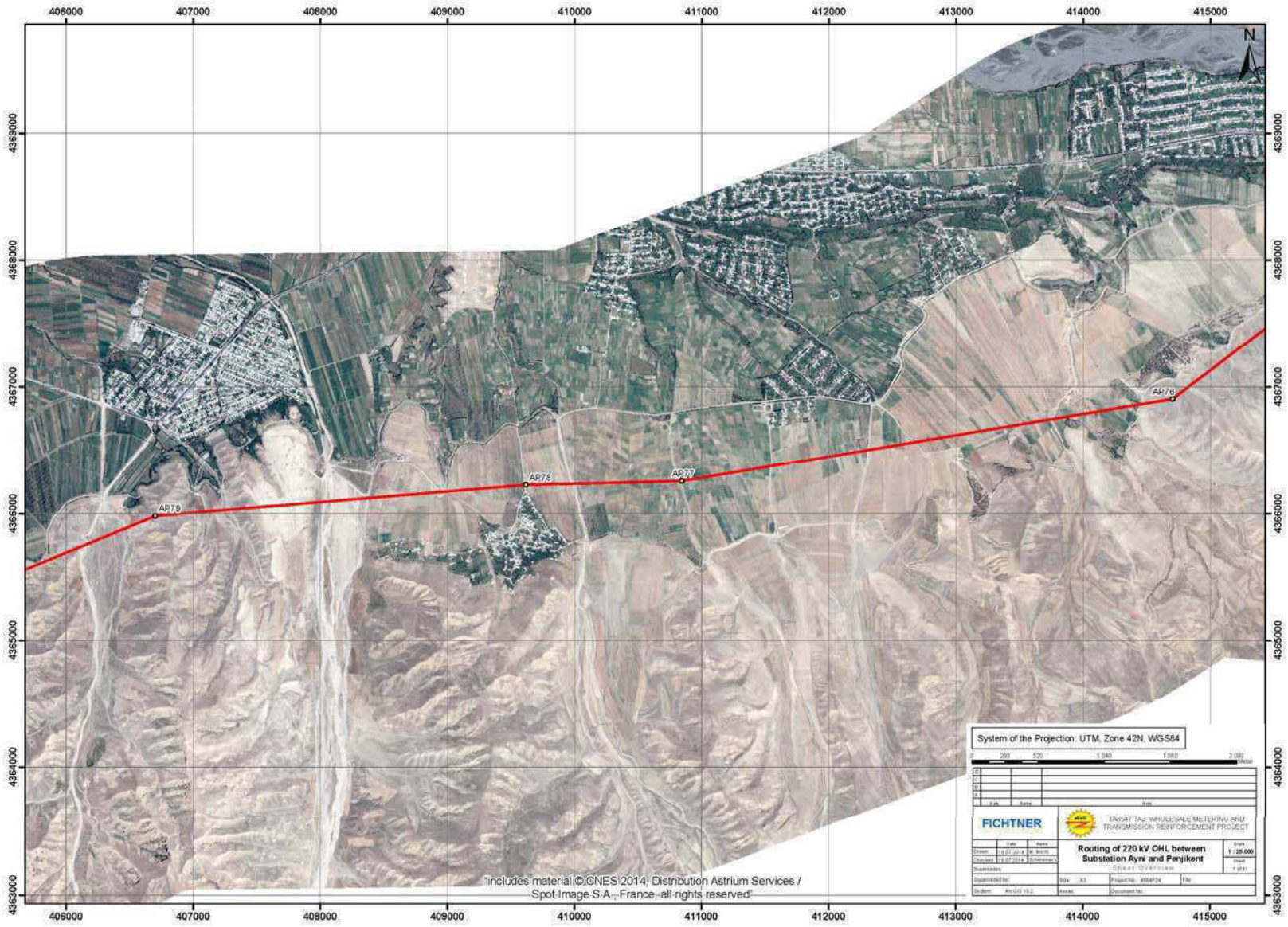
Map 10-4: Line routing sheet 4



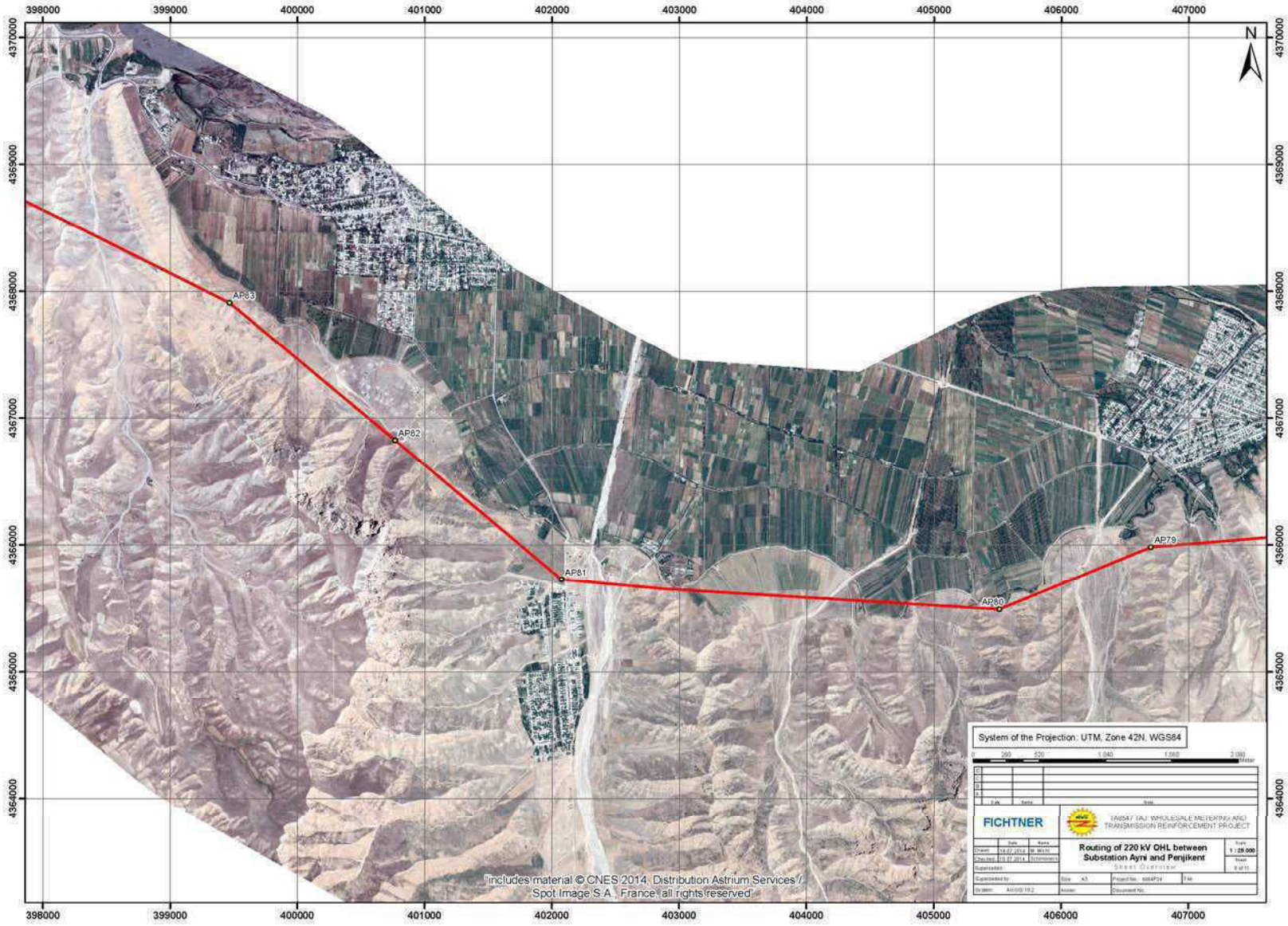
Map 10-5: Line routing sheet 5



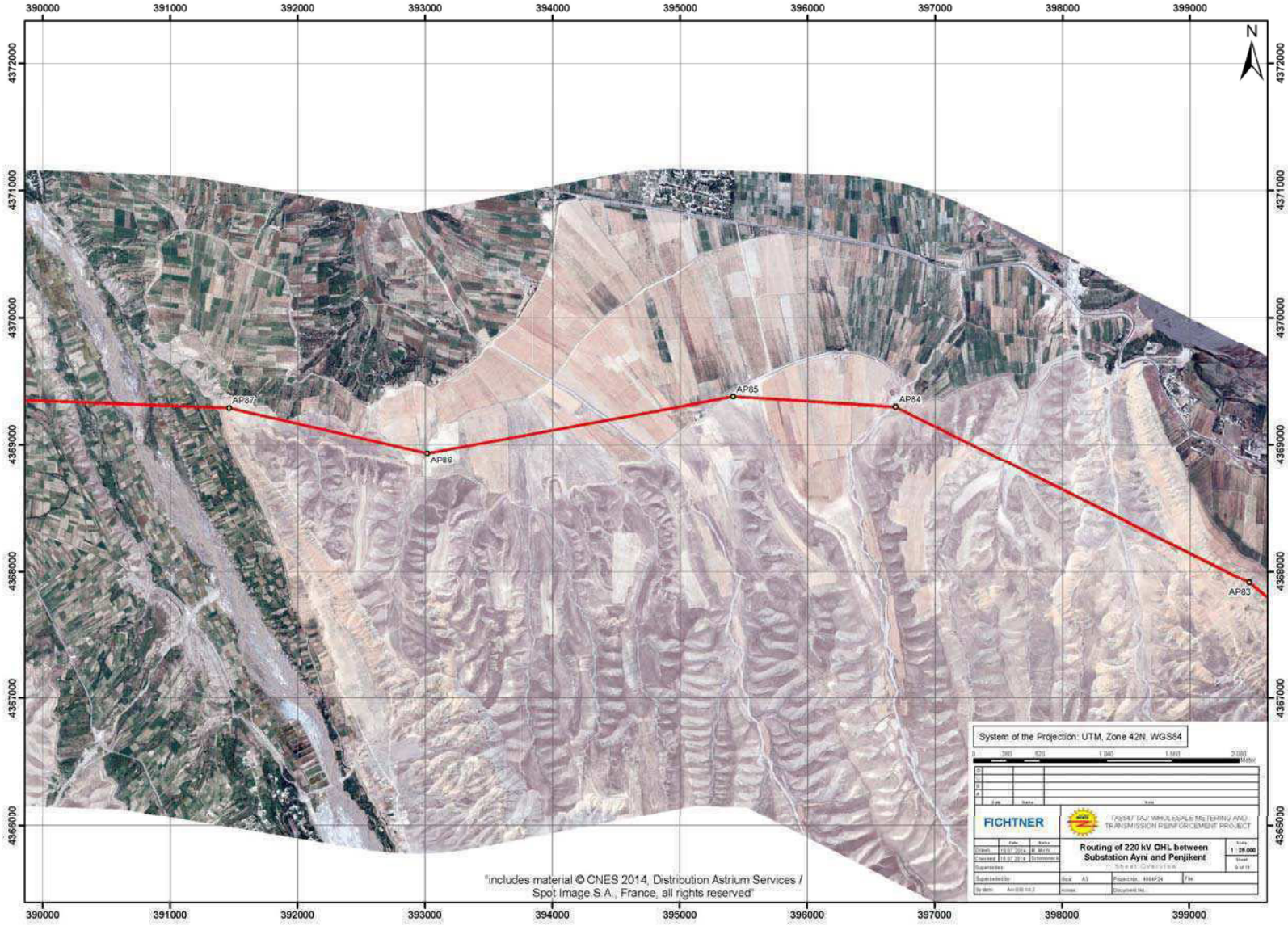
Map 10-6: Line routing sheet 6



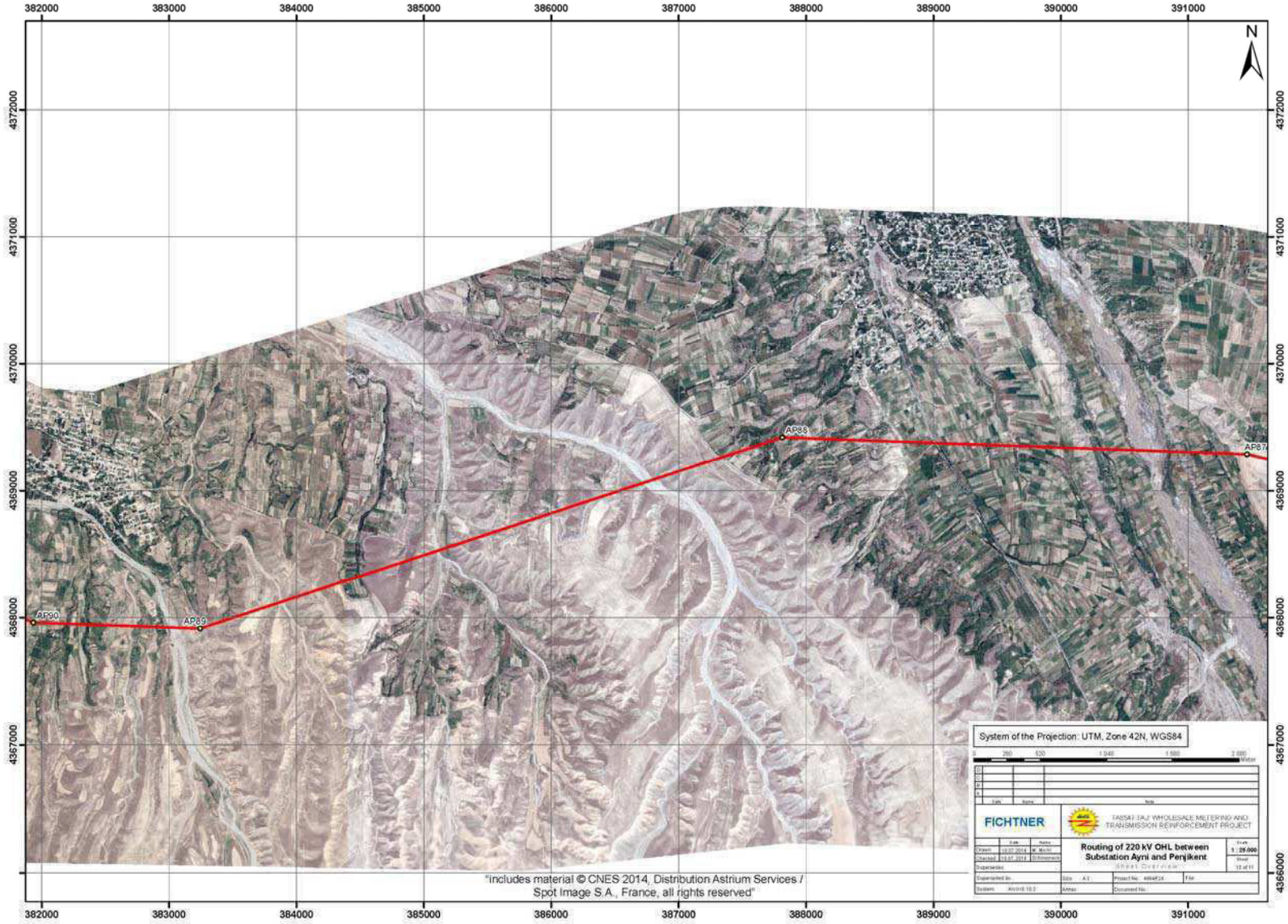
Map 10-7: Line routing sheet 7



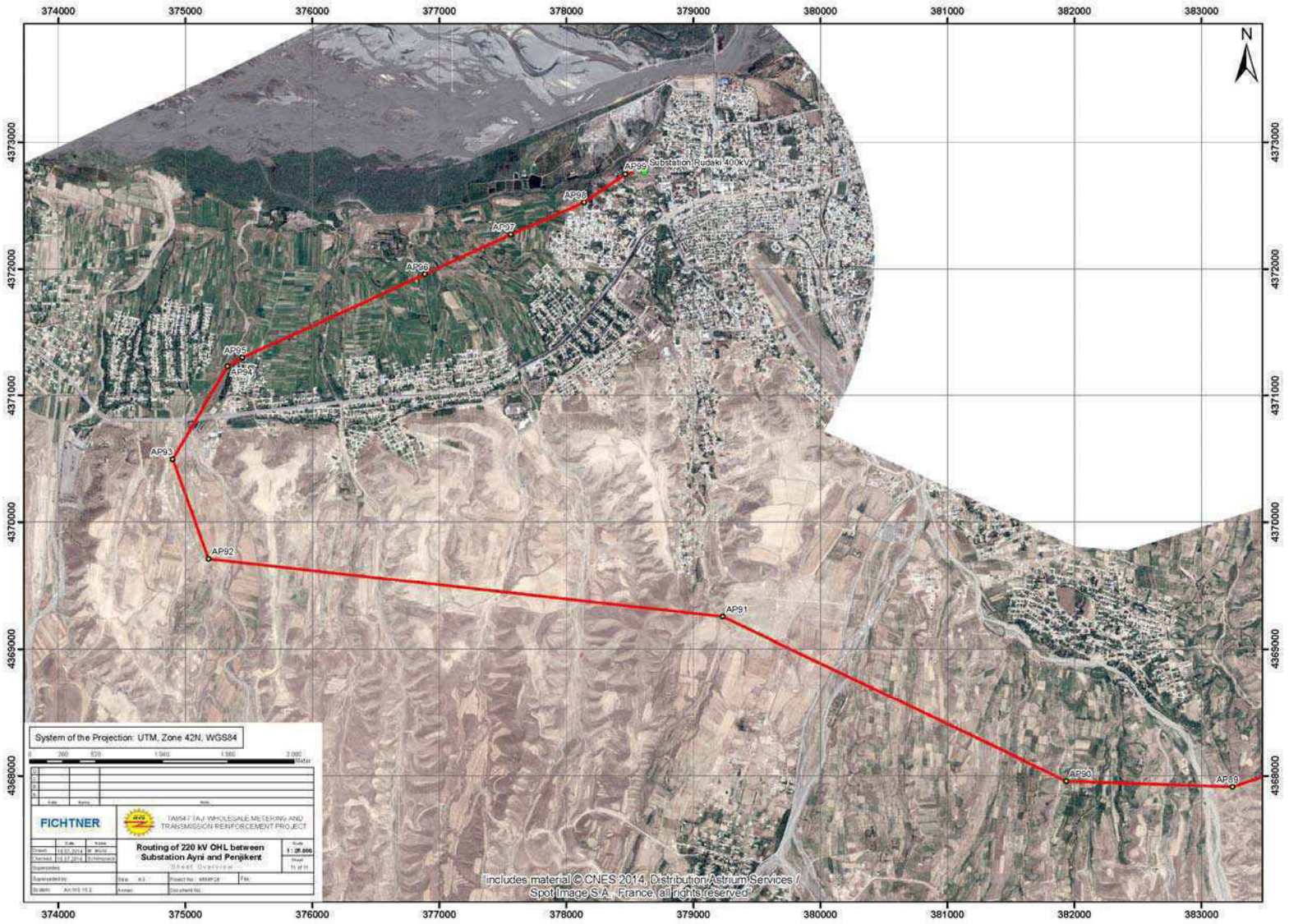
Map 10-8: Line routing sheet 8



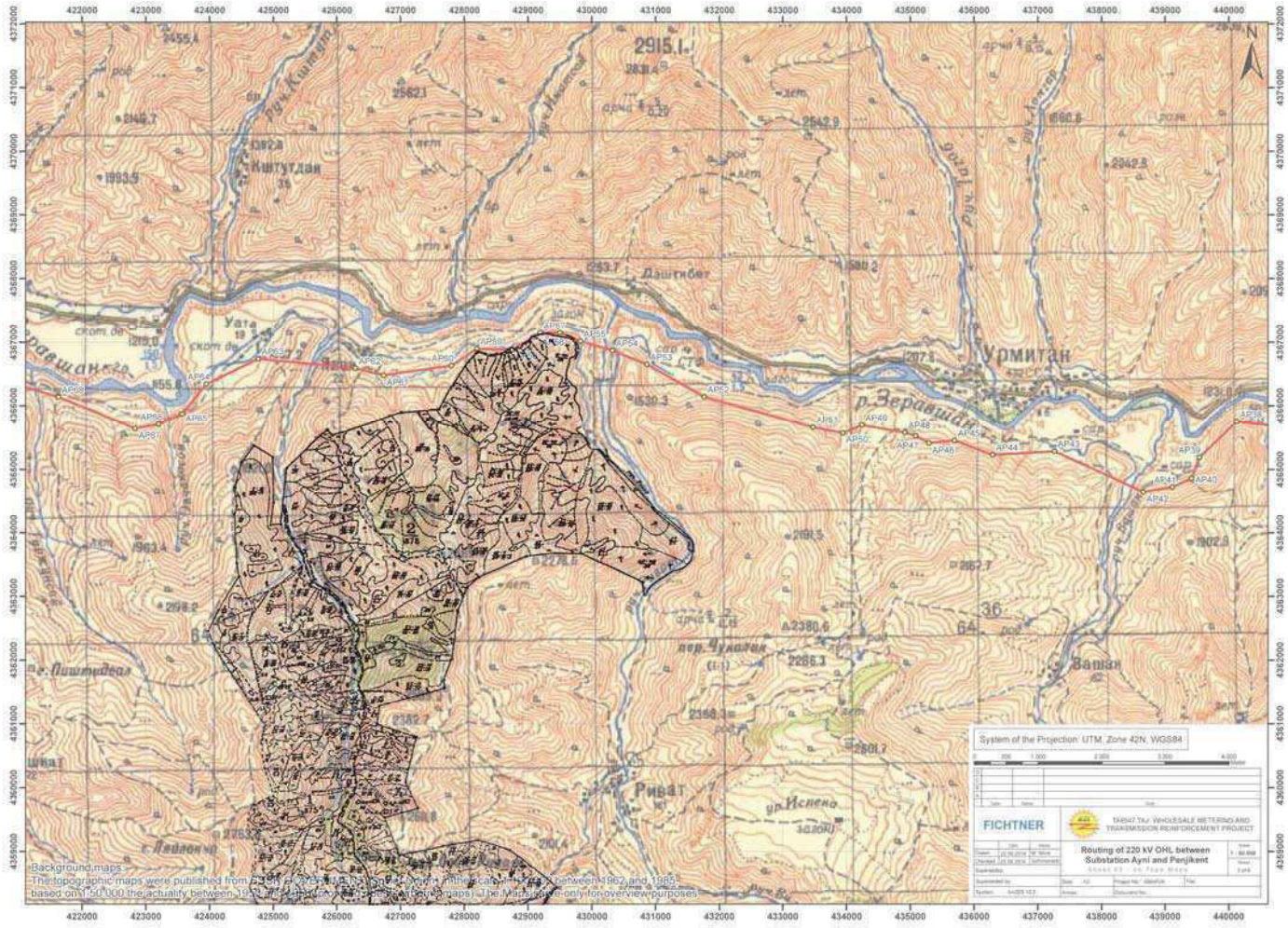
Map 10-9: Line routing sheet 9



Map 10-10: Line routing sheet 10



Map 10-11: Line routing sheet 11



Map 10-12: Line routing and Soy Vota Natural Reserve

10.3 Photographic Documentation

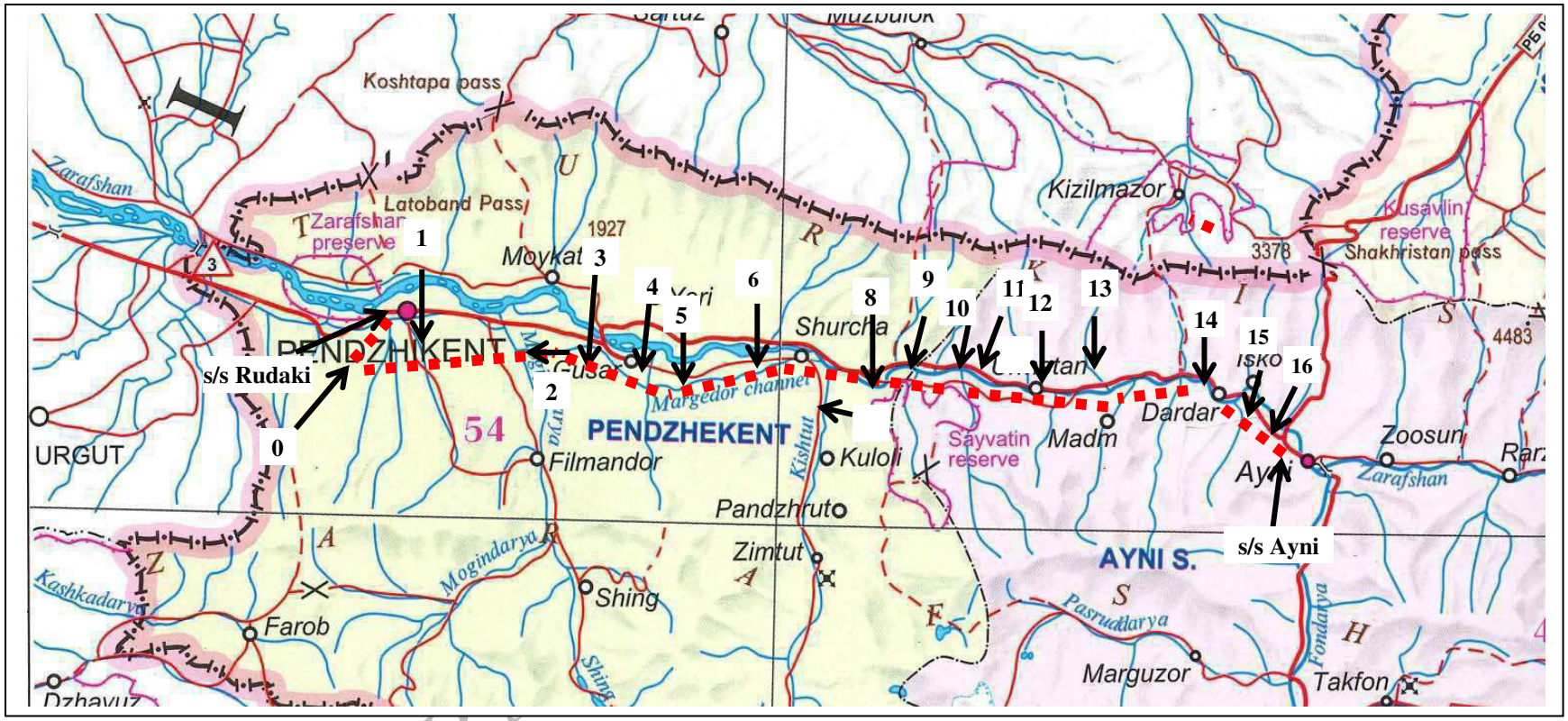


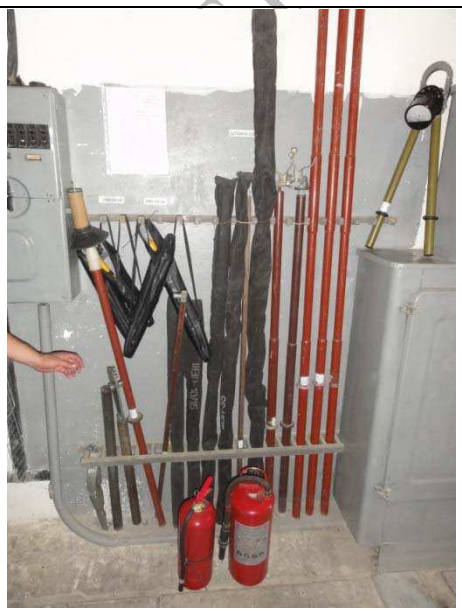
Figure 10-1: Locations of photo documentation

Transformer at s/s Rudaki to be exchanged

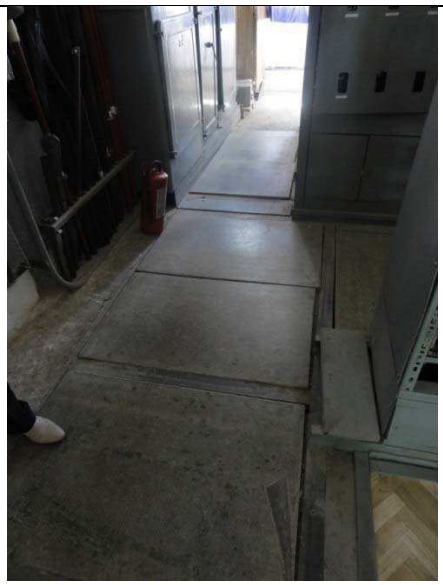
Circuit breakers at s/s Rudaki to be exchanged

First aid kit at control room s/s Rudaki

Fire extinguishers in the control Building s/s Rudaki



Safety equipment for working under high voltage



Panels covering cable ducts possibly containing asbestos

Figure 10-2

Toilet at s/s Rudaki

Shower at s/s Rudaki

Possible extension side s/s Rudaki (not needed)

Storage place s/s Rudaki

Starting from s/s Rudaki the new line runs parallel to the old 220 kV corridor coming from to Uzbekistan (Location 0)

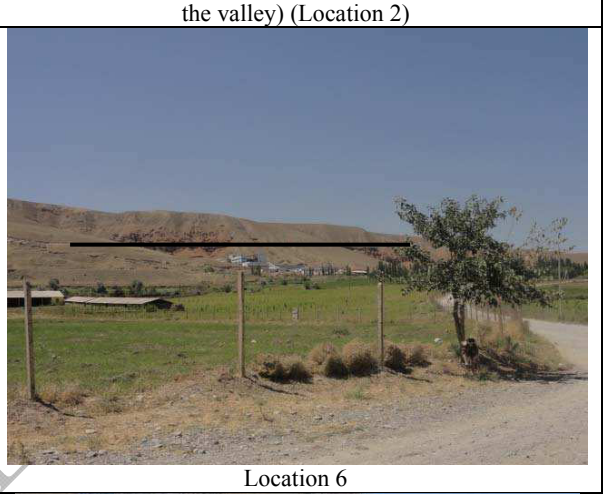
Site for angle tower south of s/s Rudaki (Location 0)

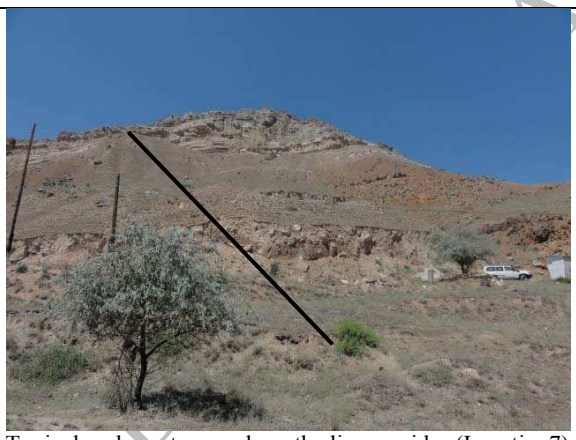
Figure 10-3


Line route avoids agricultural land(Location 1)

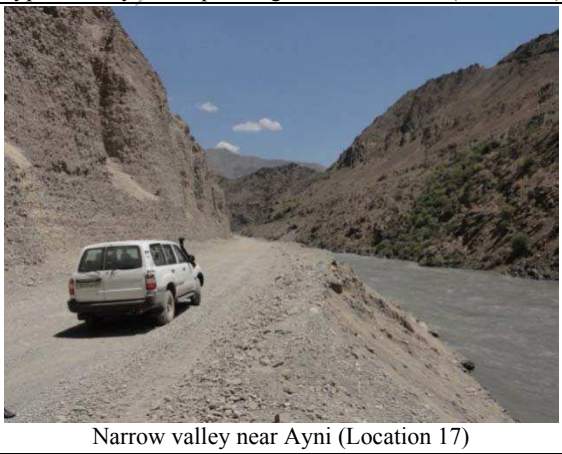

Corridor crosses Mogiyodarya (about two towers needed in the valley) (Location 2)


Location 4


Location 6


Typical rocky outcrops along the line corridor (Location7)


Line routing along the Zarafshan River (Location 10)


Narrow valley near Ayni (Location 17)


Connecting site of the 220 kV line to s/s Ayni

Figure 10-4

10.4 Statement of Forest Department Ayni on the Soy Vota Reserve

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Annex 3.9

АГЕНТИИ ХОЧАГИИ ЧАНГАЛИ НАЗДИ ХУКУМАТИ ЧУМХУРИИ ТОҶИКИСТОН

МУАССИСАИ ДАВЛАТИИ ХОЧАГИИ ЧАНГАЛИ НОҲИЯИ АЙНИ

735520 Чумхурии Тоҷикистон вилояти Суғд н. ноҳияи Айни тел: 22-2-62-

№ 108
14.08.2014сол

Ба муассисаи давлатии
«Маркази идораи лоиҳаҳои
бахши электроэнергетики»

Ба маълумот мерасонам Лоиҳаи хати интиколи барқи 220кв «Айни-Рудаки» дар сарҳади ноҳияи Айни ва Панҷакент қад-гали дарёи Зарафшон мегузарад дар ҳудуди кишлоқхои Вота, Ёвон ба парвариши Сой- Вота ба сарҳади он ягон алокаманди надорад ва ба парваришгох зарар намерасонад.

Директор: Х. Корнев.

FROM : FAX NO. : 19 Sep. 2011 3:59PM P1

Annex 3.9

To:

Project Management Unit for Energy sector

We would like to inform you that 220 kV Ayni-Rudaki line routing is passing on the border of Ayni and Penjikent regions and along the Zeravshan river throught Vota, Evon regions, makes no harm to the Soy-Vota reserve and is not affecting it's borders.

Director H. Koriev

10.5 Record of Meetings and field visits

Date	Agency/ Institution	Place	Name of Person consulted Position	Reason for Visit
08./09.06. 2014	Field trip	Line routing between Penjikent and Ayni		Localization of section with possible environmental problems
25.-28.07. 2014	Environmental Protection Department of Penjikent	Penjikent	Bobboev Gurezi Rahmatovich Inspector	Location of Zarafshan Reserve
25.-28.07. 2014	Environmental Protection Department of Ayni	Ayni	Khalilov Sharaf Head of Department	Location of Sayvatin Reserve
25.-28.07.2014	Committee for Environmental Protection	Dushanbe	Nurali Saidov (Phone call) Director of Committee for Environmental Protection	Maps of Zarafshan Preserve and Sayvatin Reserve in Penjikent and Ayni District
01.09.2014	Field trip	Soy Vota Nature Reserve	Director of the Forest Department (M. Koriev, together with Hikmat Dzhunaydovich and Turokulov Nazar).	Confirmation of the exact location of the Reserve

Tab. 10-1: Record of Field Surveys and Meetings in 2014

For further meetings see Chapter 6.

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10.6 List of participants public consultation in Zerabad (Dar-Dar, Ayni)

Список участников фокус-групп дискуссий в Джамоате Дар-Дар, село Зеробод

Мужчины

1. Муродов Амин
2. Арбобов Ашур
3. Бекмуродов Элмурод
4. Гиясов Шучоатдин
5. Зокиров Собир
6. Усмонов УСмонбек
7. Турсунов Джура
8. Ашуров Арбобнияз
9. Солехов Завкибек
10. Хайдаров Аликул
11. Миров Абдукувайс – 92 749 77 57

Женщины

12. Хусейнова Охиста
13. Хозирова Ниёзбиби
14. Ниязова Рисолат
15. Изатуллоева Гулнора
16. Икромова Угулой
17. Исматова Гули
18. Ходжакулова Ниёзджон
19. Нурова Одиначон
20. Джобирова Одиначон
21. Икромова Субхигул

DRA

10.7 Checklist for Preliminary Climate Risk Screening

Screening Questions		Score	Remarks[16]
Location and Design of project	Is siting and/or routing of the project (or its components) likely to be affected by climate conditions including extreme weather related events such as floods, droughts, storms, landslides?	1	The project routing is located in between Penjikent (950 msl) and Ayni (1400 asl) and runs close to the river Zerafshan surrounded by high steep sloped mountain. Areas are at risk to erosion, mass movements (i.e. landslides, flooding/ flashfloods, mudslides, and avalanches). These risks are likely to be exacerbated by climate change and variability.[17]
	Would the project design (e.g. the clearance for bridges) need to consider any hydro-meteorological parameters (e.g., sea-level, peak river flow, reliable water level, peak wind speed etc)?	1	The project has already identified some of the risks (i.e. flooding, erosion, mass movements). The project routing will not cross any river and risk of flooding is minimal considering that most of the infrastructures are built 50 to 200 meters above the river. IEE states that the existing guiding principles on how to minimize the risks from these areas will be followed in the detailed line design.[18] The 220 kV OHL has been routed in close collaboration with the local expert of the Penjikent Electrical Network who have a dedicated local knowledge and experience of the features of the line corridor area. For tower locations risky debris banks and other disadvantageous positions have been avoided. Known landslide areas have been identified and avoided by selecting an alternative routing. In general, the foundations of the towers will be designed for "soft soil" conditions what results in a kind of 'oversized' dimensions compared to a normal application in order to carry possible additional forces caused e.g. by landslides. Where necessary the finally selected tower locations which may be exposed to avalanches in the future will be equipped with V - formed avalanche protectors. The related costs for that of approximately 90,000 USD are already included in the project cost estimate.

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[16] If possible, provide details on the sensitivity of project components to climate conditions, such as how climate parameters are considered in design standards for infrastructure components, how changes in key climate parameters and sea level might affect the siting/routing of project, the selection of construction material and/or scheduling, performances and/or the maintenance cost/scheduling of project outputs.
[17] Republic of Tajikistan. 2008.Second National Communication of the Republic of Tajikistan under the United Nations Framework Convention on Climate Change. Source: http://unfccc.int/resource/docs/natc/tainc2.pdf
[18] See section 3.3.4 Line Routing and Survey of Draft RRP and IEE Sections 4.5 and 5.4 on Climate Change

Materials and Maintenance	Would weather, current and likely future climate conditions (e.g. prevailing humidity level, temperature contrast between hot summer days and cold winter days, exposure to wind and humidity hydro-meteorological parameters likely affect the selection of project inputs over the life of project outputs (e.g. construction material)?	0	The weather conditions in combination with a safety margin are considered in the design of the towers and the OHL.
	Would weather, current and likely future climate conditions, and related extreme events likely affect the maintenance (scheduling and cost) of project output(s) ?	0	After commissioning the OHL will be put in operation. In normal conditions the OHL will be inspected completely only once every 12 months. In case of extreme conditions this inspection may be rescheduled, when the situation has turned back to normal.
Performance of project outputs	Would weather/climate conditions, and related extreme events likely affect the performance (e.g. annual power production) of project output(s) (e.g. hydro-power generation facilities) throughout their design life time?	0	Integration of strategic climate adaptation measures[19] [20] in the construction and operation of the transmission line can help mitigate risks to project.

Options for answers and corresponding score are provided below:

Response	Score
Not Likely	0
Likely	1
Very Likely	2

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[19] Please refer to IEE section on Climate Change Risk (Sections 4.5 and 5.4).

[20] Refer to the ADB Climate Proofing Energy Investment Project . Among the potential adaptation measures listed include the following: a) for extreme events: i) increase the systems ability to return to normal operations rapidly if outages do occur; change routes of overhead lines /towers, etc. b) for precipitation and flooding: i) design improved flood protection measures for equipment at ground level in substations, ii) forbid construction in flood / flash flood prone areas

Responses when added that provide a score of 0 will be considered low risk project. If adding all responses will result to a score of 1-4 and that no score of 2 was given to any single response, the project will be assigned a medium risk category. A total score of 5 or more (which include providing a score of 1 in all responses) or a 2 in any single response, will be categorized as high risk project.

Result of Initial Screening (Low, Medium, High): Medium
RRP will include in Due Diligence component a section on climate change risks and how this will be addressed

Prepared by: CWER CC Climate Change

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10.8 Sulfur Hexafluoride (SF_6)

Sulfur hexafluoride (SF_6) is used within GIS substations. This gas is an effective gaseous dielectric that allows the safe transmission and distribution of electricity. SF_6 provides excellent insulation and arc quenching performance. SF_6 gas itself is an inert gas, which has no influence on humans, animals or plants. However, as a result of the electric arc, extremely small traces of agents detrimental to health may be formed.

On the other hand, SF_6 is a very highly effective and persistent greenhouse gas (substances absorbing infrared). One ton of SF_6 corresponds to about 23,900 tons of CO_2. Once emitted into the atmosphere it lasts more than 3,000 years (!) until SF_6 is disintegrated by energy-rich UV radiation.

Up to now, the effects of SF_6 in the atmosphere are minor compared to other industrial greenhouse gases. The total worldwide quantitative contribution to global warming of SF_6 is below 0.1% with respect to the other man-made greenhouse gases (for the European Community it is guessed to be about 0.05 %). However, actually the SF_6 concentration in the atmosphere is increasing (an exponential increase in the late 90ties and a slight decrease since beginning of this century is reported) which requires consequently specific careful handling with this substance.

Some guidelines for proper handling of SF_6 are given below:

- CIGRE 1998: High Voltage Overhead Lines – Environmental Concerns, Procedures, Impacts & Mitigation.
- Recommendations of the International Council on large Electric Systems (CIGRE: SF6 Task Force: Handling and given Recycling of SF6 Mixtures) (www.cigre.org);
- DIN EN* 60376 ‘Specification of technical grade sulfur hexafluoride (SF6) for use in electrical equipment’
- DIN EN 60480 ‘Guidelines for the checking and treatment of sulfur hexafluoride (SF6) taken from electrical equipment and specification for its re-use’
- IEC 62271: High-voltage switchgear and controlgear - Part 303: Use and handling of sulphur hexafluoride (SF6)

The amount of SF_6 emitted during the operational phase by GIS stations will be absolutely minimized if:

- Best Available Technique (BAT) is used;
- The guidelines mentioned above are followed;
- The recommendations of the International Council on large Electric Systems (CIGRE: Sf_6 Task Force: Handling and given Recycling of SF_6 Mixtures) is taken into consideration (**www.cigre.org**);
- ISO 14040 is followed;

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- Detectors indicate immediately any leak from which SF_6 will be emitted.
- IEC International Electrotechnical Commission
- DIN Deutsches Institut für Normung (German Industrial Standard)
- EN European Norm

10.9 Electric and Magnetic Fields

Being in operation the strength of electric and magnetic fields is one of the permanent effects on the environment especially for people living e.g. along transmission lines or working in substations (mainly open-air substations). These fields can have effects on organism but can also interfere with other technical installations.

As at present extensive discussions take place about effects of electromagnetic fields on the health all over the world especially related to the use of mobiles, this issue should be considered comprehensively in HSE studies to such projects. Doing so, it has to be clarified that we are talking about electromagnetic fields only in high frequency ranges as used by mobiles.

In power transmission 50 Hz (low frequency) is used. Here, the generation of electromagnetic fields is not relevant because of its large amplitude. Using 50 Hz we have to consider both electric fields and magnetic fields separately. The electric field exists permanently if voltage is impressed, whereas the magnetic field only results if actual current is flowing.

In Annex 10.12 some results of recent scientific researches concerning biological and health effects of electric and magnetic fields are given. Annex 10.10 describes internationally used standards and limit values and in Annex 10.11 an excerpt is given about the guideline of the internationally accepted International Commission on Non-Ionizing Radiation Protection (ICNIRP).

Regarding the project, it has to be stated very clearly that the selected design of the proposed GIS indoor substations is directed to reduce electric and magnetic fields to an absolute minimum. Through their metal-clad construction, GIS substations effectively shield the electrical field from the surroundings. Thus, the electrical field outside GIS substations is practically negligible. There is no exceedance of electric and/or magnetic field expected, as discussed in the Annexes. According to measurements in other similar projects, the fields around the substations will be far below any internationally excepted standard. The standards stipulated below, however, can become relevant in case of high voltage overhead lines if settlements are closely bypassed and within high voltage substations for workplaces.

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10.10 Internationally Used Standards/Limit Values Concerning Electric and Magnetic Fields (50 Hz) for the Public and at Working Places

Source	El. Field strength [kV/m]	Magn. flux density [µT]
ICNIRP recommended 50/60 Hz (see Annex 10.11)		
Reference levels for exposure to time-varying electric and magnetic fields (unperturbed r.m.s. values)		
occupational exposure	10	500
general public exposure	5	100
Limit values according to the European Directive 2004/40/EC		
exposure of workers	10	500
Limit (r.m.s) value as per 26. BImSchVer 12/96		
general public up to 24 hours /day	5	100

r.m.s. = root mean square (value)
ICNIRP=International Commission on Non-Ionising Radiation Protection,
BImSchVer=German Bundesimmissionsschutzverordnung,

In countries of the former USSR a formula is used to calculate the exposure time of workers that is:

$$T_{[hrs]} = 50/E - 2$$

E = electric field [kV/m]

That means that the exposure time in an electric field of 25 kV/m is 0 hrs. Working in an electric field of 25 kV or more is not allowed without special protecting clothing. This formula is actually used in Tajikistan.

As it can be seen from the data given above, limit values arising from different organizations and used in different countries can vary. The core problem is that up to now nobody knows exactly what the effects of electric and magnetic fields on the biology are and what the best limit values are to protect human health as discussed in Annex 10.12.

However, some generally accepted recommendations can be given. At the moment, it is internationally agreed that for the public and for permanent exposure, the electric field must not exceed 5 kV/m and the magnetic flux density must not exceed 100 µT. This means, outside the fence of substations 5 kV/m and 100 µT respectively is the limit. The same is valid for settlements/houses along transmission lines. The corridor for transmission lines has to be wide enough that the electric and magnetic field strength at the edge of this corridor is less than the limits mentioned above.

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10.11 ICNIRP Guidelines and Statements (Extract) Guidelines for Limiting Exposure to Time-varying Electric, Magnetic, & Electromagnetic Fields

In 1974, the International Radiation Protection Association (IRPA) formed a working group on non-ionizing radiation (NIR), which examined the problems arising in the fields of protection against the various types of NIR. At the IRPA Congress in Paris in 1977, this working group became the International Non-Ionizing Radiation Committee (INRC).

In co-operation with the Environmental Health Division of the World Health Organization (WHO), the IRPA/INIRC developed a number of health criteria documents on NIR as part of WHO's Environmental Health Criteria Program, sponsored by the United Nations Environment Program (UNEP). Each document includes an overview of the physical characteristics, measurement and instrumentation, sources, and applications of NIR, a thorough review of the literature on biological effects, and an evaluation of the health risks of exposure to NIR. These health criteria have provided the scientific database for the subsequent development of exposure limits and codes of practice relating to NIR.

At the eighth International Congress of the IRPA (Montreal, 18-22 May 1992), a new independent scientific organization - the International Commission on Non-Ionizing Radiation Protection (ICNIRP) - was established as a successor to the IRPA/INIRC. The functions of the Commission are to investigate the hazards that may be associated with the different forms of NIR, develop international guidelines on NIR exposure limits, and deal with all aspects of NIR protection.

Biological effects reported as resulting from exposure to static and extremely low frequency (ELF) electric and magnetic fields have been reviewed by UNEP/WHO/IRPA. Those publications and a number of others, provided the scientific rationale for the guidelines for limiting exposure to time varying electric, magnetic, and electromagnetic fields.

The main objective of the guidelines is to establish the limiting of EMF exposure that will provide protection against known adverse health effects. An adverse health effect causes detectable impairment of the health of the exposed individual or of his or her offspring; a biological effect, on the other hand, may or may not result in an adverse health effect.

Studies on both direct and indirect effects of EMF are described; direct effects result from direct interaction of fields with the body, indirect effects involve interactions with an object at a different electric potential from the body. Results of laboratory and epidemiological studies, basic exposure criteria, and reference levels for practical hazard assessment are discussed, and the guidelines presented apply to occupational and public exposure.

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The guidelines will be periodically revised and updated as advances are made in identifying the adverse health effects of time-varying electric, magnetic, and electromagnetic fields. In establishing exposure limits, the Commission recognizes the need to reconcile a number of differing expert opinions. The validity of scientific reports has to be considered, and extrapolations from animal experiments to effects on humans have to be made.

There is insufficient information on the biological and health effects of EMF exposure of human populations and experimental animals to provide a rigorous basis for establishing safety factors over the whole frequency range and for all frequency modulations. In addition, some of the uncertainty regarding the appropriate safety factor derives from a lack of knowledge regarding the appropriate dosimetry.

The restrictions in the guidelines were based on scientific data alone; currently available knowledge, however, indicates that these restrictions provide an adequate level of protection from exposure to time-varying EMF. Two classes of guidance are presented:

- Basic restrictions
  Restrictions on the effects of exposure are based on established health effects and are termed basic restrictions. Protection against adverse health effects requires that these basic restrictions are not exceeded.
- Reference levels
  Reference levels of exposure are provided for comparison with measured values of physical quantities; compliance with all reference levels given in these guidelines will ensure compliance with basic restrictions. If measured values are higher than reference levels, it does not necessarily follow that the basic restrictions have been exceeded, but a more detailed analysis is necessary to assess compliance with the basic restrictions.

Basic restrictions:
Basic restrictions on exposure to time varying electric, magnetic, and electromagnetic fields are based directly on established health effects. Depending upon the frequency of the field, the physical quantities used to specify these restrictions are current density (J), specific energy absorption rate (SAR), and power density (S). Only power density in air, outside the body, can be readily measured in exposed individuals.

Different scientific bases were used in the development of basic exposure restrictions for various frequency ranges. For electric power transmission and distribution only the low frequency (50 Hz) fields are relevant which are indicative of much more slighter biological effects than fields caused by high-frequency energy. This is the reason that the basic restrictions for the range of frequencies between 1 Hz and 10 MHz are provided exclusively on current density to prevent effects on nervous system functions. The basic restrictions for current densities, whole body average SAR, and localized SAR for frequencies between 1 Hz and 10 GHz are presented in Table 10-1**.**

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The occupationally exposed population consists of adults who are generally exposed under known conditions and are trained to be aware of potential risk and to take appropriate precautions. By contrast, the general public comprises individuals of all ages and of varying health status, and may include particularly susceptible groups of individuals.

In many cases, members of the public are unaware of their exposure to EMF. Moreover, individual members of the public cannot reasonably be expected to take precautions to minimize or avoid exposure. It is these considerations that underlie the adoption of more stringent exposure restrictions for the public than for the occupationally exposed population.

Table 10-1: Basic restrictions for time-varying electric and magnetic fields for frequencies up to 10 GHz

Exposure Characteristics	Frequency Range	Current Density f. Head and Trunk (mA m^{-2}) (rms)	Whole-Body average SAR (W Kg^{-1})	Localized SAR (Head + Trunk) (W Kg^{-1})	Localized SAR (limbs) (W Kg^{-1})
Occupational	up to 1 Hz	40	-	-	-
Exposure	1 – 4 Hz	20/f	-	-	-
	4 Hz - 1 KHz	**10**	-	-	-
	1 -100 KHz	f/100	-	-	-
	100 KHz-10MHz	f/100	0.4	10	20
	10 MHz- 10 GHz	-	0.4	10	20
General Public	up to 1 Hz	8	-	-	-
Exposure	1 – 4 Hz	8/f	-	-	-
	4 Hz - 1 kHz	**2**	-	-	-
	1 –100 kHz	f/500	-	-	-
	100 kHz-10MHz	f/500	0.08	2	4
	10 MHz- 10 GHz	-	0.08	2	4

*** Note:**

1. *f is the frequency in hertz.*
2. *Because of electrical inhomogeneity of the body, current densities should be averaged over a cross- section of 1 cm^2 perpendicular to the current direction.*
3. *For frequencies up to 100 kHz, peak current density values can be obtained by multiplying the rms value by √2 (~1,414). For pulses of duration t_p the equivalent frequency to apply in the basic restrictions should be calculated as f = 1/(2t).*
4. *For frequencies up to 100 kHz and for pulsed magnetic fields, the maximum current density associated with the pulse can be calculated from the rise/fall times and the maximum rate of change of magnetic flux density. The induced current density can then be compared with the appropriate basic restriction.*
5. *All SAR values are to be averaged over any 6-min period.*
6. *Localized SAR averaging mass is any 10 g of contiguous tissue; the maximum SAR so obtained should be the value used for the estimation of exposure.*
7. *For pulses of duration t_p the equivalent frequency to apply in the basic restrictions should be calculated as $f = 1/(2t_p)$. Additionally for pulsed exposures in the frequency range 0.3 to 10 GHz and for localized exposure of the head, in order to limit or avoid auditory effects caused by thermoelastic expansion, an additional basic restriction is recommended. This is that the SA should not exceed 10 mJ Kg^{-1} for workers and 2 mJ kg^{-1} for the general public, averaged over 10 g tissue.*

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Reference levels
These levels are provided for practical exposure assessment purposes to determine whether the basic restrictions are likely to be exceeded. Some reference levels are derived from relevant basic restrictions using measurement and/or computational techniques, and some address perception and adverse indirect effects of exposure to EMF.

The derived quantities are electric field strength (E), magnetic field strength (H), magnetic flux density (B), power density (S), and currents flowing through the limbs (l).

Quantities that address perception and other indirect effects are contact current (lc) and, for pulsed fields, specific energy absorption (SA).

In any particular exposure situation, measured or calculated values of any of these quantities can be compared with the appropriate reference level.

Compliance with the reference level will ensure compliance with the relevant basic restriction. If the measured or calculated value exceeds the reference level, it does not necessarily follow that the basic restriction will be exceeded. However, whenever a reference level is exceeded, it is necessary to test compliance with the relevant basic restriction and to determine whether additional protective measures are necessary. The reference levels are intended to be spatially averaged values over the entire body of the exposed individual, but with the important proviso that the basic restrictions on localized exposure are not exceeded.

Reference levels for exposure of the general public have been obtained from those for occupational exposure by using various factors over the entire frequency image. These factors have been chosen on the basis of effects that are recognized as specific and relevant for the various frequency ranges. Generally speaking, the factors follow the basic restrictions over the entire frequency range, and their values correspond to the mathematical relation between the quantities of the basic restrictions and the derived levels as described below:

In the frequency range up to 1 kHz, the general public reference levels for electric fields are one-half of the values set for occupational exposure. The value of 10 kV m^{-1} for 50-Hz or 8.3 kV m^{-1} for a 60-Hz occupational exposure includes a sufficient safety margin to prevent stimulation effects from contact current under all possible conditions. Half of this value was chosen for the general public reference levels i.e. 5 kV m^{-1} for 50 Hz or 4.2 kV m^{-1} for 60 Hz, to prevent adverse indirect effects for more than 90% of exposed individuals.

Table 10-2 shows the related reference levels for occupational and for general public exposure. ICNIRP notes that the industries causing exposure to electric and magnetic fields are responsible for ensuring compliance with all aspects of the guidelines.

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Table 10-2: Reference levels for occupational and general public exposure to time-varying electric and magnetic fields (unperturbed rms values)

	Frequency Range	E-FIELD Strength ($V\ m^{-1}$)	H-FIELD Strength ($A\ m^{-1}$)	B-FIELD Strength (μT)	Equivalent plane wave power density S_{eq} ($W\ m^{-2}$)
Occupational Exposure	up to 1 Hz	-	1.63×10^5	2×10^5	-
	1 – 8 Hz	20000	$1.63 \times 10^5/f^2$	$2 \times 10^5/f^2$	-
	8 – 25 Hz	20000	$2 \times 10^4/f$	$2.5 \times 10^4/f$	-
	0.025 – 0.82 kHz	**500/f**	**20/f**	**25/f**	-
	0.82 – 65 kHz	610	24.4	30.7	-
	0.065 – 1 MHz	610	1.6/f	2.0/f	-
	1 – 10 MHz	610/f	1.6/f	2.0/f	-
	10 – 400 MHz	61	0.16	0.2	10
	400 – 2000 MHz	$3f^{½}$	$0.008f^{½}$	$0.01f^{½}$	f/40
	2 – 300 GHz	137	0.36	0.45	50
General Public Exposure	up to 1 Hz	-	3.2×10^4	4×10^4	-
	1 – 8 Hz	10000	$3.2 \times 10^4/f^2$	$4 \times 10^4/f^2$	-
	8 – 25 Hz	10000	4000/f	5000/f	-
	0.025 – 0.8 kHz	**250/f**	**4/f**	**5/f**	-
	0.8 – 3 kHz	250/f	5	6.25	-
	3 – 150 kHz	87	5	6.25	-
	0.15 – 1 MHz	87	0.73/f	0.92/f	-
	1 – 10 MHz	$87/f^{½}$	0.73/f	0.92/f	-
	10 – 400 MHz	28	0.073	0.092	2
	400 – 2000 MHz	$1.375f^{½}$	$0.0037/f^{½}$	$0.0046f^{½}$	f/200
	2 – 300 GHz	61	0.16	0.20	10

**** Note:***

1. *f as indicated in the frequency range column.*
2. *Provided that basic restrictions are met and adverse indirect effects can be excluded, field strength values can be exceeded.*
3. *For frequencies between 100 kHz and 10 GHz. S_{eq}, E^2, H^2, and B^2 are to averaged over any 6-min period.*
4. *For peak values at frequencies up to 100 kHz see Table 13-1, note 3.*
5. *For peak values at frequencies exceeding 100 kHz see Figs.1 and 2. Between 100 kHz and 10 MHz, peak values for the field strengths are obtained by interpolation from the 1,5-fold peak at 100 kHz to the 32-fold peak at 10 MHz. For frequencies exceeding 10 MHz it is suggested that the peak equivalent plane wave power density, as averaged over the pulse width does not exceed 1000 times the S_{eq} restrictions, or that the field strength does not exceed 32 times the field strength exposure levels given in the table.*
6. *For frequencies exceeding 10 GHz, S_{eq}, E^2, H^2, and $B^2$are to be averaged over $68/f^{1.05}$–min period (f in GHz).*
7. *No E-field value is provided for frequencies <1 Hz, which are effectively static electric fields.*

   Electric shock from low impedance sources is prevented by established electrical safety procedures for such equipment.

   Perception of surface electric charges will not occur at field strengths less than 25 kVm^{-1}. Spark discharges causing stress or annoyance should be avoided.

More information about the work of ICNIRP can be found in the Internet under **www.icnirp.org**.

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10.12 Biological and Health Effects of Electric and Magnetic Fields

In precise physical terms when speaking about electrical facilities, a distinction has to be made between two types of fields: the electric and the magnetic field.

The **electric field** denotes the difference in electric potential measured as a voltage between two points one meter apart. If an electric current flows in a conductor, a magnetic field will always build up around it.
The electric field is generated by the line voltage on the conductors. The electric field of power lines depends on the voltage, on the circuit numbers, on the design of the circuits and on the design of the cable itself. Its strength lessens rapidly according to the distance. Normally, the field is strongest in the middle of the line span where the phase conductors have the greatest slag. The strength of the electric field is expressed in volts per meter, and in the power line context usually in kV/m. Strong 50 Hz electric fields occur mainly in high voltage installations, i.e. inside switchyards and below transmission lines. Electric fields are shielded by objects which are earthed, such as trees, buildings etc.

The magnetic field around a power line is generated by the current in the conductors. Since the current is proportional to the line's load, the magnetic field often varies both over 24 hours and from one season to another. The magnetic field under a power line is strongest in roughly the same areas as the electric field. The magnetic field is expressed in terms of teslas [T] (1 T = 1 Vs/m^2), which is a measure of the field's flux density. In the context of power lines, microteslas [µT] are used. An older unit, Gauss [G], is used in e.g. USA (1 mG = 0.1 µT). Magnetic fields are not shielded by walls and roofs. Around power lines they are often weaker than those one may come into contact with in many other contexts in everyday life at work.

In Tajikistan, electricity is transmitted with alternating current at a frequency of 50 Hz (change of polarity at 50 cycles per second).
The field which this gives rise to is referred to as an alternating electric and magnetic field.

There follows a brief discourse on the status of knowledge concerning the influence of 50 Hz electromagnetic fields on the environment. Investigations and research on these effects of low frequency electromagnetic fields have been more intensive worldwide since the early seventies.

In the Federal Republic of Germany, with the establishment of the subcommittee "Electric and magnetic fields" in the Association of German Electricians (VDE), a forum for discussions has been created, in which an intensive exchange of experience and ideas takes place.

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The International Radiation Protection Association (IRPA), a body working under the auspice of the World Health Organization (WHO), has initiated activities concerned with non-ionizing radiation by forming a working group in 1974. At the IRPA Congress in Paris in 1977, this working group became the International Non-Ionizing Radiation Committee (INRC). An excerpt of the "Guidelines for limiting exposure to time varying electric, magnetic, and electromagnetic fields" is given in Annex 10.11.

Magnetic fields have the property of penetrating the human organism. Low-frequency fields which arise in connection with 50 Hz alternating current can cause tissues and cells to enter into an excited state due to energy absorbed by the human body. If fields are intense, this can result in stimulation of nerves, muscles and organs.

The above effects are felt especially in the higher frequency range.

The general rule is the higher the cycling rate of the alternating electromagnetic field, the more its effects become relevant to health. High-frequency fields in the range above 30,000 Hz, which occur, for example in communications in the form of radio waves, have a disproportionately high significance for the human organism, as these give rise to heating effects.

The biological effects of electric and magnetic fields depend primarily on their field strengths. Greater biological impact is ascribed to magnetic fields than to electric fields. Electric fields can be screened relatively easily, whereas magnetic fields are highly penetrating. Though electricity has intensively been used in industry and household for more than a century, as shown above, thorough scientific research on biological effects of electromagnetic fields has been conducted only in the last 25 years.

Today, among scientists there is still a considerable difference of opinion as to the degree of possible detrimental health influence caused by these fields. There are several investigations and publications reporting a severe influence of electromagnetic fields, but the discussion about biological and health effects is still going on. The International Council on Large High Voltage Electric Systems (CIGRE), a permanent non-governmental and non-profit-making international association based in France, publishes from time to time summaries of latest researches on biological and health effects of electric and magnetic fields. An excerpt of the actual results is given below:

Cancer
In October 1996 a large-scale evaluation was published in the U.S. (U.S. National Research Council EMF Committee, 1996) reviewing more than 500 studies from 1979 on. The report came to the conclusion that 'no clear, convincing evidence exists to show that residential exposures to electric and magnetic fields (EMF) are a threat to human health'. The same conclusion was drawn by WHO (Radiation and Environmental

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Health Department of Protection of the Human Environment) in 2002 as discussed in the publication 'Establishing a Dialogue on Risks from Electromagnetic Fields'

Some other epidemiological studies have demonstrated statistical associations between childhood cancer, especially leukemia, and proximity to power lines. However, childhood leukemia is a rare illness and the number of cases is very small what makes statistical statements very difficult. In addition, a statistical association is not synonymous with proof that a causal connection exists.

Although several studies show that leukemia and brain tumors are more common in 'electrical occupations', animal-experiment studies have failed to link exposure to electric or magnetic fields with an elevated cancer risk.

However, electric and magnetic fields have an influence on melatonin rhythm. Melatonin is a hormone formed in the pineal gland of the brain and from that hormone it is known that it plays a role in the development of certain hormone-dependent types of cancer, such as breast cancer.

Reproduction
There is no evidence that electric or magnetic fields have any impact on fertility, miscarriage, malformations or other reproduction parameters in either animals or human beings.

Effects on nervous system
Soviet and Swedish studies suggest various symptoms, such as headache, tiredness, insomnia, mild depression, etc. arise among male switchyard workers. A possible mechanism can be the proven influence of electric and magnetic fields on melatonin excretion. Melatonin also controls sleep, wakefulness, and mood. One entirely new research field is the possible connection of magnetic fields and certain forms of dementia, such as Alzheimer's disease. However, no actual direct influence of magnetic and electric fields on the diseases in human beings noted above have yet been demonstrated in scientific experiments or investigations.

Conclusion
The descriptions given above show that much research has been undertaken with contradictory results and results that are often hard to interpret. However, some large-scale research is now under way in Germany, USA, Canada, UK, and Sweden, and it is expected that knowledge in this field will grow substantially over the next few years.

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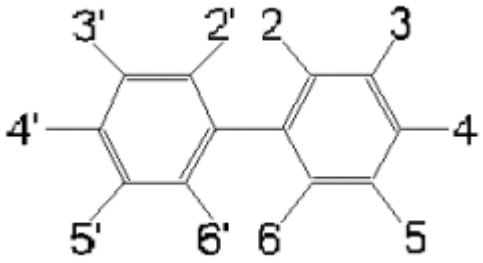
10.13 Polychlorinated Biphenyls (PCB)

10.13.1 General information

In former times, PCBs have been widely used as coolants and lubricants in transformers, capacitors, and other electrical equipment because PCBs possess good insulating properties and are fire-retardant.

PCBs are a group of manufactured organic chemicals. There are no known natural sources of PCBs. PCBs are oily liquids and are colorless or light. They have no known smell or taste. These substances consist of two phenyl rings that can contain different amounts of chlorine molecules in the positions given below:



Due to this fact, there are 209 individually chlorinated chemicals possible, known as congeners. Some of them have a chemical similarity with 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD). That is why the WHO considers the toxicity of these PCBs to be similar to the toxicity of TCDD.

However, in general the acute toxicity is small, but looking at the chronic effects a high toxic potential of PCBs has to be stated. So, in 1968 about 1,200 people got severely sick in Japan after having used polluted rice oil for cooking. Several people died. The sickness was called ‚Yusho sickness'. In addition, PCBs are suspected to cause cancer if people are exposed to these substances over a longer period.

Extraordinary problems, however, arise when PCBs are exposed to high temperature as they occur during e.g. transformer fires. Between 600°C and 900°C, PCBs form highly toxic and carcinogenic furans (PCDF) and dioxins (PCDD). The toxicity of dioxins is well known since the accident in Seveso, Italy in 1976. Destroying of PCB molecules without generating of dioxins requires temperature of about 1,200°C as prevailing in special incineration plants.

As it is not possible to analyze all congeners of PCBs, it is internationally accepted to measure six different typical PCBs following DIN 38414 S20 E according to Ballschmiter and Zell. (‘Analysis of Polychlorinated Biphenyls (PCB) by Glass Capillary Gas Chromatography, Fresenius Z. Anal. Chem. 1980, 302, 20-31). These measurements allow to draw conclusions about the total PCB content in oil samples.

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The mentioned PCB congeners are:

PCB 28 2,4,4-trichlorobiphenyl
PCB 52 2,2,5,5-tetrachlorobiphenyl
PCB 101 2,2,4,5,5-pentachlorobiphenyl
PCB 138 2,2,3,4,4,5-hexachlorobiphenyl
PCB 153 2,2,4,4,5-hexachlorobiphenyl
PCB 180 2,2,3,4,4,5,5-heptachlorobiphenyl.

US EPA gives now the following definitions: a transformer is 'a transformer that contains PCB' if the concentration of PCBs is higher than 500 ppm. Oil containing between 50 and 499 ppm PCBs is considered to be polluted with PCB and specific methods for disposal are necessary (e.g. specific incineration plants). According to **EU Directive 75/439/EEC**[21] oil containing less than 50 ppm PCBs can be considered to be PCB free and can be burned in a regular incineration plant.

Annex A of the '**Stockholm Convention'** requires to cease production of new PCBs immediately and to eliminate the use of equipment containing PCBs by 2025. Tajikistan is a signatory of this convention.

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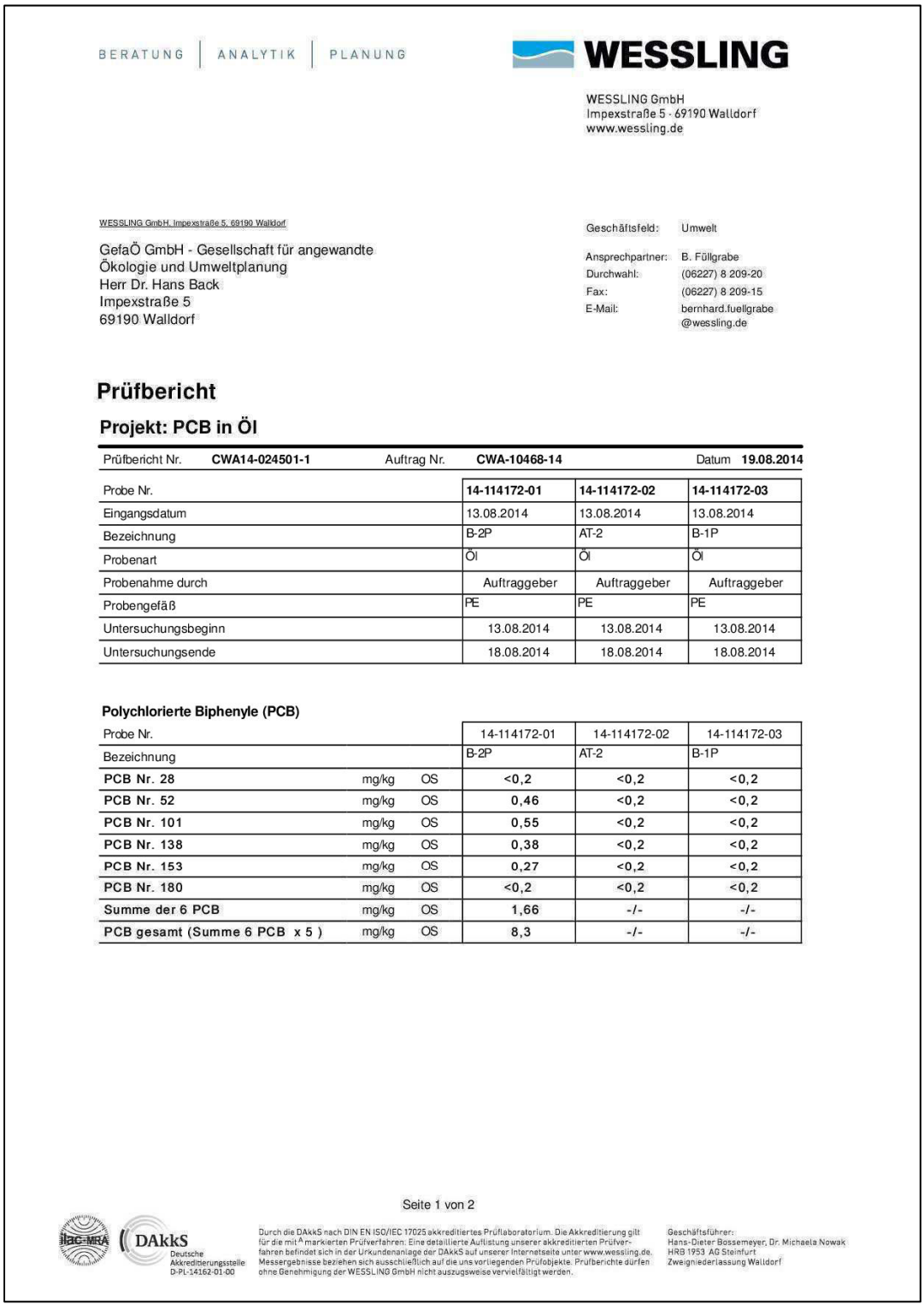
[21] Other important EU Directives with PCB relevance are: 59/96/EC; 850/2004/EC

10.13.2 Laboratory report on analysis of PCB in oil



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Prüfbericht

Projekt: PCB in Öl

Prüfbericht Nr. **CWA14-024501-1**	Auftrag Nr. **CWA-10468-14**	Datum **19.08.2014**

Probe Nr.	**14-114172-01**	**14-114172-02**	**14-114172-03**
Eingangsdatum	13.08.2014	13.08.2014	13.08.2014
Bezeichnung	B-2P	AT-2	B-1P
Probenart	Öl	Öl	Öl
Probenahme durch	Auftraggeber	Auftraggeber	Auftraggeber
Probengefäß	PE	PE	PE
Untersuchungsbeginn	13.08.2014	13.08.2014	13.08.2014
Untersuchungsende	18.08.2014	18.08.2014	18.08.2014

Polychlorierte Biphenyle (PCB)

Probe Nr.			14-114172-01	14-114172-02	14-114172-03
Bezeichnung			B-2P	AT-2	B-1P
PCB Nr. 28	mg/kg	OS	**<0,2**	**<0,2**	**<0,2**
PCB Nr. 52	mg/kg	OS	**0,46**	**<0,2**	**<0,2**
PCB Nr. 101	mg/kg	OS	**0,55**	**<0,2**	**<0,2**
PCB Nr. 138	mg/kg	OS	**0,38**	**<0,2**	**<0,2**
PCB Nr. 153	mg/kg	OS	**0,27**	**<0,2**	**<0,2**
PCB Nr. 180	mg/kg	OS	**<0,2**	**<0,2**	**<0,2**
Summe der 6 PCB	mg/kg	OS	**1,66**	**-/-**	**-/-**
PCB gesamt (Summe 6 PCB x 5)	mg/kg	OS	**8,3**	**-/-**	**-/-**

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ilac-MRA DAkkS Deutsche Akkreditierungsstelle D-PL-14162-01-00

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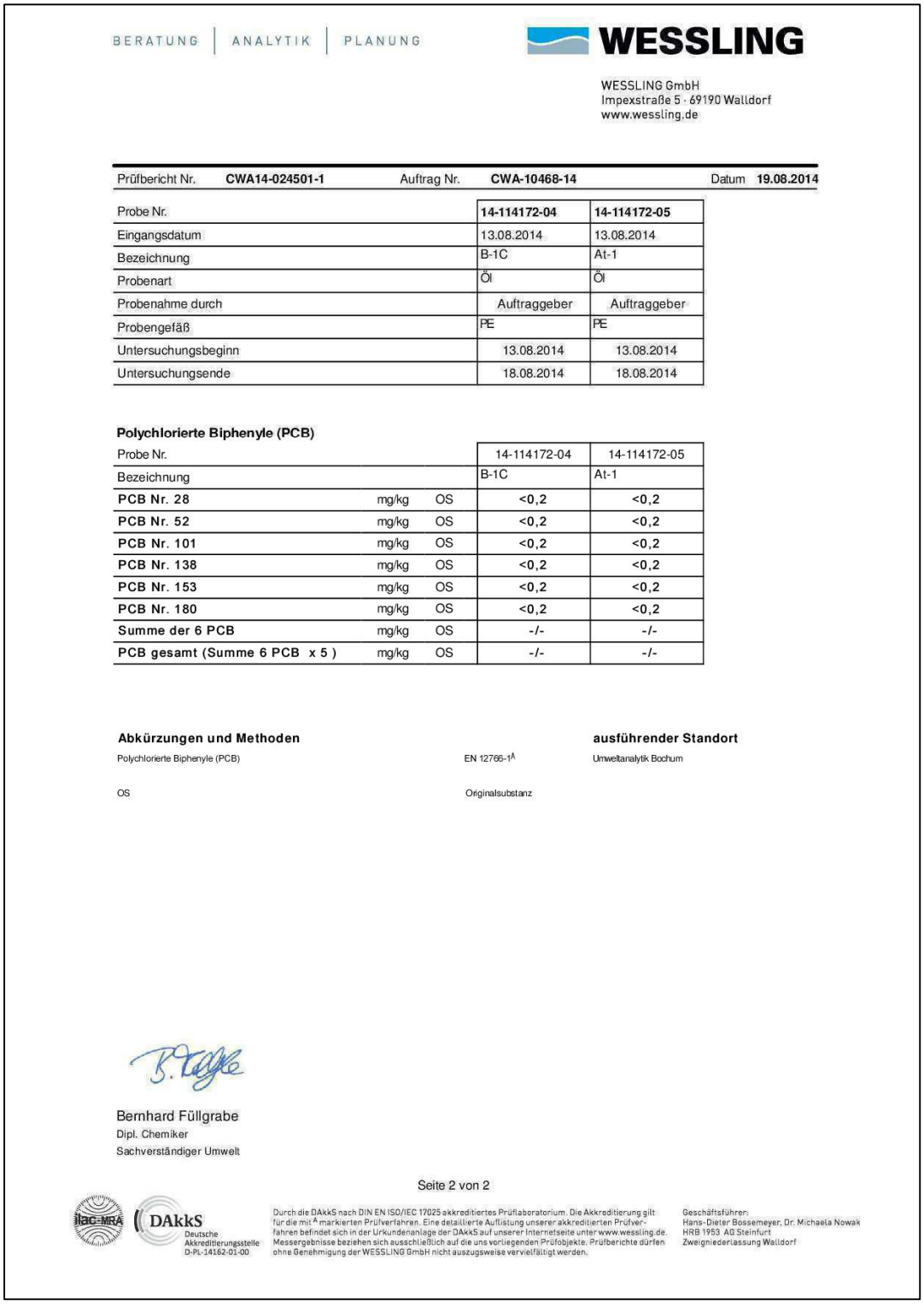
Geschäftsführer:
Hans-Dieter Bossemeyer, Dr. Michaela Nowak
HRB 1953 AG Steinfurt
Zweigniederlassung Walldorf

Figure 10-5: Laboratory report on oil tested for PCB, page 1



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Prüfbericht Nr.	CWA14-024501-1	Auftrag Nr.	CWA-10468-14	Datum	19.08.2014

Probe Nr.	14-114172-04	14-114172-05
Eingangsdatum	13.08.2014	13.08.2014
Bezeichnung	B-1C	At-1
Probenart	Öl	Öl
Probenahme durch	Auftraggeber	Auftraggeber
Probengefäß	PE	PE
Untersuchungsbeginn	13.08.2014	13.08.2014
Untersuchungsende	18.08.2014	18.08.2014

Polychlorierte Biphenyle (PCB)

Probe Nr.				14-114172-04	14-114172-05
Bezeichnung				B-1C	At-1
PCB Nr. 28	mg/kg	OS		<0,2	<0,2
PCB Nr. 52	mg/kg	OS		<0,2	<0,2
PCB Nr. 101	mg/kg	OS		<0,2	<0,2
PCB Nr. 138	mg/kg	OS		<0,2	<0,2
PCB Nr. 153	mg/kg	OS		<0,2	<0,2
PCB Nr. 180	mg/kg	OS		<0,2	<0,2
Summe der 6 PCB	mg/kg	OS		-/-	-/-
PCB gesamt (Summe 6 PCB x 5)	mg/kg	OS		-/-	-/-

Abkürzungen und Methoden

Polychlorierte Biphenyle (PCB)	EN 12766-1[A]	Umweltanalytik Bochum
OS	Originalsubstanz	

ausführender Standort

Bernhard Füllgrabe
Dipl. Chemiker
Sachverständiger Umwelt

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DAkkS Deutsche Akkreditierungsstelle D-PL-14162-01-00

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Geschäftsführer:
Hans-Dieter Bossemeyer, Dr. Michaela Nowak
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Zweigniederlassung Walldorf

Figure 10-6: Laboratory report on oil tested for PCB, page 2

Wholesale Metering and Transmission Reinforcement Project
Comments to the Initial Environmental Examination

Date:	August 15, 2014
Country:	Tajikistan
Project Name:	Wholesale Metering and Transmission Reinforcement Project
Project No	47017-001
Type of Report	Initial Environmental Examination
Submitted for review by	Consultant
Submission date	August 11, 2014

	General comment	Response/Action
	The first draft Initial Environmental Examination submitted for ADB's review in August 2014 is generally satisfactory. The IEE provides policy, legal and administrative framework, description of the project, project alternatives, description of environment, impact assessment and mitigation measures, public participation, disclosure and grievance redress mechanism. Also the report includes an environmental management and monitoring plan. However, as the IEE notes there are two issues requiring further clarification: the detailed map of the Saivota Botanic Reserve and presence of PCBs in old oil of Rudaki s/s. Besides, the description of environmental legislative and administration framework is outdated. Detailed discussion of those and other specific issues is given below.	
	Specific comments	**Response/Action**
Chapter 1	Chapter 1 needs to be updated after updating Chapters 2-11.	done
Chapter 2	The structure of the chapter is confusing – environmental legislation issues are covered under environmental institutions. Please re-structure the Chapter to provide a current status of 1) environmental legislative framework, 2) administrative framework.	done
Chapter 2.2	The environmental legislation referred to in Chapter 2.2. is outdated. The Law on Environment Protection of 2003 was superseded by 2011 Law on Environment Protection. 2003 Law on Ecological Expertise was superseded by	done

	new 2012 Law on Ecological Expertise (State environmental review). The new 2012 Procedure on Ecological Expertise details provisions of this law. Governmental Decree 'course of the Assessment of Environmental Impact' of 2006 was amended in 2013 and is called as the Procedure on Environmental Impact Assessment. Please also give a short description of the above laws and the following bylaws: - List of activities for which preparation of environmental assessment is required (2013) Other relevant laws: - 2011 Law on Specially Protected Natural Areas - 2011 Law on Environmental Monitoring - 2011 Law on Environmental Audit - 2011 Law on Environmental Information - etc	
Chapter 2.5	To avoid confusion with old ADB environmental policy it is recommended to refer to Safeguard Policy Statement, rather than ADB environmental policy.	done
Chapter 2.5	Please add to the ADB requirements definition of the environmental Categories: C, B, and A to give an understanding of Category B.	done
Chapter 3.4	The first paragraph states: "According to the ADB Project Data Sheet (last update April 2014), the Project was proposed to be classified as a Category B Project having only minor impacts on the environment". It is better to say that Category B was preliminary assigned to project based on the rapid environmental assessment.	done
Chapter 4.6	Information about protected areas is insufficient or missing. Besides boundaries of the protected areas the IEE need to include the types of the reserves, and its objective. In this instance, Sayvota is a botanical reserve to conserve juniper, and Zerafshan is to protect habitat of Phasianus colchicus zerafshanicus. No information is given about Srazm Important Bird Area (http://www.birdlife.org/datazone/sitefactsheet.php?id=21998) inhabited by endangered Saker Falcon and vulnerable Yellow-eyed Pigeon. Please give the relevant baseline data.	done
Chapter 4.8	Some data provided are old, for example, unemployment data (2003), or unreliable – taken from unofficial sources (worldinfozone.com). For instance, the Agency on Statistic refers to population of Ayni District of 73.1 thousand (2012), while the IEE figure is 120,000. Besides, the data are too generic. The sources of some data are unknown, for example, GDP per capita. Therefore, please consider presenting more detailed project-related statistics from official	done

	sources of data such as Agency on Statistics (stat.tj).	
Chapter 4.10	In addition to Dushanbe airport, please provide baseline information about airports in Ayni and Penjikent. Penjikent airport was reopened for flights from Dushanbe in July 2014.	done
Table 5.1	Please complete an assessment of environmental impacts to the Protected areas Sayvota and Zerafshan.	The line corridor does not touch any of these protected areas.
Table 5.1	Please assess potential conflict of the airports and a transmission line route.	done
Table 5.3	Please complete an impact assessment and propose mitigation measures of environmental impacts to the Important Bird Area	Is not affected
Chapter 7	It is not obvious from the description what alternative is preferred. Please consider making an analysis in tabular form to compare preferred, parallel, and "instead of existing OHL" alternatives.	This chapter describes only alternatives not being realized. The chapter is revised in order to make it more clear which alternatives have been considered.
Chapter 7	Information about public consultation is incomplete. It is unclear where exactly public consultations have been conducted, what groups of stakeholders were invited and participated, whether vulnerable groups of stakeholders attended, and how many stakeholders attended. Please attach the attendance sheet as well.	More information is provided
Chapter 9.1.1 Disturbance of protected areas	Please replace the text with new information when available.	done
Chapter 9.1.1	Please add: Conflict of OHL with Ayni and Penjikent airport if there is a potential impact.	done in table 9-3
Chapter 9.4.	The structure and responsibilities under the project's environmental, health and safety management system is not obvious. Please prepare an organizational diagram, and describe resources, roles, and responsibilities of all stakeholders including Contractor, Consultant, PMU, ADB, and Committee of Environment Protection. Information from Chapter 2.2. can be used.	done
Chapter 9	Please assess whether capacity building through training and awareness raise is required for the PMU staff. Envisage fund for trainings if required.	done
Chapter 11	The conclusion states "In summary, from the results of the investigation it can be seen that the Project will have only low environmental and social impacts if the proposed mitigation measures are implemented". Typically, in ADB practice the impact of this magnitude are called "site-specific", rather than low. Please	done

	consider this terminology while revising the report.	
	Typos and other minor comments	**Response/Action**
	None	