E4738

***January 30, 2015***

# High Voltage Electric Networks

## Electricity Transmission Network Improvement Project

## Rehabilitation of Ashnak substation

## Environmental Management Plan
## *Final*

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# Acronyms and Abbreviations

| | |
|---|---|
| CC | Construction Contractor |
| CCGT | Combined Cycle Gas Turbine |
| CE | Construction Engineer |
| dB | Decibel |
| EHS | Environmental, Health and Safety |
| EIA | Environmental Impact Assessment |
| EMF | Electromagnetic Field |
| EMP | Environmental Management Plan |
| ESRP | Electricity Supply Reliability Project |
| ETNIP | Electricity Transmission Network Improvement Project |
| GIIP | Good International Industry Practice |
| GRM | Grievance Redress Mechanism |
| HSEMS | Health, Safety, and Environment Management System |
| HSMP | Health and Safety Management Plan |
| HSMS | Health and Safety Management System |
| ICNIRP | International Commission on Non-Ionizing Radiation Protection |
| IFC | International Finance Corporation |
| kV | Kilo Volts |
| MW | Mega Watts |
| NGO | Non-Governmental Organization |
| OP/BP | Operational Policies / Bank Procedures |
| OTL | Overhead Transmission Line |
| PAP | Project Affected People |
| PCB | Polychlorinated Biphenyl |
| PPE | Personal Protective Equipment |
| RA | Republic of Armenia |
| SNCO | State Non-commercial Organization |
| ToR | Terms of Reference |
| TPP | Thermal Power Plant |
| USD | US Dollar |
| WB | World Bank |

# 1. Executive Summary

Electricity Transmission Network Improvement Project (the Project) is under preparation. The Project will finance the rehabilitation of the Ashnak substation, among others. In order to allow for reliable power supply in Northwestern Armenia, there is no alternative to the proposed rehabilitation measures.

In general, the Project intervention into the Ashnak substation will imply replacement and extension of electrical equipment and some construction works as well. The main measures on the electrical side are the replacement of and extension of auto transformers and replacement of and extension of current and voltage transformers. The newly installed $SF_6$ circuit breakers are in good condition. Civil works will include construction of a new station service building and new cable ducts. An important issue is the rehabilitation of the drainage system beneath the oil containing equipment. With this system oil and oil containing waters can be collected and the oil can be separated from the water.

Likely main negative impacts of works at Ashnak substation include generation of hazardous wastes such as used oil, batteries, and possibly asbestos. The entire part of the rehabilitation activities of the substation will be restricted to the property of the state-owned company High Voltage Electric Networks (HVEN). All of the rehabilitation measures will take place within the building and fenced areas of the substation. There is no need for any land acquisition outside the existing substation area.

The used oils may be treated and reused. Because at present there is no infrastructure for permanent disposal of hazardous waste in Armenia, and neither arrangement for its export does exist, hazardous wastes will be stored on site of Ashnak substation.

The 2010-installed generating circuit breakers are state-of-the-art $SF_6$ circuit breakers. The amount of $SF_6$ gas is very small and possible leakages are controlled automatically. Thus the risk of any $SF_6$ release to the environment is minimal.

The Project will result in a more reliable power supply to power consumers in the Project area. An increased reliability of the electricity supply, especially if a raising demand is expected, is a positive impact of the Project.

The final draft version of the present Environmental Management Plan (EMP) will be disclosed to the public in English and Armenian versions for sufficient time to allow stakeholders to familiarize with it. In order to ensure that local communities have realistic access to the EMP, it will not only be posted on HVEN's website, but will also be delivered in printed copies to the local administration offices and advertisements about their availability will be made. Printed copies will also be provided to relevant stakeholders as representative civil society organizations and to different NGOs. Received feedback will be incorporated into the final version of the EMP.

In the course of civil works at Ashnak substation, unexpected impacts may occur or mitigation measures may not be carried out properly. In order to provide an efficient channel for the local people to voice their concerns, a grievance redress mechanism shall be established and maintained throughout the construction period. The EMP provides an outline of the mechanism for submitting grievance and redressing them.

Most of the costs for mitigation of negative impacts during construction phase are included in the regular construction costs. Extra costs with respect to environmental mitigation are related to additional measures to ensure safe management of the oil wastes, safe storage of scrap metals, as well as quarterly supervision of construction site to be performed by an internationally experienced auditor. Considering a construction period of about 3 years, costs for implementation of the present EMP sum up to **203,500 USD.**

A local environmental specialist will be employed within HVEN. This specialist shall monitor the proper implementation of the EMP during monthly supervision at Ashnak substation.

EMP for the rehabilitation of Ashnak substation will be integral part of the tender documents and will be included into the design, supply, and installation contract for the rehabilitation.

In summary, if the present EMP is adequately implemented, the Ashnak substation may be reconstructed and operated without significant adverse impacts on the natural and social environment.

# 2. Legal and Regulatory Framework

According to the national environmental legislation of the Republic of Armenia, any activity which may cause environmental impacts needs a positive conclusion of an Environmental Impact Assessment. Environmental impacts of a planned activity or program have to be assessed during the preparation period. The **RA Law on Environmental Assessment and Expertise** of 2014 carries provisions regarding environmental impact assessment, impacting the environment, and conditions under which causing of such impact is allowed. In this law "*Overhead transmission lines of 100 kV and higher voltage*" are listed requiring an EIA process however rehabilitation of substations is not on the list.

The Project triggers the World Bank's safeguard policies OP 4.01 *Environmental Assessment* and OP 4.12 *Involuntary Resettlement*. According to OP 4.01, ETNIP is classified as environmental Category B. Activities to be undertaken at Ashnak substation also qualify for Category B. The present EMP is prepared following the World Bank's safeguard policies. The WB/IFC Environment, Health and Safety (EHS) Guidelines also apply and are technical reference documents with general and industry-specific examples of Good International Industry Practice (GIIP). More specifically, EHS Guidelines on Electric Power Transmission and Distribution are applicable to works at Ashnak substation.

# 3. Project Description

The Ashnak substation is on the balance sheet of the HVEN. Commissioned in 1983 it was designed and operated with 220/110/10 kV switchgears. Some of the breakers and disconnectors are dilapidated to an extent creating significant risks if operated further. Steel structures are rusted, eroded and bended. Many foundations are defragmented. The substation was designed with two autotransformers, but currently only one transformer is in operation with frequent failures, which reduces the power supply reliability. Oil is leaking from one transformer and bunds around the other transformer are broken (see Photo 3-1).

**Photo 3-1:** Bunds around a transformer are broken at s/s Ashnak

Currently 16 persons are working at Ashnak substation.

A visit to Ashnak substation was conducted by *Fichtner's* environmental specialist together with a national environmental expert on 26th September 2014 in order to check the situation at the substation and to take oil samples for PCB analyses (see Photo 3-2 and Photo 4-6).

**Photo 3-2:** Head and staff of substation Ashnak during consultation

Nearly all equipment at the substation will have to be replaced with the exception of the $SF_6$ circuit breakers installed in 2010 (see Photo 3-3). Equipment such as circuit breakers, disconnectors, current transformers, primary and secondary equipment (with related wiring cables), the control building and support structures need replacement because of lack of spare parts, frequent malfunction, and erosion of concrete foundations and steel supports. In all analyzed oil samples the concentrations of PCB were below 20 ppm. Thus, the oil is not considered to be PCB-containing oil and can be reused or recycled without any further treatment.

**Photo 3-3:** $SF_6$ circuit breakers installed in 2010 at s/s Ashnak

Consequently, this EMP is developed for works that imply full refurbishment of the substation, including demolishing a dilapidated control building and replacing it with a new building.

All demolishing / construction works will be done within the existing fenced areas. Extension of the substation site is not foreseen. The access road to the substation is in good condition and may be used also for transport of heavy equipment (see Photo 3-4).

**Photo 3-4:** Wide access to substation site at s/s Ashnak

Considerable amounts of waste will be generated by dismantling of old substation equipment. Main potentially hazardous wastes will be old batteries, used oil, and possibly asbestos. Domestic, sanitary and construction waste may be disposed of at the Talin landfill based on a written agreement with local authorities. Scrap metal may be sold by HVEN for recycling purposes to specialized companies (e.g. Open Joint Stock Copmany *ASCE Group*, Charentsavan). Until disposal or recycling, wastes will be stored at Ashnak substation site under relevant conditions and security provided (e.g. concreted and bunded floor, roofing etc.).

Because smooth operation of Ashnak substation is important for power evacuation from the Armenian Nuclear Power Plant (ANPP), HVEN and the Construction Contractor under taking works at Ashnak substation will inform management of the ANPP on the expected power cuts and any other events related to construction that may affect ANPP in any way.

ANPP operates in accordance with the Government Decree on Norms and Rules for Safety of Nuclear Power Plants, adopted on August 22, 1994 (Decree #394). The review of ANPP's compliance with the technical, operational, chemical, radiation, staff qualification, and radioactive waste management requirements, set forth in Rules and Regulations, is checked on annual basis by the Ministry of Energy and Natural Resources. Moreover, regular technical audits are conducted by the International Atomic Energy Agency (IAEA) and the World Association of Nuclear Operators (WANO). The latest check-up by the Operational Safety Review Team of IAEA was conducted in 2011 and no major safety and reliability issues were identified. ANPP also undergoes regular reviews of its environmental compliance with local regulations, including disposal of water and storage of fuel. The latest environmental compliance review in 2013 did not identify any environmental issues or breaches of the applicable legislation. There are no complaints related to environmental aspects of the ANPP operations and no lawsuits.

The Ashnak substation is situated in western Armenia south of Talin city in Aragatsotn Marz (see Map 3-1).


**Map 3-1**: Location of the Ashnak substation

# 4. Baseline Data

## 4.1 Health and Safety at Substations

Within HVEN, the Safety Engineering and Reliability Service is responsible for all safety aspects at the high voltage substations.

In general, due to lack of money, even minimum health and safety standards are not fully met at the substation site. As an example, the covers of the cable ducts which are used as pathways are broken and / or have holes and reinforcing iron bars sometimes form obstacles (see Photo 4-1). This is dangerous for the personnel, specifically at the night.

**Photo 4-1:** Badly maintained cable ducts at s/s Ashnak

Substation building has poor illumination (inside and outside), poor regulation of inside temperature (too hot in summer and too cold in winter), and substandard ventilation. The existing drainage system appears to be also in a bad condition.

At all substations in Armenia the same health and safety (H&S) system is applied. Responsible for safety aspects (inspection and training) is the 'Safety Engineering and Reliability Service' which is running departments at the different branches of HVEN. Substation staff attends monthly meetings dedicated to communicating updates on H&S regulations. Staff is subject to examination on awareness of H&S rules. Such tests are conducted by regional branches of HVEN on annual basis. Ledgers of conducted tests and their results are kept on file.

At all HVEN substations medical first aid kids are available. According to the staff, these kits are inspected and renewed regularly. However, the kits were found to be in a very poor condition (see Photo 4-2). A defibrillator was not available at the substation.

**Photo 4-2**: Poorly equipped first aid kit inside the control building at s/s Ashnak

Fire walls between transformers are not installed and a sprinkler system around transformers is not in place. This means that in case of a transformer fire, the fire could spread to other equipment and cooling of a burning transformer would not be possible. In the control building sufficient fire-fighting equipment is available. Most of the fire extinguishers are regularly maintained and checked and are in a good condition. The extinguishers are mostly powder-based and suitable for fighting fire in electrical installations (see Photo 4-3). The Fire Department at Talin is trained to fight fire in electrical installations and oil fires. From time to time, substation workers share trainings of the Fire Department.

**Photo 4-3**: Fire extinguisher (powder) inside control building at s/s Ashnak

Basic personal safety equipment, as helmets, gloves, tools for working under high voltage, is available at the substation (see Photo 4-4), and are used by the substation staff. Metal cladded clothes to protect workers from electric fields when working under high voltage are not available.

Photo 4-4**: Safety equipment and tools for working under high voltage at s/s Ashnak**

Running water is available at Ashnak substation. The substation is connected to the water supply system of Talin city. However, the hygienic situation in general is bad (see Photo 4-5).

**Photo 4-5**: The only toilet at s/s Ashnak

With respect to maximum permissible field strength allowed for workers' exposure, the former USSR formula to calculate the exposure time of workers is used in Armenia, which is equivalent to the thresholds specified in the Guidelines for Limiting Exposure to Time-Varying Electric and Magnetic Fields, published by the International Commission on Non-Ionizing Radiation Protection. The formula is:

$T_{[hrs]} = (50/E) - 2$
E = electric field [kV/m]
This 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. The details for the exposure time are laid down in the 'Regulations (rules) of technical safety for exploitation of electrical equipment' (2nd issue Moscow, Energoatomizdat, 1988). However, no electric/ magnetic field metering device is available at the substation.

## 4.2 Waste Management

All wastes ever generated have been stored at the substation site over decades. Thus, old equipment as old circuit breakers, ceramic parts and steel as well as old batteries and old oil not suitable for further use are stored all on the substation site, which provides sufficient room for storage. They are on the balance of HVEN.

In order to collect oil and / or oily waters from leaking equipment or in case of a transformer fire, normally a drainage system fitted with oil separators is installed below the substation site. The oily waters from this drainage system are collected in underground tanks which are emptied if needed. However, a functioning drainage system is missing at the substation at present.

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.

The rehabilitation project planned for Ashnak substation includes replacement of old autotransformers, voltage and current transformers. All this equipment contains oil. In order to decide what environmentally sound approach for removal, neutralization or elimination of PCB containing waste is, different samples of oil of the inspected substation were taken (see below and Section 10 - Appendix II) and analyzed for PCB in a certified German laboratory (certification see Section 10 – Appendix III). The results of the analyses are given in Table 4-1.

**Table 4-1:** Concentration of total PCB in oil samples taken at s/s Ashnak

| Location | Equipment | Date | PCB ppm |
|---|---|---|---|
| s/s Ashnak | Transformer | 07 Oct 2014 | 0,55 |
| s/s Ashnak | Circuit breaker | 07 Oct 2014 | 11,2 |

In all analyzed oil samples the concentrations of PCB were below 20 ppm. 50 ppm is the threshold of PCB content; above this value specific measures would be triggered. Following Stockholm and Bern Conventions, relevant EU Directives (e.g. 75/439/EEC) and U.S. EPA recommendations oil with a

PCB concentration of less than 50 ppm is not considered to be PCB-containing oil and can be reused or recycled without any further treatment[1].

**Photo 4-6:** Taking of oil samples from transformer at s/s Ashnak

# 5. Environmental Impacts and their Mitigation

The proposed rehabilitation of Ashnak substation will have various environmental impacts. The EMP covers a set of measures that need to be taken to ensure that the negative impacts from the rehabilitation of Ashnak substation are avoided or minimized.

Protected areas are not affected by the Project. The most significant impacts arise during the construction phase. They can be traced back to wind and water erosion, dust, vehicle and equipment movement, the potential for spills, improper waste disposal, handling of hazardous substances and $SF_6$, and power shortage during construction.

The rehabilitation activities will be restricted to the property of HVEN - building and fenced plots of the substation. There is no need for any land acquisition outside the existing substation area. Enough space for the additional equipment is available at the substation site. The access to substation site is possible by asphalted roads broad enough to take in also heavy equipment.

The biggest threat arising from works at the substation is the generation of potentially hazardous wastes such as used oil, old batteries and possibly asbestos. The potential hazardous waste will be stored on-site until proper disposal or recycling facilities are developed or an agreement for waste disposal will be developed.

During operation phase, environmental impacts from electric and magnetic fields (EMF) are not expected, because the substation will be constructed following state of the art technology. The internationally used standards for workplaces and for the public outside the substation will not be exceeded

[1] See also UNEP, Guidelines for the Identification of PCBs and Materials Containing PCBs, August 1999

(see Section 10 – Appendix IV). $SF_6$ leakages are very unlikely and will be continuously monitored by HVEN.

Beside domestic wastes generated by the workers, considerable waste will be generated by dismantling of old equipment. Thus, following main wastes being potentially hazardous will come up:

- old batteries
- used oil (about 240 t)
- old scrap metals like iron / steel / copper (about 324 t)
- asbestos (possibly)
- ceramics

It has to be mentioned, that all hazardous wastes, generated during the construction phase such as old batteries, used oil, scrap metals etc. are subject to passportization (registration) and control, in accordance with the Articles 12 and 13 of the RA Law on Waste, RA Government Decision N 2291-N (adopted on 09.12.2005) and Decision N47-N (adopted on 19.01.2014). Recycling, neutralization, storage, transport and disposal of hazardous waste are subject to licensing in accordance with Article 43 of the RA Law on Licensing.

**Table 5-1**: List of installed oil containing equipment at s/s Ashnak following information gained by HVEN

| Equipment description | Quantity | Weight [kg] | Oil [kg] | Total weight [kg] | Total oil [kg] |
|---|---|---|---|---|---|
| **220 kV Switchyard** | | | | | |
| Autotransformer three-phase, three-winding with tap changer | 2 | 93,200 | 57,000 | 186,400 | 114,000 |
| Transformer three phase, linear adjustment | 2 | 24,100 | 11,900 | 48,200 | 23,800 |
| Few oil switches unipolar drive | 9 | 2,112 | 265 | 19,008 | 2,385 |
| Current transformer | 9 | 1,410 | 850 | 12,690 | 7,650 |
| Current transformer | 12 | 355 | 85 | 4,260 | 1,020 |
| Voltage transformer | 7 | 970 | 490 | 6,790 | 3,430 |
| **Total 220 kV** | | | | **277,348** | **152,285** |
| **110 kV Switchyard** | | | | | |
| Current transformer | 15 | 760 | 300 | 11,400 | 4,500 |
| Oil switch | 10 | 2,400 | 8,000 | 24,000 | 80,000 |
| Few oil switches | 3 | 2,434 | 333 | 7,302 | 999 |
| Few oil switches | 1 | 1,450 | 250 | 1,450 | 250 |
| Voltage transformer | 7 | 320 | 100 | 2,240 | 700 |
| **Total 110 kV** | | | | **46,392** | **86,449** |
| **Total s/s Ashnak** | | | | **323,740** | **238,734** |

The analyses for PCB revealed that the oil in transformers / circuit breakers is not polluted with PCB (see Section 4.2). However, HVEN does not plan to reuse the old oil and will store it at the substation area until final disposal.

At Ashnak substation site a special area will be prepared where the old oil can be stored safely. This area will be sealed and surrounded with a concrete bund to exclude soil / groundwater pollution even if the tanks are leaking. The place will be roofed to minimize corrosion of the tanks. An existing oil storage site is shown in Photo 5-1. For oil storage special tanks will be used. These tanks will be double walled and fitted with suitable possibilities to take out the oil for reuse purposes. The dimension of the tank(s) will be big enough to take over the intended 240 t, the oil already stored at the substation site, and also future intentions. It is recommended to use several tanks of about 25 $m^3$ to reduce the risk in case a tank starts leaking.

**Photo 5-1:** Oil storage site at s/s Ashnak

The storage of batteries will be done at the substation site using existing facilities at the substation where old batteries are already stored (see Photo 5-2) or newly constructed storage facilities. The batteries will be stored in a way that access is possible to every single battery in case they start to leak. Stock piling of batteries will be avoided. The existing room has an effective ventilation system in case sulfuric acid leaks from the batteries. Substation staff permanently oversees safety of storage and will adhere to this practice in future.

**Photo 5-2:** Storage room for used batteries at s/s Ashnak

The storage of metals like iron / steel and copper will be done on a graveled area on the substation site, large enough for the intended 324 t and the scrap metal already stored at the substation site. An existing storage is shown in Photo 5-3.

**Photo 5-3:** Storage of old circuit breakers at s/s Ashnak

Demolishing of the existing building at the Ashnak substation may result in the generation of asbestos-containing waste. Material containing asbestos shall not be shredded, but stored in concreted, roofed and secured facilities until a reasonable possibility for disposal will be available. If asbestos containing material is found but has not to be touched in the course of the refurbishment activities, it is good practice to leave this material as it is. While handling asbestos-containing materials, all workers must wear personal protective gear and the work site shall be sprinkled to minimize dust.

The implementing agency (HVEN) and the Construction Contractor will inform the authorities, which are responsible for the safety of the Armenian Nuclear Power Plant (ANPP) in advance about any planned power cut or immediately in case of a spontaneous / accidental power cut during construction works, in order to exclude any risk for the power supply of the ANPP during construction works.

## 5.1 Environmental Mitigation during Construction Activities

Almost all mitigation measures have to be implemented during the construction phase. Managing hazardous waste storage facilities on-site will be an important measure for mitigating operation phase risks.

In summary, if the proposed EMP will be fully implemented, it can be concluded that the proposed rehabilitation and modernization of s/s Ashnak, can be constructed and operated without having significant adverse impacts on the ecological and social environment.

**Table 5-2:** Summary of Mitigation Measures during Construction Activities concerning Soil and Water Pollution

| **Mitigation measures to be applied during construction phase** | | |
|---|---|---|
| **Issue for Mitigation: Soil and Water pollution** | | |
| **Mitigation measures** (considering EHS-Guidelines: Water and Sanitation, Wastewater and Ambient Water Quality, Waste Management, Hazardous Material Management) | **Responsible Party** | **Budget for implementing (USD)** |
| Regular maintenance of all vehicles and machines at regular service stations, if possible | Construction Contractor | Included in construction costs |
| Maintenance and re-fueling of the construction equipment only on sealed and enclosed areas | | |
| Store all liquid materials (e.g. fuel, engine oil, etc.) and lubricants in locked tanks and on sealed and roofed areas | | |
| Store construction material as bags of cement etc. in containers in order to avoid rinsing out | | |
| Provide proper sanitation facilities with hand-washing facilities in adequate number, separately for men and women | | |
| Train workers in appropriate sanitation practices | | |
| Design bunds around and oil collecting system beneath transformers to prevent contamination of soil and groundwater | | |
| Train transporters and workers in spill prevention and control especially in handling of oil and fuel | | |
| Provide proper equipment (as drip pans) and implement procedures to handle transformer oil | | |
| Provide spill-control materials to drivers and workers, in order to clean up spills, if necessary | | |
| Report and respond to spills promptly and train workers in how to report | | |
| Remove contaminated soil if spills occur and handle as hazardous waste | | |
| Collect contaminated spill materials and manage as hazardous waste | | |

**Table 5-3:** Summary of Mitigation Measures during Construction Activities concerning Waste Management

| **Mitigation measures to be applied during construction phase** | | |
|---|---|---|
| **Issue for Mitigation: Risks from Waste** | | |
| **Mitigation measures** (considering EHS-Guidelines: Water and Sanitation, Wastewater and Ambient Water Quality, Waste Management, Hazardous Material Management) | **Responsible Party** | **Budget for implementing (USD)** |
| CC will have to clarify with local authorities, where different kind of wastes may be disposed of | Construction Contractor<br><br>Local authorities | Included in construction costs |

| **Mitigation measures to be applied during construction phase** | | |
|---|---|---|
| **Issue for Mitigation: Risks from Waste** | | |
| **Mitigation measures** (considering EHS-Guidelines: Water and Sanitation, Wastewater and Ambient Water Quality, Waste Management, Hazardous Material Management) | **Responsible Party** | **Budget for implementing (USD)** |
| Development of Waste Management Plan within the HSE Management Plan considering following principles: (i) waste management hierarchy of avoidance-minimization-reuse-treatment-disposal; (ii) segregation of waste; (iii) minimization of construction waste by good technical planning; (iv) training of staff | Construction Contractor | Included in construction costs |
| Implementation of a Waste Management System | | |
| Train workers in handling and disposal of recyclable, sanitary, solid, liquid and hazardous waste | | |
| Store asbestos in concreted, roofed and secured facilities, if necessary | | |
| Maintain records of all wastes disposed of onsite and record GPS coordinates and dimensions of waste disposal sites | | |
| Segregate hazardous waste and store in suitable drums or containers in secure facilities (fitted with roofs, concreting, bunds etc.), and clearly identify hazardous waste | | |
| Dispose of oil-contaminated soil in adequate storage facilities (see above) or landfills | | |
| Store used oil in suitable tanks and at proper areas at substation site (see Section 4.2) including storage of already existing oil onsite | | **80,000** (storage sites) |
| Store batteries onsite in suitable storage sites (see Section 4.2) including batteries already stored onsite | | Included in construction costs |
| Store scrap metal (iron, steel, copper, etc.) onsite for later recycling through HVEN (see Section 4.2) including material already stored onsite | | **15,000** (storage sites) |

**Table 5-4:** Summary of Mitigation Measures during Construction Activities concerning Handling of $SF_6$

| **Mitigation measures to be applied during construction phase** | | |
|---|---|---|
| **Issue for Mitigation: Handling of $SF_6$** | | |
| **Mitigation measures** (considering EHS-Guideline: Air Emissions and Ambient Air Quality) | **Responsible Party** | **Budget for implementing (USD)** |
| Fit the $SF_6$ switch gears with automatic gas leakage detection systems, if necessary | Construction Contractor | Included in construction costs |
| Equipment for maintenance and handling of $SF_6$ must be supplied from the manufacturer | | |
| Apply relevant general guidelines for handling $SF_6$ | | |

**Table 5-5:** Summary of Mitigation Measures during Construction Activities concerning Employee Health and Safety

| **Mitigation measures to be applied during construction phase** | | |
|---|---|---|
| **Issue for Mitigation: Risks for Employee Health and Safety** | | |
| **Mitigation measures** | **Responsible Party** | **Budget for implementing (USD)** |
| Development of an HSE Policy for the construction phase, in advance of construction activities | Construction Contractor | Included in construction costs |
| Development of an HSE Management Plan for the construction phase (shall include Waste Management Plan), in advance of construction activities | | |
| Installation of an HSE Management System (HSEMS) during the construction phase | | |
| Provide proper sanitation facilities with hand-washing facilities in adequate number, separately for men and women | | |
| Implementation of health and safety workshops for construction workers | | |
| Installation of warning signs "Danger of Electrocution" at towers, substations etc. | | |
| Consider possible occurrence of poisonous snakes during working. Workers shall wear e.g. thick gloves when opening old ducts etc. | | |
| Provide workers with appropriate protective equipment (PPE) (dust, noise, etc.) | | |
| Hire only accredited workers for specific jobs, which require specialized training, such as working at heights, handling of large equipment and machinery, handling of hazardous material, etc. | | |
| Provide first aid kits and fire extinguishers at all Project sites and in all vehicles | | |
| Forbid alcohol and other drugs at construction sites | | |
| Assure transfer of injured workers to hospitals in the case of serious accidents | | |
| Identify area emergency responders, hospitals, and clinics, and provide advance notice of Project activities | | |
| Implement programs for medical screening, health and safety monitoring, and reporting | | |
| Limit occupational exposure to EMF by use of shielding materials, and train workers accordingly | | |
| Record all accidents and incidents | | |

**Table 5-6:** Summary of Mitigation Measures during Construction Activities concerning Public Health and Safety

| **Mitigation measures to be applied during construction phase** | | |
|---|---|---|
| **Issue for Mitigation: Risks for Public Health and Safety** | | |
| **Mitigation measures** (considering EHS-Guideline: Community Health and Safety) | **Responsible Party** | **Budget for implementing (USD)** |
| Ensure that traffic is not interfered by construction through proper traffic management | Construction Contractor | Included in construction costs |
| Notification of the public on upcoming construction, in advance of construction period | | |
| Public education and outreach efforts to provide information about hazard awareness, upcoming construction activities, safety measures, reporting unsafe conditions and environmental impacts, in advance of construction period | | |
| Inform population along public roads in advance in case of transporting heavy equipment | | |
| Provide adequate security measures to prevent accidents and injury (e.g. keeping speed limits on public roads, grounding objects) | | |
| Provide adequate security to prevent public access to the substations, work sites, hazardous materials and waste | | |
| Erect fire walls between or at new transformers foreseen in switchyard of s/s Ashnak to prevent spreading of fire in case of an accident | | |

**Table 5-7:** Summary of Mitigation Measures during Construction Activities concerning Noise

| **Mitigation measures to be applied during construction phase** | | |
|---|---|---|
| **Issue for Mitigation: Noise** | | |
| **Mitigation measures** (considering EHS-Guideline: Noise Management) | **Responsible Party** | **Budget for implementing (USD)** |
| Reduce vehicle speeds (stick to recommended speeds) in populated areas | Construction Contractor | Included in construction costs |
| Allow truck movements only during daylight, but not between 7 pm and 6 am | | |
| Utilization of low sound power mechanical equipment like bulldozer, air compressor, concrete pumps, excavator, concrete mixer etc. whenever possible | | |
| Regular maintenance and service of building machinery and other during construction works | | |
| Shut down or throttling down of noisy machinery to a minimum | | |
| For workers noise levels shall be kept below 80 dB (A), wherever possible. In case of exceeding this value, hearing protections must be provided to workers and warning signs must be installed | | |
| Noise level may not exceed 55 dB (A) for residents | | |

| **Mitigation measures to be applied during construction phase** | | |
|---|---|---|
| **Issue for Mitigation: Noise** | | |
| **Mitigation measures** (considering EHS-Guideline: Noise Management) | **Responsible Party** | **Budget for implementing (USD)** |
| Notify nearby residents and businesses at least 24 hours in advance if particularly noisy activities are anticipated | Construction Contractor | Included in construction costs |
| Conduct noise-generating activities during normal work hours during the day | | |

**Table 5-8:** Summary of Mitigation Measures during Construction Activities concerning Air Quality

| **Mitigation measures to be applied during construction phase** | | |
|---|---|---|
| **Issue for Mitigation: Risks for Air Quality** | | |
| **Mitigation measures** (considering EHS-Guideline: Air Emissions and Ambient Air Quality) | **Responsible Party** | **Budget for implementing (USD)** |
| Reduction of speed and limited movement of vehicles | Construction Contractor | Included in construction costs |
| Maintain vehicles and construction machinery properly, as recommended by suppliers | | |
| Use dust-suppressing water on unpaved roads, e.g. spraying of water with watering trucks in advance of transportation activities | | |
| Cover truck beds with tarps during material transport | | |
| Use dust-suppressing water spray during civil works, where necessary | | |
| Use equipment with dust suction devices in enclosed spaces during civil works, where necessary | | |
| Store and handle material appropriately to limit dust (e.g. protect cement with tarpaulins) | | |
| Avoid unnecessary idling of construction machines and vehicles | | |
| Burning of rubbish onsite must be strictly forbidden | | |

**Table 5-9:** Summary of Mitigation Measures during Construction Activities concerning Social Impacts

| **Mitigation measures to be applied during construction phase** | | |
|---|---|---|
| **Issue for Mitigation: Social Impacts** | | |
| **Mitigation measures** | **Responsible Party** | **Budget for implementing (USD)** |
| Develop in advance of construction period and implement a non-discriminatory hiring and wage policy (clearly stating that the company will not discriminate in hiring and salaries based on gender, age, religion, ethnicity or place of origin) | Construction Contractor<br><br>NGO | Included in construction costs |
| Prosecute offenses related to payment of wages by sub-contractors strictly | | |
| Provide adequate workers' accommodation (e.g. private rooms or workers' camp) near construction site | | |
| Prioritize employment of local people for construction works (skilled and unskilled workers) | | |
| Improve recruitment of women for construction works | | |
| Facilitate other economic opportunities for local communities (e.g. providing food services or other supplies to Contractors and workers) | | |
| Health awareness workshops for workers by a specialized NGO | | |
| Zero tolerance for sexual harassment at the work place or in workers' camp / overnight locations | | |
| Strengthen district administrations on gender issues (i.e. receive complaints by women) | | |
| Inform authorities relevant for the safety of the Armenian Nuclear Power Plant in advance about any planned power cut or immediately in case of a spontaneous / accidental power cut during construction works, in order to exclude any risk for the power supply of the Nuclear Power Plant during construction works. | Construction Contractor<br><br>HVEN | |
| Establish green area around substation site | Construction Contractor | |
| Develop and implement a Grievance Redress Mechanism (see Chapter 7) | | |

**Table 5-10:** Summary of Mitigation Measures during Construction Activities concerning Traffic Management

| **Mitigation measures to be applied during construction phase** | | |
|---|---|---|
| **Issue for Mitigation: Risks from Traffic** | | |
| **Mitigation measures** | **Responsible Party** | **Budget for implementing (USD)** |
| Announce start and duration of works through media and signs to the public in advance of construction period | Construction Contractor | Included in construction costs |
| Use of existing access roads to construction site | | |
| Keep to speed limits in public roads | | |
| Establish rights-of-way, speed limits onsite (20 km/h, walking pace for heavy trucks), vehicle inspection requirements, operating rules and procedures before commencement of construction | | |
| Licensing and training of drivers; improvement of driving skills | | |
| Ensure that industrial vehicle operators are licenses in the safe operation of specialized vehicles | | |
| Maintain vehicles regularly and use manufacturer approved parts to minimize potentially serious accidents caused by equipment malfunction or premature failure | | |
| Minimize transport distances by using locally sourced materials, if possible | | |
| Ensure safely design of exits and entrance for vehicles to construction site | | |
| Collaborate with local communities and authorities to improve signage, visibility and overall safety of roads, particularly along stretches located near schools or other locations where children may be present, in advance of construction period | | |
| Collaborate with local communities on education about traffic and pedestrian safety, in advance of construction period | | |
| Coordination with emergency responders | | |

## 5.2 Environmental Mitigation during Operation and Maintenance

**Table 5-11:** Summary of Mitigation Measures during Operation and Maintenance Activities concerning Employee and Public Health and Safety

| **Mitigation measures to be applied during operation and maintenance period** | | |
|---|---|---|
| **Issue for Mitigation: Employee and Public Health and Safety** | | |
| **Mitigation measures** | **Responsible Party** | **Budget for implementing (USD)** |
| Develop a Health and Safety Management Plan (HSMP) and implement an Health and Safety Management System (HSMS) for operation and maintenance of s/s Ashnak | HVEN | Development of an HSMP for the operational phase (to be set up by HVEN), is recommended |

**Table 5-12:** Summary of Mitigation Measures during Operation and Maintenance Activities concerning Handling of $SF_6$

| **Mitigation measures to be applied during operation and maintenance period** | | |
|---|---|---|
| **Issue for Mitigation: Handling of $SF_6$** | | |
| **Mitigation measures** (considering EHS-Guideline: Air Emissions and Ambient Air Quality) | **Responsible Party** | **Budget for implementing (USD)** |
| Circuit breakers fitted with automatic leakage detectors | HVEN | Included in operational costs |
| Regular control of $SF_6$ fill level | | |
| Follow international used guidelines for $SF_6$ gas handling | | |

## 5.3 Monitoring during Construction Activities

**Table 5-13:** Monitoring during Construction Activities

| **Activity / Impact** | **What** (Is the parameter to be monitored?) | **Where** (Is the parameter to be monitored?) | **How** (Is the parameter to be monitored?) | | **When** (Define the frequency / or continuous?) | **Who** (Is responsible for monitoring?) |
|---|---|---|---|---|---|---|
| | | | **Method** | **Indicator** | | |
| Soil and Water Pollution (Part 1) | Regular maintenance of all vehicles and machines at regular service stations, if possible | Construction sites at Ashnak substation | Inspection of maintenance records | All vehicles and machines adequately maintained | Regularly during construction | HVEN<br><br>External expert |
| | Maintenance and re-fueling of the construction equipment only on sealed and enclosed areas | | Visual inspection of maintenance and re-fueling areas | No unsuitable areas used for maintenance and re-fueling | | |
| | Store all liquid materials (e.g. fuel, engine oil, etc.) and lubricants in locked tanks and on sealed and roofed areas | | Visual inspection | All materials adequately stored | | |
| | Store construction material as bags of cement etc. in containers in order to avoid rinsing out | | | | | |
| | Provide proper sanitation facilities with hand-washing facilities in adequate number, separately for men and women | | | Adequate number of sanitation facilities separately for men and women; and in proper condition | | |
| | Train workers in appropriate sanitation practices | | Inspection of training records | All workers trained accordingly | | |
| | Design bunds around and oil collecting system beneath transformers to prevent contamination of soil and groundwater | | Visual inspection | All transformers fitted with bunds and oil collecting system | | |
| | Train transporters and workers in spill prevention and control especially in handling of oil / fuel | | Inspection of training records | All workers trained accordingly | | |

| Activity / Impact | What (Is the parameter to be monitored?) | Where (Is the parameter to be monitored?) | How (Is the parameter to be monitored?) | | When (Define the frequency / or continuous?) | Who (Is responsible for monitoring?) |
|---|---|---|---|---|---|---|
| | | | Method | Indicator | | |
| Soil and Water Pollution (Part 2) | Provide proper equipment (as drip pans) and implement procedures to handle transformer oil | Construction sites at Ashnak substation | Inspection of equipment | Equipment provided | Regularly during construction | HVEN<br><br>External expert |
| | Provide spill-control materials to drivers and workers, in order to clean up spills, if necessary | | | | | |
| | Report and respond to spills promptly and train workers in how to report | | Inspection of spill reports, and training records | Number of spill reports<br><br>All workers trained accordingly | | |
| | Remove contaminated soil if spills occur and handle as hazardous waste | | Inspection of spill reports and storage areas | All contaminated materials adequately stored | | |
| | Collect contaminated spill materials and manage as hazardous waste | | | | | |
| Waste Management (Part 1) | CC will have to clarify with local authorities, where different kind of wastes may be disposed of | Construction sites at Ashnak substation | Control of written agreement | Written agreement provided | In advance of construction works | HVEN<br><br>External expert |
| | Development of Waste Management Plan within the HSE Management Plan | | Control of Waste Management Plan | Waste Management Plan developed | | |
| | Implementation of a Waste Management System | | Control of Waste Management System | Waste Management System implemented | Regularly during construction | |
| | Train workers in handling and disposal of recyclable, sanitary, solid, liquid and hazardous waste | | Inspection of training records | All workers trained accordingly | | |
| | Maintain records of all wastes disposed of onsite and record GPS coordinates and dimensions of waste disposal sites | | Control of waste data sheets | Records in proper condition | | |

| Activity / Impact | What (Is the parameter to be monitored?) | Where (Is the parameter to be monitored?) | How (Is the parameter to be monitored?) | | When (Define the frequency / or continuous?) | Who (Is responsible for monitoring?) |
|---|---|---|---|---|---|---|
| | | | Method | Indicator | | |
| Waste Management (Part 2) | Store asbestos in concreted, roofed and secured facilities, if necessary | Construction sites at Ashnak substation | Visual control of storage areas at substation | All hazardous materials and scrap metal stored in appropriate storage areas | Regularly during construction | HVEN<br>External expert |
| | Segregate hazardous waste and store in suitable drums or containers in secure facilities (fitted with roofs, concreting, bunds etc.), and clearly identify hazardous waste | | | | | |
| | Dispose of oil-contaminated soil in adequate storage facilities (see above) or landfills | | | | | |
| | Store used oil in suitable tanks and at proper areas at substation site including storage of already existing oil onsite | | | | | |
| | Store batteries onsite in suitable storage sites including batteries already stored onsite | | | | | |
| | Store scrap metal (iron, steel, copper, etc.) onsite for later recycling through HVEN including material already stored onsite | | | | | |
| Handling of $SF_6$ | Fit the $SF_6$ circuit breakers with automatic gas leakage detection systems, if necessary | $SF_6$ circuit breakers at Ashnak substation | Visual inspection | All $SF_6$ circuit breakers fitted with automatic gas leakage detection system | In advance of construction works | HVEN<br>External expert |
| | Equipment for maintenance and handling of $SF_6$ must be supplied from the manufacturer | | | All equipment supplied from manufacturer | | |
| | Apply relevant general guidelines for handling $SF_6$ | | Verification of application of $SF_6$ guidelines | Relevant guidelines applied | Regularly during construction | |

| Activity / Impact | What (Is the parameter to be monitored?) | Where (Is the parameter to be monitored?) | How (Is the parameter to be monitored?) | | When (Define the frequency / or continuous?) | Who (Is responsible for monitoring?) |
|---|---|---|---|---|---|---|
| | | | Method | Indicator | | |
| Employee Health and Safety (Part 1) | Development of an HSE Policy for the construction phase, in advance of construction activities | Construction sites at Ashnak substation | Inspection of relevant documents | HSE Policy developed | In advance of construction works | HVEN<br><br>External expert |
| | Development of an HSE Management Plan for the construction in advance of construction activities | | | HSE Management Plan developed | | |
| | Installation of an HSE Management System (HSEMS) during the construction phase | | | HSE Management System implemented | | |
| | Make sure that all workers have a health insurance | | Inspection of workers' health documents | All workers have health insurance | | |
| | Provide proper sanitation facilities with hand-washing facilities in adequate number, separately for men and women | | Visual inspection | Adequate number of sanitation facilities separately for men and women; and in proper condition | Regularly during construction | |
| | Provision of HIV /AIDS protection equipment for workers | | Interviews | Protection equipment provided | | |
| | Implementation of health and safety workshops for construction workers | | Inspection of workshop records | Workshops implemented | | |
| | Installation of warning signs "Danger of Electrocution" at towers, substations etc. | | Visual inspection | Warning signs installed | | |
| | Provide workers with appropriate protective equipment (PPE) (dust, noise, thick gloves against snake bites etc.) | | Inspection of accident records<br><br>Interviews | All workers provided with PPE | | |
| | Provide first aid kits and fire extinguishers at all Project sites and in all vehicles | | Visual inspection | First aid kits and fire extinguishers provided | | |

| Activity / Impact | What (Is the parameter to be monitored?) | Where (Is the parameter to be monitored?) | How (Is the parameter to be monitored?) | | When (Define the frequency / or continuous?) | Who (Is responsible for monitoring?) |
|---|---|---|---|---|---|---|
| | | | Method | Indicator | | |
| Employee Health and Safety (Part 2) | Train workers in regard to working at heights, electrical safety, vehicular safety, handling of hazardous materials, PPE, use of first aid and rescue techniques, emergency response, poisonous snakes etc. | Construction sites at Ashnak substation | Inspection of training records | All workers trained accordingly | Regularly during construction | HVEN<br>External expert |
| | Forbid alcohol and other drugs at construction sites | | Inspection of incident records | No workers found under influence of alcohol or other drugs | | |
| | Assure transfer of injured workers to hospitals in the case of serious accidents | | Inspection of accident records | Workers transferred to hospital in case of serious accidents | | |
| | Identify area emergency responders, hospitals, and clinics, and provide advance notice of Project activities | Area emergency responders | Interviews | Area emergency responders informed about Project activities | In advance of construction works | |
| | Implement programs for medical screening, health and safety monitoring, and reporting | Construction sites at Ashnak substation | Inspection of records | H&S programs implemented | Regularly during construction | |
| | Limit occupational exposure to EMF by use of shielding materials, and train workers accordingly | | Interviews<br>Inspection of training records | Shielding materials in place<br>All workers trained accordingly | | |
| | Record all accidents and incidents | | Inspection of records | Recording implemented | | |
| Public Health and Safety (Part 1) | Ensure that traffic is not interfered by construction through proper traffic management | Residents living near Ashnak substation | Inspection of complaints | No complaints from residents | Regularly during construction | HVEN<br>External expert |
| | Notification of the public on upcoming construction | | Interviews | Public informed about upcoming construction | In advance of construction | |

| Activity / Impact | What (Is the parameter to be monitored?) | Where (Is the parameter to be monitored?) | How (Is the parameter to be monitored?) | | When (Define the frequency / or continuous?) | Who (Is responsible for monitoring?) |
|---|---|---|---|---|---|---|
| | | | Method | Indicator | | |
| Public Health and Safety (Part 2) | Public education and outreach efforts to provide information about hazard awareness, upcoming construction activities, safety measures, reporting unsafe conditions and environmental impacts, in advance of construction period | Residents living near Ashnak substation | Interviews<br><br>Inspection of complaints | Public accordingly informed<br><br>No complaints | In advance of construction<br><br>Regularly during construction | HVEN<br><br>External expert |
| | Inform population along public roads in advance in case of transporting heavy equipment | Residents along public roads | Inspection of complaints and accident records | No complaints from residents; no accidents | Regularly during construction | |
| | Provide adequate security measures to prevent accidents and injury (e.g. keeping speed limits on public roads, grounding objects) | Residents living near Ashnak substation | | | | |
| | Provide adequate security to prevent public access to the substations, work sites, hazardous materials and waste | Construction sites at Ashnak substation | Visual inspection<br><br>Inspection of records | Security measures implemented<br><br>No incident records | | |
| Noise (Part 1) | Reduce vehicle speeds in populated areas | Residents living near Ashnak substation | Inspection of complaints | No complaints from residents | Regularly during construction | HVEN<br><br>External expert |
| | Allow truck movements only during daylight, but not between 7 pm and 6 am | | | | | |
| | Utilization of low sound power mechanical equipment like bulldozer, air compressor, concrete pumps, excavator, concrete mixer etc. whenever possible | Construction sites at Ashnak substation | Visual inspection<br><br>Inspection of complaints | Low sound equipment used<br><br>No complaints from residents | | |
| | Regular maintenance and service of building machinery and other during construction works | | Inspection of maintenance records | Equipment regularly maintained | | |

| **Activity / Impact** | **What** (Is the parameter to be monitored?) | **Where** (Is the parameter to be monitored?) | **How** (Is the parameter to be monitored?) | | **When** (Define the frequency / or continuous?) | **Who** (Is responsible for monitoring?) |
|---|---|---|---|---|---|---|
| | | | **Method** | **Indicator** | | |
| Noise (Part 2) | Shut down or throttling down of noisy machinery to a minimum | Construction sites at Ashnak substation | Inspection of complaints | No complaints from residents | Regularly during construction | HVEN<br><br>External expert |
| | For workers noise levels shall be kept below 80 dB (A), wherever possible. In case of exceeding this value, hearing protections must be provided to workers and warning signs must be installed | | Instrumental measurement in case of particularly noisy activities | Noise level below 80 dB (A); if noise levels higher than 80 dB (A): workers fitted with PPE and warning signs installed | | |
| | Noise level may not exceed 55 dB (A) for residents | Residents living near Ashnak substation | Instrumental measurement in case of complaints | Noise level below 55 dB (A) | | |
| | Notify nearby residents and businesses at least 24 hours in advance if particularly noisy activities are anticipated | | Interviews | Residents informed in advance | | |
| | Conduct noise-generating activities during normal work hours during the day | Construction sites at Ashnak substation | Inspection of complaints | No complaints from residents | | |
| Air Quality (Part 1) | Reduction of speed and limited movement of vehicles | Construction sites at Ashnak substation | Inspection of complaints | No complaints from residents | Regularly during construction | HVEN<br><br>External expert |
| | Maintain vehicles and construction machinery properly, as recommended by suppliers | | Inspection of maintenance records | Equipment regularly maintained | | |
| | Use dust-suppressing water on unpaved roads, e.g. spraying of water with watering trucks in advance of transportation activities | Unpaved roads used for transport | Inspection of complaints | No complaints from residents | | |
| | Cover truck beds with tarps during material transport | Construction sites at Ashnak substation | | | | |
| | Use dust-suppressing water spray during civil works, where necessary | | | | | |

| Activity / Impact | What (Is the parameter to be monitored?) | Where (Is the parameter to be monitored?) | How (Is the parameter to be monitored?) | | When (Define the frequency / or continuous?) | Who (Is responsible for monitoring?) |
|---|---|---|---|---|---|---|
| | | | Method | Indicator | | |
| Air Quality (Part 2) | Use equipment with dust suction devices in enclosed spaces during civil works, where necessary | Construction sites at Ashnak substation | Visual inspection | Dust suction devices used where necessary | Regularly during construction | HVEN<br>External expert |
| | Store and handle material appropriately to limit dust (e.g. protect cement with tarpaulins) | | | Appropriate storage | | |
| | Avoid unnecessary idling of construction machines and vehicles | | | No unnecessary idling | | |
| | Burning of rubbish onsite must be strictly forbidden | | | No rubbish burned | | |
| Social Impacts (Part 1) | Develop and implement a non-discriminatory hiring and wage policy | Construction sites at Ashnak substation | Inspection of complaints | No complaints | Regularly during construction | HVEN<br>External expert |
| | Prosecute offenses related to payment of wages by sub-contractors strictly | | | | | |
| | Provide adequate workers' accommodation near construction site | Workers' accommodation | Visual inspection<br>Interviews | Workers' accommodation in proper condition | | |
| | Prioritize employment of local people for construction works | Construction sites at Ashnak substation | | Percentage of local people employed | | |
| | Improve recruitment of women for construction works | | | Percentage of women employed | | |
| | Facilitate other economic opportunities for local communities | Residents living near substation | | Other economic opportunities established | | |
| | Health awareness workshops for workers by a specialized NGO | Construction sites at Ashnak substation | Inspection of workshop records | All workers participated | | |
| | Zero tolerance for sexual harassment at the work place or in workers' camp / overnight locations | Construction sites and overnight locations | Inspection of complaints | No complaints | | |

| Activity / Impact | What (Is the parameter to be monitored?) | Where (Is the parameter to be monitored?) | How (Is the parameter to be monitored?) | | When (Define the frequency / or continuous?) | Who (Is responsible for monitoring?) |
|---|---|---|---|---|---|---|
| | | | Method | Indicator | | |
| Social Impacts (Part 2) | Strengthen district administrations on gender issues (i.e. receive complaints by women) | District administration | Inspection of complaints | Percentage of complaints adequately treated | Regularly during construction | HVEN<br>External expert |
| | Inform authorities relevant for the safety of the Armenian Nuclear Power Plant in advance about any planned power cut or immediately in case of a spontaneous / accidental power cut during construction works, in order to exclude any risk for the power supply of the Nuclear Power Plant during construction works. | Authorities relevant for the safety of the Armenian Nuclear Power Plant | Interviews | Relevant authorities informed | In advance of construction<br>During construction | |
| | Establish green area around substation site | Around substation site | Visual inspection | Green area established | During construction | |
| | Develop and implement a Grievance Redress Mechanism | Construction sites at Ashnak substation | Inspection of grievances | Percentage of grievances adequately treated | Regularly during construction | |
| Traffic Management (Part 1) | Announce start and duration of works through media and signs to the public in advance of construction period | Residents living near substation | Interviews | Public informed about construction works | In advance of construction | HVEN<br>External expert |
| | Use of existing access roads to construction site | | Inspection of complaints | No complaints from residents | Regularly during construction | |
| | Keep to speed limits in public roads | | | | | |
| | Establish rights-of-way, speed limits onsite, vehicle inspection requirements, operating rules and procedures before commencement of construction | Construction sites at Ashnak substation | Visual inspection | Speed limits, inspection requirements, operating rules established | | |
| | Use licensed drivers only; provide on-the-job training for drivers for | | Inspection of licensing records | All drivers licensed and trained | | |

| Activity / Impact | What (Is the parameter to be monitored?) | Where (Is the parameter to be monitored?) | How (Is the parameter to be monitored?) | | When (Define the frequency / or continuous?) | Who (Is responsible for monitoring?) |
|---|---|---|---|---|---|---|
| | | | Method | Indicator | | |
| | the improvement of driving skills | | | | | |
| Traffic Management (Part 2) | Training industrial vehicle operators in the safe operation of specialized vehicles, including safe loading / unloading, and load limits | Construction sites at Ashnak substation | Inspection of training records | All vehicle operators trained and licensed | Regularly during construction<br>In advance of construction | HVEN<br>External expert |
| | Maintain vehicles regularly and use manufacturer approved parts to minimize potentially serious accidents caused by equipment malfunction or premature failure | | Inspection of maintenance records | Vehicles regularly maintained and approved parts used | | |
| | Minimize transport distances by using locally sourced materials, if possible | | Visual inspection | Locally sourced material used, if possible | | |
| | Ensure safely design of exits and entrance for vehicles to construction site | | | Vehicle exits and entrance designed safely | | |
| | Wash tires of vehicles and machinery prior to existing works site in muddy conditions | | | Vehicle exists | | |
| | Collaborate with local communities and authorities to improve signage, visibility and overall safety of roads, particularly along stretches located near schools or other locations where children may be present | Local communities | Interviews | Improvement of overall safety of roads started | | |
| | Collaborate with local communities on education about traffic and pedestrian safety | | | Education program about traffic and pedestrian safety established | | |
| | Coordination with emergency responders | Emergency responders | | Coordination established | | |

## 5.4 Monitoring during Operation and Maintenance

**Table 5-14:** Monitoring during Operation and Maintenance

| **Activity / Impact** | **What** (Is the parameter to be monitored?) | **Where** (Is the parameter to be monitored?) | **How** (Is the parameter to be monitored?) | | **When** (Define the frequency / or continuous?) | **Who** (Is responsible for monitoring?) |
|---|---|---|---|---|---|---|
| | | | **Method** | **Indicator** | | |
| Employee Health and Safety | Develop HSMP and implement HSMS for operation and maintenance of s/s Ashnak | Ashnak substation | Visual inspection | HSMP developed and HSMS implemented | After construction works are finished | Development and implementation recommended for HVEN |
| | Erect fire walls between or at new transformers foreseen in switchyard of s/s Ashnak to prevent spreading of fire in case of an accident | | | Fire walls erected | | HVEN |
| Handling of $SF_6$ | Fill level of $SF_6$ | Circuit breakers at Ashnak substation | Record of fill level | Adequate fill level | Automatically or in regular intervals as specified by the manufacturer of the equipment | HVEN |

# 6. Implementation Arrangements and Reporting Needs

HVEN is an implementing entity for ETNIP and will manage all aspects of its implementation, including application of environmental and social safeguard policies. The responsible HVEN department for dealing with safety and health issues relevant for workers is the '*Safety Engineering and Reliability Service*' installed at the headquarters in Yerevan. This Service is running departments in regional branches. Among others, this Service performs annual tests of workers at the substation sites regarding health and safety issues. However, environmental aspects are not covered by this Service.

A local environmental specialist will be employed within HVEN. The environmental specialist will carry out the overall supervision of the implementation of the EMP, reveal and report on incompliance with the EMP or issues that may arise in the course of construction works that had not been covered in the EMP, develop a time-bound plan of corrective actions to address issues revealed / damage done and recommend it to the administration of HVEN, and follow up to track and oversee progress towards alleviation of problems.

In case of discrepancies the specialist shall implement proper actions to establish compliance with the EMP. If this is not possible and if the discrepancy is considered to be severe, the person(s) in charge shall be empowered to stop the work immediately until compliance is achieved again.

The environmental specialist will also be responsible for conception and implementation of all monitoring activities during the construction phase and provide training to relevant staff of the operator in order to ensure that all monitoring activities for both the construction and operation phases can be executed in an appropriate manner. The specialist shall perform formal monthly field monitoring checks of all active works sites and produce monthly monitoring reports, including photo documentation. Overall, this will require three months' work for monitoring and reporting per year.

An external internationally experienced auditor shall perform quarterly supervision of the implementation of the EMP and monitor the implementation of the mitigation measures. Based on the quarterly supervision and the monthly reports provided by the environmental specialist of HVEN, the external auditor will produce narrative analytical quarterly reports on environmental and social performance in the course of rehabilitation of Ashnak substation and furnish these reports to the World Bank. The costs for this supervision will sum up to **90,000 USD**.

The Construction Contractor shall determine persons being responsible for environmental and social performance at all construction site(s).

# 7. Grievance Redress Mechanism

The project will use the existing grievance redress mechanism of HVEN, described in the Resettlement Policy Framework (RPF) of the World Bank financed Electricity Supply Reliability Project, which is under implementation. The GRM will be operated by HVEN for both substations (YTPC and Ashnak) and allow project affected people and other interested stakeholders to submit all types of complaints, suggestions, or questions related to the project. HVEN will be responsible for widely advertising the availability of the GRM in the vicinity of both substations (on public billboards, in the vicinity of construction sites, in its offices, etc.), and it will accept complaints submitted via regular mail, email, phone, or as part of in-person meetings. All complaints will be registered by HVEN and a tracking registration number will be assigned to each complainant.

In a first step complaints resolution will be attempted at the community level in a negotiation procedure with an informal mediator and community authorities. If the grievance persists, a grievance form can be submitted at the responsible committee under the responsibility of HVEN. The committee then decides whether to settle or go to court. The decision has to be taken within 15 days. In case of failure of the grievance redress system, the Project Affected People (PAP) can submit their case to the appropriate court of law.

The Committee is composed of permanent and non-permanent members:

- Permanent members: HVEN, the contractor and a lawyer.
- Non-permanent members: Appropriate marz representative, community representative and NGO representative.

Non-permanent members will be notified of the date and venue of the meeting 10 days before the meeting. Absence of non-permanent members cannot be the reason for the cancellation of the meeting. A lawyer can be represented by one of the permanent members.

HVEN will carry out works that include:

- A staff member responsible for grievance procedure coordination, hereby referred to as grievance coordinator (including first contact, periodical site visiting of mitigation measure to be implemented by contractor);
- A telephone line, e-mail address and contact name on project boards;
- Arbitration of grievances with contractor and PAP.
- Liaison with court.

Community leaders will act as informal mediators in case of complaints. However PAP have the option to choose a different representative or directly liaison with HVEN staff, responsible for grievance redress. Vulnerable households will have the support of their individual social worker and legal support.

NGOs will monitor grievance redress negotiations, assist with grievance arbitration, raise public awareness. PAP need to be informed that in case of

conflict with the community leader they can address NGO staff to follow up their complaint. NGOs will monitor relationship between PAP and community leader.

The aggrieved person (PAP) is encouraged to proceed in the following way:

a) Contact the contractor's designated grievance staff during periodical site visits in person or via designated telephone number or the community leader or NGO staff
b) Lodge complaint and provide information on the case
c) Agree with the contractor on mitigation measure
d) Agree with the contractor on time limit for grievance settlement. Grievances have to be settled within two weeks, or otherwise specified in scheduled agreement.
e) Sign if the mitigation measure has been implemented as agreed
f) Seek redress from HVEN if not satisfied with above mentioned procedure
g) Seek redress from World Bank if not satisfied with response by HVEN
h) Involve appropriate NGOs
i) Seek redress from court if all else fails.

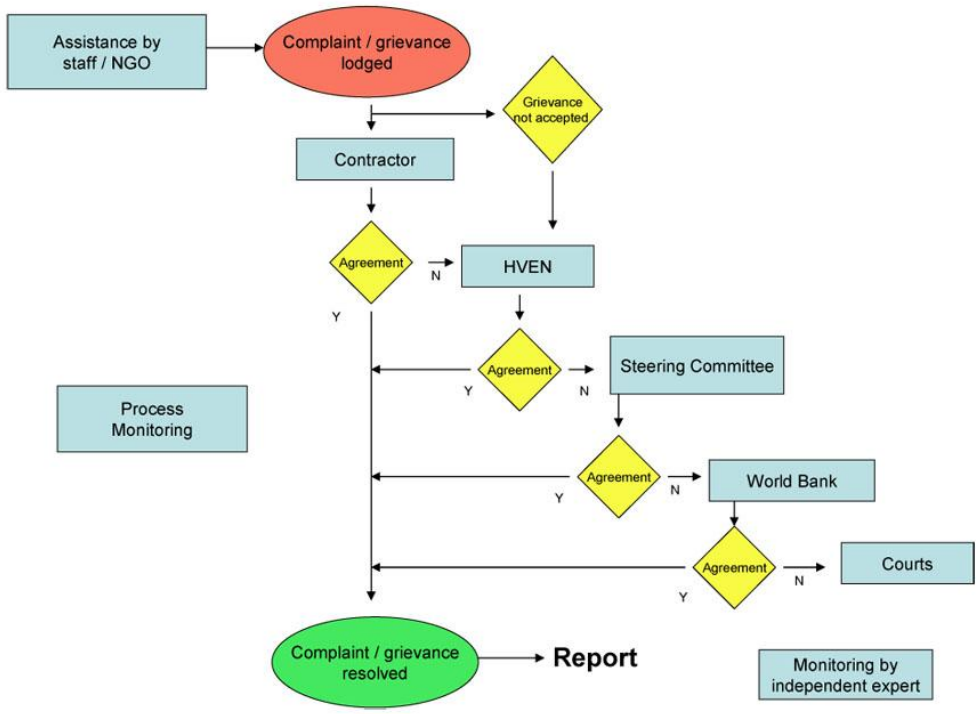


**Figure 7-1:** Grievance Mechanism Flow Chart

Nevertheless, the above mentioned grievance mechanism does not limit the citizen's right to submit the case straight to the court of law just in the first stage of grievance process. The grievance mechanism is designed to avoid lengthy court procedures.

The World Bank is not directly a part of the Grievance procedure, but should receive reports which complaints were received and how they have been followed up / mitigated.

Special consideration has to be taken for PAP living in remote areas and vulnerable people as complaint mechanisms may be unusual and contact with legal procedures let alone courts of law may appear not very promising from their experience. This would prevent the most disadvantaged persons from addressing their grievance.

Vulnerable PAP (all women headed households and all households below the poverty line) will be entitled to a legal aid / social worker to support them with complaints procedures.

For further details about GRM see the Project related RPF.

# 8. Information Disclosure, Consultation, and Participation

The World Bank policies require that public consultations are held during development of an EIA/EMP. According to these policies, *Fichtner's* environmental and social specialist, together with the national environmental consultant, held meetings in municipalities nearby the Ashnak substation (see Section 10 – Appendix I).

The municipality of Talin city was consulted and informed about the upcoming works. In addition, waste disposal possibilities at Armenia were discussed there.

During the visits of the substation workers were also interviewed to hear their personal view of living and working conditions related to substations and power supply.

Major concerns at the substation were the poor illumination outside the substation and inside the building, and the poor heating and air conditioning systems to adjust the temperatures in the very cold winters and the hot summers. Solid and liquid waste management are considered being priority issues at Ashnak substation and considered as one of the main environmental impacts in general.

The EMP for Ashnak substation - both in English and Armenian languages - was published to solicit public feedback. The timeframe of December 19, 2014 to January 13, 2015 was allowed for expressing concerns and providing comments from concerned persons via regular mail (full address of HVEN was provided), email and corporate telephone number, which was available from 9 AM to 6 PM on business days.

**Materials and Methods**

The English and Armenian versions of the EMP were posted on the web site of the High Voltage Electric Networks CJSC (http://hven.am/events_34_2.html). Hard copies of EMPs were also submitted to the following state authority: Talin city municipality, the centre of the region where Ashnak substation is located. Brief information on rehabilitation works, locations (web site addresses and municipality/administrative district) of disclosed EMP, and HVEN's contact information (including full address, email, telephone number, and contact person's name) were placed at the entrance/fencing of the substation (please see photos) to allow people to express any questions or concerns regarding the documents. The notification was placed on the wall of the substation.

The electronic copies of the EMP were also submitted to the following non-governmental organizations:

- Armenian Aarhus Centers
- "Energy Saving Alliance" Armenian Branch
- "Association of Energy Service delivery Enterprises of Armenia"

- Transparency International Armenia
- Acopian Center for the Environment, American University of Armenia

**Conclusion**

Over the public consultation period no concerns, questions, or comments have been received on the EMP from any individual or a legal entity. Therefore, this document is considered final in its present iteration.

***Photo: Notifications placed at Ashnak substation***


# 9. Costs of Implementation of EMP

Most of the costs for mitigation of the impacts during the construction period of the rehabilitation of Ashnak substation are included in the regular construction costs. Extra costs with respect to environmental mitigation are related to additional measures to ensure safe management of the oil wastes, safe storage of scrap metals, as well as quarterly supervision of construction site to be performed by an internationally experienced auditor.

Considering a construction period of about 3 years costs for implementation of the EMP sum up to **203,500 USD** (see Table 9-1).

**Table 9-1:** Costs for mitigation measures and monitoring

| | **Phase** | **Issue** | **Costs [USD]** |
|---|---|---|---|
| Mitigation | Construction | Storage of oil | 80,000 |
| Mitigation | Construction | Storage of scrap metals | 15,000 |
| Monitoring | Construction | Quarterly supervision of construction site | 90,000 |
| **Sum** | | | **185,000** |
| 10 % contingencies | | | 18,500 |
| **Total** | | | **203,500** |

# 10. Appendices

## Appendix I: Record of Meetings and Field Visits

| Date | Agency / Institution / Company | Place | Name of Person consulted Position | Reason for Visit |
|---|---|---|---|---|
| 24 Sep 2014 | HVEN | Yerevan | Aram Petrosyan Deputy Chief Engineer | Kick-off and possible technical measures |
| 26 Sep 2014 | HVEN substation Ashnak | Substation Ashnak City of Talin | Albert Arustamyan Head of Substation | Situation at substation, taking of oil samples |
| 26 Sep 2014 | Municipality of Talin | City of Talin | Sargis Aramyan Mayor of the City of Talin | Situation related to the project |
| 27 Sep 2014 | Ministry of Nature Protection | Yerevan | Khachatur Khachatryan Head of Legal Department | EIA Process in Armenia |
| 01.10.2014 | ELBAT Battery | Yerevan | Telefon call | Battery recycling |
| 01.10.2014 | ASCE Group OJSC | Charentsavan | Telefon call | Scrap metal recycling |
| 02.10.2014 | Ministry of Nature Protection State non-commercial organization | Yerevan | Henrik Grigoryan Deputy Director | Environmental permitting procedure in Armenia |

# Appendix II: Results of Oil Analyses for PCB

BERATUNG | ANALYTIK | PLANUNG

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WESSLING GmbH
Impexstraße 5 · 69190 Walldorf
www.wessling.de

WESSLING GmbH, Impexstraße 5, 69190 Walldorf

GefaÖ GmbH - Gesellschaft für angewandte
Ökologie und Umweltplanung
Herr Dr. Hans Back
Impexstraße 5
69190 Walldorf

Geschäftsfeld: Umwelt

Ansprechpartner: B. Füllgrabe
Durchwahl: +49 6227 8 209 20
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E-Mail: bernhard.fuellgrabe@wessling.de

## Prüfbericht

### Projekt: SIS Ashnak, SIS TTP Yerevan, Armenic

Prüfbericht Nr. **CWA14-030385-1** Auftrag Nr. **CWA-12612-14** Datum **14.10.2014**

| Probe Nr. | **14-141473-01** | **14-141473-02** | **14-141473-03** |
|---|---|---|---|
| Eingangsdatum | 07.10.2014 | 07.10.2014 | 07.10.2014 |
| Bezeichnung | SIS TTP Yerevan Circuit breaker | SIS TTP Yerevan Transformer Oil | SIS Ashnak Circuit Breaker |
| Probenart | Öl | Öl | Öl |
| Probenahme durch | Auftraggeber | Auftraggeber | Auftraggeber |
| Probengefäß | PE | PE | PE |
| Untersuchungsbeginn | 07.10.2014 | 07.10.2014 | 07.10.2014 |
| Untersuchungsende | 13.10.2014 | 13.10.2014 | 13.10.2014 |

**Polychlorierte Biphenyle (PCB)**

| Probe Nr. | | | 14-141473-01 | 14-141473-02 | 14-141473-03 |
|---|---|---|---|---|---|
| Bezeichnung | | | SIS TTP Yerevan Circuit breaker | SIS TTP Yerevan Transformer Oil | SIS Ashnak Circuit Breaker |
| **PCB Nr. 28** | mg/kg | OS | **0,41** | **1,1** | **0,12** |
| **PCB Nr. 52** | mg/kg | OS | **0,66** | **0,79** | **0,79** |
| **PCB Nr. 101** | mg/kg | OS | **<0,1** | **0,54** | **0,54** |
| **PCB Nr. 138** | mg/kg | OS | **<0,1** | **0,2** | **0,2** |
| **PCB Nr. 153** | mg/kg | OS | **0,11** | **0,25** | **0,25** |
| **PCB Nr. 180** | mg/kg | OS | **<0,1** | **0,34** | **0,34** |
| **Summe der 6 PCB** | mg/kg | OS | **1,18** | **3,22** | **2,24** |
| **PCB gesamt (Summe 6 PCB x 5 )** | mg/kg | OS | **5,9** | **16,1** | **11,2** |

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| Prüfbericht Nr. | **CWA14-030385-1** | Auftrag Nr. | **CWA-12612-14** | Datum | **14.10.2014** |
|---|---|---|---|---|---|

| Probe Nr. | **14-141473-04** | **14-141473-05** |
|---|---|---|
| Eingangsdatum | 07.10.2014 | 07.10.2014 |
| Bezeichnung | SIS TTP Yerevan stored oil | SIS Ashnak Transformer Oil |
| Probenart | Öl | Öl |
| Probenahme durch | Auftraggeber | Auftraggeber |
| Probengefäß | PE | PE |
| Untersuchungsbeginn | 07.10.2014 | 07.10.2014 |
| Untersuchungsende | 13.10.2014 | 13.10.2014 |

**Polychlorierte Biphenyle (PCB)**

| Probe Nr. | | | 14-141473-04 | 14-141473-05 |
|---|---|---|---|---|
| Bezeichnung | | | SIS TTP Yerevan stored oil | SIS Ashnak Transformer Oil |
| **PCB Nr. 28** | mg/kg | OS | **<0,1** | **<0,1** |
| **PCB Nr. 52** | mg/kg | OS | **<0,1** | **<0,1** |
| **PCB Nr. 101** | mg/kg | OS | **<0,1** | **0,11** |
| **PCB Nr. 138** | mg/kg | OS | **<0,1** | **<0,1** |
| **PCB Nr. 153** | mg/kg | OS | **<0,1** | **<0,1** |
| **PCB Nr. 180** | mg/kg | OS | **<0,1** | **<0,1** |
| **Summe der 6 PCB** | mg/kg | OS | **-/-** | **0,11** |
| **PCB gesamt (Summe 6 PCB x 5 )** | mg/kg | OS | **-/-** | **0,55** |

**Abkürzungen und Methoden**

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

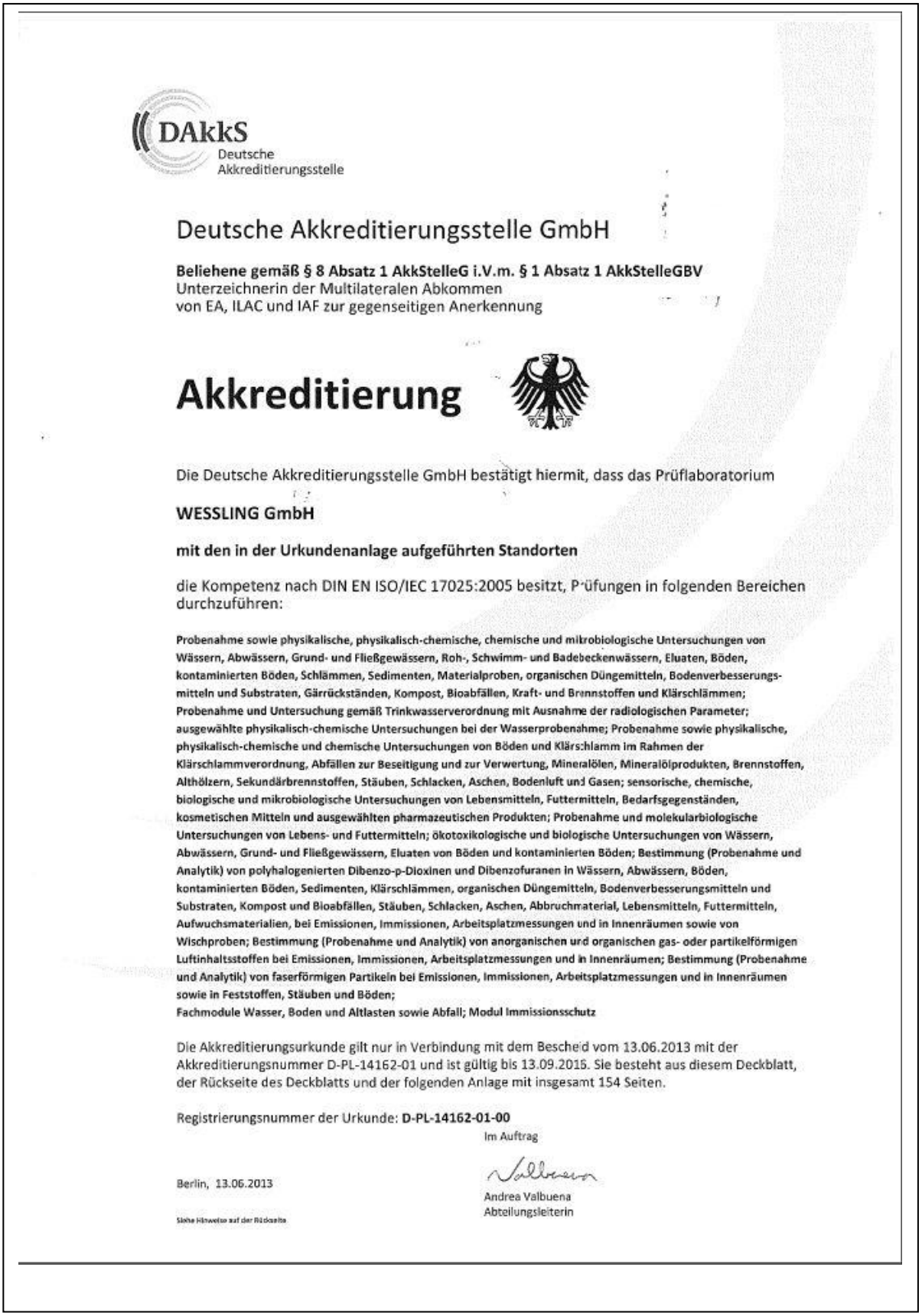
**ausführender Standort**

Umweltanalytik Altenberge

i.A.

Bernhard Füllgrabe
Dipl. Chemiker
Sachverständiger Umwelt

## Appendix III: Certificate of the Analytical Laboratory



DAkkS
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Deutsche Akkreditierungsstelle GmbH

**Beliehene gemäß § 8 Absatz 1 AkkStelleG i.V.m. § 1 Absatz 1 AkkStelleGBV**
Unterzeichnerin der Multilateralen Abkommen
von EA, ILAC und IAF zur gegenseitigen Anerkennung

# Akkreditierung

Die Deutsche Akkreditierungsstelle GmbH bestätigt hiermit, dass das Prüflaboratorium

**WESSLING GmbH**

**mit den in der Urkundenanlage aufgeführten Standorten**

die Kompetenz nach DIN EN ISO/IEC 17025:2005 besitzt, Prüfungen in folgenden Bereichen durchzuführen:

**Probenahme sowie physikalische, physikalisch-chemische, chemische und mikrobiologische Untersuchungen von Wässern, Abwässern, Grund- und Fließgewässern, Roh-, Schwimm- und Badebeckenwässern, Eluaten, Böden, kontaminierten Böden, Schlämmen, Sedimenten, Materialproben, organischen Düngemitteln, Bodenverbesserungsmitteln und Substraten, Gärrückständen, Kompost, Bioabfällen, Kraft- und Brennstoffen und Klärschlämmen; Probenahme und Untersuchung gemäß Trinkwasserverordnung mit Ausnahme der radiologischen Parameter; ausgewählte physikalisch-chemische Untersuchungen bei der Wasserprobenahme; Probenahme sowie physikalische, physikalisch-chemische und chemische Untersuchungen von Böden und Klärschlamm im Rahmen der Klärschlammverordnung, Abfällen zur Beseitigung und zur Verwertung, Mineralölen, Mineralölprodukten, Brennstoffen, Althölzern, Sekundärbrennstoffen, Stäuben, Schlacken, Aschen, Bodenluft und Gasen; sensorische, chemische, biologische und mikrobiologische Untersuchungen von Lebensmitteln, Futtermitteln, Bedarfsgegenständen, kosmetischen Mitteln und ausgewählten pharmazeutischen Produkten; Probenahme und molekularbiologische Untersuchungen von Lebens- und Futtermitteln; ökotoxikologische und biologische Untersuchungen von Wässern, Abwässern, Grund- und Fließgewässern, Eluaten von Böden und kontaminierten Böden; Bestimmung (Probenahme und Analytik) von polyhalogenierten Dibenzo-p-Dioxinen und Dibenzofuranen in Wässern, Abwässern, Böden, kontaminierten Böden, Sedimenten, Klärschlämmen, organischen Düngemitteln, Bodenverbesserungsmitteln und Substraten, Kompost und Bioabfällen, Stäuben, Schlacken, Aschen, Abbruchmaterial, Lebensmitteln, Futtermitteln, Aufwuchsmaterialien, bei Emissionen, Immissionen, Arbeitsplatzmessungen und in Innenräumen sowie von Wischproben; Bestimmung (Probenahme und Analytik) von anorganischen und organischen gas- oder partikelförmigen Luftinhaltsstoffen bei Emissionen, Immissionen, Arbeitsplatzmessungen und in Innenräumen; Bestimmung (Probenahme und Analytik) von faserförmigen Partikeln bei Emissionen, Immissionen, Arbeitsplatzmessungen und in Innenräumen sowie in Feststoffen, Stäuben und Böden;
Fachmodule Wasser, Boden und Altlasten sowie Abfall; Modul Immissionsschutz**

Die Akkreditierungsurkunde gilt nur in Verbindung mit dem Bescheid vom 13.06.2013 mit der Akkreditierungsnummer D-PL-14162-01 und ist gültig bis 13.09.2015. Sie besteht aus diesem Deckblatt, der Rückseite des Deckblatts und der folgenden Anlage mit insgesamt 154 Seiten.

Registrierungsnummer der Urkunde: **D-PL-14162-01-00**

Im Auftrag

Berlin, 13.06.2013

Andrea Valbuena
Abteilungsleiterin

Siehe Hinweise auf der Rückseite

## Appendix IV: 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 | | |
| 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 |
| Limit values as per VDE V 0848 Part 4/A3 at 50 Hz | | |
| r.m.s. values for equivalent field strength in exposure range 1 for exposure times up to 1 h/d | 30 | 4,240 |
| r.m.s. values for equivalent field strength in exposure range 1 for exposure times up to 2 h/d | 30 | 2,550 |
| r.m.s. values for equivalent field strength in exposure range 1 for continuous exposure | 21.32 | 1,360 |
| r.m.s. values for equivalent field strength in exposure range 2 | 6.67 | 424 |

* exceedance of value requires specific actions

r.m.s. = root mean square (value)

**Exposure range 1** includes monitored areas, e.g. operating zones, areas monitored by operators generally accessible areas, in which, owing to the operating mode or the length of stay, it is guaranteed that exposure only occurs for a short period of time

**Exposure range 2** includes all areas in which not only short-term exposure can be expected, for example: areas containing residential and social buildings, individual residential sites, parks and facilities for sport, leisure and relaxation, operating zones where a field generation is not expected under normal conditions

(ICNIRP=International Commission on Non-Ionising Radiation Protection, BImSchVer=German Bundesimmissionsschutzverordnung, VDE=Verband Deutscher Elektrotechniker e.V., Cenelec=European Committee for Electrotechnical Standardisation)