1. EXECUTIVE NON TECHNICAL SUMMARY

1.1 Introduction

Eesti Energia has teamed up with YTL Power International and local partner NEI, through a special purpose company, Attarat Power Company ("APCO"), to develop an oil shale fired generation project which will supply NEPCO with electricity under a 30-year Power Purchase Agreement. APCO (referred to as 'the Company' throughout this report) is planning to develop oil shale mining and power production project within Attarat area in Jordan. The nominal capacity of the power plant at average ambient conditions is expected to be 532[+/-5%] MW (gross) (corresponding to net output of 490[+/-5%] MWe). The average output is set to 490 MWe, which will be used throughout the EIA.APCO is the owner of the proposed project, and has the purpose of developing and operating the mining and oil shale fired power plant project. APCO is a subsidiary fully owned by Enefit Jordan. Enefit Jordan's ownership arrangement is as follows:

- 65% is owned by the Estonian state owned company EestiEnergia;
- 30% is owned by YTL Power International Berhad (YTLPI);
- 5% is owned by the Jordanian investor Near East Investments (NEI).

APCO was established as ''Estonian Power Generating Company'' 5th of April 2011 and was later renamed to APCO on 2 June 2011 and is expected to comply with the guidelines put forward in this report.

Project activities include open cast oil shale mining, direct burning of the oil shale for power production and disposal/stockpiling of mining and oil shale processing wastes.

According to the requirements of the Ministry of Environment (MoE), power purchase agreement with NRA, and approved EIA terms of reference approved by Ministry of Environment (MoE) in April 2011, The Company must prepare a comprehensive Environmental Impact Assessment for the power project and its associated mining activities.

The Company has appointed Pöyry Management Consulting Oy (Pöyry) to undertake the lead supervisory role in preparing the EIA for the power production project. Pöyry have subcontracted Arabtech Jardaneh (AJ) to be the local Jordanian partner to help undertake a part in the activities of preparing the EIA Study.

This EIA study will be completed in line with the requirements of the Jordanian Environmental Impact Assessment ("EIA") Regulation 37/2005, in addition to the requirements for the social and environmental assessment of the Equator Principles and IFC Performance Standards, to identify environmental, social and health receptors susceptible to potential impacts as a result of the project activities (i.e. construction, operation and decommissioning).

The proposed power plant and mining project is anticipated to enhance Jordan's electrical capacity; which gives a potential possibility in boosting Jordan's energy sector in the long-run; which will in turn generate positive economic returns to the country.

1.2 Legislative Framework

The Competent Environmental Authority for projects within the Kingdom of Jordan, the Ministry of Environment, is responsible for the evaluation of the environmental impacts of the project and the issue of associated approvals and permits.

When the Impact assessment is approved the project will get the letter of approval and commence the proposed activities while adhering to the environmental mitigation and management systems specified and approved in the study. Any deviation from those guidelines would render the project to violations.

The Principal relevant national legislations and guidelines were taken into account while conducting this EIA Study and are listed in Section 3 of this Report which specifically outlines regulations relevant to the natural environment of Jordan and describes relevant standards, conventions and treaties signed and ratified by Jordan and incorporated into the national law.

As for International standards and guidelines, this EIA study took into account the relevant World Bank operational policies and International Finance Corporation (IFC) Performance Standards such as the Environmental, Health and Safety Guidelines and Practice Notes, in addition to the Equator Principles (which also adopts the IFC's performance standards) provide guidelines on conducting environmental, social and health assessments and address a variety of issues for different types of projects and sectors.

1.2.1 Identification of Gaps between National and International Standards

Jordan's current regulations are not fuel specific and mainly designed to regulate industry and gas fired power plants. Internationally it is common practice to have fuel specific laws as gas and solid fuel power production needs to be regulated differently, taking into account that gaseous fuels and solid fuels have different environmental impacts. Therefore APCO has proposed a regulation specific for the solid fuel based power industry to the Government of Jordan (GoJ) in September 2011, which has been amended based on feedback from Ministries, and is currently being discussed and reviewed by the Council of Ministers and Legislative Bureau.

Table 8under section 3.5.1 presents the current Jordanian laws, regulations and guidelines, and the reasoning behind APCO's need for updating the regulations to be applicable for a solid fuel based power industry in Jordan. It is expected that APCO's comprehensive proposed regulation will be adopted into law.

1.3 Project Description

This EIA represents the aspects and dimensions of the Power Project including open cast oil shale mining, direct burning of oil shale for power production and disposal/stockpiling of mining and oil shale processing wastes.

1.3.1 Project Location and Area

The project will be located in the Attarat Um Ghudran oil shale deposit located 50 km east of the village of Al Qatranah. Al Qatranah is located 70 km south of Amman by the main desert highway connecting the city of Amman with Al Aqaba.

The size of the Combined Project area is approximately 73 km^2 which will be divided between the Oil Project and Power Project. The SRCA is governing the oil project and a mining license, Power Purchase Agreement (PPA), Implementation Agreement (IA)and Land Lease Agreement (LLA) are planned to govern the power plant project, where the

power plant project with the adjacent mining operation are the subject of this EIA document.

1.3.2 Process Description

Oil Shale Mining

According to the conceptual mining plan APCO is expected to hold the mining license and mining right issued by the Natural Resources Authority (NRA) in respect of oil shale contained within the LLA part of the project area in Attarat as shown in **Figure 6**in section 4.

The proposed mining concept indicates that mining is first developed in the south-western part of the SE-block and then progressed towards to North-East as illustrated in **Figure 6**of section 4. The total surface of the minable part of the SE-block covers some 11 km².

The mine will be sized for an annual delivery of up to 13Mt/y of oil shale "as extracted", based on the requirements of the power station operating at full load (2 units, each 245 MWe).

According to the conceptual mining plan a combination of excavators/wheel loaders and off-highway mining trucks could be used to handle the required annual volumes of oil shale and overburden. Average mined overburden will be ca 19 Mm3/y for the 13 Mt/y production rate. The oil shale is transported after passing an in-pit primary crusher by belt conveyer to the fuel yard at the power plant site. The overburden is transported to different dumpsites and can later be used for backfilling the mined-out areas. The overburden material is used for building protective barriers on both sides along of Wadi el Ghadaf to prevent flooding of the mining site and power plant site. The overburden will also be used as filling material in order to level areas where buildings or ash dumps will be created. The overburden could also be used to construct a bridge across the wadi to connect the mining area with the power plant site.

The mine will be operated up to seven days week 24 hours a day.

The optimal main mine access to the opencast mine was selected opposite the planned power plant site at a central location in the project area on the east bank of Wadi el Ghadaf. The pre-stripping will go in a north-easterly and eastern direction. Mining of oil shale will then follow in the same direction.

The construction and pre-stripping works on site will be initiated in the range of 2-3 years ahead of oil shale extraction.

Pre-stripping continues until extend the benches reaches the necessary bench width of >50m.

The oil shale is generally mined simultaneously on several benches, depending on actual thickness of mineable seam and selected equipment. The oil shale is then hauled by trucks from the mining face to one or more in-pit primary crusher(s), where the ROM material is crushed to a grain size less than 300 mm and transported by a belt conveyor system to the fuel yard of the power plant.

Backfilling the opencast will start as soon it is possible, today it is foreseen to be after 7 - 9 years of normal mining operations.

Overburden consists of fractions with different characteristics; the softer parts can be directly excavated by excavators, whereas the harder layers require either mechanical breaking by impact hammers or drilling and blasting. Drilling will be done by mobile drill

rigs. Blasting operations are foreseen to be carried out once a day (preferably at shift change or lunch time). Explosive truck(s) for transportation and charging of explosives and blasting materials will be used.

Excavating and loading operations could be supported by track dozers equipped with rippers or tractors to prepare smooth surfaces for truck transport.

To meet a grain size of <300 mm convenient for belt conveyor transport, one or more crusher(s) are installed in the pit. The crushed oil shale is loaded to the main belt conveyor system, which delivers the oil shale to the fuel yard at the power plant site.

Power Production

APCO is planning to commence with the construction and operation of a 2 electricity production units each approximately 245 MWe. The main systems within the power plant consist of: 1) fuel handling and feeding system; 2) boiler plant; 3) water steam cycle and related components; and 4) ash handling system.

The electrical power will be generated with steam turbines. The energy of the oil shale will be used for the production of the steam which will drive the steam turbine. The combustion will take place in Circulating Fluidized Bed (CFB) boilers. CFB combustion is a proven technology, which has certain flexibility for fuel variations and is thus well suitable for oil shale.

The advantage of using CFB boilers lies in the residence time of the combustion and in the moderate combustion temperatures.

CFBC is used in the current power production in Estonia, and it is the preferred technology for future capacity development.**Figure 7**in section 4.5.3illustrates the CFB process.

1.3.3 Water Requirements and Usage

The main supply of water will be from groundwater wells, but water collected from wadis and the mine as well as water derived from oil processing will also be utilized. APCO has already tested the water quality from the aquifer A7/B2 and kurnub and can confirm that none of these aquifers meet the potable water standards of Jordan.

It is envisaged that rain water from the plant site will be captured and reused opportunistically for mining and dust control as will mine water inflows to the mining operation. Rights to collect this water for the oil project are granted in the concession agreement, as for the power project, the potential rights to collect water from wadis will be approved via this EIA study.

Water derived from the process will be treated for internal reuse or for mine de-dusting and ash handling.

Water will be used in the power production process for cooling systems, steam production and for washing and cleaning. Steam production requires a high quality water production from Reverse Osmosis or other technologies. High brine streams are produced, which can be evaporated for disposal with potential for recovery of dissolved chemicals. Runoff is collected and reused where possible.

In order to minimize the water consumption in the in power plant air cooled condensers are used in the steam process.

Dust suppression is also an important consideration. Water is used for mine and road dust suppression as well as wetting of the ash to ensure it is not excessively dusty after processing and during disposal processes. Conveyors protected from wind are planned to transport the ash from the plant to the ash storage site in order to reduce the water needs for de-dusting as explained above.

An estimate of the anticipated total water consumption for mining, power production and for consumption at the housing for the power plant is between 2,625,000- 3,225,000 m3/year. A more detailed breakdown for water consumption is shown in **Table 10** of section 4 of this EIA report.

1.3.4 Ash Handling and Disposal

As discussed in detail in the project description of this EIA, section 4.5.4, and based on a comprehensive series of studies conducted for this project in order to get a clear understanding of the ash's physical and chemical properties, the ash handling technique that will be used in Jordan will rely on dry ash disposal due to the country's scare water resources. The dry ash disposal technique is requires water but to a much less extend than wet disposal method.

The results of the studies conducted on the chemical and physical properties of ash showed that the oil shale has an ash content of approximately 63%, and that both bottom ash and fly ash consists of a very fine and dusty material. This means that the ash has to be treated with water in order to handle it in a safe manner during transport and dumping of the ash.

The geotechnical studies showed that the ash can be dumped in a stable way both in dry or wet state. Dry, in terms of geotechnical stability, means less than 35% of water.

The most promising method for conditioning the ash is to transport the ash dry from the power plant to an ash handling facility in closed systems, most likely by using pneumatic transport. At the ash handling facility the ash will be cooled and sprayed with water to a moisture content of approximately 25-35%. After this treatment the ash is transported on conventional conveyors protected from wind to the dumping site.

At the end of the conveyors the ash will be dumped by stackers and the surface of the ash dump will be sprayed with water to keep the surface wet until the surface has cementified or been covered by overburden which will create a cemented top layer.

If cracks appear in the surface layer the water will infiltrate the lower un-hydrated ash and chemical reactions will create more impermeable rock effectively sealing the crack again. Therefore, ash layer will create a self-sealing surface layer that will prevent water from reaching the lower parts of the ash dump, effectively removing leachate problems from the ash hill, as any rain fall will run off as surface runoff.

To minimise the water consumption the ash mount will eventually be covered with overburden layers so only the active parts of the ash dumps needs the continuous water addition.

For the first 7-9 years the ash will be disposed south-west of the power plant on an ash dump together with overburden most likely by using the dry ash handling techniques as described above. After 7-9 years the mine will be so developed that backfilling to the mine void can be initiated. This will use the same principles as for the initial ash dump.

The total area of the initial ash dump is approximately 1.8 km^2, and it is planned to build it up in phases. The ash dump will be covered with overburden as the dump progresses, thereby effectively minimizing the water usage.

The final size of the ash dump is shown in **Figure 10**in section 4.5.4.

1.3.5 Manpower Requirements and Workers Accommodation

The combined project (for both mining and power activities) will employ about 3,000 personnel during the construction phase which may live on temporary camps on site until construction is completed.

During the operation phase, around 800 to 1000 personnel will be employed; approximately 300 employees will be living in the offsite housing in Qatranah; while the remaining will reside in the on-site housing located within the project area.

The proposed concept for the accommodation is to house:

- Permanent employees accounting for approximately 300will be accommodated with their families in an Offsite Housing Complex (OHC) nearby Al Qatranah.
- Contract workers at an Onsite Labour Camp (OLC) within the project area that will host about 500 to 800 workers and will not cater for any family or dependent members of the workers.

1.4 Environmental and Socio-economic Baseline

This section describes the physical, biological and socio-economic environment in which the proposed project will operate. The information obtained during specialised studies conducted for this project, field surveys, in addition to the review of secondary data sources has been presented here.

Available information has been reviewed and persons having specific knowledge of the region have been consulted as well.

1.4.1 Physical Environment

Meteorology and Climate

The nearest weather station to the project area is found to be Al-Qatranah Station. The initial meteorological characteristics for the project area have been obtained based on the data averages for the years (1990 to 2010) recorded by this station. **Table 1** below summarizes the climate data as per the data provided by the Department of Meteorology. Detailed average monthly meteorological data recorded by Al Qatranah weather station are included in **Annex B**.

Table 1: Average Climate Data for the last twenty years

Parameter	Qatranah Station
Ave. Max Temp (ºC)	24.7
Ave. Min Temp (ºC)	10.3
Ave. Mean Temp (ºC)	17.5
Ave. Monthly Rainfall Amount (mm)	7.6
Ave. Total Annual Rainfall Amount (mm/year)	91.2
Ave. Mean Wind speed ‘ (m/s)	1.86

Parameter	Qatranah Station
Prevailing Wind Direction (Degrees from True North)[1]	263 (SW)
Total Evaporation, Class "A" Pan 'mm'[2]	170.6

The average maximum and minimum temperatures recorded at Al-Qatranah station indicate moderate summers and winters.

Air Quality

An air quality monitoring programme was conducted at the project site in Attarat from December 22nd 2010 to December 18th, 2011 which covered the following emission parameters: Carbon Monoxide (CO), Sulphur Dioxide (SO2), Hydrogen Sulphide (H2S) Nitrogen Dioxide (NO2), Nitric Oxide (NO), Nitrogen Oxides (NOx), Inhalable Particulate matter (PM10), Fine Particulate matter (PM2.5), Lead (Pb), Cadmium (Cd), Polycyclic Aromatic Hydrocarbons (PAHs) measured as Benzo (a) Pyrene. In order to put the monitored concentrations into context, the results were compared to the Jordanian Ambient Air Quality standards (JS1140/2006) which include twelve parameters for ambient air quality. Some of the monitored compounds are not included in the standard.

During the monitoring year all results of gaseous emission concentrations were far below the limit values of Jordanian ambient air quality standard JS1140/2006. However, the concentrations of particulate matters (PM10 and PM2.5) were on a clearly higher level than any other emission compounds. PM10 exceeded the limit value during January, February, March and May - a total of 11 times. Altogether 3 exceedences for PM2.5 were all occurred during February. These exeedances is mainly due to natural conditions, such as sand storms and monsoon winds. Also light traffic in the area could have influenced as well.

The detailed results of the air quality monitoring programme are presented for all parameters in section 5.2.2 of this EIA.

Noise

Given that the project area is situated in a remote area, away from nearby settlements and residential areas, the only known noise emission sources known to exist within the vicinity of the project site are those associated with the Royal Jordanian Air force training and number of quarries scattered outside the project boundaries.

Noise spot measurements within the project site were taken. The average noise levels (LA eq) recorded within the site was 47.6 dB. Since the site will be classified as an industrial zone the recorded average was found to be lower than the maximum allowable noise levels of 75 dBA for day time and 65 dBA for night time provided by the Jordanian Standards for the prevention and elimination of noise (2003) and the IFC noise level guidelines standards of 70 dBA for both daytime and night-time within industrial and commercial zones.

[1]Data available from 1990- 2009

[2]Data available from 1990- 2009

Topography, Morphology and Soil

The project area in Attarat falls within the 'east Jordan limestone plateau' land region as demonstrated in Figure 36 of section 5.2.4. It mainly consists of highly dissected rocks from the Umm Rijam and Muwaqqar chalk and marl formations in the west (700-1000 m altitude range), with very gently undulating paleofans and limestone plateau to the east and north; including the sediments of the Azraq depression at 500 m altitude. A feature of the region is the large number of very broad, shallow wadi channels running eastward to the Azraq-Sirhan depressions. The region has arid moisture regime and hyperthermic temperature regime. The area is very sparsely vegetated with the exception of the numerous broad wadi channels that support significant vegetation of palatable species, which provide browse for sheep. In the north, barley is grown very occasionally when there is adequate wadi flow. Otherwise, there is no cultivation within this region. Major soil subgroups are the typic camborthids and calciorthids.

Geology

The project site i.e. Attarat Um Ghudran belongs to the Balqa group within the B4 and B3 formations (Umm Rijam and Muwaqqar formations), which fall within the palaeocene and upper cretaceous systems. In terms of sedimentary rocks these formations consists of chalk, chert, limestone and marl, the B3 formation is sometimes bituminious.

Attarat Um Ghudran which is known as part of the central Jordan oil shale locality that is considered one of the important areas containing oil shale deposits of commercial scale interest, representing the core for future investment interest in central Jordan.

The main geological units within the project area with their approximate thicknesses are the following:

Tertiary to Upper Cretaceous Belqa Group (B):

- Muwaqqar Formation (B3) mainly composed of marl, and overlain by relicts of Eocene cherty limestone. Approximate thickness: 78 m;
- Al Hisa and Amman limestones (B2), underlain by the Wadi Umm Ghudra chalky limestone (B1). Approximate thickness: 289 m.
- Upper Cretaceous Ajlun Group (A):
- Wadi As Sir fractured limestone (A7). Approximate thickness: 185 m;
- Shuayb limestone and evaporite (A6/A5), Hummar (A4), Fuheis (A3) and Naur (A2/A1) units, mainly composed of limestone, dolomite and marl. Approximate thickness of A1/A6: 314 m.
- The Lower Cretaceous Kurnub Group (K), consisting of sandstone with intercalated marl layers. Approximate thickness: 396 m.

Tectonic Setting

Overall, the rate of current seismic activity in Jordan, including the project area, is minor with many of the strong seismic events located along the axis of the Dead Sea Rift.

The project site i.e. Attarat lies within the minor magnitude of Richter's scale which is illustrated on the seismic hazard distribution map of Jordan shown in**Figure 45**in section 5.2.6. Therefore, if an earthquake was induced in that area, it is anticipated that the intensity will fall between the 3.0 to 3.9 magnitude (yellow colour), which is barely felt on the ground, with no destructive effects (Richter Scale Explained, 2011).

Water Resources

Surface water

The project area is located within the Azraq surface water basin which is one of Jordan's major water basins.

There are two desert ponds in the area storing about 1 MCM of rainfall flooding. Currently water is being pumped out from these ponds by water tankers and distributed to locals' within the area. The first pond which is called Wadi Al Ghadaf pond is located within the boundaries of project area with a storage capacity of 0.5 MCM. The Attarah pond is located a few kilometres north-west of the project area with a storage capacity of 0.5 MCM.

The water level in each pond is correlating to the amount of rainfall in the area, which means that the water level fluctuates with the season.

However, long term average precipitation inside the Azraq catchment ranges varied between 50mm/y at southeast region of the catchment near Al Omari and 300mm/y at Al Arab Mountain (Jabal Al Arab). The mean annual precipitation over the catchment is about 100mm as mentioned before.

Azraq basin is considered as a closed catchment. It can be sub-divided into 10 sub-catchments as follows with wadi streams flowing towards the Azraq depression (Qa'a Al Azraq) near the center of the catchment.

The project area is located within wadi Al Ghadaf, the rainfall average is about 58mm and it covers approximately a 2400 km2 area. The project area is about 73km2 which is considered as 3% of Wadi Al Ghadaf area.

On basis of the topographical map the complete drainage basin was divided into seven catchment areas show in section 5, Figure 50. The borders of these particular catchment areas were established by the watershed heights for each wadi. Inside the catchment areas the surface is divided into the different soil types and the wadis itself.

In order to evaluate the amount of water quantities in each sub-catchments surface water modelling has been conducted, based on analysis of all metrological parameters in Al Qatranah weather station, based on the results of analysis of the rainfall data, an IDF (intensity, Duration, and Frequency) curve was developed**Figure 51**. The Surface Water Model results are provided in **Annex C** of this EIA report.

Groundwater

The project area is located in the central to southerly part of the Azraq basin, and the most important aquifer system in Azraq groundwater basin is the Amman-Wadi Sir Aquifer (B2/A7) which is related to Upper Cretaceous limestone aquifer. It is considered the main aquifer in the project area.

Groundwater flow is generally directed towards northeast to north directions. The groundwater flow pattern in the B2/A7 in the project area is north to northeast direction.

Pumping Tests

Three exploration wells were drilled in the project area during June and July 2011. The three wells were called ENEFIT-1,-2 and -3, with the following depths, respectively: 425 m, 703 m and 972 m. They were designed to assess the local capacity and characteristics

of the three target aquifers below the project concession area, respectively: the (i) A7/B2 Aquifer, (ii) Hummar and Naur (also known as A4, A1/A2), and (iii) Kurnub aquifers. The three wells were drilled along wadi Attarat Um Ghudran, on its south bank near the eastern borders of the project area as shown in **Figure 55**. The pumping test results are summarized below:

- **Well No. ENEFIT 1 (A7/B2 Aquifer):** it is strongly recommended not to dewater ENEFT 1-Well at the producing level of 174 mbgl. The A7/B2 aquifer significantly contributes to the Great Amman water supply, is overexploited and shows a general 1 to 2 m/year decline over large areas.
- **Well No. ENEFIT 2 (Hummar and Naur (also known as A4, A1/A2)):** the well is unable to sustain a yield of more than 15m3/hr. No samples were collected for comprehensive analysis; however, the short pumping tests showed a very low transmissivity and low permeability value. During the tests, the pumped water was very cloudy with greenish aspect.
- **Well no. ENEFIT 3 (Kurnub Aquifers):** the groundwater quality of the kurnub aquifer does not meet the drinking water standards because of a high TDS value and H2S smell, the kurnub aquifer is presently weakly exploited in central and southern Jordan. This means that the probability that new pumping wells compete with existing ones is likely to be small.

  A crucial point for exploiting the Kurnub aquifer in the project area is the very deep water level – 377 mbgl in static conditions and obviously more in any exploitation scenario – combined with hot water temperature and high TDS content in addition, all water quality parameters exceeding JS drinking water standards. Therefore it is recommended to exploit the Kurnub sandstone aquifer through ENEFIT 3 well for mining and industrial water needs.

1.4.2 Biological Environment

Ecological and biological baseline assessment has been undertaken for the proposed project, and the main conclusion of the study and field visits indicated that large portions of the project area fall under the Saharo-Arabian realm, which is characterised by extensive gravel plains that are either devoid of vegetation or with annual grasses. Wadi Al Ghadaf crosses the project area in some parts.

The project area is not in close vicinity to any existing or proposed Protected Areas (PA), grazing areas or Important Bird Areas (IBA), as defined by the designated national authorities in Jordan.

There are no mammals with significant conservation status in the project area. *Psammomys obesus* (Fat Sand Jird) is the most common species in the study area.

With the exception of the spiny tailed lizards with the tendency to take refuge inside its borrow when threatened, the other rare, vulnerable or threatened mammals and reptiles are most likely to escape the area to a more secure grounds avoiding the direct impacts from the various project activities. Noise-sensitive species including mammals, reptiles (including the spiny-tailed lizard) and birds would be expected to avoid the project area during construction. Similarly, species intolerant to surface disturbance and human activities would also be expected to avoid proximity to project activities.

1.4.3 Socio-economic Baseline Conditions

The project study area includes the project site at Attarat Um Ghudran, in addition to Al-Damkhi, due to its proximity to the project area, and Al-Qatranah due to its proposed candidacy for locating the off-site housing complex.

The qualitative and quantitative description of the findings of the socio-economic baseline conditions is based on:

- Participatory consultative processes with local populations (sex and age-disaggregated focus groups, public consultations and roundtable sessions).
- Socio-economic baseline survey of a sample of households in Al-Damkhi, Al-Qatranah, and a sample of nomadic herders utilizing the concession area; and
- Literature review of local and national socio-economic context.
- Stakeholder interviews were held with stakeholders with the local community, and others including community and tribal leaders, government officials and civil society organisations. Relevant stakeholders in Amman were also interviewed including government bodies, NGOs and donors that work in sectors or on projects relevant to the socioeconomic study of this project.

Key baseline socio-economic conditions relevant for the project are summarised below, however for more details of the socio-economic situation and survey findings, please refer to section 5.4 of this EIA report.

- The project area is currently an industrial zone falling within the municipal boundaries of Um Al-Rassas within the Amman Governorate in east-central Jordan. Within the vicinity of the project area there are no permanent settlements except for some nomadic groups moving during the grazing season. These groups use also the Wadi Al Ghadaf and Attarah soil dams to water their animals; the Ghadaf pond is located within the project area, however away from the mining activities, while Attara pond is outside the project area. The herders use the rangeland for grazing their sheep and goats during the grazing season, which varies from year to year based on the level of rainfall in the region.
- The project area is located within a traditionally-recognized tribal zone historically belonging to the Al-Haqeish tribe.
- The project area land is documented as government lands as per the signed Concession Agreement by the Government of Jordan and the Company in 2010.
- The closest settlement to the concession area is the small village of Al-Damkhi (population of 995 people) that locates within Um Al-Rassas municipality, and at 53 km to the west of the site, and 68 km south of Amman along the Desert Highway. The municipality of Al-Qatranah is another settlement at 20 km to the south of Al-Damkhi and 60 km far from the site. It is a larger settlement (population of 5,420 people), with more domestic and commercial services.
- The settlements surrounding the project area are comprised of nomadic Bedouins whom have more recently adopted a resident life style in response to socio-economic changes. The communities of Al-Damkhi and Al-Qatranah have strong tribal and social organization.
- Both Al-Damkhi and Al-Qatranah are very homogenous and insular, with the majority of households identifying with local Jordanian tribes. However, Al-Qatranah is slightly more open with some other populations living within the community (including Egyptians, Yemenis, Turkish, Chinese, Syrian, Saudi).
- An estimated 48% of households in Al-Qatranah and 32% of households in Al-Damkhi live below the average estimated household poverty line. The average household income is JOD 357 in Al-Damkhi for an average family size of 6.56 and is JOD 332 in Al-Qatranah for an average family size of 5.6. Over half of the households in Al-Qatranah and Al-Damkhi earn less than the estimated average

household expenditures on basic necessities including education, healthcare, food, and electricity.

- The labour force in Al-Qatranah consists of 1,920 persons, of whom 43% (820) are unemployed. The labour force in Al-Damkhi consists of 198 persons, of whom 41% (81) are unemployed. The labour force in the rest of the Um Al-Rassas municipality consists of 1,541 persons, of whom43% (665) are unemployed, and in Al-Jiza (a municipality north of Al-Damkhi along the Desert Highway) the labour force consist of 11,848 of whom 25%(2,933) are unemployed.
- The current minimum wage in Jordan is JOD 190 per month. The unemployed families in Al-Qatranah and Al-Damkhi receive JOD 120 monthly in financial assistance from the government. Locals, particularly, women, that have worked for less than JOD 200 monthly at factories in the area have high turn-over because the compensation for working long hours is almost equivalent to government financial assistance.
- There are no vocational training schools in Al-Damkhi or Al-Qatranah to develop the skills of the labour force. The nearest vocational training centre is in Lajjoun (Karak Governorate), and the lack of reliable transportation makes it difficult to access, particularly for women.
- Women, men, and youth lack access to resources to start new businesses, including access to financial capital, credit, and entrepreneurial/ business management skills training.
- Although water is available in Al-Damkhi and Al-Qatranah, there is poor water pressure and the community is not satisfied with the water. Wastewater treatment facilities and sewage systems are not available in Al-Damkhi or Al-Qatranah.
- Over the past 35 years, due to the improved access to schools as well as settling of nomadic populations in the communities, there has been an increased school attendance. Less than 5% of males and females in Al-Qatranah and Al-Damkhi between the age of 6 to 24 have never attended school, compared to more than 80% of men and women over the age of 60 in Al-Damkhi and more than 64% of men in the same age group in Al-Qatranah.
- Females in Al-Damkhi have the highest rates of illiteracy among their peer group (14%) compared with their male counterparts (4%).For males and females in Al-Qatranah the number is 6.5% and 5%, respectively), and illiteracy is more common among men and women in both communities over the age of 28.
- No comprehensive health centres exist in neither Al-Damkhi nor Um Al-Rassas municipality. Small primary health centres in the area provide health services to residents from 8am to 2pm. The nearest hospital is located approximately 40km away from Um Al-Rassas in the District of Theban in Madaba Governorate, indicating that the hospital nearest to the project area is located approximately 125 km to the west. There is a health centre located in Al-Qatranah in acceptable condition with adequate equipment. However, it is already overloaded with patients, and would not be able to provide services to an additional population (e.g. additional foreign workers in the area).

1.4.4 Archaeology and Cultural Heritage

The archaeological and cultural heritage sites identified during the baseline assessment include three locations:

- **Site 1:** A destroyed site with few lithic tools.
- **Site 2:** A burial site, which is of low significance without any archaeological remains.

- **Site 3:** A heap of sand scattered all over the lower slopes of low mound, where field investigations revealed no presence of archaeological remains at the site.

None of these three sites found within the project area is under direct or indirect threat by the proposed project activities during the construction, operation and decommissioning phases as these are not located in close proximity to mining and power operations.

1.5 Environmental and Socio-economic Aspects and Receptors

ISO 14001:1996 Environmental Management Systems – Specification with Guidance for Use (ISO, 1996) defines the environmental and socioeconomic aspects adopted for this ESHIA. An environmental aspect is denoted where an activity has the potential to interact with the environment. A socio-economic aspect can be considered to occur when an activity has the potential to interact with the social or economic environments within or at the vicinity of a specific project area.

In order to identify environmental and socio-economic aspects for this project, project activities, which may affect environmental and socio-economic receptors, require identification. This has been achieved through:

- Project documentation
- Consultation with the project proponent, i.e. APCO
- Consultation with the Ministry of Environment during the Scoping Session and ToR in addition to relevant stakeholders along the course of the project

Environmental and Socio-economic receptors in relation to this Project have been identified in Section 6, which includes receptors within the physical, biological and socio-economic environments. In addition, the possible interaction between the environmental aspects and receptors relevant to this project have been identified and presented in Section 6. This includes the main project activities/environmental & socio-economic aspects and the potential environmental impacts associated with each activity related to the Project. The impacts are mainly generated from construction, operation, and decommissioning activities.

1.6 Stakeholder Identification and Engagement

In compliance with local EIA regulations, the IFC Performance Standard 1 on Social and Environmental Assessment and Management Systems, the World Bank OP 4.01, and the Equator Principle No. 5 on Consultation and Disclosure, stakeholder engagement will be an ongoing process throughout the project, in order to ensure transparency with all stakeholders that may be affected by, or have influence on, the project.

Prior to the preparation of the social impact assessment; scoping and baseline activities, stakeholder engagement activities were carried out as follows:

- Project stakeholders and all parties affected or related to this project were identified;
- A public scoping session was held on December 14th 2010 and documentation of its results in a public scoping statement were conducted submitted with the Final Terms of Reference that was approved by the Ministry of Environment in April 2011;
- Stakeholders within the project site and those impacted by the project works were consulted; and
- Public consultation documents were made publicly available and easily accessible.

In order to inform the development of the social impact assessment, the following stakeholder engagement activities were carried out as follows during social assessment and baseline preparation:

- A stakeholder analysis to confirm previously identified project stakeholders and all parties affected or related to this project, and identifying additional stakeholders were carried out;
- Stakeholder interviews with experts in Amman and with locals within the project area were carried out
- Qualitative interviews with a representative sample of herders utilizing the project area for grazing were carried out
- A socio-economic baseline survey including questions related to potential community concerns regarding the project was carried out; (Annex D).
- A series of sex-disaggregated public consultation sessions within the affected communities was carried out;
- A series of sex- and age-disaggregated focus groups within the affected communities were carried out; and
- A series of roundtables with local community leaders, tribal leaders, teachers, and health care providers within the affected communities were carried out.

A Resettlement Action Plan (RAP) was also conducted for the project where stakeholders were also engaged as a data source for the development of the RAP, in addition to the data and findings already available from the social impact assessment and baseline.

Stakeholders who were engaged in the RAP activities included individuals representing different social institutional disciplines such as parliamentarians, local governors and tribal and community leaders.

1.7 Assessment of Project Alternatives

This analysis for this project only contains two options/alternatives which are the “No Project” versus “Project” alternative.

The results of this analysis show that the project will have potential impacts on topography and soils due to waste generation and disposal, specifically for the ash resulting from power plant combustion process.

Medium to low significance potential impacts on air quality, noise, water resources, public health and safety, traffic and are also anticipated, however, the application of the mitigations will minimise the significance. These management and mitigation measures are discussed in more detail in Section 10; and in the Environmental and Social Management Plan, Section 11.

Impacts on ecological resources are also considered of low significance.

In terms of positive impacts, the project is anticipated to encourage beneficial macro-economic impacts for Jordan.

These results indicate that it is favourable to encourage development of the project but with proper application of appropriate mitigation and management measures so as to ensure that the significant potential negative impacts are either eliminated or minimised to acceptable levels.

1.8 Impact Assessment

An identification and assessment of environmental, socio-economic and health issues potentially arising from the Project have been undertaken, and mitigation measures were proposed aiming to reduce the potential impacts that may result from the Project.

Details of impact assessment and impact significance are provided in Section 9 of this EIA. In addition, an Environmental and Social Management Plan have been developed including a waste management plan to ensure that potential impacts are sufficiently monitored and mitigation measures are implemented.

A brief summary of the key potential impacts and their corresponding mitigation measures and monitoring requirements are presented in **Table 2**, **Table 3** and**Table 4** below.

A summary of waste disposal and treatment methods as part of the Project's waste management plan is also provided below (**Table 5**).

1.9 Environmental and Social Management Plan

The Environmental Management Plan (EMP) and Social Management Plan (SMP) for the respective project phases are presented in the following tables below.

Table 2: Environmental Management Plan during Construction Phase

No.	Aspect	Summary of Potential Impacts	Mitigation / Control Measures	Monitoring Requirements	Monitoring Frequency	Responsibility	Reporting
1	**Air Quality**	• Dust emissions from excavation works and movement of vehicles across dirt/unpaved roads, especially during windy conditions. • Exhaust emissions due to movement of trucks and vehicles during construction works.	***Dust Control*** • Setting an appropriate site speed limit to reduce dust generation from vehicles travelling over unmade surfaces. • During construction dust generated on unpaved roadways and work areas should be controlled by the application of water on an "as needs" basis. • Conduct a regular and/or when needed air quality monitoring programme from first day of commencement of work through the life of the project. • Utilize necessary PPE such as dust inhalation masks and wind proof glasses during high wind seasons. Pave the main roads, which will also be used after project moves into operation phase, to and from the construction site in addition to optimum selection of the other service roads. • Unnecessary handling of dusty materials will be avoided such as minimising drop heights when loaders dump soils into trucks. • Train workers to handle construction materials and debris during construction to reduce fugitive emissions. ***Exhaust Emissions*** • Ensure adequate maintenance and inspection of vehicles to minimize exhaust emissions.Not running engines for longer than is necessary.	Visual monitoring of exhaust and dust emissions during earthworks and construction activities of the mine and power plant. Conduct air quality monitoring for PM, NOx, SOx	Daily In case of complaints	Contractor/sub-contractor to ensure that complaince with Jordanian Ambient Air Quality standards (JS 1140/2006) during the construction phase.	N/A To EPC Contractor if standards are exceeded.
2	**Noise and Vibration**	Noise generating activities such as: • Opening access roads to camp and facilities • Haulage activities, excavation and backfilling • Operation of vehicles and equipment • Trucks and drilling equipment and associated plants movement on the access roads • Construction of workers preliminary facilities and	During construction activities, a series of site controls can be implemented to limit the noise generations, these include the following: • Adopt good site management practices, and ensure all machinery is correctly maintained and operated. Ensure operation of machinery in accordance with the manufacturers' instructions and locate plant equipment away from the noise sensitive areas as far as practicable. • It is recommended that engines and machinery are not kept idle when are not in operation. • Set up guidelines for limiting traffic movements within the site. • All workers to follow the health and safety measures on site, e.g. put on necessary personal protective equipment,	Noise monitoring to be undertaken during construction activities, at the site and at the accommodation facilities like workers camp, in order to demonstrate compliance with the National environmental noise guidelines using a portable noise meter. Compliance with MoE and National guideline limits for environmental	Monthly	Contractor / Sub-contractor	To EPC Contractor in case of complaints or deviations on site.

No.	Aspect	Summary of Potential Impacts	Mitigation / Control Measures	Monitoring Requirements	Monitoring Frequency	Responsibility	Reporting
		accommodation	and ear plugs especially during noisy activities. However it is recognizable that noise impacts will occur within the project site for several months during the construction phase, however these impacts as stated in section 9, will be temporary.	noise at sensitive receptors. As for the project, allowable limits for industrial areas apply.			
3	**Topography**	• Surface disturbance with changes to topography and consequent impact to surface-water runoff patterns due to various construction activities such as mine opening, materials lay down, trenching and backfilling, haulage, spoil and wastewater disposal, material/chemical/fuel storage, vehicles and equipment operation. • Minor site grading to mark access tracks in addition to levelling	• The contractor shall ensure general cleanliness and good housekeeping practice at the project site at all times. • Reduce the requirement for the construction of site access tracks through the use of existing tracks where possible.	Visual inspection of general housekeeping and cleanliness at site and waste management	Daily	Contractor/Sub-constractor	N/A
4	**Soils**	• Impact to the project area's top soil especially in some areas along the wadis with vegetation that would be vulnerable to disturbance. • Impacts to soil due to drilling operations as well as from possible leakage from stored chemicals and fuel	• Training and equipping of on-site personnel with Oil Spill Contingency kits to contain or minimize any accidental spillage during Project activities. Mobile spill kits should be readily available at all 'active' locations under construction within the project area. • Specific procedures shall be developed for the removal of waste or spilled fuel, oil and contaminated soil at approved recycling / disposal facilities. • Proper storage for chemicals and fuel within confined areas on site and adopting proper safety measures when handling those chemicals to prevent their leakage and infiltration into the soil. • Hazardous wastes and liquid wastes generated during construction will either be recycled or disposed off-site to an approved waste facility. • To control soil erosion surface run-off should be collectedfrom all paved working areas into retention ditches to restrict concentration of flows. • As preventive measure, place drip trays under generators or standby machineries on site. • All consruction vehicles and machinery shall comply with using the defined access roads either paved or dirt into the	• Visual Inspection of storage area, and machinery through conducting regular audits of on-site activities and incident reporting forms. • Condition of tanks and ponds on site to be inspected monthly for signs of fracture or deterioration. • All site workers to be trained in spill response procedures.	Weekly	Contractor /Sub-contractor must ensure the following: • Number of spills or incidents to be recorded during on-site audits. • Training records of personnel trained in spill response procedures must be filed.	To EPC Contractor

No.	Aspect	Summary of Potential Impacts	Mitigation / Control Measures	Monitoring Requirements	Monitoring Frequency	Responsibility	Reporting
			project site and the surrounding area.				
5	**Water Resources (surface and groundwater)**	Anticipated impacts on surface water and ground water are interrelated: • Improper solid and liquid waste disposal. • Contamination with vehicles and equipment maintenance waste and operations such as waste fuel and oil. • Contamination with stored Chemicals and fuel due to inadequate storing operation. • Temporary or permanent disposal of excavated material within wadi beds that may alter the flow of surface water at these wadies • Excessive use of water for controlling dust generation during construction phase. • Improper disposal for domestic wastewater generated by workers at the construction camps.	• All fuel storage must be appropriately confined and refuelling must be undertaken following set procedures. • Develop a spill response plan, to control any inadvertent leakage or spillage of hydrocarbons. Spill response measures should be instigated (as necessary) to contain and clean up any contaminated soil present. • Adopt appropriate soil conservation measures, such as reducing the disturbed area and scheduling work, where practical, to avoid working during periods of high rainfall. • Adopt measures to minimize contamination outside the site by any surface water run-off that may occur during rainy seasons. • Contaminated soil should be removed and disposed of in accordance with Municipality guidelines. • All inert and domestic waste generated during construction must be removed from site and disposed in accordance with the requirements of landfills approved by the local municipality. • Hazardous wastes and liquid wastes generated during construction will either be recycled or disposed off-site to an approved waste facility. • Collection of black and grey water separately to allow the use of grey water for dust suppression on site, and the transportation of black water off site to a waste water treatment facility. • If no sewerage system is available during construction, appropriate lined sanitary septic tanks should be put in place to collect wastewater resulting from domestic use by construction workers.	Spetic tanks for domestic wastewater collection shall be regularly monitored to avoid overflow. Accidental spills of oil or other chemicals Visual inspection of erosion from construction area and transport of sediments and contaminants	Weekly Daily During heavy rainfall	Contractor / Sub-contractormust ensure the following: • Number of spills or incidents to be recorded during on-site audits. • Training records of personnel trained in spill response procedures must be filed.	To EPC Contractor
6	**Aesthetics**	• Visual intrusion and a disruption to aesthetics due to materials lay down, backfilling, spoil and wastewater disposal, as well as workers temporary facilities and housing	• The contractor shall ensure general cleanliness and good housekeeping practice at the project site at all times. • Comply with the Waste Management Plan (Table section 11.4)	Visual inspection of general housekeeping and cleanliness at site and waste management	Daily	Contractor/Sub-contractor	To EPC Contractor in case of any deviations are found
7	**Biological Environment (flora, fauna & natural habitats)**	• Potential disturbance to biological environment due to construction activities such as noise and vibration, air emissions, waste discharges and chemicals,	• Minimize width of access tracks. • Avoid/Minimize clearing of vegetation. • Limit driving to marked tracks and lines except in emergencies. • Define certain locations for machinery parking and defining	Visual inspection within project site.	Quarterly	Contractor/Sub-contractor	To Ministry of Environment in case of any disturbance to biological environment

No.	Aspect	Summary of Potential Impacts	Mitigation / Control Measures	Monitoring Requirements	Monitoring Frequency	Responsibility	Reporting
		and operation of heavy machinery and movement of vehicles.	machinery tracks to be utilized in order to minimize any potential disturbance to faunal communities (if present). • Prevent hunting by workers on site. • Proper storage and safety measures for chemicals and fuel so as to prevent their leakage and infiltration into environment and consequently to the flora and fauna. • Minimize dusting in order to reduce potential impacts on biodiversity both in site and offsite.				
8	**Traffic**	• Vehicles and pickups may cause traffic to the project location may increase the probability of accidents between the project's vehicles • Heavy Excavation, Lifting and loading machineries may impact the Asphalt road from the desert highway	• Pedestrians Safety: All project vehicles and trucks shall comply with the proposed speed limits inside the urbanized areas; however, a speed limit shall be implemented for the non-urbanized areas which can be determined using risk assessment during the construction. • Ensure adequate maintenance and inspection of vehicles • Implement Journey management procedure; that includes for example documentation of journey destination and expected time frames. • Heavy loads trucks shall avoid passing through urbanized areas if possible., **Figure 99**and**Figure 100** in section 10 propose routes for transporting heavy loads that are expected to be imported during construction phase. This mitigation measure also considers the expected heavy loads according to the allowed axial loads for the proposed routes. • At areas that have livestock crossing the roads, following mitigations shall be implemented: o Stop at least 10metres from the herd o Do not use the horn o Switch off engine if the waiting time is likely to be for more than 5minutes o Allow the flock and herder to clear the road before continuing • Certain heavy and large volume loads shall receive relative permit from the traffic police department prior to the transport process proposed route and the transportation time shall be defined in order to obtain required permit as per Jordanian regulations. • Disturbance related to emissions and noise shall be controlled through: o Switch off engines during time consuming operations i.e. loading an unloading o Avoid unnecessary revving of engines	Control mechanism shall be performed in order to monitor speed compliance Visual Inpesction and documentation of inspection results Record compliants recieved from locals or authorities.	Daily Every week and when needed	APCO/ Contractor / sub-contractor APCO/ Contractor / sub-contractor	To APCO 's relevant Management N/A

No.	Aspect	Summary of Potential Impacts	Mitigation / Control Measures	Monitoring Requirements	Monitoring Frequency	Responsibility	Reporting
9	**Health and Safety**	• Risks from injuries and heat stress • Exposure to dust • Excavation, use of pneumatic drills for cutting through hard rock, working at heights, welding, etc • Falls, burns, and accidents during manoeuvring of drilling plants.	Compliance with project's HSE-MS in addition to Contractor's health and safety procedures to manage and control the activities with regard to occupational health and safety. The mitigation measures proposed in the HSE-MS are summarized below: • Inform herders of start date of the project in due time alerting them of the project activities and potential disturbances (such as noise, dust, light, etc.). • The control room and accommodation sites shall be located upwind from the dominating wind direction where possible, in order to minimise direct exposure to dust and emitted air pollutants. • First aid kits shall be available at construction site, and shall be easily accessible to all workers. In addition, workers must be educated in the use of first aid kits; and informed of their location within the project site. • Adequate PPE shall be provided for employees on site. • All drivers are to be licensed or trained to the machinery they will be handling. • Any generators shall be shielded or stored in locked buildings for safety. • All electrical equipment shall be checked by a competent person prior to commencement of work. • A fire safety procedure shall be developed identifying potentially hazardous areas. • Select chemicals with least hazard and lowest potential environmental and/or health impact, whenever possible. • For each chemical used, a Material Safety Data Sheet (MSDS) should be available and readily accessible. • Workers are to drink sufficient fluids, and use of appropriate clothing and sunscreen (particularly in summer time) to minimise the risk of sunburns and sunstroke. • Visitors' access to the construction site shall be restricted, and access shall only be through security. • Site tidiness shall be maintained at all times. • Adequate accommodation shall be available at all times and a cleaning regime shall be implemented. • Fuel for machinery is to be kept on site, refuelling must be undertaken following set procedures. Oil spill kits to be put in place. • Equipment and noisy activities are to be located away from sensitive receptors, noise monitoring to take place.	Adherence of workers to health and safety procedures.	Daily visual inspection	Contractor and sub-contractor	To Contractor's HSE Manager if any deviations are found

No.	Aspect	Summary of Potential Impacts	Mitigation / Control Measures	Monitoring Requirements	Monitoring Frequency	Responsibility	Reporting
			• Availability of medical treatment • For employees safety, all internal surfaces to be easily cleaned, drain openings, WC basins to be sealed with water tight seal, adequate and closed storage for refuses awaiting collection or disposal outside houses • Daily waste collection to be implemented on site • All employees to receive manual handling training, heavy equipment substituted for lighter equipment where possible, materials are to be supplied in small easily handled quantities where feasible. • Provide immediate medical attention and treatment through contacting the nearest Civil Defence Station to the construction site. Refer to section the full HSE-MS report (**Annex F**)forcomprehensive control measures.				
10	**Archaeology and Cultural Heritage**	• Only potential concern can be impacts on possible unseen archaeological sites or remains (chance find)	• All construction works shall be ceased if any historical or archaeological sites are chance found during construction or mining activities. • In the event potential cultural resources are discovered during construction activities, the Department of Antiquities (DoA) shall be invited for consultations and assessment of the finding. Chance find procedures are further discussed in Section 10.1.1 of this EIA report. • Work shall be resumed only after archaeological experts from DoA and official authorities are consulted and appropriate mitigation measures are implemented.	• Minimum of one site inspection • Informing workers of chance find procedures in case any archaeological or cultural resources were encountered	Immediately after chance find	Contractor / Department of Antiquities (DoA) and APCO	To Department of Antiquities

Table 3: Environmental Management Plan during Operation Phase

No.	Aspect	Summary of Potential Impacts	Mitigation / Control Measures	Monitoring Requirements	Monitoring Frequency	Responsibility	Reporting
1	**Air Quality**	• Fugitive dust will be generated as a result of mining activities such as drilling, blasting, and other activities such as ripping, dozing and excavating • Based on the modelling results (Annex E) the minimum stack height for the common stack scenario is 90 metres and the minimum stack height scenario for two individual stacksis 140metres. • For both scenarios the project area does not have a sensitive receptors pertaining air pollutant since the emissions based on the stack height scenarios are complying with the allowable ground level concentrations • As a result of oil shale combustion ash will be produced. Transportation of ash to the dumping site and the dumping itself will generate dusting, however, with proper mitigation measures, dust can be minimized.	***Mining Operations*** • Approved method statements (including health and safety considerations for workers) shall be prepared prior to the execution of blasting or dusty mining activities i.e. crushing of oil shale in coordination with relevant authorities. • Implement dust control measures for the transport of the mined oil shale to the power plant through compaction of dirt road and regular spray of water. ***Power Plant Operations*** Based on the results of the air dispersion modelling (**Annex E**) the following are the proposed mitigations to be implemented: • The minimum stack height for the common stack scenario is modelled to be of 90metersand for the individual stack scenario 140 meters, based on maximum allowed limit values plus maximum 25% of ambient air limit values as required by IFC. The actual final stack height needed in order to comply with all regulations will be determined during the detailed design of the power plant taking into account all relevant regulations. • Regular air quality monitoring shall be performed during the operation phase of the project. ***Ash Dust Control*** • The dry ash from the power plant will be transported to an ash handling facility in closed systems, most likely by using pneumatic transport. • At the ash handling facility the ash will be cooled and sprayed with water to a moisture content of approximately 25-35%. After this treatment the ash is transported on conventional wind protected conveyors to the dumping site. • At the end of the conveyors the ash will be dumped by stackers and the surface of the ash dump will be sprayed with water to keep the surface wet until the surface has cementified or been covered by overburden. This will according to the studies on the chemical properties of ash conducted for APCO create a cemented top layer, in which the ash layer will create a self-sealing surface layer. • The ash mount will be covered with overburden	Monitoring for the storage conditons of blasting material. Patrolling around the defined buffer zone during blasting to ensure absence of any individual inside the blasting zone. Conduct an air quality monitoring programme and assessment for the project emissions and connected online with MoE. Main objectives are: - To judge compliance of APCO's project with Standards for Environmental, health, and safety guidelines for thermal power plants (JS 2044:2012 IFC:2008) and The proposed Regulation on Environmental Requirements Applicable to Oil Shale Power Production Industry No. [ ] of 20[ ] , Atrical 6 and 7 Issued pursuant to Article 25 of the Law of Protection of the Environment No. 52 of 2006, and Article 32 of the Law of Standards and Metrology No. 22 of 2000, if approved by the authorities with respect to power plant emissions; in addition to compliance with Jordanian Ambient Air quality Standards (JS 1140/2006) with respect to occupational health within the project site. - To provide a data base for assessment during operation phase.*Parameters to be monitored:*NOx, CO, SO2,HCl and	Monthly Prior to blasting oeprations. Continuous monitoring through the air quality monitoring station at the project site Continuously during	APCO	• Monthly internal report to APCO's Management. • Audit report to the Ministry of Environment (if required).

No.	Aspect	Summary of Potential Impacts	Mitigation / Control Measures	Monitoring Requirements	Monitoring Frequency	Responsibility	Reporting
			layers as a final remediation. • An Emergency Response Plan for ash handling to be developed by APCO during the operation phase.	PM10 - To implement applicablecorective measures for controlling any detected exceedences. *Monitoring Location:*existing air quality monitoring station at the project site *Training Requirements:* Train a compliance officer on carrying out the required monitoring programme. Site inspection during ash handling and disposal on site.	ash handling		
2	**Noise and Vibration**	• Mining activities that involve haulage, excavation, backfilling, blasting, crushing and conveying of oil shale and operation of vehicles and equipment. • Noise from the power plant operations.	• For blasting there will be blasting window(s), in order to concentrate the needed blastings during the day. Employees on-site will be informed about such windows in order to be prepared • Certain PPE must be used before entering noisy areas within the power plant, which should be clearly signed. • All staff and workers entering mining area on site should be equipped with proper PPE in order to prevent any potential hearing damage. • Keep all equipment and facilities well maintained throughout their working life, in accordance with the manufacturer requirements.	Conducting a noise monitoring programme, its objectives are: - To judge compliance of APCO's project with national Noise Standards for Heavy Industrial Areas. - To provide a data base for assessment of subsequent project phases. - To ensure that the project does not impact future industrial expansions within surrounding areas of the project. *Monitored Parameter:*Environmental and Occupational Noise. *Monitoring Location:* At site boundary and at 1m from major noise emission sources for occupational health hazards. *Training Requirements:* Train a compliance officer on carrying out the required monitoring programme.	Once per month	APCO	• Monthly internal report to APCO's Management. • Audit report to the Ministry of Environment (if required).
3	**Topography**	• During mining activities, change of topography will be major within the mining area at the project site and minor around it as it would only be caused by movement of	• Application of remediation methods which will be developed for this project as part of a remediation plan. • Solid wastes generated (excluding mining waste and ash) will either be recycled or disposed off-site to an approved waste facility.	Monitoring of ash/overburden dumping and backfilling activities.	Ongoing	APCO	• Monthly internal report to APCO's Management. • Audit report to the Ministry of Environment (if

No.	Aspect	Summary of Potential Impacts	Mitigation / Control Measures	Monitoring Requirements	Monitoring Frequency	Responsibility	Reporting
		vehicles and heavy equipment. • Solid wastes disposal activities on site (ash and mining waste stockpiling on the surface on site on ash dump area of approx. 1.8 km2 and a maximum height of 80 m including a 20 m overburden base layer). The ash mount will be built up in layers and eventually covered with overburden. • The ash and mining waste will be backfilled to the mine after 7-9 years when the mine is progressed enough	• As for ash and mining waste on-site disposal should be used, adhere to waste management plant section 11.4				required).
4	**Soils**	• Removal of overburden through mining and the compaction of soil due to movement of heavy trucks and machinery. • soil compaction could potentially affect the soil permeability and hence the ability of the area to absorb surface run-off • Accidental spill of chemicals or liquid fuels which could lead to soil pollution. • Ash dumping on site	• Minimize transportation to and from the project area to the extent possible. • Specific procedures shall be developed for the removal of waste or spilled fuel, oil and contaminated soil at approved recycling / disposal facilities. • Proper storage for chemicals and fuel within confined areas on site and adopting proper safety measures when handling those chemicals to prevent their leakage and infiltration into the soil. • Hazardous wastes (excluding ash) and liquid wastes generated will either be recycled or disposed off-site to an approved waste facility. • As for ash and mining waste on-site disposal should be used, adhere to waste management plant section 11.4 • Prepare an emergency response plan for the accidental spill or leakage of hazardous chemicals. • Overburden will be stored in designated areas on site i.e. in protective barriers for the mine and ash dump, and could be used as cover for the ash dump both during operations and post operations, in a thicker more permanent cover as will be set out in detail in the company's remediation plan • Mobility within the mining area to be limited to the	Inspect the presence of any disturbed areas in and around the project site for erosion Visual inspection of oil storage tanks, waste storage area and fuel storage area for spills and leaks Leaks of oils and grease from machinery and equipment All site workers to be trained in spill response procedures in order to conduct regular audits of on-site activities and fill out incident reporting forms when necessary. Maintain readily available records of all workers training.	After rainfall Weekly Weekly 'As needs basis'	APCO	• Monthly internal report to APCO's Management. • Audit report to the Ministry of Environment (if required).

No.	Aspect	Summary of Potential Impacts	Mitigation / Control Measures	Monitoring Requirements	Monitoring Frequency	Responsibility	Reporting
			defined access roads inside the mining area. • Parking of mining machines shall be prohibited outside the site boundaries.				
5	**Water Resources**	**<u>Surface Water:</u>** • Water quantities required for operation are estimated to average 2.9 MCM which equivalent to about 0.2% of the total amount of water that can be harvested yearly at Azraq basin. Based on that if the majority of the required amount of water for the project will be sourced from underground aquifer, such impact is considered insignificant. • The Wadi rerouting and water harvesting within the mining area will have insignificant impact on downstream runoff and ground water recharge. Since the project catchment area is contribute in only 17% of Wadi Al Ghadaf and 3% of Azraq Basin. **<u>Groundwater:</u>** • Mining activities will involve the removal of overburden and the exposure of the deeper layers to the atmosphere. This will result in such layers being exposed to contact with rainfall, surface water runoff and oxygen. The change in chemical environment means a potential increase in the natural leachate from the remaining soil below the	**<u>Surface Water:</u>** • All surface water runoff draining from undisturbed areas should be diverted around the mining site using suitable methods (protective barriers, diversion ditches, culverts, etc.). • As most of the surface rain water runoff arrives at point 3 (**Figure 90)** it offers the possibility to build a dam and harvest water for industrial use. • Al Ghadaf dam could be kept available for the sheep herders of the region as long as it is in safe distance from the mining activities and outside the safe zone. • To make sure that the industrial installations will not be flooded during stormy rain events a controlled flow has to be secured, this could be achieved by diverting attributes at the location that feed into Wadi Al Ghadafor to install embankments to guide the water safely from the southern border of the project area on towards the north. • Take appropriate actions to eliminate or reduce the potential storm floods that could happen in the rainy season • Take appropriate action and monitoring for the wastewater treatment plant effluent to meet the Jordanian standards if discharged. **<u>Groundwater:</u>** • Proper storage for chemicals and fuel within confined areas on site and adopting proper safety measures when handling those chemicals to prevent their leakage and infiltration into the soil. • Develop an emergency action plan for controlling any detected water quality deterioration due to abstraction. • Based on the leaching experiments conducted for this project, the findings indicate that ash is not expected to leach into groundwater since it was concluded that the ash can be stabilised by moistening it to about 25-35 % water content. In this stabilised form the ash can be transported to the dumping site without dusting within the project	Monitoring for flood control measures regarding leakage and / or damages Flood control early warning system Monitoring the wastewater effluent quality to comply the Jordanian standard. Monitoring of diversion method used for any potential leak or damage. Implement blasting according to approved procedure by APCO and authorities if needed (Public Security). Conduct a groundwater monitoring	After heavy rainfall During rainy reason Weekly Monthly Prior to each operation	APCO APCO	• Monthly Report to APCO's Management • Report to Ministry of Water and Irrigation (WAJ) when required.

No.	Aspect	Summary of Potential Impacts	Mitigation / Control Measures	Monitoring Requirements	Monitoring Frequency	Responsibility	Reporting
		mine floor. • Disposal of ash will require water that will be extracted from the deep groundwater aquifer that taps the Kurnub aquifer, which already has unsuitable water quality for potable use. Moreover, APCO will explore other water reuse options that will be performed on site • Potential leachability of ash and overburden, however studies showed that ash layers solidified as cement and acted as impermeable barriers when hydrated, thus preventing leaching.	site. When ash is fully hydrated it will solidify to a rock with low permeability. This chemical reaction will prevent ash leaching to groundwater. In practise the hydration will be done so that the ash dump will be sprayed with low amounts of water to keep the surface wet as per the permitted use and estimated water consumption mentioned in **Table 10**. If cracks appear in the surface layer the water will infiltrate the lower un-hydrated ash and chemical reactions will create more impermeable rock effectively sealing the crack again. If the water supply is of such quantity that ettringite and gypsum are formed, these will block the open pore space and thereby create layers with low permeability, meaning that with a thorough planning of the disposal site, most of the water could be surface run-off and also evaporate. Therefore, the solution is the use of dry ash disposal to provide the best protection of groundwater, where the structure and expansion of impermeable layer of ash can easily be monitored using geophysical methods in any chosen destinations.	programme at a nearby well in coordination with WAJ to monitor the following Parameters:Water level, temperature, pH, electrical conductivity, dissolved oxygen, calcium, magnesium, sodium, potassium, chloride, sulphate, alkalinity, nitrate, nitrite, ammonia, fluoride, faecal coliforms.	Quarterly in the first 3 years; if things are stable, then once per year of monitoring for the rest of the project period.		
6	**Aesthetics**	Anticipated visual intrusions: • Mining pit and its activities • Operation of the vehicles and heavy machinery including possible accidents • Power plant including its stack emissions • Ash dumping areas • Other facilities such as generation of spoil, solid waste generation, wastewater treatment plant, and other facilities on site.	• The power plant is an entirely new development within the project area, however since it is located within a desert and far away from sensitive receptors, it is not considered to cause any visual nor aesthetic impacts. • Adopting good housekeeping practices and cleanliness within the project area will minimize potential aesthetic impacts within the project area. • Adhere to waste management plan (section 11.4) in terms of ash handling and disposal on site.	Visual inspection of general housekeeping and cleanliness at site and waste management Ensure compliance of Waste Management Plan	Daily	APCO	• Audit report to the Ministry of Environment (if required and/or in case of any deviations found).
7	**Biological Environment (flora, fauna & natural habitats)**	Low impacts to flora and fauna due to discharge of the wastewater effluents and the potential accidental spills of chemicals and hazardous wastes.	• Minimize width of access tracks. • Avoid/Minimize clearing of vegetation. • Limit driving to marked tracks and lines except in an emergency. • Define certain locations for machinery parking and defining machinery tracks to be utilized in order to	Monitor proper application of required control measures and report on any specific observation noted during the monitoring period.	Quarterly	APCO	• Audit report to the Ministry of Environment (if required).

No.	Aspect	Summary of Potential Impacts	Mitigation / Control Measures	Monitoring Requirements	Monitoring Frequency	Responsibility	Reporting
			minimize any potential disturbance to faunal communities (if present). • Minimize human and vehicular contact with fauna, including their burrows / nests and feeding grounds. • Prevent hunting by workers on site. • Proper storage and safety measures for chemicals and fuel so as to prevent their leakage and infiltration into environment and consequently to the flora and fauna. • Assign a buffer zone around the mine area to decrease potential impacts on biodiversity outside the mine site. • Dust suppression in addition to controlled blasting and ash dumping to effectively reduce potential impacts on biodiversity both (in site and offsite).				
8	**Traffic**	• Crossing of main roads during the project works • Potential increase in traffic density along the road from the Desert Highway to Al Qatranah may increase the probability of vehicles accidents due to an increase in number of commuters and vehicles. • Increased traffic volumes would develop in the area due to the proposed method of transporting products and necessary equipments to the receiving facilities (i.e. specialised road trucks on the local highway).	• It is recommended to prepare a Traffic Access Management Plan (TAMP) to control movement of all machineries used in the project. • Heavy machineries transportation or heavy loads transportation shall apply for permits from Ministry of Public works and Housing and Traffic Police. • Disturbance related to emissions and noise at or close to urban areas shall be controlled through: o Do not leave engines idling either when are queues or parked unless absolutely necessary o Avoid unnecessary revving of engines	Monitor the proper application of TAMP to be developed as recommended. Record complaints recieved from locals or authorities.	Monthly	APCO	Quarterly internal report to APCO's Management. Report to Traffic Police Department in case of emergencies and when required.
9	**Health and Safety**	• Risks from injuries and heat stress • Exposure to dust and emissions • Falls, burns, and accidents during manoeuvring of drilling plants.	Compliance with project's HSE-MS procedures to manage and control the activities with regard to occupational health and safety. The mitigation measures proposed in the HSE-MS are summarized below: • Workers to wear personal protective equipment (PPE) when required to avoid potential injuries from activities such as welding, dust, potential fires, in addition to having ear plugs/ear muffs on	Monitor the proper application of the HSE-MS during all project phases. Provide regular occupational health and safety training for workers on quarterly basis.	Daily Inspection Maintain records of health and safety training for workers	APCO	Quarterly Internal Reporting to APCO's HSE Manager, in addition to maitaining workers training register to keep track of training records.

No.	Aspect	Summary of Potential Impacts	Mitigation / Control Measures	Monitoring Requirements	Monitoring Frequency	Responsibility	Reporting
		• Exposure to oil shale dust and ash	during noisy operations and mining activities. • Explosives used for blasting shall be stored in a designated and secure place and according to the requirements of the relevant authorities (public security, and the Engineering Force of the Army). • A blasting zone shall be defined inside the mining area with clear warning prior to blasting activities. • Define a buffer zone around the mining pits during and post-operations. • During ash handling, ash must be wetted to minimise dust when transported by the ash conveyor. • Respiratory protective equipment and eye goggles are to be worn in areas and situation where extreme dusts can occur such as ash handling. • Clear warning signs near conveyors. During the mandatory HSE-MS training for all employees the danger of moving conveying belts should be clearly emphasized. • Ensure angles on mining slopes are not steeper than the geotechnical stability of the rock will minimise the risk of falling rocks. If steeper angles are needed it is recommended to use wire mesh for covering the side walls. Employees should also be educated that close to the edges they should stay inside the operating machinery and always wear required PPE. • Vehicles should be suitable for mining conditions and vehicles are to be inspected daily by the driver and maintained and inspected regularly by a competent person. • Drilling rig operators should have a recognized qualification in the operation of drilling rigs. Drilling rigs are to be inspected according to user manuals. • Use of adequate clothing, in areas where heat stress is anticipated. • Onsite labour housing is recommended to be located at a location upwind of the dominating wind direction from the power plant in order to minimise the exposure of emitted air pollutants from stack and dust from mining and ash backfilling operations. • First aid kits should be available at the project site and easily accessible to all workers. In addition,				

No.	Aspect	Summary of Potential Impacts	Mitigation / Control Measures	Monitoring Requirements	Monitoring Frequency	Responsibility	Reporting
			workers must be educated in the use of first aid kits; and informed of their location within the project site. • Hazardous chemical assessments and Material Safety Data Sheets (MSDS) are required for the hazardous substances used on site. All hazardous chemicals used on site must be placed in a designated and secure area to avoid accidental human contact. • Any generators shall be shielded from working areas or stored in locked buildings for safety. • Fuel for machinery is to be kept on site, specific refuelling areas to be identified on the site plan (away from accommodation). Oil spill kits to be put in place. • All electrical equipment is to be checked by a competent person prior to commission of the equipment. • An adequate emergency plan is to be produced and drills carried out to confirm its effectiveness. • A fire safety plan is to be developed identifying potentially hazardous areas and fire drills should be scheduled regularly. • Workers are to drink sufficient fluids, and use of appropriate clothing and sunscreen to minimise the threat of sunstroke • All drivers are to be licensed or trained to the machinery they will be handling. • Visitors' access to the project siteand mining area will be restricted and shall only be through security. • Plant operators are to have a recognized qualification for the operation they will be performing in the plant • Availability of medical facilities in accordance to Jordanian regulations • For employees safety, all internal surfaces to be easily cleaned, drain openings, WC basins to be sealed with water tight seal, adequate and closed storage for refuses awaiting collection or disposal outside houses • Equipment and noisy activities are to be located away from sensitive receptors, noise monitoring to take place. Noise map for the field operation may				

No.	Aspect	Summary of Potential Impacts	Mitigation / Control Measures	Monitoring Requirements	Monitoring Frequency	Responsibility	Reporting
			need to be issued if required.				
10	**Archaeology and Cultural Heritage**	Refer to Construction Phase					

Table 4: Social Management Plan - during all project phases

No.	Aspect	Summary of main impacts	Mitigation / Control Measures	Monitoring Requirements	Monitoring Frequency	Responsibility	Reporting
1	**Labour and Working Conditions**	• Unfavourable working conditions in a remote area • Potential discrimination between workers(contractors/ subcontractors potential incomliance by labor rights)	• Adopt a human resources (HR) policy providing employees with information regarding their rights under national labour and employment law, including their rights related to wages and benefits; ensure policy is clear and understandable and is explained to each employee upon taking employment. • Include in HR policy a section on anti-discrimination policy basingemployment on principle of equal opportunity and fair treatment. • Include in HR policy a section on gender equality. • All work contracts must be in written format, and in the case of illiteracy workers must be verbally provided with terms of contract. • Set reasonable/ legal working hours complying with national law. • Overtime pay must be included in the employee's contract. • Develop grievance mechanism for workers and representative organizations (if they exist), informing them of the mechanism at time of hire and made easily accessible to them. Mechanism should address concerns promptly, using an understandable process that provides feedback to those concerned, without any retribution. Ensure that contracted workers have access to a grievance mechanism. • Include in contract sub-clauses with contractors, and sub-contractorsrequirements to prevent exploitation of workers, and termination clause if contractor engages in exploitation or serious unmitigated national/ international labour violations. This procedure applies to also suppliers if there is a high risk of child labour or forced labour. • Contractually require contractors to oblige to all national labour codes and enforce punishment and terminate contract if violation does not end after the cure period. • Regularly document all work permits for migrant workers and require regular reporting from contractors and sub-contractors on status of work permits and situation of employed migrant workers.	Application of HR policy on terms of employment, wages, and benefits; review effectiveness and frequency of awareness training Regular reporting by contractors on grievances received, resolution, and if employee is satisfied, third-party audits Monitoring girevance system regularly to ensure workers on site have an effective way of communicating grievances and their issues to be adequately resolved during operation phase.	Monthly and Annual reporting; annual audit (if required)	Contractors, and sub-contractors during construction and decommissioning. APCO's Human resources during operation	Quarterly reporting to APCO's Management and conduct 3rd party audit (if required).

No.	Aspect	Summary of main impacts	Mitigation / Control Measures	Monitoring Requirements	Monitoring Frequency	Responsibility	Reporting
			Prohibit employment of children under the age of 18, particularly in dangerous or hazardous work conditions (except in a vocational training programme for workers between the age of 16 and 18, where appropriate and free of hazardous conditions).				
2	**Employment Generation**	Overall positive impact, since the project owner is committed to hiring locals and will not favour foreign labour if the required qualifications were actually present within the local community. Indirect jobs can be expected because of the project; typically in the range of 1:3, which would mean a minimum 250 additional indirect jobs	• The Company will comply with Jordanian laws and requirements • The company policy should include hiring preference for local community members (male and female), and filling of jobs with all qualified community members from Al-Damkhi, followed by Al-Qatranah and other municipalities in Um Al-Rassas, when possible, before filling positions from outside the local community. • Recommend contractors and sub-contractors to implement hiring preference for local community members. • Advertise job opportunities with the project locally and through mediums where locals receive information; announce vacancies to municipality, community leaders, and community liaisons for disbursement. • Consider providing skills training appropriate to project and technical training on semi-skilled and skilled jobs that the power plant and mine may require in order to increase the knowledge and skills of the local community. • Consider investing in developing relevant project-related skills of local male and female workforce to increase their qualifications for filling employment positions.	Documentation of skills training provided to locals (including type of training provided, number and demographics of trainees, location of training, and outcome of training), number of job placements after training	Quarterly	Contractors, and sub-contractors during construction and decommissioning. APCO's Human resources during operation	Quarterly reporting to APCO's Management and conduct 3rd party audit (if required).
3	**Economic Growth**	Positive Benefits such as: • Opportunities for new or existing small businesses to provide services to the project; • Attraction of other investments in the area that may result in increased employment opportunities and wages • Increase in land prices (positive impacts to locals who own land) Power production from oil shale is significantly cheaper than power	• Contractually encourage contractors and sub-contractors to have a preferred list of local suppliers to meet supply needs locally first, particularly for food and agricultural products for the power plant, mine and labour camp. • Consider holding a local business to business event(pre-construction) in Al-Damkhi and Al-Qatranah to inform existing businesses and entrepreneurs of supply needs during construction and operation, and project requirements in qualifying to meet supplier requirements. • Encourage staff/ employee to use local businesses, particularly around the off-site housing complex in Al-Qatranah. • At the time of decommissioning in later years, it is recommended to hold consultations with local businesses within neighbouring local communities in a timely manner to inform them of decommissioning plans, schedule, and outlook.	Ensure realization of positive impacts to local economic growth, including increased commercial activity and job creation	N/A	Contractors, and sub-contractorsduring construction and decommissioning. APCO during operation	N/A

No.	Aspect	Summary of main impacts	Mitigation / Control Measures	Monitoring Requirements	Monitoring Frequency	Responsibility	Reporting
		production based on Heavy Fuel Oil and Diesel generators.					
4	**Land Use and Resettlement**	Potential Economic displacement for herders occuring during grazing period only such as: • Loss of assets in the form of the surface water resources if surface water will be harvested for the project • Loss of access to assets (pastoral areas and rural dams); • Loss or altering of livelihood and/or increased cost-of-living/ cost-of-production for nomadic herders utilizing the biological resources of the project area; • Livelihood impacts on livestock owners consequent to the increased cost-of-production for animal feeding of livestock utilizing the biological resources of the project area.	Refer to Resettlement Action Plan Framework (**Annex A**)				
5	**Utilities and Infrastructure**	Overall Positive Impact, since the construction of new roads is not expected to require acquisition of land or other constructions outside the project area. In addition, during project operation, the steady supply of	• The power plant will supply the national power grid with reliable electricity and potentially improve the currently unreliable power supply within the local community areas.	N/A	N/A	NEPCO	N/A

No.	Aspect	Summary of main impacts	Mitigation / Control Measures	Monitoring Requirements	Monitoring Frequency	Responsibility	Reporting
		electricity from the power plant plus the needed upgrade of the electricity network done by NEPCO could potentially improve the currently unreliable power supply in Al-Damkhi and Qatranah					
6	**Social Cohesion**	• Survey respondents from local community reported that they do not prefer the presence foreign workers living and working in or near their community. However, if they are located further away, it is considered less of an issue to the local community. • Lack of community engagement	• Develop a strict Employee's Code of Conduct including requirements for respecting and behaving appropriately within the host community especially important for foreign experts. • Provide a grievance mechanism for community members to report to project owner any conflicts that arise with workers within the community, providing resolution.	To ensure prevention and mitigation of conflict between local community and non-local workers (if occurred) through regular reporting on content, result, and attendance of trainings and community outreach activities; documentation of community grievances and resolution	Quarterly	Contractors and sub-contractors during construction and decommissioning. APCO during operation.	Annual Report to APCO's Management during all project phases.
7	**Community Liaising and Development**	Potential positive impact: • Social benefits through access to skills training, sustainable employment opportunities, increasing wages and living standards; • Improved possibilities for marginalized groups to increase income-generating opportunities; • Building trust of the local community and positive community relations.	• Developing a stakeholder engagement plan for the project to establish community liaisons and grievance mechanism to maintain effective communication with the local community. • Developing a consistent message to provide realistic expectations.	Assessment of community attitude towards the project through periodic consultation with local community as per the stakeholder engagement plan (if needed)	Quarterly	Contractors and sub-contractors during construction and decommissioning. APCO during operation	Annual Report to APCO's Management during all project phases.

Mitigation and Management Measures during Decommissioning Phase

As can be noted, no impacts with high significance are anticipated to take place during the decommissioning phase of the project since all facilities will be removed, power plant dismantled and the mining area remediated and restored to sustainable options. Therefore, this phase will involve some operation of machinery of equipment.

Based on the analysis in section 9, impacts on various environmental and social receptors are considered low to medium or even negligible in some cases during this phase given that APCO will be committed to implementing the recommendations proposed in the Remediation Plan that will be prepared for this project.

The potential impacts of medium significance during decommissioning phase include those relating to:

- Water Resources (surface water, groundwater, and hydrology)
- Health and Safety
- Soil

Moreover, the potential impacts of low and negligible significance during decommissioning are:

- Air Quality
- Noise
- Topography
- Aesthetics
- Biological Environment
- Traffic
- Archaeology

The main mitigation and monitoring measures to minimize or reduce the environmental and social impacts during decommissioning are anticipated to be similar to those identified for the construction phase. Therefore, for detailed and inclusive mitigation and management measures please refer to**Table 2** above.

Remediation Measures Guidelines

A Preliminary Remediation Plan shall be developed for the rehabilitation and restoration of the site after decommissioning of work and project activities. This plan shall be developed subsequent to the EIA and updated throughout the time frame of consequent project phases in order to reflect with emerging environmental issues and results of monitoring activities.

This Preliminary Remediation Plan consists of project and site description, legal framework for the plan, results of site investigations and monitoring activities, objectives of rehabilitation plan, detailed remediation activities, and approach to implementing these rehabilitation activities.

The preliminary identified site remediation activities to be addressed by the Plan will include, but not limited to the following:

- Sloping and shaping the ash and overburden dump areas.
- Protect remaining mine void with fence or equivalent safety instalments.

- Dismantling of the project facilities according to a developed demolition and disposal plan.
- Site restoration activities such as measures needed for decommissioning the water wells in an acceptable manner.
- Internal Roads Network.
- Any remediation measures needed to treat the site from contamination caused by accidental spills of chemicals or hazardous wastes.
- Groundwater sampling should be conducted, on continuous basis and predetermined intervals, as part of environmental monitoring and/or remediation processes to assess potential impacts on groundwater quality as a result of the project. If contamination was found and can be linked to the actual project activities, then the Company should hold the prime responsibility to develop a groundwater remediation plan to be implemented at its cost.
- Continuous monitoring of remediation activities by a specialized contractor assigned by APCO during the decommissioning phase.

1.9.1 Health, Safety and Environmental Management System

As part of this EIA report, a Health, Safety, and Environmental Management System (HSE-MS) manual has been prepared together with hazard identification and risk/impact assessment of various potential activities of the oil shale mining and development of an oil shale fired power plant project. The management system includes also social issues when applicable.

The HSE-MS is based on the requirements set in ISO 14001:2004, OHSAS 18001 and IFC´s Performance Standard 1 (PS 1) Assessment and Managements of Environmental and Social Risks and Impacts and is presented in **Annex F** of this report.

1.9.2 Waste Management Plan

Table 5below provides a summary of the expected wastes and the likely storage, treatment and disposal methods. Proper training in, and enforcement of, waste segregation among site workers is critical to the implementation of the waste management methods proposed for thus project.

Table 5: Summary of Waste Storage and Disposal Methods during project

Type of Waste	Origin	Storage / Handling Methods	Treatment/Disposal Methods and/or Alternative Uses
PROCESS WASTE			
Ash[3]	Power production (due to combustion of oil shale in the power plant)	• Dry ash disposal will take place as described in section 4.5.4, which requires much less water than wet ash disposal methods. The dry ash will be transported from the power plant to an ash handling facility in closed systems, most likely by using pneumatic transport. • At the ash handling facility the ash will be cooled and sprayed with water to a moisture content of approximately 25-35%. After this treatment the ash is transported on conventional conveyors protected from sun and wind to the dumping site. • At the end of the conveyors the ash will be dumped by stackers and the surface of the ash dump will be sprayed with water to keep the surface wetuntil the surface has cementified or been covered by overburden. When sprayed with water, the ash layer will cementify and act like a 'sealing surface' preventing water from reaching to the lower layers of the ash dump. • According to the stability calculations presented in thegeotechnical properties of the Jordanian oil shale ash. Ash disposal and ash dump alternatives Report conucted for APCO in 2012; the ash can be disposed in about 50 m	• Alternative uses for ash such as sales to the cement industry should be investigated in order to reduce the amount of ash to be returned to the mine or stockpiled on the surface within the project area bounaries. • Based on studies conducted for APCO on Geotechnical properties of Jordanian Oil Shale Ash in 2012; it was found that there is potential production of building material out of ash by using a correct technological scheme. Further investigations are needed to be done by the cement industry in order to study and confirm the viability of ash use alternatives.

[3]**Ash:**Spent shale with total organic content of not more than 5 percent (5%).

Type of Waste	Origin	Storage / Handling Methods	Treatment/Disposal Methods and/or Alternative Uses
		(pure ash) high heaps with the outer slope ratio of 1:1 (slope angle 45°). The actual height of the ash mounts is up to 80 m, as up to 20 m of overburden will be used to level the surface of the ash dump area. • During the initial phase of the project it will not be possible to return the mining wastes and ash into the mine void as the mine void needs a certain size before backfilling[4] can be initiated. Therefore, for the first 7-9 years the ash will be disposed south-west of the power plant on an ash dump together with overburden most likely by using the dry ash handling techniques as described above. After 7-9 years the mine will be so developed that backfilling to the mine void can be initiated. The total area of the initial ash dump is approximately 1.8 km^2, and it is planned to build it up in phases. The ash dump will eventually be covered with overburden as the dump progresses, thereby effectively minimizing the water usage and in addition add even further protecting against dust formation. • All site staff handling transportation of ash shall be educated in ash handling and instructed to use the required personal protection equipment.	

[4] **Backfilling:** Returning of the Ash and Mining wastes to the mine and/or storing of the Ash and Mining wastes in a pile on surface that has not been mined.

Type of Waste	Origin	Storage / Handling Methods	Treatment/Disposal Methods and/or Alternative Uses
Mining Wastes (overburden) [5]	Mining process	• As mentioned above, during the first 7–9 years of the project, parts of the overburden will be disposed together with the ash south-west of the power plant within the project area. To minimise the water consumption the ash mount will eventually be covered with overburden layers so only the active parts of the ash dumps needs the continuous water addition; this will also protect against dust formation. Additional overburden will be used to create protective barriers next to wadi al Ghadaf in order to make a long term protection of the mine throughtout the lifetime of the mine, • After 7-9 years the mine will be so developed that backfilling to the mine void can be initiated.	• APCO is planning to build overburden protective barriers within the project site.
HAZARDOUS			
Waste oil/ Batteries/Tires	vehicles, equipment	• Drums in designated areas with spill retention.	• Disposal at Al Swaqa landfill or Recycle (if possible). If recycling is to be carried out, MoE must be informed and their approval must be obtained on the recycling contractor and location. • Recycling of this waste can be carried out by the following companies: o Batteries: Hopica located in Sahab. o Tires: Advanced Technologies Company located at the Zarqa Free Zone. o Oil: to be collected by any of the contractor'sapproved by MoE to be

[5] **Mining Waste:** Overburden and oil shale mined but not used in the power production process.

Type of Waste	Origin	Storage / Handling Methods	Treatment/Disposal Methods and/or Alternative Uses
			transported to the Oil refinery for recycling.
Chemicals	Mining, office buildings, housing township, and laboratory analysis	• Drums in designated areas with spill retention.	• Liquid state chemicals are either treated or incinerated. Temporary storage in Swaqa landfill before incineration. • Solid state chemicals are directly disposed at the Al Swaqa Waste disposal Center
Absorbent material	Used for small spills of chemicals	• sealed drums	• Disposal at Al Swaqa Landfill site
Ink cartridges and printing material	Camps, project offices, laboratory	• Boxes	• Recycling or disposal at Al Swaqa Hazardous Waste Landfill
Empty drums	Various potential sources	• rinse and store in designated area	• Disposed at Al Swaqa Landfill site
NON-HAZARDOUS			
Scrap metal	Camp, mining,	• open yard	• Either recycled at one of the steel plants industry, (e.g. Abboura Factory in Marka) or

Type of Waste	Origin	Storage / Handling Methods	Treatment/Disposal Methods and/or Alternative Uses
	operation of the plant, and warehouses		disposed with the other wastes at any of the approved dumpsites[6].
Kitchen waste	Camps, office buildings, and housing township	• closed containers	• landfill disposal currently, however a Bio Gas/ Composting Plant in Rsayfeh is being planned to reduce wastes.
Paper and wood	Camps, office buildings, laboratory, and housing township	• containers	• Paper is to be recycled where feasible. • Wood for construction to be reused if feasible.
INERT			
Plastic	Office buildings, laboratory, and housing township	• containers	• Recycled effectively as separation techniques are followed either at the source of disposal by individuals, or at the landfills where contractors are assigned to be responsible for separation. This method is followed at most landfills except for Greater Amman Municipality Landfill.

[6]**Dumpsites:** Also known as landfills (hazardous and nonhazardous) for the disposal of solid waste by burying it in layers of earth within low ground.