ENVIRONMENTAL IMPACT ASSESSMENT

FOR THE PROPOSED
ALUMINIUM SMELTER IN AHMAD ABAD
KERMAN PROVINCE
ISLAMIC REPUBLIC OF IRAN

MAN FERROSTAAAL Industrieanlagen GmbH

November 2005
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2. EXECUTIVE SUMMARY

2.1. Introduction

Kerman Development Organization (KDO) together with MAN Ferrostaal Industrieanlagen GmbH (MAN FIA) proposes to establish a primary Aluminium Smelter in the Ahmad Abad Industrial Zone in order to serve the fast growing aluminium demand in Iran and worldwide.

KDO is a private Iranian company focussed on the realization of industrial projects for the province of Kerman. The shareholders of KDO are Kerman Khodro and local municipalities of the Kerman province.

MAN FIA is one company within the German MAN Group, focussed on the front-end realization and financing of industrial plants, including metallurgical plants like primary Aluminium Smelter.

The aluminium smelting technology will be provided by Aluminium Pechiney (AP), a French company belonging to the ALCAN Group. AP is one of the largest primary aluminium producer in the world and the world leader in design and supply of aluminium production technology.

The technology will be state-of-the-art with a capacity of 155,000 t/a of aluminium ingots and sows.

This EIA has been prepared for EULER-HERMES Kreditversicherung, a German state owned company for credit insurances, to fulfil international standards in regard of sustainability and environmental protection of Greenfield projects.

2.2. Local Context

Ahmad Abad Industrial Zone belongs to the province of Kerman and is located in the Rafsanjan region in the south-east center of the Islamic Republic of Iran. The site is framed in the north by a salt desert, in the east by the Rafsanjan plain and in the south and west by Qohrud mountains. The major railway connecting the important harbor Bandar Abbas at the Persian Gulf with the Iranian capital Teheran and the interstate highway between Rafsanjan and Yazd are passing directly by the Ahmad Abad Industrial Zone.

The realization of a primary Aluminium Smelter follows the regional industrial plan to establish industry in already defined locations. The Ahmad Abad Industrial Zone was chosen because of the very poor biological activities with lack of big agriculture there as well as the very good connection to national traffic systems such as railway, highway and airport.

2.3. Proposed Aluminium Smelter

The Aluminium Smelter project will be realized in two phases, each with a capacity of 155,000 t/a. Raw aluminium will be produced with continuously operation of 24 hours a day using the state-of-the-art AP33 smelting technology.

The final products will be aluminium ingots and sows mainly for the local market but also for export to international markets via the harbor of Bandar Abbas.

An overview of the Aluminium Smelter general data can be seen in the Figure below.
### BASIC DATA:

<table>
<thead>
<tr>
<th>Plant Area (Phase 1 &amp; 2)</th>
<th>100 hectares</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Potlines</td>
<td>1</td>
</tr>
<tr>
<td>Number Potrooms</td>
<td>2</td>
</tr>
<tr>
<td>Length of Potline (Phase 1)</td>
<td>approx. 570 meters</td>
</tr>
<tr>
<td>Number of Electrolysis Cells (Phase 1)</td>
<td>168</td>
</tr>
</tbody>
</table>

### OUTPUT:

<table>
<thead>
<tr>
<th>Production Capacity</th>
<th>155,000 t/a</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct Jobs – Construction Phase</td>
<td>Approx. 2,900 average &amp; 3,500 peak</td>
</tr>
<tr>
<td>Direct Jobs – Operation Phase</td>
<td>760 employees</td>
</tr>
<tr>
<td>Indirect Jobs created by Smelter Operation</td>
<td>Approx. 1,500 in the region</td>
</tr>
<tr>
<td>Solid Waste to Waste Disposal Sites</td>
<td>Approx. 2,650 t/a</td>
</tr>
<tr>
<td>Solid Waste for External Recycling</td>
<td>Approx. 5,660 t/a</td>
</tr>
<tr>
<td>Domestic Wastewater</td>
<td>Approx. 70,000 m³/a</td>
</tr>
<tr>
<td>Industrial Wastewater</td>
<td>None</td>
</tr>
<tr>
<td>Main Air Emissions</td>
<td>Carbon Dioxides (CO₂), Hydrogen Fluorides (HF), Sulphur Dioxides (SO₂)</td>
</tr>
</tbody>
</table>

### INPUT:

<table>
<thead>
<tr>
<th>Alumina Consumption</th>
<th>Approx. 300,000 t/a</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-baked Anodes Consumption</td>
<td>Approx. 83,000 t/a</td>
</tr>
<tr>
<td>Power Supply</td>
<td>Approx. 270 MW</td>
</tr>
<tr>
<td>Electricity Supply</td>
<td>2 x 230 kV lines</td>
</tr>
</tbody>
</table>

### Raw Materials

Alumina is the most important raw material, which has to be imported in a relation of almost 2:1 of the aluminium produced. It will be delivered as bulk via ship to the port of Bandar Abbas and from there via train to Ahmad Abad Industrial Zone. Alumina will be stored in silos and conveyed inside the plant with an automated material handling system. Baked anodes will be imported via ship, transported on pallets either with train or with truck to the Smelter and stored there in a separate baked anodes storage building. Aluminium fluoride will be delivered in big bags via train or truck.
Smelting Process & Product

The Ahmad Abad Aluminium Smelter is a continuously operating plant producing solid aluminium metal. The main plant facilities are the potline consisting of two potrooms where liquid aluminium is generated using the raw material alumina, aluminium fluoride and carbon. Liquid aluminium will be transferred to ingots and sows in the casthouse. Other plant facilities are the material handling for the internal supply of alumina, the anode rodding for preparing the imported baked anodes to serve the pots and general facilities as electricity rectification and transformation, several workshops, laboratory and a warehouse.

Project Schedule

Detail Engineering is planned to start in the beginning of 2006 and construction is anticipated to commence in the middle of 2006 allowing first metal production by the end of 2008 and full capacity operation up to the middle of 2009.

The lifetime of the Ahmad Abad Aluminium Smelter is expected to reach 30 to 40 years.

Employment

A maximum of 3,500 employees during construction has to be expected with an average of 2,900 during the main construction phase.

In the operation phase of the Smelter 760 employees will be required, 700 employees will work inside the Smelter and 60 in Teheran for administration and sales.

Beside this direct jobs another 1,500 jobs might be created in the region as sub-contractors.

2.4. Biological, Physical & Social-Economic Conditions

Geology and Climate

The geology of the region is mainly characterized by igneous rocks of eosin with a northwest-southeast orientation, Ahmad Abad Industrial Zone lies east beneath of this mountains. North and north-east of Ahmad Abad Industrial Zone is a large desert pit covered with salt.

Rivers are existing only temporarily in this area mostly served by floods coming from the nearby mountains in case of strong rainfalls.

The Ahmad Abad Industrial Zone lies in the Rafsanjan plain that is dominated by semi-desert conditions. Rafsanjan plain is 1620 meters above sea level and has a mean annual precipitation of 105 mm. The average temperatures are changing over the year from 30°C and minimal around 0°C and lower. The yearly average is 19°C.

Dominant winds were those of southwestern direction with a yearly average steadiness of 48 %.

Air Quality

There are no precise measurements undertaken in the Ahmad Abad Industrial Zone. Generally the quality should be normal without major pollutants except those of cars, trucks and diesel driven railway origin.

As a natural consequence of the desert character of the area temporarily natural dust emissions into the air appear.
Biology

Biological activities on the area of the Ahmad Abad Industrial Zone are minimal due to the fact that this area has semi-desert conditions and there isn’t a considerable surface area of cultivable lands for agricultural and horticultural products. However, some desert plants grow in the study area and pistachio orchards surround the city of Rafsanjan and can also be found on the other side of the highway that passes Ahmad Abad. Endangered or vulnerable species of plants or animals could not be found in the Ahmad Abad Industrial Zone.

Social-Economic Context

About 24% (a population of 500,000) out of the total population of Kerman province i.e., 2,004,328, would reside in the wider Rafsanjan area in 1996. Population concentration of Rafsanjan area is about 12 per km².

The area is through its poor agricultural use fixed on extensive pistache production only. In the closer area of Ahmad Abad no other industrial plants can be found. Therefore the unemployment rate is above 10% for the wider Rafsanjan area and a high migration activity towards the cities can be found. The recipients of this migration are located in the more developed south of Kerman or in urban centers of other provinces.

The infrastructure around the Ahmad Abad Industrial Zone is very high developed by a two-line railway with direct access via Ahmad Abad station, an interstate highway that will be extended on two separate lines in each direction, an airport in the distance of 35 km in Rafsanjan, two 132 kV lines passing right through the Ahmad Abad Industrial Zone as well as a new gas pipeline connected to the big overland gas pipelines.

Mainly in the South of Kerman several facilities for car manufacturing has been settled down and also in other parts of Kerman province Aluminium Downstream Industries are under development.

2.5. Environmental Impact Assessment and Mitigation

The local authorities – in this case the Department of Environment of the Islamic Republic of Iran – as well as the International business led by the World Bank requires an Environmental Impact Assessment especially for industrial Greenfield projects. The background for preparing an EIA is to guarantee the sustainable development of our world.

The term “environment” refers not only to the biophysical components of our life space like land, water, air, soil, flora and fauna, but also to the cultural, social, economic and political components.

The process of EIA has four main steps:
- Scoping to identify the issues to be addressed in the EIA
- Specialists studies to investigate the issues raised and to predict the scale of impacts
- Integration and preparation of the Report of EIA
- Decision of the relevant institutions to proceed with the project.

The EIA (ERA) has been made in 2005 to meet the requirements of the national Iranian Department of Environment as well as the World Bank requirements. It has been designed under international accepted best practice for Impact Assessment.
An overview of the issues and the main positive or negative impacts is given in the following paragraphs.

**Macro-economic Impacts**

This project will have positive effects on global, national and regional economy, in adoption of non-petroleum industrial policy for Iran and in providing industrial development and diversification for the province of Kerman and this leads to find **positive impacts of high significance**.

**Regional economic Impacts**

The construction of the Aluminium Smelter will increase the local demand by the number of employees as well as through required services and this will contribute approximately 13 Mio. EUR of indirect taxes. The operating smelter and all related enterprises will contribute local governmental, corporate and secondary taxes as well as levies and customs. Hence the increased government revenue shows **positive impacts of medium-high significance**.

The GDP of Kerman province will be increased about 10% through the aluminium production and the enterprises around the Smelter. For the Kerman economic situation the **positive impacts** are assessed to be of **high significance**.

**Social Impacts**

It shall have positive effects in respect of prevention of emigration from the district and removal of poverty. As well the economic situation in Kerman will be stabilized because of the diversification of the economy by installing the Aluminium Smelter. Therefore **positive impacts of high significance** have to be stated.

In the Rafsanjan area the unemployment rate will be significantly reduced and the income structure will be increased, this leads to a **high significance** of **positive impacts**.

**Soil Quality**

The soil quality in the Ahmad Abad Industrial Zone is of a low quality and no major bad effects are expected through the Smelter construction and operation. Therefore the **negative impacts** are assessed to be of **low significance**.

**Air Quality**

The Aluminium Smelter will emit a certain amount of Dust, Fluorides and Sulfur Dioxides but due to the high advanced technology the amounts are below the recent international and Iranian limits. The amounts have been checked and no significant risk from the Smelter emissions could be found. Under the mentioned conditions and with the proposed features an operation permission would be expected in Western Europe as well.

Hence the **negative impact** on the air quality is assessed to be of **low significance**.

According to the limits of emissions given by the legislative of the Islamic Republic of Iran the Ahmad Abad Aluminium Smelter emissions are far under these limits. Related to experiences in Western Europe and the limits of comparable Aluminium Smelter with same technology no health effects neither chronic nor acute towards any healthy or sensitive individual can be expected. Therefore the **negative impacts** for human health are assessed of **low significance**.
Water Quality
Because there is no (industrial) water emission to the environment beside the normal sanitary used water the negative impacts are assessed to be of low significance.

Impacts on Flora and Fauna
With operating the Aluminium Smelter no direct endangering of vegetable, animal or human organism can be found. Also indirect endangering has been appraised as small due to the altitude and wind situation as well as the big distance to population centers. The negative impacts on flora and fauna are appraised as being of low significance.

Materials Handling
There is only a very small potential of dust generation, emissions and spillage's from material handling at all stages of the logistic chain with only small volumes of eventual emissions or spillage's. Therefore a low significance of negative impacts arising from material handling can be stated.

Waste Generation
Waste generally is a major point of potential negative impacts on the environment. Two issues are the volume of waste and the endangering by e.g. hazardous wastes. For this project the waste management plan shows that there is only low significance for negative impacts due to a low volume of waste during operation, recycling measures for the generated waste and sufficient waste treatment and disposal quantities in Iran.

Traffic and Transportation
There is the negative effect to an increase of transportation movements for delivering alumina and baked anodes from Bandar Abbas to Ahmad Abad Industrial Zone as well as the use of Diesel Engines on the railway from Bandar Abbas to Ahmad Abad.

The Establishment of ISO 14000 Management System in the construction and operation phases, may reduce such a negative effect through a reasonable management of any displacement. Anyhow transportation activities lead to a medium significance of negative impacts due to diesel engine emissions and the volume of transportation by train.

Noise
The closest living areas next to the Aluminium Smelter are in a distance of approx. 5 km and the noise levels calculated for all possible events are under the world bank standards. For noisy facilities inside of the Smelter noise protection for the workers will be mandatory. Therefore the negative impacts of noise are assessed to be of low significance.

Visual Impacts
In the poor and meager landscape the Aluminium Smelter will be expected to improve the good visual feeling of the local population as well as for the people driving through on the interstate highway. This extraordinary statement has to be understood in the Iranian context where industrial activities and the pride on regional development has a high ranking. Therefore positive impacts of low significance have to be stated.
2.6. Results

A review of all the issues discussed in this report and estimation of all the environmental effects together with case-by-case necessary or recommended measures of mitigation of the project reveal that the positive effects and consequences of the project are of greater importance and scope than negative effects. There could not be found any negative impact of high significance or any no-go situation.
3. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

This EIA is presented by the German company MAN Ferrostaal Industrieanlagen GmbH, harmonized by Aluminium Pechiney and Kerman Development Organization. It has been designed under international accepted best practice for Impact Assessment. The bases is the EIA (“ERA”) prepared 2004-2005 by KDO together with the Iranian consulting company PISGAMAN SANAT Co. using studies from the Kerman office of the Iranian Ministry of Industry and Mines, the Department of Environmental Protection Kerman and the specialists Eng. Parsi, Eng. Tafti and Eng. Saveh. The EIA/ERA was prepared to obtain the permission of the Iranian Department of Environmental Protection (DOE) and was prepared with several revision rounds on request on the DOE.

3.1. Policy Framework

The Aluminium Smelter for Ahmad Abad is targeted by the Kerman Development Organization (KDO), a company owned by an automotive company and several municipalities of Kerman province. The project has the aim to increase the industrialization of the province of Kerman as well to serve the existing and planned automotive industry beside others with aluminium. The positive impacts of decrease of unemployment and diversification of the industry in Kerman are highly appreciated by the political institutions. The increase of the income of the people as well as of the government via higher tax income and higher GDP are another positive impact.

The project is highly supported by the regional politicians and the administration. As a first step an industrial zone has been chosen in Ahmad Abad in the wider region of the city of Rafsanjan. This industrial zone has been defined for several different industries beside the Aluminium Smelter.

3.2. Legal Framework

The basis law for the environmental survey inside of Iran is the “50th rule of the Constitutional Law of the Islamic Republic of Iran, where it is said: “ In Islamic Republic of Iran and in the society that new generation and next generations live and grow up, environment protection is a general obligation. For this reason all economic activities and others, which are caused pollution and irreparable demolition of environment are forbidden.”.

From this stipulation the necessity of an “Environmental Report Assessment” (ERA) is defined by the Central Department of Environment at the Ministry of Environment for big industrial projects as a bases for the environmental permission given by the regional Department of Environmental Protection after approval by the national Department of Environmental Protection in Teheran.

ERA is also considered as an executive and managerial tool for those preparing, taking decision in respect of and designing development projects – including the respective Departments of Environment (DOE). In other words, it is a complementary aspect to technical and economic studies of the projects. Environmental management and monitoring is an essential part of the studies and is also called as an output to those studies.

The course of reaching the permissions starts with an application to the regional DOE that gives a statement about the necessity of an assessment report. After a positive requirement the ERA has to be prepared in respect of the international world bank guidelines for EIA.
The results of the ERA will be analyzed and examined by specialists normally at the National DOE in Teheran, that may require comparative reports. After passing through the National DOE gives a letter of recommendation for the permission to the regional DOE. The whole process is shown in the figure below.

**Figure 2** Work Turning chart of Environmental Report Assessment Review
A conditional permission will be then given by the regional DOE for the project, followed by permission for the begin of construction and for the start of operation.

3.3. Administrative Framework

The regional Department of Environment (DOE) was first contacted to obtain the permission for the general industrial area of Ahmad Abad. This permission from October 17th, 2003 – shown in the Figure below – was as well the start of the permission procedure for the permission from the national department of environment in Teheran.

Figure 3  Permission of DOE Kerman from October 17th, 2003

After this permission for the Industrial Zone of Ahmad Abad the DOE Kerman required an Environmental Report Assessment (ERA). This ERA was made by KDO together with the environmental consulting company PISGAMAN SANAT – who prepared the studies. The ERA was reviews and supplemented by new studies and finally accepted by the national DOE in Teheran.
The DOE Teheran then officially approved the project and gave the recommendation to the regional DOE on May 3rd, 2005. Following this the DOE Kerman elaborated the examination orders for several indicators of the project and gave the permission on June 19th, 2005 (see figure below).

**Figure 4**  Permission of DOE Kerman from June 19th, 2005

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[Image of the permission letter]
4. PROJECT DESCRIPTION

4.1. Proposed Project

The Aluminium Smelter will be operated with new generation smelting technology (AP33) developed by the French company Aluminium Pechiney (AP). The state of the art AP33 smelting technology represents significant capital and operating cost advantages, and high standards of environmental performance.

The project will comprise a Potline with 168 electrolysis cells (pots) together with associated facilities for aluminium casting, anode rodding, materials handling and storage.

MAN FIA proposes to begin with Engineering in early 2006, commencing construction the middle of 2006 and fully operation in the middle of 2009 (shown in the figure below).

Figure 5 Activities on realization of the Aluminium Smelter

<table>
<thead>
<tr>
<th>Activity</th>
<th>Schedule</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contract Coming into Force</td>
<td>End of 2005</td>
</tr>
<tr>
<td>Construction &amp; Erection</td>
<td>Middle of 2006</td>
</tr>
<tr>
<td>First metal production</td>
<td>End of 2008</td>
</tr>
<tr>
<td>All pots in operation</td>
<td>Middle of 2009</td>
</tr>
</tbody>
</table>

It is planned that construction will take 32 months leading to the first metal production end of 2008 and operation of all pots 6 months after first metal production. The duration of the project from beginning of the construction to start production is expected to be 36 months. The lifetime of the Aluminium Smelter can be calculated to be 30 to 40 years.

The financing will be sourced by KDO and a loan from a consortia of Iranian banks together guaranteed by the Iranian Central Bank (Markasi). The project will be covered by the German ECA EULER-HERMES together with the French ECA COFACE, due to the fact of a certain share of French equipment and services.

4.1.1. General Details

- Plant Area 100 hectares
- Number of Potlines 1
- Number Potrooms 2
- Length of Potrooms approx. 570 meters
- Number of electrolysis cells 168
- Production Capacity 155,000 t/a
- Alumina consumption approx. 300,000 t/a
- Pre-baked Anodes consumption approx. 83,000 t/a
- Power Supply approx. 270 MW
- Voltage of Power Supply 2 x 230 kV lines
4.1.2. Site Plan

Construction is anticipated to commence in mid of 2006 and last to a period of 32 months. The proposed site with the Smelter orientation can be seen in the following Figure.

Figure 6 Site Plan

4.1.3. Technical Description

The AP33 Aluminium Smelter is a continuously operating plant producing the aluminium metal (see attached scheme). Aluminium ingots will be the primary product that will be produced for local supply and export to international markets.

Aluminium metal is produced by electrolytic reduction of alumina. Raw alumina (the white powdery oxide of aluminium produced through refining of bauxite) is first passed through a dry scrubber where it is used to adsorb fluoride emissions from the electrolysis cells or “pots”. Fluoride enriched alumina is then fed into the Potlines, consisting of multiple reduction cells (pots) connected electrically in series (for the whole steps please see figure below). Aluminium oxide (alumina) will be reduced to aluminium and carbon dioxide by the oxidation of carbon:

\[ 2Al_2O_3 + 3C \rightarrow 4Al + 3CO_2 \]

The smelter consists of 3 major process components:
- 1 Potline with the pots (electrolytic cells);
- 1 Rodding Shop for preparing of anodes;
- 1 Casthouse for casting ingots and sows.
Figure 7  Aluminium Production Process of Ahmad Abad Aluminium Smelter
Potline and Pots

The Potline will consist of two elongate potrooms measuring 570 m x 30 m. Each room will house 84 pots arranged side-by-side.

Each pot represents one large electrolytic cell (based on pre-baked anode cell technology) lined with conducting carbon blocks (cathodes) and insulating bricks. A steel-reinforced structure supports the overall pot including the anode system, potshell, a hooding system and alumina supply hopper.

The cathode assembly will be contained within a rigid shell, containing carbon blocks and sealed steel bars to conduct current. Layers of refractory and insulating bricks will provide thermal insulation. The impregnated cathode has to be rebuilt approx. every 5 years.

An electric current will be passed through the line of electrically connected pots (along the Potline). Inside the pot the alumina will be automatically fed at several points on the axis of the pot and dissolved in a molten bath of sodium aluminium fluoride (Cryolith) in the start-up and later in aluminium fluoride. The direct current will cause the alumina to separate into aluminium and oxygen through the electrolytic process while the heat generated will maintain the molten bath at about 950/970°C. The aluminium will be tapped periodically by vacuum suction.

Associated with the Potline will be one Gas (Fume) Treatment Center (GTC) that will be positioned between the potrooms to receive emissions through a closed system from the pots. In addition to CO₂, emissions will consist primarily of fluoride and dust. The GTC is a closed dry scrubbing unit, having the primary role of recycling almost the total of fluoride and dust captured from the pots. The emissions are treated in the GTC to extract the fluoride using alumina as a scrubbing agent. The ‘fluorinated alumina’ is then charged into the covered pots.

Anode Rodding

The anode rodding shop is designed to meet several functions:
- separating the spent anode assemblies (= anodes + stems),
- cleaning and correcting the stems,
- recovering materials like frozen electrolytic bath that appears as left-over from the use inside the pots on the spent anodes,
- connecting the cleaned stems with the new baked anodes in a stable way to built new anode assemblies.

The left-over of the spent anodes (“butts”) will be collected and brought to a re-use inside of an anode factory.

The stripped cast iron used to fix the anodes will be removed, cleaned and melt again to fix the new anodes assemblies, ready back to the Potline.

Casting

Molten aluminium metal is extracted from the pots by vacuum and siphoned into large ladles. Specific vehicles will transport these ladles to the Casthouse. Metal will be siphoned from the ladles into holding furnaces in preparation for casting. The metal is then cast into ingots or sows and bundled for shipping.

A by-product of the casting is dross because of some (re-) oxidation of aluminium.
Material Handling and Storage

Major raw materials required for the smelting process are:
- fresh alumina;
- pre-baked anodes; and
- aluminium fluoride;

All of these materials will be imported via ship through Bandar Abbas harbor in the south of Iran. Ahmad Abad industrial area is connected with Bandar Abbas by a railway line of approx. 400 km.

Fresh alumina will be transported to the Smelter site on railway by dedicated vessels, which carry loose, dry-bulk material then unloaded and charged into an alumina silo. From the silo the alumina is fed via a conveyor system to the daily storage silo at the Gas Treatment Center.

Aluminium fluoride will probably be imported in one ton big bags or 25 kg layer bags and transported by train or truck to the site for storage and use.

All material handling and storage facilities inside the plant are equipped with dedusting units which will work constantly. The filtered dust will be recovered inside the processes.

Figure 8  Main raw materials balance per year

<table>
<thead>
<tr>
<th>MATERIAL</th>
<th>AMOUNT</th>
<th>TRANSPORTATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alumina</td>
<td>297.600 t/a</td>
<td>Imported by dedicated ships to the harbor of Bandar Abbas and transported by train to the alumina silos of the plant.</td>
</tr>
<tr>
<td>Baked Anodes</td>
<td>83.200 t/a</td>
<td>Imported on pallets by dedicated ships and transported by train or truck to the site, where they will be stored in a separate building inside the plant.</td>
</tr>
<tr>
<td>Aluminium Fluoride</td>
<td>2.500 t/a</td>
<td>Packed in big bags and imported via ship and train or truck.</td>
</tr>
</tbody>
</table>

The final product will be aluminium in the form of ingots and sows. They will be delivered by train to a port in order to export them by ship or transported by train or truck for use inside of Iran.

Electricity Supply

The operation of the Aluminium Smelter requires in the first Phase 270 MW of electrical power. The local energy supplier KREC will provide the electricity via two independent 230 kV lines to Ahmad Abad Industrial Zone which will be connected to the nationwide network. The power production in Kerman meets already the requirements of Phase 1 operation of the Ahmad Abad Aluminium Smelter, but it will be increased with the new power plant in Sirjan and the extension of the power plant of Kerman up to 2007 of about 1.230 MW.

For the construction phase electricity will be provided by an existing 132 kV line that passes through the Ahmad Abad Industrial Zone.

KDO already made an agreement for the supply of electricity with KREC for the time of operation.
4.1.4. Construction Phase

The construction will last around 32 months including the installation and commissioning of the Aluminium Smelter. While this materials and equipment as well as personnel has to be transported to the site. Imported materials and equipment will be brought from Bandar Abbas harbor preferably by train but also with truck. Waste streams generated mostly of packaging materials from delivered equipment have to be recycled either on site or in dedicated facilities outside the plant or disposed on waste disposal sites.

4.1.5. Employment

A maximum of 3,500 employees during construction has to be expected with an average of 2,900 during the main time of the construction phase. Accommodation of the required personnel will be given in the housing areas in Ahmad Abad (distance: 5 km), Kashku’iyeh (distance: 8 km) and Rafsanjan (distance: 35 km to the center). The town Kashku’iyeh already establishes new housing areas inside the town for the development of the Ahmad Abad Industrial Zone.
For construction 100 to 150 expatriates will work on site. Their accommodation will be in Rafsanjan housing areas that already exists.
In operation the workforce at the Smelter will amount to 700 and another 60 employees will work in Teheran for administration and sales activities.
4.2. Geographic Situation

The Aluminium Smelter will be located near the town of Ahmad Abad (marked red in the following Figure) belonging to the Rafsanjan plain, 35 km west from the city of Rafsanjan (northern latitude 52-29-31031 and eastern longitude 55-56141) in the Province of Kerman.

**Figure 9** Map of Kerman Region with Ahmad Abad and Rafsanjan

The province of Kerman is located in Central Iran and surrounded by:
- The Iranian province of Khorasan in the North,
- The Iranian province of Sistan-o-Balucestan in the East,
- The Iranian province of Hormozgan in the south,
- The Iranian provinces of Fars and Yazd in the West.

Greater city areas around the site of the Aluminium Smelter are:
- Rafsanjan: approx. 35 km east with approx. 110,000 inhabitants,
- Kerman: approx. 130 km east with approx. 400,000 inhabitants,
- Shahr-e-Babak: approx. 70 km south-west with approx. ___ inhabitants,
- Sirjan: approx. 130 km south with approx. 145,000 inhabitants,
- Yazd: approx. 200-250 km northwest with approx. 350,000 inhabitants.
The nearest housing areas are the town of Ahmad Abad 5 km east with approx. 200 inhabitants and Kashku’iyeh 8 km north with approx. 1,000 inhabitants.

Ahmad Abad Industrial Zone is directly connected with a two-line railway for both directions between Bandar Abbas in the south and the capital Teheran. The railway station Ahmad Abad is already installed next to the Ahmad Abad Industrial Zone — shown in the figure below.

There is a highway between the major cities Rafsanjan and Yazd that is passing through the town of Ahmad Abad. For the time being a second lane for this road is under construction and will be finished in the end of 2005.

**Figure 10** Aerial view of the Ahmad Abad Industrial Zone with railway and highway
4.3. Ecological Situation

Considering the below described premises, destructive burden of establishment phase under this project is extremely small and negligible.

4.3.1. Soil Activities

Considering that the area for the erection of the plant is almost flat and the fact that the land plot has been purchased to this effect – among the areas having been subject to a site development for Ahmad Abad Industrial Town –, there shall be no requirement for a land leveling. However a soil-lifting of about 100,000 square meters has been provided for in this project considering the foundation needed by some steel and concrete structures and the necessity for the construction of some facilities on a lower level than that of the land plot. All the masses from soil-lifting shall be used in bedding and relative uplifting of the area to be used for the creation of a green space and therefore this project shall have no soil masses in excess.

No requirement for excavation and explosion exists under this project, and no operations of those categories have been provided for. Piling necessities are not researched finally yet but will not expected.

4.3.2. Flora & Fauna Clearing

Considering the elements such as poor flora and fauna of the area and the previous site preparation by Kerman Development Organization, there shall be no flora and fauna clearing under this project.

4.3.3. Water Clearing

The elements such as low underground water level in the vicinity of the industrial town, the absence of impermeable layers near the ground surface and also the plans developed for the removal of surface waters have all removed any necessity for drainage operations.

Considering the location for the establishment of the plant in Ahmad Abad Industrial Town, no requirement for the change of course of surface water has been considered.

For protection of the plant area in case of temporarily water flooding from the nearby mountains a flood water canal has to be built to guide the water around the Smelter site.

4.3.4. Existing Industry and negative impacts

In the wider area of Kerman are several industrial facilities and especially some which might generate negative impact on the environment – e.g. copper mines. The distance of these to Ahmad Abad is higher than 100 km.

Additional emissions to nature in the Ahmad Abad area only caused by traffic through cars and trucks as well as the close railway that is served by diesel driven locomotives.
4.4. Social Situation

Considering the Iranian average for direct employment requirement it may be forecasted that the production of 155,000 t of aluminium per year with three work shifts of 8 hours each shall be a need for 700 workers and specialists. Additionally there shall be a need for 60 employees for administrative and non-production affairs. This number of employees meets the AP experience for Aluminium Smelter outside of Europe and Northern America.

Figure 11 Personnel Structure and Numbers

<table>
<thead>
<tr>
<th>NO</th>
<th>Title</th>
<th>Division</th>
<th>Direct Production</th>
<th>Indirect Production</th>
<th>Administration &amp; Distribution</th>
<th>SUM</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Managing director</td>
<td>Administrative</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Financial manager</td>
<td>Financial</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>Administrative manager</td>
<td>Administrative</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>Production manager</td>
<td>Technical</td>
<td>3</td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>Production supervisor</td>
<td>Technical</td>
<td>27</td>
<td></td>
<td></td>
<td>27</td>
</tr>
<tr>
<td>6</td>
<td>Worker</td>
<td>Technical</td>
<td>700</td>
<td></td>
<td></td>
<td>700</td>
</tr>
<tr>
<td>7</td>
<td>Employee</td>
<td>Admin./Financ.</td>
<td></td>
<td></td>
<td></td>
<td>10</td>
</tr>
<tr>
<td>8</td>
<td>Warehouse Keeper</td>
<td></td>
<td>5</td>
<td>4</td>
<td></td>
<td>9</td>
</tr>
<tr>
<td>9</td>
<td>Guard</td>
<td></td>
<td>8</td>
<td></td>
<td></td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>TOTAL</td>
<td></td>
<td>730</td>
<td>5</td>
<td>25</td>
<td>760</td>
</tr>
</tbody>
</table>

Beside the jobs created directly in the Aluminium Smelter various jobs in the logistic chain for supporting the Smelter, for serving the employees inside the Smelter, for all activities regarding the Smelter personnel – for example recreation, cultural activities, etc. – as well as the logistic chain for aluminium and other output materials will be created. The amount of these jobs can only be roughly calculated, the office of the Ministry of Industry and Mines proposes 1,500 jobs and the economic officer of the Government of Rafsanjan proposes even a higher job creation by taking the small-medium-micro-enterprises (SMME) into consideration.
4.5. Temporal Context

4.5.1. Ahmad Abad Industrial Town

Ahmad Abad Industrial Town that has been established based on broad expertise studies on the situation, available resources, transportation routes and sub structural pre-requisites (water, energy power, natural gas and fuel resources) by Kerman Development Organization, is among the projects that has provided for the blooming and development of great part of the province through a timely satisfaction of requirements attraction of major financial resources and by taking use of effective manpower in the province.

The objectives of the establishment of this town were creation of optimal industrial investment grounds, employment and development of economic activities. Establishment of the aforesaid town in a most ideal way, has provided for the optimal operation of the land plot of interest through the provision of sub structural installations including water, power, road and telecommunications.

The aforesaid town was established based on the order dated 17.03.2001 of the cabinet that was in accordance with the proposal of the Ministry of Industry & Mining and clause (N) to Note 21 of Budget Act-2001 that provides for the issuance of licenses for the creation of new industrial towns by private and cooperative sectors but not by the governmental sector.

The Kerman province office of the Ministry of Industry and Mines issued the license and approved the establishment of Ahmad Abad Industrial Zone in accordance with the aforesaid act.

4.5.2. Development of Kerman Province

The Province of Kerman can be characterized through its tremendous industrial development – far away from the typical Iranian oil and gas industries. Especially in the automotive industry several projects for manufacturing are planned or already realized.

4.5.3. Aluminium Consumption in Iran

Iran is among developing countries and has completed and/or has in process of completion some short-term, mid-term and long-term projects in order to improve the volume of operations in the fields such as automotive industry, airplane manufacturing industry, electrical and electronic industries etc. It may be estimated on the basis of the premises herein above that the demand for aluminium shall exceed 200,000 t during the years to come.

Iran intends to fabricate 500,000 automobiles a year at the end of the Third Development Plan according to the strategy developed. The new advancements in automotive industry encourage the manufactures to take use of ever greater volumes of aluminium. Fabrication of each automobile is expected to involve the use of 150 kg of aluminium. A further objective of automotive industries are making an increase in number of the automobiles manufactured and providing for the presence in world markets. Considering the premises above one may estimate that automotive industries shall create a yearly demand of 100-150,000 t within the twenty years from now on. Conclusion of contracts for domestic fabrication of different airplane will also be a source of demand for aluminium.
Yearly consumption growth rate has been estimated to be 2-3 percent during the first decade of the 21st century and the growth rate for aluminium demand in Iran is expected to exceed the global mean volume and to be 4-5 percent in line with the acceleration of scientific and technical advancements and considering the special industrial and economic status of the country.

Therefore, an estimate of minimal aluminium consumption of 300,000 to 350,000 t within the ten years to come and of 450,000 to 500,000 t during the twenty years from now can never be far from reasonable thinking and it can be considered a reasonable estimate. An estimate of the demand can also be based on a demand per capita for aluminium in different countries of the world. Developed nations have a much greater demand per capita for aluminium as compared to that of underdeveloped countries. The demand per capita for aluminium is currently 1.75 kg in Iran. The present population is 60 million in Iran and the population growth rate is about 1.47%. therefore, Iran shall have a population of 85 million in 2021. However, the demand per capita for aluminium exceeds 10 kg in South Korea that is already considered an industrialized country. It is about 4.7 kg in Malaysia as a developing country. Hence in case Iran enjoys a development rate that provides for Iran to rank in 2021 a status between Korea and Malaysia of today (and a faster development rate doesn’t seem to be a reasonable per capita for aluminium can be estimated to be 6 kg in 1400 and hence the country shall have a demand for about 500 thousand t of aluminium in 2021.
5. BASELINE DATA

5.1. Dimensions of the Study Area

Area of the land plot: 3,300,000 m²
Natural status: Extremely poor flora – nearly a desert
Slope: The plot has a mild mean slope of 2-3 percent
Roughness of the land plot: No significant roughness is observed
Soil type: A mixture of windblown sand and clay is located under a layer of meadow soil and the dup layers are conglomerate the status of land
Winds: northwest to southeast.

5.2. Physical Conditions

5.2.1. Geology & Earthquake

Geology
The geology of the region is mainly characterized by igneous rocks of eosin with a northwest-southeast orientation, major rocks are igneous and sedimentary rocks. Ahmad Abad Industrial Zone lies east beneath of this mountains. North and north-east of Ahmad Abad Industrial Zone is a large desert pit covered with salt.
The landscape of Ahmad Abad Industrial Zone is falling off to northeast direction with a 3% inclination.

Earthquake
The Ahmad Abad area is part of Sanandaj-Rafsanjan zone and is located on southeast to the zone. It has experienced numerous tectonic motions during different geological eras. Geological units of Rafsanjan zone are in the form of numerous anticlines and synclines that have been converted into the fractures and dislocations from the actions of faults. The faults have two directions that is, northeast-southwest and northwest-southeast courses. Major faults have northwest-southeast courses. The direction of geological formations, the course of altitudes and of anticlines and synclines are the same as well. The aforesaid faults have had their roles in the disintegration of rocks and greater connection with alluviums.

As an example, the action of faults in Karan area (south Rafsanjan) has brought a decrease in thickness to the alluviums in north and hence a deepening of rocks and increase in thickness of alluvium in the south part of the village.

Earthquake are proposed to appear with a strength up to 5,5 of the Richter scale. In the area of Ahmad Abad it is recommended to design buildings with the second highest Iranian earthquake factor.
5.2.2. Climate & Air Quality

Climate

The Ahmad Abad Industrial Zone lies in the Rafsanjan plain that is dominated by semi-desert conditions. Rafsanjan desert is 1620 meters from sea level and mean annual precipitation was 105 mm as studied in a 21 year period with a range of the maximum monthly precipitation between 0 in August and September and 20.6 mm/m² in January. The mean number of days with precipitation amounts to 29 over the year.

The average temperatures are changing over the year from 30°C and minimal around 0°C and lower. The yearly average is 19°C. The ten year mean maximum temperature was 36°C and the mean minimal temperature was –5°C.

Relative humidity amounts to a minimum of 18 % in August and a maximum of 47 % in January.

Dominant winds were those of southwestern direction with of around 18 %. The wind intensity is on average not higher than 9 knots and the steadiness amounts to approx. 60 %.

Air Quality

There are no precise measurements undertaken in the Ahmad Abad Industrial Zone. Generally the quality should be high without major pollutants beside those of car and diesel driven railway origin.

As a natural consequence of the desert character of the area temporarily natural dust emissions into the air appear.

5.2.3. Topography

Ahmad Abad Township has a dynamic topographic status the altitudes are over 2000 m in major part of its surface area and the remaining portion has the altitudes of 1500-2000 m (Ahmad Abad Industrial Town is at 1.470-1.620 m).

Figure 12  Topographic Status of Study Area:

<table>
<thead>
<tr>
<th>Name of plain</th>
<th>Ahmad Abad</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Area (km²)</td>
<td>8200</td>
</tr>
<tr>
<td>Mountain Area (km²)</td>
<td>4214</td>
</tr>
<tr>
<td>Mountain Area (%)</td>
<td>51.39</td>
</tr>
<tr>
<td>Plain Area (km²)</td>
<td>3986</td>
</tr>
<tr>
<td>Plain Area (%)</td>
<td>48.61</td>
</tr>
</tbody>
</table>

The highest peak looking down upon Ahmad Abad domain is Khorin mount with a height of 3443 m and Sartakht mount is 3010 m from sea level. The nearest altitude to Ahmad Abad is the mountainous area on the south that stretches to northeast of Shahr Babak and the highest mount of the range is Ayoub with a height of 3368 m.

Among other altitudes of Ahmad Abad area, Sartakht mount with 3.010 m of altitude is located at the east of the domain and calkas altitudes with mounts of 3.765 m and 2.610 m that from the origins to Abpakhsha and Gardou rivers.
Kouhsorteh mountains have been stretched out with their height of 2.395 m at 43 km from the south of this township Badbakhtkouh is among the altitudes of this district. The outskirts of Badbakhtkouh have a great importance from the viewpoint of type and quality of flora.

The lands on the margins of Ahmad Abad have a low gradient and they meet Ahmad Abad with an east, northeast and southwest course. On the west of salt pan, the gradient changes from the altitudes to the pan. The gradient is 0.02 to 0.05 on Sirjan plain and it varies from 0.01 to 0.007 in some areas (the gradient is 2-3 percent in industrial town).

Desert lands have a surface area of 10.215 km$^2$ in Ahmad Abad domain with its area stretching on a surface of 18.919 km$^2$. Ahmad Abad salt pan has some altitudes on the west with a height of 2.662 m. Ahmad Abad salt pan or Marvast desert is a special topographic form in the study area. Ahmad Abad pan that is surrounded by clay pans, salt pans and drifting sands (north to northwest margins), has thick salt-water in geometrical forms in its central parts. This desert has the form of marshy lands, clay pans and fine-sand pans. Part of Ahmad Abad desert pan seems as a lake overflowing with salt. The surface of saltwater is covered with a thick cover of geometric plates of salt or salt-water contains a mass of sludge and a salt cover. Anyway, the pan takes the form of a marsh to it. Marvast Desert can be considered as a vast salina part of which would contain some water from flooding currents on a temporary basis in wet years and would quickly evaporate.

Ahmad Abad Town is located on Bayaz plain and it is at 1.470-1.620 m from sea level on an average. There is a large desert pit on the south and west to the plain and it is covered with salt. The desert pit has a height of 1560 m and Bayaz plain and the altitudes on the south look down upon the pit. Topographic specifications and granulation of the soil on Bayaz plain follow the same general rules as such plains do, in a way that mountain outskirts are the first to be encountered on a north-south axis and the plain has a southward course at a relatively acute slope.

On mountain outskirts the soil has a large granulation and coarse and heavy materials having carried about as a result of erosion, have been deposited here. This same fact has caused the lands to have a low cultivability and has prevented major housing communities to be formed on it.

The gradient of land decreases on a gradual basis from north to south on the lands and the soil begins to have a finer granulation. It is on these lands that Ahmad Abad Town has been erected. It has a uniform topography. However, the land has a considerable gradient toward the south. Topographic status of the district is indicative of the situation of Bayaz plain among three mountain ranges surrounding the plain on the north, east and south. South, southwest and west of the plain are limited by desert pits and this is for the same reason that villages are distributed on a space between the desert pit and central portion of the plain.
5.3. Biological Conditions

Rafsanjan desert areas have a hot dry climate and salinity and draught resistant flora. They have drifting sands and the presence of Salina systems in Rafsanjan and Zarand and the 120 daily winds blowing from early to late in may are the elements that weekend desert ecosystem. They are accompanied by sulfur, dust and sand-storms with their considerable effects on biocenosis. This is for the same reason that species diversity decreases.

5.3.1. Water Resources

Considering the climate, the study area has not an optimal status from the viewpoint of surface water resources. Climatic structure of the district prevents the formation of permanent rivers and only provides for seasonal currents and floods. The only permanent river is Kaboutarkhan River that is a recreative fishing place. The term “river” can only be used on a conditional basis in respect of some currents in this district. Form a limnologic point of view, surface currents can be termed as “river” only in case the mean flow rate is at least 1m³/s.

Mean flow rate of this river fluctuates between 13m³/s in may and 2m³/s in August the emergence of limnological variations of the rivers of this kind is not far from expectation considering the fluctuations in the values of solubilized oxygen, temperature and flow rate of the water.

Ab Bakhsha (Kaboutarkhan)Earth Dam is the only permanent hydrologic ecosystem of the study area and its impounding in 2001 was accompanied by the attraction of birds and animals and increase in the diversity of species.

The areas with proper ecological status within the limits of Rafsanjan have already been identified and put under protection by Environment protection Organization. The following are the descriptions of main ecologically important units.

Groundwater is reached in a depth of around 200 m. in the Ahmad Abad region.

5.3.2. Flora

The Rafsanjan plain is dominated by a dry desert climate with dry cold winter and dry hot summer the presence of sediments is indicative of water and soil erosion and the low precipitation is an element that creates poor flora. Flora is extremely poor and there are sporadic desert plants and shrubs. The dominant flora consists of sagebrush sporadically growing on the attitudes.

The direct Ahmad Abad area is dominated by karst landscape with extremely low ground vegetation. The earth there is not cultivated and not able to be cultivated. Small farming areas are in a distance of 5 km northeast of Ahmad Abad industrial area.

All plant species that are approved to appear in the Ahmad Abad and Rafsanjan region are not part of any international protection list like IUCN red list. Therefore it can be stated that no endangered or vulnerable flora may be impacted through the Ahmad Abad Industrial Zone and it facilities.
5.3.3. Fauna

The animal world in the direct Ahmad Abad industrial area is poor and of low vegetation, no distinctive fauna and no vulnerable or rare animals can be found there. Because of missing vegetation big animals would not be able to find food and also the fact that Ahmad Abad Industrial Zone is framed by railway and interstate highway, wild animals of bigger size can not be expected there anyway. In such semi-desert landscape usually no farming animals are breed.

For the appraisement of impacts through the Ahmad Abad Aluminium Smelter on the wider area around Ahmad Abad, the appearance of endangered or vulnerable animals was studied by the DOE Kerman.

The highest diversity of animal life could be found in a zone that is only protected against hunting. The Bidooyeh Hunting Prohibited Zone is representative for the animals living in the direct Rafsanjan area. This zone lies close to the city of Kabutarkhan approximately 74 km east-south-east of Ahmad Abad. Some animals can be found there which are internationally protected and mentioned in the IUCN red list (shown in the table below).

<table>
<thead>
<tr>
<th>Species [Latin Name]</th>
<th>IUCN Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gazella subgutturosa</td>
<td>LR/nt</td>
</tr>
<tr>
<td>Capra aegagrus aegagus</td>
<td>VU A2 cde</td>
</tr>
<tr>
<td>O. v. blanfordi &amp; laristancia</td>
<td>VU A2 c</td>
</tr>
<tr>
<td>Cricetulus migratorius</td>
<td>LR/nt</td>
</tr>
<tr>
<td>Emberiza cineracea</td>
<td>LR/nt</td>
</tr>
</tbody>
</table>

**Legend:**
- LR / nt Lower Risk / near threatened
- VU Vulnerable (not critically endangered, but facing higher risks)

The table above and the explanation of the classification shows that there are no critical endangered animals that could be impacted by the smelter. None of these animals has been approved in the area of Ahmad Abad Industrial town, hence the erection of the Aluminium Smelter is not disturbing the living conditions of the above mentioned animals directly. To be concern about even lower risks the impacts e.g. through Smelter emissions has to be identified.

There are two official protected zones in the wider Rafsanjan area that give conditions for a fauna diversity much higher than in Ahmad Abad industrial area. Both zones are beyond the mountain chain that covers Ahmad Abad area in the south and south-east.

**Bahram-e-Gour Protected Zone** is located on the east of Neiriz township and Ghatrouyeh, Harat, Marvast and Sirjan Deserts with a distance of approx. 140 km south-east from the Ahmad Abad industrial area. This zone came under a control as a free zone in 1968 and it was brought under Environment Protection Organization as Bahram-e-Gour protected zone in 1972.

Bahram-e- Gour Protected zone is located within the limits of Neiriz township and is managed by Neiriz Environment Protection Department. It is a semi-desert zone that has been created for the protection of vulnerable wildlife such as Zebras, Jaguars etc.

The protected zone is a living colony to Zebras.
Main mammals of this zone are: Zebras, rams, ewes, wild cats, fox, rabbits, hyena, wolf, jackals, porcupine, deer. Among the birds of this zone are: Partridge, raven, pray birds, vultures etc.

**Sorkh Kouh zone** is on the south of Rafsanjan township in Marvast desert with a distance of approx. 100 km from the Ahmad Abad industrial area. The zone has considerable colonial diversity and covers mountainous and desert areas in two different aspects. The protected area is 49,400 ha and it is 3,443 m from seal level (maximum height that is Khorin Mount). Sorkh Kouh Zone is located in Rafsanjan township district and is managed by Environment protection Department of Rafsanjan.

The zone is among major colonies of mammals. It has also a great diversity of bird species. The zone is a colony of valuable bird species such as partridges, Jays and other different birds.
5.4. Socio-economic Conditions

The area is fixed through its poor agricultural use on extensive pistachio production only. In the closer area of Ahmad Abad no other industrial plants can be found.

? Cultural heritages: none in a circle of approx. 50 km.
? Population or cultural minorities: none effected.
? Unemployment rate of the province of Kerman amounts to 10.5% in 2004.

The status of land from the viewpoint of future civil developments: the future developments shall have no effect on the industrial town considering the distance between the city and the scope of development.

Ownership of the land: the land plot is among nationalized lands. The price of land plot has not a considerable value in Rials considering the situation and the class of land plot.

The situation and the fact that the site has been located among some rural communities, counties and townships provides a high availability of manpower.

The comments of competent authorities on the land plots in industrial town: provincial department of environment, housing & urban planning organization, agricultural jihad, water department and power department have declared agreement to the establishment of the industrial town.

Distance from the nearest township is about 35 km to Rafsanjan.

Distance from the main road, the railway, from airport and the port: It is separated from the main road and the railway only by right of way lines and it is at thirty five km from the airport.

Ahmad Abad Industrial town is on the route of power transmission network and the power required by the plant may be supplied by erection of a 230 kV transformer station for the Ahmad Abad Industrial Zone.

The nearest gas supplying network is that of Rafsanjan to Anar that passes directly through the area of Ahmad Abad Industrial Zone.

Aquifers with relatively desirable quality are available at depths of around 200 meters.

5.4.1. Population

About 24% (a population of 500,000) out of the total population of Kerman province i.e., 2,004,328, would reside in the wider Rafsanjan area in 1996. Population concentration of Rafsanjan area is about 12 per square kilometer that is, something close to the population concentration in Kerman province.

Ahmad Abad has a high potential of human force because of its neighboring with Rafsanjan, Anar and Sirjan. The latest census gives the number 135,000 for college graduates, 9000 for college students, and 500,000 for inhabitants in the Rafsanjan area.

The most important characteristics of this township from the viewpoint of population can be seen under the following Figure.
Main variations in population of Rafsanjan are close to those of Kerman province.

Greatest portion of the population resides in civil areas and Rafsanjan is a focus of population.
Rural population growth rate was negative during the period from 1986 to 1996 and this represents the trend of emigration from rural areas to Rafsanjan, Ahmad Abad and other urban centers.

**Figure 15** Trend of Urbanization in Rafsanjan Township:

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Rafsanjan</td>
<td>19568</td>
<td>39464</td>
<td>90072</td>
<td>107887</td>
<td>135024</td>
<td>+ 401%</td>
</tr>
</tbody>
</table>

**Figure 16** Trend of population Growth Rate In Ahmad Abad Township and the province:

<table>
<thead>
<tr>
<th></th>
<th>Rural Center</th>
<th>Urban Centers</th>
<th>Total (urban + rural)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>76-86</td>
<td>86-91</td>
<td>86-96</td>
</tr>
<tr>
<td>The province</td>
<td>2.42</td>
<td>1.83</td>
<td>-0.01</td>
</tr>
<tr>
<td>Ahmad Abad</td>
<td>3.25</td>
<td>1.97</td>
<td>-1.38</td>
</tr>
</tbody>
</table>

5.4.2. Tribes

Ahmad Abad township has long been a center of animal husbandry and specially of sheep. The tribes of Ahmad Abad had a migratory style of life and maintenance however, some tribes have chosen to settle in the villages and they earn their lives through both animal-husbandry and agriculture. A great number of tribes have chosen to live in urban centers and specially in Rafsanjan in order to enjoy better standards of life.

Eastern part of Ahmad Abad is the mountainous area where tribes come to stay in the summer. The district includes the villages of Bayaz, Khatounabad, Dehaj, Mashahim and Hosseinabad and also Kaboutarkhan, Nassereieh, Robat, Saedi and Kouh Sorkh Orchards and gardens. Some tribes of Rafsanjan have been moved to this district during the reigning periods of the Safavid, the Afshari and the Qajar dynasties and some other tribes have been moved to Khorasan and Azarbaijan.

**Afshar Tribe:**

It is the greatest tribe that was moved to Rafsanjan and Zarand and Bardsir Areas. “The Culture In Rafsanjan”, published in 1987 reads: “Afshar and Amouei Afshar are the tribes that were moved to Fars province from Urmia and Zanjan about 156 years ago and they moved to Zarand and Rafsanjan afterwards. They speak Turkish.

**Bochaghi Tribe**

Bochaghi is among the old tribes of Ahmad Abad that was moved to this district from Azarbaijan during the age of Nadershah Afshar. They reside on the east and southeast of Ahmad Abad including Nassereieh, Dehoueieh and Kaboutarkhan (50 km) from the east of Ahmad Abad industrial area.
Lori tribe

Lori tribe lives on the banks of Fereidouni river and Bagh Khoshk, Hefdah Chenar and Mensar areas. As the results of the studies on the district represent, Lori Tribe moved to this district during the reigning period of Nadershah Afshar. They speak Farsi. According to what “The Culture In Rafsanjan”, a periodical, wrote in 1957, “Lori Tribe of Bardsir is a group of Lori Tribe of Mirza Hosseini that was moved to this district some years ago.”

Khorasani Tribe

“Geography of Kerman” is a book that gives the following account on Khorasani Tribe:

“Khorasani Tribe is under the authority of Rafsanjan. The members of this tribe have a great affection towards the offspring of Esmaiel, the son of Imam Jafar Sadegh (P.U.H).

Noamadism Affairs Department of Rafsanjan considers Khorasani Tribe to consist of Najmi, Mohammadi, Khodabakhshi, Jaheiri and Yaghoubi ethnic groups and believes that it includes 700 families. It gives Eshaghabad, Dochahi and Najafabad as their places of residence.

Raeini Tribe

Raeini Tribe is from Raein, 132 km from Rafsanjan. It moved to Choopar area because of a ravaging flood and destruction of Raein and subsequently came to stay in Rafsanjan. They speak Farsi.

Ataollahi Tribe:

“Geography of Kerman” by the late Vaziri (2nd edition, P.157) gives the following account about Ataollahi Tribe: “Another prominent tribe of the district is Ataollahi. This tribe stays in Rafsanjan and Shahr Babak and its members have a firm belief toward Esmaeili Sadat (the descendants of Esmaeil, a holy Character).

Al-e-Saedi Tribe

This tribe moved to Pariz from Dehbid in Fars province. Its summering resorts are Sarkouh and Sarcheshmeh and its wintering resorts are Ghanat Chenr, Pariz and Dorahi.

Many members of the aforesaid tribes have emigrated to Rafsanjan and/or have chosen to work in Sarcheshmeh Copper Mines.

5.4.3. Economic Status

A survey of economic activities in the wider Rafsanjan area shall reveal that the present status is to a great extent a function of the economic developments of recent years.

A survey of total employment in major economic and social sectors in the wider Rafsanjan area indicates a population of 500,000 in 1996 and the distribution percentages of active and employed population in major sectors (agriculture, industry and service) were 16%, 30% and 54% respectively (see following figure).

The unemployment in the province of Kerman amounts to 12% with approx. 2,000,000 inhabitants and a share of approx. 33% workforce. Rafsanjan city has only an unemployment of 10.5% due to some industries and service companies. This spread to the rural land around the city is big.
A survey of the employment shares of major economic sectors in Rafsanjan area and comparison of the same with corresponding percentages on a nationwide basis for the year 1990 shall reveal that Rafsanjan area has a lower employment share in agricultural sector and this is not far from expectation considering the limited surface area of proper agricultural lands and shortage of water the shares of other economic sectors of this area (industry, mining, service) are almost the same as the general status of the country. A survey of the configuration of industrial employment shall indicate that a considerable share of employment belongs to mining sector. Employment in service sector mainly consists of public and social services (such as administrative jobs and treatment & education) and the area has not taken optimal use of its own capacity for providing commodity transit services. However, the recent initiative of Kerman Development Company brought service sector to the direction for an improvement. Some further steps are needed for the improvement of the industrial and mineral employment in this township and establishment of Ahmad Abad Aluminium plant is among such steps.

### 5.4.4. Industry

Greatest number of industrial units is foodstuff and medications group and the other industrial group such as cellulose and printing materials, textiles, leather, and non-metallic minerals industries. There are some other industrial units in Ahmad Abad Town among which is electrode fabrication company. The Ahmad Abad industrial town covers a surface area of 500 ha and is located at 35 km from the Rafsanjan.

### 5.4.5. Agriculture

The district is dominated by a special climatic diversity considering its geographic situation. Such conditions provides for the growth of sub-tropical, temperate Zone and desert plants, though there isn’t a considerable surface area of cultivable lands for agricultural and horticultural products and Rafsanjan area is not considered an agricultural area.

However, some desert plants grow in the study area and pistachio orchards surround the town. Yearly product is about 20,000 pounds. Wheat, barley, alfalfa, beans etc. are growing in Rafsanjan area and are considered as major products of this area. The greatest cultivated area is that of cotton (10,000 ha) and Rafsanjan area is among the major producers of cotton. Sugar-beets would be considered as a major products about 15 years ago when there stood Bardsir Sugar processing company. However major part of the lands have been converted to pistachio orchards and the surface area of sugar-beet farms is 3 ha only. Barley and lush feed are planted on a surface area of 6,000 ha.
Pistachio is the most important permanent product. Almonds rank the second from the viewpoint of importance. There is an accelerated trend of development of pistachio orchards in Rafsanjan area. It is gradually replacing all other agricultural products. Agriculture and animal-husbandry are the most important sources of maintenance for the villagers and tribes living in Rafsanjan area.

Unemployment rate of rural population was 16.5% as the detailed statistics indicated in 1996. The township enjoys a better status from the viewpoint of unemployment rate as compared to the nationwide unemployment (9.4% as a mean).

5.4.6. Mines

The existence of mineral deposits in Kerman province has provided for this province to rank first in this respect on a national basis. This province is considered as the richest province with its copper, coal, lead, zinc, ironstone, chromate, refractory materials, manganese and titan mines and also the quarries of decorative stones and the stones used on building views. Mineral exploitation products have a yearly volume of 12.000.000 t.

The geological status and the outcrops of different periods are in a way that almost all lithologic units of geological periods have their outcrops in Kerman province. The capacity and potentials for the increase of exploitation power are extremely high considering different mineral reserves and number of mines in Kerman province. There is urgent necessity for planning and investment in this sector in order to maintain local needs and to develop export sale of processed minerals.

Although the number of mines in Kerman province forms only 4.68% of that of the whole country, their status and situation provides for the production of ¼ of mineral products of the country by these mines. Mining activities in Kerman province have attracted over 20.000 people to this sector. Department of Mining activities shall have a positive effect on the creation of employment in the district. Development of mining sector in Kerman province and consequently in Rafsanjan area shall help the related industries develop considering the district standing at a short distance from the roads and free zones, the availability of electrical energy and fuel resources and man power.

The series of geological development in Rafsanjan area has resulted in the existence of deposits of decorative stones and the stones for building views including thick layers of crystallized lime and chinastone in the outcrops of Rafsanjan belt. This tectonic belt has northwest-southeast course.

5.4.7. Tourism

Tourism and touring have mutual and complementary relations with development and environment, i.e. the development of tourism and touring shall entail economic outputs and social welfare. On the other hand, a major pre-requisite to the development of tourism is a healthy and sound environment. Therefore no development of tourism shall take place without the aforesaid requirement having been satisfied.

There is no accurate data on the number of visitors for this area. The frequency of touring and travel is a function of different variables such as seasons, holidays and commercial and administrative occasions. It should be noted that the acceleration in development shall not bring Ahmad Abad township to the status comparable to the areas such as Kerman and this is because of the presence of historical and cultural values and monuments in Kerman taking attention to the point that all antiquities, monuments etc are located beyond the limits of Ahmad Abad industrial area.
Some of the major examples are given below:

**Aba Abad Icy Home**

This monument is located at 6 km from Rafsanjan and is considered to be the work of Haj Agha Ali Rafsanjani the founder of Haj Agha Ali Complex

**Mir Zobeir**

Mir Zobeir is a historical monument on the top of a hill beside Sharifabad Aqueduct, Ghahestan, Rafsanjan. It seems to be a pre-Islamic temple. However it was rehabilitated during the reigning period of “Mohammad Mozaffar” and it would be used as a mosque. Despite the fact that the ceiling has been torn down long ago, the altar, plasterworks and the epigraphic writings from the Holy Quran are there and display the climax of Islamic architecture about 13\(^{th}\) century.

**Emamzadeh Ali**

This tomb is located at 9 km southeast of Rafsanjan beside Ghala Sang Castle. It is the tomb of a holy character (Emamzadeh Ali).

**Rafsanjan Central Mosque**

Rafsanjan Central Mosque stands opposite to Rafsanjan marketplace.

### 5.4.8. Infrastructure

**Transportation Facilities**

Rafsanjan enjoys a prominent status from the viewpoint of transportation facilities in Kerman Province and on a national basis. This township is located on an important road (Tehran-Bandar Abbas) and major part of the released and/or export commodities passes this township on its way to and from two main ports (Shahid Rajae and Shahid Bahonar Piers). Furthermore, Rafsanjan is the main point to connect the provincial center (Kerman City) with southern coasts. Rafsanjan has the greatest concentration of transit roads.

Establishment of Teheran-Bandar Abbas Railway since about 10 years ago has been added to the facilities for commercial service and activity. Rafsanjan Railway station on Teheran-Bandar Abbas Railway provides the connection of Rafsanjan to this effective transportation network and it was among the main factors in selection of Ahmad Abad for the establishment of this industrial town.

The establishment and operation of Rafsanjan Airport was a further facilitation of specialist forces to this area in line with the requirement that arise in medical, industrial and developmental fields and also a facilitation of investment by tradesmen.

**Energy Establishments**

Rafsanjan plain has the availability to both forms of environment-friendly energy by power- and natural gas transmission lines. There is an operating power plant at Kerman that will increase the capacity in the form of a combined-cycle power plant from 1.270 MW up to 2.000 MW in 2008. Major 400 kV transmission lines for electricity are under construction connecting Kerman and Yazd.

Ahmad Abad industrial town is already connected to the electricity network as well as it will be directly connected to the natural gas network by October 2005.
5.5. Development Activities

Ahmad Abad Industrial town, Kaboutarkhan Dam, Sarcheshmeh copper mines and Sirjan special economic zone are the major industrial and development projects in this district. Except for the last one, the other projects have already been described and therefore an account about Sirjan special economic zone shall be given here.

Sirjan Special economic zone has been established on a surface area of 1400 ha on the west to railway station and at 6 Km from Sirjan town. The special zone was designed by Geno consultant Engineers Company in 1992 and the design was modified by free zones consultant engineers in 1993. The zone consists of 6 main sections with each section having a certain function in the zone the sections have their own subdivisions:

- Commodity warehousing section, including docks and related administrative and service facilities.
- Industrial workshops section, including industries plans and related administrative and service facilities.
- Commercial section, including service, administrative and back-up facilities.
- Welfare section, including commercial service centers, fairs and exhibitions unit, and administrative and service facilities.
- Tourist section, including entertainment and temporary stay facilities (hotels, guest-houses etc), accommodation village and industrial park.
- Back-up section, including administrative units, governmental agencies such as customs division, commercial units, industrial affairs division, ports & Shipping affairs and dwelling community of Sirjan Special Economic zone.

Each industrial and commercial section has been designed on an independent basis and each section has its own service, industrial and commercial facilities.
6. ENVIRONMENTAL IMPACTS AND MITIGATION

6.1. Soil Quality

6.1.1. Ahmad Abad surrounding area

The soils beyond the limits of the site (under the direct effects of the project) could be affected by the operating phase in the following manner:
- The transmission of gaseous pollutants of Ahmad Abad Aluminium plant to the lands around the plant in the form of acid rain.
- Discharge of industrial wastes from the plant on the surrounding areas. Considering the following elements, no such consequences can be expected in the study area.

Apart from the strict environment protection plan of the plant and the specifications of the equipment provided for the project that would minimize emission of the gases taking role in the creation of acid rains (HF, CO₂, SO₂), the basic atmospheric conditions such as regularly rainfall are not significant in the area.

No soil pollution is expected considering the provisions made for physical and chemical purification of the sewage from the plant and the plans developed by the management of the plant for the reuse of purified water in different areas.

6.1.2. Ahmad Abad Industrial Zone

The lands on which the Ahmad Abad Aluminium Plant stands have been approved to have an industrial operation and hence the construction phase of the plant shall have no effect on the type of use of the lands. However, it seems that the demand for the conversion of the operation of marginal lands of the site in order to establish dwelling communities and for the creation of aluminium related industries (rolling mills) shall increase upon commencement of operation of the plant, and it can affect the agricultural operation of the lands in the nearby villages and result in destruction of such lands in case no preventive measures are taken.

The coordination needed has been made for the provision of dwelling for the staff members of the project under the plans devised by the related authorities such as housing organization and housing foundation of Kerman Province and this is part of the measures to prevent the adverse effects of the project as for the change of type of operation in respect of the lands and resulting from the demand for the creation of aluminium related industries, the adverse effects may be prevented considering the existence of Ahmad Abad Industrial town and the availability of many unclaimed land plots in the other areas of the township specially with the efforts that the provincial organization of industries and environment protection Organization of Kerman province make in this regard.

One of the aspects questioned in respect of operation phase of this project is the probable effect on the adjacent facilities and establishments from the air pollution created by Ahmad Abad Aluminium Plant. The points questioned in this respect are Rafsanjan Airport on the southwest, Ahmad Abad town on the west with its agricultural lands and the site itself on the north and northeast of the plant.
First it should be noted that the downstream facilities shall in no way be affected by the pollutions from the plant considering the 20 and 40 meter chimneys of the plant. But, the probability for the transmission of the dust and gas from the plant to some facilities (specially from alumina and aluminium fluoride silos) can not be negated.

Considering that alumina and aluminium fluoride shall be used in Ahmad Abad aluminium plant and the aforesaid materials shall be kept in closed silos equipped with air purification systems, the dust and gas shall be removed. Therefore a pollutant origin of dust and gas such as currently observed in IRALCO (Iranian Aluminium company in Arak), shall be absent and this shall be of a great help in the prevention of such effects on the adjacent facilities.

The probability for the occurrence of the aforesaid effect on the site of airport and on the agricultural lands of the villages in this area is to be contemplated. Environment management of the project has given proper approaches to this case.

6.1.3. Impact Assessment

As stated under the descriptions of the environment in the district, the soil in the area is among class 5 agricultural soils that are considered as low quality agricultural soils. The soils with their higher erodibility potentials have been stabilized and prepared for the establishment of industries by industrial town authority (before the issue of establishment of Ahmad Abad Aluminium plant was put forth). Therefore, the establishment of Aluminium plant shall have no adverse effect on the profile of the soil as already developed land.

On the other hand, no adverse effect shall be made on the morphology and the relative stability of the soil considering the flatness of the site. Absence of operations such as trench excavation and also the absence of soil-lifting and earth filling. Neither shall the project have an adverse effect on geological structure of the district such as inductive and chemical seism genesis considering the nature of construction operations.

The Ahmad Abad Aluminium Smelter will generate industrial and municipal wastes considering the nature of industry (see chapter waste generation). This wastes will be disposed according to the regulations of DOE Kerman. Hence no pollution of land around the plant will be expected.

The negative impacts on soil are assessed to be of low significance.

6.1.4. Mitigation

Mitigation will be generally made with further reduction of emissions and waste.

- The land quality has to be monitored before and according to the Smelter operation and pollution measurements.
- The plants growing on soils around the Smelter – in an distance of approx. 20 km – have to be monitored before and also according to the Smelter operation and pollution measurements.
- The operation manuals of the Smelter in regard of avoiding emissions have to be implemented and permanently followed by the operating personnel in order not to allow additional emissions.
- All possible emission reduction measures have to be taken into consideration in order to safe the quality of the land if any relation can be proved by the above mentioned monitoring.
6.2. Air Quality and Emissions

Among the important issues in environmental assessment of development projects are the estimation of quantity and quality of the atmospheric emissions created by a project and the scope of propagation of the emissions in vulnerable environments such as towns or wildlife areas. Considerable improvements have fortunately occurred in this field during the recent years and mathematical models have provided the possibility for the calculation and estimation of the concentration of industrial emissions in vulnerable areas, while giving transparent statements on the scope of effects so that more reasonable decisions may be taken for the execution of the project, avoidance from such a project, or decision of effective measures.

The AP33 technology is among all other available technologies for Aluminium Smelters considered to be the Best Practicable Environmental Option. This has been confirmed by the World Bank 1998. This was one of the reasons to choose AP33 technology for the Ahmad Abad Aluminium Smelter project.

Aluminium Smelter with AP33 technology are designed with the following best measures to avoid or reduce negative environmental impacts:
- Smelting with pre-baked anodes instead of Söderberg technology.
- All pots are closed by hoods and will be opened only minimal while operation.
- High efficiency of collecting the exhaust gas.
- Cleaning of pot gases with particle removal and re-processing of the Fluor contents by enriching alumina.
- Automatic control of whole operation process in order to find optimal conditions (e.g. bath composition, alumina feeding routines, alumina enrichment, reduction of number and duration of anode effects, etc.).
- Alumina will be effectively point fed to the pot.
- Permanent improvement of the technology.

6.2.1. Identification of emission sources and emission quality

The construction phase is in principle without any procedural emissions and the only significant emissions from this phase are dust emissions generated by earthworks and the sewage with human origin that has been estimated to be about 120 cubic meters a day. It was determined that septic tanks should be used before operating phase is begun and finally the output would be used as natural fertilizer green areas respectively upgrading of poor soils – according to the future directions given by the DOE Kerman.

The dust emissions mainly occur while earthworks take place, especially in the beginning of the construction phase. This dust is generated by the removed soil and does not content any hazardous elements. Therefore this source of pollutants can be neglected.

The main issue of pollution is concerned with operation phase and the origins and their quantities and nature shall be described herein below. Reduction unit (potline) and gas treatment center are the main direct sources of emission of air pollutants in this project. Although the equipment complies with European standards of the day, it is essential to initially ensure the observance of fresh air standards in the towns neighboring the site in the operation phase of this project.
The emissions created in this process are atmospheric emission among which the most important elements are fluorides, dust (particulate) and sulfur dioxide. Other emissions to the atmosphere are carbon monoxides (CO), carbon dioxides (CO$_2$), polycyclic aromatic hydrocarbons (PAH) and per-fluorocarbons (PFC).

The main concerns are toxicity of emissions with risk for human health, animals and plants and the effect on global warming. The main toxic emissions are fluorides and the main emissions supporting global warming are CO$_2$ and PFC. Another negative effect on the natural environment could be the generation of acid rain mainly through fluorides and SO$_2$ emission, but this can be neglected due to the weather conditions in Ahmad Abad area (please see chapter “Water Use and Quality”).

Beside the emissions generated in the reduction unit, dust is created during the treatment, reservation and transportation of raw materials, especially alumina and carbon from baked anodes. Dust from alumina can be created in the alumina material handling systems, in the potline and in the rodding shop while anode rod cleaning and residues pressing. Dust from baked anodes mainly occurs in the rodding shop. The dust will be reduced by dedusting systems. The dust from alumina in high volumes is slightly toxic and can cause human and animal health problems. Therefore the pots and the material handling systems are covered and equipped with gas treatment and dedusting systems. Alumina can not be emitted in endangering volumes in this plant.

**Potline emissions**

The most important pot gas pollutants are fluorides including hydrogen fluoride (HF), solid fluoride, SO$_2$ and dust.

The gas generated in the hooded pots will be collected and fed via the main duct system to the gas treatment center. There a dry scrubbing system ensures the removal of fluorides and dust by enriching fresh alumina with these pollutants.

After such an interaction, the enriched alumina and gas are taken to bag filters. Gas and solid material are separated in the bag filter through a filtration and deposition process and the treated gas is taken to the ambient air through the chimney. Part of the enriched alumina, collected from dusters, shall continuously take part in absorption reaction and the remaining part is taken to enriched alumina silo to take part in reduction process. The amount of pollutants introduced to the environment after treatment process can be seen in the table below.

The main atmospheric emission of fluorides are generated while opening the hoods of the pots for maintenance. The gases are passing the roof vents of the reduction hall into the environment. The concentration of fluorides and dust in this output gas can be seen in the table below.

**Figure 18** Emissions identification for potline

<table>
<thead>
<tr>
<th>Origin</th>
<th>Emission</th>
<th>Volume</th>
<th>Chimney height</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potline exhaust gas</td>
<td>Fluoride</td>
<td>&lt; 2.0 mg/m³</td>
<td>80</td>
</tr>
<tr>
<td></td>
<td>Dust</td>
<td>&lt; 5.0 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Roof vents of reduction hall</td>
<td>Fluoride</td>
<td>&lt; 5.1 kg/h</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dust</td>
<td>&lt; 3.8 kg/h</td>
<td></td>
</tr>
</tbody>
</table>

The emission quantified here and in the following text have to be understood as maximum emissions as a worst case scenario.
6.2.2. Emission limits in Iran

This design is based on the convention for environment protection in construction projects and the technical convention for environment protection in non-ferrous metals industry (YSJ 017-92).

This project considers emission standard for atmospheric pollutants from industrial ovens and kilns (GB 9078 – 1990), the total emission standard of atmospheric pollutants (GB 16297 – 1996), and the emission standard for atmospheric pollutants from pots (GB 13271 – 2001).

**Figure 19** Emission standard for atmosphere pollutants (mg/m³)

<table>
<thead>
<tr>
<th>Standard Emission</th>
<th>Origin</th>
<th>Emission Rate</th>
<th>Emission Rate</th>
<th>Emission Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atmospheric pollutants from industrial ovens and kilns</td>
<td>Pots</td>
<td>100 mg/m³</td>
<td>6 mg/m³</td>
<td>850 mg/m³</td>
</tr>
<tr>
<td>Atmospheric pollutants from pots</td>
<td>Pot gas</td>
<td>50 mg/m³</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>General emission of atmospheric pollutants</td>
<td>Others</td>
<td>120 mg/m³</td>
<td>9 mg/m³</td>
<td>-</td>
</tr>
</tbody>
</table>

Beside the above mentioned general standards for non-ferrous metal industry the Iranian environmental regulations are giving precise emission limits for “Aluminium Smelter Factory”. These limits and the expected emission from the stack and the roof vents are shown in the table below.

**Figure 20** Iranian standards for maximal concentrations of fluorides & expected emission

<table>
<thead>
<tr>
<th>Maximum Emission from total plant</th>
<th>Gas standard 1 – new factories</th>
<th>Gas standard 2 – with permission</th>
</tr>
</thead>
<tbody>
<tr>
<td>HF</td>
<td>3,8 µg/m³</td>
<td>5,2 µg/m³</td>
</tr>
</tbody>
</table>

The sum of emission from the stack and the roof vents are still smaller than the tougher gas standard 1 – for new factories without an environmental permission. The Ahmad Abad Aluminium Smelter already got an environmental permission and therefore the expected emissions of fluorides are far below the Iranian Standards. Hence it has to be stated that the emission from the Ahmad Abad Aluminium Smelter are complying safely the Iranian standards.

6.2.3. Emissions Concentrations

For determining the volume and significance of impacts through pollutants the concentration of atmospheric emissions on selected places in the environment shall be determined. The concentrations of the main pollutants HF and SO₂ will be calculated by a dispersion model.

Basis for the dispersion model are meteorological data of the Rafsanjan plain recorded since 1999 by the Iran Meteorological Organization (IRIMO) in Kerman. IRIMO also confirmed the data for Ahmad Abad and that no significant abnormal atmospheric conditions occurred in the region.

Beside natural dust appearance due to the desert character of the plain, no other industrial sources for emissions of high volume or negative effect could be found in the closer surrounding of Ahmad Abad Industrial Zone – as already stated before.
The air quality calculations have been carried out using the Screening Air Dispersion Model SCREEN 3. This model was developed to obtain pollutant concentration estimates. These estimates are based on the document “Screening procedures for estimating the Air Quality Impact of stationary Sources” (EPA 1995).

The main features of this model are:

- estimation of maximum ground-level concentrations and the distance to the maximum
- calculation of the maximum concentration at any number of user-specified distances in flat or elevated simple terrain, including distances out to 100 km for long-range transport
- examination of full range of meteorological conditions, including all stability classes and wind speeds to find maximum impacts
- consideration of the effects of buoyancy-included dispersion

A measurement of a wide range of monitoring points would mean very high logistical efforts and will not be economical. In order to reach comparable results the calculation has been made for pre-selected sites. This sites were chosen in all directions around the Smelter area and represent the closest residents areas as well as areas of a certain expected relatively higher impact than other sites. All calculations have been made under the premise of finding the maximum negative impact.

Therefore following places have been chosen for the dispersion model:

**Ahmad Abad township** 4,9 km south-east of the center of the Smelter area, passed through by the highway between Rafsanjan and Anar. It is the closest residential area and also the border for agricultural use of the land. Beyond the line of the highway the pistachio farm lands start – in distance of approx. 2 km from Ahmad Abad.

**Kashku’iyeh township** 7,8 km north-north-east of the center of the Smelter area. It is a growing residential area with pistachio farm behind the town.

**Hum-od-Din township** 20,9 km south-west of the center of the Smelter area. It is the closest town in this direction, a very small town located in the mountains above the Ahmad Abad Industrial Area.

**Rafsanjan city** 38,0 km east of the center of the Smelter area. It is the next city and the outskirts are reached in a distance of around 35 km. Rafsanjan has an airport and several small and medium size industrial enterprises.

**Bahreman township** 49,3 km north of the center of the Smelter area. It is a significant town in the main wind direction, therefore it has been chosen for the dispersion model.

**Kabutarkhan township** 75,1 km east of the Smelter area. There is only one natural reserve area relatively close to the Aluminium Smelter. This protection zone is located east and south-east of the Kabutarkhan township, therefore it has been chosen for the study.
The wind directions in the Rafsanjan plain are characterized through a high steadiness, therefore the concentration calculations between 3 hour maximum, 24 hour maximum and annual do not differ so much – as e.g. for other Aluminium Smelter erected in the coastline close to the sea.

6.2.4. Impact Assessment

Impacts from HF emission
The potential impacts of HF emission are higher on vegetation than on humans or animals. Comparable guidelines with fluoride limits are not common and can only be found in some countries. The strict New Zealand guideline pertain to plant and soil impacts.

The Californian EPA chronic Reference Exposure Level (REL) for annual hydrogen fluoride and fluoride particulate concentrations is 30 µg/m³. The REL pertains human health and is therefore the second indicator in this study for impacts from HF emissions.

The WHO guideline for fluorides in air is 1 µg/m³ as an annual average. It pertains livestock impacts from the consumption of plants.

The table “Expected concentrations of HF at key sites around the Aluminium Smelter” compared with the limits for emission of hydrogen fluoride in New Zealand as well as with the EPA and WHO standards shows that the expected concentration is far below the standards and therefore it has to be assessed that negative impacts from HF emissions are of low significance.
Impacts from SO$_2$ emission

The impacts of SO$_2$ emission are on human and animal health, vegetation, odors and acid rain. The acute or chronic dose response levels for SO$_2$ are defined by several institutions as follows:

**Figure 24**  Acute or chronic dose response levels for SO$_2$

<table>
<thead>
<tr>
<th></th>
<th>WHO – annual average</th>
<th>WHO – 24 hour standard</th>
<th>EPA – 1 hour standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>SO$_2$</td>
<td>50 µg/m$^3$</td>
<td>125 µg/m$^3$</td>
<td>660 µg/m$^3$</td>
</tr>
</tbody>
</table>

The standards mostly are based on studies conducted on humans with the health endpoint of “exacerbations of respiratory symptoms in sensitive individuals”. The WHO standards have both an uncertainty factor of 2 and therefore a high degree of confidence is associated with it.

**Figure 25**  Iranian standards for maximal concentrations of SO$_2$

<table>
<thead>
<tr>
<th></th>
<th>Yearly average</th>
<th>Max. concentration in 24 h</th>
<th>Max. concentration in 3 h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health Standard</td>
<td>80 µg/m$^3$</td>
<td>365 µg/m$^3$</td>
<td></td>
</tr>
<tr>
<td>Welfare Standard</td>
<td>60 µg/m$^3$</td>
<td>260 µg/m$^3$</td>
<td>13,000 µg/m$^3$</td>
</tr>
</tbody>
</table>

The highest concentration emitted from the Ahmad Abad Aluminium Smelter shown in the table above (7.69 µg/m$^3$ - Ahmad Abad town) is more than six times smaller than the hazardous quotients for acute or chronic health effects of the WHO and the Iranian welfare standard. Therefore the expected negative impact from SO$_2$ emission on the health of human individual or animals is of low significance.

Odor from SO$_2$ can be realized in concentrations from 800 µg/m$^3$. This limit is far above the expected concentrations from the Smelter emissions. Therefore this impact is negligible.

Acid rain is discussed under chapter “Surface Water, Drainage and Rainfall” and it is negligible.

Impacts from particles emission

The main potential impacts of particles are directly via respiration or indirectly via food, etc. on human health, but there are no WHO guidelines for particulate matter. Therefore the EPA guidelines has been taken for particulate matters with a mean aerodynamic diameter of 10 µm or less (PM$_{10}$) and with 2.5 µm or less (PM$_{2.5}$).

**Figure 26**  Guidelines for particulate matter

<table>
<thead>
<tr>
<th></th>
<th>US EPA – 3 year average</th>
<th>US EPA – 24 hour average</th>
<th>South Africa – annual average</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM$_{10}$</td>
<td>50 µg/m$^3$</td>
<td>150 µg/m$^3$</td>
<td>60 µg/m$^3$</td>
</tr>
<tr>
<td>PM$_{2.5}$</td>
<td>15 µg/m$^3$</td>
<td>65 µg/m$^3$</td>
<td>-</td>
</tr>
</tbody>
</table>

The total particulate matter emitted by the Aluminium Smelter will not exceed 5.5 µg/m$^3$. This is far below the above mentioned limits and therefore this negative impact is assessed to be of low significance.
Impacts from greenhouse gas emission

The Greenhouse Gases (GHG) emitted during the operation of the potline are Polyfluorocarbons and Carbon Dioxide. The GHG are contributing to global warming and climate change.

Two Polyfluorocarbons (PFC) compounds are produced during the electrolysis process by the so-called Anode Effect (AE) due to a decreased concentration of dissolved alumina in the bath: Tetrafluoromethane (CF₄) and Hexafluoroethane (C₂F₆).

These two compounds are potent greenhouse gases that are very stable in the atmosphere. The equivalent greenhouse Gas Warming Potential (GWP) per tonne of CF₄ and C₂F₆ are 6.500 and 9.200 times that of one tonne of CO₂, respectively, considered over a warming period of 100 years.

The PFC emission varies according to the aluminium production technology used. As the Ahmad Abad Aluminium Smelter will apply the AP33 Technology with point feeding system and computerised anode effect suppression system reducing the anode effect duration, the amount of PFCs released to the atmosphere will be as low as in no other Aluminium Smelter worldwide at the time being:

PFCs ? 106.600 tons/y

Carbon Dioxide (CO₂) is produced during the electrolysis process as a product of the chemical reaction between the carbon anode and alumina. The amount of CO₂ released to the atmosphere by this reaction is

CO₂ ? 248.000 t/y

In sum the Aluminium Smelter will emit 354.600 t/y of CO₂ and equivalents (CF₄ and C₂F₆).

Considering an overall power consumption of 2.254 GWh for the total Aluminium Smelter the indirect emission due to this consumption amounts to:

CO₂ from energy generation ? 473.400 t/y

Hence the total of direct and indirect CO₂ emissions amount to 828.000 t/y.

In 2002 Iran produced approx. 360,2 Mio. t of CO₂ [source: CDIAC – UN Common Database]. Taking the total direct and indirect amount of CO₂ emissions into consideration, Iran’s total CO₂ emission will be increase by 0,23 % by the Ahmad Abad Aluminium Smelter operation.

The contribution of the Ahmad Abad Aluminium Smelter to the Iranian CO₂ emission is relatively small and therefore the negative impact is of low significance.

Impacts from carbon monoxide emission

The volume of carbon monoxide (CO) emitted to the environment is negligible small due to the fact that CO very fast oxidized in the pots. The negative impact of CO therefore is of low significance.

Impacts from nitrogen oxides emission

Nitrogen oxides (NOₓ) are only generated by the diesel engines of the railway. The Aluminium Smelter does not operate with oil but only with natural gas and the amount of NOₓ emitted to the environment is negligible.
Impacts on Animals

The concentration of pollutants are described in the articles before. It was shown that there are no major negative impacts on human health to be expected due to the small emission concentrations. The areas close to the Ahmad Abad Aluminium Smelter are not used for livestock and endangered species could not be found in this area as well. Therefore it has to checked whether the areas of endangered species show a significant concentration of pollutants. The closest area with endangered species is located at the town of Kabutarkhan. The concentration of fluorides and SO\textsubscript{2} expected there is very small.

For animal life the same standards as for human health may take place. Therefore a negative impact on animal life is of low significance.

Vegetation has to be appraised differently. The main vegetation in a circle of 30 km around the Aluminium Smelter are pistachio bushes and the poor indigenous vegetation – endangered species could not be identified in the Rafsanjan region.

Impacts on Vegetation

The main vegetation in the area close to the Ahmad Abad Industrial Zone are pistachio bushes. The indigenous vegetation is very poor and no endangered plants could be identified there. This leads to the focus on pistachio bushes in this assessment.

The main impacts on vegetation may be caused by SO\textsubscript{2} and fluorides. Plants generally have a high sulfur demand for protein synthesis. There are no experiences known about the accumulation of sulfur by pistachio bushes. Therefore a guideline presented as a proposal of the European Commission will be taken to consider whether the SO\textsubscript{2} concentration is endangering the pistachio bushes. The limit value of SO\textsubscript{2} for the protection of ecosystems calendar year amounts to 20 µg/m\textsuperscript{3}. Other sources have higher limit values. The pistachio cultivation starts behind Kashku’iyeh, where an annual concentration of 3,81 µg/m\textsuperscript{3} or an 3 hours concentration of 7,46 µg/m\textsuperscript{3} has to be expected. Both concentrations are far below the limit value.

Atmospheric fluorides will be accumulated by the leaves of plants. Different from human or animal health plants are sensitive for atmospheric fluorides. There is no specification known about the impact of fluorides on pistachio bushes. Therefore three different international examples of different limit values for fluorides are shown in the table below.

<table>
<thead>
<tr>
<th>Time Period</th>
<th>Fluoride concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Federal Republic of Germany</td>
<td>Yearly average</td>
</tr>
<tr>
<td>The Netherlands</td>
<td>Monthly average</td>
</tr>
<tr>
<td>US Aluminium Association</td>
<td>Growing season</td>
</tr>
</tbody>
</table>

The concentration in a 3 hours maximum in Kashku’iyeh amounts to 0,2 µg/m\textsuperscript{3} and annually to 0,113 µg/m\textsuperscript{3}. This is still under the above mentioned limit value. For the growing seasons the expected concentrations are not far away from the limit value. Therefore the fluoride concentration shall be measured during the growing seasons of the pistachio bushes and the pistachio bushes development has to be monitored.
Anyhow the average limit values are much higher than the expected concentration therefore the negative impact will assessed to be of low significance.

Impacts on Cultural Heritages

Sensitive cultural heritages could be negatively effected mainly by acid rain. The probability for the occurrence of such phenomena is extremely little considering the climate including low precipitation, little relative humidity and in relation minimal diffusion of carbon dioxide and sulfur dioxide.

Beside this the next sensitive heritage is located at the town of Mimand in a distance of 55 km. Due to this distance there are no negative impacts on cultural heritages expected through emission of pollutants.

6.2.5. Mitigation

The most important mitigation measure to avoid pollution of the air is a proper operation and handling of the equipment in the Aluminium Smelter. the general measures should be considered:

- the hoods of the pots have to be closed and shall only be removed if absolutely necessary as well the function and maintenance of the hoods have to be controlled permanently – e.g. the proper working sealing and check for damages;
- the potline shall be operated in a way to reduce anode effects to a minimum in order to avoid PFC emissions and opening of the hoods;
- the proper function of the gas treatment center has to be checked permanently in order to guarantee the efficient abatement of fluorides in the exhaust gas;
- the emissions have to be monitored regularly with internationally accepted calculation methods, measuring routines have to be established and controlled (for measuring outside the plant please see chapter Environmental Management Plan);
- maintenance and service on equipment has to be done in defined routines and personnel shall be trained well for it;
- the dedusting equipment and the filter systems for all facilities have to be checked regularly on efficiency;
- plants development especially pistachio bushes has to be monitored in order to see any changes due to the Smelter operation, studies should be prepared about the impact of fluoride concentration on pistachio bushes.
6.3. Water Use and Quality

6.3.1. Underground water:

One of the major restrictions to the development in central part of Iran is the shortage of water. Rafsanjan plain is among the central plains suffering from shortage of water. According to the detailed studies carried out by Jamea Iran Consultant Engineers, water balance of the underground water Figure in Rafsanjan plain was negative in 1996-1997 and it had been subject to an overuse by 8,000,000 m$^3$. Another report about the effects of development on the environment in Kerman Province has been calculated the value given for such an overuse to be 36.87 million m$^3$. Anyway, both studies have confirmed that underground water level has dropped by 50 cm.

Fortunately Kaboutarkhan dam on Kaboutarkhan river (eastern altitudes of the district) was completed in line with the preventive measures taken by Kerman Regional water Organization in 2001. The dam was constructed with the aim of reservation of a yearly volume of 18,000,000 m$^3$ of the water flowing away from Rafsanjan plain onto salt desert.

Over 70% of the potable water and a small portion of irrigation water have been planned to be taken from the dam. Full operation of the dam shall result in a saving of 14,000,000 m$^3$ because of the shifting from underground resources to the dam in provision of potable water needed by the population in Rafsanjan. Part of such feed capacity may be used in restoration of underground water and part of it can be used in the industrial development requirements such as green space needed as a result of the establishment of the Aluminium Smelter.

6.3.2. Surface Water, Drainage and Rainfall

All surface water currents and resources have their origins upstream the Smelter from the viewpoint of elevation and they are far from the probable effects resulting from industrial wastes of the project. As for lower elevations also no effect are to be expected because of the big distance between Smelter and such resources (minimum 10 km). Kaboutarkhan Dam that was constructed on the only permanent river of this township, is 46 km from Ahmad Abad Aluminium Smelter and the site is beyond the catchment area of the dam considering the related elevation level.

One of the common features of pollution of soil, water and air is acid rain. The probability for the occurrence of such phenomena is extremely little considering the climate including low precipitation, little relative humidity and in relation minimal diffusion of carbon dioxide and sulfur dioxide.

No direct effect on drainage status of the area is expected considering the fact that the lands for the establishment of the Smelter have an optimal status from the viewpoint of drainage. However a floodwater canal has to be constructed to protect the plant site from heavy rain water coming from the nearby mountain. Therefore erosion may be caused at the exit area of this canal. This has to be considered. But it has no deep importance considering the limited scope of effect.
6.3.3. Sewage Water

The only sewage water appears from used water of the sanitary facilities of the Smelter. Industrial sewage water will not be generated. The sewage water system of the Aluminum Smelter will be connected to the Ahmad Abad Industrial Zone waste water system. This system will include an active sludge treatment.

The total sewage disposal standard (GB 8978-1996) will be implemented.

![Figure 28](Highest permitted concentrations in sewage water)

<table>
<thead>
<tr>
<th>PH</th>
<th>SS</th>
<th>BOD5</th>
<th>COD</th>
<th>Oil Products</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 – 9</td>
<td>200 mg/l</td>
<td>60 mg/l</td>
<td>150 mg/l</td>
<td>10 mg/l</td>
</tr>
</tbody>
</table>

6.3.4. Impact Assessment

Whereas there is no industrial waste water in the Aluminium Smelter and the sewage water will be from normal human origin, treated according to the Iranian sewage disposal standard, no negative impact of the waste or sewage water can be expected.

Taking use of underground water resources shall not aggravate the overuse conditions and does not take a role in the quality drop of underground water.

No adverse effect on the quality of underground water shall take place considering the deep water figure and clay contents of the soil.

Due to the operation of Kaboutarkhan Dam the adverse effects of the project on underground resources has, to some extent, been decreased to a minimum.

Therefore it can only be stated a low significance of negative impacts onto the water situation.

6.3.5. Mitigation

Generally the reduction of emissions to the air that might to very small extent cause acid rain will be a mitigation measure.

The water use of the employees in the Smelter area shall be reduced by special measures such as flow reducers in the toilets and cocks.

The outflow of the floodwater canal has to be designed not to cause any erosion.
6.4. Flora and Fauna

6.4.1. Flora

There are no endangered plant species found in the Rafsanjan area. The general vegetation is very poor and consequently is the potential of negative impact very small.

The only plant that has been cultivated in this region is pistachio. The effect on Pistachio bushes could be given through acid rain caused by emission from the Aluminium Smelter or directly through either outside enclosing or penetration of the emitted materials. But there is no prove of penetration of HF or SO$_2$ into the pistachio plant. The enrichment of particles including emitted materials from the Aluminium Smelter is negligible. Particles on the fruits of the pistachio bush that might reach human consumers is also negligible due to the fact that only the seeds of the pistachio fruit are eaten by animals and human beings.

6.4.2. Fauna

It has been shown in chapter 5.3.3. that endangered animal species are not disturbed directly from erection of the Smelter. The Smelter site is located between an existing railway and a major highway, also from this point of view it can not be expected that animal life of sizes bigger than mice can be in a proper living condition there.

As well the table in chapter 5.3.3. shows that there are only animal species of lower risk or not critically endangered animals found in the Rafsanjan region that could be impacted by the Smelter. None of these animals has been approved in the area of Ahmad Abad Industrial town, hence the erection of the Aluminium Smelter is not disturbing the living conditions of the above mentioned animals directly.

The emissions from the Smelter can be of effect on wild life and vegetation. Naturally the concentration of the emissions is high in the close surrounding area to the Smelter, but there is no approved endangered wild animal species in the close neighborhood to the Smelter. The next approved places of endangered animal species are in Bidooyeh Hunting Prohibited Zone.

There are two official protected zones in the wider Rafsanjan area that give conditions for a fauna diversity much higher than in Ahmad Abad industrial area. Both zones are beyond the mountain chain that covers Ahmad Abad area in the south and south-east.

6.4.3. Aquatic Colonies

The only valuable aquatic colony is the limits of the lake behind Kaboutarkhan Dam, approximately 70 km east of the Aluminium Smelter. It has obtained a colonial importance after the completion of the dam. This aquatic colony is not affected by the project as it is at a too large distance from the Ahmad Abad Aluminium Smelter.
6.4.4. Impact Assessment

The two official Protected Zones are far away beyond the mountain chain south and south-west of Ahmad Abad Industrial Zone, hence the concentration of emissions will be too small to be of any effect. For the Bidooyeh Hunting Prohibited Zone near the town Kaboutarkhan the emissions given by the dispersion model (see chapter Air Quality) are far under the limitation given by the Iranian Department of Environment as being of effect to any life. Therefore this negative impact has to be assessed as of low significance.

6.4.5. Mitigation

Generally a mitigation will be given by any reduction of emission. Additional KDO agreed to establish “vegetation for at least 10 % of total area of unit using suitable types and compatible with the environment and location in its protection and maintenance is obligatory”.

The flora and fauna shall be watched regularly especially according to possible damages through typical emissions of the Smelter operation. Together with the Department of Environment of Kerman routines for checking the situation of the habitat shall be installed and implemented.

In order to find comparison bases to the actual situation, reference groups of human beings, animals and vegetation shall be found and their actual status shall be stated with certain parameters (e.g. Fluoride contents). On a long term run the parameters will be measured in order to find out and approve possible changes in their status by operating the Aluminium Smelter.

The Smelter are has to be secured against animal penetration in order to save the equipment as well as life and health of the animals.
6.5. Materials Handling

The main material handled is Alumina that will be imported as a bulk via the harbor of Bandar Abbas and transported via dedicated railway vessels to the plant site. There it is transferred to the Alumina Silos from which it will be automatically conveyed to the potline area.

Baked Anodes will be as well imported via the harbor of Bandar Abbas and transported to the site on pallets either by train or truck. The baked anodes are transported on pallets in a stable way and do not generate emission in normal condition.

Beside the above mentioned Aluminiumfluoride, lubricants and other industrial consumables will be required by the Smelter operation. These materials will be delivered to the plant in certain standard containers, the Aluminiumfluoride in big bags.

Impacts during construction are mainly transportation and traffic based. They are described and assessed in the chapter “Traffic and transportation”.

6.5.1. Impact Assessment

The impacts caused by materials handling could be caused by atmospheric emissions, spillages and dust generation while unloading, conveying or transport in vehicles in the harbor, during transport to the Smelter, offloading at the Smelter site or inside the Smelter.

Dust generation and atmospheric emissions are reduced to an absolute minimum by capsulation of all conveying items and dedusting systems. The complete conveying system including the places of unloading or transfer in the plant area is capsulated and equipped with dedusting systems.

All places where dust will be generated e.g. crusher are covered by suction systems with filters. The filter residues will be either reprocessed or treated as waste and disposed.

The dust emissions from material handling that can not be avoided amount to 0,01 kg/t (Aluminium Pechiney 2002). Taking the total material handled by the conveying system (alumina) of approx. 300,000 t/a into consideration the fugitive emissions amount to approximately 3 t/a. Fugitive and dust emissions from the other materials can be neglected due to the small amounts.

The other materials are transported in dedicated standard container and big bags (Aluminiumfluoride).

Under the assumption that all materials will be properly handled the possibility of spillage occurring is very low. The volume of fugitive and dust emissions is very small and therefore negative impacts of spillage, fugitive and dust emissions has to be assessed as of low significance.

6.5.2. Mitigation

For handling of materials over all steps including the delivery by ship into the harbor precise handling regulation has to be issued and implemented properly including the control of all material handling activities.

Maintenance and service of all equipment for material handling shall be carried out regularly and in a sufficient way.
Generally all participants shall be well trained to deal with spillages and emission situation for example after accidents. In case of accidents all equipment has to be repaired immediately and properly.

In case of spillage's cleaning measures should be started immediately and the material has to be transported to the Smelter in dedicated containers in order to use it when possible or to dispose it properly.

A reporting system for spillage's and extraordinary emission has to installed that informs the Department of Environment in Kerman in time and routines for the reduction of possible negative impacts shall be made in such cases.
6.6. Waste Generation

The new AP technologies as AP33 were created with the target to improve production efficiency of the electrolysis cells and hence to reduce waste generation and negative impacts on environment. In comparison to other best available technologies (identified by World Bank 1998, a. o.) AP technologies are leading with the reduction of waste generation and environment friendly performance.

Two major waste streams appear being different to each other by composition and volume: The first while construction of the Smelter and the second through operation.

Wastes like particles from the gas which may precipitate outside the Smelter are not considered due to the fact that these materials are included in the sub-chapter “Air Quality”. Particles which are agglomerated though rainwater on the Smelter site are concentrated in the rainwater settling pond. This amount is considered in the quantification seen in the figures below for being disposed as hazardous waste.

6.6.1. Identification of wastes

Construction phase

The majority of wastes appearing in the construction phases are typical construction waste such as removed soil, concrete wastes, steel scrap, wooden assemblies like pallets or formworks, packaging materials like papers and plastic, wiring materials from electrical installations, different types of oils from engines and machines as well as domestic waste including e.g. organic wastes from the employees on site and sewage.

Most of this waste can be either directly reused on the site or will be recycled on site or in specialized offsite facilities. The left-over part will be brought to a landfill that has to be defined by the Department of Environment (DOE) of Kerman.

The largest amount of waste in this phase are removed soil and rubble. This wastes can be used locally for landscaping. As mentioned before the quality of soil in this area is very low and it is already used for disposal of removed soil and rubble.

The non-recyclable wastes will be disposed of at respective permitted landfills and waste disposal sites. Recyclable wastes which can not be recycled at site will be collected and given to offsite recycling facilities preferable in the Rafsanjan region.

This waste can not be quantified yet because of many different short-termed influence factors. Due to the fact that this waste only appears once in the lifetime of the Smelter, the amount can be neglected here and the waste is of low significance. But anyhow it will be collected and disposed of in accordance with the environmental authorities and regulations.

Operation Phase

As shown in the figures below the total volume of waste amounts to 8,310 t/a or 53,6 kg/ 1t Al, which meets the limits of the World Bank guideline of 40-60 kg/ 1t Al (World Bank 1998). This amount of wastes contents a high average of recyclable waste, amounting to 5,220 t/a or more than 60 % of the total waste, that will not be disposed on landfills or other waste disposal sites. Hence the volume to be disposed on landfills or other waste disposal sites amounts to 2,650 t/a.
The wastes appearing by operating the Aluminium Smelter in Ahmad Abad can be classified as waste for disposal (or waste-treatment before) and recyclable wastes. Wastes from production mostly contain a high amount of reusable material and are predestine for recycling. Wear and tear mainly generate hazardous waste with high toxicity, with a high recycling share as well. Beside wear and tear another source for hazardous waste are materials from filtration at several places of the whole processes of the plant. The amounts are described in the following figures.

The major amount of waste generated in the aluminium smelting process are recyclable. Wastes appearing in the production process that are reused inside of the normal production and pre-production processes like bath (approx. 70.000 t/a) are not taken into consideration in the figures below. Also left-over materials that can be sold as a good like butt (spent anodes after cleaning & unused anodes, approx. 22.000 t/a) are not part of the calculation. Another recyclable waste is dross, that appears by skimming the liquid aluminium.

### Figure 29 Total Waste Generation per year

<table>
<thead>
<tr>
<th>CLASS</th>
<th>AMOUNT</th>
<th>TREATMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recyclable waste</td>
<td>5.660 t/a</td>
<td>Recycling at several sites outside the plant</td>
</tr>
<tr>
<td>Non-hazardous waste: industrial and domestic waste</td>
<td>1.750 t/a</td>
<td>Permitted landfills and waste disposal sites in Kerman (to be identified by DOE Kerman)</td>
</tr>
<tr>
<td>Industrial hazardous waste</td>
<td>900 t/a</td>
<td>Permitted special hazardous waste disposal sites in Kerman (to be identified by DOE Kerman)</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>8.310 t/a</strong></td>
<td></td>
</tr>
</tbody>
</table>

The major amount of waste generated in the aluminium smelting process are recyclable. Wastes appearing in the production process that are reused inside of the normal production and pre-production processes like bath (approx. 70.000 t/a) are not taken into consideration in the figures below. Also left-over materials that can be sold as a good like butt (spent anodes after cleaning & unused anodes, approx. 22.000 t/a) are not part of the calculation. Another recyclable waste is dross, that appears by skimming the liquid aluminium.

### Figure 30 Recyclable waste generation per year

<table>
<thead>
<tr>
<th>MATERIAL</th>
<th>AMOUNT</th>
<th>CLASSIFICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dross – left over of casting</td>
<td>1.560 t/a</td>
<td>Hazardous</td>
</tr>
<tr>
<td>SPL – spent pot lining, contains spent cathodes &amp; refractory fraction</td>
<td>2.250 t/a</td>
<td>Highly hazardous – partially recyclable</td>
</tr>
<tr>
<td>Spent cathode bars</td>
<td>880 t/a</td>
<td>Non hazardous – completely recyclable</td>
</tr>
<tr>
<td>Steel scrap</td>
<td>350 t/a</td>
<td>Non hazardous – completely recyclable</td>
</tr>
<tr>
<td>Used lubricants, oils, etc.</td>
<td>10 t/a</td>
<td>Hazardous – completely recyclable</td>
</tr>
<tr>
<td>Wastewater with oily substances</td>
<td>70 t/a</td>
<td>Hazardous – completely recyclable</td>
</tr>
<tr>
<td>Industrial waste (packaging materials like paper, plastics, wood, etc.)</td>
<td>540 t/a</td>
<td>Non-hazardous – recyclable</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>5.660 t/a</strong></td>
<td></td>
</tr>
</tbody>
</table>

During production and processing of aluminium, bath, butts and dross will be generated. Bath covers the melting area of the pot, it mainly consists of cryolith and aluminiumfluoride. Butt is the left-over of carbon anodes that can not be used completely due to process reasons, it contains a high amount of carbon. Dross will be produced in the casthouse by oxidation of aluminium and minor shares of non-aluminium materials in the molten aluminium. It is skimmed off in order to avoid impurities of the liquid aluminium. Dross will be further treated to remove the aluminium content.

Bath as well as dross will be recycled without any left over. The anode left-over has to be recycled outside the plant, either as bring-back system to the supplier of baked anodes or in an anode manufacturing in Iran – e.g. at the ALMAHDI or the existing IRALCO facilities.
Spent Pot Lining

Spent Pot Lining (SPL) is a by-product of aluminium production using the Hall Héroult smelting cell technology on which ALCAN Pechiney’s AP33 Technology is based.

SPL is generated when carbonaceous and insulating lining materials are removed from the Hall Héroult smelting cell due to wear out or lining failure. It is alkaline in nature. Because SPL contains leachable cyanides and fluorides, it may, if not managed appropriately, cause contamination of soils, surface water and ground water during removal, storage, treatment and/or disposal.

SPL is generated by aluminium producers world wide up to 0.04 kg of SPL per kg of aluminium metal produced. Due to the sophisticated AP33 Technology 0.0145 kg of SPL per kg of aluminium produced will be generated in the KDO Smelter, only.

As the lining service life amounts to approx. 60 months for AP33 electrolysis cells, generation of SPL starts 55 to 60 months after start-up of production at the earliest. The maximum amount of SPL – approx. 6,000 t/a – will be achieved 6 to 7 years after start-up of production. 10 years after start-up the mean incurring quantity of SPL will be approx. 2,250 t/a.

Considering that primary aluminium in Iran will be produced by three companies in 2009 with a capacity of all together about 640,000 t/a a SPL processing plant with a capacity of approx. 14,000 t/a would be required. The aluminium producing factories are:

- 110,000 tpy: ALMAHDI: (existing)
- 120,000 tpy: IRALCO: (existing)
- 110,000 tpy: IRALCO (new Potline under construction)
- 145,000 tpy: ALMAHDI (Phase II already contracted)
- 155,000 tpy: KDO Ahmad Abad Smelter

KDO already entered into negotiations with the a.m. other Iranian aluminium producers with the aim to form a joint venture for the realisation of the SPL processing plant project enabling KDO to recycle SPL in 2014 at the latest.

Besides a number of processes which have been developed on a laboratory scale and some up to the pilot plant scale, there are four processes to treat spent potlining which have or will have reached industrial scale in the near future. These processes are:

- low-caustic leaching and liming process
  ALCAN/Canada - Aluminerie de Lauralco as well as Aluminerie Alouette - and Pechiney/France – Becancour - have joined forces to construct and operate a 60,000 tpy recycling plant in Jonquire/Quebec
- rotary kiln process
  developed by Reynolds/US
- vitrification process
  developed by VORTEC and realised by ORMET Primary Aluminium Corp./US
- top-submerged-lance process;
  developed by ALCOA of Australia together with Australian AUSMELT and realised in a 15,000 t SPL processing plant.

As SPL will incur in the Aluminium Smelter 55 months after start-up of production at the earliest KDO decided to provide a building for the storage of SPL material possibly incurring earlier to this date due to lining failure as well as for the first two years of pot lining replacement.

This building is designed and equipped in such a way that
(a) the stored SPL will be maintained in a dry condition to prevent accumulation of explosive concentrations of hydrogen & methane and toxic concentrations of phosphine & ammonia from forming realised through ventilation and monitoring of gas concentration thus keeping the respective concentrations below the limits in question (< 1 % for hydrogen and methane, < 0.3 ppm for phosphine, < 25 ppm for ammonia)

(b) the hazardous escape of SPL and SPL dust to the environment will be prevented

(c) the hazardous “tracking” of SPL dust out of the storage facility or storage area by personnel or vehicle traffic will be prevented

(d) the unauthorised, unrecognised and undetected entry will be prevented

(e) the contact of SPL with acidic materials will be prevented in order to avoid generation of lethal gas concentrations

The preferred technology for Iran is the “AUSMELT SPL Processing Technology”. This technology is based on the top-submerged-lance process (see above). The AUSMELT plant has a processing capacity of about 15,000 tpy of SPL and comprises two treatment systems:

Firstly, after suitable preparation, the SPL is fed into an AUSMELT designed top submerged lance furnace in which the cyanide-forming materials are destroyed at temperatures of up to 1,250 °C and the contained fluorine is driven off as hydrogen fluoride in the off-gases.

In the second major step, a unique gas treatment process converts the hydrogen fluoride in the off-gases to aluminium fluoride in a multi-stage fluidise bed reactor. The furnace also produces a granulated slag referred to as ‘synthetic sand’.

The aluminium fluoride is recycled into the aluminium smelting process, and the synthetic sand can be used in commercial applications such as road making and concrete products.

6.6.2. Impact Assessment

The impacts of waste are in terms of volume and therefore the reduction of disposal capacity at the waste disposal sites on the one hand and on the other causing risk to human life and nature by the hazard of the waste.

The waste occurring while construction is implemented into the Impact Assessment due to the not significant amount and the small hazard caused by it.

Non-hazardous waste

Non-hazardous waste containing approximately 1,750 t/a industrial and domestic waste will be disposed on landfills of the Rafsanjan region, probably to a landfill in a distance of 20 km according to the stipulation of the Department of Environmental Protection Kerman. This amount is very small compared to the total waste disposal of the Rafsanjan area of approximately 900 t/d (330,000 t/a). Also the capacity of the landfills – 2 additional are under advanced planning – are still sufficient for around 30 years. Therefore the negative impact of the waste generated by the Ahmad Abad Aluminium Smelter facility is assessed to be of low significance.
Hazardous waste

Hazardous waste amounting to approximately 900 t/a contains mainly SPL. As above mentioned the Iranian aluminium producers are planning to install a SPL treatment plant and they are already under negotiations. Therefore it can be proposed that for the time SPL occurs at the Ahmad Abad Aluminium Smelter a complete recycling of this hazardous waste will be possible. This has the consequence that hazardous waste amounts only to small fraction of the whole waste generated at the Aluminium Smelter.

The hazardous waste will be disposed on special hazardous waste disposal sites according to the Iranian Hazardous Materials Reservation Standard (GB 18597 – 2001) in other provinces of Iran. Hazardous waste disposal sites in Kerman are still under development. Hence there is the possibility that this waste has to be transferred to other hazardous disposal sites in the country. Hazardous treatment facilities are existing close to petrochemical factories in the south of Iran. The capacity of these sites is still increasing in the next years because of new investments into the petrochemical branch with extensions of the existing facilities and the realization of new ones. Due to the proposed smaller amount of hazardous waste together with the development of hazardous disposal and treatment facilities the **negative Impact** of hazardous waste generated by the Ahmad Abad Aluminium Smelter is assessed to be of **low significance**.

6.6.3. Mitigation

The major mitigation consequence is described above under Spent Pot Lining. Beside this step of installing a recycling plant general practice measures will be implemented for the Ahmad Abad Aluminium Smelter.

- A waste management should be installed for the project during construction and commissioning for giving the clear guidelines of proper waste handling as well as for recording all waste streams after composition, sources, amounts and the how to proceed with it.

- During construction all participants will have to follow the waste management hierarchy in order to mitigate Environmental impacts:
  - Minimization of waste generation
  - Reuse of generated waste wherever possible at the site
  - Reuse or recycle generated waste to other users at other places
  - Disposal of not re-useable waste at permitted waste disposal facilities

- MAN FIA must ensure that the waste management contractor is suitably qualified and equipped to manage the waste generated during construction.

- MAN FIA must ensure that disposal facilities have the necessary permits required in order to process the waste received from construction.

- Waste should be separated after containing materials at the place of generation in order to allow proper recycling of all elements as well as proper treatment of hazardous parts of the waste stream.
6.7. Traffic and Transportation

The location in the center of the country about 400 km away from the coast and the next harbor generally is an disadvantage because the traffic is dominated by the raw material transportation. Alumina is the major part with approximately 297,600 t/a and will be carried in dedicated vessels by railway. The second big amount of raw materials to be transported are baked anodes with approximately 83,000 t/a which will be carried on pallets either by train or truck from the harbor of Bandar Abbas. Aluminiumfluoride will be transported from Bandar Abbas packed in big bags either by train or truck. The other raw materials can be neglected here due to their small amounts.

Beside raw materials the solid aluminium with 155,000 t/a has to be transported either to the consumers in Iran as well as to the harbor of Bandar Abbas for export. The aluminium for export will be transported by train. The aluminium for use inside of the country will mainly be transported by train as well, but a certain amount that can not be defined yet will still be carried to factories inside of the province of Kerman by truck. Especially the automotive factories in the area of Bam in South Kerman may require an significant amount of the produced solid aluminium.

Generally the traffic will increase during construction from the movement of workers and employees as well as from equipment transportation – mainly from Bandar Abbas to Ahmad Abad.

In the operation phase traffic generated by the movement of employees will increase on the roads from Kashku’iyeh, Ahmad Abad and Rafsanjan – the major living areas close to the Smelter.

6.7.1. Impact Assessment

The traffic on the railways increases during construction and operation but will not influence the existing traffic because the lines passing Ahmad Abad are under there maximum capacity. The higher transportation requirement during construction will increase traffic moves on the streets around Ahmad Abad and from Bandar Abbas to Ahmad Abad. This is temporarily only and due to the well developed street system with a two lines per each direction highway between Ahmad Abad and Rafsanjan the impact is neglectable.

The traffic around Ahmad Abad will increase by migration of employees for the Aluminium Smelter. It is planned that most of the employees will live very close to the plant in Kashku’iyeh and Ahmad Abad and therefore the traffic will only increase in a small area. The mainly influenced participant of increased traffic moves is the traffic stream that passes Ahmad Abad on the interstate highway over a distance of maximum only 5 km in both directions. Due to the fact that the operation of the Smelter will be in three shifts with 8 h the peaks of traffic increase may only occur three times a day for a short duration of maximum one hour (incl. coming and leaving employees). With mitigation concepts to transfer the employees with buses the impact will be reduced significantly.

The negative impacts on traffic are therefore appraised to be of low significance.

A negative impact is the diesel engine of the trains. The diesel consumption for an loaded train will amount to 500 l per 100 km and less than half with an empty train. With a distance between Bandar Abbas of approximately 400 km and frequency of approximately 20 trains per month the diesel consumption per year will be approximately 700,000 l diesel.
The exhaust air of the diesel engine contains CO\textsubscript{2}, HC, NO\textsubscript{x} and particles. The major negative impact is the generation of greenhouse gases and their influence onto the atmosphere. Therefore this negative impact has to be assessed as of medium significance.

6.7.2. Mitigation

The major negative impact are diesel engines. Mitigation measures on long term run should be considered for electrification of the railway between Teheran and Bandar Abbas. For short term mitigation diesel engines of advanced technologies with less exhaust air and smaller diesel consumption together with installation of diesel filters should be used for the transportation.

Logistic plans for either material transportation as well as for passenger transfer has to be establish in order to avoid unnecessary movements. Especially for the transport of materials to the Smelter and from the Smelter transportation plans have to be found that reduces empty tours to a minimum – this especially for materials other than alumina that has to be transported in dedicated vessels which do not allow other materials.

Another important mitigation measure will be the installation of passenger transport lines with buses for the three shifts of work per each day.
6.8. Noise Impacts

Noise sources are identified in the construction period from all machinery and equipment used for construction and in the operation period from all activities in the Aluminium Smelter excluding the existing railway and traffic noise from the existing roads outside the Smelter Area. This could be made because both are already existing and the additional traffic will not have a significant increase according to the recent traffic and the size of the highway.

Identification of sounds levels were taken from literature and results of noise monitoring from comparable Smelter. The significance rating of the world bank was taken into consideration and following figure shows the appraisement of different noise levels:

**Figure 31** Noise levels and appraisement

<table>
<thead>
<tr>
<th>NOISE LEVEL AT BATTERY LIMIT</th>
<th>APPRAISEMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constantly / regularly &gt; 70 dB</td>
<td>high</td>
</tr>
<tr>
<td>Temporarily / in short periods &gt; 70 dB</td>
<td>medium</td>
</tr>
<tr>
<td>Constantly / regularly &lt; 70 dB</td>
<td>low</td>
</tr>
</tbody>
</table>

**Construction Phase**

The highest noise impacts will be generated by blasting, earth moving and impacting. Blasting will not be expected and piling may occur in a very small amount – depends on final soil research. Other sources for noises of high levels are jack hammers and saws.

The following table shows the various equipment with the sound level measured in a distance of 15 m and the distances in which the sound levels will reach 70 dB and 55 dB depending on the frequency. The measures are under the assumption of a hard ground.

**Figure 32** Noise emissions of equipment for construction phase (hard ground)

<table>
<thead>
<tr>
<th>EQUIPMENT</th>
<th>SOUND LEVEL – DISTANCE 15 m</th>
<th>DISTANCE FOR SOUND LEVEL of 70 dB</th>
<th>DISTANCE FOR SOUND LEVEL of 55 dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blasting (estimation)</td>
<td>110 dB</td>
<td>1.167 m</td>
<td>3.249 m</td>
</tr>
<tr>
<td>Bulldozer, Front Loader, Grader, Paver, Scraper, Tractor</td>
<td>85 dB – 89 dB</td>
<td>142 m – 211 m</td>
<td>585 m – 821 m</td>
</tr>
<tr>
<td>Compressor, Generator, Pump</td>
<td>75 dB – 79 dB</td>
<td>51 m – 78 m</td>
<td>244 m – 248 m</td>
</tr>
<tr>
<td>Concrete Mixer &amp; Pump</td>
<td>82 dB – 85 dB</td>
<td>99 m – 142 m</td>
<td>416 m – 585 m</td>
</tr>
<tr>
<td>Crane, Derrick</td>
<td>85 dB – 87 dB</td>
<td>149 m – 183 m</td>
<td>632 m – 752 m</td>
</tr>
<tr>
<td>Jack Hammer</td>
<td>90 dB</td>
<td>220 m</td>
<td>798 m</td>
</tr>
<tr>
<td>Pile Driver</td>
<td>100 dB</td>
<td>533 m</td>
<td>1.672 m</td>
</tr>
<tr>
<td>Pneumatic Tool</td>
<td>88 dB</td>
<td>181 m</td>
<td>681 m</td>
</tr>
<tr>
<td>Rock Drill</td>
<td>98 dB</td>
<td>451 m</td>
<td>1.452 m</td>
</tr>
<tr>
<td>Saw</td>
<td>90 dB</td>
<td>248 m</td>
<td>964 m</td>
</tr>
<tr>
<td>Truck &gt; 4,5 t</td>
<td>84 dB</td>
<td>128 m</td>
<td>537 m</td>
</tr>
<tr>
<td>Truck &lt; 4,5 t</td>
<td>78 dB</td>
<td>68 m</td>
<td>311 m</td>
</tr>
</tbody>
</table>
Operation Phase

The main noise sources are the main technical facilities of an Aluminium Smelter as shown and described in the table below.

**Figure 33** Noise impacts of Aluminium Smelter facilities for operation phase

<table>
<thead>
<tr>
<th>EQUIPMENT</th>
<th>APPEARANCE</th>
<th>INTENSITY</th>
<th>SIGNIFICANCE W/O MITIGATION</th>
<th>SIGNIFICANCE WITH MITIGATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alumina Silos Un- &amp; Loading</td>
<td>Daytime</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Alumina Conveyors</td>
<td>Permanent</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Anode Rodding Shop</td>
<td>Daytime</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Blower (partially permanent)</td>
<td>Daytime</td>
<td>Medium</td>
<td>Medium</td>
<td>Low</td>
</tr>
<tr>
<td>Casthouse</td>
<td>Permanent</td>
<td>Medium</td>
<td>Medium</td>
<td>Low</td>
</tr>
<tr>
<td>Compressed Air Generator</td>
<td>Permanent</td>
<td>Medium</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Electrical Substation</td>
<td>Permanent</td>
<td>Medium</td>
<td>Medium</td>
<td>Low</td>
</tr>
<tr>
<td>Gas Treatment Center</td>
<td>Permanent</td>
<td>Medium</td>
<td>High</td>
<td>Low</td>
</tr>
</tbody>
</table>

Beside the Smelter facilities the transportation of ingots by truck from the casthouse to Ahmad Abad train station or in case to another factory in the province of Kerman will generate particular noise as well.

6.8.1. Impact Assessment

This project is based on permissible Industrial Operations & Noise Pollution Standard for plants (GB 12348-90). Permissible values under the aforesaid standard are 75 dB (A) for daytime [07:00 a.m. to 10:00 p.m.] and 65 dB (A) overnight [10:00 p.m. to 07:00 a.m.]. The World Bank standards are severe with 70 dB for daytime and 55 dB for overnight. Therefore the World Bank standards has been chosen for the assessment.

Construction Phase

The highest noise emission will be generated by rock drilling and (eventually) pile driving. Pile driving will not be necessary due to the stable ground, blasting – it is yet not clear if it will be necessary at all – will only take place in very short time periods and rock drilling will as well be limited to short time periods. The distance of rock drilling to reach the limit of under 70 dB at daytime is 451 m, the highway and the town of Ahmad Abad are much more far away (approx. 2.000 m and approx. 4.950 m) hence the noise impact on people is very small. The other sources of noise emissions fall short of the permissible standard even inside of the boundary and therefore the negative impact of noise emission while construction is evaluated as being of a low significance.
Operation Phase

The above mentioned sources are well known and therefore the design of this AP33 Smelter takes the noise into consideration and such emissions are successfully reduced to a minimum. The sound level at the boundary of the Aluminium Smelter will not exceed 85 dB. The distance where the daytime sound level of 70 dB will be reached is approx. 145 m and the distance where the overnight sound level of 55 dB will be reached is approx. 600 m. Beside this the operation noise levels in the next living area will be much smaller than the permissible standards due to the distance of 4,950 m (Ahmad Abad town). Therefore the potential negative noise impacts of the operation of the Smelter are of low significance.

The engine of trucks together with wind noise and engine brake activity are another source of noise generated through normal Smelter operation. The measured noise for heavy loaded trucks in a distance of 15 m is about 83 dB for normal condition and 96 dB for a truck using its engine brakes. The acceptable daytime noise level of 70 dB will be reached at a distance of 180 m (truck with engine brakes). Under the assumption that some amount of the solid aluminium will be transported by truck on the road the significance of the negative impact is medium. Due to the fact that the major transportation medium for solid aluminium from the Smelter will be the railway and the low significance of the negative impacts of the operation of the Aluminium Smelter the negative impacts of noise generation while operation are assessed to be of low significance.

The noise inside the Aluminium Smelter has an impact on the employees of the plant. But as usual in such plants the employees in the facilities have to wear ear protection devices, therefore this negative impact is of low significance.

6.8.2. Mitigation

Construction Phase

While construction phase the management has to care that heavy and loud machines shall only be used in daytime between 07:00 a.m. and 10 p.m., otherwise the municipality shall be contacted in order to inform the local residents. Anyhow the best moderate time for operations with high noise emission shall be found accordingly.

Normal measures will be:
- Operate equipment within the specifications (e.g. Avoid overload) and with trained personnel.
- Keep equipment in good shape with specified maintenance and repair.
- Avoid similar operations at the same time (diversification).
- Equipment has to be shut off after use.
- Equipment shall be placed in sheltered locations – e.g. in partially erected buildings if possible.

Operation Phase

Generally the noise impacts for the surrounding neighbors – even they still live far away from the Smelter boundary – can be reduced effectively by arranging a buffer of trees and bushes around the Smelter. This reduces the noise spread especially in this area of hard groundcover with low vegetation.
Beside this certain measures of handling the operation shall be followed:
- Avoid unnecessary actions overnight – especially truck moves.
- Closing all doors while operating the Smelter.
- Only operate the equipment in good condition and regularly maintenance.
- Operate equipment with existing noise reduction measures and maintain these measures together with the other equipment.
- Equipment has to be shut off after use.
- Equipment shall be placed in sheltered locations – if possible.
- Employees in the operation facilities of the Smelter have to wear ear protection.
6.9. Economic Impacts

The macro-economic impacts can be determined by economical growth specified by the growth of the gross domestic product (GDP), the employment development and the industrial development with the indicators diversification of the existing industry and up- and downstream potentials.

This factors are researched for the province of Kerman only but can be taken as indicative for the Islamic Republic of Iran as well. Hence the global and national economical impacts are qualitative characters and discussing representative indicators

6.9.1. Global

The global development of the aluminium market is determined by higher increase of the aluminium demand than the aluminium production and related to this with increasing prices. Aluminium as an industrial material with the ability of multipurpose usage is a major factor for the industrial development worldwide. The future will still show a global growth of aluminium demand.

By increase of the availability of raw aluminium and allowing stable aluminium prices, the expansion of worldwide aluminium capacities has an positive effect on the world economy. The majority of the aluminium produced in Ahmad Abad will be used inside Iran, hence the relief of the tight international aluminium market will only be indirect. Therefore the positive impact on global markets is assessed to be of low significance.

6.9.2. National

The Iranian economy is characterized by a high share of income from sales of oil and gas. These products are sold without major steps of added value on them. Therefore the Iranian government is searching for international purchased products with a higher share of added value. The allocation of part of the aforesaid gas resources to power-plants and finally to the production of aluminium may provide the value added that shall be much greater than the value added obtained through the export sale of gas only. An increase of the added value has the target of decrease of the high national unemployment but also the reduction of the dependency on oil and gas export.

Another aluminium related reason is the demand of aluminium for the national industry in Iran. The major part of the aluminium supply is imported. Import of aluminium is facing additional costs by transportation and customs. Theses costs could be reduced by producing aluminium inside Iran, even if alumina – the main raw material for aluminium production – still has to be imported.

Beside the availability of a big consuming market in Iran with increasing capacities of aluminium downstream industries, the gas reserves and hence the potentials for competitive generation of electricity, Iran gains well skilled manpower at low labor costs. Therefore Iran ranks almost highest from the viewpoint of proper geographic conditions for aluminium production.

Considering the objectives of the Third Development Plan and the plans developed by the Ministry of Industry and Mines, 1.000.000 t of raw aluminium can be produced on a yearly basis with its proper markets being located in Persian Gulf region.

According to the above mentioned arguments the positive impact on development of the national economy is assessed to be of high significance.
6.9.3. Province of Kerman

The share of Kerman province of the national Iranian gross domestic product (GDP) is approx. 3.2 %, about 2.500.000.000 US-$/a. The Ministry of Mines and Industry expects an increase only from sales of the raw aluminium produced in Ahmad Abad of around 10 % of the GDP of Kerman. In this number neither additional aluminium downstream industries nor small-medium-micro enterprises are taken into consideration.

The governmental income will be increased through the Smelter operation, the local demand by the number of employees as well as through required services by direct and indirect tax income (corporate, personal, VAT, secondary, others), levies and customs. The income has been estimated to approximately 13 Mio. EUR per year. This increase will occur in small amounts directly after first aluminium sales and will increase with the end of the pay-back phase of the credit loans after 7 or 14 years respectively. Under the assumption that the lifetime of the Smelter will be around 40 years this creates a sustainable additional income for the province of Kerman and the Islamic Republic of Iran. Hence the increased government revenue shows positive impacts of medium significance.

The unemployment rate in Kerman province with about 12 % amounts to a total number of approx. 84.000 persons. The Ahmad Abad Aluminium Smelter will create 760 jobs directly, approx. 160 jobs are well or high-skilled and may be given to employees from outside Kerman. Another approx. 1.500 jobs will be created indirectly with strong relation to the Smelter, approx. 100 jobs may be given to employees from outside Kerman. Hence around 2.000 jobs may be created immediately by the Ahmad Abad Aluminium Smelter. This means a small reduction of the unemployment of the province of Kerman. Together with SMME and aluminium downstream industry the job creation is proposed to employ up to 12.000 people (see chapter Social Impacts – Employment). Beside the creation of new jobs, existing jobs will be secured by the total demands of the Aluminium Smelter, the downstream industry and related subcontracting companies and SMME. This will reduce the unemployment of Kerman significantly.

The positive impact on the economy of the province of Kerman is stated as of high significance.

6.9.4. Industrial Development

The economy of Kerman province is dominated by food production with a strong focus on the cultivation of pistachio. A big economic factor is also mining – e.g. coal, copper. Some small aluminium manufacturing companies are already established in Rafsanjan and Kerman. Long-term plans expect to establish a strong automotive industry with local center in the city of Bam, where KERMAN KHODRO together with German VOLKSWAGEN started production of the model “GOL” in 2005. Two aluminium wheel factories are starting production in 2005 and 2006.

Beside automotive industry, aluminium products are used in a broad variety of other industrial fields and this shall bring a great development to industrial units including construction materials manufacturing units in the vicinity of the site of this project. The importance of the material aluminium in the industry shows that aluminium manufacturing industry is a basis for economic development.
The installation of raw material production allows the industry in Kerman to produce aluminium products under competitive prices and stable conditions. Therefore it can be expected that further aluminium downstream industry will settle down in the province of Kerman, especially in the under-developed area of Rafsanjan. This statement is proven by several aluminium manufacturing plants that are planned to be installed or already under construction (see figure below). The planned plants are strongly depending on the realization of the Ahmad Abad Aluminium Smelter.

**Figure 34  Aluminium Industry in Kerman province**

<table>
<thead>
<tr>
<th>COMPANY</th>
<th>TOWN</th>
<th>PRODUCT</th>
<th>CAPACITY (t/a)</th>
<th>LABOR (workers)</th>
<th>STATUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>GODAZ SANAT Nonferrous Industry</td>
<td>Mashiz-Bardsir</td>
<td>Aluminium Alloy</td>
<td>3.800</td>
<td>120</td>
<td>Planned</td>
</tr>
<tr>
<td>ARGEKOSAR Aluminium Factories</td>
<td>Rafsanjan</td>
<td>Aluminium Foils</td>
<td>130.000</td>
<td>1.150</td>
<td>Planned</td>
</tr>
<tr>
<td>DEHSHIRIZADEH</td>
<td>Sirjan Industrial Zone</td>
<td>Aluminium Foils</td>
<td>500</td>
<td>50</td>
<td>Planned</td>
</tr>
<tr>
<td>HAZAR Aluminium Industry</td>
<td>Kerman Industrial Zone</td>
<td>Aluminium Foils</td>
<td>7.500</td>
<td>720</td>
<td>75% realization</td>
</tr>
<tr>
<td>AZARINKAR Metallurgical Industry</td>
<td>Kerman Industrial Zone</td>
<td>Aluminium Foils</td>
<td>600</td>
<td>18</td>
<td>Planned</td>
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<tr>
<td>ASADI Profile</td>
<td>Kerman</td>
<td>Aluminium Profiles</td>
<td>600</td>
<td>20</td>
<td>100% realization</td>
</tr>
<tr>
<td>AHAD KERMAN Aluminium Industry</td>
<td>Kerman Industrial Zone</td>
<td>Aluminium Profiles</td>
<td>2.500</td>
<td>21</td>
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<tr>
<td>SHARGH GARMAFZAR</td>
<td>Kerman</td>
<td>Aluminium Casting</td>
<td>1.200</td>
<td>60</td>
<td>100% realization</td>
</tr>
<tr>
<td>KERMAN Alloy</td>
<td>Kerman Industrial Zone</td>
<td>Aluminium Casting</td>
<td>80</td>
<td>7</td>
<td>100% realization</td>
</tr>
<tr>
<td>PHOLADJOSH Zarand Cooperative</td>
<td>Zarand Industrial Zone</td>
<td>Aluminium Casting</td>
<td>100</td>
<td>6</td>
<td>100% realization</td>
</tr>
<tr>
<td>PHAKHRABABI Factory</td>
<td>Rafsanjan</td>
<td>Aluminium Casting</td>
<td>20</td>
<td>10</td>
<td>100% realization</td>
</tr>
<tr>
<td>KARA KERMAN</td>
<td>Kerman Industrial Zone</td>
<td>Aluminium Casting</td>
<td>100</td>
<td>69</td>
<td>100% realization</td>
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<td>POURNAJAFI Factory</td>
<td>Rafsanjan</td>
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<td>30</td>
<td>19</td>
<td>100% realization</td>
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<td>HADIDKARAN</td>
<td>Kerman</td>
<td>Aluminium Casting</td>
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<td>100% realization</td>
</tr>
<tr>
<td>N. N.</td>
<td>N. N.</td>
<td>Aluminium Engines</td>
<td>100.000</td>
<td>N. N.</td>
<td>Planned</td>
</tr>
<tr>
<td>N. N.</td>
<td>Bam</td>
<td>Aluminium Wheels</td>
<td>N. N.</td>
<td>N. N.</td>
<td>Planned</td>
</tr>
<tr>
<td>ARVAND SHAHR</td>
<td>Rafsanjan</td>
<td>Aluminium Wheels</td>
<td>26,000</td>
<td>N. N.</td>
<td>Planned</td>
</tr>
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</table>

The industrial development of Kerman province and especially the Rafsanjan area will be strongly pushed forward by the installation of the Ahmad Abad Aluminium Smelter and the already existing aluminium industry will be strengthen. Therefore the positive impact is assessed as of high significance.
6.10. Social Impacts

There are various social impacts to be expected for a project of the dimension of the Ahmad Abad Aluminium Smelter. In the following, the main impacts appraised by the local responsible governmental organizations (Government of the Rafsanjan area and local office of Ministry of Industry and Mines) are discussed.

6.10.1. Impact Assessment

Socioeconomic Structure

Rafsanjan has been among the districts with little development and the rural communities have suffered poverty. The investments made on developmental substructures in recent years (such as those for the establishment of airports, dams, industrial towns etc) have provided for a better future and Ahmad Abad Aluminium plant is part of the projects that may prevent emigration villagers to urban communities.

Further positive output of the project is the improvement of economic aspects of life. Industrial development of this area may increase firstly through the establishment of aluminium related industries. It is estimated that the positive effects of the project in increasing the revenues of the Municipality of Rafsanjan and increase in the public revenues shall improve both private and public sectors and shall bring greater investment on the development.

In general the living conditions of the people in this area already increased tremendously through the investments made in connection with industrial development such as the Aluminium Smelter. The positive impact of improving the socioeconomic structure has to be appraised highly but due to the indirect character of the Ahmad Abad Aluminium Smelter it will be assessed here as of medium significance.

Migration

The Islamic Republic of Iran generally can be characterized as a country with very high migration effects. This can be seen in the development of the capital Teheran that is growing potentially over the last ten years due to migration to the cities. The province of Kerman has the problem of loosing people from the rural to the urban communities. With the installation of industry like the Aluminium Smelter the process will be reverse and the rural area around Rafsanjan will be strengthened. A slightly induced migration has to be expected.

The positive impact migration is of high significance.

Employment

In the peak of the construction phase 3.500 jobs will be created and 2.900 jobs in average of unskilled or semi-skilled workers. The duration will be short-term with a maximum employment of approx. 3 years. The positive impact of job creation is assessed to be of high significance due to the high unemployment ratio of the region for unskilled or semi-skilled people.

The operation of the Smelter requires 700 employees in the Smelter in Ahmad Abad, 60 employees for the Smelter in Teheran and another approx. 1.500 jobs outside the Smelter.
These indirect jobs will be mainly created by subcontractors who will be engaged for out-sourced activities of the Smelter such as maintenance, transportation, food supply and others.

Beside the 760 direct and the 1.500 indirect jobs, some other groups of people will be engaged in administration (private and governmental), transportation, maintenance, repair, food, health care, distribution, sale and other services in this respect. Experiences in other raw material industry such as copper mining in Kerman shows that altogether 12-16 indirect employment opportunities can be created for any single job in the aluminium plant. A majority of these jobs may be created by small-medium-micro enterprises (SMME) that covers a lot of different works and services in a country like Iran. Therefore the government of Rafsanjan area expects up to about 12.000 jobs to be connected with the project on an indirect basis.

Anyhow the positive impact of employment creation by the operation of the Aluminium Smelter is of very high significance.

Local Employment

In the construction phase mainly local unskilled or semi-skilled workers will be employed. The operation phase is characterized by a high rate of well skilled employees. These employees may partially come from the region and will be trained abroad or in the Smelter. The other part will be required from already existing Smelter in Iran.

But even the local employment for the operation phase is not possible for all positions the positive impacts are appraise to be of high significance.

Development of Human power

The Islamic Republic of Iran already offers quite sufficient skilled manpower for the aluminium industry and the existence of many technical universities in Iran and in Kerman province provides the further education of specialists. The rate of well skilled employees amounts to approx. 200 persons. Some certain specialists have to be recruited from outside of Kerman province in respect of different services needed by the plant. This combination of existing high level education together with the installation of new technologies will improve the level of knowledge in the region.

Beside this the major part of employees will be unskilled or semi-skilled and their level of education will increase through the training to prepare them for the operation of the Aluminium Smelter. The training will not be limited only for the direct Smelter personnel but also take part for personnel of the sub-contractors who will serve the Smelter requirements.

For the construction phase mainly unskilled or semi-skilled employees are required. The human power development will be almost zero due to existing companies with already sufficient employment structures.

These positive impacts are of medium significance for the development of human power in the region.

Public Health

The origin of negative impacts on public health mainly consists of atmospheric emission from Smelter operation. Other impacts are higher traffic volumes and as a positive impact the improvement of the health system due to the concentration of people in the Kashku’iyeh – Rafsanjan area.
The emissions for the next town of Ahmad Abad and Kashku’iyeh are far under the limits given by the national authority and the World Bank to be of health danger. But a final appraisement can not be made due to lack of long-term data collection on the specific emissions and conditions.

Negative impacts by increase of the traffic volume are not expectable, because the traffic systems are under extension works already and the future capacity will be able to cover the additional traffic created by the Aluminium Smelter directly and indirectly.

The health care system will be approved due to the fact that if more people live in a certain area and this people are economically in a proper condition, more doctors and pharmacies will open in this certain area as well. For example the town Ahmad Abad doesn’t have any doctor and no general pharmacy, but it will after the Aluminium Smelter starts operation.

Altogether the balance of **positive and negative impacts** amount to be zero or in other words both impacts are of **low significance**.

**Tourism**

The general tourism of the Rafsanjan area is touring and in a small amount cultural tourism – due to a lack of old cultural sites. For the whole province of Kerman the cultural tourism is leading and gives a big share of the GDP.

The impact will be an increase of tourism activities through people travelling to Ahmad Abad Aluminium Smelter such as expatriates and Iranian specialist during the construction phase. While operation specialists from Iran and from abroad as well as business man from all kind of aluminium business and people who are interested in the new technology of the Smelter will travel to Ahmad Abad. It can be expected that some of this traveler’s will be interested in tourist attractions and use their time in Ahmad Abad to visit them.

Normally the turn-over obtained by hotels and pensions can be characterized as tourism turn-over. The highly skilled Iranian and international specialists as well as typical business man will not stay in guest houses of the Industrial Zone but will use the local hotels and pensions for accommodation. Hence the operation of the Aluminium Smelter at Ahmad Abad will increase the income of the local and provincial tourism by higher accommodation rates and tourism trips to tourist attractions.

Negative impacts through the Aluminium Smelter can be neglected because the area itself is not of tourist interests and the impact of e.g. atmospheric emissions on cultural heritages amounts to zero.

The above mentioned income will sure be small compared to the turn-over of the Aluminium Smelter itself and related business in Kerman, therefore the positive impact on tourism has to be assessed as of low significance.

**Tribes**

The ground of the Ahmad Abad Aluminium Smelter is not a particular part of any living areas or movement zones for tribes existing in Kerman province or passing Kerman province. Therefore a **negative impact** has to be assessed as **zero**.
6.10.2. Mitigation

- The employees who have to move to the region shall be supported by the management of Ahmad Abad Aluminium Smelter with settling in the close surrounding area, especially in the already extending towns of Ahmad Abad and Kashku’iyeh.
- Infrastructure in terms of health care, children day care, school establishment, installation of sport sites and children playgrounds shall be supported in any way by the management.
- The local media (newspaper, magazines, etc.) shall be kept informed properly by the management about all importance in regard the Aluminium Smelter.
- Local workforce shall be considered first for any job in the Smelter during construction as well as for operation.
- For the construction phase local construction companies have to be preferred.
- Each work and service to be ordered beside the core-works of the Smelter shall be given to local companies or workers if possible.
- Sub-contractors shall be influenced by the management to prefer local labor for their activities related to the Ahmad Abad Aluminium Smelter construction or operation.
- Training of local (future) personnel shall start already while construction phase.
- Use all training possibilities to improve the skill of local employees if the existing skill are not appropriate.
- Use all training possibilities in order to substitute foreign employees.
- Improving the skills of the employees shall be a target for the management.
- The management of the Smelter shall do its best efforts to help to establish further aluminium downstream industry close to the Ahmad Abad Aluminium Smelter.
- Smelter management and local authorities shall cooperate in order to improve the conditions of the Smelter personnel, the sub-contractors and the SMME.
- The foundation and the operation of SMME shall be supported by the Smelter management.
- Give information about tourist attractions of the Kerman province to all visitors of the Smelter.
- Organization of tourist tours for visitor groups of the Smelter.
6.11. Visual Impacts

The analyses of the area in regard to the visual characteristics and visual sensitivity shows a generally very poor condition. Visual impacts on people appear when they are moving on the highway that passes the town Kashku’iyeh and crosses the town Ahmad Abad.

The view on the Smelter from the highway between Rafsanjan and Yazd shows a poor landscape with very low vegetation. On the length of this highway only stony mountains on the far back part of the view and semi-desert only sometimes interrupted by small towns in the closer area beside the street can be seen. The Aluminium Smelter will be the first difference of this permanently dreary picture.

**Figure 35** View from highway to Smelter site and mountains

6.11.1. Impact Assessment

The visual impact of an industrial facility like the Aluminium Smelter has a positive impact. The future view onto an operating Aluminium Smelter is positively appraised by the people of this area [Source: personal talks with local inhabitants at the place, confirmation through the office of the Governor of Rafsanjan]. This extraordinary statement has to be understood in the Iranian context where industrial activities and the pride on regional development has a high ranking.

Therefore the visual impact is assessed as positive of a low significance.

6.11.2. Mitigation

Generally the visual impacts for the surrounding neighbors and the passing traffic of the railway as well as the highway can be improved by arranging trees and bushes around the Smelter. This further could embellish this area of low vegetation and stony surface.
7. ANALYSIS OF ALTERNATIVES

The analysis of alternatives was not a part of this EIA. For the complete overview of the project it is described here in a short form as well.

The target of installing the Aluminium Smelter is to improve the situation for the people and the industry of the province of Kerman. Therefore only alternatives in Kerman could be taken into consideration. For the installation of major industrial projects the pre-condition was to install these projects in new industrial zones.

7.1. Alternative Industrial Zones

Before the plan of erecting the Aluminium Smelter several alternatives of new industrial zones has been chosen by the government of Kerman Province. These alternatives included environmental assessment of the sites. For the time the Smelter project came up, this alternatives were limited to two new industrial areas. The first was the existing Industrial Zone of Sirjan, located south of Rafsanjan and the second was the planned Industrial Zone of Ahmad Abad (that already has been installed for the time being).

Another limiting factor was the parallel planning of two metallurgical facilities at the same time – an Aluminium Smelter and a Steel Mill. It was assumed that the positive effects of reducing unemployment, increase of economical factors and improvement of regional industrial development of such projects could be turned into a negative effect by concentration both projects onto the same place due to environmental and traffic impacts. Therefore one pre-condition was to separate this two major projects on two different places.

An Aluminium Smelter does not request very special conditions, beside the availability of electrical energy and access to logistic systems in order to guarantee the supply of raw materials. The steel mill is characterized by the request of big volumes of water for cooling measures. Therefore the major factor for the two sites was the availability of big volumes of water.

This argument forced KDO to develop the Steel Mill at Sirjan Industrial Zone and the Aluminium Smelter at Ahmad Abad Industrial Zone.

7.2. Ahmad Abad Industrial Zone

The reasons behind the selection of this locality for the establishment on an industrial town were the small industrial diversification and the socioeconomic conditions of the region but also the advantage of the high infrastructure potential of Ahmad Abad.

Industrial production is mainly reduced on pistachio and copper. The socioeconomic conditions are characterized by a considerable income provided through the sale of pistachio together with numerous unemployed but educated people.

The infrastructure conditions are considerable due to a short distance from railway as well as from main roads and the direct sufficient connection to the national gas supplying and electricity network. The railway is suitable in volume and capacity for the transportation of materials and products to different markets at a low cost bases.
8. ENVIRONMENTAL MANAGEMENT PLAN

Observance of ultimate control measures in respect of environmental pollution resulting from the plant shall be a great necessity considering the establishment of the plant in Ahmad Abad Industrial Town. Therefore, the project management has put its major emphasis on preventive approaches and on providing reasonable solutions to environmental problems.

Four basic initiatives have been taken to minimize pollution from Ahmad Abad Aluminium Smelter:

- Selection of an environment-friendly aluminium smelting technology.
- The overall installation of pollution reduction equipment such as dedusting and dry scrubbing systems.
- Taking use of the environment compatible energy such as natural gas and electrical energy generated from natural gas.
- Avoiding the use of aluminium scrap in the casting unit, that would increase the quantity and quality of the pollutants emitted from this unit significantly.

Emission of atmospheric pollutants, production of industrial and human waste and creation of sludge are the most important forms of pollutants from Ahmad Abad Aluminium Smelter. The quantity, quality and origins of emissions, wastes and sludge have been described in this report. The design of the Aluminium Smelter will include purification, dedusting and ventilation-systems.

Beside the technological measures to ensure environmental production of aluminium measures in organization and monitoring has to be made to guarantee the proper environment around the Ahmad Abad Aluminium Smelter while construction and operation phase. Several important steps toward this target has been identified in the report already and mentioned in the mitigation articles.

These steps to be made by the project management together with the supplier have to be aligned with the enviromental demands of the regional environmental protection agencies. Therefore the process of forming an environmental management plan is still in process together with the DOE Kerman and has to be presented at a later stage of this project.
9. CONSULTATION

9.1. Regulatory Agencies

Organization of Mines and Industries Kerman

The Organization of Mines and Industries has been informed about the project from the beginning in 2003. The project will be supported by this organization in order to increase industrial development in the region and to support the existing and planned aluminium related industries in the province of Kerman. A long term target is the diversification of the industrial spectrum that is nowadays strongly orientated on the pistachio production and mining.

Governor of the district of Rafsanjan

The Governor has been involved into the whole processes of establishing the Ahmad Abad industrial zone as well as the Aluminium Smelter process. In the governor’s office the positive effect of reducing the unemployment rate is higher than the sum of negative effects.

In this office the direct and indirect job creation on a long term bases including aluminium downstream industry is expected as between 10,000 and 12,000 jobs.

The additional turn-over of the Smelter operation as well as SMME and other enterprises that will be created by operating the Smelter shall increase the GDP for Kerman province of about 10%.

Department of Environment for Kerman (DOE Kerman)

The DOE Kerman has been informed at a very early stage in 2002 about the projected new industrial area and was involved in the decision process. The DOE is especially concern about the wildlife with several protected species. This concern influenced the election of Ahmad Abad site due to the fact that there are none endangered or vulnerable species confirmed in this area.

The consultancy with DOE Kerman can be stated as permanently within the whole project phases.

Cultural Heritage and Treaty Organization (CHTO)

The CHTO has been consulted through the national Department of Environment for the permission process in the first half of 2004 as well as through KDO in April 2005. CHTO also was consulted for preparing this EIA. There are none major concerns of any risks for cultural heritages by CHTO.

The next sensitive heritage is located at the town of Mimand in a distance of 55 km. Due to this distance there are no negative impacts expected by the CHTO.

It was also confirmed that there none tribes will be directly or indirectly (e.g. old transportation routes) disturbed by the Smelter itself.

Iran Meteorological Organization (IRIMO) in Kerman

The IRIMO in Kerman has been consulted in an early stage as well and supported the preparation of the EIA with various meteorological data. The major concerns are emissions to the air and the air quality.
9.2. **Consultation of the Public**

The governor of Rafsanjan has published the general information about the Aluminium Smelter project in Ahmad Abad in the three most famous local publications “Rafsanjan”, “Bang Jars” and “Golbang”. These magazines gave general information to the people. It is planned to give more detailed information after starting to work. People accept this project and welcomed it.

Information was also given through Rafsanjan radio and Kerman Television.

Until now there are no official statements existing against the project and people in this region express their willingness to support the project. [Statement of the Vice Governor May 28th, 2005]