Socio-economic Cost of Relocation of Foundries to the Al Safa Industrial Zone

Livelihood and Income from the Environment Program Lead Pollution Clean-up in Qalyoubia

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INTRODUCTION

Lead contamination from secondary lead smelters in Shoubra El Kheima, Qalyoubia poses serious health threats to the people living and working near the former smelters. To address this problem, the United States Agency for International Development (USAID) and the Government of Egypt (GOE) designed a lead clean-up component under the Livelihood and Income from the Environment Program (LIFE). The clean-up project is called LIFE-Lead Pollution Clean-up in Qalyoubia (LIFE-Lead). The overall goal of the project is to empower local residents in the polluted communities to improve their living conditions.

LIFE-Lead is being implemented by Millennium Science & Engineering, Inc. in association with Chemonics International (MSE/Chemonics). The project has remediated seven secondary lead smelters, a copper smelter, two schools, and a medical center. The project was extended from December 31, 2007 through April 30, 2008 to allow for the completion of the site characterization for 20 flour mills located in the Governorate of Qalyoubia and the remediation oversight of a battery assembly facility that will be remediated by the owner. In addition to site remediation, the project includes activities in community involvement and public participation, communication, capacity building, and policy/legal support.

Within the framework of the policy/legal support activities, the LIFE- Lead project has taken an initiative of establishing an industrial relocation working group (IRWG), with the overall objective of facilitating the relocation process of the foundries outside of Shoubra El Kheima area to the Al Safa Industrial Zone (ASIZ).

The IRWG, operating since 2005, has successfully achieved a vital milestone in the relocation process, which is the formulation and endorsement of a cooperation protocol between all stakeholders (i.e., Governorate of Qalyoubia, Ministry of State for Environmental Affairs, Ministry of Trade and Industry, Ministry of International Cooperation, and the Federation of Egyptian Industries). The protocol acts as a vehicle for implementing industry relocation by assigning roles and responsibilities for each of the signatories and a timeline for the relocation, hence providing momentum to an otherwise unsystematic and lagging process.

In an effort to provide further support to the relocation, the IRWG has also adopted the development of a number of technical documents, to serve as information sources for stakeholders and help in the decision making process (e.g., Environmental Management Plan of ASIZ and Assessment of Infrastructure of ASIZ). This report is one among these documents and it analyzes the socio-economic cost of relocation of the foundries to the ASIZ.

The main objective of the document is to identify the type and magnitude of incurred relocation cost for ferrous and non-ferrous foundries to ASIZ. A secondary objective is to shed light on the main social impacts of the relocation process to the new area.

BACKGROUND

Shoubra El Kheima is a highly polluted area in Greater Cairo which hosts a large number of industries including foundries and smelters. The impacts of the existing industries have had a heavy toll on air and soil quality as well as on the health of the residents of the area. A number of environmental studies conducted over the last decade have repeatedly confirmed the deterioration of the state of the environment in Shoubra El Kheima and have assigned a substantial economic loss to this environmental degradation.

In 2000, the Cairo Air Improvement Project and in 2004 the Egyptian Environmental Policy Program both identified Shoubra El-Kheima as an environmental hot spot experiencing one of the highest levels of pollution in Greater Cairo. In 2007, the LIFE-Lead Pollution Clean-up in Qalyoubia project estimated the economic benefit accrued as a result of the closure and remediation of the lead smelters of between 9 and 17 million Egyptian Pounds (LE) (LIFE-Lead, Cost Benefit Analysis of Remediation, 2008).

On a national level, the decision to relocate the foundries outside of the Shoubra El Kheima area follows the Master Plan for Greater Cairo which stipulates the relocation of polluting industries to areas on the outskirts of the city. On the Governorate level, the Governor of Qalyoubia issued a decree in 1998 to relocate the foundries situated in east and west Shoubra El Kheima to a newly developed industrial site located north of Cairo with a total area of 14,223 feddans – Abu Zabaal area. In 2000, Governor Decree number 134 was issued to establish the Al-Safa Industrial Zone (ASIZ) to relocate the Shoubra El Kheima foundries (LIFE-Lead, 2007).

The ASIZ is accessed from a main road off the Cairo-Ismailia Agricultural Road as shown on Figure 1. It is bordered on the east side by the Masaken Abu Zaabal residential area beyond the vacant land that is designated for future residential development. The north side of the zone is bordered by land owned by the Egyptian Army and dedicated for a solid waste recycling project. A residential area is located north of the army land and to the northeast of the ASIZ. A large lead smelter is located to the south of the ASIZ, at its entrance and is surrounded from the southeastern direction by a licensed landfill. A radio station with high voltage cables is located along the southeastern property boundary of the zone. Railroad tracks border the site to the west (Environmental Management Plan of ASIZ, 2008).

The preference of the relocation as a policy option versus the adoption of environmental pollution abatement systems on the current sites is based on a number of justifications as described in the following:

- Foundries in the Shoubra EL Kheima area are in very close proximity to highly populated residential areas.

- The current production process implemented in the foundries does not give room for proper implementation of pollution abatement systems, and the layout of the area does

not allow for any industrial expansion to upgrade their operations. A number of the foundries undertake their smelting activities in the street (Survey of foundries in SAK, 2005).

- Heavy metals are not degradable and accumulate in the environment. Controlling emissions and waste will not necessarily guarantee that heavy metals will seize to accumulate; instead they will accumulate over a longer span of time, hence continuing to be a source of threat on human health (CAIP, 2000).

Figure 1: Map of the AL Safa Industrial Zone and its Surroundings

1. Residential area including a school
2. Land affiliated to the Army
3. Planned future residential area
4. Railway's Club
5. Residential area
6. Training center
7. Railroad tracks
8. Radio station land
9. Awadallah Lead Smelter
10. Licensed landfill

INDUSTRIAL RELOCATION: DETERMINANT FACTORS

Industrial relocation has always been associated with the idea of optimization of production whereby profits are maximized and costs are minimized. The decision making process of an industry to relocate is hence typically guided by a number of critical factors to ensure this optimization.

Factors considered include production costs (i.e., land, labor, raw materials and capital as well as transportation costs) (Centre for Asian Studies, 1996). They also extend to cover market related assessments such as degree of access to suppliers and distributors; the state of competition in the relocation area as well as the quality and availability of infrastructure and the prevailing environmental regulations.

In some cases, the decision to relocate is not purely financial and might not be a priority of the industry. The relocation decision in this case is initiated, sometimes enforced, by the Government and involves other policy considerations (e.g., political or environmental considerations). In this case the decision to relocate might not be financially viable to the industries without a proper incentive system which would replace or reinforce the naturally existing factors of attraction.

The Shoubra El Kheima foundries fall under this category. Foundries have been clustered in this area for decades, operating with low or obsolete technologies and mostly lacking any environmental standards. The relocation process has been promoted by the Governorate of Qalyoubia through an incentive scheme focusing on offering a reduced cost of land serviced with infra-structure (100 LE/m) and a soft system of installment payments (7 years). LIFE-Lead through the IRWG has launched several match-making meetings between foundry owners and donor funding agencies to facilitate the relocation process.

ESTIMATING COST OF RELOCTION OF FOUNDRIES TO ASIZ

There are a number of basic assumptions made in determining the cost associated with the relocation of Shoubra El Kheima foundries to the ASIZ. These basic assumptions include the following:

- The physical relocation will take place over 30 months from the date of receiving the land in the new area.

- The price of land will be paid in annual installments for seven years from the date of allocation, with a 3% annual interest rate.

- Present value of land will be calculated and discounted over seven years, using the social discount rate (SDR) of capital in Egypt.

- The discount rate used in this study is the Social Opportunity Cost of Capital in Egypt (i.e., SDR) and is calculated based on the following basis:

    - Long-run interest rate at which Egypt borrows from international financial institutions. It is estimated at 7% per annum (i.e., interest rate on a bond issued by the government of Egypt in US$).

- Beta in Egypt. It reflects country risk on investment in Egypt. It is estimated at 1.25 (i.e., risk in Egypt is 25% higher than developed countries) (Makary, 2004).

- Social Discount Rate is therefore estimated as follows: SDR = International Interest rate * Beta = 7% * (1.25) = 8.75 at nominal prices including inflation – 6% at constant prices excluding inflation.

- The 3% annual interest rate on the land installments are deducted from the social discount rate, therefore the SDR used to calculate the PV of land is only 3%.

- The present value of land used in this report is estimated using the following formula:

$$\mathbf{PV_L = (A / (1+s)^n)}$$

Where

PVL = Present value of land
A = Annual installment
n = Number of payment periods = 7 years
S = Social Discount Rate= 3%

- Capital cost of relocation is estimated for small and medium sized non-ferrous foundries and medium and large ferrous foundries.

- Costs are based on estimations collected obtained from foundry owners, suppliers of machinery, and officials in the Federation of Egyptian Industries.

- It is assumed that foundries can only relocate with sound environmental pollution abatement systems.

- The types of furnaces used in non-ferrous and medium sized ferrous foundries cannot be dismantled and relocated in the new area.

- It is assumed that most of the large ferrous foundries will expand during relocation. It is unclear if any of the used technologies will be dismantled and used in the new site. In case some of the equipment is relocated, its capital cost should be deducted from the current estimation and replaced by a dismantling and reinstallation cost.

- The cost estimate does not include the cost of closure and remediation of the old sites in the Shoubra El Kheima area.

- It is assumed that infrastructure would be readily available, including telephone lines, electricity, drinking water and sanitation, at relocation as proposed by the Cooperation Protocol.

Initial Relocation Capital Cost by Type of Foundry

The types of foundries set up in the Shoubra El Kheima area include iron (ferrous) and copper and aluminum (non-ferrous) foundries. Their main operations are focused on processing metal containing material to recover the metal content from it. The process then includes melting and heating the metal to a certain temperature to obtain the required composition and quality. The molten is then poured into moulds to obtain casts (CAIP, 2000).

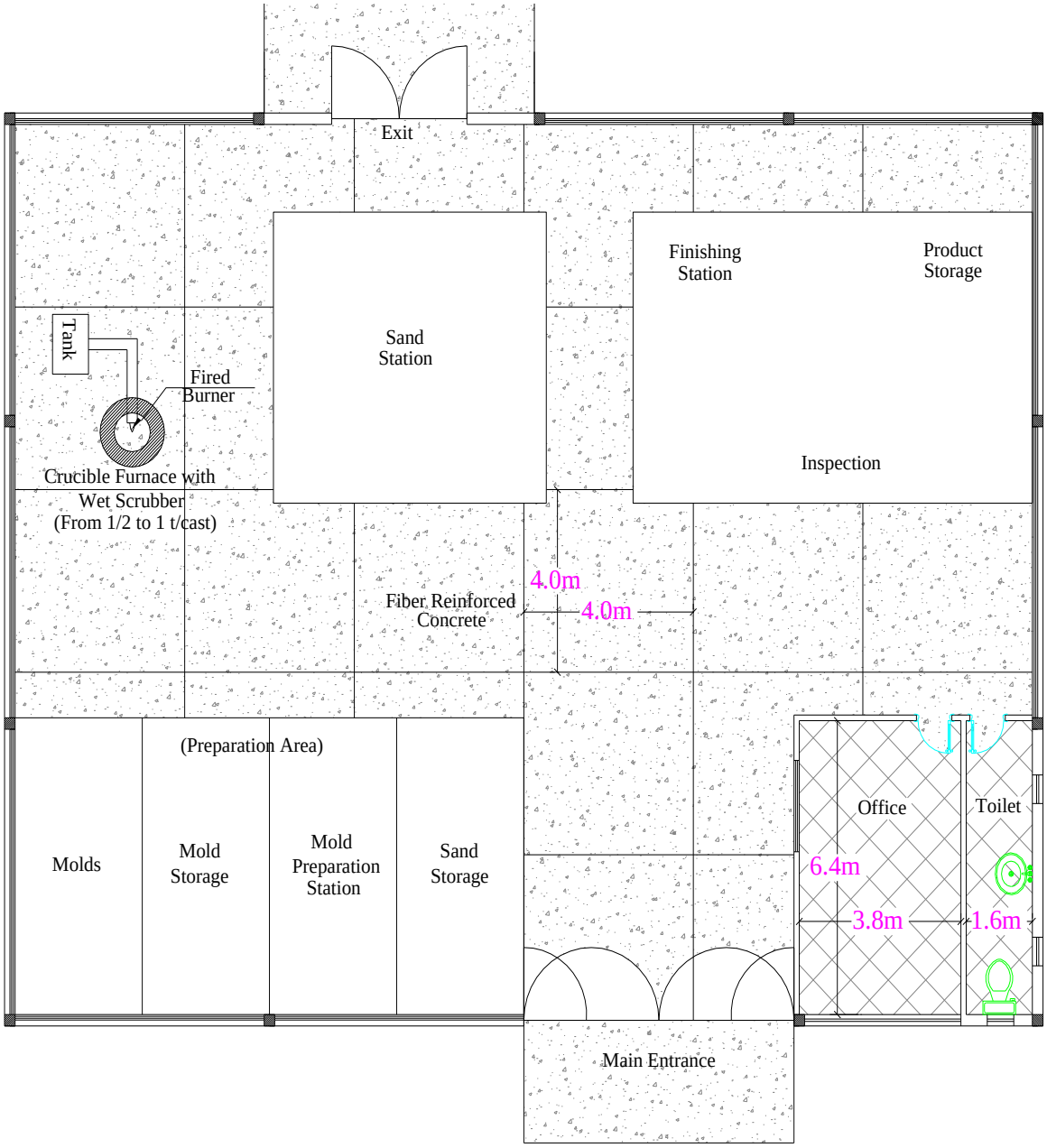
Non–Ferrous Foundries

Machinery in non-ferrous foundries generally consist of melting furnaces, burners using liquid or gaseous fuel, molds, blast cleaning machines, and a wet scrubber for pollution abatement. The type of furnace used depends on the size of the foundry which is most often small to medium in size. Small foundries usually use a crucible furnace while medium sized foundries use either a tilting crucible furnace or a rotary furnace. Tables 1 and 2 show the break down for the relocation capital cost of a non-ferrous small and medium sized foundry.

Table 1: Estimated Relocation Cost for a Small Sized Non-Ferrous Foundry - 500 m^2

Description	UNIT	Cost Per Unit	Quantity	Total Cost
Land*	m^2	100	500	40,051
Building				
Fence	m^2	89	500	44,500
Steel Structure	m^2	250	100	25,000
Fiber Reinforced Concrete Floor	m^2	50	500	25,000
Office Space	m^2	500	30	15,000
Finishing and Storage Area	m^2	500	50	25,000
Equipment				
Crucible Furnace	**Each**	5,000	1	5,000
Dual Fuel Burner and Feeding system	**Each**	20,000	1	20,000
Wet Scrubber	**Each**	15,000	1	15,000
Sand Mixing and Molding	**Lump sum**			1,000
Preparation Area for molding	**Lump sum**			2,000
Office Equipment	**Lump sum**			1,000
Total				218,551
Contingency				21,855
Total				**240,406**

Figure 2: Proposed Lay-out for a Small Non-Ferrous Foundry – 500 m^2



Non Ferrous
Small Foundary (500 m²)

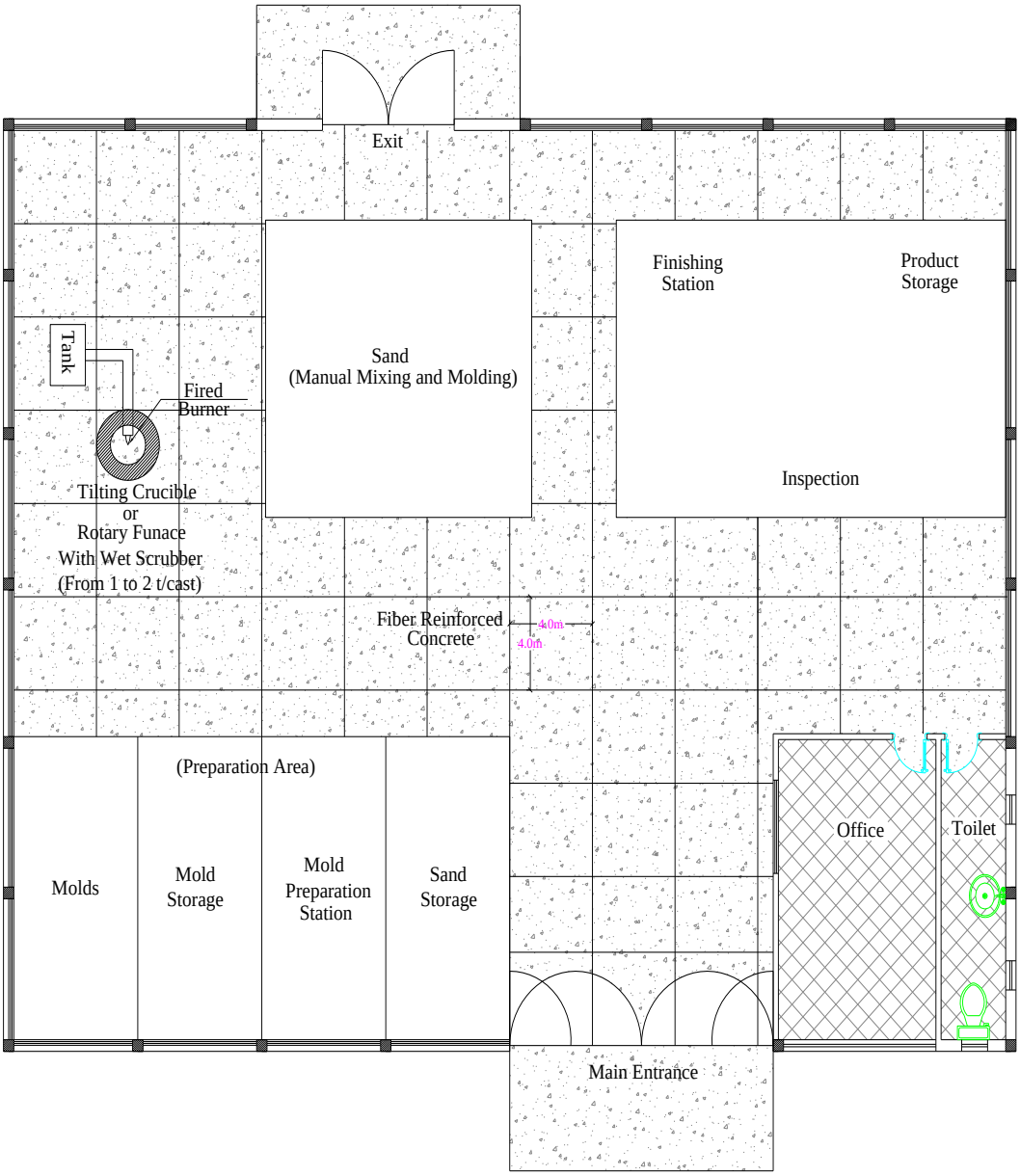
Table 2: Estimated Relocation Cost for a Medium Sized Non-Ferrous Foundry – 1,000 m^2

DESCRIPTION	UNIT	Cost Per Unit	Quantity	Total Cost
Land*	m^2	100	1,000	80,103
Building				
Fence	m^2	64.5	1,000	64,500
Steel Structure	m^2	250	200	50,000
Fiber Reinforced Concrete Floor	m^2	50	1,000	50,000
Finishing and Storage Area	m^2	500	100	50,000
Office Space	m^2	500	50	25,000
Equipment				
Tilting Crucible	**Each**	10,000	1	10,000
Dual Fuel Burner and Feeding system	**Each**	20,000	1	20,000
Wet Scrubber	**Each**	15,000	1	15,000
Sand Mixing and Molding Station	**Lump sum**			1,000
Preparation Area for Molding	**Lump sum**			1,000
Office Equipment	**Lump sum**			2,000
Total				**368,603**
Contingency				36,860
Total				**405,463**

*** Cost of land is the present value of land over 7 years of installments**

**** Rotary Furnace can be used in replacement of tilting crucible with a difference in price of 5000 LE**

Figure 3: Proposed Lay-out for a Medium Sized Non-Ferrous Foundry 1,000 m^2



Non Ferrous
Medium Foundary (1000 m²)

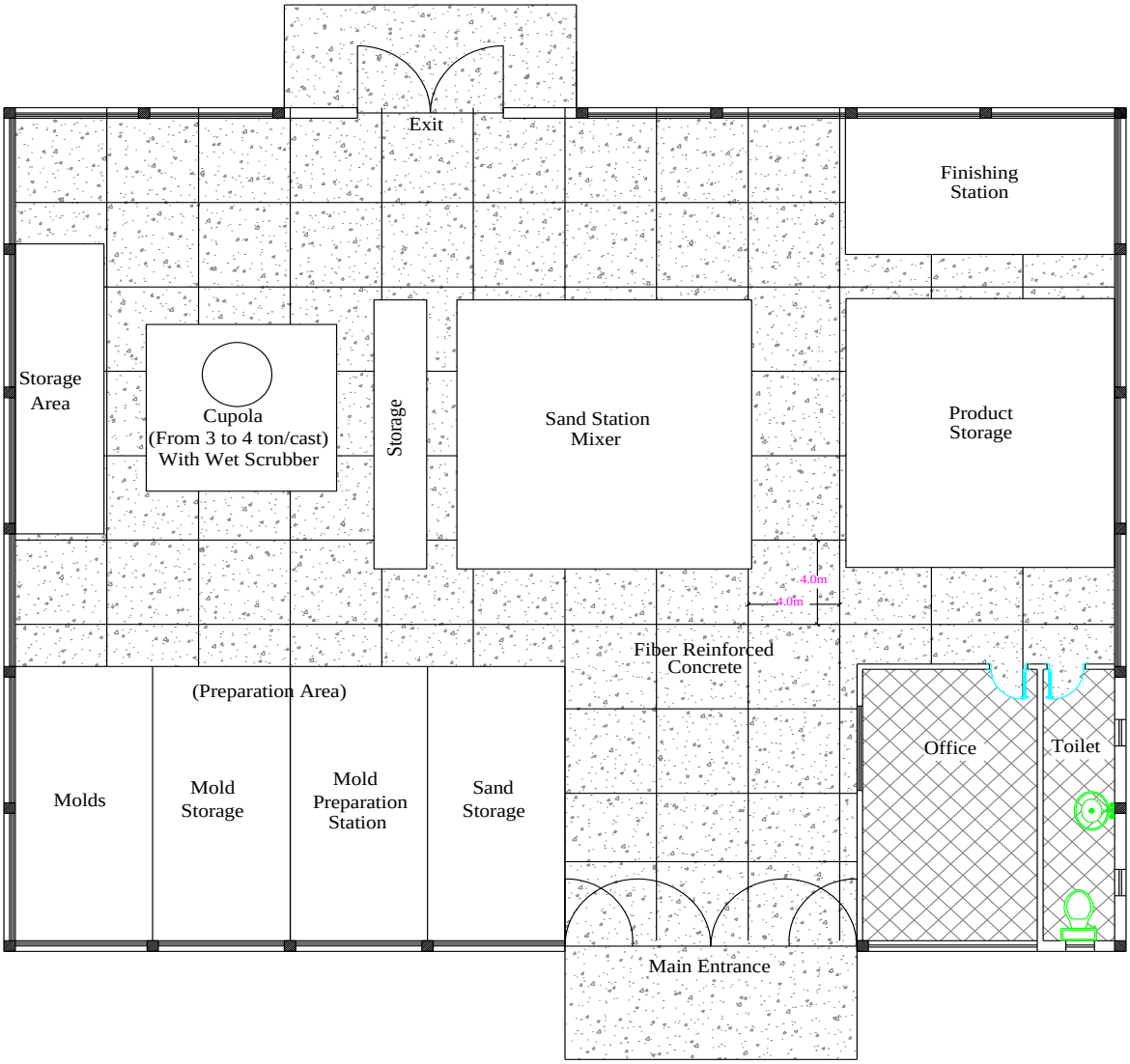
Ferrous Foundries

The size and investments in ferrous foundries vary largely. The equipment used in ferrous foundries range between the traditional cupola furnaces with manual casting up to an induction furnace with a fully automated and sophisticated casting system. Tables 3, 4, and 5 show an estimation of the breakdown of relocation capital cost of ferrous foundries.

Table 3: Estimated Relocation Cost for a Medium Sized Ferrous Foundry – 3,000 m^2

Description	UNIT	Cost Per Unit	Quantity	Total Cost
Land*	m^2	3,000	3,000	240,308
Building				
Fence	m^2	43	3,000	129,000
Steel Structure	m^2	250	500	125,000
Fiber Reinforced Concrete Floor	m^2	50	3,000	150,000
Office Space	m^2	500	100	50,000
Finishing Station	m^2	500	25	12,500
Storage Area	m^2	500	300	150,000
Equipment				
Cupola Furnace	**Each**	50,000	1	50,000
Wet Scrubber	**Each**	20,000	1	20,000
Sand Mixer	**Each**	5,000	1	5,000
Preparation Area for Molding	**Lump Sum**			3,000
Office Equipment	**Lump Sum**			4,000
	Lump Sum			
Total	**Lump Sum**			938,808
Contingency				93,881
Total				**1,032,689**
*** Cost of land is the present value of land over 7 years of installments**				

Figure 4: Proposed Lay-out for a Medium Sized Ferrous Foundry – 3,000 m^2



Ferrous
Medium Foundary (3000 m²)

Table 4: Estimated Relocation Cost for a Large Sized Non- Automated Ferrous Foundry – 5,000 m^2

Description	UNIT	Cost Per Unit	Quantity	Total Cost
Land*	**m^2**	100	3,000	400,513
Building				
Fence	**m^2**	33	5,000	165,000
Steel Structure	**m^2**	250	500	125,000
Fiber Reinforced Concrete Floor	**m^2**	50	3,000	150,000
Office Space	**m^2**	500	100	50,000
Finishing Station	**m^2**	500	25	12,500
Storage Area	**m^2**	500	300	150,000
Equipment				
Induction Furnace	**Each**	1,500,000	1	1,500,000
Pollution Control System	**Each**	500,000	1	500,000
Crane	**Each**			70,000
Sand Mixer	**Each**	5,000	1	5,000
Preparation Area for Molding	**Lump Sum**			3,000
Office Equipment	**Lump Sum**			4,000
Total	**Lump Sum**			2,974,808
Contingency	**Lump Sum**			297,480
TOTAL				**3,448,514**
*** Cost of land is the present value of land over 7 years of installments**				

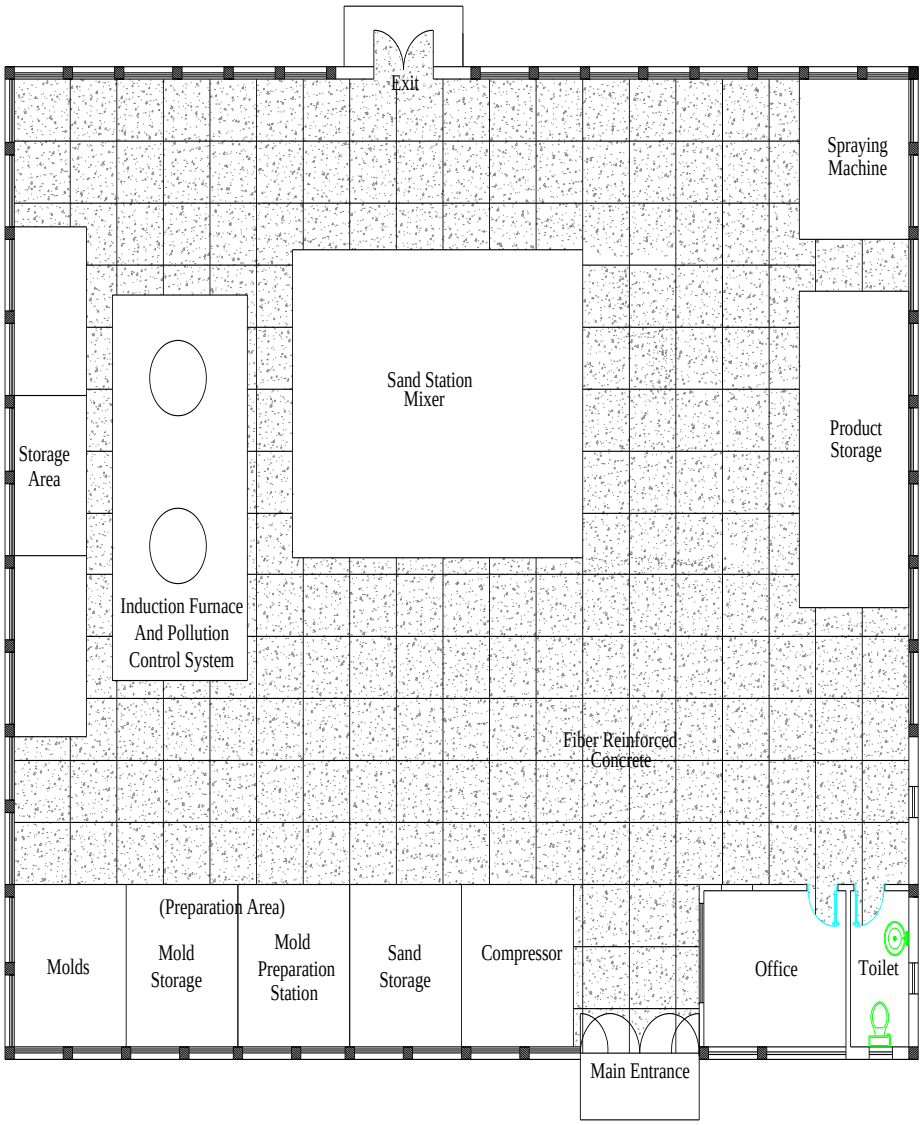
Figure 5: Proposed Lay-out for a Large Sized Automated Ferrous Foundry – 5,000 m^2

Ferrous
Large Foundary (5000 m²)

Table 5: **Estimated Relocation Cost for a Large Sized Automated Ferrous Foundry – 5,000 m^2**

DESCRIPTION	UNIT	Cost Per Unit	Quantity	Total Cost
Land*	m^2	100	5,000	400,513
Building				
Fence and Gates	m^2	33	5,000	165,000
Steel Structure	m^2	250	1,500	375,000
Fiber Reinforced Concrete Floor	m^2	50	5,000	250,000
Office Space	m^2	500	250	125,000
Equipment				
Induction Furnace with accessories	**Each**	1,500,000	1	1,500,000
Pollution Control System	**Each**	500,000	1	500,000
Crane	**Each**			70,000
Automated Casting Machine	**Each**			2,000,000
Storage /Inspection and Cleaning Area	m^2	500	500	250,000
Preparation Area for Molding	**Lump Sum**			5,000
Office Equipment	**Lump Sum**			10,000
Total				**5,650,513**
Contingency				565,051
Total				**6,215,564**
*** Cost of land is the present value of land over 7 years of installments**				

Figure 6: Proposed Lay-out for a Large Sized Non-Automated Ferrous Foundry – 5,000 m^2



Ferrous
Large Foundary (5000 m²)

Indicators for Change in Operating Expenses in ASIZ

It is challenging to estimate the changing trend, if any, in the unit cost of operations in the ASIZ after the relocation process of the foundries come to an end. Currently, the fact that infrastructure is still not fully completed, compounded by a lack of a public transportation system to serve the area, may give a false indication of an increasing trend in the unit cost of operations.

In an interview with one of the few foundries that has already relocated to the ASIZ, they stated that there is a substantial increase in their unit cost of operations post relocation to the ASIZ. It was evident from the interview that the major contributor to this trend is the increase in the transportation costs to the ASIZ which has affected the labor cost, as well as cost of raw materials and distribution of the final products of the foundry.

Skilled labor cost was the most affected, according to the relocating foundry, with a sizeable increase in labor wages of 50%. This increase is mainly attributed to the longer distance traveled by skilled labor from the Shoubra El Kheima area to ASIZ and the current lack of a public transportation system. The lack of relative proximity of ASIZ to Shoubra El Kheima has also impacted the cost of raw materials by 10% to 15% and effectively the cost of distribution of the products by the same percentage.

Problems with the infrastructure at the time of the foundry relocation have also led to an increase in the unit costs of utilities such as electricity (e.g., increased use of generators and communications). There are currently no telephone lines available.

The Cooperation Protocol guiding the relocation process indicates that infrastructure would be completed before relocation and that the Governorate will provide a public transportation service to the area. In view of this, it is not possible to estimate the trend of change in operating expenses, especially that economies of scale in production may materialize with all foundries relocating in close proximity in the ASIZ.

SOCIAL IMPACTS ASSOCIATED WITH THE RELOCATION PROCESS

Labor

Labor Mobility

Labor mobility refers to the ability of labor to commute back and forth from the ASIZ, while staying at their original place of residence. The degree of labor mobility to the new area is influenced by a number of factors. The first factor is the extent at which laborers value their work in the foundry industry versus a choice to shift to another industry. The second factor is the transportation cost to the ASIZ which will determine laborers' economic ability to continue working in the new area. Finally, labor mobility is also a factor of the quality of life expected after relocation. For example one of the foundry owners who has already relocated to the ASIZ,

argues that workers spend an average of four hours per day to reach to the new location from their residence and back. This worsens the quality of life of the workers in the form of long wasted hours spent in transportation, compared to a previously undemanding arrangement where both the work place and residence were in very close proximity.

Relocation of Labor

The relocation of labor will largely depend on the pull factors available in the ASIZ including availability and cost of housing, services (e.g., schools, hospitals, etc.) and infrastructure. On the other hand, labor relocation is also a factor of the type of community and the social networks available in their original place of residence and their willingness to trade this off for living in a new city.

Employment

Job Creation

The majority of the relocating foundries expressed interest in expanding their operations at their new facilities in ASIZ. This means that it is expected that the new industrial area in the ASIZ will create a pool of new job opportunities within this industrial sector (i.e., either within the foundries or in potential feeding and end user industries that will likely emerge). Furthermore, the extension of new services and infrastructure to the area will also create new employment opportunities.

Job Loss

There is always a risk of unemployment involved to laborers who are unable to work in the ASIZ as a result of economic or social related reasons.

Improved Health Impacts

The closure and relocation of the foundries to the ASIZ will lead to an improvement in the quality of life in terms of improved health and better environment of the community in Shoubra El Kheima. On the other hand, it is important to ensure that proper environmental pollution abatement systems are in place at the new location to avoid pollution to the new site and the neighboring residential area.

CONCLUSION

The relocation process is an intertwined and challenging one which requires commitments of all parties to guarantee its success. Optimization of production is an essential variable in the relocation equation, hence a number of factors are essential to ensure, as much as possible, that profits are maximized and costs are minimized in the ASIZ.

At the Governorate level, a number of issues have to be addressed. First, it is essential to ensure the finalization of the infrastructure of the area. Smelter operations will not be feasible without the construction and operation of all infrastructure components. The use of alternative solutions such as mobile phones instead of land lines; septic tanks instead of a proper sanitation system and polluting sources of energy instead of natural gas, will lead to an increased cost of production and or to a higher risk of pollution to the new area.

Second, the currently dire problem of labor transportation has to be tackled by the Governorate as it has both an economic and a social repercussion on the relocation process. On the economic side, the higher transportation cost of labor is currently impacting the production cost whereby labor wages have doubled in the new area according to one of the relocating smelters. Availability of a public transportation system to the area will also facilitate the emergence of other new industries and will help in creating a multiplier economic effect to the economy of ASIZ. On the social side, skilled labor may be driven out of this sector as a result of the difficulty they face in commuting to the ASIZ. This will increase their risk of unemployment.

At the foundry level, there is a need to abide by the timeline set in the endorsed cooperation protocol. This will ensure that the relocating smelters can make use of economies of scale generated by clustering in close proximity. This is especially true in the case of small sized foundries which can share some of the production facilities, hence reducing their overall costs of production.