

# Environmental Impact Assessment of Thai Iron and Steel Factory

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**ABSTRACT:** Thai Iron and Steel Factory (TISF) expanded its existing plant to cater the higher demand in the downstream industries. Together with the new plant, the total capacity will exceed 100 tons/day, which requires EIA according to Thai law. In the EIA preparation, it was found that the most significant impact from the factory was air pollution caused by particulate matters (PM). The air pollution control system has been installed as the mitigation measure to minimize the dust released. Regular monitoring of indoor air quality and the air emission from the stack also was conducted to fulfill the compliance with Thai environmental laws and standards. Public participation was part of EIA process. TISF has also made efforts to initiate discussions and establish good relations with local communities and government officials, even since the development of the first plant began. The views and concerns of the communities have been noted and acted throughout preparation of the EIA through a community consultation process conducted by some scholars from the Faculty of Public Relation of Thammasat University. The response of local communities toward the project was positive, but they concerned more about the long-term management of its potential environmental impact. TISF ensured the regular monitoring as a mitigation measure would be carefully conducted. All process and results were recorded in a final report that forms part of the project documentation and was available in a form that can be understood by non-technical people from TISF for any interested party. The monitoring results showed the compliance of the project during both construction and operation phase. The measurement of air quality was regularly conducted every six months, and no single value exceeded Thai standard.

**Keywords:** EIA, Iron and Steel Industry, Air Pollution, Thailand.

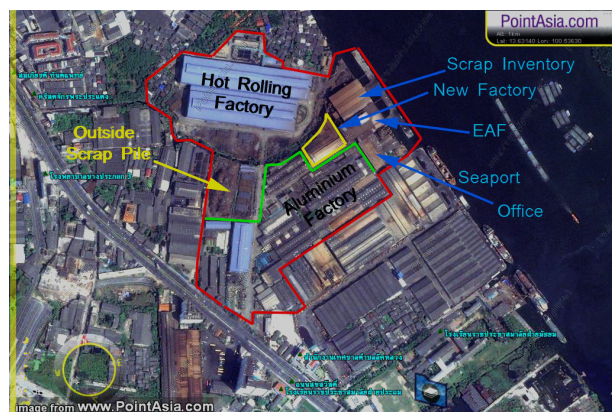
## 1. Introduction

The iron and steel industry is the important basic industry in Thailand because of the high demand of iron and steel utilization in the downstream industries. Most of the iron and steel production in Thailand use steel scraps as the major raw material. The recycling of steel scraps reduces the usage of imported pig iron produced from natural iron ore. However the demand of iron and steel in the downstream industries have increased for several years and far exceeded the production capacity of the intermediate iron and steel production, which led to the increasing volume of imported intermediate products. Then the expansion of TISF (Thai Iron and Steel Factory) increased the capacity of recycling the steel scraps and contributed to the reduction of import the intermediate products.

The total production capacity of the existing plant and the expansion project exceeded 100 tons/day, which EIA is required according to Thai law. TISF together with third party consultant took responsibility to prepare EIA report by scoping only the expansion phase and submitted to Office of Natural Resources and Environmental Policy and Planning for approval.

## 2. Project description

The expansion project was located at 42 Suksawad Road, Tambon Bangkru, Amphoe Phra Pradaeng, Samut Prakan. The new building and utility system were constructed on the company's land next to the existing plant. The location of the expansion project and the layout of the new plant are shown in Figure 1 and 2 consecutively.



**Figure 1.** Location of the expansion project

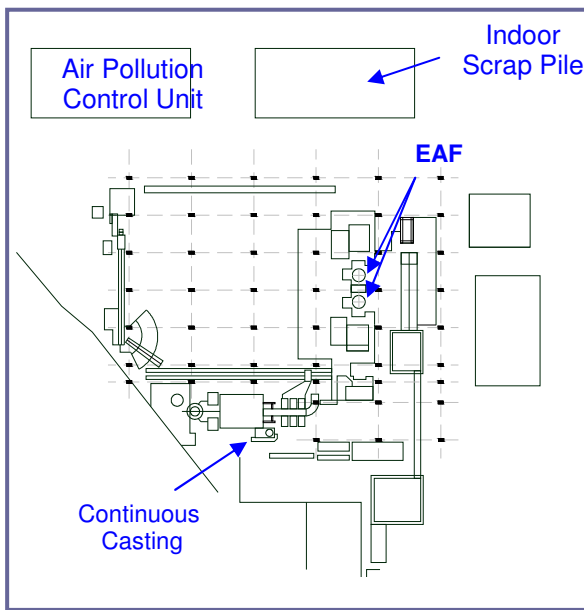


Figure 2. Layout of the expansion phase

The expansion project consisted of two Electric Arc Furnaces with capacity of 25 tons/batch/furnace, cooling system, material handling system, and air pollution control system. The main design and operation data for the plant is summarized in Table 1.

Table 1. Main design and operation data for expansion phase of TISF

Item	Data
Construction period	12 months
No. of EAF	2
Capacity of EAF	25 tons/batch
Cooling System	
- Heat exchanger	180 m <sup>3</sup> /hr
- Furnace	200 m <sup>3</sup> /hr
- Casting machine	100 m <sup>3</sup> /hr
- Air Pollution Control	200 m <sup>3</sup> /hr
- Chemical usage	scale prevention and biocide
Silo for lime	250 m <sup>3</sup>
Scrap stock area	60 m x 20 m (indoor)

The process diagram of the expansion project is shown in Figure 3.

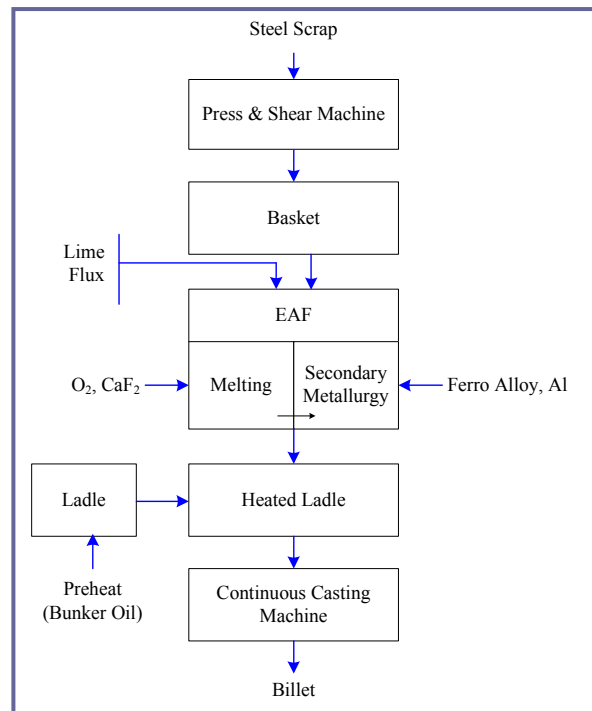


Figure 3. Process diagram of expansion project

### 3. Description of the environment

#### 3.1 Physical Environment

The expansion project is at 42 Suksawad Road, Tambon Bangkru, Amphur Prapadang, Samutprakarn. The land is belonged to TISF. Suksawad road is in front of the factory and is the main access to the factory. The back side of factory is Choa Phraya River. Most of the surrounding areas are occupied by other factories belonged to TISF cooperation. Part of the northern boundary of the project is occupied by the residential area including of small houses and commercial buildings.

The climate of Thailand is influenced by tropical monsoon winds from the northeast during winter (November to January), and for the rest of the year from the southwest. The average temperature varies from 25.0 oC in December to 29.4 oC in April. The average rainfall varies from 15.1 millimeters (mm) in December to 263.5 mm at the height of the rainy season in October. Relative humidity varies over the same period from 70.0% to 94.0%.

Because the expansion project is similar to the existing plant for both production process and capacity then the existing air quality measurement is used for the baseline and prediction of emission. The particulate matter from the stack measured on Dec 1, 2005 was 10 mg/m<sup>3</sup> (standard = 240 mg/m<sup>3</sup>). The average particulate matter in working area, in front of EAF, measured on Dec 1, 2005 was 2.5 mg/m<sup>3</sup> (standard = 15 mg/m<sup>3</sup>).

#### 3.2 Biological Environment

The northeastern boundary of the factory is closed to Chao Phraya River. The factory is located away from the river mouth around 15 km. There are mixed aquaculture in the river. The average dissolved oxygen in year 2006 of the nearby water quality station is 1.20 mg/l, which is below 2.0 mg/l as required by the surface water quality standard category 4.

### 3.3 Sociocultural Environment

The expansion project is in Amphoe Phra Pradaeng, Samut Prakan Province. Amphoe Phra Pradaeng occupies 73.37 square kilometers with total population of 38,958 people based on the data from department of provincial administration at February 25, 2007. Industrial is the major economic sector in Phra Pradaeng.

## 4. Alternatives

No Project. In Thailand, the total production capacity of semi-finished products, from iron and steel casting, in year 2006 was 5,237,160 tons/year while the production capacity of finished products was 11,492,053 tons/year [7]. In year 2006, the import value of billet was 18,421 million Baht or 1,259,471 tons/year. Since November 1, 2006 China has collected 10% tax of the exported semi-finished products such as billet and slab. This has effect on production cost of Thai industries, which import the semi-finished products as raw material. If there is no project, the current demand of semi-finished products will continuously exceed the supply side. This also increases the sensitivity of market because of the dependent of international supply.

Alternative Technology. In Thailand, there are two types of furnace used in large scale production including of Electric Arc Furnace (EAF) and Electric Induction Furnace (EIF). The EIF generates less air pollution but the tolerance of dirty scrap is low. The raw material of this project is steel scrap then the EIF is not suitable. The EAF would be used for the expansion project.

## 5. Anticipated environmental impacts and mitigation measures

The environmental impacts were assessed during both construction and operation phase. The mitigation measures and monitoring program were also proposed. The detail explanation of environmental impacts, mitigation measures, and monitoring program is described in Appendix.

### 5.1 Physical Environment

During Construction. The main impacts of the project during construction of the new building, and installation of utility and equipments were the dust and noise from construction and transportation of construction materials and equipments. Standard engineering practices were enforced on the construction site. The mitigation measures included of:

- Covering the construction materials or wetting them during storage.
- Wetting the construction area regularly
- Cleaning the equipment wheels and bodies of equipment that leaves the construction site.
- Enforcing the earmuff wearing during working.
- Regularly rotating the workers in the area with high noise levels.

During Operation. The notable impacts of the project during operational phase of the new building and use of utility and equipments included of:

- Dust and noise from the operation activities including of scrap pile, scrap transportation, EAF, continuous casting machine, and air pollution control system.
- Wastewater from the scrap pile, cooling system and slag from furnace.

The following mitigation measures were used to overcome the impacts.

- Wetting the steel scrap during transportation by crane to prevent the dispersion of dust and rusty dust.
- Covering the press and sheer machine to prevent the dispersion of dust during cutting and conveying the scrap.
- Controlling the humidity of lime to prevent the explosion and dispersion of lime during feeding into EAF.
- Installing the air pollution control system with cooling unit to minimize the dispersion of particulate matters.
- Provide noise protection equipment for workers in areas with high noise level.
- Periodically rotate the workers in areas with high noise level to minimize noise impact.
- Installing warning signs in areas with high noise level.
- Constructing the drainage system around the scrap pile and the evaporation pond connected to scrap pile to treat the wastewater.
- Sending the cooled down slag to landfill by subcontractor.

### 5.2 Biological Environment

During Construction. The main socioeconomic impact of the project during construction of the new building, and installation of utility and equipments were the contaminated water from the construction activities and Effluent from the site to Chao Phraya River. The following measures were used to mitigate these impacts.

Preparing a sedimentation pond to collect the water passing through the construction area and prevent sediments from leaching out of the site.

Rearranging the drainage system around the construction site to prevent the discharge of contaminated water to Chao Phraya River.

During Operation. Drainage water from scrap pile was the main impact of the project during operational phase. This impact was mitigated by constructing the drainage system around the scrap pile and the evaporation pond connected to the drainage system to retain the contaminated water.

### 5.3 Socioeconomics Impacts

During Construction. The main socioeconomic impact of the project during construction phase included of the direct affect to the workers, safety issues, conflicts between alien workers and local people, and increased traffic volume due to the transportation of construction materials and equipments and flooding in construction area. The following measures were used to mitigate the impacts.

Providing enough infrastructure facilities for the workers.

Providing safe conditions for workers.

Using proper materials and equipment in the construction activity to decrease the risk of causing accidents.

Providing the Personal Protection Equipments (PPE) such as helmets, shoes, glasses, gloves, and ear muffs.

Constructing materials will be trucked to the site during off-peak working hours.

Using proper construction management and provide sedimentation pond to collect rain water properly.

During Operation. The impacts of the project during operational phase were the emission impact on workers and people around the project area, dust, noise, and heat on workers, and accidents. Thus, the following mitigation measures were used.

Installing the air pollution control system and apply the good working practice to minimize the dispersion of dust.

Enforcing the wearing of PPE, including the mask, as a standard practice.

Installing warning signs in the risk area.

Arranging the working time periodically to reduce the exposure time.

Periodically providing training of emergency responses.

Landscape measures such as using tree as buffer zone.

Transporting scrap, slag, and dust during daytime and avoid congested traffic period.

Covering the scrap truck by canvas.

Coving the truck which contains slag and dust by canvas.

Limiting the loading weight to a maximum of 20 tons/round.

Maintaining trucks in good condition.

## 6. Economic assessment

The project's quantifiable costs consisted of the capital costs, operations and maintenance costs, utilities cost, labor, and administration cost. The project concerned on the environmental issues by installing the air pollution control system, which cost about 15 million Baht. The total project cost was around 300 million Baht by using the accumulated profit and loan from Thai Bank in the ratio of 30:70.

## 7. Insitutional requirements and environmental monitoring

The predicted environmental impacts were monitored and reported to the related agencies such as the municipality and Department of Industrial Works during the construction and operation phase.

The management of related environmental issues was handled by the registered environmental personal as specified by the Announcement of Ministry of Industry B.E. 2545. The proper training programs on good practice of environmental management were provided periodically to ensure the minimization of environmental impacts.

## 8. Public involvement

TISF recognized the project's potential impacts on the local communities in terms of employment, environment issues, and activity levels. It has made efforts to initiate discussions and establish good relations with local communities and government officials since the development of the first plant began. The views and concerns of the communities have been noted and acted on throughout preparation of the EIA.

The formal consultation process has taken place in two stages. First, the fieldwork which is necessary to formalize and record public opinion about the potential impact of the project was undertaken by experts from AIT, Envi Research Laboratory. Next, a public hearing process was conducted in order to report and confirm the results of the first work to the local communities.

A community consultation was established as the most positive and constructive arrangements for a formal public hearing process. After several consultations among TISF, the Government and the regulatory authorities, it was agreed that community consultation would be far more beneficial than arranging a single event within the rigid confines of public hearing process. The community consultation was arranged in three parts: (i) provision of updated information to the communities and to conduct meetings to clarify details of the Project, answer questions, and note views and concerns; (ii) visits by community groups and officials to the existing plant that includes scraps storage area, hot rolling plant, and associated facilities; and (iii) an attitude survey conducted by the Faculty of Public Relation of Thammasat University.

Notice of the arrangements for each stage was provided via normal community channels. The attitude survey concluded that most people support the new expanding plant construction, but many are concerned about long-term management of its potential environmental impact. TISF has confirmed that it will appropriately manage operation in the whole plant and will continue to give close attention to the concerns of the community. The process and results are recorded in a final report that forms part of the Project documentation and is available from TISF for any interested party.

TISF confirms that all of the documents, illustrations, brochures, and any other material used during the community consultation processes have been presented in Thai alphabets and all presentations, discussions, consultative meetings, and informal discussions have been conducted in Thai language. Strenuous efforts have been made to presents the facts in a form that can be understood by non-technical people.

### 9. Monitoring results

During the construction phase, the regular monitoring has been carried out to ensure the conducting of good engineering practice. The 24-hours monitoring of total particulate matters and PM10 during the construction showed the average value of 0.2 and 0.05 mg/m<sup>3</sup> respectively (For ambient air: Total particulate matters standard = 0.33 mg/m<sup>3</sup> and PM10 standard = 0.12 mg/m<sup>3</sup>), and no single value exceeded the standard. The noise levels measured during the construction were in the acceptable range. The measuring methods used during the monitoring are as specified in the related laws.

During the operation phase, the ambient air quality, indoor air quality, and the stack emission were monitored every three months. Until now there was no single value exceeded the standard value. The maximum total particulate matter value of the ambient air quality, indoor air quality, and stack emission were 0.15, 2.5, and 9 mg/m<sup>3</sup> based on 24-hours measuring while the standard values were 0.33, 15, and 240 mg/m<sup>3</sup> respectively. The maximum PM10 value of the ambient air quality, and indoor air quality were 0.05 and 2 mg/m<sup>3</sup> based on 24-hours measuring while the standard values were 0.12 and 5 mg/m<sup>3</sup> respectively. The measuring methods used during the monitoring are as specified in the related laws. The picture of monitoring of emission from stack is shown in Figure 4.

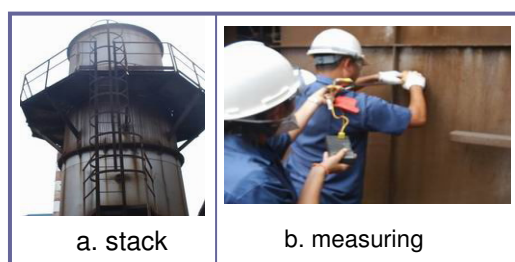


Figure 4: Monitoring of air emission from stack.

### 10. Conclusion

The project was an expansion of the existing Thai Iron and Steel Factory (TISF). The expansion project was similar to the existing plant for both production process and capacity. The project was designed to comply with the environmental standards in Thailand, specifically those related to air emission, ambient air quality, effluent standard, and noise.

As industrial sector was the major economic driver in Phra Pradaeng, this expansion project provided more job opportunities for the people in this location with no adverse impacts on socio-cultural environment.

The project's environmental impacts identified could be mitigated by using the established environmental management techniques. The impacts of both, during construction and operational phase of the project were further monitored and supervised. The necessary mitigation measures were also taken, especially to cope with the major concern on air pollution.

TISF has also made efforts to initiate discussions and establish good relations with local communities and government officials, even since the development of the first plant began. The response of local communities toward the project was positive, but they concerned more about the long-term management of its potential environmental impact.

The monitoring results showed the compliance of the project during both construction and operation phase. The measurement of air quality was regularly conducted every six months, and no single value exceeded Thai standard.

### 11. References

Book:

- [1] Department of the Environment and Heritage, Australian Government (1999) *Emission Estimation Technique Manual for Iron and Steel Production*
  - [2] European Commission (2001) *Integrated Pollution Prevention and Control (IPPC) Best Available Techniques Reference Document on the Production of Iron and Steel*, pp 274 - 318
  - [3] Office of Natural Resources and Environmental Policy and Planning (2005) *Environmental Impact Assessment System in Thailand*
  - [4] Office of Natural Resources and Environmental Policy and Planning (2002) *Guideline for Preparing Environmental Impact Assessment (EIA) Report of Industrial and Industrial Estate Projects*
  - [5] Office of Natural Resources and Environmental Policy and Planning (2006) *Guideline for Public Involvement and Social Impact Assessment in Environmental Impact Assessment Process*
  - [6] Office of Natural Resources and Environmental Policy and Planning (2006) *Manual of Environmental Impact Monitoring*
- Report:

[7] Status of Iron and Steel Industrial Sector in Year 2006 and Trend in Year 2007, *Office of Industrial Economics*, pp. 1-8

Internet Source:

[8] Inland Water Quality Information System – *Pollution Control Department*

Available: <http://iwis.pcd.go.th/IWIS/index.php>