Thailand's Coal-fired Power Plant Pollution Control

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- ❖ **Environmental Impact Assessment(EIA) / Environmental Health Impact Assessment (EHIA)**
- ❖ **Emission and Effluent Standards**
- ❖ **Lesson Learned**
  - ➢ **Lesson Learned for SO_2 Control in Coal-fired Power Plant in Thailand (Mae Moh Power Plant)**
  - ➢ **Krabi coal-fired power plant project was opposed by communities**
  - ➢ **Anti-coal protester in Samut Sakhon**
  - ➢ **Unsafe mercury levels found in fish in a river nearby industrial estate in Prachin Buri**
- ❖ **Recommendations**

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Environmental Impact Assessment(EIA) / Environmental Health Impact Assessment (EHIA)

	Type of projects or activities	Sizes
EIA	Thermal Power Plant	Productivity of electricity is 10 MW or more
EHIA	Thermal Power Plant as follow: Electric Plant using coal as fuel	Total productivity of electricity is more than 100 MW
	Coal mining which is specifically loaded Coal from the area by trucks.	More than 200,000 ton per month or 2,400,000 ton per year

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Emission and Effluent Standards

- Emission Standards for New Power Plant
- Industrial Emission Standards (used coal as fuel)
- Industrial Effluent Standards

Emission Standards for New Power Plant

Power Plant type (size and fuel type)	TSP (mg/m^3)	SO_2 (ppm)	NO_x (ppm)
Coal			
❑ Power Plant Size ≤ 50 MW	80	360	200
❑ Power Plant Size > 50 MW	80	180	200
Oil	120	260	180
Natural gas	60	20	120
Biomass	120	60	200

Source : Pollution Control Department, 2009

Note: Approved by the National Environment Board since 18 June 2008

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Industrial Emission Standards (Criteria pollutants)

Pollutant	Source	Emission Standard	
		Production Process without Fuel Combustion	Production Process with Fuel Combustion
Particulate Matter : mg/m^3	Boiler or Heat generating source		
	- Heavy oil	-	240
	- Coal	-	320
	- Biomass	-	320
	- Other fuel	-	320
	Production Process	400	320
Sulfur Dioxide : ppm	Boiler or Heat generating source		
	- Heavy oil	-	950
	- Coal	-	700
	- Biomass	-	60
	- Other fuel	-	60
	Production Process	500	-
Oxides of Nitrogen (as Nitrogen Dioxide) : ppm	Boiler or Heat generating source		
	- Heavy oil	-	200
	- Coal	-	400
	- Biomass	-	200
	- Other fuel	-	200
Carbon Monoxide : ppm	Production Process	870	690

Industrial Effluent Standards

Parameters	Effluent limits
1. pH value	5.5-9.0
2. Total Dissolved Solids (TDS)	not more than 3,000 mg/l depending on receiving water or type of industry under consideration of PCC but not exceed 5,000 mg/l not more than 5,000 mg/l exceed TDS of receiving water having salinity of more than 2,000 mg/l or TDS of sea if discharge to sea
3. Suspended solids (SS)	not more than 50 mg/l depending on receiving water or type of industry or wastewater treatment system under consideration of PCC but not exceed 150 mg/l
4. Temperature	not more than 40°C
5. Color and Odor	not objectionable

Industrial Effluent Standards

Parameters	Effluent limits
6. Sulphide as H_2S	not more than 1.0 mg/l
7. Cyanide as HCN	not more than 0.2 mg/l
8. Fat, Oil & Grease (FOG)	not more than 5.0 mg/l depending of receiving water or type of industry under consideration of PCC but not exceed 15.0 mg/l
9. Formaldehyde	not more than 1.0 mg/l
10.Phenols	not more than 1.0 mg/l
11.Free Chlorine	not more than 1.0 mg/l
12.Pesticides	not detectable
13.Biochemical Oxygen Demand (BOD)	not more than 20 mg/l depending on receiving water or type of industry under consideration of PCC but not exceed 60 mg/l

Industrial Effluent Standards

Parameters	Standard Values
14.Total Kjedahl Nitrogen (TKN)	not more than 100 mg/l depending on receiving water or type of industry under consideration of PCC but not exceed 200 mg/l
15.Chemical Oxygen Demand (COD)	not more than 120 mg/l depending on receiving water of type of industry under consideration of PCC but not exceed 400 mg/l
16.Heavy metals 1) Zinc (Zn)	not more than 5.0 mg/l
2) Chromium (Hexavalent)	not more than 0.25 mg/l

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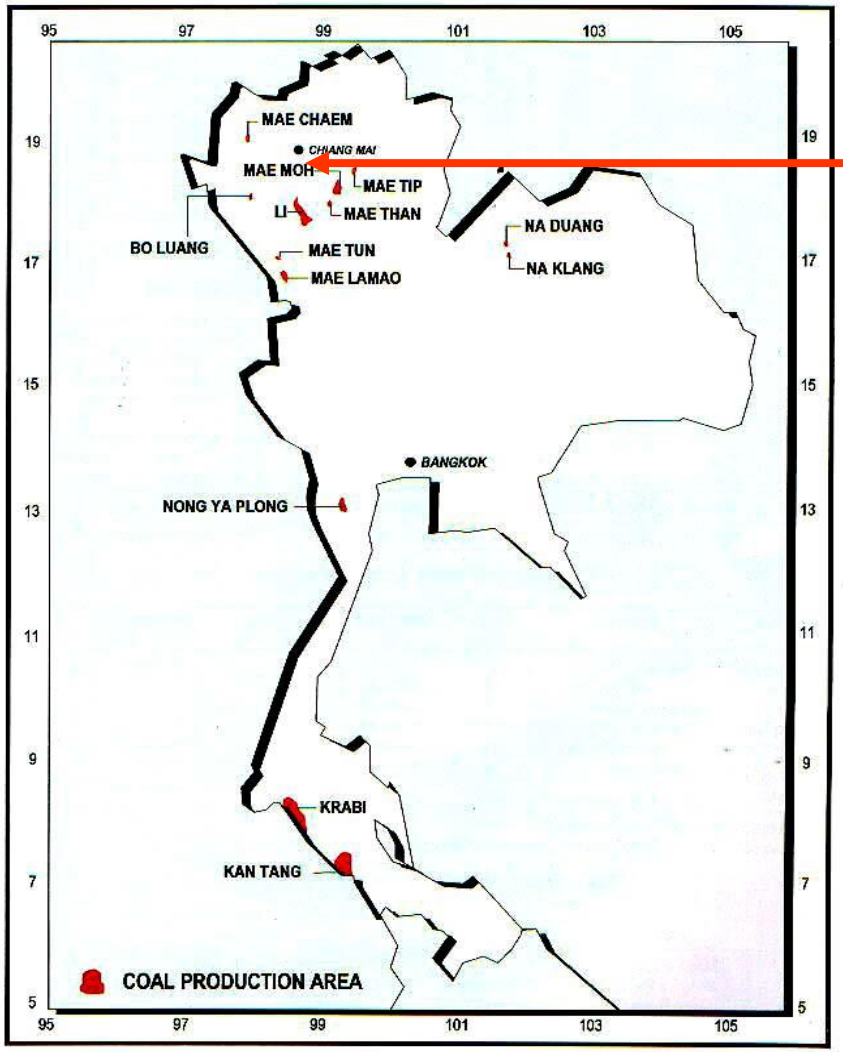
Industrial Effluent Standards

Parameters	Effluent limits
16.Heavy metals (continued)	
3) Chromium (Trivalent)	not more than 0.75 mg/l
4) Copper (Cu)	not more than 2.0 mg/l
5) Cadmium (Cd)	not more than 0.03 mg/l
6) Barium (Ba)	not more than 1.0 mg/l
7) Lead (Pb)	not more than 0.2 mg/l
8) Nickel (Ni)	not more than 1.0 mg/l
9) Manganese (Mn)	not more than 5.0 mg/l
10) Arsenic (As)	not more than 0.25 mg/l
11) Selenium (Se)	not more than 0.02 mg/l
12) Mercury (Hg)	not more than 0.005 mg/l

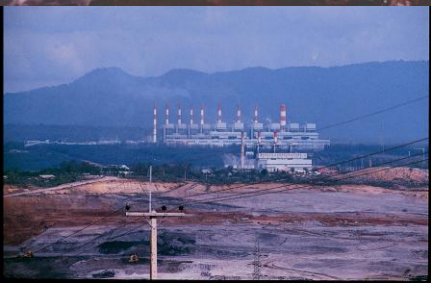
Lesson Learned for SO_2 Control in Coal-fired Power Plant in Thailand



Mae Moh Power Plant

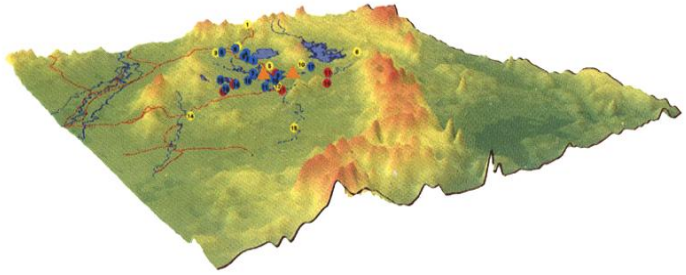
Located in Mae Moh District, Lampang Province

Mae Moh Power Plant



- Total installed capacity is 2,625 MW
- 13 generating units using lignite as fuel
- Lignite consumption ~ 50,000 tons/day
- Average sulfur content ~ 3% by weight
- High SO_2 emission ~ 150 tons/hr if no control

Units	Installed capacity (MW/unit)	Stack Height (m)	Air Pollution Control System
1 -3	75	80	EP (99.9%) Low NOx Burner
4 -7	150	150	EP (99.9%) Low NOx Burner
8 -13	300	150	EP (99.9%)/ Low NOx Burner / FGD (Unit 12, 13)



History of SO_2 episode in Mae Moh

First Episode: October 1992

- Large amounts of SO_2 emitted from the power plant
- Accumulation of SO_2 in the air above the Mae Moh Basin
- Observed hourly concentration of SO_2 was very high in the areas south of the power plant
- Complaints from people living in the villages around the power plant
- Reports of people suffering from respiratory irritation, and effect on plants and live stocks

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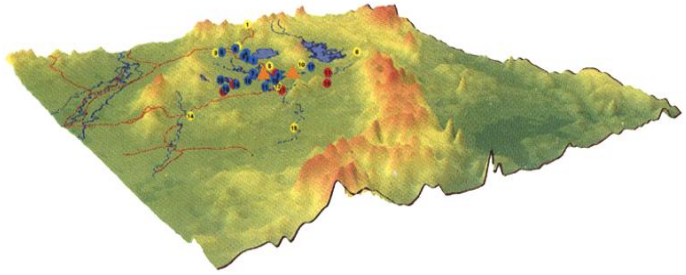

History of SO_2 episode in Mae Moh

Immediate mitigation measures

- Reduce generating loads
- Use low sulfur lignite
- Continuously monitor ambient SO_2 concentrations in the villages around the power plant
- Set preliminary hourly ambient air quality standard for SO_2 at 1,300 µg/m^3

Long term mitigation measures

- Establish hourly ambient air quality standard for SO_2 at 780 µg/m3 (300 ppb), in addition to daily (300 µg/m3) and annual (100 µg/m3) standards
- Determine SO_2 carrying capacity of the Mae Moh Basin
- Determine the most cost-effective SO_2 control measures

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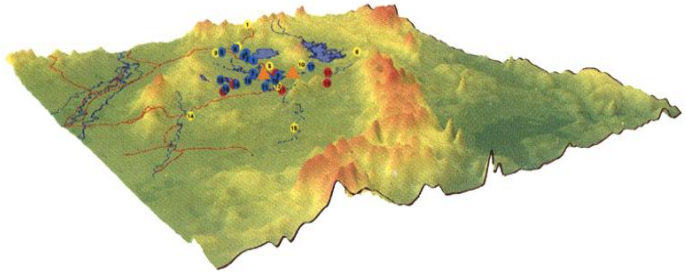

History of SO_2 episode in Mae Moh

The most cost-effective SO_2 emission control measures

- No more new power plant in the Mae Moh Basin
- Not allowed to emit SO_2 more than 11 ton/hrs at anytime and not more than 7 ton/hrs during winter months
- Retrofit Units 4-11 with Wet Limestone Forced Oxidation FGD with 98% control efficiency (Units 12-13 have FGDs with original design)
- Use lignite S <1%
- Install Continuous Emission Monitoring System in all generating units
- Continuously monitor ambient air quality
- Not allowed to operate the power plant without FGD in operation

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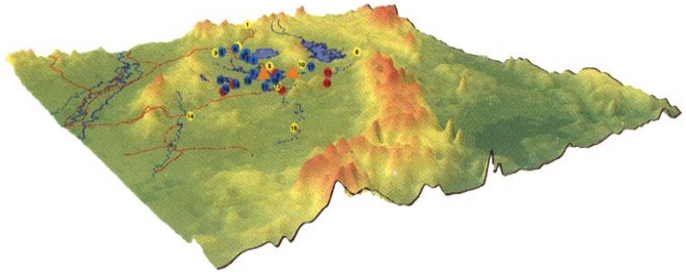

History of SO_2 episode in Mae Moh

Second Episode: August 1998

- FGD systems are not yet installed in all units
- Two installed FGD systems were out of service and some were shut down for the maintenance
- Power plant continued to operate the two generating units without FGD in operation
- Abrupt change in the atmospheric condition, i.e. cool air and rain
- High levels of hourly concentrations of SO_2 was observed
- Impacts to human health, plants, crops and livestock were observed

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Achievement in SO_2 Control in Mae Moh Basin

- The installation of the last FGD system was completed in February 2000
- SO_2 emission is reduced from 150 tons/hrs to less than 7 tons/hrs
- Gradual reduction of ambient SO_2 concentrations has been observed since 1998
- SO_2 concentrations in Mae Moh basin meeting the standards
- Maximum hourly concentration of SO_2 is reduced from >3,000 µg/m³ to <300 µg/m³

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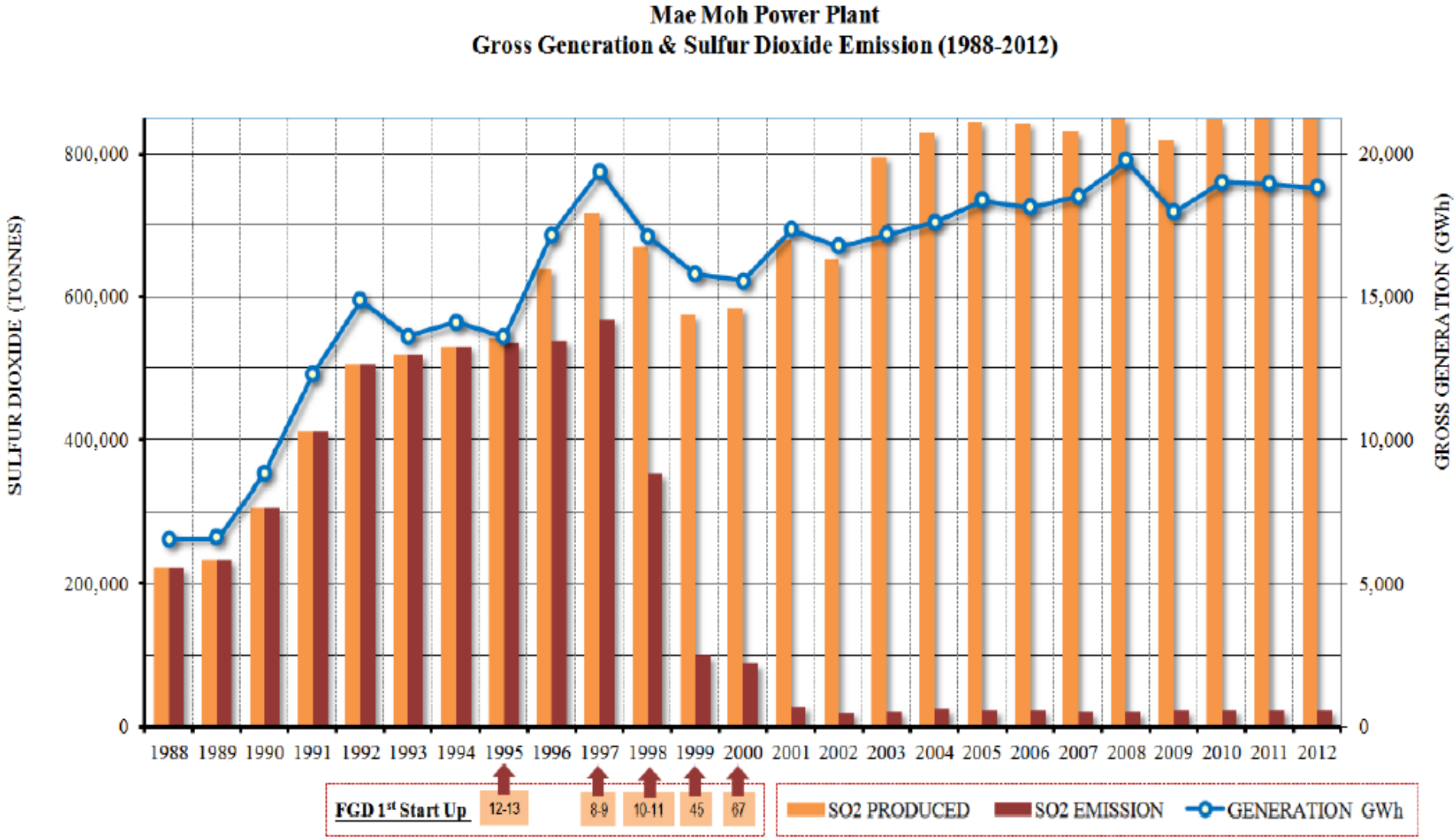
SO_2 Control in Mae Moh Power Plant



Source : Electricity Generating Authority of Thailand

Krabi coal-fired power plant project was opposoed by protester

- Since early 2014, the Electricity Generating Authority of Thailand (EGAT) has proposed to build a controversial 60 billion baht (about USD 1.8 billion) coal-fired power plant with 870 megawatts (MW) capacity and a coal seaport adjacent to it in Krabi Province
- Environmental activists protest against coal-fired power plant project in southern Thailand
- The government's decision to set up a joint committee that includes all stakeholders to discuss, study and improve the plan to build a 800MW coal-fired power plant in Krabi

Source : www.nationmultimedia.com
www.prachatai.com

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Anti-coal protester in Samut Sakhon

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Unsafe mercury levels found in fish in a river nearby industrial estate in Prachin Buri

- Pollution Control Department (PCD) found 17 kinds of fish out of 23 sampled contained high mercury levels, although they were within international safety levels under the Codex Alimentary Commission
- Exceeds the standard set by the Public Health Ministry. Under this standard, the level of mercury in food should not exceed 0.02mg/kg.

Source : http://www.nationmultimedia.com/

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Recommendations

- Dispose coal combustion residuals by effective management and utilization of coal ash as raw material for other industries
- Value added products and applications of fly ash and bottom ash
- Apply green supply chain management for Coal Transportation
- Apply Best Available Technique for all industries using coal as fuels

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