



# Thailand's Coal-fired Power Plant Pollution Control



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# Thailand's Coal-fired Power Plant Pollution Control

- ❖ **Environmental Impact Assessment(EIA) / Environmental Health Impact Assessment (EHIA)**
- ❖ **Emission and Effluent Standards**
- ❖ **Lesson Learned**
  - **Lesson Learned for SO<sub>2</sub> 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

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

|             | Type of projects or activities   | Sizes   |
|-------------|--|---|
| <b>EIA</b>  | Thermal Power Plant  | Productivity of electricity is 10 MW or more              |
| <b>EHIA</b> | Thermal Power Plant as follow:<br>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 |



# 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<br>(size and fuel type)   | TSP<br>(mg/m <sup>3</sup> ) | SO <sub>2</sub><br>(ppm) | NO <sub>x</sub><br>(ppm) |
|--|-----------------------------|--------------------------|--------------------------|
| <b>Coal</b>  |                             |                          |                          |
| <input type="checkbox"/> Power Plant Size ≤ 50 MW<br><input type="checkbox"/> Power Plant Size > 50 MW | 80                          | 360                      | 200                      |
|  | 80                          | 180                      | 200                      |
| <b>Oil</b>   | 120                         | 260                      | 180                      |
| <b>Natural gas</b>   | 60                          | 20                       | 120                      |
| <b>Biomass</b>   | 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 <u>without</u> Fuel Combustion | Production Process <u>with</u> Fuel Combustion |
| <b>Particulate Matter</b><br>: mg/m <sup>3</sup>             | Boiler or Heat generating source |   |  |
|  | - Heavy oil                      | -   | 240  |
|  | - Coal                           | -   | 320  |
|  | - Biomass                        | -   | 320  |
|  | - Other fuel                     | -   | 320  |
|  | Production Process               | 400   | 320  |
| <b>Sulfur Dioxide</b><br>: ppm                               | Boiler or Heat generating source |   |  |
|  | - Heavy oil                      | -   | 950  |
|  | - Coal                           | -   | 700  |
|  | - Biomass                        | -   | 60   |
|  | - Other fuel                     | -   | 60   |
|  | Production Process               | 500   | -  |
| <b>Oxides of Nitrogen</b><br>(as Nitrogen Dioxide )<br>: ppm | Boiler or Heat generating source |   |  |
|  | - Heavy oil                      | -   | 200  |
|  | - Coal                           | -   | 400  |
|  | - Biomass                        | -   | 200  |
|  | - Other fuel                     | -   | 200  |
| <b>Carbon Monoxide</b><br>: 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<br>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 <sub>2</sub> S     | 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  |
|---|--|
| <b>14.Total Kjeldahl Nitrogen (TKN)</b> | not more than 100 mg/l depending on receiving water or type of industry under consideration of PCC but not exceed 200 mg/l |
| <b>15.Chemical Oxygen Demand (COD)</b>  | not more than 120 mg/l depending on receiving water of type of industry under consideration of PCC but not exceed 400 mg/l |
| <b>16.Heavy metals</b>                  |  |
| 1) Zinc (Zn)                            | not more than 5.0 mg/l   |
| 2) Chromium (Hexavalent)                | not more than 0.25 mg/l  |



# Industrial Effluent Standards

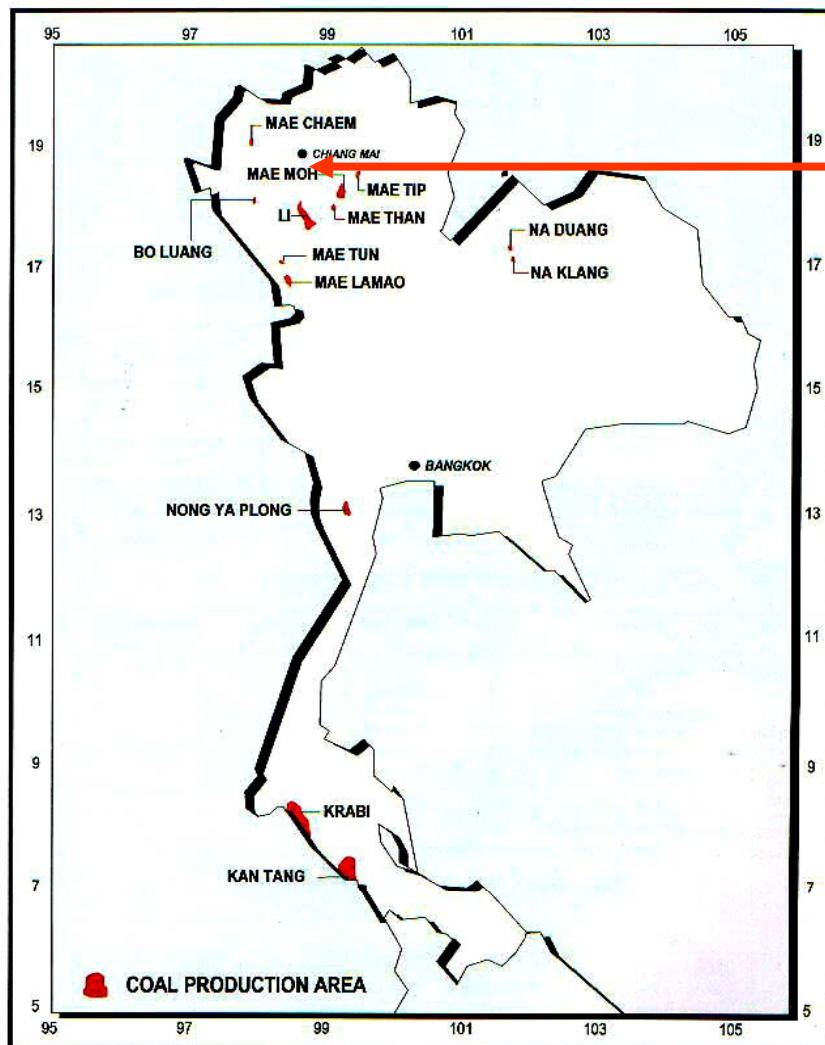
| Parameters                         | Effluent limits          |
|------------------------------------|--------------------------|
| <b>16.Heavy metals (continued)</b> |                          |
| 3) Chromium (Trivalent)            | not more than 0.75 mg/l  |
| 4) Copper (Cu)                     | 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<sub>2</sub> Control in Coal-fired Power Plant in Thailand

## Mae Moh Power Plant

Located in Mae Moh District,  
Lampang Province

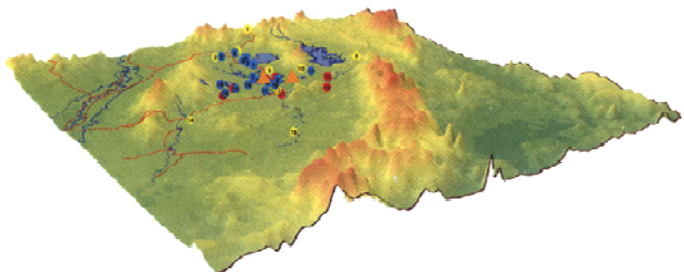




# Mae Moh Power Plant

- ❖ 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<sub>2</sub> 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%)<br>Low NOx Burner                      |
| 4 -7  | 150                          | 150              | EP (99.9%)<br>Low NOx Burner                      |
| 8 -13 | 300                          | 150              | EP (99.9%)/ Low NOx Burner / FGD<br>(Unit 12, 13) |

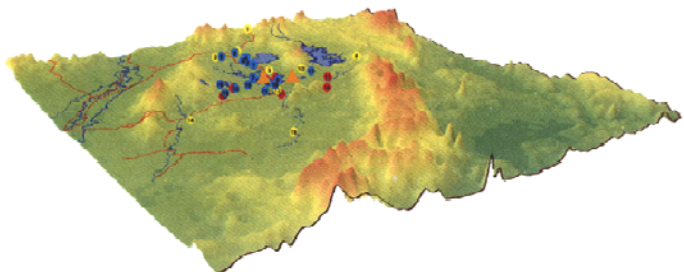


## History of SO<sub>2</sub> episode in Mae Moh

### First Episode: October 1992

- ❖ Large amounts of SO<sub>2</sub> emitted from the power plant
- ❖ Accumulation of SO<sub>2</sub> in the air above the Mae Moh Basin
- ❖ Observed hourly concentration of SO<sub>2</sub> 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





## History of SO<sub>2</sub> episode in Mae Moh

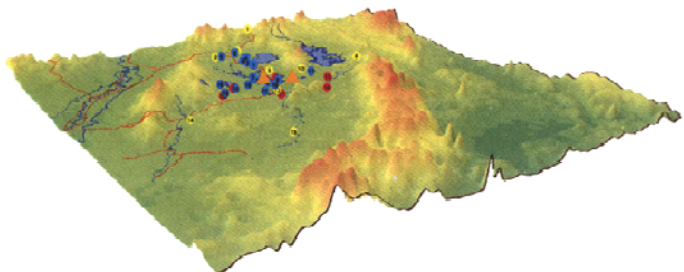
### Immediate mitigation measures

- ❖ Reduce generating loads
- ❖ Use low sulfur lignite
- ❖ Continuously monitor ambient SO<sub>2</sub> concentrations in the villages around the power plant
- ❖ Set preliminary hourly ambient air quality standard for SO<sub>2</sub> at 1,300 µg/m<sup>3</sup>

### Long term mitigation measures

- ❖ Establish hourly ambient air quality standard for SO<sub>2</sub> at 780 µg/m<sup>3</sup> (300 ppb), in addition to daily (300 µg/m<sup>3</sup>) and annual (100 µg/m<sup>3</sup>) standards
- ❖ Determine SO<sub>2</sub> carrying capacity of the Mae Moh Basin
- ❖ Determine the most cost-effective SO<sub>2</sub> control measures



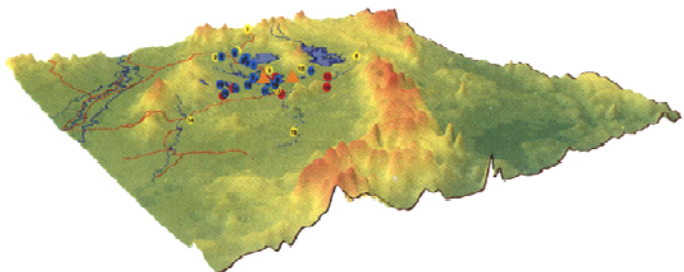


## History of SO<sub>2</sub> episode in Mae Moh

### The most cost-effective SO<sub>2</sub> emission control measures

- No more new power plant in the Mae Moh Basin
- Not allowed to emit SO<sub>2</sub> 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





## History of SO<sub>2</sub> 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<sub>2</sub> was observed
- ❖ Impacts to human health, plants, crops and livestock were observed





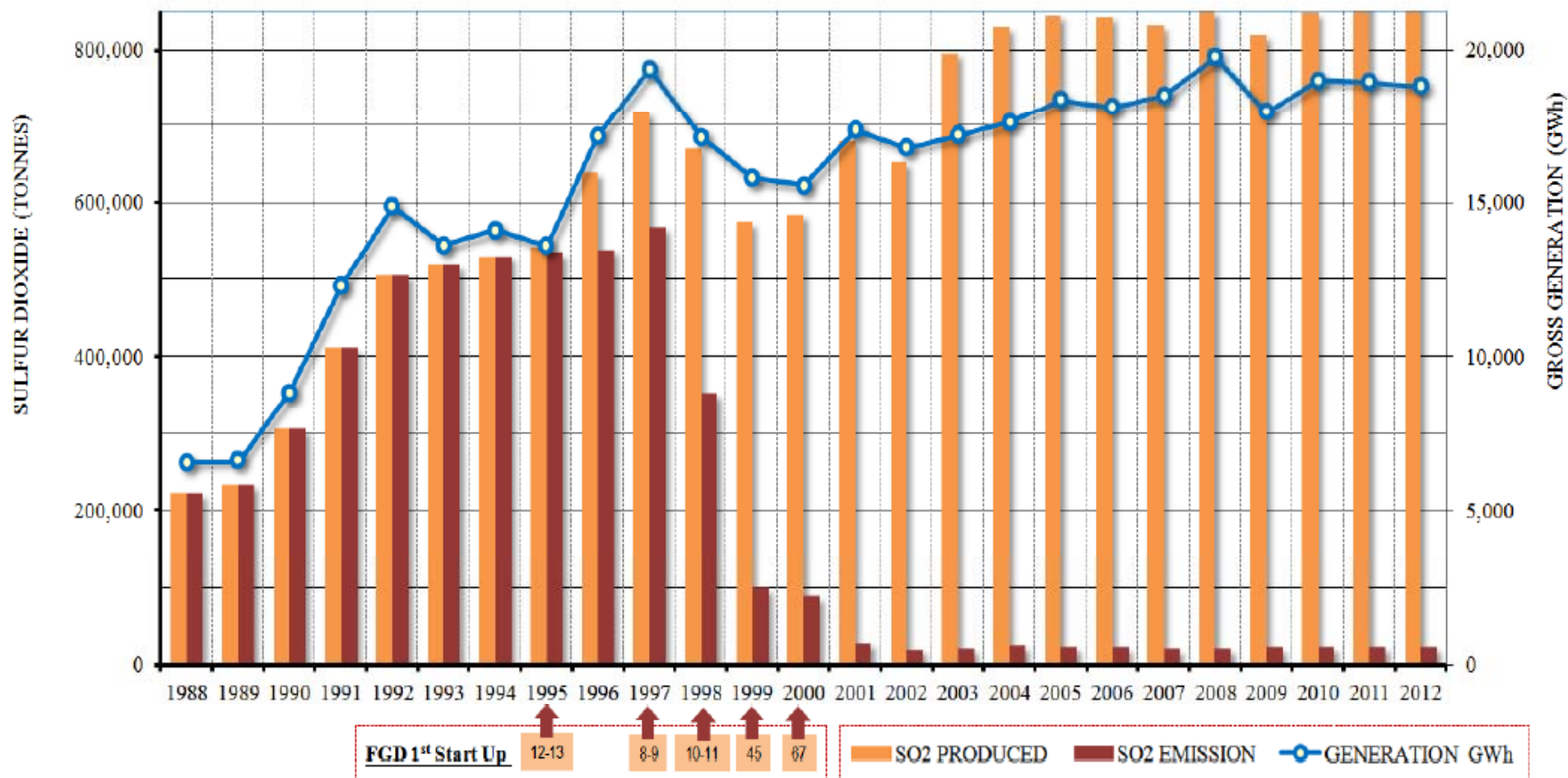
# Achievement in SO<sub>2</sub> Control in Mae Moh Basin

- ❖ The installation of the last FGD system was completed in February 2000
- ❖ SO<sub>2</sub> emission is reduced from 150 tons/hrs to less than 7 tons/hrs
- ❖ Gradual reduction of ambient SO<sub>2</sub> concentrations has been observed since 1998
- ❖ SO<sub>2</sub> concentrations in Mae Moh basin meeting the standards
- ❖ Maximum hourly concentration of SO<sub>2</sub> is reduced from >3,000 µg/m<sup>3</sup> to <300 µg/m<sup>3</sup>



# SO<sub>2</sub> Control in Mae Moh Power Plant

**Mae Moh Power Plant**  
Gross Generation & Sulfur Dioxide Emission (1988-2012)



Source : Electricity Generating Authority of Thailand

# Krabi coal-fired power plant project was opposed 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](http://www.nationmultimedia.com)  
[www.prachatai.com](http://www.prachatai.com)

# Anti-coal protester in Samut Sakhon



# 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/>



# 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**

