Introduction

In the past recent years smog problem have profoundly affected the Northern region, especially Chiang Mai province in various aspects. Smog problem has been classified as “serious” and “urgent” by Thai governments since 2003. However, the problem still endures.

Smog crisis in Northern Thailand starts in the dry season from February to April of every year, especially in March, of which the problem becomes most serious. During this period, the Northern region is covered by fine particulate matter smaller than 10 microns (PM10) higher than safety standard, i.e. 120 milligram per cubic metre within 24 hours. Data shows that during the dry season of the past several years, level of particulate matter smaller than 10 microns reached the level that is harmful to people’s health as well as the environment as shown in the following table.

Table 1: Highest level of PM10 in Chiang Mai Province from 2008-2010

<table>
<thead>
<tr>
<th>Year</th>
<th>Air Quality Station</th>
<th>Date with Highest Rate of PM10</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yupparaj Wittayalai School (downtown)</td>
<td>2008 206.2 171.3 24 March 2008</td>
</tr>
<tr>
<td></td>
<td>Wittayalai School (downtown)</td>
<td>City Hall</td>
</tr>
<tr>
<td></td>
<td>2009 238.3 215.0 14 March 2009</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2010 279.9 268.4 17 March 2010</td>
<td></td>
</tr>
</tbody>
</table>

Source: Pollution Control Department (www.pcd.go.th)

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From the table, it is clear that level of fine particulate matter (PM10) is increasing every year, with the highest level in March. The latest highest number was 279.9 milligram per cubic metre, double the acceptable safety standard. Smog problem in Thailand persists and is likely to become more serious. Statistics from Pollution Control Department reveals that number of days that Chiang Mai Province has level of PM10 higher than acceptable standard has been increasing since 2008 as shown in graph number 1, which means that Chiang Mai Province has encountered longer and more serious smog problems.

**Graph No. 1: Days that PM10 higher than acceptable level in 2008-2010**

Source: Pollution Control Department ([www.pcd.go.th](http://www.pcd.go.th))

As shown in graph number 1, there were only 14 days that level of fine particle matter (PM10) exceeded acceptable standard level during dry season in 2008. The number increased to 18 days in 2009; and reached 23 days in 2010. This statistics shows upward trend that does not seems to diminish any time soon. Graph number 2 shows numbers of days (2008-2010) that level of fine particulate matter (PM10) exceed acceptable level of 120 milligram per cubic metre.

**Graph No. 2: Level of Fine Particle Matter (PM 10) in 2008-12010**

Source: Pollution Control Department ([www.pcd.go.th](http://www.pcd.go.th))

Even though the duration of smog problem in Chiang Mai and other Northern provinces is brief, i.e. 3 months from February to April, smog problem can seriously
harm local people and its economy, both direct and indirectly, both short term and long term. An immediate effect is that when smog problem occurs, numbers of outpatients Chiang Mai skyrocket, especially those with respiratory diseases and allergies.

Graph No. 3 Top 3 ratios of out-patients per 1,000 populations according to illnesses/symptoms (2002-2009)

In a long run, accumulated smog problem profoundly risks health of the people living in Chiang Mai area. Statistics show the numbers of people infected with respiratory diseases and allergies have been increased dramatically. Graph number 3 shows number of out-patients according to their illness in 7-year period from 2002-2009. Blue bars represent respiratory diseases. As you can see from the chart, respiratory diseases rank number one for six years in a role. This tendency continues.

Constant exposure to small particulate matter increases a risk for lung cancer for Chiang Mai residents. A study by Chiang Mai University professor, Dr. Phongthep Wiwatthanadej found that annual risk rate for lung cancer among the population in the North is now 40 per 100,000 people - compared to 20 per 100,000 people in other region. Up to 600 Chiang Mai residents will face lung cancer risk each year, out of a total population of 1.7 million people living in this Northern provinces.

The persisting smog problem causes many serious problems for the local people as well as the economy. As stated earlier, constant exposure to seasonal smog

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can cause lung cancer twice as risk of people living elsewhere. Exposure to smog can also induce other health risks such as respiratory problems and eyes irritation. Per economic concern, smog problem is harmful to the tourism industry, which is the main source of income of Chiang Mai province and the Northern region. Moreover, the problem requires large budget allocation for preventing and eradicating problem.

**Causes of Smog Problem**

Smog problem normally occurs for a brief period from February to April each year. The crisis lasts only three months and peaks in March. It means that the root causes of smog crisis in the Northern provinces is seasonal rather than yearly. Thus, even though it has been known that smoke from industrial plants and car exhaustion contributing to smog problem, these sources of air pollution are not strong enough to cause smog crisis. So the question remains, what is the main causes of smog crisis in the dry season?

Of all Chiang Mai area, Mae Chaem District has the highest rate of “hot spot” shown on the sattelite map. On March 17, 2010 when number of fine particulate matter (PM 10) reached the highest level at 279.9 microgram per cubic metre, sattelite map showed most of “hot spot” that day occurred in Mae Chaem District, i.e. 80% of hotspot in agricultural area, 43.75% of hotspot in forest conservation area, and 72% of hotspot in national forest in Chiang Mai happened in Mae Chaem District. These “hot spot” were mostly causes by forest fires and agricultural wastes burning. Nevertheless, these fires and burings are not natural. It is worth study the cause of this smog crisi in order to holistically understand this phenomenon.

Mr. Amoraphan Nimana, former Governor of Chiang Rai, reported to the Deputy Prime Minister on March 13, 2008 that new mode of production called contract farming has profoundly changed the way farmers in the Northern region produce agricultural products. Contract farming is an agreement between farmers and buyers that establishes conditions for production of a specific agricultural product or products due to the need of buyers or market, normally in a large quantity. In the case of Northern provinces, big conglomolate agricultural company like CP promotes for maize production (both for human consuption and animal feeds) in 25 provinces in the Northern region. As of now, there are approximate 5-6 million rai of corn farm.
Corn can be harvested in 45-60 days, thus, in one season, farmers can plant corn approximately 4-5 times. Corn also requires significantly less water consumption comparing to rice production. Therefore it can be planted in an areas where irrigation system is inadequate, such as mountain area. Moreover, corn has high demand with government’s price guarantee policy. The promising high income from corn production makes corn framing expand exponentially. Contract framing brings a lot of income to the village, but it’s not with out downturns. In order to expand farming areas to match the demand from buyers, farmers expand their agricultural area into the forest conservation areas and national forests by means of slash-and-burn

A farmer in Mae Chaem District reflects his concern about an exponential growth of contract farming that as of now there were about 80,000 to 120,000 rai of corn farm in 2009, 20 times higher than it used to be in Mae Chaem area. State as well as private agro-industrial companies has been strongly promoting corn farming, which requires large agricultural lands and new farming techniques that are harmful to the environment.  

This statement is supported by a research study done by Siriporn Keeratilarnkul, a Deputy Director of the Economics Research and Agriculture Forecasting Center, Mae Jo University entitled “Smog, a Recurring Problem.” Siriporn surveyed 1,526 samples from 6 districts in Chiang Mai province namely, Omgoi, Hot, Samoeng, Chomtong, Mae Chaem, and Mae Wang. These six districts are areas where smog problem occurs repeatedly. Results show that most informants believed that severe smog problem in their areas was due to man-made fire. Mae Chaem District has the highest rate of burning 78.8%, followed by Omgoi District 78.2%. Informants identified causes of burning as preparation for agriculture 35.7% and burn to hunt for forest mushroom and other plants 33.6%.  

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As mentioned earlier, the reason why Mae Chaem District has the highest rates of burning and forest fire is due to the need of the villagers for subsistence income. Thus, they turn to cash crops like corn because it can be harvested in a very short period of time and can be planted multiple times in one season, coupled with high market demand and concrete support for the government and private investors. As a result number of corn farming in Mae Chaem area expanded rapidly, which in turn led to more forest burning in order to prepare for farmland. Processing corn also requires burning. Large amount of corns mean large amount of corn cobs as well. Table 3 shows amount of corn cobs (ton). There is no other measure to get rid of corn cobs that is easier and cheaper than burning.

Table 2 Amount of corn cobs/debris in Mae Chaem District, 2009.

<table>
<thead>
<tr>
<th>District</th>
<th>The Amount of Corn Farming Area (Rai)</th>
<th>Corn Wastes (Dead Corn and/or Corn Cob (Ton))</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Mae Na Jon</td>
<td>14,050</td>
<td>7,025</td>
<td>1 rai of animal feed corn produces</td>
</tr>
<tr>
<td>2. Chang Keang</td>
<td>13,125</td>
<td>6,562.50</td>
<td>1. Corn yield of 800-1,000 kg</td>
</tr>
<tr>
<td>3. Tha Pha</td>
<td>12,950</td>
<td>6,475</td>
<td>2. Wastes from corn production such as dead corn, cobs etc. 400-500 kg</td>
</tr>
<tr>
<td>4. Mae Suek</td>
<td>11,940</td>
<td>5,970</td>
<td></td>
</tr>
<tr>
<td>5. Pang Hin Fon</td>
<td>8,140</td>
<td>4,070</td>
<td></td>
</tr>
<tr>
<td>6. Kong kak</td>
<td>8,100</td>
<td>4,050</td>
<td></td>
</tr>
<tr>
<td>7. Ban Tub</td>
<td>6,140</td>
<td>3,070</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>74,445</td>
<td>37,222.50</td>
<td></td>
</tr>
</tbody>
</table>

Source: Handout for focus group discussion under the project “Empowering Community for Fighting Smog Problem 2010” at the Royal Project Mae Hae
External Factors for Smog Problem

In addition to local burning and natural forest fire, another contributing cause of smog crisis in Chiang Mai province comes from outside the country. An image taken by NOAA satellite on March 16, 2010, just before the rate of fine particulate matter (PM 10) reached the highest level, show many hotspots in the Northern region of Thailand as well as in the neighboring countries, i.e., 383 spots in Laos, 499 spots in Cambodia, and 155 spots in Vietnam. Thailand has the second most hotspot in the region, mostly in the Northern part of the country. On that particular day, Mae Chaem had on 35 spots on the map, from 49 spots of Chiang Mai. Even though Chiang Mai had a very high rates of hotspots, it ranks third in the country after Mae Hong Son and Nan as shown in Table 3.

Table 3 shows the province is the largest heat 1-4 on March 17, 2010 at 14:10.

<table>
<thead>
<tr>
<th>Province</th>
<th>Conservation Areas</th>
<th>National Forest Areas</th>
<th>Agricultural Areas</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nan</td>
<td>17</td>
<td>37</td>
<td>3</td>
<td>57</td>
</tr>
<tr>
<td>Mae Hong Son</td>
<td>33</td>
<td>21</td>
<td>2</td>
<td>56</td>
</tr>
<tr>
<td>Chiang Mai</td>
<td>16</td>
<td>28</td>
<td>5</td>
<td>49</td>
</tr>
<tr>
<td>Chiang Rai</td>
<td>6</td>
<td>19</td>
<td>-</td>
<td>25</td>
</tr>
</tbody>
</table>


Nevertheless, if we look closely at the hotspot map shown below, we will see that numbers of hotspots in Thailand is significantly lower than neighboring countries. Smog problem is a trans-boundary problem. Burning outside the country can contribute to smog crisis in Thailand as well as the other way around. Thus, if we focus only on solving specific problems in the Mae Cheam District, it will not be able to put smog crisis to an end.

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7 Department of National Parks, Wildlife and plant control, forest fire statistics for the occurrence of forest fires, a map showing the detection of heat. (Hotspots Maps) [online], accessed from: http://www.dnp.go.th. (The search June 24, 2010).
Challenges in Eradicating Smog Problem

1. Challenges from local area

As aforementioned, major cause of fire in Mae Cheam area is agricultural production related such as preparation for agricultural land and burning agricultural wastes. Thus, if we want to stop burning, it is crucial for the government to provide alternatives for handing large volume agricultural wastes such as making fertilizer from wastes. However, these alternatives also have limitations. Mayor Omgoi Tambon Administrative Organization, Mr. Boonyen Jaita is very skeptical about making fertilizer from agricultural wastes, especially corn. Making fertilizer very much depends on the terrain. Making fertilizer from agricultural wastes only works on the flatland due to it needs granulators in the preparation of fertilizer. It is not logical to haul such a heavy machine up the mountain to produce a cheap fertilizer that may not be able to make any profit except for internal use.

2. Challenges from external factors

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8 Personal interview.
However, the smog crisis is not only our problem anymore. Our neighboring countries for example Myanmar, Laos, Vietnam and Cambodia are facing the same situation. Even though the smog problem can be managed inside our country, the smog from our neighborhood would affect us unconditionally and unavoidably.

According to our geographical shape which looks like a big bowl, the smog easily come by wind but hardly go. This nature factor is unavoidable and uncontrollable. Therefore, plus with the dust pollution in Chiang Mai which, the smog problem was exceeded the standard to 279.9 micrograms per cubic meter on 17 March 2010. So the problem needs to be resolved simultaneously. Building a strong international cooperation among neighboring countries is extremely concerned in order to share ideas and finding the sustainable solution for solving this crisis problem in international level.

**Government’s Measures for Managing Smog Problem**

Since 2003, Chiang Mai has issued the smog problem as the serious priority issue to be solved. The approval of the National Master Plan on the Control of burning was created for forest fire problem. Moreover, the way of solving wildfires and all emergency situations regarding to the smog in the Northern part was covered by this plan too. In 2010, the assigned relevant agencies were done their job as the following activities.

Ministry of Natural Resources and Environment is responsible for emergency measures especially within the country. Plus, the relevant agencies were assigned to operate the plan in 2010 and to look into the forest management again in order to prevent the forest fire which the main cause of smog problems.

Ministry of Interior has a role to cooperate the headman and local authorities in the village for monitoring and performing the regulatory control about the open burning during the dry season, strictly. This aim need a lot of cooperations and understanding from local people. Avoid burning waste residues and solid waste in agricultural areas should be suggested to those villagers.

Ministry of Natural Resources and Environment is the supporting sector for a project that cooperates among neighboring countries regarding to monitor the air quality in the Mekong sub-region.
The mobile unit will examine the air quality and set an air quality measure in the Union of Myanmar and Laos in dry season. The first operation was conducted firstly in Lao PDR on March 15, 2010 and then it was scheduled to Myanmar on March 29, 2010. Moreover, this problem was put into the agenda as an urgent pollution problem in The First Mekong River Commission Summit which was held during the 2 to 5 April 2010 at Hua Hin District, Prachuap Khiri Khan Province.

Next, Ministry of Agriculture will be responsible for driving and promoting the optional way of reducing the smog problem such as the alternative waste management, farming ladder and mixed farming.

Ministry of Science and Technology will be responsible for supporting the projects that are using geospatial technologies and satellite imagery to monitor and evaluate the burned areas.

In Chiang Mai, many sectors were aware of the smog problem. Then, after the Chiang Mai’s government declared this problem as a priority, the new policy and strategy were announced to Chiang Mai people officially on November 25, 2009 in order to prevent and control the pollution in Chiang Mai and as same as in the surrounded provinces. This strategy plan was develop as a three-year plan (during 2010 – 2013) with a budget about 75 million bath. The plan was done under the creation of partnership from various sectors. Plus, setting up a network of community management regards the natural resources and environment in Chiang Mai is also part of the plan. Combining with 24 community leaders, the representatives from local administrative organization were included and informed about their important role of being a middle man between government sector and local people in order to solve this problem together.

Moreover, many seminars have conducted aiming for discussing and finding some practical. However, due to many conditional factors and a lot of uncontrollable matter, the smog crisis was increased critically during February – April. Therefore, the afterward question about the potential and ability of the involved sectors were

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raised and questioned to the Chiang Mai government. Also, the successful policy and a serious measure were suddenly requested by local people.

**Conclusion**

Even though the smog crisis was aware in both local and national level, this problem seem to be uncontrollable and unavoidable due to many internal and external factors. Also, the unique geological area of the place that this problem occurred was one of the difficulties. Therefore, the appropriate solution that fit perfectly to each area was needed. Moreover, the deep analysis on a conservative lifestyle of the local farmers needs to be concerned in order to develop a proper understanding and a sustainable solution toward this problem. A serious policy and measure need to be done actively and continually. Moreover, the cooperation from all sectors is highly needed in order to helping each other to overcome this smog crisis. Besides, not only the cooperation inside our country but the agreement to solve this problem needs to be seriously concerned in international level.