

2007

A Hazy Situation

... be clear about it ...

Team Members:
Kweh Ren Hao Clement
Lee Ji Heng
Liu Weihao
Samuel Swee Jin Quan

Coach:
Ms Sharon Xu



ORACLE ThinkQuest
EDUCATION FOUNDATION

© A Hazy Situation
Raffles Institution, Singapore
All Rights Reserved



Table of Contents

1. About Us	
1.1 Who We Are	4
1.2 Research Methodology	4
1.3 Reflections	6
2. Introduction to Haze	
2.1 Purpose	9
2.2 Target Audience	9
2.3 Definition	10
2.4 Introduction to Measures	11
2.5 History	18
2.6 2006 Situation	21
2.7 El Nino: Worse 2007	23
2.8 Combat Organizations	24
3. Causes	
3.1 Farmers method of clearing	25
3.2 Large corporations – timber and palm plantations	25
3.3 Government’s Role	25
3.4 Presence of Strict Laws	26
4. Impacts	
4.1 Health Impacts	27
4.2 Environmental Impacts	28
4.3 Impact on Tourism	28
4.4 Economical Impacts	29
5. Social Survey	
5.1 Abstract	30
5.2 Results Details	30
5.3 Conclusion	35



6. Interviews	
6.1 Interview 1: Face-to-face interview with Mr Lee	36
6.2 Interview 2: Telephone interview with Dr Chang	36
6.3 Interview 3: Face-to-face interview with Dr Huang	36
7. Summary	37
8. Suggestion – The 3Ps	39
9. References, Acknowledgements and Links	42
10. Appendix	48
10.1 Interview Transcripts	
10.2 Permission Letters	



1. About Us

1.1 Who we are



Our ThinkQuest team consists of

- 1 Samuel Enjoys reading and playing computer games
Aspires to become a teacher.
- 2 Clement Enjoys playing with computer software and reading books.
Aspires to become a language teacher.
- 3 Weihao Enjoys playing softball and drawing cartoons.
Aspires to become a softballer.
- 4 Ji Heng Enjoys playing the piano, surfing the Internet, drawing and eating.
Aspires to become a teacher.

We are currently studying in Raffles Institution, a secondary school in Singapore. Every year, students in our school are tasked with a research project work and we are free to research on topics of our own interests. Hence this year we have decided to adopt ThinkQuest and carry out research on the topic of the haze situation that happens in South-East Asian countries every year during the September to October period.

1.2 Research Methodology



To start up our research journey, we first brainstormed for the topic that we want to research about, and the objectives. We are to develop an educational website that aims to provide a complete view of the annual haze situation and suggest ways to protect, prevent and prepare. With clear objectives in our mind, we sorted tasks for everyone.

Before we conducted interviews and surveys, we needed to have a deep understanding of the haze situation, including the history, causes, impacts of the haze and other minor details. We gathered our data from different sources: print (from the library) and non-print sources (from the web). We took every effort and care to ensure that the data we produced was not plagiarized.

The websites that gave us insight into the haze situations include:

1. National Environment Agency of Singapore
2. Haze FAQ
3. Singapore Institute of International Affairs



We came into contact with Ms Tay Lee San, Senior Scientific Officer, Pollution Control Department, and The National Environment Agency when we wanted to obtain the PSI Readings of 2006 in Singapore. She was friendly and approachable, and did not hesitate to help us clear our doubts, whenever the need arose.

When we had some queries and could not find the information from sources, we resorted to using Yahoo! Answers, which proved to be quite useful.

We planned out the questions for the survey. We ensured that these questions could fill any gaps of knowledge from our data generation. Following that, we generated and posted our survey through an online resource called AsknLearn. We publicized our survey through a few websites and forums. For example, Yahoo! Answers. Of course, we had to determine our target group and our aims of the survey first.

As for the interview, we needed to seek professional views so as to further substantiate our data presented. Thus, we sourced for suitable institutions and organizations and arranged to have face-to-face interviews/telephone interviews. The questions which we planned to ask were mostly opinions which we wanted to hear from the experts who were located in Singapore. In total, we conducted 3 interviews.

Interview 1

Mr Desmond Lee Kok Onn
Assistant Director
International Relations Department
Policy & Planning Division
The National Environment Agency

We found Mr Desmond Lee through the National Environment Agency's website and made an appointment soon after. We needed his opinions since he was from the government sector and we wanted to find out more or less what the Singapore government has been doing about the haze. From our interview with him, we learnt about the term Transboundary Pollution. We also found out about the different organizations (e.g. ASEAN Specialized Meteorological Centre) formed to counter the haze problem.



Interview 2

Dr Chang Chew-Hung

Assistant Professor

Humanities and Social Studies Education Academic Group

National Institute of Education

Nanyang Technological University, Singapore

We found Dr Chang through the Nanyang Technological University website where we requested to have an interview with one of the professors. So, Dr Chang was chosen to help us with our interview.

During our 10 minute telephone interview with Dr Chang, we found out that environmental impacts of haze were reduction in visibility and air quality. We found out that alternative methods to clear land would depend on the different agricultural sectors. The alternative methods would range from a small scale subsistence level to a large scale commercial plantation. We also gained insight as to the fact that the prediction of the haze getting worse this year might be inaccurate since there were other factors involved.

Interview 3

Dr Chris Huang Chia Yu

MBBS (Melbourne)

DIP of Dermatology (UK)

Huang's Surgery, Singapore

Through our face-to-face interview with him, we learned more about the impacts of haze on the human body and health. He also cleared our doubts on some of the data which we gathered. Through this interview, we had gained a much better insight into the impacts of the haze and what could be done to protect ourselves from haze such as installing air filters in our houses.





1.3 Reflections

In the course of this project, all of us took away much from it. We learnt the importance of teamwork and time management. Values such as responsibility, sense of urgency, punctuality and patience were gained along the way.

At the beginning, we were all very excited and enthusiastic over this project and could not wait to get started. Owing to examinations, we could only begin work in October 2006. By then, some problems arose. One of them was that we were unable to work cohesively when we realized that we were all rather headstrong and could not really acknowledge one person's leadership role. All of us tried to lead others. This became quite a big problem causing us being reluctant to share our files and information with each other. On hindsight, it seems so laughable that we almost fell out over this. The unhappiness soon dissipated and we were back as a team once again after some rather personal emails and talks.

Another obstacle we encountered was the starting of the school term. During December, not much work was done and with all of us being committed to our activities like camps and extra-curriculum activities. We found that our schedule was too packed to even mention ThinkQuest and "meetings" were reduced to status reports during break and lunch. This almost became our downfall as we realized that we just could not take time off to have a good meeting and consolidation of information. Due to this, information was insufficient and the deadline started drawing closer and closer. This gave rise to us staying back for long periods of time in school to finish up our stuff. Also, with the stress and pressure of academic projects and examinations, we were really on a tight schedule.

The third problem we encountered was our academics. Due to the time-consuming nature of this project, we were sandwiched between our grades and the project. Some of our grades suffered and homework ended up being done between lessons or before school. This was where time management came in and where we actually begin to understand its importance.

Overall, the process and experience we gained in this project were unforgettable and really meaningful. Working as a team let us further understand each other and we share laughter and fun along the way. The project also enabled us to interact more with our teacher mentor and this really bridged the teacher-student gap. Although we worked hard and we were under tremendous stress, we had absolutely no regret in choosing this project. Our site contains the blood, sweat and tears of our research and efforts and we are extremely proud of it. This is not just a project to us; this became an integral part of our lives, an unforgettable archive of memories.



At first, when we started researching on the cause of the haze, we began to blame the Indonesian farmers for setting the forest fires and causing the haze and inconveniences to the countries affected by the haze. However, as we slowly progressed, we began to empathize with these farmers and their poor living conditions. We were even planning on going down to Indonesia to interact with the farmers to understand their needs and offer them help, and in turn help them find alternative methods to clear the land for crop-planting. Our actions may even inspire others to do something for these Indonesian farmers and begin to change their attitude towards them. Our actions too would reflect on the role we play towards helping the environment. By so doing, we would be contributing back to the society.



2. Introduction to Haze

2.1 Purpose



Since 1997, during the annual September to October period, South East Asia would be shrouded in a blanket of haze and smoke. The haze is a recurring and annual problem in South East Asia caused by forest fires raging in Indonesia due to the “Slash and Burn” method of clearing land. This haze has a great impact, on human being’s health; the tourism and the trading industry of the SE community; as well as the global environment.

The terrible haze in 2006 sparked off our research on the haze. We asked ourselves, “Why is the haze occurring annually?” and “How can we stop this situation?” With these questions in mind, we embarked on our project.

Our website, “A Hazy Situation - be clear about it”, aims to provide people in South East Asia and the entire global community with a holistic view of the annual haze situation, exploring it’s history, causes, measurement and impact.

The following are our objectives:

- Investigate the past year Haze situation and the causes of it.
- Investigate the impacts of Haze on economy, health, tourism and environment.
- Provide suggestions on how we can protect, prevent and prepare for the future Haze problem.
- Share our research findings and generate greater public awareness of the haze situation.

2.2 Target Audience



Our target audience is mainly the people in and around ASEAN countries, as well as anyone else who would like to learn about the haze situation.



2.3 Definition



What is haze? We found the following definitions of 'haze' from reliable online dictionaries and Wikipedia.

From Cambridge Dictionaries Online:

"When the air is not very clear because of something such as heat or smoke, making it difficult to see well."

From AskOxford.com:

"A slight obscuration of the lower atmosphere, typically caused by fine particles of dust, pollutants, etc."

From Merriam-Webster's Online Dictionary:

"Fine dust, smoke, or light vapor causing lack of transparency of the air."

From Dictionary.com:

"An aggregation in the atmosphere of very fine, widely dispersed, solid or liquid particles, or both, giving the air an opalescent appearance that subdues colors."

From Online Medical Dictionary:

"Light vapor or smoke in the air which more or less impedes vision, with little or no dampness; a lack of transparency in the air; hence, figuratively, obscurity; dimness."

From American Heritage Dictionary:

"Atmospheric moisture, dust, smoke, and vapor that diminishes visibility."

From Wikipedia.com:

"Atmospheric phenomenon whereby dust, smoke and other pollutant particles obscure the usual clarity of the air."

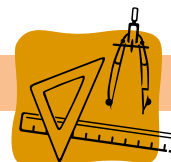
We then compiled our own definition, which we think is more understandable by teenagers.

Our Definition:

Haze refers to the accumulation of dust, smoke and other pollutant particles in the air which leads to the unclarity of the atmosphere, lower visibility level and detrimental effects on the human body.



2.4 Introduction to Measurement



Six commonly found pollutants

- Sulphur Dioxide
 - A colorless gas when in high levels can cause humans respiratory problems.
- Carbon Monoxide
 - A toxic gas difficult to identify and is fatal at high levels. Has been known to cause headaches and impaired vision.
- Nitrogen Dioxide
 - A gas that irritates the eye, nose and throat.
- Ground-level Ozone
 - Causes respiratory problems from the mildest (cough) to the most severe (aggravated asthma).
- Volatile Organic Compounds
- Particulate Matter.(i.e. PM10/2.5)
 - Made up of fine particles that can cause a range of respiratory and heart problems depending on the size of the particles.

Introduction to Particulate Matter (PM)

Particulate matter is basically particles of solids or droplets of liquid. They are sometimes emitted directly from a source or are formed when pollutants in the atmosphere react with each other. These particles come in a wide range of sizes. Those that are smaller than 10 micrometers (i.e. PM10) are potentially harmful to our health for they can get into our lungs to do some serious damage. These PM10 particles actually damage human health and could cause many different respiratory effects on us. Also, these PM10 are produced from the haze with the many minute particles of dust and smog suspended in the air during the haze.

Introduction to Ground – level Ozone

According to <http://www.airqualityontario.com/science/pollutants/ozone.cfm>, the Ground level Ozone “results from photochemical reactions between oxides of nitrogen (NO_x) “

Measurements

In order to measure the amount of pollutants in the air of a certain place, indexes are essential to enable environmentalists to express the degree of pollution in a way that is universally understood. With the indexes, media sources will be able to report air quality daily and enable the public to be aware of the air pollution levels. Across the globe, several types of air pollutant indexes exist. Here we will be introducing a few indexes used in SEA countries and other countries.



SNO	Index Currently Used	Countries
1	PSI	Singapore, Taiwan
2	AQI	US, Canada
3	API	Hong Kong, Malaysia
4	ISPU	Indonesia

1. PSI (Pollutant Standard Index)

Singapore uses PSI to keep track of air quality. According to e-notes.com (<http://science.enotes.com/science-fact-finder/environment/what-pollutant-standard-index>), it does so by “measuring the concentrations of pollutants in the air, in parts per million”. The table below describes the general health effects for the various levels of air pollution.

PSI	Descriptor	General Health Effects
0 – 50	Good	None
51 – 100	Moderate	Few or none for the general population
101 – 200	Unhealthy	Mild aggravation of symptoms among susceptible persons <ul style="list-style-type: none"> those with underlying conditions such as chronic heart or lung ailments; transient symptoms of irritation eye irritation, sneezing or coughing in some of the healthy population
201 – 300	Very unhealthy	Moderate aggravation of symptoms Decreased tolerance in persons with heart or lung disease More widespread symptoms of transient irritation in the healthy population
301 – 400	Hazardous	Early onset of certain diseases in addition to significant aggravation of symptoms in susceptible persons Decreased exercise tolerance in healthy persons
401 – 500	Extremely Hazardous	LIFE-THREATENING to ill and elderly people Healthy people may experience adverse symptoms that affect normal activity

Fig 1.1 taken from <http://app.nea.gov.sg/cms/htdocs/article.asp?pid=1251> (permission gotten)

The PSI was developed by the United States Environmental Protection Agency (USEPA). It incorporates only particulate matter smaller than 10 (PM10). In 1999, US EPA changed the PSI to the AQI so that it will be more accurate in calculating PM2.5 and ozone gases rather than just PM10.

2. AQI (Air Quality Index)

According to Wikipedia (http://en.wikipedia.org/wiki/Air_Quality_Index), “the AQI is also an indicator of air quality at a specific place. It measures mainly the ground-level ozone and volatile organic compounds (VOCs) in the presence of sunlight, which is brought about by



mainly human activities. It is mainly used in the US and Canada. Particulates (fine particles of either solid or liquid suspended in the air) may also include sulphur dioxide and nitrogen dioxide, a gas poisonous to inhale, but is still a common air pollutant.”

According to AirNow, A cross-agency U.S. Government Web site (<http://www.airnow.gov/index.cfm?action=aqibroch.aqi#2>), AQI is divided into the following 6 categories

Index	Status	Description
0 to 50	Good	Acceptable air quality; minimal risks
51 to 100	Moderate	Largely acceptable, poses risk to a minority
101 to 150	Unhealthy for Sensitive Groups	Sensitive people may run into respiratory problems
151 to 200	Unhealthy	Population experiences health problems; sensitive groups may run into serious problems
201 to 300	Very Unhealthy	Health alert stage. All may experience severe health problems
301 to 500	Hazardous	State of emergency would be declared. All will be affected.

Fig 2.1 modified from <http://www.airnow.gov/index.cfm?action=aqibroch.aqi#2>, (Permission gotten)

Comparison between PSI and AQI

Let us now compare the difference between the two indexes discussed so far, the AQI and PSI.

AQI	PSI
More sensitive — includes particulates that are only larger or around 2.5 micrometers	Less sensitive — includes particulates which are larger of around 10 micrometers
Used mainly by US and Canada	In several countries such as the United States and Singapore
More for research purposes (for environmentalists to get a better understanding / idea of pollutants present in the air; help in research)	Used because government wants to let citizens be aware of the state of pollution of air. Easier for media broadcasting

3. API

Air Pollution Index (API) is used in Hong Kong and Malaysia. Malaysia measures the amount of the 4 main greenhouses gases (sulphur dioxide, carbon monoxide, ozone and nitrogen dioxide) in a day based on the possible health effects of air pollutants, while Hong Kong measures 6.

When level(s) of the pollutant(s) bridge(s) the healthy range, the indicator would rise to 100 or above. Advice pertaining to precautionary actions would then be disseminated to public by the Hong Kong Environmental Protection Department.

API	Air Pollution Level	Health Problems	Action Plan
0 – 25	Low	Not expected	No response needed
26 – 50	Medium	Not expected for the general population	
51 – 100	High	Acute health effects are not expected , but chronic effects may be observed if one is persistently exposed to such levels of air pollution	No immediate response needed; detrimental effects may be seen in the long run
100 – 200	Very High	People with existing heart or respiratory illnesses may notice mild aggravation of their health conditions Generally healthy individuals may also notice some discomfort	Population with medical condition is advised to refrain from physical activities; general population is advised to refrain from forceful physical activities
201 – 500	Very High	People with existing heart or respiratory illnesses may experience significant aggravation of their symptoms . There may be widespread symptoms in the healthy population like <ul style="list-style-type: none"> • eye irritation • wheezing • coughing • phlegm • sore throats 	General population should refrain from physical actives and population with medical condition(s) should take extra care/

Fig 3.1 taken from http://cleanair.hk/eng/air_pollution.htm, with modification (Permission gotten)

The Malaysian API can exceed 500. When it reaches this level, a state of emergency is declared in the affected area.

The table below shows the API Status indicator used in Malaysia.



API	Status
0-50	Good
51-100	Moderate
101-200	Unhealthy
201-300	Very unhealthy
301-500	Hazardous
Above 500	Emergency

Fig 3.2 taken from http://www.doe.gov.my/index.php?option=com_content&task=view&id=188&Itemid=370&lang=en

Comparison between API and AQI

Let us now compare the difference between the two indexes discussed so far, the AQI and PSI.

API	AQI
Measures the 4 main Greenhouse gases	Measures particulates that are only larger or around 2.5 micrometers
Used mainly by Malaysia and Hong Kong	Used mainly in US and Canada
Takes into consideration major pollutants which include sulphur dioxide, nitrogen dioxide, carbon monoxide, ozone, particulates and volatile organic compounds. However, focuses on the main 4.	More for research purposes (for environmentalists to get a better understanding / idea of pollutants present in the air; help in research)



4. ISPU (Indeks Standar Pencemaran Udara)

Translated, it means: Indonesia's Standard Air Pollution Index or Standard Air Pollution Index

The ISPU is used by Indonesia in calculating the haze level. It basically takes into consideration 3 major pollutants that affect air quality which are namely: ozone, sulphur dioxide and PM10. The crux of the ISPU is that it shows the air quality of major air pollutants and its potential threat to the general population's health in one reading. Two other air quality indicators are also included, Ground Level Ozone and Toxic Air Release, but Ground level Ozone is reported separately due to changes in regulations regarding it.

(<http://www.theharbinger.org/xviii/000411/envision1.html>)

ISPU	Band
0 – 50	Good
51 – 100	Moderate
101 – 199	Unhealthy
200 – 299	Very Unhealthy
300 and higher	Hazardous

Fig 4.1 generated from data gathered at <http://www.theharbinger.org/xviii/000411/envision1.html>

Acknowledgements

Big thanks to [rynkiedink](#) of Yahoo!Answers for providing us with the links after we posted a question on Yahoo!Answers as we were unable to find out what was ISPU.

Branching out

Suggestions for the lack of information on the Indonesian Air Quality Index

- Perhaps the government should be more transparent and release information to the public (i.e. English Website [something which we could not find])
- Through this, researchers will then be able to gain more information about the situation and hence, be able to conduct more research.

Conclusion

After researching the four pollutant indexes above, we are aware that there are other indexes in use across the globe that we have not explored. Our team then had a question in mind — why do people in all over the world have to create so many different indexes to measure air quality? We felt that if we could have one single, standardized index that would be used throughout all the countries, then it would make work easier for both the citizens and professionals (environmentalists, researchers, scientists). There would then be no more



confusion between people of different nationality who want to know the air quality in each others country.

Therefore, we felt that it definitely would be excellent if the governments or rulers of all countries arrange to come together to develop and agree on a standardized air quality index to facilitate the measurement of air quality in their respective countries.

Index	Area of Focus
PSI	PM10, media broadcasting
AQI	PM2.5, more sensitive
API	4 major pollutants (carbon monoxide, sulphur dioxide, nitrogen dioxide and ozone)
ISPU	Potential threat to general population's health Considers 3 main pollutants – Ozone, PM10 and Sulphur Dioxide





2.5 History

Since the Pleistocene Age, recurring forest fires have been a part of SE Asia. These fires were due to large amounts of time with no rain, resulting in dry forest, a hotspot for fires. Recently, this disturbance, known as El Nino, has returned. (HazeOnline.com)

SINGAPORE

In 1997, the haze took SE Asia and Singapore by storm. September 1997, the 3-hour PSI reading hit 226, the highest ever recorded in Singapore history. As quoted from TODAY Singapore 13 October 2006, "Singapore was estimated to have suffered USD 300 million in losses. Health costs, USD 5 million; Loss in tourism, USD 210 million; Loss in visibility, USD 41 million; Loss in recreation, USD 95,000. The economic loss per household was estimated at about USD 400 while losses to each Singaporean were USD 100." This was the extent of damage on Singapore. Since then, Singapore has been experiencing haze annually. In some years, it was worse; in other years, it was better. The haze did not seem too bad until 2006.

In 1999, there was also a rather serious haze episode. However, owing to the wet weather, the haze was not as bad as 1997 as the rains prevented further burnings. The Indonesia also passed a law, banning open burnings, in this similar year.

In 2002, Singapore experienced yet another severe haze. The PSI of October that year hit 79 on a Sunday night and 69 on a Monday night. However, the PSI did not rise above the 100 mark like it did in 1997, said Michelle Tan, spokeswoman for Singapore Environmental Agency. The rages on island of Borneo and Sumatra combined with the wind sent bouts of haze to Singapore, Malaysia and southern Thailand.

In 2006, smog started to cloud the September skies of Singapore. Euston Quah, head of economics at Singapore's Nanyang Technological University told the Agence France Presse and TODAY Singapore of his "back-of-the-envelope, round figure" estimate of Singapore's economic losses due to haze in October 2006 was USD 50 million. This was also the figure that economists came up with that was reported in TODAY Singapore. These losses encompassed health costs, loss in tourism, loss in visibility and loss in recreation as well as economic losses. The severity and great impact of the haze can be seen considering these losses were accounting for only the month of October.

MALAYSIA

In the 1997 haze, Malaysia was also badly, if not worse, hit by the haze like Singapore. Figures showed that the number of tourists at that year fell 13% from 7.1 in 1996 to 6.2 million in 1997.

In 2005, Malaysia experienced a severe haze situation. Port Klang and Selangor were declared a haze emergency state on 11 August 2005. The API at Port Klang was 424 on 10



August 2005. This was just 76 short of the “Dangerous” mark on the API. Visibility dropped so low (less than 1300 feet) that flights at Subang airport near Kuala Lumpur were suspended. Schools and one of Malaysia’s key ports, Northport, followed suit and were suspended. Shipping in the Malacca Straits was also affected by the haze. One example was the CSCL Kobe beached while moving to Westport on Monday, 8 August 2005. Health Minister Chua Soi Lek said “some government hospitals and clinics were seeing a 150 per cent rise in respiratory complaints”. A state of emergency would be declared if the API reading went over the 500 mark. The only time such an event occurred was in the 1997 haze, Sarawak. The Natural Resources and Environment Minister Adenan Satem noted that, “The situation is not getting better. It is getting worse.”

The situation in 2006 was similar. Haze shrouded most parts of Malaysia such as Eastern Sarawak and West and South Malaysia. In fact, visibility was so bad that it posed a threat to ships without navigation devices. An API reading of 171 was taken from Putrajaya, a reading considered to be unhealthy (101 -200).

INDONESIA

Indonesia has generally been the root cause of the SE Asia haze. Due to the cheap Slash and Burn method, many farmers resort to it and it has caused much disruption to the neighboring countries. Indonesians themselves are also affected with haze readings hitting hazardous levels. Visibility in certain areas dropped to 200 meters in 2006. The New Zealand Press Agency reported on 6 Oct 2006 (www.channelnewsasia.com), “In Pontianak, visibility was less than 300 meters while in Palangkaraya, it was just 200 meters, meteorological officials there said.

Health officials in both provinces have reported that more people have been seeking medical help for respiratory ailments in recent weeks. ”

Drivers had to turn on headlights in the day and flights were cancelled due to the thick smog obscuring the region on 8 October 2006.

THAILAND

In 1997, there was a fall in Thailand’s tourist arrivals with only 0.95 percent of tourist as compared to the same period in 1996 due to *both* the haze and economic crisis. Papers have reported these losses partially due to the haze.

In 2006, the haze was so bad in Thailand that people were advised to refrain from outdoor activities. As visibility had fallen to 100 meters, it was difficult to see for fishing boats in the Gulf of Thailand.



THE PHILIPPINES

Dow Jones International News reported on 22 Sep 1997 that flights to Palawan and General Santos City were cancelled due to the haze billowing from Indonesia. The haze caused much disruption within the country. Quoting navy spokesman Lt. Cmdr. Salvador Cuba from Dow Jones International News noted that, "Military planes and ships also were taking precautions in affected areas." The haze also grounded 150 planes in the Philippines with visibility at 3 km, short of 5 km for light planes to fly.

In 1999, the haze returned to Philippines. Though it caused some disruptions, it was not as serious as that of 1997.

BRUNEI

In 2005, the haze, combined with the dry weather, resulted in numerous bushfires around Brunei and visibility dropped on 21 March 2005. This caused more haze and set the 340 hectares Berakas Recreation Park ablaze.

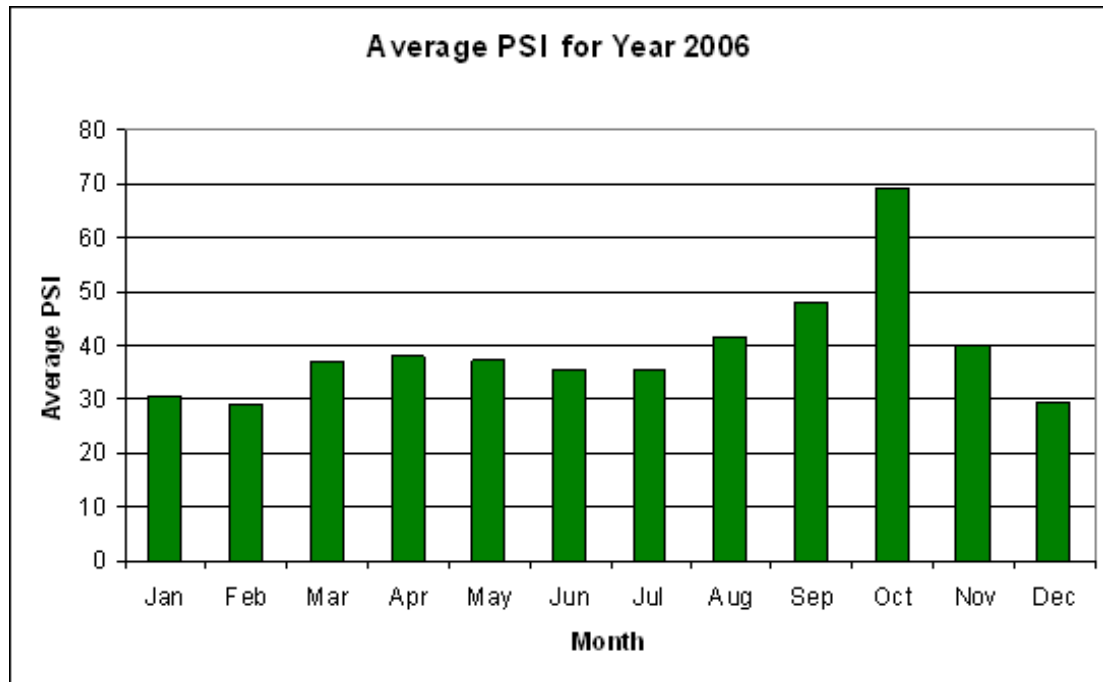
In 2006, Brunei faced a similar haze to that of Indonesia and Singapore with haze readings pushing to the danger zones.



2.6 2006 Situation



SINGAPORE



Thanks to National Environment Agent of Singapore who provided us with the detailed PSI readings for the year 2006, we generated the above graph reflecting the average PSI for the whole year. Obviously October was the one with the highest PSI. The average PSI reading for October was almost twice as the average reading for the whole year. Such a devastating phenomenon was caused by the burning of trees by Indonesian farmers and the El Nino which coincided with the burning season. It explains why the haze always occurs during the September to October period.

On 7 October 2006, the 3-Hour PSI reading at 1000hrs read 130. At 10 pm, it moved to a new high for the year at 150 since 1997. This was the highest reading for the whole year.

Euston Quah, head of economics at Singapore's Nanyang Technological University told the Agence France Presse and TODAY Singapore of his "back-of-the-envelope, round figure" estimate of Singapore's economic losses due to haze in October 2006 was USD 50 million. This was also the figure reported by economists in TODAY Singapore (a newspaper). These losses encompassed health care costs, loss in tourism earnings, loss in visibility and loss in recreation as well as economic losses. The severity and impact of the haze can be seen considering that losses were accounted for only the month of October.

MALAYSIA

As for our neighbor, Malaysia, it was reported in the 4 Oct Bernama – Malaysian National



News Agency that the haze “has yet to affect the tourist industry.” Quoting from New Straits Times Press (Malaysia) Berhad, 10 October 2006, “The haze has caused much resentment and hardship among Malaysians.” Health Minister Datuk Sri Dr Chua Soi Lek also commented that “it also had implications on tourism and economic activities, such as hawking, night markets and outdoor activities.”

PHILIPPINES AND BRUNEI

The haze caused similar problems in the two countries with visibility decreasing and haze levels pushing the limits. Also, large losses were incurred.



2.7 El Nino: Worse 2007



Experts have predicted a worse haze in 2007 due to a returning, and stronger, El Nino. This haze could possibly match that of 1997-1998 or even worse. "If the El Nino extends to the next slash-and-burn season, we can definitely anticipate a haze matching that of 1997," said Assistant Professor Chang Chew Hung of the National Institute of Education.

Professor of meteorology, Xie Shang-Ping of the International Pacific Research Centre (IPRC) was quoted by Bernama The Malaysian National News Agency that, "Instead of rain towards November, Singapore may very well be faced with a prolonged El Nino, causing the haze to linger to possibly February 2008." (The Malaysian National News Agency, 30 Oct 2006 issue)

The terrible El Nino phenomenon, which was seen in 1997-1998, was what triggered the devastating haze that was estimated to have cost **SE Asia USD 9 billion losses**. It damaged **9 million hectares of land** in Indonesia and affected **70 million people**. This led to the signing of the 2002 ASEAN agreement on transboundary haze pollution by the ASEAN countries.



2.8 Combat Organizations

a) ASEAN Ministerial Meeting on Haze/ Regional Haze Action Plan

Ministers from countries affected by the haze come together to meet and come up with solutions to solve the haze problem that is caused by the Indonesian forest-fires. The Action Plan introduced during the meeting calls for specific measures to prevent forest-fires from being set by drawing up and enforcing better policies. Educating the public on the haze is also essential. Technology is used to monitor the forest fires. The fire-fighting force of the region is also strengthened. The ministers of different countries agreed that they would continue work together to solve the haze problems by enforcing the preventive measures.

b) ASEAN Specialized Meteorological Centre

This centre was established in January 1993 to enhance the benefit from the advances made in meteorological science and technology. It is also to strengthen the support provided to weather-sensitive segments of their economies. The centre also provides relevant information on the weather and also to conduct forecasts. This would serve as an early warning service for storms and climate-related occurrences over the South-East Asian regions. The forecasts can then be handed over to each individual country for review, where the government can then inform the citizens about the current climate condition of the region and take appropriate actions. During the haze period, this would in turn help a lot as it provides the haze-affected countries an essential reference of their current air quality so that the government of the countries can know what actions they should take.

c) Haze Technical Task Force

According to "Association of Southeast Asian Nations", the Haze Technical Task Force (HTTF) was "established to operationalize and implement the measures recommended in the ASEAN Cooperation Plan on Transboundary Pollution relating to atmospheric pollution". It was created to "demarcate critical areas of forest fires", identify the periods whereby the smoke haze occurs, to "develop a system for National Focal Points to alert ASEAN Senior Officials on the Environment (ASOEN) on impending haze", "facilitate the proper collection and effective dissemination of meteorological data to the haze-affected countries", to develop a proper system to monitor the actions taken on ground to tackle the forest fires and also to "report on the status of projects relating to the control of the transboundary haze pollution involving international organizations and developed countries".

d) Sub-Regional Firefighting Arrangement

Main priority is to ensure that fires do not economic or environmental threat. The arrangements will ensure that fires triggered off be quickly extinguished. THE SRFA is funded by contributions from sources all over the world.



3. Causes



3.1 Farmers' method of clearing the land

The Indonesian farmers carry out the “slash-and-burn” method to clear the forest and make more land for crop planting. This method is definitely the cheapest and fastest way to obtain a cleared space. However, it causes serious consequences to the environment, causing severe haze to contaminate the air in neighboring countries.

Surprisingly, Wikipedia.com recorded that one of local villagers interviewed “appeared to be unconcerned with the smog, saying it was ‘normal’.” The villager said, “If we do not burn the forest, where are we going to get our food from?”

This negligent attitude will not be tolerated by the neighboring countries. The result of their self-centeredness is the inconvenience and torment which neighboring countries had to endure for many weeks after the burnings started.

The farmers would have to be educated about the effects of their inconsiderate actions. That is also why we are doing this project, to inform the Indonesian farmers hear clearly on behalf of the world, “Stop with your burning! You are damaging the environment!”

3.2 Large corporations – timber and palm plantations

Large corporations often want to employ the cheapest way to clear space to start their timber and palm plantations in order to save more money. Hence they employ workers to carry out the “slash-and-burn” method to clear the forest so as to free land for planting crops. This is a major contribution to the haze. The corporations should not be doing this as they are damaging the environment in the long run (not ethical at all). The government should send officials to inspect the forest sites regularly and check if the workers are going to use this method to clear the land. When caught red-handed, the operators of the corporations should be punished by being heavily fined. This would then stop them from doing this unethical act in future.

3.3 Government's Role

The Indonesian government plays an essential role in tackling the haze situation that originates in its country. In order to prevent the situation from worsening over the years and to eventually bring it to a stop, the Indonesian government needs to be very strict enough toward farmers and organizations who contribute to the haze. If the government does its part actively, it would be very possible that the haze would not occur anymore this year (2007)!



The government must understand that the farmers are from poor families. They use the slash-and-burn method to clear land because it is the most affordable method for them. They are not able to afford machinery to clear the land. To prevent the farmers from using this destructive method to clear land in future, the Indonesian government should provide them with alternative ways to clear the land to plant more crops. A possible way is to provide the farmers with subsidies for them to purchase the required land-clearing machinery (e.g. forestry mowers, excavators). With the help of machinery which is affordable to them, the farmers would not have to start forest fires.

3.4 Presence of strict laws

More stringent laws should be established against farmers who are responsible for contributing to the haze. Farmers who are caught using the slash-and-burn technique should be dealt with strictly. Jail-terms should be implemented if they have been repeat offenders. Guilty individuals or organizations should also be heavily fined. The government should be more active in sending officials to conduct frequent checks at the farming sites especially around September to December. This will reduce the chance of farmers using the slash-and-burn method to clear land to plant more crops.



4. Impacts



4.1 Health impacts

During the haze period, quite a number of people experienced respiratory related problems; asthma attacks, bronchitis. Many too suffered from coughing/wheezing, runny noses and sore throats. People complained of eye irritation and reddening of eyes. Those with respiratory problems (e.g. Asthma and chronic bronchitis), heart conditions (e.g. Chronic heart disease), skin conditions (Eczema) and the young and old would be severely affected by the haze.

Professor Euston Quah, head of economics department of Nanyang Technological University, mentioned that there was even a possibility of stunted growth for children's lungs if the children were repeatedly exposed to haze for a long time.

From our interview with Doctor Chris Huang, he felt that this statement is not true. Haze is not likely to stunt the growth for children's lungs, except for babies because their lungs are not fully developed yet. Hence, when they are exposed to particulate matter from the haze and their lungs are irritated, the result might be the scarring of their lungs. Furthermore, it might lead to other serious health conditions such as pneumonia, which could cause permanent damage to lungs. Nonetheless, this does not stunt the lung growth of the babies.

The haze pollutants contain particles such as ozone and sulphur dioxide (also greenhouse gases) may cause damage to the heart and lungs. Particulate matter 10 (PM10), the more commonly-found particle in the smoke haze, happens to be the most dangerous threat to lungs. When breathed in, PM10 might cause lungs to function at a decreased rate, causing shortness of breath!

During a serious haze situation, civilians would be advised by the government to stay indoors and limit outdoor activities so that the people are less exposed to unhealthy, polluted air. Nonetheless, PM10 is still able to enter buildings through fresh air vents.

In the First week of October 2006, when the haze was at its worst in Singapore, approximately 15 000 citizens complained of illnesses associated with the heart and lungs.

Haze has been linked to premature death recently according to HazeOnline website. If a person is exposed to too much pollutants from the haze, that could lead to premature death. The two main causes of this premature death are the two gases sulphur dioxide and nitrogen oxide which are part of the haze.



4.2 Environmental Impacts

The haze situation in South-east Asia mainly resulted from the burning of the trees in Indonesian forests. The gases that evolved from the combustion are sulphur dioxide, ozone, nitrogen dioxide and carbon monoxide. These are greenhouse gases and hence contributed to global warming and affected the atmosphere tremendously. This in turn speeds up global warming, causing shifting climate changes and unpredictability of the weather.

There is loss of biodiversity due to the forest fires. Flora and fauna are burnt and lost in the fires. We might have endangered even more species of animals and also destroyed rare species of organisms. This will cause a disruption in the ecosystem.

The haze pollutants cause a negative change in air quality in the neighboring countries. This would also affect the human's respiratory system. Humans need fresh air, but if the air quality is not good, the human's health will be affected detrimentally. Therefore, there would be a rise in patients with respiratory and eye problems caused by the inhalation of haze pollutants.

PM 2.5 mostly causes reduction in visibility. Reduction in visibility might also cause trade transport to travel with lots of difficulty. Trading ships may crash accidentally into objects if sailors are not alert and careful about their course, especially when it is so difficult to see ahead during the haze. As for airplanes, the haze would hinder the sight of the pilot, making it difficult to maneuver the aircraft, hence compromising the safety of the passengers.

4.3 Impact on Tourism

When haze hit Thailand on 12th of March 2007, flights were disrupted (13 cancelled) and had to be delayed. Tourists normally tend to shun countries with images of smoke and civilians wearing surgical masks, hence resulting in the decline of the tourism rate in the countries affected by the haze. Due to the fact that flights were cancelled, many tourists were left stranded at the airport since they had already checked out of their hotels while locals could still return back to their homes.

Though immediate cancellations were less observed, this showed that people planning for trips may reconsider their holiday destinations. Fewer tourists have visited Thailand, posing a problem towards Thailand's tourism, and the root of the problem is haze. Should the haze problem be solved, then Thailand's tourism would not be affected negatively.

An interviewed tourist was very annoyed with the haze situation because there was no sight of the sun after 9 days when he had come to Singapore to enjoy the sun.

In 1997, 13 flights from Singapore were cancelled due to the poor visibility from the haze. In that same year, airports in Malaysia such as West Kalimantan were closed. Also, 9 out of 11



Indonesian airports closed due to the haze. Visibility had worsened to 300 meters. There was even an Indonesian plane crashed which involved the lives of 234 people. The cancelling of flights and closing of airports prevented tourists from coming in to Singapore, causing a fall in tourism.

4.4 Economical Impacts

There would be a surge in medical costs since there would be many people going to the doctors for treatment of cough, and other haze-related illnesses. As a result, less people would turn up for work, reducing the efficiency of the different industries during that period.

People would flock to pharmacies to purchase eye drops to sooth their irritated eyes; face masks to filter the air they inhale, facial masks to prevent their faces from getting too dry and air purifiers to purify the air inside air-conditioned buildings.

Retailers and businesses may be affected due to the fact that most people try to stay indoors (definition: at home). However, there are some people who would rather stay indoors (definition: shopping centers) and spend their day there doing shopping, having meals, watching movies, et cetera. However, retailers in neighborhoods or places which are not air-conditioned will be affected adversely.

During the haze period, theme parks, sports facilities and coaches, alfresco dining restaurants and sightseeing tours (e.g. Ducktours in Singapore) had losses between 10 to 50 percent. Singapore lost an estimated S\$425 million during the 1997 haze period which lasted 3 months. US\$210 million tourism; US\$95 thousand recreation; US\$5 million health; US\$41 million visibility- airplanes and ships cannot navigate properly. The highest PSI was 226.

Should the haze last for a month, economic losses for Singapore would be maximum of \$70 million, according to Professor Quah. Imagine, if a worse haze were to last for more than a month, what would be the consequences be like to the country?

*Losses are affected by duration and intensity of haze.



5. Social Survey



5.1 Abstract

The social survey was conducted online from 23 February 2007 to 9 March 2007. It consisted of a few knowledge questions to test the population's understanding of the haze situation and opinion questions to hear the voices of the people. Overall responses were good.

5.2 Result Details

* Figures are rounded off to 2 decimal places

Question 1 (Knowledge Question)

How is the haze level measured in Singapore?

Option	Respondents (%)	Comments
1) AQI	0.00	
2) PSI	100.00	Correct Answer
3) API	0.00	

Analysis

All survey respondents knew that the "haze level" was measured using the PSI. This shows that respondents had an overall good basic understanding of the haze.

Question 2 (Knowledge Question)

At what range is the PSI considered to be healthy?

Option	Respondents (%)	Comments
1) Up to 50	52.27	Correct Answer
2) Up to 100	22.73	
3) Up to 80	25.00	

Analysis

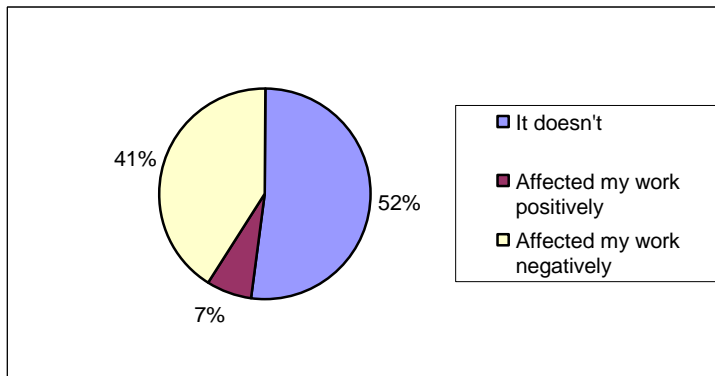
It is quite worrisome that almost 50% of the respondents think that the PSI level is healthy when above 50.

Question 3

How has the haze affected your work? E.g. Sales rate?

Option	Respondents (%)	Comments
--------	-----------------	----------

1) It doesn't	52.27	
2) Affected my work positively	6.82	
3) Affected my work negatively	40.91	



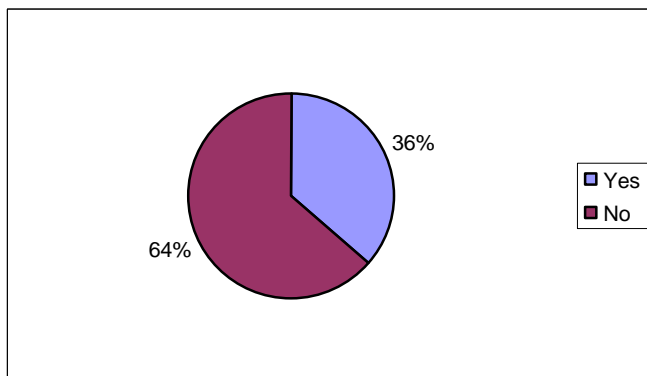
Analysis

From the results, it seems that half of the respondents were unaffected by the haze and while the rest are *mostly* negatively affected. This shows that the haze indeed has a detrimental effect on the general population.

Question 4

Do you exercise outdoors when the PSI level is above 80?

Option	Respondents (%)	Comments
1) Yes	36.36	
2) No	63.64	



Analysis

From the results, we can infer that most of the population does take some form of precaution against the haze subconsciously.

Question 5

(i) Has the haze affected you health in anyway?

Option	Respondents (%)	Comments
1) Yes	50.00	
2) No	50.00	

Analysis:

From the results, the general population is evenly split over this. However, when cross-referenced with other results, it seems that most actually are *affected*.



(ii) If “Yes”, could you provide us with some examples?

Option	Respondents (%)	Comments
1) Respiratory difficulties	23.08	
2) Red/Sore eyes	20.51	
3) Sore throat	33.34	
4) Rashes	2.56	
5) Others	20.51	Includes flu and stomach flu

Analysis

As predicted, it seems that the most common ailments during the haze period are sore throats, respiratory difficulties and red/sore eyes.

Question 6

What precautionary measures do you take during the haze period?

Option	Respondents (%)	Comments
1) None	63.84	
2) Wear a mask when outdoors	6.38	
3) Use a hydrating mask	0.00	
4) Use an air purifier	14.89	
5) Others	14.89	Most common includes stay indoors. A smaller minority answered drinking more water

Analysis

It seems that although most of the population are conscious about the haze, they do not take much precautionary measures. Some reasons generated might be that the haze was not as bad as the 1997 one where the PSI went over 200 as compared to the highest 150 in 2006. However, it is still worrisome that not all take measure as the haze could be potentially detrimental to one's health.

Question 7

On a scale of 1 to 10, how badly has the haze affected you with 1 being it has not really made a difference to me and 10 being I am disrupted from my daily routine.

Option	Respondents (%)	Comments
1) 1	9.09	
2) 2	6.82	

3) 3	20.45	
4) 4	20.45	
5) 5	9.09	
6) 6	9.09	
7) 7	20.45	
8) 8	4.55	
9) 9	0.00	
10) 10	0.00	

Analysis

Note: This question attempts to sum up the respondent's overall feelings to the haze.

It appears that most of the population are coping with the haze rather well but there is also an equal number who feel that the haze is affecting them rather badly.

Question 8

Do you think if the haze situation is improving over the years?

Option	Respondents (%)	Comments
1) Yes	13.64	
2) No	86.36	

Analysis

As clearly seen from the response, most of the people feel that the haze situation is now improving. Actually, when checked with figures, the haze situation is neither, with it being worse and better at different years. However, this question tells us the general perception that the haze situation is getting worse.

Question 9

Could you kindly provide us with an explanation of your response in Q11?

Most responses indicate that the respondents do know the cause of the haze. Below is one of the more comprehensive response.

"The haze situation, compared to previous years, seems very much worse, save for maybe 1997. All indications also point towards the fact that the situation will probably worsen as time goes along."

[*Note: There have been recent news reports that meteorologist predict a worse haze this year (2007) due to El Nino]

However, there are some who clearly pointed out the actual situation.



"I cannot really say that. In 2005 the haze situation didn't affect S'pore at all but during Oct last year (2006) the situation was terrible!" [Edited for grammar]

"It has been improving and deteriorating(...)"

Question 10

Do you think the haze situation will stay with us forever? Why?

Majority are unsure of this with hopes that technology might be able to turn this situation around. Also, an equal majority feel that the haze is going to stay forever. Reasons for this include the people being unaware/uneducated about the consequences of their actions and that there is only empty talk.

Some responses are listed below:

"Yes, as long as the other side remains unconcerned about the consequences and repercussions of their actions, the environment will never improve."

"Yes. Forest fires are caused by a mix of natural and human factors. Even if we reduce the human factors area, the natural factors will still stay and there will still be forest fires which will lead to haze, but less."

"Hopefully not. We just need to help the people to enforce laws and stop these forest burnings."
[Edited]

"Not necessarily. One day, maybe the farmers will find new techniques for clearing their land. Or one day, technology will be such that fires can be put out quickly and easily."

Question 11

How do you think we can solve this annual haze situation?

Option	Respondents (%)	Comments
1) New technologies to burn	23.53	
2) Educate the farmers	40.00	
3) Enforce laws	32.94	
4) Others:	3.53	

Analysis

Most respondents chose a combination of Option 2 and 3. It shows that the general population does



have an idea of how we can help but when cross-referenced with Question 12, it seems that most of them think that we cannot really help.

Question 12

What do you think we as individuals can do?

Responses are mainly negative with comments that we cannot do anything for it is out of our hands.

“Conserve the environment by practicing the 3Rs, recycle, reuse and reduce.”

“We must conserve the environment in any means, planting more trees, go the extra mile to use unleaded petrol, etc.”

“Educate ourselves and those around us.”

“Support the government”

However, majority of the responses were in the field of:

“As an individual it is hard to make an impact on the haze situation.”

“Nothing much”

5.3 Conclusion

Our main aim for this survey is to get the opinion of the public and at the same time, see how much they actually know. Through the many open-ended questions, we concluded that most of the public are aware of the haze situation and know of measures to take. Respondents were familiar the cause of the problem and what can actually be done. However, when asked about what we can do, most felt that we could not do much as an individual.

Overall, this survey has definitely improved our understanding of the public opinion and it has helped us to determine what areas the public needed more understanding in.





6. Interviews

6.1 Interview 1: Face-to-face interview with Mr Lee

The haze situation for different countries can be different during different years – Singapore was not really affected by the haze, though Malaysia was severely affected. When wind blows smoke haze to other regions, it is known as transboundary pollution. It is also mentioned that Indonesia took action to extinguish the forest fires by getting a Russian aircraft. This shows Indonesia's effort and sincerity in curbing the haze problem. The real reason behind the slashing and burning of trees is that the land is needed to grow plants like palm trees (very popular and in high demand for palm oil). If there were less demand for such plants, the situation might change for the better.

6.2 Interview 2: Telephone interview with Dr Chang

Dr Chang mentioned that the environmental impacts were reduction in visibility and air quality. He also cleared our doubts about haze contributing to global warming. It is the cause (forest fires) that contributes to the global warming. The ones that are contributing more to the haze are usually the richer ones. They can afford the machinery, not like the subsistence farmers. 2007's haze may not necessarily be worse as predictions are not fully accurate. Whether the haze becomes worse or not depends on the human and nature factors. Should both do things to worsen the haze, then there really is cause to worry. As the laws passed down were not followed through, many people still continued slash and burn with little chance of getting caught.

6.3 Interview 3: Face-to-face interview with Dr Huang

From this interview, we understand that there would be many health implications caused by the haze such as skin problems, respiratory problems, eye problems and possibly other human systems that are exposed to the haze particles. Particulate matter may indirectly cause permanent damage to undeveloped lungs. HEPA filters (air purifier) and masks can be used to filter out the pollutants at indoors and outdoors respectively, but the effectiveness of the masks will be reduced after a while when the moisture from breathing wets the mask.

Doctor Huang also gave us some precautionary measures such as avoiding maximum exposure to the haze and stay indoors. Elderly and children are more advised to stay at home because they are more prone to health complications. During the haze period, Doctor Huang saw an increase of patients with respiratory problems.

*For the full transcript, refer to the appendix.



7. Summary



The haze situation that occurs in South-east Asia is originated from Indonesian forests. It started in 1997 and that year, the haze was the worst seen. Farmers and large corporations use the “slash-and-burn” method to clear the forest. This method is, of course, the cheapest and fastest technique to make more land for crop-planting. However, it has serious consequences on the environment as the haze evolved not only contaminates the air but also poses a great threat to health.

While most farmers turn to employing this technique because they are poor and cannot afford land-clearing machinery, corporations have the intention of clearing space to start timber and oil palm plantations as it is the cheapest way to save money.

Added to that, should the El Niño Southern Oscillation (ENSO) phenomenon happen during the haze period, the results could be drastic. ENSO causes drier conditions, thus increasing wild bushfires. Haze periods could extend from one month to 3 months and the air quality would drop dramatically. Negative impact done to health, economy, tourism and environment would be far greater than usual. A very good example would be during the 1997-1998 haze period. The PSI in Singapore shot up to 226 during that time and at least \$7 billion was incurred in losses.

When exposed to the haze particles, many people experienced respiratory-related problems, such as



People with allergies and health conditions may also be negatively affected.

The haze pollutants might also cause damage to the heart and lungs. Especially for Particulate matter 10 (PM10), which can be found commonly in the pollutants, which when inhaled would cause the lungs to function at a decreased rate. This might result in shortness of breath, which is fatal! Even more, this pollutant is very hard to be avoided.

The forest fires also produced greenhouse gases that contributed to global warming — shifting climate changes and unpredictable weathers results. The fires might also have



destroyed rare species of organisms and endangered animals. It also posed threats to different modes of transportation.

The haze caused many flights to be cancelled and tourism rates in affected countries to decline tremendously. It made tourists unsatisfied about their vacations and even caused cases of accidents among modes of transport!

The haze situation caused a surge in medical costs as many people demanded treatment for illness brought about by it. People fell ill and less workers turn up for work, reducing efficiency of different industries during that period. People flocked to purchase health products to keep themselves healthy. Most stayed at home during that time to avoid inhalation of pollutants while many others went to indoor (air-conditioned) shopping centers. There were great losses in the economical and business world due to the drop in retail customers.

We have also come up with various suggestions in the course of our project. After researching on the different pollutant indexes used in different countries, we felt that if we could have just one single, standardized index, it would make work much easier for both citizens and professionals to measure air quality. It would be great if governments of all countries world-wide come together to develop and agree on a standardized air quality index to facilitate measurement of air quality in their respective countries.

The Indonesian government ultimately plays the most essential role in solving the haze situation and preventing it from repeating itself or even worsening in future. We suggest that it impose more stringent laws towards farmers and corporations that contribute to the haze so as to ensure that both parties put a stop to their inconsiderate actions.

Farmers could be provided with subsidies by the government to purchase the required proper land-clearing machinery (forestry-mowers, excavators). Farmers caught as repeat offenders should be fined or even jailed. Large corporations have the resources to do that, so if they are caught setting forest-fires, they should be punished severely by being heavily fined.

We learnt from our interview with Dr Chang Chew Hung that it is not enough just to draw up a law against farmers who use the “slash-and-burn” method of clearing the land, but it also includes enforcing it. The government should be more active in sending officials to conduct frequent checks at the potential fire-setting sites, especially around September to December annually. This would reduce the chance for farmers to set forest-fires to clear land. Unless the government plays an active role in taking prevention measures against forest-fire setters, the haze situation would never be solved.



8. Suggestion – The 3Ps



Protect

During the haze period (October to December), what should we do to protect ourselves from being affected by the Haze?

Environmental Agencies of the countries affected to the haze should always release the latest air quality index readings on a regular basis to the public in order to create awareness of the air quality in the regions. It is also to alert the public to take actions when the air quality reaches the unhealthy level.

We should minimize the outdoor activities and stay indoors. If there is a need to have outdoor activities, wear a mask to filter the pollutants in the air. In times of the absence of a mask, a suitable alternative is a wet or moist cloth. It would be able to eliminate most of the haze pollutants present in the air. For the people with weak health constitution, they should always stay indoors to avoid worsening of their conditions.

Equip buildings, schools and enclosed places with air purifiers. This would help to keep the air inside the buildings clean and free from most of the haze pollutants.

Cloud seeding troops should be formed within the air force of the countries affected by the haze. In times of very unhealthy levels of air quality and shortage of rain, the troops can be sent out to seed the clouds.

Tourists who happen to visit the countries affected by the haze during that period of time should be provided with a booklet in which contains suggestions, tips and advice about where they should tour in the country — places of interest that are less affected by the haze. The booklet should be able to convey the message to them that although haze is present in the air, life can still go on normally and not compromised in any way. In other words, the tourists should still enjoy their vacation in the country despite the presence of the haze.

Posters on how to keep healthy during the haze situation should be published and put up around airports of haze-affected countries, so that when tourists arrive they would be able to read them and know how to protect themselves from the haze. Our team suggests that tourists put on facial masks when walking in the streets in the countries. Pharmacies should package skin lotions, masks and vitamin pills for tourists' purchase. They should bring these packages together with them wherever they go.



Prepare

According to new reports, the haze would occur again in the later part of this year and it is predicted that the situation would be worse as there would be a more serious El-Niño effect this year. The weather would be drier than before because of it. Hence, it would be essential for the government and the public to be very prepared for it with the following.

1. Every family in the affected countries should be made available to a haze-combating kit, consisting of an air purifier, masks, vitamin pills, moisturizer and a booklet containing emergency hotlines.
2. Doctors from countries affected by the haze situation can come work together to publish a booklet that contains the symptoms that people with health conditions should look out for during the haze situation to check whether their health status is worsening or not. It should also provide advice on how the people should react if they diagnose themselves to such symptoms.
3. Doctors from the countries affected by the haze can also come together to form a network of clinics with specially trained medical staff to screen patients with health conditions worsened by the haze situation. These clinics would then be the centre of treatment during the haze period. The contact information of these clinics could be posted on somewhere accessible for everyone — a complete portal that the public can access information related to haze. They can also book appointments in advance with the doctors — this would reduce waiting time.
4. A set of action plans can be developed as a joint effort by the countries affected by the haze.
5. The government should educate the citizens from young about what they should do; how they should respond when the air quality reaches different levels of healthiness. The media authority can be employed to convey the message to the public on how they should respond when the air quality reaches different levels of health standard.
6. Subsistence farmers can be educated on other simple and more efficient ways to clear land. Funding from different charitable organizations can be used to purchase the necessary land-clearing machinery (bulldozers, excavators) for the farmers to clear the land by cutting down the trees without polluting the air. The wood can then be sold and the revenue earned can be added to the income of the farmers to support their families and also to pay for upgrade of the machineries.



7. A standardized global air quality index should be established throughout all the countries across the globe. This would make cross-referencing of the air quality measurements among different countries much easier, and in turn make work easier for professionals — scientists and environmentalists.

Prevent

Farmers could be provided with subsidies by the Indonesian government to purchase the required proper land-clearing machinery (forestry-mowers, excavators). In this way, farmers would be able to clear the forest the proper way, without causing air pollution. Farmers caught as repeat offenders should be fined or even jailed. Large corporations have the resources to do that, so if they are caught setting forest-fires, they should be punished severely by being heavily fined.

The government should draw up more stringent laws to deal with the farmers and corporations that contribute to the haze situation. People responsible should be punished severely by being heavily fined. Repeat offenders should even be jailed. From our interview with Dr Chang Chew Hung, we learnt that it is not enough just to draw up a law against farmers who use the “slash-and-burn” method of clearing the land, but it also includes enforcing it—the government should be more active in sending officials to conduct frequent checks at the potential fire-setting sites, especially around September to December annually. This would prevent farmers from setting forest-fires to clear land. However, if the officials discover that fires have already been started, they should immediately take action by mobilizing the fire-fighting force to extinguish the flames as soon as possible before it spreads to the entire forest.

Indonesian farmers causing the haze might not know the terrible implications of their inconsiderate acts of setting forest-fires to clear land for crop-planting. That is why our team has put in lots of time and effort to develop this web portal, “A Hazy Situation”, to inform the farmers about the consequences of their acts, and on behalf of South-East Asia, tell them, “The haze has severe impact on the environment and health — please stop it!”





9. References, Acknowledgements and Links

Non-Print Sources

1. The Harbinger Mobile, Alabama, The Harbinger, Progress Indicator for Environmental Quality (<http://www.theharbinger.org/xviii/000411/envision1.html>)
2. Department of Environment, Ministry of Natural Resources and Environment, Department of Environment – Information on Air Pollutant Index (http://www.doe.gov.my/index.php?option=com_content&task=view&id=188&Itemid=370&lang=en)
3. Project CLEAN AIR, The Hong Kong General Chamber of Commerce, Project Clean Air (http://cleanair.hk/eng/air_pollution.htm)
4. AIRNow, United States Environmental Protection Agency, AIRNow – AIRNow – Air Quality Index Brochure (<http://www.airnow.gov/index.cfm?action=aqibroch.aqi>)
5. National Environment Agency, Singapore, Haze Action Plan (<http://app.nea.gov.sg/cms/htdocs/article.asp?pid=1251>)
6. enotes.com, What Is the Pollutant Standard Index? – Science Fact Finder (<http://science.enotes.com/science-fact-finder/environment/what-pollutant-standard-index>)
7. Ontario Ministry of the Environment, Government of Ontario, Ground-level Ozone (<http://www.airqualityontario.com/science/pollutants/ozone.cfm>)
8. Cambridge, Dictionaries Online, Cambridge Dictionaries Online – Cambridge University Press, (http://dictionary.cambridge.org/define.asp?key=HW*98000317&dict=CLD2)
9. AskOxford.com, Oxford Dictionaries, AskOxford: haze¹ (http://www.askoxford.com/concise_oed/haze_1?view=uk)
10. Merriam-Webster Online, Merriam-Webster, Definition of haze – Merriam-Webster Online Dictionary, (<http://www.m-w.com/dictionary/haze>)



11. Dictionary.com, haze – Definitions from Dictionary .com
(<http://dictionary.reference.com/browse/haze>)
12. Online Medical Dictionary, Centre for Cancer Education, University of Newcastle upon Tyne, haze from Online Medical Dictionary (<http://cancerweb.ncl.ac.uk/cgi-bin/omd?query=haze&action=Search+OMD>)
13. Bartley.com, The American Heritage® Dictionary of the English Language: Fourth Edition. 2000, haze 1. The American Heritage® Dictionary of the English Language: Fourth Edition 2000. (<http://www.bartleby.com/61/51/H0095100.html>)
14. Wikimedia Foundation, Inc., 2007, Haze – Wikipedia, the free encyclopedia
(<http://en.wikipedia.org/wiki/Haze>)
15. Department of the Environment and Water Resources, Australian Government, NPI: Particulate matter 10 micrometers or less in diameter fact sheet
(<http://www.npi.gov.au/database/substance-info/profiles/69.html>)
16. American Association for Aerosol Research, AAAR, American Association for Aerosol Research (<http://www.aaar.org/>)
17. Green Facts: Facts on health and the Environment, GreenFacts asb, Air Pollution – Particulate Matter: Level 1 – Summary on Particulate Matter
(<http://www.greenfacts.org/air-pollution/particulate-matter-pm/index.htm>)
18. Catalyst, abc tv.au, Catalysts: Dirty Little Secrets – ABC TV Science
(<http://www.abc.net.au/catalyst/stories/s1630007.htm>)
19. Taylor and Francis, Taylor and Francis Group, Aerosol Science and Technology
(<http://www.tandf.co.uk/journals/titles/02786826.asp>)
20. Heath Canada, Regulations Related to Health and Air Quality (http://www.hc-sc.gc.ca/ewh-semt/air/out-ext/reg_e.html#2)
21. Green Facts: Facts on health and the Environment, GreenFacts asb, Air Pollution – Nitrogen Dioxide: Level 1 – Summary on Nitrogen Dioxide
(<http://www.greenfacts.org/air-pollution/nitrogen-dioxide-no2/index.htm>)
22. US Environmental Protection Agency, Ground-level Ozone | US EPA
(<http://www.epa.gov/air/ozonepollution/>)



23. New Mexico Environment Department, New Mexico Environment Department Air Quality Monitoring (<http://air.state.nm.us/>)
24. Environmental Protection Department, The Government of Hong Kong, Special Administrative Region, Environmental Protection Department (<http://www.epd-asg.gov.hk/>)
25. Spare the Air in the Bay Area, Bay Area Air Quality Management District, Spare the Air – Air Quality Index (http://www.sparetheair.org/data/air_quality.htm)
26. Met Office, MetOffice: Weather and Climate Change (<http://www.metoffice.gov.uk/>)
27. Saipan Tribute, Saipan Tribute
(<http://www.saipantribune.com/newsstory.aspx?cat=1&newsID=61706>)
28. Brudirect.com, Brudirect.com News, Brudirect.com – Local News
(<http://www.brudirect.com/DailyInfo/News/Archive/Nov06/011106/nite03.htm>)
29. Reuters AlertNet, Reuters Foundation, Reuters AlertNet – Russian planes to help Indonesia fight haze (<http://www.alertnet.org/thenews/newsdesk/JAK284005.htm>)
30. MediaCorp News, ChannelNewsAisa, Channelnewsasia.com
(<http://www.channelnewsasia.com>)
31. ENTA, TNA English News, MCOT: TNA English News
(<http://etna.mcot.net/query.php?nid=25459>)
32. Breaking News, bangkokpost.com, Bangkok Post Breaking News,
http://www.bangkokpost.com/breaking_news/breakingnews.php?id=106974
33. TAO, El Niño Theme Page, El Niño Theme Page: distributed information on El Niño
(<http://www.pmel.noaa.gov/tao/elnino/nino-home-low.html>)
34. International Federation of Red Cross and Red Crescent Societies, 1999 Red Cross World Disaster Report: El Nino and La Nina – the Pacific's deadly duo
(<http://www.ericjlyman.com/elnino.html>)
35. Bureau of Meteorology, Australian Government, BOM – Glossary of Terms
(<http://www.bom.gov.au/lam/glossary/soid.htm>)



36. El Niño theme page, U.S. Department of Commerce, NOAA/PMEL/TAO – What is El Niño (ENSO)? (<http://www.pmel.noaa.gov/tao/elnino/el-nino-story.html>)
37. HazeOnline, RHAP CSU ASEAN Secretariat, HazeOnline >> Main Page (<http://www.haze-online.or.id/help>)
38. Singapore Institute of International Affairs, Yearly haze may turn foreign talent off (http://www.siiainline.org/yearly_haze_may_turn_foreign_talent_off)
39. Wild Singapore, Haze Hits Northern Thailand, Disputes Flights (<http://www.wildsingapore.com/news/20070304/070313-3.htm>)
40. ENN, Environmental News Network, Form asthma attacks and sore throats :: ENN (<http://www.enn.com/today.html?id=11570&ref=rss>)
41. Rainforest Portal, Ecological Internet, Indonesia: Singapore, Clouded in Haze, May Face Deteriorating Air Quality (<http://www.rainforestportal.org/shared/reader/welcome.aspx?linkid=62041>)
42. Asian Development Bank, Executive Summary, Abbreviations and Acronyms (http://www.adb.org/Documents/Reports/Fire_Smoke_Haze/Executive_Summary/executive_summary.pdf)
43. ASMC Intranet (<http://intranet.mssinet.gov.sg/asmc/asmc.html>)
44. ASEAN Secretariat, (2003). Appendix (Establishment of Haze Technical Task Force By ASOEN). (<http://www.aseansec.org/8943.htm>)
45. Relief Web, (2007). from Press Releases: Southeast Asia: Environmental Agency - Sep 1997, ASEAN Update Vol. 1/98 (<http://www.reliefweb.int/rw/RWB.NSF/db900SID/ACOS-64D3Q5?OpenDocument>)
46. Environmental Protection Agency, (2007). from Carbon Monoxide | An Introduction to IAQ (<http://www.epa.gov/iaq/co.html>)



47. stock.xchg , the leading free stock photography site
(www.sxc.hu)

48. Environmental Protection Agency, (2006). from Nitrogen Dioxide | An Introduction to Indoor Air Quality | Indoor Air | Air |US EPA
(<http://www.epa.gov/iaq/no2.html>)

49. Environmental Protection Agency, (2006). from Ground-Level Ozone | An Introduction to Indoor Air Quality | Indoor Air | Air |US EPA
(<http://www.epa.gov/air/ozonepollution/health.html>)

50. Environmental Protection Agency, (2006). from Particulate Matter | Air and Radiation | An Introduction to Indoor Air Quality | Indoor Air | Air |US EPA
(<http://www.epa.gov/oar/particlepollution/health.html>)

51. ASEAN Secretariat, (2006). from ASEAN Ministerial Meeting on Haze
(<http://www.aseansec.org/1645.htm>)

52. Government of Ontario, Canada, (2007). from Sulphur Dioxide (SO₂)
(<http://www.airqualityontario.com/science/pollutants/sulphur.cfm>)



Print Sources

53. The Straits Times (Singapore)
54. TODAY Singapore
55. Agence France Presse
56. New Zealand Press Agency
57. Dow Jones Press International News
58. Bernama – Malaysian National News Agency
59. New Straits Times Press (Malaysia) Berhad



Acknowledgements

1. Ms Sharon Xu Lei, teacher mentor and coach, for her invaluable guidance and advice along the way much in the areas of administrative work such as contacting organizations and securing interview timeslots for us, as well for opening the school computer labs and staying late into the night to supervise our work, giving us much needed time and resources to work on our site and ordering food for us.
2. Mrs Cheryl Yap, who helped us in vetting our project and providing valuable comments and suggestions
3. Ms Mabel Chia, our English-Literature teacher, for helping us read through the site
4. Chen Kailun, our classmate, who provided some of the photographs in the gallery
5. Various respondents from the public who we surveyed
6. Mr Desmond Lee, Assistant Director of International Relations Department, Policy & Planning Division, The National Environment Agency (Singapore), for taking time off from his busy schedule to grant us an interview on this topic
7. Dr Chang Chew-Hung, Assistant Professor of Humanities and Social Studies Education Academic Group, National Institute of Education, Nanyang Technological University, Singapore, for taking time off his busy schedule to grant us a short interview regarding this topic
8. Dr Chris Huang, Doctor at Huang's Surgery at Valley Point, for taking time off his busy schedule to grant us an interview on this topic
9. Ms Tay Lee San, Senior Scientific Officer of Pollution Control Department, The National Environment Agency, Singapore, for providing us with much statistical data, helping us with our questions and liaising with us
10. Our parents, for picking us up late at night from school and being so understanding in the course of our project
11. EclipseCrossword, Green Eclipse 2002-2006©

And anyone else who has helped us or contributed to our project in one way or another!



Links:[Project CLEAN AIR](#)

A Hong Kong government website concerning the air pollution situation in Hong Kong. It provides much useful information about the API, pollutants and effects.

[AIRNow](#)

A US cross agency government website that provides the AQI reading in the US. It also provides basic understanding and about the AQI and commonly asked questions with answer.

[NEA](#)

The Singapore National Environmental Agency website. Constant updates of the PSI readings in Singapore are provided there. A list of links there also provides much useful information about the PSI.

[Department of Environment](#)

The Malaysian government environmental website. Provides a informative figure on the API with their suggested action plan(s)

[The Harbinger](#)

Information on the Indonesian ISPU or Air Pollution Standard Index can be found here. Look under the segment Air Pollution Standard Index, Mobile Country | Technical Notes

[PDF from Asian Development Bank](#)

This is a very informative PDF Document that gives a good overview of the haze with details that elaborate on the causes and impacts. It also talks of the underlying causes and explains many much-used abbreviations.



10. Appendix



10.1 Interview Transcripts

Interview 1:

1) What are the causes of the annual haze situation in Singapore?

Answer: Farmers use the slash and burn method to clear trees for their plantations as it is the fastest and cheapest method available. Some of the crops they grow would include palm trees. When the trees are burnt, with the aid of the wind, the fire goes out of control and forms smoke haze. This is also due to the South-west Monsoon where we are experiencing a dry season and there is little or no rainfall. Therefore, there is transboundary pollution when the wind blows the smoke haze to other countries (Singapore).

2) The haze situation occurs annually during August to October. But As far as you can remember, in which year exactly did the annual haze situation start to occur?

Answer: It was during 1997. There was low rainfall and it was also during the dry season. It so happens that when farmers clear the land, it coincides with the dry season.

3) As you know, the annual haze situation has been occurring for the past few years. Can you please tell us MORE about the measures taken by Singapore to lessen the impact of /prevent the haze on Singapore's economy and also to help our people?

Answer: NEA gives health advisories. Their website is constantly updated with the latest PSI every 3 hours during the haze period It also provides hourly PSI readings on TV.

4) As we have read in article written about the haze, besides from providing assistance by cloud seeding and sending fire fighters to Indonesia to extinguish the forest fires, what else did Singapore do to aid Indonesia?

Answer: In 2005, Singapore sent an aircraft, C1-30 to seed clouds and also 54 firemen with fire-fighting equipment. In 2006, Singapore did offer help to Indonesia, however, Indonesia had already arranged for a special Russian aircraft which could scoop up seawater and extinguish the fires. Other than the above mentioned, Singapore also provided Satellite pictures which showed the location of hotspots. With these co-ordinates, Indonesia was able to quickly rush to the fires and put them out efficiently, enforcing effort in helping to arrest the people responsible.



5) Whenever we read the news, we have the idea that most Singaporeans blame Indonesia for the haze since they are the ones who caused it by burning the forest. What is your view on this issue?

Answer: GENERAL SINGAPOREAN VIEW – Naturally, Singaporeans would feel unhappy as they would not be able to carry out outdoor activities. Those who are asthmatic will feel worse.

6) Amy Khor, Senior parliamentary secretary (Environment and Water Resources) mentioned that citizen's concern will help drive action. What is your opinion on her statement?

Answer: It is just like your neighbor cooks curry everyday and you dislike the smell. Either you tell the neighbor to stop cooking curry or do nothing about it. There is a haze action plan.

7) Indonesia organized a workshop in November last year to look into new measures to solve the haze problem. In your **PERSONAL** opinion, are the new measures effective/measures taken by Indonesia effective?

Answer: Effort is put in to engage Indonesians. Sub-regional Ministerial Steering Committee (MSC) was set up during the meeting in Jakarta in November. The MSC is headed by the environment ministers of Singapore, Malaysia, Thailand and Indonesia.

The meeting in Jakarta was spear-headed by our Prime Minister. Of course, before MSC was founded, there were other organizations such as Haze Technical Task Force (HTTF) and Sub-Regional Fire-fighting Arrangements (SRFA) which were monitoring the haze closely. The MSC was set up due to the severity of the haze. They also hope to improve the situation in future years.

8) So far, some companies in Indonesia have been under investigation as they have been suspected for contributing to the forest fire. And if they are prosecuted, do you think that the haze in this coming year to be less serious?

Answer: Information provided*. There are such companies like paper and pulp or palm tree plantations. Even if they are suspected, they can still deny responsibility. Only if they are caught red-handed, would there be fewer fires started. Although Indonesia has attempted to prosecute them, they always appear to be innocent.

9) Dr Yaacob once mentioned during a parliament session that the farmers in Indonesia have to be convinced to stop using the slash and burn method and adopt the other method of clearing land. In your opinion, will they be easily persuaded?



Answer: Farmers use slash and burn method because of the low cost and efficiency involved. Farmers are poor and are unable to afford machinery to slowly cut down the trees. Indonesia is receiving funds from ASEAN countries. Singapore and Indonesia has pledged US \$50 000 respectively. The funds gained will be used to subsidize/ defray the cost of the machines, lessening the burden of the farmers. Funds will be also used to develop programs to educate the farmers. Educating the farmers is a long process. In the long run, it will be successful. Companies will not receive any benefits/help from this fund as they are profit driven. More help is given in the form of equipment.

10) In your **PERSONAL** opinion, has the haze issue affected ties between Singapore and Indonesia, especially after Singapore brought up the haze issue at the United Nations General Assembly?

Answer: Since Indonesia set up MSC with Singapore, it just shows how sincere Indonesia is working together with Singapore. All ASEAN countries are trying to help out.

11) Do you feel that it will be a good idea for NEA to come up with certain activities related to the annual haze situation in Singapore (interactive games or talks) once in a while to educate Singaporeans on the haze? (E.g. how it is formed, what are the factors that make the haze worse etc.)

Answer: During 1997, after the occurrence of the haze, a talk was held. Recently, Mr Lee gave a talk for half a day at the Singapore Environment Institute. NEA passes on whatever information it has to the media/press, thus there has been some interaction between NEA and citizens. Singapore is the host of the ASEAN Specialized Meteorological Centre (ASMC). ASMC monitors the haze situation/weather for all the ASEAN countries.



Interview 2:

- Professor : Hello Samuel, how can I help you?
- Samuel : We need your expertise and we would like to ask you a few questions.
- Professor : Go ahead. I think I have ten minutes with you.
- Samuel : Ok, firstly, I would like to ask you about the haze that has been affecting Singapore and South-east Asia annually.
- Professor : Annually?
- Professor : I don't think we have a smoke haze annually.
- Samuel : I mean, around October... It is around the October period
- Professor : So you are asking me about the environmental impacts of the smoke haze when it comes around October. When you say annually, I think you mean every year?
- Clement : Yes, actually it kinds of occur every year. It is just that it is more serious some years; it is less serious in other year.
- Professor: : Okay, so you are asking me what sort of impacts.
- Samuel : Yes.
- Professor : And I would say the usual environmental impacts would include change in air quality, reduction in visibility and things that you probably can read off the web. I was thinking that you could be asking me some questions that are more wide, stuff that you can't get from the web.
- Samuel : Actually, we came up that, you know haze in a way contributes to global warming right?
- Professor : No it doesn't contribute. What gave you the idea?
- Clement : Can you explain to us how come it does not?
- Professor : Why don't you just tell me why you think it affects or it contributes to global warming, and then I'll see if you're on the right track.
- Ji Heng : You know during this project we actually went online to research for background information. We found out that the farmers in Indonesia use the 'slash-and-burn' method to clear the land because it is cheap, correct?
- Professor : All the land and as well as the large plantations, yes.
- Ji Heng : Using this method they burn the land and the fire produces carbon dioxide when combusting. Carbon dioxide is one of the major greenhouse gases and will contribute to global warming.
- Professor : No doubt.
- Ji Heng : So can we like... actually... know why just now you said that ah... yah
- Professor : Ok what you meant was that smoke haze is global warming. But what you are saying is that fire contributes to global warming. These are two different things.
- Ji Heng : Okay.
- Professor : One is the cause, one is the result! So what you say is that the result of



the burning causes the global warming, which is inaccurate. What is accurate is that the activity of slash-and-burn reduces the carbon in the biomass in the carbon dioxide and therefore contributes to global warming. Correct. But the smoke haze, being phenomena, whereby the increased air pollution causes global warming, no.

- Ji Heng : Oh ok.
- Professor : They are entirely different issues.
- Ji Heng : Okay.
- Professor : Mmm. So did you get that?
- Group : Yes sir.
- Ji Heng : Moving on to the next question... uh can you suggest any other alternative methods for farmers to clear the land, like because as you explained just now, farmers use the slash-and-burn method. But actually we would ask for your opinion on other alternative methods.
- Professor : Well, there are alternative methods for various scales of agriculture. At the local field when you're talking about the traditional agriculture, there are few options for the farmers as they are not economically well to do. For them it probably is difficult to think of other methods to clear the land for cultivation. On the other hand for companies that own large plantations, they probably are the ones who will contribute more to the haze situation. The large plantations should look at the method of their clearing and they have the resources to do that. They can always use machinery and they can also be very careful about how they can minimize the effect of their clearing to the surrounding land. So agriculture is practiced at different scales in Indonesia one at the subsistence level and one at the commercial level. And the change in the practice in large scale plantations that will be more impact on the environment.
- Ji Heng : Ok thank you. We indeed get a better insight. We did not manage to get this off the web.
- Clement : Sir I'm Clement, another of Samuel's project group.
- Professor : Sure.
- Clement : So in this year 2007 what's your take on the haze? Do you think it is going to be worse, like the newspaper said, or what?
- Professor : At the moment it is still a question. According to the latest predictions by the Ento-centre that basically looks at whether there is a El-Nino or not, there are no clear indications of what the condition would be like at the later part of the year. The predictions are only accurate up to about 50%, so we cannot really predict. However, if the type of agriculture activity that are conducted in the next parts of the year, whether is there going to be an El-Nino condition or not will still result in the smoke haze. Because if



annually there is some kind of smoke haze, difference comes in the magnitude. So it is very hard to predict because there are two factors that are involved here –one, human and two, nature. But when both human and nature work in the same direction to increase the smoke haze production then it would be a more terrible one.

- Clement : Ok yes.
- Ji Heng : Sir can we ask a follow-up question?
- Professor : Of course, go ahead!
- Ji Heng : You know actually the haze situation this year and maybe in future may actually be closely related to the Indonesian government – their role in the solving of this haze situation right? Do you get me, sir?
- Professor : I got your statement but I didn't get your question.
- Ji Heng : Oh ok. Now I just ask... You know this government... what do you think the government should actually imply... uh no.. what role should the government play; what actions should they take to solve the haze problem?
- Professor : Well I have to clarify – what actions should they take or what actions will they take?
- Ji Heng : What actions should they take, in your own opinion, because...
- Professor : Ok fine. It has all been the biggest concern as the world has been focusing on them since the 1997 smoke haze. Um and the worse event on using fire as a method of land-clearing during this Sahara's rain 1997. What we saw was that there was no follow through of that particular law. By looking at the historical incident what we can understand is that the government level policies such as _____ an example would be useful in inserting the right directions for the rest of the people in the country, whether it is industrialist, agriculturist, and so on. It sort of let them know that the government wants to do something to stop this haze. However having a legislation of such a law is not sufficient. The government should also take part in some kinds of active policing of such legislation. That means you can have a law, but the law is not useful unless you get people to enforce the law and check if the farmers are doing their work correctly. It isn't simply drawing up a law. It is also after drawing a law drawing up, maybe, committees or departments or organizations that will take part actively and routinely check on the activities around and make sure that people are abiding to those laws. Ok so it is not just law-making but also law-enforcing.
- Ji Heng : We see the two sides have very great parts to play — the people and the government – the people will have to carry out the law.



Interview 3:

- Samuel : We started our research because we were intrigued by what happened last year during the October period. What we wish to find out from you is more or less the health impacts. Through our research, the survey we conducted and the interviews we conducted, we gained much knowledge about haze. In our survey, we found out that some people mentioned that during the haze period, they complained of stomach flu. What we would like to ask you is if it is possible that haze causes the stomach flu.
- Doctor H : The answer is no.
- Ji Heng : Can you elaborate?
- Doctor H : Stomach flu is a very general term, when someone comes to me and says that they have stomach flu, there can be two things, one is food poisoning that is causing the indigestion, pain, vomiting, diarrhea. And this can be caused wither by food poisoning or a virus. Some viruses, I can't really remember exactly which ones, echo viruses, that cause an infection in intestines and they have the same symptoms as food poisoning is mainly pain, indigestion, vomiting, and diarrhea, so normally with a virus infection, there tend to be fever. Food poisoning, usually no. But sometimes, it can cause a fever too.
- Samuel : For all other health problems, like asthma, cough, flu, wheezing, are they all affected by the haze?
- Doctor H : Yes, yes. So I think haze in general tends to affect more of the respiratory system, means the lungs, the nose, eyes is not the respiratory system but it is exposed to the haze, thus resulting in eye irritation. Nose irritation, throat irritation, lung irritation, and skin.
- Samuel : Allergy? Eczema? How about the heart? Like the heart chronic disease?
- Doctor H : Basically haze doesn't cause any problems to the heart. But what happens is if the person. Usually a person with heart disease tends to have other illnesses such as asthma. They may be smokers so they have some sort of lung impairment. So when their lungs are stressed out by breathing difficulties from haze, then it can affect the heart and put a strain on the heart. And cause heart failure for example.
- Samuel : Then we would like to ask you about your personal experiences as a doctor. So during the last year's haze period or maybe the previous years for the haze periods, did you receive an increase in patients?
- Doctor H : Not a lot. I think it depends on where you practice. My area here, I mainly see more office workers. And sort of families, we call it family practices. So I didn't see a huge increase. I think the ones that see the huge increase are the doctors that work more in the hometown like HDB and clinics so



on. More people who are sick, they will go down and see a doctor there straightaway. They are not going to come all the way to work to see the company doctor and then go back home. So I think those people tended to see an increase in the incidents of haze related illnesses. I didn't see that many. But I did see some with a bit of coughing problems and nose problems, we call it allergic rhinitis. A little bit of asthma, skin problems, not really.

Samuel : Then on the occasions that you treated patients, what was the most common illness?

Doctor H : Breathing problems like asthma. Difficulty in breathing.

Ji Heng : Now you see, this haze is actually, during our research, we done lots of research, and it was mentioned that this PM10, it actually affected the growth of children's...

Doctor H : What is PM10?

Us : Particulate Matter.

Ji Heng : Can you explain to us how does this actually happen?

Doctor : Oh, actually I don't see how it will affect the growth of lungs in children unless it is over a very chronic exposure.

Samuel : It is actually the growth of lungs.

Doctor H : Oh, actually, I don't see how it will affect the growth of lungs in children. Maybe in babies. In the sense that they are not completely developed yet, so when they get exposed to particulate matter or irritation, that may cause scarring of the lungs. It may cause irritation that leads on to infection like pneumonia. And pneumonia can cause damage to the lungs so it won't stunt the growth of the lungs but it may cause permanent damage to the lungs. If these babies get infection.

Samuel : What do you mean scarring of the lungs?

Doctor H : For example, when you cut your skin, there is a wound there, the wound heals up and there is a scar there. We call it keloid tissue. That keloid tissue is not almost skin. It is hard. Same for lungs, when lungs are infected, it is actually an injury. So when the lungs get damaged, it does not repair itself. So that area of lungs doesn't work anymore. SO to say. Its not that bad. When you look at the PSI Index. There are a number of ranges. Below 50 is quite safe. 50-100 is not so safe. Over 100, it can cause damage and so on.

Samuel : What precautionary measures would you suggest that the people during the haze period? Then, specifically what measures for those with different illnesses like eye irritation or heart chronic.

Doctor H : It is very hard to protect yourself from the haze because it is all over the place. The only sure way of protection is to stay home. Close the windows



and get a very special filter called HEPA filter. That filters off particles from the air. Otherwise, there is no other way we can completely protect ourselves from the haze. The precautions you can take... For example, you have very bad allergic problems, eye problems, sinus problems or asthma, try to work indoors. For people who are more prone to asthma attacks, there are medicines you can use. They are called inhalers. They prevent asthma attacks. Some patients if they do not have any complications or any secondary illnesses like asthma and so on. Theoretically, they shouldn't be affected. I think the main thing is to try to avoid exposure whatever means you can. Staying at home or in the office. Using a mask will help to some degree.

- Ji Heng : I would like to ask a question, it's not listed here (questions paper). When people come to you and you see most working people. Do they have any infections during the haze period? Do you actually give them advice what they should they take or what should they buy.
- Doctor H : I think the advice is basically quite general. Again, I said avoid the haze if you can. And then are medicines they can use to help reduce irritations or sinus irritation or asthma.
- Ji Heng : Just now you said wearing a mask. Wearing a mask, many people would find it uncommon, so when you walk on the streets with a mask, everyone would be looking at you. Do you think there are any alternatives to this? What other things can they do other than wearing a mask when outside?
- Doctor H : There isn't much they can do. Being outside with the haze around you. There isn't much you can do to not inhale the dust.
- Samuel : When one wears a mask, if I am not mistaken, our research mentioned that if worn for more than a few hours, there will be breeding of bacteria. How many hours would you recommend them to wear before changing the mask.
- Doctor H : Not really a few hours. Actually within a few minutes. Once the mask becomes wet. Usually within 15 minutes. The efficiency of filtering bacteria reduces. Once you breathe and condense the mask, it becomes ineffective.
- Samuel : During the haze period, the government would more or less advice children, the elderly and people with respiratory and heart problems to stay home. Why is this so? Why does the government not advise working adults?
- Doctor H : I think what they are trying to say is to advise people who are more prone to getting complications to stay at home. So it is the very young, the babies. The very old who may have some other health complications.
- Samuel : Just now, you mentioned HEPA Filter, what does it stand for?



- Doctor H : I think it stands for High Efficient Particulate Filter. And during that period, you would notice that places like Best Denki selling many brands of air filters. They are basically taking advantage of the situation to earn money. Air purifiers basically work only in enclosed areas. Like for example a room with closed doors. This is because nothing comes in or out (bacteria or particles) of the room.
- Samuel : Other than the circulatory and respiratory system, what other systems are affected?
- Doctor H : Any system that is exposed to the air. And like I said, haze contains chemicals, which may damage lining of lungs and lining of blood vessels. If it damages the lungs, it will also damage the immune system.



10.2 Permission Letters

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

Hi,

Feel free to use the image. Please credit "United States Environmental Protection Agency" as the source.

Thanks,
Scott

il drago scuro

<[REDACTED]>

To: AIRNOWComments@EPA

04/06/2007 04:55 AM

Subject: Permission for information use

-----Original Message-----

From: il drago scuro [mailto:[REDACTED]]

Sent: Friday, April 06, 2007 5:06 PM

To: chamber@chamber.org.hk

Subject: Permission for information use

Dear Sir/Ma'am,

We are students from Raffles Institution in Singapore. We are creating a nonprofit, educational website for the ThinkQuest competition. We would like to include the following table from your website.

The file name of the table we wish to use is: Air Quality Index (AQI): Ozone. It is located at <http://airnow.gov/index.cfm?action=aqibroch.aqi#aqioz>

Our final website will be published in the ThinkQuest Library, a free educational resource located at <http://www.thinkquest.org>. We will honor your copyright by giving your organization full credit and citing you as one of our sources.

Please respond to this message and let us know if we may use this image in our project. Our deadline for publication is [insert date], and we would appreciate your quick response. Thank you for your time and consideration.

Sincerely,
Clement Kweh
Liu Weihao
Lee Ji Heng
Samuel Swee
Ms Sharon Xu
1 Raffles Institution Lane, Raffles Institution
[REDACTED]

*Emails blackened to protect sender's privacy.



PROJECT CLEANAIR

Dear All

We do not have objection if you wish to link to the Project CLEAN AIR website. For further information about the API of the HKSAR, you may wish to visit the Environmental Protection Department website as below:

http://www.epd-asg.gov.hk/english/api_you/apitell.php

Regards,
Thinex Shek
Senior Manager, Business Policy
Hong Kong General Chamber of Commerce
Tel: 28231270; Fax: 25279843
www.chamber.org.hk

-----Original Message-----

From: il drago scuro [mailto: [REDACTED]]
Sent: Friday, April 06, 2007 5:06 PM
To: chamber@chamber.org.hk
Subject: Permission for information use

Dear Sir/Ma'am,

We are students from Raffles Institution in Singapore. We are creating a nonprofit, educational website for the ThinkQuest competition. We would like to include the following table from your website.

The file name of the table we wish to use is: Air Pollution Index (API). It is located at http://cleanair.hk/eng/air_pollution.htm

Our final website will be published in the ThinkQuest Library, a free educational resource located at <http://www.thinkquest.org>. We will honor your copyright by giving your organization full credit and citing you as one of our sources.

Please respond to this message and let us know if we may use this image in our project. Our deadline for publication is 16 Apr 07, and we would appreciate your quick response. Thank you for your time and consideration. We look forward to our favorable reply.

Sincerely,
Clement Kweh
Liu Weihao
Lee Ji Heng
Samuel Swee
Ms Sharon Xu
1 Raffles Institution Lane, Raffles Institution
[REDACTED]

*Emails blackened to protect sender's privacy.

