



**Air & Waste Management Association  
and  
People to People Citizen Ambassador Programs**



**October 2007 Professional and Environmental  
Mission to People's Republic of China**



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## 1. Introduction

The Air & Waste Management Association (A&WMA) is a nonprofit, nonpartisan professional organization that enhances knowledge and expertise by providing a neutral forum for information exchange, professional development, networking opportunities, public education, and outreach to more than 9000 environmental professionals in 65 countries. A&WMA also promotes global environmental responsibility and increases the effectiveness of organizations to make critical decisions that benefit society.

The *Mission* of A&WMA is to assist in the professional development and critical environmental decision-making of our members to benefit society. The core purpose of A&WMA is to improve environmental knowledge and decisions by providing a neutral forum for exchanging information.

Back in 1956, the 34<sup>th</sup> President of the United States of America, Dwight David Eisenhower, believed that ordinary citizens of different nations, if able to communicate directly, would solve their differences and find a way to live in peace. This simple thought—that people can make the difference where government cannot—is People to People's foundation.

People to People Citizen Ambassador Programs provides foreign educational travel experiences for professionals and unique access programs for selected avocations. Through meetings, seminars or humanitarian efforts, and cultural activities, participants connect with people with similar interests or professions while overseas. The programs join common interests in uncommon places through journeys that enrich the world, one person at a time.

People to People recently became the first organization to receive the Knight for Peace (*Cavaliere per la Pace*) distinction. The International Center for Peace in Assisi, Italy, assigns the award to individuals who aid in the spread of peace and understanding to cultures all over the world. The list of past recipients includes Pope John Paul II, Mikhail Gorbachev, and Mother Teresa. In today's global climate, there has never been a stronger need for the educational exploration programs that People to People provides. Current world events call for us to continue, with unwavering dedication, our mission of peace through understanding.

This professional environmental mission to People's Republic of China, jointly organized by People to People Organization Citizen Ambassador programs and the A&WMA, offered the possibility for environmental, technical and professional exchanges between Chinese professionals and the members of the delegation. Cultural, social and historic visits of important sites in the visited regions permitted the delegation members to have an overview of some aspects of the country's history, culture and daily life.

Thirteen professional delegates participated in this environmental mission to China, together with four guests. This delegation was led by Mr. Robert E. Hall, past president of the A&WMA. Two other delegations were also travelling at the same time, they were the *Trial Lawyers* and the *Career and Technical Education Delegations* to China.

Each year, People to People Ambassador Programs develop over 150 professional delegations across the globe, covering fields as diverse as education, law, medicine, science and agriculture.

## 2. Résumé of China's geography, recent history, population and economy

### 2.1 Geography:

The geography of China (figure 1) stretches some 5,026 kilometers across the East Asian landmass bordering the East China Sea, Korea Bay, Yellow Sea, and South China Sea, between North Korea and Vietnam in a changing configuration of broad plains, expansive deserts, and lofty mountain ranges, including vast areas of inhospitable terrain.

The eastern half of the country, its seacoast fringed with offshore islands, is a region of fertile lowlands, foothills and mountains, deserts, steppes, and subtropical areas. The western half of China is a region of sunken basins, rolling plateaus, and towering massifs, including a portion of the highest tableland on earth.

The vastness of the country and the barrenness of the western hinterland have important implications for defense strategy. In spite of many good harbors along the approximately 18,000-kilometer coastline, the nation has traditionally oriented itself not toward the sea but inland, developing as an imperial power whose center lay in the middle and lower reaches of the Yellow River on the northern plains. China also has the Tibetan Plateau to the south. The Tibetan Plateau is a very large plateau with high altitudes. To the north of the Tibet Plateau lies the Gobi and Taklamakan deserts, which stretch from the extreme northwest eastward through Mongolia.

China is the world's fourth-largest country in total area (after Russia, Canada, and the United States). Figures for the size of China differ slightly depending on where one draws a number of ill-defined boundaries. The official figure by the People's Republic of China is 9.6 million square kilometers, making the country slightly smaller than the United States. The Republic of China based in Taiwan puts this figure at 11 million square kilometers, but this includes Mongolia, an independent sovereign state. China's contour is reasonably comparable to that of the United States and lies largely at the same latitudes. The total area is estimated to be 9,596,960 km<sup>2</sup>, with land accounting for 9,326,410 km<sup>2</sup> and water for 270,550 km<sup>2</sup> (around 3 percent).



Figure 1 : Map of China : courtesy of *Star Professional programs* during the in-country briefing.



Northern China has wet summers and dry winters. On the northern plain, it is colder in winter than anywhere else in the world at the same latitude, and for at least a month, the temperature is constantly below freezing. Further south, it is warmer and in the valley of the Yangtze River the winter is milder with a little rain. In the far south conditions are hot all year round. June to September are the wettest months when the summer monsoon blowing in from the south and southeast brings much rain.

China is administratively divided (figure 2) into 23 provinces, 5 autonomous regions, 4 centrally administrative municipalities and 2 special administrative regions (SAR).

People's Republic of China (PRC):  
Administrative Divisions & Territorial Disputes



Figure 2 : Provinces, autonomous regions, municipalities and special administration regions; from *Wikipedia, the free encyclopedia*.

The 23 provinces are Anhui, Fujian, Gansu, Guangdong, Guizhou, Hainan, Hebei, Heilongjiang, Henan, Hubei, Hunan, Jiangsu, Jiangxi, Jilin, Liaoning, Qinghai, Shaanxi, Shandong, Shanxi, Sichuan, Yunnan, Zhejiang and Taiwan\*.

The 5 autonomous regions are: Guangxi, Inner Mongolia, Ningxia, Tibet (Xizang) and Xinjiang and the 4 municipalities: Beijing (Peking), Chongqing, Shanghai and Tianjin. Municipalities are directly under the administration of central government. A municipality has the same political, economical and jurisdictional rights as a province.

\*Taiwan Issue: a result of China's civil war in late 1940s'. In the earlier years of separation of mainland China and Taiwan, both sides of China (also called People's Republic of China "PRC" or "communist China", "red China", "mainland China") and Taiwan (also called Republic of China "ROC") claim the legal sovereignty over China. Mainland China keeps claiming Taiwan as one of its provinces while Taiwan regards itself as an independent country.)

The 2 Special Administrative Regions (SAR): are Hong Kong and Macao. They were established and specially designed for solving Hong Kong and Macao issues. They are based on the concept of "one country, two systems". SAR is in a pattern within which two completely different social systems (socialist system and capitalist system) and ideologies can coexist. A SAR has more autonomous power regulated clearly by laws, including executive, legislative and independent judicial power.

## 2.2 Recent history

China, one of the countries that can boast of an ancient civilization, has a long and mysterious history - almost 5,000 years of it! Like most other great civilizations of the world, China can trace her culture back to a blend of small original tribes that have expanded until they became the great country we have today.

It is recorded that *Yuanmou* man is the oldest huminoid in China and the oldest dynasty is Xia Dynasty. From the long history of China, there emerge many eminent people that have contributed a lot to the development of the whole country and to the enrichment of its history. Among them, there are emperors like *Li Shimin* (emperor Taizong of the Tang) and philosophers like Confucius, and so on (figure 3).

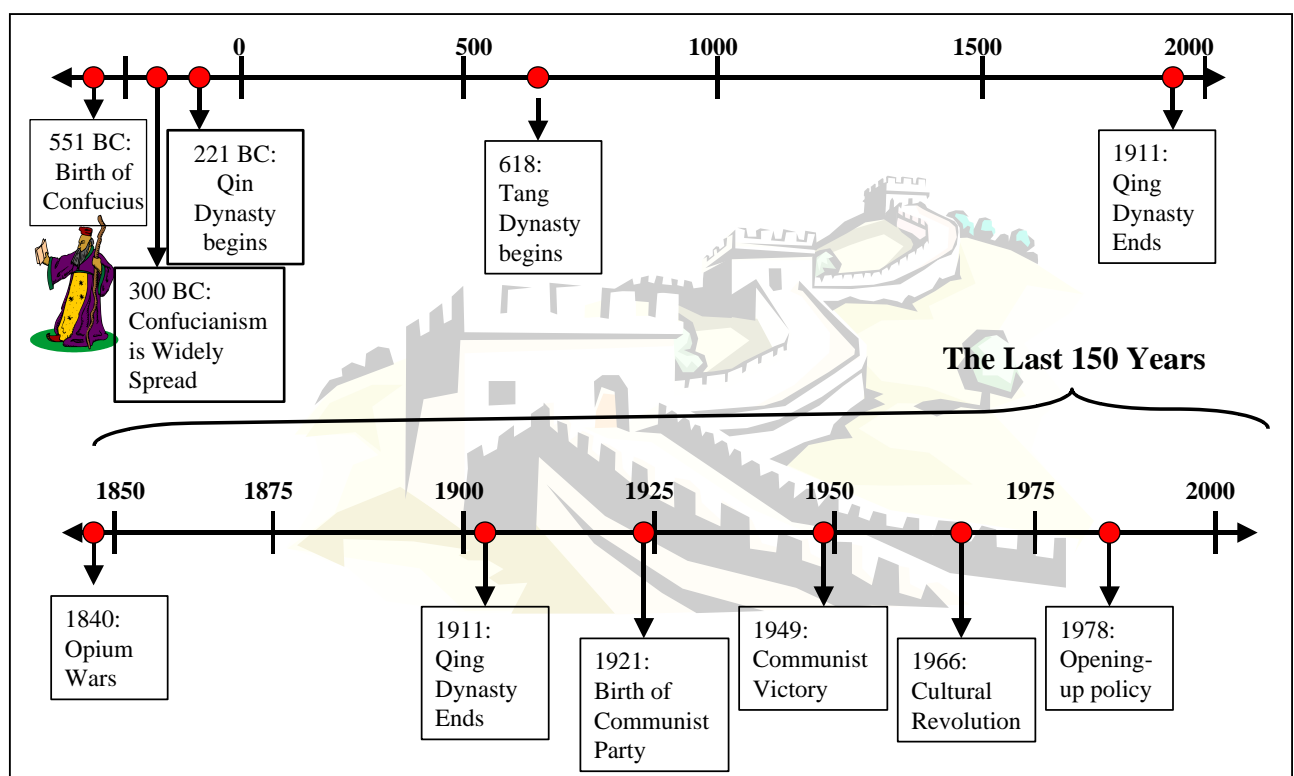


Figure 3 : Recent history of China : courtesy of *Star Professional programs* during in-country briefing.

Chinese society has progressed through five major stages - Primitive Society, Slave Society, Feudal Society, Capitalist Society and Socialist Society. The rise and fall of the great dynasties

forms a thread that runs through Chinese history, almost from the beginning. Since the founding of the People's Republic of China on October 1st, 1949, China has become a socialist society and become stronger and stronger. After the Chinese cultural revolution that began in 1966, a governmental opening-up policy was decided by 1978.

No reform was initiated for the purpose of introducing a market economy or democratic system in the western sense. The leaders viewed themselves as being at the primary stage of socialism and wanted to reach the end phase more quickly. Results of reform and opening-up policies resulted in a shift of not only the economic, but also the justice and political systems. Export-oriented growth policy and the intended support of foreign investment brought with it the need for stability.

*"China's opening up is comprehensive in nature"* said Chinese Premier Wen Jiabao in his speech at the National University of Singapore, in Singapore on Nov. 19, 2007. *"We are open not only to developed countries, but also to developing countries. We are open not only in the economic field, but also in the scientific, technological, educational, cultural and other fields... China's opening up policy is based on mutual benefit"* he told the teachers, students and other audience members from various circles.

The gulf in the standards of living among provinces, in particular among coastal and still underdeveloped western ones, has widened; provinces go more and more their own ways, developing their own markets and independent financial and taxation policies. Economic policy, therefore, has had the consequence of decentralizing administrative responsibilities.

### 2.3 Population

With just over 1.3 billion people (1,321,851,888 as of mid-2007), China is the world's largest and most populous country. As the world's population is approximately 6.6 billion, China represents a full 20% of the world's population so one in every five people on the planet is a resident of China.

China's population growth has been somewhat slowed by the one child policy, in effect by 1979. As recently as 1950, China's population was a mere 563 million. The population grew dramatically through the following decades to one billion in the early 1980s. China's total fertility rate is 1.7, which means that, on average, each woman gives birth to 1.7 children throughout her life. The necessary total fertility rate for a stable population is 2.1; nonetheless, China's population is expected to grow over the next few decades. This can be attributed to immigration, to a decrease in infant mortality and a decrease in death rate as national health improves. By the late 2010s, China's population is expected to reach 1.4 billion. Around 2030, China's population is anticipated to peak and then slowly start dropping.

There are 56 ethnic groups (figure 4) in China that are officially recognised by the government of the People's Republic of China. The Han Chinese are the largest ethnic group, where some 91.5% of the population was classified as Han Chinese (~1.2 billion). Besides the majority Han Chinese, China recognizes 55 other "nationalities" or ethnic groups, numbering approximately 105 million persons, mostly concentrated in the northwest, north, northeast, south, and southwest but with some in central interior areas. The major minority ethnic groups are Zhuang (16.1 million), Manchu (10.6 million), Hui (9.8 million), Miao (8.9 million), Uyghur (8.3 million), Tujia (8 million), Yi (7.7 million), Mongol (5.8 million), Tibetan (5.4 million), Buyei (2.9 million), Dong (2.9 million), Yao (2.6 million), Korean (1.9 million), Bai (1.8 million), Hani (1.4 million), Kazakh (1.2 million), Li (1.2 million), and Dai (1.1 million).

There are also 24 Taiwanese aborigines ethnic groups. The People's Republic of China (PRC) classifies all of these groups into a single ethnic group, Gaoshan. The Republic of China (ROC) in Taiwan officially recognizes 13 of these groups. There are 9 other groups in China that are not officially recognised by the government of the People's Republic of China.

#### China: Ethnolinguistic Groups



Figure 4 : Ethnolinguistic map of China, from *Wikipedia, the free encyclopedia*.

The governments of Hong Kong and Macau do not use the official PRC ethnic classification system, nor does the PRC's official classification system take ethnic groups in Hong Kong and Macau into account. As a result, minority groups such as Filipinos, Indonesians, Europeans and South Asians in Hong Kong, as well as Portuguese and Macanese (people of mixed Chinese-Portuguese ancestry) in Macau, do not appear in the PRC's list of ethnicities in China.

Very shortly speaking, chinese people valorise humility and respect. An occidental visitor should keep in mind that the real message comes often after an humble preamble or presentation.

## 2.4 Chinese economy

China's economic growth surge continued in 2007, to an anticipated 11.5%. The size of the Chinese economy is likely to climb, in world rankings, from its current position as the sixth largest to the second largest by 2030, said recently economists with global investment bank Lehman Brothers.

Industrial production has grown around 18%, marginally up on 2006. Fixed asset investment has grown around 27%, up four percentage points from the previous year. Industrial profits have expanded by more than 30% for the second straight year and profit margins have held steady. The trade balance is expected to reach about 280 billion dollars, up by two-thirds from 2006; exports growing by about 26% and imports by about 21%.

The government described its monetary policy this year as "moderately tight". It has lifted interest rates five times, bringing the one-year loan rate from 6.1% to 7.3% and raised bank required reserve ratios from 9.0% to 14.5%.

A strong and resilient economy is quickly pushing China to the forefront of the global financial stage and will make the Asian nation a force to be reckoned with in 2008. According to *The Heritage Foundation*, a conservative think tank based in Washington, D.C., China has surpassed the United States in manufacturing output and is the global leader in the production of steel, copper, aluminum, cement, and coal. Cahal Milmo, writing for *The Independent* in Great Britain, said January 1, "*China is set to make 2008 the year it asserts its status as a global colossus by flexing frightening economic muscle on international markets...*"

John J. Tkacik, Jr., the Senior Research Fellow in China, Taiwan, and Mongolia Policy in the Asian Studies Center at The Heritage Foundation, wrote December 28, 2007 that "...*Washington can no longer condescend to China as a 'developing' nation in need of U.S. tax dollars for programs relating to energy, environment, and the like. China has ample money and resources to pay for these programs by itself.*"

According to data cited by *The Independent*, Chinese banks, which are controlled by the government in Beijing, are set to start spending foreign currency reserves in British financial markets, sparking worries about the possible takeover of British ventures by the Chinese government. The trade gap between China and the rest of the world, which has been the subject of considerable debate in the United States Congress, will grow even wider this year according to figures provided by *The Independent* and *The Economic Times* of India.

A report by *The Economic Times* of India says that the Chinese economy will experience double digit growth in 2008, the sixth consecutive year in which that has happened. And while inflation in China is considered to be high, the *Economic Times* says, China's gross domestic product (GDP) is likely to grow nearly 11 percent during the next twelve months. Strong economic performance can lead to significant inflation of prices, and several analysts have reported that inflation in China is near a decade high.

Mandarin language is among the most if not the most spoken language on earth. It is written using up to 41 000 pictographic square characters. There have been many different systems of transcription used for learning to pronounce Chinese. Today the official transcription accepted on an international basis is the Pinyin alphabet, developed in China at the end of the 1950's. Pinyin is used by very young children, and also by foreigners, to learn the language basis.

### 3. Mission programme and participation

#### 3.1 China October 2007 Mission programme

The ideals and goals of People to People have remained unchanged since the program was founded by President Dwight D. Eisenhower in 1956. The cornerstone of People to People is its international activities which focus on building relationships through communication between individuals of many nationalities. Each project strives to fulfill President Eisenhower's vision of promoting better understanding and cooperation, as well as mutual respect between people of different cultures.

As national boundaries disappear, a new international community is emerging with political and economic implications that affect us all. This larger international cross-cultural framework requires bringing colleagues together to network and exchange information, discussing current issues, comparing research and management techniques, examining regulations, evaluating education and on-site training programs, and exploring new avenues for joint ventures.

To fulfill this need, People to People delegations visit foreign countries at the invitation of their governments, professional societies, or institutions or by special request of a U.S. organization. Each delegation spends several days overseas, visiting one or more countries, participating in briefings, meetings, discussion sessions, workshops, site visits, and social encounters with foreign counterparts. Cultural and sightseeing activities are planned to complement the professional program. Spouses and guests also travel with the delegation and, in some cases, special activities may be scheduled for them.

Briefly speaking, the October 2007 China environmental mission professional part of the programme is summarized as follows:

Tuesday, October 9 <sup>th</sup>	Arrival in <i>Beijing</i> from <i>Hong Kong</i> and <i>Los Angeles</i>
Wednesday, October 10 <sup>th</sup>	In-Country briefing Meeting at China State Environmental Protection Administration (SEPA)
Thursday, October 11 <sup>th</sup>	Meeting at <i>Tsinghua</i> University Meeting at Global Village of <i>Beijing</i>
Saturday, October 13 <sup>th</sup>	Departure for and arrival in <i>Xi'an</i>
Monday, October 15 <sup>th</sup>	Meeting at the Thermal Power Research Institute Visit at <i>Wang Yan Chang</i> village
Tuesday, October 16 <sup>th</sup>	Departure for and arrival in <i>Kunming</i>
Wednesday, October 17 <sup>th</sup>	Meeting at the <i>Yunnan</i> Environmental Science Society (YESS) Meeting at <i>Yunnan</i> Green Environmental Protection Engineering Co. Ltd.
Friday, October 19 <sup>th</sup>	Departure for <i>Hong Kong</i> and to <i>Los Angeles</i>

### 3.2 Mission participation

Thirteen professional delegates were part of this October 2007 China environmental mission to China, together with 4 guests.

The 17 participants are listed as follows:

Last name	First name	City	State	Organization	Type	Occupation
Hall	Robert	Cary	NC	A&WMA	Leader	Supervisory Environmental Engineer
Anderson	Larry	Denver	CO	University of Colorado	Professional	Department of Chemistry
Broadbent	Jack	San Francisco	CA	Bay Area Air Quality Management District	Professional	Executive Officer
Cha	Maryann	Fremont	CA	Cha & Associates	Guest	Director
Garner	Erin	Monte Sereno	CA	Bay Area Air Quality	Professional	Director
Garner	Susan	Monte Sereno	CA	-	Guest	-
Godleski	Mary	Milton	MA	-	Guest	-
Godleski	John	Milton	MA	Harvard University	Professional	Department of physiology
Manley	Bobby	Austin	TX	Myramid Analytical inc.	Professional	President
Manley	Carol	Austin	TX	Myramid Analytical inc.	Guest	CFO
Mazurek	Monica	Piscataway	NJ	Rutgers University	Professional	Dept. Of Civil & Env. Eng.
Pillersdorf	Azrael	Tel Aviv	Israel	Nesher Israel Cement Entreprises	Professional	Environmental Affairs Div.
Poissant	Ronald	Montréal	QC	Ville de Montréal	Professional	Prof. Engineer
Ross	Mark	San Francisco	CA	Bay Area Air Quality Management District	Professional	Chairperson
Torliatt	Pamela	San Francisco	CA	Bay Area Air Quality Management District	Professional	Director
Vranka	Robert	Oakland	CA	Environmental Science Associates	Professional	Senior technical Associate
Zannetti	Paolo	Fremont	CA	EnviroComp Consulting Inc.	Professional	President

## 4. Mission Professional Meetings

### 4.1 Beijing Area:

#### 4.1.1 State Environmental Protection Administration (SEPA)

SEPA was set up as a ministry in March 1998 when the *National Environmental Protection Agency* (NEPA) was upgraded from a sub-ministry to a ministry. With respect to cleaner production and pollution prevention, the following responsibilities of SEPA are of particular interest:

- to formulate the national policy, laws and administrative regulations for the environmental impact assessment of major economic and technological policies, development planning and key economic development plans and to formulate the national environmental protection plans; to formulate and monitor the implementation of the national plan for pollution control and ecological conservation in key regions and river basins, and to organize the zoning of environmental functions of different regions;

- to coordinate and organize pollution prevention and control of key river basins at the national level; be responsible for the environmental supervision and management and administrative inspection of the environmental protection; organize and undertake the examination of the enforcement of environmental laws and regulations at the national level;

- to formulate the national standards for environmental quality and for pollutants emission and discharge and launch them according to the relevant procedure; be responsible for filing of local environmental standards; to organize the compilation and submission of the national report on the environmental quality and the issuance of the national report on the state of the environment, to release on a regular basis the report of the environment quality of key cities and river basins, and to participate in the development of national program for sustainable development;

- to organize the development of environmental science and technology and important research projects and technical demonstration projects; to manage the national environmental management system and the certification of environmental labels; to establish and organize the implementation of the rule of accreditation for the qualification for environmental market access and to guide and promote the development of environmental industry;

- to be responsible for the environmental monitoring, statistics and information collection; to formulate the rules, regulations and specifications for environmental monitoring ; to organize the construction and management of the national network of environmental monitoring and of environmental information; to organize the monitoring of the environmental quality and the supervisory monitoring of the pollution sources at the national level; to organize, supervise and coordinate the environmental education, publicity and publication and to promote the participation of the public and non-governmental organizations in environmental protection.

A recent structure of SEPA is shown in appendix I. The meeting at the SEPA office in Beijing was held with the following officials:

Mr. Li Xinmin	Deputy Director General	Department of pollution control -SEPA
Mrs. Yu Fei	Director	Solid Waste & Toxic Chemicals Management Division
Mr. Tang Dagang	Director General	Vehicle emission control center -SEPA



After a presentation of every professional delegates, three formal presentations were made. Mr. Ronald Poissant, professional engineer from Montréal, Canada, made the first presentation. Mr. Jack P. Broadbent, executive officer from the Bay Area Air Quality Control Management District in San Francisco, California, made the second one and Dr. John Godleski, M.D. from the Havard School of public Health made the third.

Essentially, Mr. Poissant explained that the Montreal wastewater treatment plant is among the largest wastewater treatment plants of the world, with a dry wastewater flow of about 29 m<sup>3</sup>/sec. Although there is an industrial sources discharge control enforcement in Montréal, a problem was observed, these last years, in mercury concentrations of the atmospheric effluent from the wastewater treatment plant sludge incinerator. A study was initiated and it was established that possibly around 30% of the mercury reaching the wastewater treatment plant came from dental clinics on the Island of Montréal. Other sources of mercury were atmospheric depositions, hospitals and health clinics discharges to sewers and unkowned others sources.



Figure 5 : Mrs. Yu Fei and Mr. Li Xinmin, in Beijing.

No significant industrial sources of Hg to sewers were identified during the study. As work was already being done in hospitals and health clinics, the decision was made to enforce the installation of amalgam separators in every dental clinic on the Montréal island. This was made through a wastewater discharge bylaw modification. Within 2 to 3 years, every dentists clinics and also dentists schools in Universities, had to install a proper amalgam separator. This resulted in an appropriate reduction in mercury concentrations in the effluent to the atmosphere of the Montréal wastewater treatment plant incinerator.

Mr. Jack P. Broadbent (figure 6) offered a presentation on certain actions made in the Bay Area in San Francisco, California. In USA, criteria air pollutants were established, among others, for ozone, carbon monoxide, NO<sub>x</sub>, SO<sub>x</sub> and particulate matters. A «*Spare the air program*» was implemented in the San Francisco area which allows free buses and free subway on bad air quality days in the area. New vehicles stringent emission control specifications were also established by California.

Since the vehicle mean lifespan is between 10 to 15 years in California, the Bay area has established an old vehicle repurchase programme. An annual budget of 2 to 3 million US\$ was made available for that. 650 US\$ per vehicle is paid to the owner if the vehicle is taken off the road. Open burning is also recognised as an important problem in California. Open burning restrictions apply. The US EPA is also active with Australia aiming at control of open burning. Both nations work with the United Nations on this matter.



Figure 6 : Mr. Jack Broadbent from Bay Area.

Dr. John Godleski from Harvard University explained the ambient particulate concentration system that was used to expose chosen animals to high PM concentrations. Essentially, multiple complex reactions in the atmosphere result from the different pollutants emitted from different sources. Air samples can be taken either from ambient air or from a stack effluent.



Figure 7 : Dr. Godleski from Harvard School of public health.

PM<sub>2.5</sub> levels of 10 to 12  $\mu\text{g}/\text{m}^3$  can be concentrated 30 to 50 times using the Harvard Ambient Particle Concentrator, and delivered directly to animals by inhalation exposures. A canine model of ischemic heart disease, which is characterized by a reduced blood supply to the heart muscle (usually due to coronary artery disease), was used in the studies.

It was clear that soluble constituents, ultrafine particles, and nanoparticles can cross the pulmonary epithelium and have a systemic distribution. The main conclusion of this presentation is that air pollution can make ischemic heart disease and heart attacks much worse than they would otherwise be.

Mr. Li Xinmin and Mrs. Yu Fei informed the delegates that a mercury project was initiated in hospitals of China in 2006. China aims at getting rid of mercury thermometers and to eliminate Hg in dental amalgams. In China, open burning is also recognized as an important problem. SEPA recently regulated new car and motorcycle emissions.

Euro III regulation applies since 2007 and a more stringent one, equivalent to Euro IV, will apply in 2010. Coal combustion is known to be a source of mercury and particulates. Other industries and transportation are also important sources of pollution. Gobi desert duststorms and fireworks have been mentioned as causes of bad air quality episodes in Beijing. Lately, thousands of obsolete taxis and buses were taken off the road in Beijing. Subway tariff was reduced from 35 to 20 yuans and traffic restrictions were applied. In preparation for the 2008 Olympics, it is considered to shutdown some power plants and important industrial sources that can influence air quality in the Beijing region.



Figure 8 : Mr. Xinmin receiving souvenirs from Bob Hall and Mark Ross.

All important construction projects in the Beijing area have to be completed before the Olympic games to get a permit or will be suspended during the games. Natural gas should be supplied for commercial and domestic users in Beijing before the 2008 games in order to replace the use of coal and wood. Roads, sidewalks, buildings, building roofs, etc. are going to be cleaned in order not to cause secondary or tertiary air pollution. Traffic restrictions are considered for the duration of the Games. A complete air quality control strategy for the Beijing area is scheduled to be approved by the State council.



Figure 9 : Air pollution in Beijing is still of concern.

Workers stand near the Olympic Stadium (right on figure 9), amidst hazy conditions in Beijing on October 25, 2007. Beijing's air pollution remains a concern for the 2008 Olympics, even though the city is well on its way to fulfill the environmental pledges made when it bid to host the Games. Incidentally, many flights have been canceled in Beijing on Friday, October 25, 2007. The municipal observatory increased the fog warning level from yellow to orange and experts warned the elderly and children to stay indoors to avoid contracting respiratory diseases.

Lately, by the beginning of 2008, an important steel plant in Beijing, the Shougang group plant (figure 10), which is one of the biggest steel plants of China and one of the most important pollution source in Beijing, announced the beginning of shutdowns. Before the Olympic games, the plant production will be reduced to less than 30% of its normal capacity and pollutant emissions will be reduced by more than 70% during the games. China will launch its first complete pollution sources national inventory by February 2008. These data will greatly help to reduce pollution, one of the objectives of the 11<sup>th</sup> 5 year plan of China.



Figure 10 : The Beijing steel plant to almost shutdown for the 2008 Olympic games.



Figure 11 : The Beijing subway will expand for 2008 Olympic games and up to 2015.

In the first half of 2008, Beijing Subway Line 7 will be put into operation and the airport line will follow. Line 4, Line 8, Line 9, the second phase of Line 10 (Yizhuang) and the first phase of Line 6 (Daxing) are under construction; Subway Lines 7 and 14 will begin construction this year. The Ministry of Communications will accelerate rail transit construction next year to complete the construction of the city centre's traffic network and build cumulative mileage to 440 km by 2012. For a period of time, Beijing will complete and open one transit line annually.

By 2015, Beijing will have 19 metro lines, involving a static investment of 170 billion yuan and a dynamic investment of 273 billion. Starting from 2008, the municipal government will provide 10 billion yuan each year in rail transit construction funds to ensure the smooth progress of the construction.

#### 4.1.2 Tsinghua University

Tsinghua University is a comprehensive and State key university offering disciplines of science, engineering, management and social science, but with engineering as its main focus. As one of the important national bases for higher learning and for scientific research and technological development, Tsinghua University shoulders great responsibility of educating high-level talents and promoting China's national economic construction.

Tsinghua University consists actually of 6 schools, 31 departments, 44 research institutes, 9 engineering research centers and 163 laboratories, including 15 national key laboratories. The university offers 37 Bachelor's degree programs as majors, 107 Master's degree programs and 64 Ph.D. degree programs for graduate students. There are 16 post-doctoral research centers. To fully implement *China Education Reform and Development Program*, Tsinghua University is aiming at the next century and sets up its new development targets for the next 15 years. Based on its strength in engineering fields, the university will promote the development in the science and management departments. Humanities and social sciences should be focused on certain areas with high academic standards.

The meeting at the Tsinghua University was held at the Institute of Environmental Science and Engineering with the following persons:

Dr. Jiming Hao	Professor and Dean	Institute of Env. Science and Engineering
Dr. Shuxiao Wang	Associate professor	Department of Env. Science and Engineering
Mr. Charles N. Freed	Consultant	Vehicle and fuel emissions consultations

There was an introduction of the People to People delegation members.

Professor Hao began the meeting on behalf of the Tsinghua Group, mentioning that a China/Japan workshop on environmental catalysis was also being held on the same day.

Mr. Bob Hall then talked about mercury pollution. He said that US EPA and SEPA had a workshop in 2005 on Hg emissions from coal fired boilers and cement kilns. US EPA studies show that, even though there are only small amounts of Hg in coal, the large fuel usage results in large Hg emissions. US EPA estimates that 50% of the Hg levels in the air in the U.S. are from Hg emissions in Asia, mainly from China. China is lately reported to add 1 to 2 coal-fired power plants/week, and they have cement kilns and zinc smelters also emitting Hg.

The main point of the 2005 workshop was that Hg can be controlled with existing NO<sub>x</sub>, SO<sub>x</sub>, and PM control technology that will have the co-benefit of controlling Hg. US EPA would like the new plants to install controls, and they estimate that there would be little or no extra cost. Fabric filters can be used to capture Hg that is adsorbed onto the fly ash, and then, addition of sorbents, like activated carbon, can be made to capture Hg vapor. Another technology for capturing Hg would be to use Selective Catalytic Reduction (SCR) for NO<sub>x</sub> control; this approach oxidizes Hg, which can then be scrubbed to get about 98% Hg control efficiency.

Following Bob Hall's discussion, Professor Monica Mazurek from Rutgers University made a presentation on her work on organic speciation of vehicle exhausts, both diesel and gasoline vehicles and other pollution sources (figure 10). This work has been done in collaboration with New York State Department of Environmental Conservation (NYDEC). They are monitoring chemicals for use in chemical mass balance (CMB) models.



They are finding that cooking oils and greases are a big source of fine particulate in some areas. They are monitoring in NY, NJ and CT, and in 2002-2003 they collected 400 filters of  $PM_{2.5}$ . They used GC/MS on 50% of the filters for measuring pollutants, elemental carbon (EC) & organic carbon (OC) measurements on 25% of the filters, and liquid chromatography (LC) and mass spectroscopy (MS) on 25% of the filters for measuring polar molecules. They relied on dynamometers to measure emissions from light duty vehicles and measured hydrocarbons, CO,  $CO_2$ , NOx,  $PM_{2.5}$ , EC and OC.



Figure 12 : Professor Mazurek presenting her work on molecular markers and speciation.

They used molecular markers to determine source apportionment of ambient PM. They found that in New York City, the airshed is fairly well mixed for these pollutants. They looked at specific PAH species for various vehicle types to develop markers. Diesel shows a distinct profile that is different than gasoline.

There is a lot of restaurant cooking in the area and these emissions can confound the signals from vehicles. They can differentiate restaurant types. They looked at the composition of cooking oil and the distribution of fatty acids in  $PM_{2.5}$  near roadways in order to distinguish cooking oil from vehicle organics in the ambient air. Monica said that there are no regulations for these types of restaurants in the region. Mark Ross of BAAQMD, then commented that the San Francisco Bay Area is developing regulations for fast food outlets and restaurants with char-broilers to reduce PM.



Figure 13 : Professor Anderson presenting his research on HAPs exposure in Denver.

Professor Larry Anderson of the University of Colorado talked about the research he is carrying out, which is an exposure assessment for hazardous air pollutants (HAPs) in the Denver area. His group monitored VOCs in the range from  $C_6$  to  $C_{12}$  every 6<sup>th</sup> day using sorbent tubes. Sites include locations near freeways and toll booths. They looked at BTEX near highways. They saw high levels of BTEX in the morning and late evening, where the late evening levels would be due to inversions and limited mixing.

They also measured black carbon (BC) and CO, and found similar trends. They looked at traffic counts and CO levels and found a similar relationship.

Professor Godleski of Harvard, said that he has seen similar trends as those reported by Professor Anderson, where there are a greater number of heart attacks between 4:00 A.M. and 6:00 AM, when blood pressure is the highest and black carbon levels may also be at the highest.

Professor Jiming Hao of Tsinghua University then introduced members of his team who are doing research in air pollution. They have a total of 60 faculty and graduate students who are doing work in this area. They are measuring profiles for a number of emission sources, including PM and VOCs. They have measured emissions from about 30 different vehicle types.

University researchers are measuring Hg emissions in coal plants and in residences and are doing Hg speciation in stack gas to determine present levels. They have developed emission inventory approaches for input into air quality models and are looking at the spatial and temporal distribution of pollutants. The researchers have done reverse modeling to verify emission inventories. They are using the CMAQ model and the GEOS-CHEM model in their analyses and are looking at primary aerosols and the formation of secondary aerosols in their modeling. They are incorporating photo-chemistry in the modeling. They looked at PM<sub>2.5</sub> characteristics in Beijing and at OC in PM samples, as well as particle size distribution and developed source apportionment. These studies also related ozone and secondary PM generation, and they have incorporated smog chamber studies in the analyses.



Figure 14 : Associate Professor Shuxiao Wang presenting work done in the department of Env. Science and Engineering; Prof. Hao and Charles Freed are in the background.

The groups have looked at the impacts of air pollution on human health and on ecosystems. They have used the CMAQ model to calculate pollutant levels on a gridded area covering Beijing and the surrounding area. The grid resolution in the modeling has ranged from 4 kilometers to 30 kilometers. They found from their modeling studies that regional emissions have a significant impact on air quality levels in Beijing, where the regional emissions contribute 30% to 40% of Beijing levels. They also looked at the contribution of mobile sources to ambient PM levels of air pollution and estimate that mobile sources contribute about 8% to the ambient levels. For ozone levels, their modeling shows that vehicles contribute about 38%. They have generated several reports that address the contributions of various sources to ambient levels in Beijing in preparation for the 2008 Olympics. They plan to publish their results in the Environmental Science and Technology (ES&T) Journal, and they are working jointly with scientists and engineers in the U.S. and Japan on this problem.



Figure 15 : Dr. Jiming Hao receiving a certificate for the delegation leader, Bob Hall.

Bob Hall offered a certificate of appreciation to Dr. Jiming Hao (figure 15) and other souvenirs were given. M. Hall also asked the Chinese colleagues if they are studying emissions related to climate change and if China will develop a policy addressing this matter. The China group said that they announced a policy regarding this matter and are recognizing that CO<sub>2</sub> reductions are important on a regional and local level. They are comparing their strategies with other nations. China has organized a large group to address environmental protection over the next five years.

Chinese colleagues also said that, although China has been adding recently up to two coal fired power plants a week to address the nation's energy shortage, this shortage has now been reduced considerably, and the addition rate will drop considerably in the future. They expect growth to be about 5% in the coming years.

In addition, they are looking at ways to reduce fugitive dust, and they plan to change from diesel powered engines to natural gas fired engines. They plan to begin to clean the city of Beijing in the spring of 2008 to reduce fugitive PM emissions in time for the upcoming summer Olympic Games. They are working with U.C. Riverside on studies related to Ozone/PM formation, and Professor Hao plans on going to U.C. Riverside in February 2008 to look at a smog chamber.



Figure 16: Delegation members leaving their Chinese colleagues at Tsinghua University.

#### 4.1.3 Global Village of Beijing

Founded in 1996 as one of the first NGOs in China, Global Village of Beijing (GVB) is a non-government, non-profit organization dedicated to environmental education and civil society strengthening. GVB's environmental campaigns focus on the promotion of sustainable development and a green life-style. Its main functions include the production of environmental television programs and other publications, the organization of journalist trainings, the development of green communities, the organization of public events and forums and several other projects in the field of sustainable development and consumption.

Additionally, as a Chinese grassroots portal of United Nations Environmental Programme (UNEP), GVB is an implementation carrier of Chinese projects of international environmental organizations. GVB has established a stable network of Chinese partner-NGOs and is constantly promoting communication between national and international partners, NGOs, corporations and public officials through forums, consultations and newsletters.

GVB's office is located in ChaoYang District of eastern Beijing and currently has 15 office staff and over 1000 officially registered volunteers in its grassroots network. GVB's founder and president is Ms. Sheri Liao who became an Environmental Advisor of the Beijing Organizing Committee for the Games of the XXIX Olympiad.

GVB's mission is to help China to achieve sustainable development by increasing public awareness and enhancing public participation. The meeting with GVB representatives was held in their Beijing office. The main persons met were the following:

Mao Da	Advisor	Chemical program of GVB
Li Ly	Executive director	GVB
Elaine Li	Vice director	GVB
Hu Xin	International Coordinator	Climate and energy GVB
Dr. Jentai Yang	US EPA retired	GVB board member

Attendees presented brief self introductions. Elaine Li provided a ~30 minute slide presentation of the Global Village of Beijing, entitled: «*This endangered planet: a Chinese view*». This was an overview of the history of GVB, its key members, including Sheri Xiaoyi Liao (GVB President), and recent and current activities.



Figure 17 : Air pollution from a plant in China.



Figure 18 : Duststorm in the Gobi desert.



The key mission of GVB is to "...emphasize the public's right and responsibility to participate in environmental activities, giving prominence to sustainable consumption issues and policy development." GVB uses modern electronic communication technology to spread its environmental messages. Because nearly every household in China possesses a TV and a VCD player, one of GVB's main activities, therefore, is the production of television material on environmental issues in China and other countries.



Figure 19 : Gobi desert duststorm effects in Beijing suburbs.

In February 2003 GVB began writing, editing and distributing a monthly newsletter, «*Voices of Grassroots*», in Chinese and English. The publication is a unique forum for other NGOs to discuss environmental issues and progress. It is an important mechanism that supports networking and capacity building efforts among the partner organizations. The publication is geared to strengthening the «... *collaboration between grassroots organizations, governments, and the business sector by providing the latest news on environmental activities, policies, laws and public ideas.*» It aims to assist NGOs in their capacity building efforts by sharing the experiences of relevant organizations and experts.

Finally, *Voices of Grassroots* aims at expanding the influence and relevancy of NGOs nationwide through broadened dissemination of environmental technology and education. The major environmental theme areas of GVB are air, water, solid waste, energy and sustainability. Several grassroots projects targeting these areas are the focus of current GVB projects and campaigns to promote public awareness and participation. The principal projects include:

- a) Journalist Forum on Energy: a grassroots effort to increase public awareness and advocacy of energy efficient policies and the development and implementation of renewable energy sources in China for sustainable growth. GVB particular means by which to influence government policy from the grassroots level remains mass media campaigns designed to penetrate the public consciousness;
- b) Training Center: a NGO-managed conservation area covering over 187 hectares of wilderness with mountains, forests, springs and wetlands. The Center is 70 km outside Beijing in Yanqing county. Its goal is to provide environmental education, consultation, and training programs to the public in a beautiful, natural environment;
- c) Voices of Grassroots: a monthly newsletter that publicizes the opinions and activities of environmental NGOs across China. It is a source of information aimed at promoting the participation of Chinese grassroots organizations in pursuing sustainable development in China. The newsletter disseminates the latest news on environmental activities, policies, laws and public ideas;
- d) Green Train: a program focused on the preservation of biodiversity in Southwestern China through public education campaigns that promote green living and green consumption. These measures, along with publicity for ecotourism in the region, are targeted at various administrative levels to promote ecological and environmental education;

- e) Mercury Campaign: an extensive China-USA collaboration involving the U.S. EPA, U.S. Department of Energy, and the U.S. Geological Survey along with the State Environmental Protection Administration, Tsinghua University, Zhejiang University, Institute of Geochemistry, and Global Village of Beijing, China. The major foci are emissions source characterization, emissions inventories, transport, modeling, monitoring, risk assessment and preparedness, and development of public information materials on mercury risks and management strategies. The GVB hosted the first conference on Mercury Pollution and Prevention on August 20<sup>th</sup>, 2004. Research specialists were brought together to discuss current problems relating to mercury pollution and how best to educate the public as to the effects of mercury emissions;
- f) Green Community: a program emphasizing "green living" and the creation of sustainable communities. In 1996, the Beijing *Da Cheng Xiang* community created the first garbage-sorting site as the result of several GVB campaigns. GVB cooperated with the *Xuan Wu* municipal government in 1999, founding the first Green Community in China. The characteristics of a Green Community include environmentally sound architecture (green building) combined with energy and water conservation, garbage collection and sorting, and public participation consisting of government ministries, companies, public organizations and community representatives. A large group of public volunteers promote the environmental protection campaigns and Green households. Besides community development, self-management, autonomy and self-education remain important aspects of community building and civil society in general. The Beijing Olympic Committee adopted the GVB Green Community model for the 2008 Summer Games. Nearly 100 leaders from 18 government departments visited GVB's Green Community in September 2000 to learn how to duplicate the model in other parts of the city;
- g) Environmental TV Production: a program focused on the production of television material on environmental issues in China and other countries. GVB produced, between April 22, 1996 and March of 2001, three hundred shows for its weekly television program, "*Time for the Environment*." GVB produced the series "*Global Environmental View*" which examines the environmental experiences of other countries to help the Chinese people to learn from international examples, approaches and strategies;
- h) 26 Degrees Campaign: the program seeks to decrease energy consumption during the summer months by increasing indoor temperature from 22-24 °C to 26 °C. Six environmental organizations in Beijing, (Global Village of Beijing, WWF China, China Association for NGO Cooperation, Friends of Nature, Institute for Environment and Development, Green Earth Volunteers) actively work with businesses, private and government groups by urging the adoption of 26 °C indoor temperatures. This saves electricity and protects the environment during the summer months, since air conditioners are responsible for 40%-50% of the total power consumption in Beijing.

After the GVB overview, interactive discussions began.

Mark Ross of the Bay Area Air Quality Management District asked if California NGO's could possibly help with the 2008 Beijing Olympics in support of GVB and their efforts. Mark mentioned the air programs in place in the San Francisco Bay Area that have been successful in reducing air pollution might be similarly adopted in the Beijing metropolitan area. Specifically, he refers to programs that remove and recycle onroad vehicles with high levels of emissions. Also, congestion management programs might be useful in decreasing traffic and pollutant concentrations during the 2008 Summer Olympic Games.

Bob Hall of US EPA suggested more stringent emission standards for onroad vehicles is important for improving urban air quality in China. Jentai Yang commented there was an effort to move the steel manufacturing plants from the Beijing suburbs to farther locations. There were other short term studies to evaluate air quality measures by allowing odd/even driving days for licensed vehicles based on the vehicle license plate and by enhancing the Beijing public transit system (buses, trains). Jentai Yang said how GVB receives funding for its activities. It is not easy. However, GVB receives funding from international foundations (Ford, Energy, Evergreen, and Asian Foundations) and US EPA programs. GVB is now registered in California as a member of the US China Association for Environmental Education and can receive funds from donations to this association.

Azriel Pillersdorf asked for more information about GVB's relationship with industries in China. In particular, he commented that industries in China do not have a good or strong sense of social responsibility. Jentai Yang mentioned that fine particle emissions reduction programs with the US EPA and Chinese industrial and government partners have been developed. This effort should support future reduction of airborne particles.

Bobby Manley suggested that U.S. industries should be engaged in order to help leverage existing air pollution technologies with Chinese industries. Technologies should be shared. Mark Ross asked about environmental justice in China. He commented there seems to be little information released to the public in China about environmental conditions. How is information released to the citizens of China? Google was a source of information to the outside. He cited 760,000 people in China die each year from pollution (50% from air exposure; 50% from water exposure).

Discussion moved on the GVB programs aimed at improving the living conditions of the rural population. The solar/rural energy programs aimed at providing energy for heating and cooking and water heating were showing encouraging results. Rural homes are equipped with small solar collectors with high collection efficiency. Mao Da discussed waste, air quality and toxics from municipal and industrial wastes. Mercury, especially, is a concern but SEPA does not wish to openly discuss this topic because coal burning power plants are the major sources. GVB is partnering with international partners to work on decreasing gas and particles emissions from coal burning power plants. Cars are a source of mercury release to the environment from mercury in electrical switches. GVB is working with the U.S. to recycle mercury and other pollutants from automobiles through improved recycling programs.



Figure 20 : View of the air visual quality in Beijing during the mission.

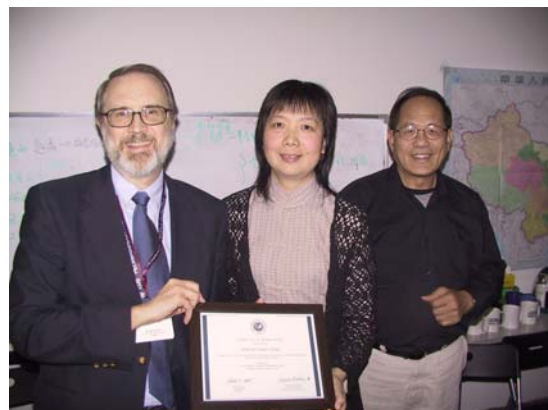


Figure 21 : Bob Hall offering a certificate of appreciation to Li Ly and Jentai Yang of GVB.

Mark Ross mentioned a San Francisco Bay Area program that «buys back» older, high emission vehicles that are then recycled, using a single recycling plant to remove the polluting components and to retrieve parts that can be recycled for other uses. Bob Hall commented that the public needs to be informed of what materials are recovered and reused and that the components are not simply added to landfills.

Jentai Yang mentioned that recycling in China was showing success. First, people must be made aware of the benefits of recycling. People will sort their waste streams if they are educated to do this. Second, there must be enforcement of recycling programs. The government must impose consequences for not adopting recycling programs. Third, technology must improve to increase the efficiency and recovery of toxics and useful materials.

In California, the municipal solid waste streams were managed in a variety of ways. Bottles and cans have deposits and have economic value as recycle materials. Packaging companies and manufacturers often require the consumer to bear some of the cost of recycling. Bob Hall commented that there are international efforts to improve incineration processes and to adopt programs for waste reduction, reuse and recycling. He added that SEPA is not really showing support for reduction and reuse programs.

Dr. John Godleski mentioned the trash-to-energy plants in Boston, MA pay communities for solid waste. In addition, towns are fined for having too much plastic in the waste streams. Separating materials from waste streams are important for energy production from the new incineration technologies. Lifecycle assessment models are important for municipal solid waste management. There is a need for data that will lead to economic incentives, environmental benefits and good financial policy. Mark Ross commented that options must be provided in order to see change in higher level policy. What is important is doing the right thing; sometimes it takes more time to get on the right track.

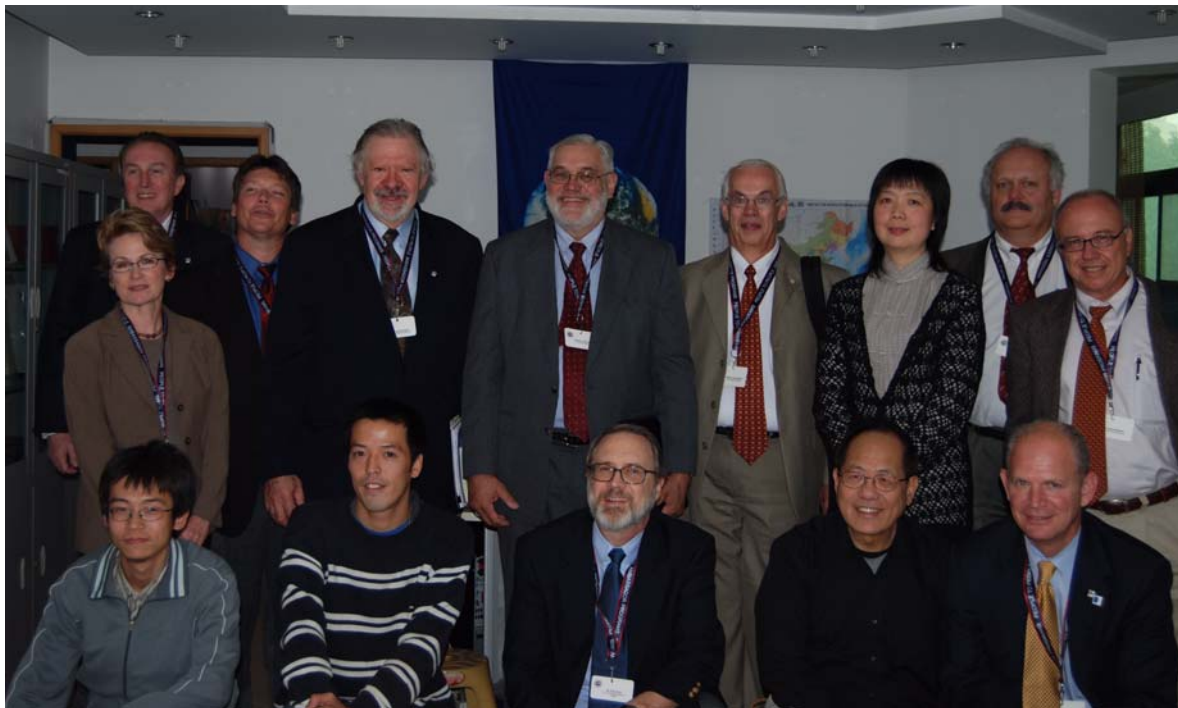


Figure 22: Delegates and GVB colleagues at the end of the meeting.

## 4.2 Xi'an Area:

### 4.2.1 Technical Power Research Institute

TPRI is a research organization devoted mainly to engineering technologies and fossil-fired power plants equipment. Its history can be traced back to a half century ago. In 2001, it was transferred from a government-sponsored institution into a state-owned scientific enterprise of the *State Power Corporation of China*. It has its name now registered by the State Industrial and Commercial Bureau as the Thermal Power Research Institute (TPRI).

The objectives of TPRI are to improve safe, economic and reliable operation and to reduce pollutants of the fossil-fired power plants in China. Its R&D activities cover the fields of fossil-fired power plant operation, power plant automatic control, auxiliary equipment of power generating units, clean coal power generation and power generation by renewable resources. In the past decades, TPRI has undertaken a good number of key and important R/D programs given by government authorities and has been very active in many international cooperation projects. As one of the principal research institutions of the Chinese power sector, it has enjoyed a very good reputation for its qualified technical consultation services and its footprints can be found in almost all of the Chinese large-capacity power plants. It provides technical consultations and services, engineering contracts, equipment completion, business trading in the areas of thermal power engineering and equipment, control system of industrial process, chemistry and materials engineering, thermal metrology and testing, environmental protection, energy and water savings. Moreover, its emphasis is laid on research, development, engineering application, dissemination, manufacture and sales of high-tech products. The meeting at the TPRI was held at their office in Xi'an with the following persons:

Mr. Xiao Ping	Director Scientist	Coal fired boiler department TPRI
Mr. Jiang Jianzhong	Deputy manager	Coal fired boiler department TPRI
Mr. Huang Zhong	Master engineer	National Eng. Research center for clean coal combustion
Mr. Bi Jun	Deputy director	Project management dept. TPRI

Bob Hall was introduced, followed by individual introductions by our group. The TPRI president was absent since he participated in a workshop on clean coal in fired boilers. Mr. Xiao Ping gave a presentation to introduce TPRI. It is the leading research institute in thermal power engineering, equipment and technology in China.

TPRI has 21 departments dealing with R & D and services. There are 1200 employees of which 89% have technical backgrounds. It also operates two branches, one in Beijing and the other in Suzhou. The National Engineering Research Center for Clean Coal Combustion has six departments, which are mostly boiler related. The IT Center has two departments and the Automation Technology Center has three departments.

Funding for TPRI comes from shareholders, NDRC/MOST(government), manufacturers, power plants, and other industries. Some of the R & D fields include operation technology, power plant automation, and nuclear.



Figure 23 : Mr. Xiao Ping presenting TPRI mission and activities.



Areas of research include: coal ash and limestone characterization, optimization, low NO<sub>x</sub> combustion, desulfurisation and denitrification, CFD boiler, fly ash utilization, 1 MW combustion test facility, 1 MW CFD test facility, turbine R&D – thermal system optimization, water/oil chemistry, metal materials – for use in supercritical areas and materials research. Green Gen program activities include: integrated gasification combined cycle (IGCC), natural gas combined cycle (NGCC), coal gasification – Syngas clean-up, fuel cells and hydrogen turbines, IGCC power plant to be operational 2008-09, renewable power and nuclear power.

Cooperative programs exist with many countries, but these do not include the U.S.A.. Bob Hall asked if relationships existed with the Electric Power Research Institute (EPRI), but there are none. Bob Hall informed the group that EPA, DOE, MOST and SEPA were working to set up a Multi-Pollutant Workshop scheduled for Hangzhou next spring, in 2008, that will deal with NO<sub>x</sub>, SO<sub>x</sub>, PM and Hg control. He also introduced some of the capabilities of the EPA labs. They are working with a 4M Btu/hr pulverized coal combustor, with Hg and CO<sub>2</sub> control, SCR for NO<sub>x</sub>, ESP and fabric filter for PM control, and scrubber for SO<sub>2</sub> control. Research is focused on integrating Hg control and sorbents and additives for CO<sub>2</sub> control. U.S. vendors will be present at this Hangzhou workshop, which is a follow-on to the NO<sub>x</sub> and SO<sub>x</sub> workshop held in Dalian, two years ago. Then, Bob Hall outlined some of the presentations that might be of interest to TPRI, mainly health effects of aged aerosols from power plants, molecular markers, air pollution modeling and techniques for HAPs screening. Dr. John Godleski made a presentation entitled «*Teresa project*», on health effects of power plant emissions on animals. He described the engineering involved to carry out field studies, and the experiments that have been conducted to expose animals to high PM concentrations derived from power plant effluents. Sulfuric acid seems to have the largest effects on the respiration of animals. Neutralized sulfate with the addition of a naturally occurring organic, pinene, also had adverse health effects. Cardiac arrhythmias in a model of acute myocardial infarction were enhanced during 5 hrs of exposure to aged neutralized aerosol from power plant effluents paralleling epidemiologic myocardial infarction onset studies. The effects of CAPs persisted for 24 hrs. Coronary vascular perfusion of the myocardium is globally decreased with coronary occlusion and CAPs exposure, and is most severe in the ischemic tissues. Coronary artery resistance is substantially increased with CAPs exposure especially in the ischemic zone. There was additional discussion about the kind of work that TPRI does.



Figure 24 : Dr. Godleski presenting the Teresa project.



Figure 25 : Mr. Xiao Ping receiving a certificate of appreciation from the mission leader, Bob Hall.

There are consulting experts within the departments. About 50% of the income is from consulting for the larger power generating facilities. TPRI is involved in commissioning power plants. They operate the plants for 168 days prior to the transfer of operation to the owner. They are involved in performance testing and accident testing. Gypsum from the cement industry is not used in flue gas desulfurization (FGD) in China, although about 40% of the plants have FGD. China uses natural gypsum, instead of waste.

Dr. Azriel Pillorsdorf mentioned that all waste gypsum in Israel is used in the cement industry, instead of landfilling it. Dr. Monica Mazurek suggested that she would put the Rutgers Center for Advanced Energy Research (CAER) in contact with TPRI. Currently 99% of the electric power in China is generated with coal. Gas pipelines are being installed to displace coal and wood and use natural gas instead, in a program realised from the West to the East of China, but this will be largely for residential use, not for power generation.

Concerning greenhouse gases, a few months ago, there was an APEC agreement with Australia for CO<sub>2</sub> reduction. The Beijing Thermal Power Plant is working on building facilities for CO<sub>2</sub> reduction. The PC Power Plant will do research on CO<sub>2</sub> capture techniques.



Figure 26: Delegates and TPRI colleagues at the end of the meeting.

#### 4.2.2 Shaanxi Volunteers Mothers Association for Environmental Protection

Biogas from pigs provides an environmentally friendly alternative to wood fuel and coal in the Shaanxi province of China. Led by their determined founder, Wang Mingying, the Shaanxi Mothers have overseen the installation of almost 1,300 biogas systems in farming households across the province. The main source of the gas is waste from humans and household pigs. By replacing wood and coal as a cooking fuel, it is saving families time and money, as well as contributing to China's reforestation efforts.

The project is a triumph for the Shaanxi Mothers – a largely voluntary group of women whose commitment and persistence have overcome huge obstacles to create a thriving environmental success story.

Finding alternatives to wood and coal for cooking fuel is becoming an increasingly urgent task in China's central Shaanxi province. Like many parts of China, it has suffered from decades of deforestation and soil erosion. The government is now addressing this by placing severe restrictions on tree felling and wood cutting, and undertaking a reforestation programme.

The terraced hillsides are now out of bounds to crops, except a limited ratio of fruit trees. Instead, farmers are paid to plant trees; everywhere you look, there are saplings and small trees coming up. In this context, moving from wood or coal to biogas for cooking is not only essential from an environmental viewpoint, it also makes sense for the farmers as keeping pigs in order to produce biogas helps replace hillside crop growing as a source of income.



Figure 28 : Welcoming ceremony in Wang Yang Chang village for the delegation visit.

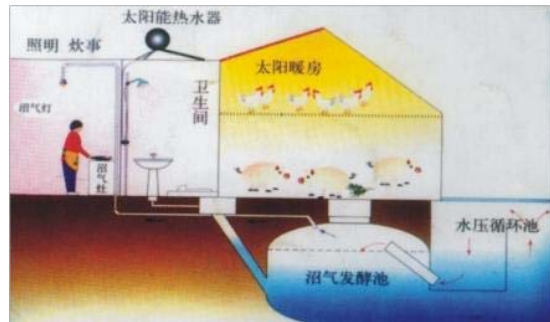


Figure 27 : Methane generated from human & animal wastes is used for cooking and lighting.

Many farmers in Shaanxi keep pigs in pigsties, and their waste, combined with human waste from an adjacent toilet, forms the basis of the biogas. The sties are specially built as part of a structure that includes the biogas pit. Most systems provide enough gas for a two-burner stove and a single indoor light. The waste from pigs or people is simply sluiced down directly into the 'input' for the biogas pit; warm water is then added, and due to a process of anaerobic digestion, biogas is produced which is then piped into the home for cooking. An added benefit is the remaining slurry which acts as an effective fertiliser, allowing farmers to cut down massively on chemical fertilisers.

A system price varies from around 380-\$US560, depending on size and accessories like a shower room powered by solar energy. The user pays about 1/3 of the cost, with the remainder coming from central/local government (about 1/3) and the Shaanxi Mothers (the remaining third).



Figure 29 : Cooking with biogas in Wang Yang Chang village, China.



Figure 30 : Bob Hall gives a certificate of appreciation to Mrs. Wang Mingying.



For their part, the Mothers raise their funds through local activities and from a range of NGOs, and government bodies (notably the German Embassy). They also receive donations from WuFang XiaoWei, Friends of Earth Hong Kong. Our A&WMA delegation members spontaneously donated enough funds to pay the cost of one complete biogas installation.

Savings of around 1,000 yuans (US\$120) per year can be made for families who produce and use the biogas due to a reduction in expenditure on coal or wood, fertiliser and electricity. An increase in food production as a result of the slurry fertiliser can also increase income by up to 2,000 yuans. If you add these together, the biogas plant pays for itself in around 18 months.



Figure 31: Delegates with Mrs. Wang Mingying and village residents after the visit.

Compared to preparing wood or coal fires for cooking, biogas is simplicity itself. The time saved is used for working in the fields, making clothes and shoes for the children (so saving money), and spending more time with relatives, neighbours and friends. The Mothers stage huge tree planting campaigns, many involving children and young people. Since 1997 one million people have taken part in the 'Hand in Hand' project run jointly by the Mothers and the Women's Federation.

Shaanxi Volunteers Mothers Association for Environmental Protection was awarded the 2006 Ashden Awards for sustainable energy. Ashden awards aim to reward and promote excellent local sustainable energy solutions in the UK and the developing world.

#### 4.3 Kunming Area:

Yunnan is a border province, located in the Southwest of China (see figure 2). It has varied minorities enjoying a harmonious co-existence, with colorful ethnic cultures and customs. It is endowed with diverse topography and eco-systems, which create unique natural resources, pristine and mysterious eco-environment. All this advantages provide a pleasing livelihood environment to the Yunnan people. A Yunnan representative recently declared during the 2007 17<sup>th</sup> China communist party congress in October: «*Yes to the economic development, but not to the detriment of the Environment.*»

##### 4.3.1 Yunnan Environmental Science Society

Yunnan Environmental Science Society (YESS) was founded in 1981. It was organised by people working in the environmental science field, environmental management and by environmental enterprises. The YESS mission is to enhance the environmental protection in Yunnan province, and to devote to ecological protection and harmonious development in Yunnan.

YESS services its members, enterprises and the local government. The main areas of these services include:

- organising academic sharing and exchange, and promoting cooperation between different disciplines;
- environmental impact assessment and appraisal, technology consultancy, and training;
- environmental education for the general public and the youth;
- research performed in environmental science, and offering suggestions to the local government;
- securing the legal rights of environmental scientists, and,
- capacity building of environmental fellows and sectors.

YESS is a local membership organization, registered at Yunnan Civil Affair Bureau. YESS is monitored and supervised by Yunnan Science and Technology Association and the Yunnan Environmental Protection Bureau. YESS has about 1200 individual members and 22 organizational members from all regions of Yunnan. The Member Representative Committee is the leading organization of YESS. The executive Board is elected by the Member Representative Committee.

YESS has now 30 full time employees: engineers and senior engineers, environmental scientists, environmental educators, chemists, environmental managers and ecologists. The meeting at the YESS was held at their office in Kunming with all delegates and the following key persons:

Mrs. Li Wei	Director, senior eng.	Solid Waste Control, YESS
Prof. Zheng Zhihua	Professor	Air pollution control and modelling, Kunming University
Prof. Yang Changliang	Professor	Air and water pollution control, Yunnan University

Director Li Wei welcomed everybody and mentioned there was a National Ecology Conference actually being held in Kunming. Bob Hall was then introduced, followed by each individual delegate self introduction.

Mrs. Li Wei explained that China is actually running on its 11<sup>th</sup> 5 year plan. The plan calls for efforts to build a harmonious society and environmental protection is part of the plan. Two strategic lines -the scientific concept of development and the goal of building a harmonious society - run through the whole outlines of the plan. China aims at reducing its energy consumption and to control air pollution. In Kunming, a «small» (in a Chinese sense) city of 5 million people, the environmental pressure is less intense than in big Chinese cities. An important part of the air pollution in Kunming comes from vehicles. Industrial plants have to get an environmental license in Yunnan.



Figure 32 : YESS scientific colleagues in Kunming

Although the Yunnan province is in a better position than other provinces of China because there are fewer pollution sources in Yunnan, SO<sub>2</sub> source control is a priority. There is also a limitation to the use of coal in certain districts close to Kunming: gas or diesel have to be used. Desulfurization for coal fired thermal power plants is being planned in Yunnan. Prof. Zheng Zhihau adds that many pollution reduction projects have already been achieved. The Yunnan province has made important progress in pollution control these last years. There is an air quality surveillance network in the Kunming area including 9 stations among which 5 are in Kunming. National annual air pollution emission statistics are available from SEPA, as each province and the China 4 municipalities report their territory emissions to SEPA each year. SEPA wants to control PM, SO<sub>2</sub>, NO<sub>x</sub> and Hg emissions in China. In Kunming, for persons older than 60 years old, the public buses are free of charge. There was also a car free day in China on September 22<sup>nd</sup>, 2007.

Dr. Monica Mazurek mentioned it is important to consider local sources of PM<sub>2.5</sub> and organic carbon. Molecular markers studies have demonstrated that cooking emissions, together with vehicle emissions and biomass combustion emissions are important local sources of pollution. Also, PM<sub>2.5</sub> effective control must address wood burning, agricultural burning and trash burning. Diesel trucks and buses are important sources of PM and PM<sub>2.5</sub>. Although prohibited and subject to a fine of 200 yuan, open burning is largely practiced everywhere in every countryside in China. Farmers burn their domestic and farm wastes this way. Mr. Bob Hall will forward a copy of an EPA report on agricultural and open burning.

Dr. Paolo Zannetti offered a presentation on the importance of modelling. Simulations can be used to illustrate past, present, future or eventual and hypothetical situations. Simulations can influence decisions about capital cost projects costing billions of dollars. Dr. Zannetti is specialised in post accident simulations. Accidents can be reconstructed and emission characteristics established. Meteorological data are used and the plume is modelled. Visualisation and adverse effects, or the absence of adverse effects, can be demonstrated.



Figure 33 : Dr. Paolo Zannetti : importance and reasons of modelling.



Figure 34 : Bay Area air pollution control presented by Jack P. Broadbent

Jack P. Broadbent then talked about the Bay Area Air Quality Management District. There are 7.5 million people in this area. Effective controls are made in 5 oil refineries, 24 thermal power plants and cement facilities. Main classic pollutants controlled are O<sub>3</sub>, CO, NO<sub>x</sub>, PM and SO<sub>2</sub>. O<sub>3</sub> and PM are respectively the two pollutants of concern in the area. All thermal power plants use natural gas and no coal is allowed. Coal is only used in some cement plants.

Control is also required for restaurants, wood burning, water heaters, ships, trains, buses and vehicles. The comprehensive vehicle control includes emission standards and vehicle inspection.

A budget of 40 million dollars/year is dedicated to diesel engine pollution control. There is a program designed to scrap vehicles that were built before 1985.

When ozone is high or forecast to be high, free access is granted to public transportation. This happened twice during the summer of 2007 and it was very successful. There was a 20% increase in public transportation during Spare the Air days, and BAAQMD, along with the local transportation agency, pays for the free transit. Carpooling and ridesharing are encouraged. Wood burning is prohibited on those nights when high levels of PM are predicted. Ambiance wood burning is discouraged and installation of gas fireplaces is encouraged.



Figure 35 : The mission leader, Bob Hall, offers a certificate of appreciation to Mrs. Li Wei.



#### 4.3.2 Yunnan Green Environmental Engineering Co Ltd

The Yunnan Green Environmental Engineering limited company registered in 1998. It holds 3 new patents and a national distinction award. The company management scopes include:

- purifying agent, water and wastewasters treatment equipement;
- production and sale of air treatment equipment;
- environmental protection products and scientific research;
- environmental protection design and,
- environmental protection projects.

The meeting at the company was held at their office in Kunming with all delegates and the following key persons:

Mr. Zhu Tiannan	President, senior eng.	Yunnan Green Environmental Engineering co ltd
Mr. Gui Huiguang	Professor	Yunnan Green Environmental Engineering co ltd
Mr. Lin Jing Cheng	Vice president	Yunnan Green Environmental Engineering co ltd
Dr. Yang Shuhua	Professor	Yunnan Green Environmental Engineering co ltd



Figure 36 : Company officials during the meeting in Kunming.

The president, Zhu Tiannan, welcomed everybody and told us that the company produces ethanol from waste and also succeeded by having farmers buy green organic fertilizers produced from waste. From 3 tons of organic wastes, the following is produced: 1 ton of ethanol, 1 ton of organic fertilizer and 0.8 ton of CO<sub>2</sub>. Dr. Monica Mazurek mentioned however that a US geological 1987 traces components study indicated that prescription drugs, hormones and steroids were detected in wastewaters discharged to the environment. This was the object of an article in Environmental Science and Technology magazine.

Dr. Larry Anderson mentioned that, in USA, a great deal of corn is used to produce ethanol and significant amount of organic waste results from this process. Obviously, such a green recovery process could be of great interest. The Chinese colleagues said that the company is greatly interested in the agricultural waste management. In China, the use of corn to produce ethanol is not allowed, as human food production is favored.

Ronald Poissant mentioned that in some places in Europa and eventually in Montréal, Canada, yeast plants produce or could produce methane using their waste vinasse instead of discharging it directly into city sewers or to the environment, causing important nuisances and problems to the receiving body, the wastewater treatment plant and important rejects to the atmosphere. This could be an interesting opportunity for Chinese yeast plants.

Some research and studies are also being performed in order to modify the genome of plants to be able to produce fuel more easily. Enzymes could eventually be used to break more easily

modified cellulose/lignin. USA department of Energy, British petroleum, Chevron and Shell have invested in this type of research to modify plant genetics. Dr. Mazurek mentioned that some people at Rutgers University are working on similar projects and contacts can be established. The company representatives mentioned that they are greatly interested.

The company officials and Chinese people are very open to new ideas that will help to increase energy production, reduce waste production, etc. The company officials added that the cost of organic fertilisers is less than the one of synthetic ones, so there are no state subventions to the organic fertilisers production and farmers are nevertheless interested in the organic fertilisers anyway.

Dr. Azriel Pillersdorf added that cement kiln dusts can be mixed with municipal wastewater treatment sludge. The addition of those two materials is exothermic. The result is an aseptic and pasturised material that is accepted as a fertiliser.

Prof. Yang Shuhua mentioned that it is difficult for a company in China to concentrate in the environmental field. There are, however, many organic wastes from the food industry in China. The sugar manufacturing processes used in China, Cuba and in other places in Asia, produce more wastes than the process used in USA. One way to recover this source of carbon is to concentrate the wastewaters by using wasted energy in sugar plants.

Prof. Larry Anderson then made a verbal presentation on ethanol use in gasoline in the USA. He mentioned that with 10% ethanol in gasoline, formaldehyde emissions from cars are 10 times higher. He also mentioned that formaldehyde and acetaldehyde are toxic and are O<sub>3</sub> precursors. The vapor pressure of gasoline is increased by ethanol addition, so VOC emission could be greater. The use of ethanol should be done with caution, since the emission of benzene and of other pollutants can be increased. We should really know all or more on possible consequences for the air quality before a final decision on massive use of ethanol is made.



Figure 37 : Mr. Zhu Tiannan receiving a certificate of appreciation from the mission leader, Bob Hall.

## 5. Cultural Visits and Others

Delegates and guests had the occasion to taste many different Chinese meals in great Chinese restaurants in every city visited. They experienced the *Kung Fu* theatre show in Beijing. They also had a tour of the Tianamen Square (figure 37), the Forbidden City, and the Great Wall in the Beijing area. They visited the old Xi'an city wall and an ancient temple while in Xi'an. They also visited the Terra Cotta Warriors and museum, and a Jade factory in Xi'an. A silk store and the Stone Forest were visited while in Kunming. The final day concluded with a foot massage and the Farewell Dinner.



Figure 37: The entire group of delegates and guests with the local and national guides at the Tianamen Square before the visit of the closely Forbidden City, in Beijing, on October 12, 2007.

An amateur DVD movie of some portion of the trip was produced and is available through the mission leader Bob Hall at US EPA. Also, guests had their own activities while professional meetings were held throughout the trip.

Professional cards of the professional delegates and of the key persons met during each professional meeting are attached in Appendix II.

## 6. Guidance during the mission



Figure 38 : Mrs. Yang Jie receiving a souvenir.

Guidance during the whole mission was very efficiently made by *Star Professional programs*. Our national guide was Mrs. Yang Jie (figure 38) who was accompanied by a local guide in each of the three cities visited. Especially in Xi'an, the delegates and guests had the occasion to enjoy a supper in the local guide's family apartment. It was a great occasion for people to meet and exchange ideas and gifts.

## 7. Conclusion

Throughout this October 2007 environmental professional mission to China, delegates and guests had the wonderful opportunity to learn or to know more about China, the Chinese people, its history, its present and its future.

China's economy is growing rapidly. This brings important changes in China and elsewhere in the world. The quality of life is planned to increase in China as the gross national product per capita (GNP/capita) is expected to double in five years. Furthermore, the environmental quality of life is planned to greatly improve in the next five years, as evidenced by the determination of citizens and government officials to enforce better environmental policies and solutions. Chinese environmental quality improvement expectations constitute very good news for Chinese people and also for the world.

The People to People organization mission was fulfilled: *«Through meetings, seminars or humanitarian efforts, and cultural activities, participants connect with people with similar interests or professions while overseas. The programs join common interests in uncommon places through journeys that enrich the world, one person at a time.»*

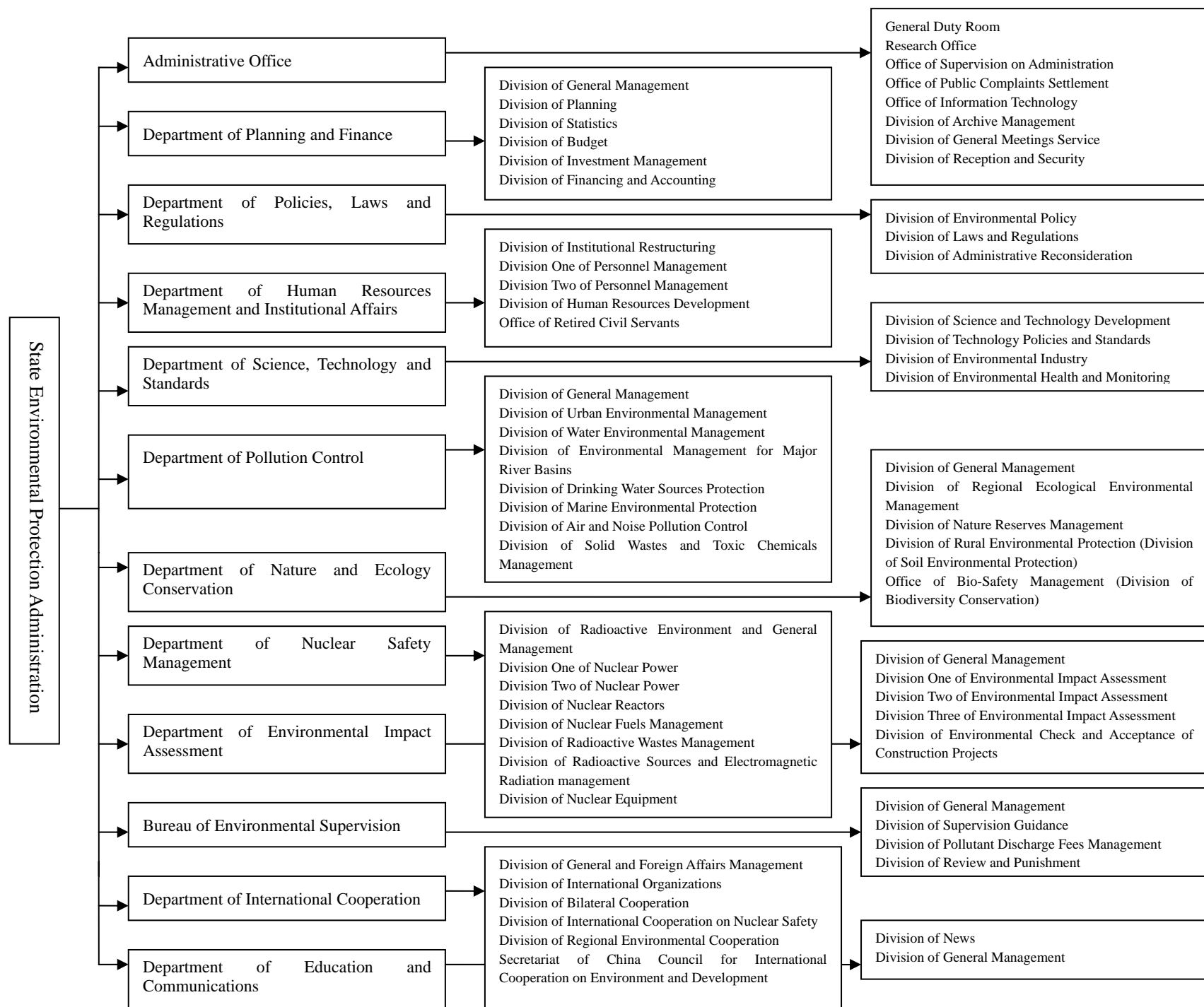
The Air & Waste Management Association (A&WMA) mission is also fulfilled: a neutral forum was provided to enhance knowledge and expertise, information was exchanged. This October Mission to China was an occasion for professional development, networking opportunities, and an outreach opportunity for professionals from China, USA, Israel and Canada.

We, the delegates and guests, all know China and Chinese people a lot more now, and in a way that we would never be able to achieve without this mission.

We will never forget such an amazing experience and all the wonderful people we have met.



# **APPENDIX I**



# **APPENDIX II**



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