Country Synthesis Report on Urban Air Quality Management

Lao PDR

Discussion Draft, December 2006

ADB

CLEAN AIR INITIATIVE for Asian Cities

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ADB facilitated this study through its Regional Technical Assistance 6291: Rolling Out Air Quality Management in Asia.

The Study was led by the CAI-Asia Secretariat and the information contained in this report was developed by the CAI-Asia Secretariat with inputs by a range of organizations and air quality experts from across Asia and elsewhere.

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Abbreviations

ADB	Asian Development Bank
AQ	air quality
EIA	environmental impact assessment
EPL	Environmental Protection Law
GDP	gross domestic product
GHG	greenhouse gas
MCTPC	Ministry of Communication, Transport, Post and Construction
NO_2	Nitrogen dioxide
PDR	People's Democratic Republic (the Lao)
PM	particulate matter
PM_{10}	particulate matter with diameter not more than 10 microns
SO_2	Sulfur dioxide
TSP	total suspended particulates
$\mu g/m^3$	microgram per cubic meter
UNEP	United Nations Environment Programme
WHO	World Health Organization

Note: "$" means "US dollar" in this publication.

Acknowledgments

This series of country and city synthesis reports (CSRs) is the first time that a comprehensive overview of urban air quality management (AQM) at the country and city—in the case of Hong Kong Special Administrative Region of the People's Republic of China (PRC)—levels has been prepared in Asia. Research compilation for this country and city synthesis reports on Urban Air Quality Management was led by the Clean Air Initiative for Asian Cities (CAI-Asia) Secretariat with inputs by a range of organizations and air quality experts from across Asia and elsewhere, and facilitated by the Asian Development Bank (ADB) through its Regional Technical Assistance No. 6291: Rolling Out Air Quality Management in Asia. The primary authors of the reports are Ms. Aurora Fe Ables, Ms. May Ajero, Mr. Herbert Fabian, and Ms. Ninette Ramirez, all from CAI-Asia, under the supervision of Mr. Cornie Huizenga, Head of Secretariat, CAI-Asia.

The CSRs were prepared with assistance from volunteer authors from the different countries, and facilitated by CAI-Asia local networks in Nepal (Clean Air Network-Nepal), Pakistan (Pakistan Clean Air Network), Philippines (Partnership for Clean Air [PCA]), the People's Republic of China (PRC) (CAI-Asia Project Office), Sri Lanka (Clean Air Sri Lanka), and Viet Nam (Viet Nam Clean Air Partnership). CAI-Asia local networks have also organized a development partners meeting on clean air in the respective countries and city where initial drafts of the CSRs were presented to local AQM stakeholders.

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» Part One

General Information

Geography and Climate

The Lao People's Democratic Republic (Lao PDR) is a landlocked country surrounded by Myanmar, Cambodia, the People's Republic of China (PRC), Thailand, and Viet Nam. The total land area of the country is 236,800 square kilometers (km^2) with a largely mountainous topography. The capital, Vientiane, however lies on a plain. The country is bordered on the west by the Mekong River, making the river an important artery for transportation, communications, and trade with other countries sharing tributaries of the Mekong River.

The country has a tropical monsoon climate, characterized mainly by a rainy season (May to October) and dry season (November to April) and temperatures ranging from 5°C to 40°C depending on the altitude. Humidity is generally high (in the 70 to 80% range).

Urbanization and Population

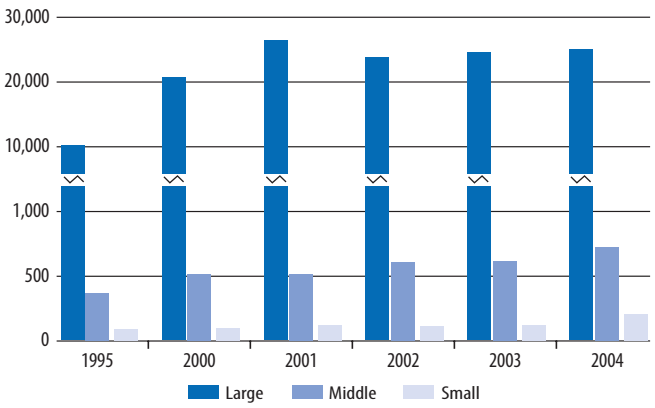
As of mid-2005, the population of the Lao PDR is estimated to be at 5.6 million and is growing at an average of 2.4% annually. Urban population makes up only 17.6% of the country's total population, making it the least urbanized country—next to Cambodia—in Southeast Asia. The country's urbanization rate of 3.8% annually is almost the same with neighboring countries such as Cambodia, Myanmar, and Viet Nam in the Mekong subregion (Asian Development Bank [ADB] 2006). The population growth rate of Vientiane is 4.7% and the country's second largest urban center, Savannakhet, has a population growth rate of 5.4% annually (United Nations Environment Programme [UNEP] 2001).

Economy and Industry

The Lao PDR is still largely an agricultural country with 82% of its labor force employed in the agriculture sector, while the industry and services sector's employment share is only at 9% each (2003). This agriculture employment share is one of the highest, if not the highest, in Asia. The contribution of the agriculture sector to the country's gross domestic product (GDP), however, has been decreasing—61.2% in 1990 to 47.0% in 2005. On the other hand, the industry and services sector's contribution to GDP has been showing an increase. The industry sector's share (14.5% in 1990 to 27.3% in 2005) is increasing faster than that of the services sector (24.3% in 1990 to 25.7% in 2005) (ADB 2006).

The Lao PDR does not have many large-scale industries. The industry sector is in fact dominated by small establishments that make up 96% of the total number of industries in the country (2005) (see Figure 1.1).

FIGURE 1.1
Number of Establishments by Size



Source: Ministry of Industry and Handicraft as quoted in National Statistics Centre 2006.

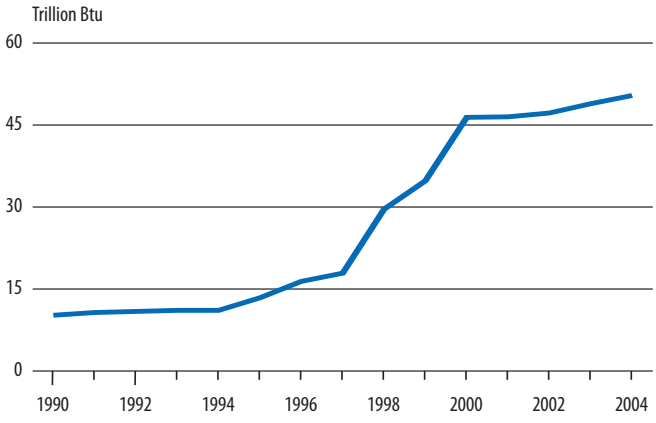
The Lao PDR per capita GDP is still low and about 39% of the country's population still live below the poverty line (UNEP 2001). In terms of human development index, the Lao PDR was also listed as among the lowest among 174 nations and the last among Southeast Asian countries (United Nations Development Programme 2000).

Energy

To date, the Lao PDR does not have proven reserves for oil and natural gas. The Lao PDR, however, has high potential for hydropower and has some major lignite deposits of low sulfur content in the northwestern part of the country (UNEP 2001).

The Lao PDR's demand for oil is supplied mostly by imports and is usually used for transportation purposes. Energy consumption in the country has experienced rapid increases from 1995 to 2000, but has slowly stabilized in the past 5 years (Figure 1.2).

FIGURE 1.2
Trend of Energy Consumption in the Lao PDR



Source: Energy Information Administration, 2006.

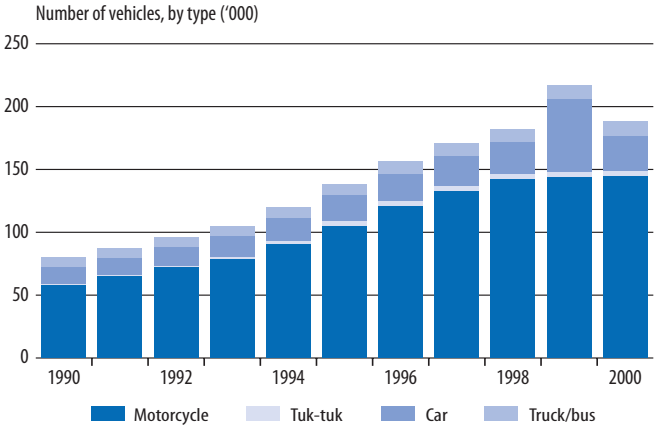
Almost all electricity generated in the Lao PDR comes from hydropower facilities. Despite the high potential for hydropower, only 20% of the total population has access to electricity from the grid. Distribution is also variable. Only 8% of rural areas have access to electricity, while more than 60% of Vientiane residents have electricity (UNEP 2001).

Transport

The vehicle fleet of the country is categorized by the dominance of motorcycles (78%) and a very low number of vehicles for public transport use, mostly registered in the Vientiane municipality (57%). Road transportation is not considered a major problem in the country because vehicle ownership is still considerably low, especially when compared to other countries (see Figure 1.3).

The motorcycle market is booming in the country because of poor public transport facilities and the infiltration of cheap Chinese motorcycles. Prior to the Asian economic crisis in 1997, an average growth rate of motorcycles in the country was 13% per annum. It remained high (at 9%) even in 1997, but generally stabilized until 2000. The low registration in 2000, however, may be due to the stoppage of registration when the Vientiane registration building was razed by fire that same year.

FIGURE 1.3
The Lao PDR Vehicle Fleet, 1990–2000



Public transport by buses is generally poor in the country. Instead, the three-wheeled tuk-tuks frequently service areas not well-covered by the bus system. Rides in tuk-tuks, however are quite expensive and most are of the more polluting 2-stroke engine type. Converting two- and three-wheelers to 4-stroke engines is still a task ahead for the country.

Despite the increase in vehicle number, overall traffic density remains low. Road accidents are common because of poor

vehicle maintenance and poor road safety practice. A mix of traditional human and animal, with motorized transport on the road, is a common sight that also often leads to increasing road fatalities.

Air pollution from mobile sources in the country is also contributed by unpaved roads. Of the estimated 32,620 km of total road networks in 2002, only 14% are paved (Central Intelligence Agency [CIA] 2006).

» Part Two

Sources of Air Pollution

Compilation of emissions inventories for criteria air pollutants is not a routine task of the government. Emissions inventory data for common pollutants such as particulate matter (PM), Sulfur dioxide (SO_2), and Nitrogen dioxide (NO_2) are not currently available.

The Lao PDR submitted to the United Nations Framework Convention on Climate Change its First National Communication, which includes an inventory of its greenhouse gas (GHG) emissions and sequestrations. One of the issues identified in the document, lack of resources (technical capacity and funding) to conduct GHG emissions inventory, could be the same reason that no emissions inventory for air pollutants has been compiled to date.

» Part Three

Status of Air Quality

Air Quality Monitoring

Air quality (AQ) monitoring is still not a routine practice in the country. Monitoring of the concentrations of pollutants in the air remains to be on an ad-hoc project basis. The most recent monitoring conducted was in March to April 2004 in three sites in Vientianne. Prior to this, a DANIDA-funded study also monitored air quality in 2003 to 2004 in seven different sites in Vientiane. There is no information whether the government is planning to install air quality monitoring systems or conduct routine monitoring in the next few years.

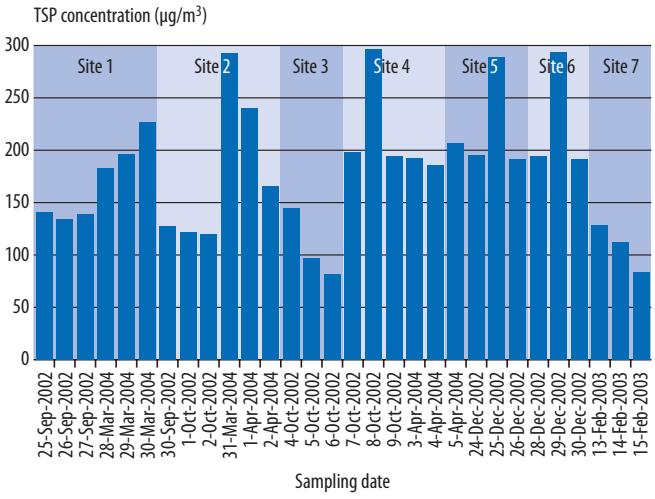
Air Quality Data

Since monitoring was conducted only for 3 consecutive days per year at most, AQ data results are insufficient for comparison with annual guidelines of the World Health Organization (WHO). But they can only be compared with 24-hour standards. Table 3.1 shows the site number and the location as well as sampling dates.

Total suspended particulates (TSP) monitoring data for all locations indicate concentration levels ranging from 82µg/m^3 to 296µg/m^3. This suggests that TSP is a problem in Vientiane (Figure 3.1).

FIGURE 3.1

TSP Monitoring Results in Seven Locations in Vientiane, 2002–2004



µg/m^3 = microgram per cubic meter, TSP = total suspended particulates
Source: STEA graphed by CAI-Asia.

TABLE 3.1

Location of Sampling Sites and Corresponding Sampling Dates in Vientiane

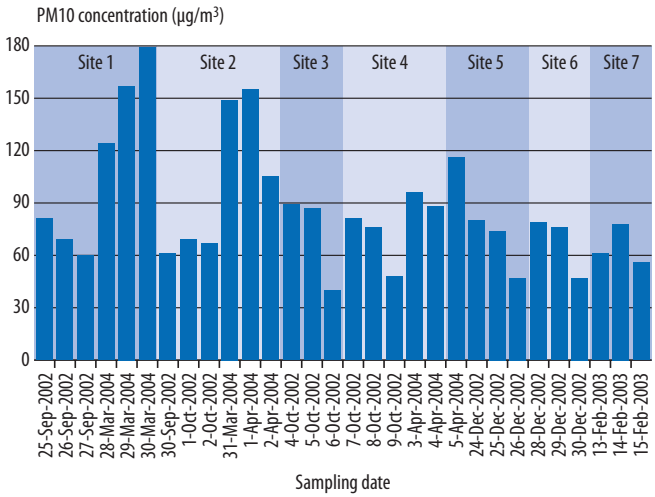
Site Number	Location	Sampling Dates	Pollutants
1	Ministry of Industry & Handicrafts	25–27 September 2002 / 28–30 March 2004	TSP, PM_{10}, NO_2, SO_2
2	Department of Geology & Mines	30 September 02 Oct 2002 / 31 March 31 02 April 2004	TSP, PM_{10}, NO_2, SO_2
3	Department of Industry	04–06 October 2002	TSP, PM_{10}, NO_2, SO_2
4	Department of Meteorology	07–09 October 2002 / 03–05 April 2004	TSP, PM_{10}, NO_2, SO_2
5	Phone Tong Electricity St.	24–26 December 2002	TSP, PM_{10}, NO_2, SO_2
6	Sokphalong Electricity St.	28–30 December 2002	TSP, PM_{10}, NO_2, SO_2
7	Lao Telecom	13–15 February 2003	TSP, PM_{10}, NO_2, SO_2

NO_2 = Nitrogen dioxide, PM_{10} = particulate matter with diameter not more than 10 microns, SO_2 = Sulfur dioxide, TSP = total suspended particulates
Source: STEA graphed by CAI-Asia.

PM_{10} monitoring results in Vientiane showed a range of concentrations between 40µg/m³ to 179µg/m³ and an average of all 30 measurements at 87µg/m³ (Figure 3.2). If the measurements are compared with the newly released 2005 WHO 24-hour guideline update (50µg/m³), only 4 or 13% of the measurements comply with the standard. This also suggests that PM10 is a problem for Vientiane.

FIGURE 3.2

PM_{10} Monitoring Results in Seven Locations in Vientiane, 2002–2004



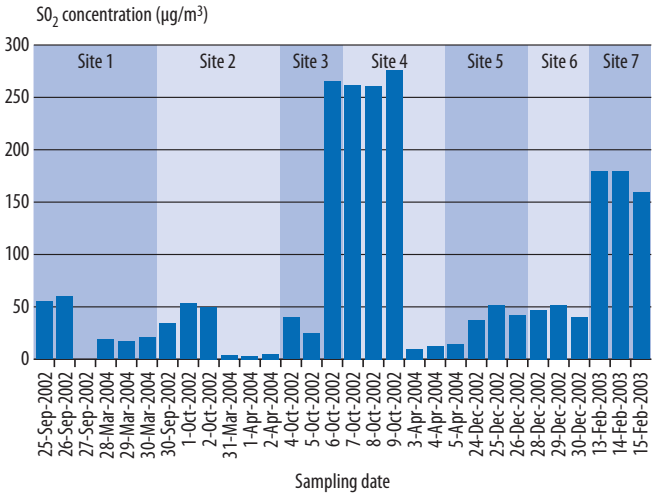
µg/m³ = microgram per cubic meter, PM_{10} = particulate matter with diameter not more than 10 microns
Source: STEA graphed by CAI-Asia.

SO_2 measurements in Vientiane show varying levels depending on the location. The range of measurements is from 3µg/m³ to 276µg/m³. Only 8 of 29 measurements or (27.6%) comply with the WHO 24-hour guideline of 20µg/m³. This suggests that SO_2 is an issue, but on the limited evidence available, less so than PM.

NO_2 measurements in Vientiane are generally very low having only a maximum reading of 50µg/m³. WHO does not have 24-hour guidelines for NO_2 but only has a 40µg/m³ annual guideline and a 200µg/m³ hourly guideline. Considering that most of the NO_2 readings (90%) in Vientiane are below 10µg/m³, on this evidence, NO_2 is not currently a problem in the city.

FIGURE 3.3

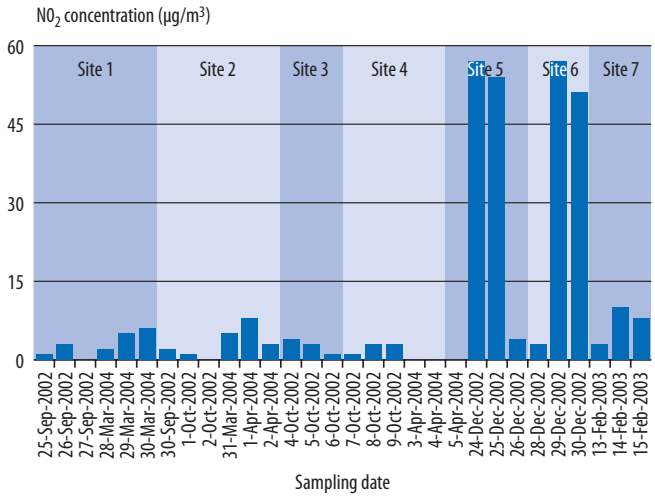
SO_2 Monitoring Results in Seven Locations in Vientiane, 2002–2004



µg/m³ = microgram per cubic meter, SO_2 = Sulfur dioxide
Source: STEA graphed by CAI-Asia.

FIGURE 3.4

NO_2 Monitoring Results in Seven Locations in Vientiane, 2002–2004



µg/m³ = microgram per cubic meter; NO_2 = Nitrogen dioxide
Source: STEA graphed by CAI-Asia.

Reporting of AQ Information

Results of AQ monitoring and their assessments are only made available in study reports and are not made public. There is no air pollution index system in place in the country.

» Part Four

Impacts of Air Pollution

The country's most serious health problems are still those of rural areas and infectious diseases, as well as water-borne diseases. The five major causes of morbidity and mortality are malaria, pneumonia, gastritis, influenza, and diarrhea (WHO 2006a). Life expectancy in the country is also very low at 59 years old (WHO 2006b).

To date, no study assesses the impact of outdoor air pollution on the health of the public. One project, however, has already initiated the measurement of indoor air pollution impact on health in 2005. There is no indication that any study on impacts of outdoor air pollution will be conducted any time soon.

» Part Five

Air Quality Management

Legislation and Mandate

No specific air pollution control law provides a legal framework for AQ management in the country. Article 17 of the Lao PDR's Constitution (1991) has a provision for environmental protection. Article 17 provides that "all organizations and citizens must protect the environment and the natural resources: land, underground, forests, fauna, water sources, and the atmosphere."

In addition to the Constitution, the Environmental Protection Law (EPL) (1999) is the main environmental legislation relevant to the Lao PDR at the national level. The EPL mandates the Science Technology and Environment Agency at the Prime Minister's office as the main government agency responsible for environmental protection.

Ambient AQ Standards

The Lao PDR has not adopted its own set of ambient AQ standards. There is no indication whether the Lao PDR is drafting or planning to adopt its own national ambient AQ standards in the near future.

Management of Mobile Sources

No specific regulation controls the emissions of pollutants from mobile sources. The EPL also does not stipulate any specific provisions on this sector. The Transport Policy however of the Ministry of Communications, Transport, Post and Construction (MCTPC) has also set forth policy objectives and statements strongly supporting cleaner transport technology and mode shifting to more sustainable modes. The main environmental objectives of the MCTPC include reduction of emissions from vehicles, reduction of noise as well as reduction of accidents. The MCTPC also has adopted the following strategies (Table 5.1):

Although there is a vehicle registration system in place in the Lao PDR, compliance with any emissions standards does not seem to be a legislated requirement.

Management of Stationary Sources

Although the Lao PDR does not have a large number of large industries, industrial air pollution from stationary sources are also managed by the Science Technology and Environment Agency and the Ministry of Industry and Handicrafts. Stack monitoring of industries such as cement factories are also being conducted to ensure that these industries do not pollute the atmospheric environment of the country.

The environmental impact assessment (EIA) system, a requirement for industries and establishments also, is a way to monitor and regulate air pollution from the industry. The EIA system utilized in the Lao PDR, however, is still informal and ad hoc in nature (Tan 1998).

Public/Nongovernment Organization Participation

No domestic nongovernment organizations are working on environmental issues in the Lao PDR (Tan 1998). Although some international organizations have offices or are working in the Lao PDR, the focus of their work is not on air pollution but on matters that relate mostly to water, forestry, and biodiversity issues.

TABLE 5.1

MCTPC Transport Strategies

Area	Strategy
Nonmotorized transport	Promotion of nonmotorized transport
	Improve safety and security
	Improve comfort
	Reduce walking distances to public transport
Public transport	Decrease travel times
	Increase service frequency
	Improve reliability and punctuality
	Provide customer information systems
	Introduce convenient fare systems
	Introduce high-capacity vehicles, where appropriate
	Integrate public transport fully with other modes
	Use cleaner fuels for public transport
	Integrate land-use and public transport planning
	Establish appropriate institutional structures for managing public transport
	Provide priority for public transport in road space
Private vehicle restriction measures	Reduce private vehicle usage through internalization of impacts
	Introduce greater parking restrictions
	Examine potential for higher vehicle import taxation and petrol taxation

Source: MCTPC, 2005.

» Part Six

Conclusion

The economy of the Lao PDR is still highly agriculture based. Industrialization, rapid urbanization, and motorization with associated emissions are in the early stages, but are expected to grow. This presents the Lao PDR with the opportunity to ensure that the nation's economy develops using the experiences of its neighbors to avoid the major AQ issues that other nations have experienced.

AQ in the Lao PDR is still generally good and an AQ management system is still not a major requirement, but the results of limited monitoring conducted in Vientiane suggest that the city has excessive ambient concentrations of PM. As these concentrations suggest significant health impacts on the residents of Vientiane, there is a need for a technical scientific understanding on the status of PM in Vientiane, the emission sources and action to address this issue. There is a need to start AQ management with at least a basic understanding of this issue through AQ monitoring and compilation of an emissions inventory to provide the basis for decision making.

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