



Lao People's Democratic Republic

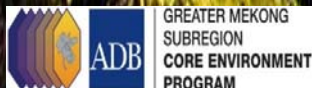
Peace – Independence - Democracy – Unity - Prosperity

National Pollution Control Strategy and Action Plan 2018 – 2025, with Vision to 2030

(Full draft # 16)

WITH STRATEGIC VISION AND ULTIMATE GOAL:
"The People of the Lao PDR commit to a
pollution free, clean and healthy for the
sake of the country's prosperity and
sustainable development"

Prepared by
The Ministry of Natural Resources and the Environment
with Technical Support from GMS Core Environment Programme



Vientiane, December 2017

Forward

In recent years, initially important results have been made in environmental protection work and pollution control. This can be attributed to due attention increasingly paid to the implementation of the Law on Environmental Protection (Revised in 2012); National Instructions on Pollution Control and Hazardous Waste Management (2015); Natural Resources and Environment Sector Five Year Action Plan for the period of 2016 to 2020 (2015); National Environmental Standards (revised in 2017); and a new mandate of National Department of Pollution Control - PCD (revised in 2017).

Nevertheless, for various reasons, the environment of the country continues experiencing degradation at a considerable rate, and in some-where some time at concerned level. Land is being under erosion and deterioration; the quality of water resources strongly declines, the quality of air is already polluted in key urban centers and residential areas; biological diversity is being seriously threatened; and the supply of clean drinking water and environmental sanitation is not sustained in many places, causing adverse impacts on the local people's health and living conditions, and sustainable development of the country.

The Lao PDR Pollution Control Department (PCD) of the Ministry of Natural Resources and Environment (MONRE) is tasked to prepare a National Pollution Control Strategy to 2025 with Vision to 2030 (NPCSAP) pursuant to the Revised Law on Environmental Protection 2012 and subsequent decrees, regulations and instructions.

This strategy and long-term vision to 2030 will guide the country's environmental pollution prevention and control work in the period of promoting industrialization and modernization of the country. The Strategy is an extremely important guiding instrument for the country's environmental protection work until 2030.

In addition to a general assessment of the environment of the country in the past, the Strategy presents the guiding views on, objectives and activities of, and solutions to environmental pollution prevention and control, and an Annex comprising of 36 priority programs on environmental pollution prevention and control.

It is my great honor to present the Strategy and Action Plan to all levels of the authority, sectors and national and international organizations.

Vientiane, December 2017

Sommath Polsena

Minister of Natural Resources and Environment

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Abbreviations and Acronyms

ADB:	Asian Development Bank
AKASEP	Awareness, Knowledge, Attitude, Skill, Evaluation and Participation
BC:	Black Carbon
ASEAN	Association of Southeast Asian Nations
B	Boron
BAT	Best Available Practices
BET	Best Environmental Technique
BHC:	Benzene hexachloride
BOD:	Biological Oxygen Demand
CBO:	Community Based Organizations
CBS:	Central Bureau of Statistics
Cd	Cadmium
CEP	Core Environment Programme
CH ₄ :	Methane
CO:	Carbon monoxide
CO ₂ :	Carbon dioxide
COD:	Chemical Oxygen Demand
CP	Cleaner Production,
CP:	Cleaner Production
Cu	Copper
dB:	decibel
DDC	District Development Committee
DDE:	Dichlorodiphenyl Dichloroethylene
DDT:	Dichlorodiphenyltrichloroethane
DNREO	District Natural resources and Environment Office
ECCDA	Environment Conservations and Community Development Association
EIA	Environmental Impact Assessment
EIA:	Environmental Impact Assessment
EMMP	Environmental Management and Monitoring Plans
EMP:	Environmental Management Plan
EMS	Environment Management System
EOC	Environment Operation Center
GDP	Gross Domestic Product
GMS	Greater Mekong Subregion
GNI	Gross National Income
GOL	Government of Lao PDR
HCI:	Health Care Institute
HS	Hazardous Substances
HSB:	Hochschule Bremen
IPPS	Industrial Pollution Projection System
Lao PDR	Lao People's Democratic Republic
LNCCI:	Lao National Chambers of Commerce and Industries
Mn	Manganese
MOAF	Ministry of Agriculture and Forestry
MOE	Ministry of Education
MOF	Ministry of Finance
MOFA	Ministry of Foreign Affairs
MOH	Ministry of Health
MOHA	Ministry of Home Affairs
MOIH	Ministry of Industry and Handicrafts
MOJ	Ministries of Justice
MOLSW	Ministry of Labor and Social Welfare

MONRE:	Ministry of Natural Resources and Environment
MOPWTH	Ministry of Industry and Handicrafts
MOST:	Ministry of Science and Technology
MOTP	Ministry of Transport and Public Works
MRF	Material Recovery Facilities
MVIETS	Motor Vehicle Inspection and Emission Testing System
N2O:	Nitrous oxide
NEPPCSC	National Environment Protection and Pollution Control Steering Committee
NES	National Education System
NGO:	Non-Government Organizations
NH3:	Ammonia
Ni	Nickel
NICC	National Implementation Coordination Committee
NIU	National Implementation Unit
NOx:	Oxide of Nitrogen
NPAP	National Pollution Control Action Plan
NPCS	National Pollution Control Strategy
NPCSAP	National Pollution Control Strategy and Action Plan
NREI	National Resources and Environment Institute
NRM	Natural Resources Management
ODF	Open Defecation Free
PANs	Peroxy-Acetyl-Nitrates
Pb	Lead
PCBs	Polychlorinated Biphenyls
PCD	Pollution Control Department
PCS	Pollution Control Strategy
PDOCNRE	Provincial, Capital Natural Resources and Environment Department
PM:	Particulate Matter
PM10	Particulate Matters of size less than 10 microns
POPs	Persistent Organic Pollutants
PPA:	Public Procurement Act
PPP	Public Private Partnership
SDG	Sustainable Development Goal
SEDP	Socio-Economic Development Plan
SEZs	Special Economic Zones
SMMP	Social Management and Monitoring Plans
SP	Strategic Pillar
TSS	Total Suspended Solids
UXO	Unexploded Ordnance
VDC	Village Development Committee
VOC	Volatile Organic Compounds
WCP	Wastewater Charge Programme
WEPA	Water Environment Partnership in Asia
Zn	Zinc

PART I

BACKGROUND OF POLLUTION CONTROL IN LAO PDR

I.1. Introduction

The land-linked Lao PDR has abundant natural resources: high levels of forest cover, a large per capita volume of internal renewable water resources, and considerable mineral resources such as gold, lignite, and copper. These natural resources have catalyzed the country's economic growth and played a vital role in supporting rural livelihoods.

In recent years, Lao PDR has rapidly integrated into regional and global economy resulting in a surge of both domestic and (especially) foreign direct investment mainly in mining, hydropower generation, and agro-industries. Gradual agriculture intensification, mining explorations, hydropower and industrialization, in otherwise predominantly an agriculture based economy, is offering new growth opportunities as well as new environmental challenges. Recognizing the importance of natural resources conservation and environmental protection, the Government of Lao PDR has recently enacted new laws and policies regarding Natural Resources Management (NRM). However, poor enforcement has caused significant environmental damage (WB 2013).

Pursuant to the new Law on Environmental Protection, No. 29/ NA dated 18 December 2012 and subsequent decrees, regulations and instructions on environmental protection and pollution control, this National Pollution Control Strategy and Action Plan 2018 - 2025 with Vision to 2030 (PCS) is prepared by The Lao PDR Pollution Control Department (PCD) of the MoNRE, with technical assistance from GMS Core Environment Programme (CEP).

The Strategy is an extremely important guiding instrument for the country's environmental pollution control work. The Strategy presents the guiding views, vision, mission, principle, objectives, activities and solutions to environmental pollution control, and priority programs to pursue sound environmental management, and provides a series of options for governments to implement the commitment to pollution prevention and control.

The implementation of the Strategy and Action Plan is envisaged to contribute to achieving the third Outcome of the Eighth Five-Year National Socio-economic Development Plan 2016 - 2020 –(8th SEDP), reflecting the Socio-economic Development Strategy until 2025 and Vision 2030, making Lao PDR Green, Clean and Beautiful.

I.2. Context

The Lao People's Democratic Republic (Lao PDR) is in a period of dynamic change. Robust economic growth, averaging over 7 percent since 2006. The increasing economic activity in Lao PDR during the last decade or so has considerably had an impact on the country's natural environment.

Rapid urbanisation, increasing industrial pollution, and highway construction pose additional threats to the environment. Poor vehicle and road maintenance are the main causes of air quality problems that Lao PDR is currently experiencing.

The industrial sector in Lao PDR has grown 12 percent annually. The industrial sector GDP share has grown from 18.4 percent to 31.2 percent 2002–2012, of which manufacturing industry accounted for 8 percent and 10 percent in the period of 2003 and 2010 (MPI 2015 - 8th SEDP). The number of Special Economic Zones (SEZs) increased from 2 to 10 in the same period. Of these, 50 percent are located in Vientiane Capital, 30 percent in the Central region (Khammuane and Savannakhet provinces) and 20 percent in the Northern region (Luangnamtha and Bokeo provinces). Major manufacturing activities include food and beverage, construction materials, wood processing, and garment and motorcycle assembly industries. The latest statistics show that a majority of enterprises in Lao PDR is small- and household-scale, accounting for more than 95percent (31,910 enterprises out of 33,066). Medium- and large-scale enterprises comprise 4percent and 1percent (645 and 511 enterprises out of 33,066) of all enterprises. The industrial pollution project exercise conducted under CEP reveals that industrial development contributes to air, water and toxin pollution (CEP II/EOC -2015).

The rapid increase in personal incomes particularly in urban areas have knock-on effects on increasing consumption. The GNI per capita of Lao PDR has more than doubled in the last decade, from 2,100 PPP \$ in 2003 to 4,550 PPP \$ in 2013. As a result, people have more access to energy and material goods. The increasing economic activity in Lao PDR during the last decade or so has considerably had an impact on the country's natural environment.

Currently population is growing at the rate about 2.2 percent annually. Urbanization is growing at even higher rate, with urban population growing at the estimated rate in-between 4.3 and 4.8 percent (MPI 2015 - 8th SEDP). As consequences of this growth, the environmental services are being subjected to increased pressure. With rising populations in urban areas, which are often located along rivers, water pollution is compromising sources of clean and safe potable water.

Similarly, number of vehicles has been growing rapidly at almost rate of 10 percent annually in urban areas such as Vientiane, severely affecting air quality (NREI 2014). Furthermore, transport infrastructure network is expanding rapidly, evidenced by increased road network from 39,584 km in 2010 to 41,042 km in 2011, further driving the urbanization with the emergence of new urban centers along major transport corridors (MPI 2013).

For various reasons, Lao PDR's environmental quality continues experiencing degradation in several key environmental parameters resulting in air and noise pollution in major urban centers and residential areas; soil is being under erosion and deterioration, and pollution; the quality of water resources strongly declines, biological diversity is being seriously threatened; and the supply of clean drinking water and environmental sanitation is not sustained in many places, causing adverse impacts on the local people's health and living conditions, and sustainable development of the country.

I.3. The state of pollution

I.3.1 Air Pollution

Rapid economic growth of the country will increase industrial development, resulting in higher pollutant levels. Air pollution mostly generated by the load of hazardous substances and pollution load to air of each type of activities such as from industrial facilities, electric facilities using coal, construction areas, transportation, agriculture, mining and urban activities.

The main problem of air quality in Lao PDR results from the soil transport, stone, sand, building construction, land development for shelters, construction and road maintenance, dirty road. Beside of this, in some areas air pollution comes from vehicles smoke (exhaust), waste burning, agricultural clearance (rice field, garden), and factories (steel, concrete, brick). The services in a slum: construction sell shops, garages and smoke from food processing in house (CEP/EOC-2015).

Table 1. The number of complaining on air pollution from handicraft and industries.

Year	Type of industries	Amount	Complains
2000	Luandry, sewing	2	Bad smell from wastewater
2003	Cigarette production	1	bad smell is dangerous
2005	sipact roofts	1	Bad smell, stink, color, bad smell
2006	Nailproduction, garment	3	Noise, dust, bad smell
2007	Garment, car assembly and tyre production	2	Release waste water, smell, dust
2009	Furniture productions, vehicle assembly, paper production, salt processing factory, cassava power factory	5	Release waste water, stink, smell, dust
2010	Mattress pastic production (foldable), Tiger Beer production, furniture production, cassava power production, rice noodle-noodle, concrete and etc.	13	Bad smell, stink, dust, smoke
2011	Wooden menufacturing, steel industry, color spray, car color garage, tire factory	10	Bad smell, stink, dust, smoke
2012	SINOHYDO factory (stell processing group), pig rais, extraction of used engine oil.	5	Bad smell, stink, dust

Source: Industry Department, Vientiane Capital Office of Natural Resources and Environment-2017

All air pollutant emissions the “cement, lime, and plaster” sector is the largest emitter in aggregate. It is also the largest emitter of Sulfur dioxide (SO₂) and Nitrogen dioxide (NO₂), particulate matter (PM₁₀) and TSP. This sector represents less than 1percent of all enterprises in the dataset and 1.62 percent of all industrial employment, but contributes a majority of industrial air emissions in the country. The “basic industrial chemicals” and “non-ferrous metal basic industries” sectors are the next-largest emitters of air pollutants. The sectors producing the largest quantities of VOC are different than those producing other air pollutants (CEP/EOC-2015).

Within each sector for each air pollutant, the largest 10 emitters produce a majority of pollution. The largest 10 enterprises in the “cement, lime, and plaster” sector produce 80.87percent of its SO₂, NO₂, PM₁₀, and TSP emissions, and the largest 25 enterprises produce almost all of the sector’s air pollution. This indicates that significant reduction in aggregate emissions of air pollutants could be achieved if a limited number of enterprises were to reduce their emissions (CEP/ EOC -2015).

Three sectors account for the bulk of toxic metal pollution discharges, such as: “non-ferrous metal basic industries”, “iron and steel basic industries,” and “basic industrial chemicals”. All other sectors make insignificant contributions to such discharges. Within these three sectors most discharges are accounted for by a relatively small number of facilities. In “non-ferrous metal basic industries” the largest 10 enterprises account for more than 70percent of all toxic metal discharges. The same three sectors account for the largest share of discharges of toxic pollution.

Energy production in factories can be roughly categorized into two main types of fuel: firewood and fossil fuel. Burning firewood causes emission of particulate and carbon monoxide. But high technology factories that burn fuel oil are increasing. Burning of fuel oil (or diesel) causes black fumes, sulfur dioxide and oxides of nitrogen. Even though the factories are using different kinds of fuel, these fuel types are causing degraded air quality. Particulate, sulfur dioxide and oxides of nitrogen are discharged into the atmosphere and are affecting people in cities across Lao PDR (MONRE 2012).

Rapid urbanization and highway construction pose additional threats to the urban environment. The number of vehicles has been growing rapidly at almost rate of 10percent annually in urban areas such as Vientiane, to consider the impact on the environment affecting air quality. Even though most fuel used for transport in Vientiane is unleaded and low in sulfur, vehicles are still the major source of other pollutants: TSP, PM10 and CO. Particulate matter, especially PM10, has the most serious potential impact on health, including decreased lung function, cancer and possibly death from respiratory illness. Furthermore, transport infrastructure network is expanding rapidly, evidenced by increased road network from 39,584 km in 2010 to 41,042 km in 2011, further driving the urbanization with the emergence of new urban centers along major transport corridors (MPI 2013).

Poor vehicle and road maintenance are the main causes of air quality problems that Lao PDR is currently experiencing. The problems mainly stem from the large percentage of two-stroke-engine motorcycles (78 percent) on the road, 57percent of which are registered in Vientiane. Air pollution from mobile sources in the country is also contributed by unpaved roads (Jica 2012).

Most of the population use wood or charcoal for their daily cooking. The use of wood fuel and charcoal is far more prevalent among poor households than in the general population. This, together with the mountainous terrain of northern Lao PDR, a colder climate, different cultural practices and housing styles, and more indoor cooking, suggests that indoor air pollution may cause respiratory health problems for the poor people in upland areas.

Lao PDR has ambient air quality standards. However, the compilation of emissions inventories is not performed routinely. Emissions inventory data for common pollutants such as particulate matter (PM), Sulfur dioxide (SO₂), and Nitrogen dioxide (NO₂) are not currently available.

Monitoring is done by the Environment Quality Monitoring/Hazardous Chemical Center and the WERI, which are contained within the WREA (MONRE 2012). The compilation of emissions inventories is not performed routinely. The monitoring of air pollutants and the legal framework for managing air pollution are also unsatisfactory. Outdoor air pollution monitoring is performed for only three consecutive days in a year (Jica 2012).

I.3.2 Noise Pollution

Noise pollution is a growing environmental problem usually in some major urban areas in Lao PDR. Despite the fact that noise levels are steadily growing, but the problem is not properly recognized. It has been shown that noise is a potential hazard to health, communication and enjoyment of social life. It is becoming an unjustifiable interference and imposition upon human comfort, health and quality of modern life with noise-related damage to humans ranging from annoyance and sleep disturbance to cardiovascular effects, mental defects and even death (Mato and Mufuruki, 1999).

In Lao PDR, traffic is the dominating source of noise, and different types of traffic noise pollution in the urban areas of Lao PDR (Joshi et al., 2003). However, there are very few reports on sound level monitoring. Preliminary studies in various parts of the country have revealed that noise levels in urban zones/areas are generally much higher than recommended in National Standards. Due to lack of

vehicle maintenance regulations in Lao PDR, old vehicles responsible for high traffic noise are freely running in urban areas.

Industrial and entertainment noise is also of growing concern in urban areas of Lao PDR. This type of noise may contain predominantly low or high frequencies. Among the major sources are mechanical processes like weaving, blasting, pressing, drilling, cutting, metal chipping and riveting. Entertainment noise is also generated from pubs, clubs and other venues

Noise pollution can have adverse effects on human health and wellbeing. Extremely loud noises that exceed the acceptable human hearing range may result in hearing impairment. It has also been proven that noise pollution can have negative psychological effects on public health.

Vibration is also an important health concern. It can be transmitted to the human body through solid structures and can be dangerous to health. In addition to its effects on humans, vibration is also harmful to the natural environment and the human infrastructure. Vibration originates mainly from different modes of transportation (e.g cars, trucks, airplanes etc.), commercial premises, industry (e.g. use of machinery), strong winds and construction work (e.g drilling, quarrying, crushing etc.). If not controlled properly, vibration can induce cracks in constructed structures and cause their subsidence. Heritage sites, due to their older age and less resilient structures can potentially be at a higher risk of suffering from vibration effects.

Lao PDR does recognize vibration as a source of pollution on human health, animals, plants and the environment. Persons and organizations engaged in activities producing vibrations have to abide by the prescribed limits (Jica, 2013).

1.3.3 Soil Pollution

Pollution decreases land's value for human purposes. Agriculture, forestry, and home owners, usually add pesticides, nutrients, and sediments into soil directly influencing its chemistry in various manners. In worst cases, agricultural pollution can represent permanent and irreversible depletion of soil resources. Nitrogen and phosphorus are the main nutrients to be added into soil through fertilizers. Various forms of nitrogen are HNO_3 , NO_2^- , NO_3^- , PANs (peroxy-acetyl-nitrates), and other nitrous oxides. Phosphorus exerts its greatest influence by increasing eutrophication of watersheds. Nearly all nitrogen fertilizers are very soluble in water, and as the final oxidized form, nitrate moves readily in water bodies.

Heavy rain or irrigation following nitrogen application can wash the fertilizer off the soil into surface flow and carry urea and nitrates into the drainage waters especially on sandy soils.

Many inorganic chemicals accumulate into soils. Burning of fossil fuels in different processes releases into the atmosphere emissions that can be carried long distances, and be later deposited on vegetation and soil. Among the pollutants spreading this way are gasoline additives lead (Pb), nickel (Ni), and boron (B). Borax is used in detergents, fertilizers and forest fire retardants, all of which commonly reach the soil. Super phosphate and limestone, two widely used soil amendments, usually contain small quantities of cadmium (Cd), copper (Cu), manganese (Mn), nickel (Ni) and zinc (Zn). Cadmium is used in plating metals and in batteries. Arsenic can be used as an insecticide on cotton, tobacco, fruit crops, lawns, and as a defoliant or vine killer. Some of the substances mentioned are found as constituents in specific organic pesticides and in domestic and industrial sewage sludge.

The quality of land, in general, in Lao PDR is still in good condition even though some agricultural lands and wetlands are being degraded (MONRE, 2011). Land degradation takes several forms, such as nutrient depletion, structural decline and compaction, biological decline, chemical deterioration (e.g. salinization), and soil erosion. All of these are present in Lao PDR.

Soil pollution is mostly resulted from illegal land use, uncontrolled mining, electronic waste and chemical waste of chemical contamination from agriculture production. The soil may be chemically contaminated with a wide range of pollutants, including pesticides, lead and cadmium. Agricultural activities, industry, landfills and emissions from road transport are all major sources of soil pollution (Jica 2013). To our knowledge, at the time of writing, no comprehensive assessment of the current and potential magnitude and extent of soil pollution has been undertaken yet.

Land degradation is mainly resulted from practicing of slash and burn cultivation and it is reported that provinces in the north, including Louangprabang, Houaphan, Udomxay, Louangnamtha and Phongsaly are experiencing bigger problems than provinces in the south because most of agricultural land in the north, approximately 80 percent, is located in mountainous areas with high degree of slope which is susceptible to soil erosion. In contrast, agricultural lands in some provinces in the middle part of Lao PDR are facing problems of biodiversity loss and salinity (MONRE, 2011).

Agricultural land degradation is resulting from shifting cultivation in forested lands, specifically in upland areas. While some forms of shifting agriculture, including long rotational widen are not harmful to the land, short rotational swidden or known as “pioneer slash and burn” has huge impacts on the land, in particular where the land has high degree of slope, and this method is still used in Lao PDR.

Degradation of wetland in Laos is still at the early stage and it is resulting from chemical wastes in industrial sector and long periods of droughts (ResearchGate, 2012).

Tropical forest soils, especially on steep slopes, are particularly prone to degradation once the forest cover is removed. Most land degradation in Lao PDR is associated with shifting cultivation, particularly in areas where population pressure has led to a significant decrease in the rotation period or where traditional lowland farmers encroach on neighboring uplands to make up for low and often declining yields on their lowland paddy fields.

Mono-culture industrial plantation projects pose enormous negative impacts on natural resources - its forests and biodiversity, that are being cleared at the alarming rate and also soils because much of the top soil in the areas is covered by sand which is vulnerable to become arid lands in the future (UNDP, 2010).

The main source of the chemical contamination in the agriculture land comes from the use of chemical fertilizer and chemical pesticide. This contamination contributes to the decrease of the quality and nutrition of soil resulting in the reduction of agricultural production, in the toxic of agricultural products impacting on consumer's health; and in the loss of the protein insects, in biodiversity loss, in imbalance of ecosystem. Currently, the use of chemical and organic fertilizers of the agricultural households covered about 40 percent of total national agricultural households, meanwhile the use of machinery tends to increase significantly compared to the last 10 years. The percentage of farmers using tractors, particularly small walking tractors covered 64 percent of total farmers throughout the country (CEP/EOC-2015).

Lao PDR has the limit of agriculture productive areas and agricultural land is still abundant; there is no any organization certify that there is a chemical residue in soil, there is only the risk areas of UXO and the areas has Dioxin during the war. The concerns and trend to increase is that turning of productive mode to be the agriculture rely on the nature or organic fertilizer and grass cutting is now changing to use the chemical that not follow the technical such as; utilize the chemical fertilizer, insecticide and pesticide.

The soil chemical residue by UXO and others which found in the agricultural land will have an impact to the ecological system, health of farmers and consumers. Lao PDR however has promoted the organic products, promote to use the organic fertilizer to reduce the use of chemical in agricultural production.

In Lao PDR, there is very little information about soil pollution and fertility losses by spatial location, type of cultivation, and land-use categories. Studies are necessary to cover as many dimensions of the soil problem and as many geographical areas as possible so that acute soil issues can be addressed.

I.3.4. Water pollution

The country is generally rich in water resources. The water quality of the rivers within Lao PDR and the Mekong is considered good relative to international standards. The oxygen level is high, and the nutrient concentration is low. Sediment is the primary pollutant affecting rivers. Sedimentation loads in tributaries vary considerably from 41 tonnes/km²/year to 345 tonnes/km²/year. Tributaries and river reaches with high sedimentation are Nam Sebanghieng, Nam Sedone, Nam Ou, and the upper and lower stretches of the Mekong. However, water quality is deteriorating due to the pressures of rapid demographic growth, socio-economic development and urbanisation. In 1999, it was estimated that 35 percent of liquid effluent disposal from all sources to inland surface waters was treated. The actual quantity was unknown (WEPA 2012).

Since developments in Lao PDR are in their initial stages, there have not been any significant impacts on the water environment from industry and other developments yet. Coupled with the abundance of water per capita, the water resource status of the country for quality and quantity is good (WEPA 2012). However, the current rapid development of water resources and impacts on watersheds is now bringing about greater risks for water quality deterioration.

The Water Quality Laboratory of the Ministry of Agriculture and Forestry reports that over the past 15 years of monitoring, water quality in Lao PDR has generally been good and is not significantly affected by human activities, but there are localized exceptions. However, with the pressure of rapid demographic growth, economic development and urbanization, water quality is increasingly likely to deteriorate.

There are two main sources of wastewater are point source and non-point source. The wastewater point source from households and services (such as: restaurant, guest house, clinic, textile, tanning, slaughter house, market, etc.), and from SMEs (noodle factories), from other industries. The non-point sources of wastewater from using chemicals in mining, and in agriculture production wash out by rain and run naturally into the water body. The wastewater from these sources is discharged directly into the river,

canals, marshes, ponds without treatment. Chemicals (river, stream, lakes, pond, etc.). However, the information and data on water quality and water pollution is limited.

Population growth in cities, towns and villages leads to extensive municipal waste and organic matter release to waterways. No urban centers have access to comprehensive piped sewerage systems. Treatment and disposal of urban waste water is generally not satisfactory; most households rely on soak pits for wastewater disposal. Urban drains act as secondary sewers, carrying industrial discharges and septic tank seepage and overflow in the rainy season. As a result, water in the drainage system is invariably contaminated with fecal matter from latrines and coliform from septic tank effluent.

Water pollution is rapidly increasing in both urban and rural areas. Most of the urban areas have no wastewater treatment facilities, so inadequate sewerage facilities have accelerated the discharge of domestic liquid wastes to water bodies. Due to haphazard urbanization, discharge of domestic sewage, fecal sludge, industrial effluents and dumping of solid waste, to water bodies and intensive use of chemical fertilizer, pesticides in agricultural practices have severely affected the rivers deteriorating the water quality.

The growing number of industries has increased the incidence and risk of pollution. The larger mills and industries of concern in Lao PDR are pulp and paper, timber, food processing, garment manufacturing and cement factories and gravel pits. Most of these have only limited wastewater treatment systems for reducing waste concentrations and loads in the final effluent discharge to waterways.

Organic and nutrient pollution and sediment can be discharged from agricultural areas. These contaminants tend to increase during the rainy season's high runoff and river flows. The use of agricultural chemicals in Lao PDR is still relatively low and is expected to remain so during coming years, apart from areas of more intensive, commercial production, including animal production. Increased irrigation can lead to increased nutrients, pesticides and sediment entering waterways through agricultural drainage. An increase in the extent of irrigation can also open new areas for waterborne disease vectors (mosquitoes, snails).

In mountainous areas, the installation of hydropower schemes poses some important water quality problems or risks. In most deep-water reservoirs in the tropics, in the first few years following impoundment, oxygen depletion will take place in the lower part of the reservoir. This situation is mainly due to thermal stratification and the decomposition of submerged biomass or organic matter (overhead vegetation and carbon contained in the soil). Water quality in the downstream river is strongly affected by water quality variations in the reservoir. If the turbinized water comes from a single, low-level discharge from the reservoir, it will be low in dissolved oxygen (anoxic) and may be high in noxious compounds (methane, mercury, etc.).

Forest cover has been reduced by slash-and-burn agriculture, conversion of land to agriculture, road construction and logging. The main trend in slash-and-burn systems has been a rapid decline in the length of fallow periods due to an increased demand for land and resources. Rotational cycles have declined to as low as 3 – 5 years. Such short rotations ultimately degrade the soil and increase the time that steep slopes are exposed and susceptible to serious erosion, leading to sedimentation, changes in the downstream flow pattern and other impacts on the downstream water ecosystem. If special precautions are not taken, pollution discharges and the resulting reduction of ambient water quality will increase in frequency and impact. Aquatic ecology will be particularly affected.

Lao PDR is rich in mineral resources and is increasing its exploitation of these resources. In a number of parts of the country exploration, planning and actual mining are underway. Mining uses water in both the mining and ore processing stages, although little information is currently available on the amount of water which is consumed. Water use is not included in mining licenses. In some cases, mines, processing areas and mine tailings (waste) storage areas are close to rivers and reservoirs.

Broadly pollution sources are categorized to point sources and non-point sources. Point sources include municipal and industrial wastewater, storm sewer outfalls and any other sources for which specific point of entry can be identified. The nonpoint sources include general land runoff and other diffuse contributions.

Water pollution mostly generated by the load of bacteria and hazardous chemical contamination from each type of activities' primary source such as building, hotel, hospital, education institute, office, mall, market, service place, restaurant, industrial facility, construction place, agriculture and mining.

Sources of main potential pollutants, which may enter into water-courses are from natural sources, agricultural sources, wastewaters, impoundments and other miscellaneous sources. Water pollution problems may be caused principally by substances originating from one source but, more commonly, they are the result of accumulated contributions from several sources.

Emitters of organic water pollution are: "Iron and steel basic industries," "non-ferrous metal basic industries" and "pulp, paper and paperboard" are the largest dischargers of TSS, with "iron and steel basic industries" representing more than 60percent of all industrial discharge. "Pulp, paper and paperboard," "basic industrial chemicals" and "dairy products" are the largest dischargers of BOD. In the "pulp, paper and paperboard" sector fewer than 10 enterprises account for 100 percent of both TSS and BOD discharge.

Wastewater sources are mainly from the households, service office, agricultural areas, industries, urban slums, small business areas (noodle factory), restaurants, health services, garment factories, animals farm, etc. In addition, wastewater is also from the mining processing factories, chemical use in agricultural. Wastewater from these sources is discharged directly to the river, lake, stream, pond without any treatment.

For the prevention and control of water pollution, some mechanisms have been adopted. National Environmental Standards (revised in 2017) for specific type of polluting industries and efforts are made to minimize pollution load through the enforcement of standards.

The Environment Protection Law (Revised in 2012) and Regulations on Environment Impact Assessment (EIA) or Initial Environment Examination (EMP) based on the size and nature of project/industry with Environment Management Plan (EMP) for prevention and control of pollution. The Law on Water Resource (revised in 2013) is the umbrella Act governing water resource management. It establishes a system of licensing, and prohibits water pollution. Lao PDR Water Quality Guidelines, Drinking Water Quality Standards and Discharge standards are important instrument to control water pollution in Lao PDR.

I.3.5. Urban Solid Waste

The generation of solid waste in urban areas in Lao PDR is on the rise, and already degrading the quality of surface and groundwater. Expanding urban populations, poor collection, and largely inadequate disposal facilities are compounding the level of pollution. In 2000, waste production raised to approximately from 0.65 kg/person/day to 0.69 kg/person/day. In 2011 in big cities, the rate of waste production rate was increased to 7.5 percent/year and the waste production rate in big cities was 0.79 percent and in rural areas was 0.31 percent (MONRE, 2017). Waste generation has been increased significantly in urban centers of Lao PDR, and only about 45-50 percent has been collected (UN, 2013).

The waste generation is on the raise in the major cities, such as: Vientiane Capital, Luanprabang, Pakse, Thakek, Xayabury and Kaison Phomvihanh District. The calculation, in the below, shows the rising of waste is relying on the population growth and the density is a major factor. The bellow table shows the increasing of the waste from year to year as the population growth.

Table 2: Summary of waste generation in major cities in the period of 2000 to 2015

Cities	Waste generation in the years of			
	2000 (ton)	2005 (ton)	2010 (ton)	2015 (ton)
Vientiane Capital (9 District)	141,876	165,676	193,608	214,905
Kaisone/Savannakhet	24,134	26,789	35,978	39,575
Thakek/Khammouan	17,945	19,919	21,145	26,593
Luangprabang	16,934	18,628	21,752	23,927
Xayabury	16,075	17,247	20,742	22,919
Pakse	16,967	18,664	21,794	23,974

Source: Vientiane UDAA, Provincial UDAA, Statistic Department, LPP- 2017

Solid waste in Lao PDR comprises mainly of organic material, plastic, paper, and glass, cans and other metals. The waste contains of organic material about 30 percent, plastic bag 30 percent, paper 15 percent, glass, can and other metals about 25 percent (MONRE, 2017). Hazardous and toxic wastes (such as: batteries, old paint cans, aerosols, chemical bottles, health care waste, and other refuse) are also mixed with these wastes. The comparatively low content of organic material in municipal solid waste is mainly due to the fact that a large proportion of food waste is recycled as animal feed even in urban areas. As of 2011, the urban population made up 34.3 percent of the total population (CIA 2013), with an annual urbanization rate of 4.41 percent.

The solid waste collection and disposal services are only available in the major cities and secondary cities. In 2010, the waste services only cover of: 48 percent in Vientiane Capital, of 47.5 percent in 4 secondary cities, of 47 percent in 17 smaller cities/towns. there are only 14 cities out of the whole 141 cities/towns having landfill. Therefore, most of solid waste, in small towns and villages, is illegally

dumped at the abandon land, outskirts, river, river site, wilderness and burnt out in open areas ((MONRE, 2017).

The capital city of Vientiane, municipalities and secondary towns have landfill sites, whereas small towns have open and uncontrolled dump sites. Solid wastes in urban areas degrade the quality of surface and ground water. The improper handling of wastes also results in health risks for people living in the area.

The quantity of solid waste, especially in the rapidly growing towns of Lao PDR continues to increase. In a small number of cases, including the principal cities, the waste management capacity has more than kept up with the population increase but the same has not been the case in other urban areas. On the whole, the management of solid wastes was poor in Lao PDR despite some improvements in landfill establishment in secondary towns in recent years. The quality of the disposal continued to be inadequate.

The operations of landfills are subject to significant seasonal fluctuations with volumes and weight increasing substantially during the rainy season (July to October) when burning of waste is difficult. The waste that is not taken to landfills is disposed of by informal private sector operators. In a small number of cases, the waste is sorted and some converted into fertilizer for agriculture or home gardens. The remainder is either burnt or dumped in low-lying plots or water bodies. Waste disposal in smaller towns relied entirely on ad hoc and environmentally poor local solutions.

Open Dumping Predominates According to a recent survey in 57 urban areas, only Vientiane City and the four secondary towns of Luangprabang, Thakhek, Savannakhet and Pakse use landfills for solid waste disposal. However, the disposal areas are small, and have no leachate collection and monitoring wells. Elsewhere, open dumping and burning are common practice for waste disposal in Lao PDR. Hazardous and infectious wastes are often disposed of with municipal waste. Despite the existence of landfills in Vientiane and the four secondary towns, collection services are limited to accessible areas and profitable target groups such as markets and high-income households (MONRE 2013).

During the dry season, a large portion of the waste generated is burnt. Throughout the year, much waste is dumped in local water courses including the Mekong River. In most settlements, the solid waste that is collected is deposited in uncontrolled open dumps that are a significant environmental, aesthetic and health hazard.

The waste dumped into canals exacerbates flooding and accumulation of stagnant water poses a significant health risk. The sight of randomly scattered rotting waste, combined with the black, putrid water in stagnant drains reduces tourism potential and economic growth opportunities. At present, waste collection in Vientiane take place once a week. The frequency of collection is similar in other towns where organized waste collection exists. To this day, waste management infrastructure tends to be poorly funded, collection service unreliable and equipment inadequately maintained.

Lao PDR started the waste collection for a long time and it has mentioned in the legislations e.g. Environmental Law 1999 (revised in 2012), technical manual and awareness on waste management in each period of time. At present, the Government has implement the policy on Clean, Green and Beautiful by conducting the Lao pilot project on Environment (Japan's support through the ASEAN Secretariat) and Lao government in 4 provinces: Vientiane capital, Xayabouly, Champasak and Luang Prabang provinces.

The average waste collection ratio for urban households, in the five largest urban areas, is of 45 percent. Only in the Luang Prabang, waste collection ratio reaches to more than 50 percent. In smaller towns, solid waste collection is often limited to commercial establishments in the town center and the market place.

Recycling of municipal solid waste that has highly commercial value, such as: plastic, paper, glass, cans and metals, is about 70 percent. However, the general waste recycling is still very modest in Lao PDR. Waste recycling systems are normally based on the informal collection and selling of valuable waste to junkshops and dealers. In addition, there is no system for dealing with hazardous waste (UNCRD 2013).

The main reasons for waste increased are summarized as bellow.

- Waste collection service is not good due to poor equipment and lack of service workers;
- The dumpsite (landfill) is not built and operated properly;
- No classify the type of waste;
- Some people do not use the waste collection service (the reason why people like to burn the waste and disposal everywhere);
- The public awareness is not continuously raised, and people are not well participating/cooperating;
- The Law enforcement and regulation including monitoring of relevant sectors is not strict;
- Promoting the private sector to make the investment such as develop the standard landfill, incinerator, recycling, collection service, transport and waste management is not good enough.

Poor solid waste management will not only cause health and environment costs, but affects loss of natural resources, water scarcity and decrease in economic growth. Therefore, solid waste management needs to look into as holistic approach with integrated and multidisciplinary sectors. To prevent this, waste management has to be seen as a holistic approach with integrated and inter-sectoral activities.

Waste management in Lao PDR is shared by national and provincial government, although primarily implemented through local authorities. Progress in waste management has heavily depended on donor support, including that of non-governmental organizations (NGOs) and private sector participation. For now, the public health and environmental dimensions of waste management are recognized by the Government and increasingly also by the Lao society.

I.3.6. Hazardous Waste

With a greater integration of Lao PDR into the global economy, the use of hazardous substances in the country has increased. The largest category by volume is agricultural chemicals several of which are toxic. Sanitary landfills exist only in Vientiane and four secondary towns (Luang Prabang, Thakek, Savannakhet and Pakse). In Vientiane, hazardous wastes are separated from the main disposal area inside the landfill perimeter. In Luang Prabang, a special fenced-off area for hazardous waste disposal exists. Everywhere else, hazardous wastes are mixed with the non-hazardous waste.

Management of hazardous substances in Lao PDR is in its infancy stage in Lao PDR. Most municipal and some rural wastes include varying proportions of hazardous substances. When describing parameters such as the volume of waste or waste disposal percentages, the non-toxic and toxic waste streams are combined, as they are, unfortunately in practice for the time being.

Management of hazardous substances in Lao PDR remained weak despite some progress in special segments of the activities, i.e. management of unexploded ordinance. For the most part, hazardous waste continued not to be separated from other types of solid waste let alone being treated and disposed of appropriately. The relatively small and possibly declining per capita volume of hazardous substances

has masked the problem of insufficient knowledge about the pattern of past and current use, and poor control over imports of substances banned elsewhere.

There is very little separation of hazardous waste from other solid waste in Lao PDR as pointed out previously. In these circumstances, it is reasonable to expect adverse public health impacts. Unfortunately, there are no reliable data in Lao PDR of sickness or death episodes linked to the use of agricultural or other hazardous chemicals.

Relatively little is known in Lao PDR about hazardous substances (HS). An inventory of hazardous substances, monitoring of trade, use and handling of HS is a prerequisite of a good safeguards policy and practice. Many of the hazardous chemicals continue to be harmful a long time after their application.

Hazardous and infectious wastes are often disposed in the same areas and manner as municipal waste. There is inadequate solid waste management in the secondary cities of Lao PDR. It is clear that the landfills were not monitored if they had cause groundwater quality problems, as leachate contains a wide variety of contaminants and hazardous chemicals. During raining season, Surface water run-off from the landfills could also cause waste sediment loads in receiving water bodies (rivers, lakes).

Medical waste is a mixture of sharp objects such as needles, blood, body parts, chemicals, pharmaceuticals, and medical devices, which may contain harmful components. Healthcare waste as a mix of medical waste and general waste, and there is still a lack of regulation and guidelines and low waste segregation rates in healthcare facilities. Workers such as truck drivers and landfill-workers lacked the proper training and knowledge to handle healthcare waste (Jica 2013).

Hazardous and toxic wastes such as batteries, old paint cans, aerosols and other refuse are also mixed with these wastes. Hazardous chemicals of concern include heavy metals such as mercury, lead, cadmium, arsenic, chromium, copper, and zinc as well as persistent organic pollutants such as dioxins and furans, polychlorinated biphenyls, and various pesticides and herbicides that are now banned globally. At present their environmental impact is still poorly understood in Lao PDR.

Heavy Metal contamination results primarily from industrial activities, which are increasing significantly as the country develops. Of particular concern is lead production and rudimentary metal smelting facilities in the country, as well as releases of mercury, cyanide, copper, cadmium and other heavy metals from mining activities. Surface water quality in areas downstream of industrial and mining activities therefore needs to be carefully monitored to avoid potential human impacts.

Of emerging concern in Lao PDR is lead production and rudimentary metal smelting, and releases of mercury, cyanide, copper, cadmium and other heavy metals associated with mining activities. Surface water quality in areas downstream of industrial and mining activities increasingly need to be monitored to avoid potential human impacts.

PCBs are still found in old transformers throughout Lao PDR, but these are being phased out. PCB oils are now being adequately stored in the country, but there are concerns related to historical spills and dumping sites.

Persistent Organic Pollutants Presently, herbicides and pesticides are used only in moderate levels in Lao PDR, mostly as a result of low per-capita incomes and traditional agricultural practices in rural areas. However, there is evidence of banned pesticides and herbicides still being imported into Laos from neighboring countries, and dumping of empty barrels in landfills has been recorded in Vientiane Capital City and other major cities. There is a lack of baseline information on the extent of the problem in the country, and its potential effects on human health.

A special factor to consider is the uncertain effect of past releases of toxic substance: Dioxin. Significant quantities of dioxin were released on the territory of Lao PDR during the Indochina War. More than 200,000 gallons or 1.8 million m³ of herbicides were sprayed within a six-month period in the mid-1960,

some on Lao territory, producing dioxin as a by-product. (ERI/STEА, 2004). Unfortunately, information is limited on the extent of dioxin contamination that remains today in the country. The second special consideration is the extent of unexploded ordinance, a special type of hazard, looked at in more detailed below.

Dioxin and furan contamination in Lao PDR occurs mainly from combustion of solid and industrial waste, burning of wood and oil for fuel, and forest fires. However, significant quantities of dioxin were also released during the Indochina War from the use of Agent Orange and other toxic herbicides. Dioxin residues may occur near the Vietnam border and along the former Ho Chi Minh Trail (WB, 2005). Dioxin is known to have serious health and environmental impacts.

Herbicides and pesticides are used only in moderate amounts in Lao PDR. Mostly as a result of low per-capita income and predominance of traditional agricultural practices in rural areas. The usage of herbicides and pesticides in Lao PDR is still at a moderate level compared to the neighboring countries. The “average” (rather than “low”) rating is chosen despite the modest levels of hazardous substances’ use because of insufficient control over the types of hazardous substances used and insufficient public awareness of the risks involved. Customs data show a decreasing trend in the import of hazardous substances during the past decade. However, it is believed that some pesticides banned in other countries are still being imported into Lao PDR without accurate information about which ones and in what quantities.

Today, with improvements in the solid waste management system, 48 percent of the urban households in Vientiane are now served by solid waste collection services. About half of the solid waste generated is now collected and disposed of at the sanitary landfill facility located 18 kilometers from the city center. It accepts domestic, construction, industrial and hospital waste, and provides separation for hospital waste within fenced compound. The waste is collected by Vientiane Municipal Services (Jica 2013).

The past relative neglect of hazardous substances management at a policy level was mentioned earlier in connection with solid waste management. This situation is beginning to change: The National Hazardous Chemicals Strategy up to 2020 and Action Plan; and Instructions on Hazardous waste Management in 2015. It spells out the actions and measures to be taken to improve the management of hazardous substances in Lao PDR.

Lao PDR’s ratification of the Stockholm Convention and increased attention to one category of hazardous substances, i.e. persistent organic pollutants (POPs) such as dioxins, furans, and polychlorinated biphenyls (PCBs), has given impetus to hazardous waste management as a whole. In May 2003, STEA established a POPs Committee with representatives from line ministries (Department of Agriculture, Department of Industry and Handicraft, Department of Food & Drugs, Department of Health, etc. Furthermore, STEA’s Environmental Research Institute (ERI) is the national focal point for a POPs enabling activities project, implemented through UNIDO, and with financial support from GEF (Global Environment Facility). The aim of the project is to strengthen national capacity and enhance knowledge and understanding amongst decision-makers, managers, the industry, NGOs and the public at large on POPs and to develop and formulate a National Implementation Programme.

I. 4. Laws, Policies and Legislations

1.4.1. Domestic Laws, Policies and Legislations

The Revised Environmental Protection Law (2012) provides an overarching regulatory framework for pollution control in Lao PDR. The revised law contains a large number of new and/or revised provisions that are directly related to pollution control, most relevant are presented in box below.

Box 1: Environmental Protection Law (2012) provisions that are directly related to pollution control

Chapter 1:	Article 22 – Environmental Impact Assessment (revised) Article 24 – Clean Technology (revised) Article 26 – Chemical Accidents (revised) Article 27 – National Environmental Quality Standards (new)
Chapter 2:	Pollution Control (<i>This is almost completely revised with some new provisions</i>)
Chapter 3:	Toxic chemical control and waste disposal (new)
Chapter 5:	Article 47 – Public Information (new)
Part VI:	Environmental Emergencies and Natural Disasters (<i>all articles [59-61] dealing with emergencies are new</i>)
Part X:	Management and Inspection (<i>the right of MoNRE in take specific actions against polluters is found in Article 79, #8; this right is not extended to Provinces in the case of investment projects but does extend to household businesses</i>). <i>In practice, MoNRE has no capacity to carry out pollution control inspection.</i>

The details on how the Law is implemented are articulated under several legislations. There is no Pollution Control Law yet. The national environmental standard was just revised in 2017. Other relevant legislations are presented in table below.

Table 3: Summary of legislations pertinent to pollution control in Lao PDR

Legislations	Description
National Environmental Standards (revised 2017)	Defines the National Environmental Standards as the basis for environmental monitoring and pollution control on water, soil, air and noise
Decree on Environmental Impact Assessment (2010)	<p>Supports implement of the Law on Environmental Protection, in relation to Environmental Impact Assessment. Defines principles and rules, and adopt measures on establishment, functions, management and monitoring of environmental impact assessment.</p> <p>Ensures that all public and private investment projects, both domestic and foreign, operating in Lao PDR which create or may create adverse environmental and social impacts, are designed with the correct and appropriate environmental and social impact prevention and mitigation measures or environmental management and monitoring plans (EMMP) and social management and monitoring plans (SMMP).</p> <p>Effectively prevent, minimize and resolve adverse environmental and social impacts derived from investment projects.</p>

Ministerial Instruction on the Process of Environmental and Social Impact Assessment of the Investment Projects and Activities	Support implementing and extending the provisions prescribed under The Law on Environmental Protection. This Instruction aims to ensure the uniformity in the conductance of the Environmental and Social Impact Assessment by every Investment Projects and Activities of a public and private both domestic and foreign enterprise operating in Lao PDR that causes or is likely to cause environmental and social impacts. Those Investment Projects and Activities shall conduct the efficient Environmental and Social Impact Assessment, contribute in the sustainable socio-economic development of the country and shall mitigate as well as enhance the climate change adaptation.
Ministerial Instruction on the Process of Initial Environmental Examination of the Investment Projects and Activities (2013)	This Instruction is for implementing and extending the provisions of the Law on Environmental Protection. This Instruction aims to ensure the uniformity in the conductance of the Initial Environmental Examination by every Investment Projects and Activities of a public and private both domestic and foreign enterprises which operate business in Lao PDR that cause or are likely to cause environmental and social impacts.
Tax Law (2011)	Article 57 defines Environment tax is a direct tax imposed on individuals, legal entities and organizations permitted to conduct business activities, import [products and services] or use natural resources, which cause environmental pollution; negative impact on health of human, animal and plant and biodiversity. Article 58 identifies scope of environmental tax Individuals, legal entities and organizations, including Lao nationals, aliens, foreign nationals and stateless persons permitted to conduct business activities, import [products and services] or use of natural resources, which cause pollution to environment win the territory of Lao PDR are obliged to pay environmental tax aimed to treat or restore or eliminate such pollution in order to retrieve suitable living conditions in the environment.
Presidential Provision on Environmental Tax (2017-proposed)	Identify principles, regulations, environmental taxation rates. In addition, identifies necessary measures to manage and monitor, environmental protection and public health. Promotes investment and builds the government revenue sources to support environmental management in Lao PDR.
Law on Water and Water Resources (1996)	Determines the necessary principles, regulations, and measures relating to the administration, exploitation, use and development of water and water resources. Article 29 specifies that individuals, legal entities, or organizations have the obligations to preserve water and water resources, to not cause water to become shallower, to be depleted, to be polluted or to become noxious and to not cause damage to water, water resources, public property and the property of other individuals Articles of: 30, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41 mention about the prohibition of discharges of wastewater, solid wastes, pollutants and effluent to water bodies and to land; the ambient water quality standards; wastewater discharge standards and wastewater discharge permits; the role of The Ministry of Natural Resources & Environment in responses to water pollution; groundwater protection; Protection of wetlands from unauthorized drainage.

Land Law (2003)	<p>Determine the regime on the management, protection and use of land in order to ensure efficiency and conformity with [land-use] objectives. Land is classified into regions and categories (Article 11). Within each category, parcels of land may be assigned to specific uses or objectives.</p> <p>Article 60 stipulates obligation of land user not to cause damage to land quality and not to cause adverse impact to the natural or social environment, however law is silent on quality standards.</p>
Law on Agriculture (1998)	<p>The Law on Agriculture has the function of determining principles, rules, and measures regarding the organization and activities of agricultural production which is the basis of the country's economy, including management and preservation of agricultural activities and production with the following aims: to encourage, promote, and expand agricultural production to guarantee the food supply and [to guarantee] commodity production; to create favorable conditions for building and expanding agro-industrial processing; to contribute to national economic growth; to make people wealthy; to strengthen the nation; and to avoid damaging and endangering the environment.</p> <p>Article 6 stipulates that Individuals and organizations undertaking agricultural production are obligated to protect the environment. Agricultural producers must use appropriate methods and measures to protect the land, water, forests, the air and others.</p> <p>Chapter provides provision on fertilizer and animal feeds, of which article 29 stipulates that the use of all types of fertilizer must be done properly and strictly according to rules relating to the use of fertilizers, such as: using fertilizers according to their purpose, type and volume to [achieve] efficient use of [such] fertilizers, [and] ensuring that the fertilizers cause no danger to the lives or the health of people and animals.</p> <p>Similarly, chapter 5 provides provision on pesticides and animal medicine, of which article 34 stipulates that those using insecticides or animal medicines must strictly adhere to rules and regulations and use them in compliance with their intended purpose, including the storage of such substances¹⁹ for the efficient use of such insecticides or animal medicines, to ensure that there is no danger to health or to the lives of people or animals.</p>
Law on Land Traffic (2000)	<p>Define principles, regulations and measures on the establishment, activities and management of land traffic to facilitate and control the movement of human beings and the use of various vehicles on the roads, and land communication and transport, in order to ensure convenience, safety and order, to contribute to the protection and maintenance of the roads and the environment</p> <p>Article 36 subject's fines in case of non-compliance to the emission standard</p>

Law on Urban Plans (1999)	<p>Determines principles, regulations and measures regarding the management, land use, construction and building of structures at national and local levels to ensure conformity with policies and laws, aiming at urban development to meet the direction of the national socio-economic development plan, ensuring that all social activities in the city maintain order, safety, discipline, hygiene, [and] civilization, as well as preserving ancient places, [and] the architectural work of cultural structures, meanwhile protecting the environment and natural scenery.</p> <p>Lacks any provision on urban environmental quality standards and infrastructure planning needs for urban environmental management.</p>
Law on the Processing Industry (1999)	<p>Determines principles, regulations, and measures relative to establishing, undertaking, and administering industrial and handicrafts processing activities to expand industry and handicrafts, interrelating the processing industry to agroforestry; transforming the natural economy of farmers into a goods-based economy, interrelating the economic structures of the agro-forestry, industry and services [sectors] to increase the living standards of the multi-ethnic peoples.</p> <p>Article 4 stipulates that the Industrial and handicrafts processing operations must assure environmental protection as provided for in the Law on Environmental Protection.</p> <p>Chapter 5 further stipulates provision on environmental protection including pollution control.</p>
Law on Minerals (2011)	<p>Defines the principles, regulations and measures regarding the management, protection, utilization of minerals and mineral resources, and the inspection of minerals activities, with the aim of ensuring that prospecting, exploration, mining and processing of minerals are highly efficient in conjunction with environmental protection and are consistent with the National Socio-Economic Development Plan in order to create conditions for gradual economic growth, industrialization, progressive modernization, sustainable mineral development and to improve the standard of living of all ethnic groups.</p> <p>Articles 15, 17, 18, 23, 58, and 60 have provision on environment protection.</p>

Despite legal provisions to minimize and manage pollution, there is a lack of an overarching law or effective legal and policy frameworks, and the roles and responsibilities of various ministries and agencies are neither clear nor sufficient. Information about current and projected pollution sources, intensity, impacts, and geographic spread is mostly lacking, as are monitoring and compliance systems. As a result, the country is unable to effectively manage pollution and has requested support to address this situation.

I.4.2. International Agreements

The Government of Lao PDR (GoL) has signed several international treaties, conventions and protocols dealing with pollution control. An overview of the relevant international treaties and conventions signed by the GoL is shown in the table below.

Table 4: Major Relevant International Agreements Signed by the Government of Lao PDR

No	International Agreement
1	United Nations Convention on Combat Desertification
2	United Nations Framework Convention on Climate Change
3	Kyoto Protocol on the United Nations Framework Convention on Climate Change
4	Montreal Protocol on Substances that Deplete the Ozone Layer
5	Vienna Convention for the Protection of the Ozone Layer
6	Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade
7	Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal
8	Stockholm Convention on Persistent Organic Pollutants

Source: UN 2013

I.4.3. Environmental quality standards and compliance

With great effort to strengthen the pollution prevention and control, and to better improve the quality of human health, animal life, and environment in Lao PDR. The National Environmental Quality Standards (issued 2009), were revised and upgraded in March 2017. The revised national environmental standards provide a common platform for both of the Ambient Environment Standards and common Pollution Control Standards as well as to determine Parameters, Indicators and levels of pollutant concentrations, as scientific reference, in the monitoring of the environmental quality and controlling of pollutions emitted to air, or discharge to soil and water including disturbance that may have impact on human and animal life, health and environment.

However, the Parameters listed in the revised National Environment Standards are often not possible to analyze using national laboratories although analytical laboratory capability has expanded substantially over the last ten years, with a couple of international laboratories have established facilities in Vientiane and mining and hydropower projects having set up their own laboratories. Domestic capacity remains limited. Most government laboratories lack the capacity to analyze the long list of parameters for drinking water and many of the groundwater parameters. Indicated detection levels are often not achievable by national laboratories. Listed parameters for other standards are even more extensive.

As could be seen from the list of legislations, the ongoing emphasis to pollution control in Lao PDR (as in most other countries) in general could be characterized as a command-and-control approach. This approach essentially relies on:

- Instructing polluters in what they can do and cannot do (command). This instruction most often takes the form of maximum allowable concentrations of different pollutants that polluters may discharge into the air or water (concentration standards);
- Analyzing the behavior of these polluters, and assessing whether or not they comply with the command (monitoring); and
- Using the threat of fines and penalties as an incentive mechanism to induce polluters to comply with the command (control).

Given the weak institutional capacity in Lao PDR, this approach suffers from significant monitoring and compliance capacity challenges. Pollution control authorities typically lack the necessary technical, financial, and human resource capacity to put in place a reliable and credible monitoring strategy to assess the extent of compliance with the 'command'. For example, the continuous monitoring of air quality is only conducted in Vientiane, for only few criteria pollutants (PM10 and NOx); the data are insufficient to draw any conclusion on compliance (NREI 2014). In addition, this approach faces several other limitations:

- Since all polluters (within a sector or region) face the same 'command', this approach does not allow polluting units to exploit significant differences in marginal pollution control costs. As a result, pollution control costs to achieve a given target level of aggregate pollution are not minimized;
- Once a polluter complies with the command, it has no incentive to continue reducing its pollution since it can pollute freely for as long as it complies with the concentration standards;
- Fines and penalties are typically set at levels which are too low to generate incentives for polluters to pay serious attention to their pollution discharges. As a result of the weak monitoring and insufficient enforcement of environmental regulations, an appropriate profit-maximizing strategy for polluters is generally to ignore the presence of such regulations; and
- Since a polluter can discharge pollution freely up to the regulatory standards, the approach fails to generate fiscal revenues from these polluters based on their use of the environment.

The MoNRE is currently examining the possibility of using economic instruments to complement the above approach in order to create incentives for a reduction of pollution and waste in the country.

I.5. Organization Responsibilities

The institutional structure and organization responsibilities for environmental quality management and pollution control in Lao PDR can be described as follow.

- MONRE as the main manager, monitor and coordinator of environment matters at the national level, and other relevant ministries with the mandate to mitigate environment and social issues arising from their sectoral development activities, MONRE in turn has a responsibility to guide inter-sectoral coordination among agencies;
- Provincial and district authorities that have devolved responsibility for environmental protection at the local level; and
- Mass organizations which support the government in promoting participation and awareness.

Primary mandate for pollution control lies with the PCD, which is the most recent department of MONRE. The overall mandate and structure of PCD is according to the MONRE Agreement on Pollution Control Department's Structure and Mandates, dated 03 July 2017. Nevertheless, authority for industrial production and regulation also lies in different ministries, depending on the type of industry, often rendering confusion on the role of PCD.

- The Ministry of Industry and Commerce and Commerce Department of Industry and Handicrafts is mandated to "mitigate the impacts of industry on the environment."
- The Ministry of Agriculture and Forestry Department of Agriculture is mandated to assess and respond to pollution from agriculture.
- The Ministry of Public Works and Transport is responsible for waste management. The responsibility of waste collection and disposal also lies with local authorities (cities and provinces).

There is no clear coordination mechanism for monitoring and reporting on compliance to PCD, which often results in either repetition or task undone. PCD's capacity to coordinate, monitor and manage is

compromised by its weak capacity. MoNRE is a new ministry that developed from an earlier Water Resources and Environment Agency within the Prime Minister's Office that, in turn, was developed from another agency Science Technology and Environment Agency of the Prime Minister's Office. The PCD staff is mainly inherited from preceding agency; therefore, do not always have a background on pollution monitoring and control. While there have been many years of environmental capacity building at central and provincial levels with Swedish, then Finnish support, JICA this did not specifically include pollution control although in 2014 some advisory support for PCD was forthcoming from the EMSP program. Budget provision for departments is much less than required to fulfill their mandates. Therefore, PCD (like any other departments) relies heavily on external support from donors for substantive work. This lack of capacity is also found at province and district level.

This distribution of mandates, in combination with a vague definition of specific tasks and responsibilities, leads to uncertainties and repetition of monitoring and enforcement tasks. Additionally, the staffs of both PCD and MOPWTH have been absorbed from their former ministries and therefore do not always have a background on pollution monitoring and control. This lack of capacity is also found at province and district level. In addition, there is no clear mechanism for coordinating and reporting compliance to PCD and MOPWTH as a basis to carry out pollution control inspections.

One of PCD's core responsibilities is to maintain an inventory on pollution sources. Currently only a fraction of potential pollution sources is captured in paper form, often with gaps, and then manually transcribed into electronic form (CEP II/EOC, 2013). MOPWTH collects and updates their enterprise database with the help of province staff, a process that has also led to data inconsistencies and gaps.

I.6. Issues affecting Formulation of the Pollution Control strategy and Action Plan

Mainstreaming Pollution Control Measures

Mainstreaming pollution control in development efforts means that pollution related concerns and issues should be incorporated in the development plans, programmes and activities along with required resources (budget and human resources) and organizational responsibilities. GOL has initiated mainstreaming from the very top level, eg. tasks of high level agencies including the Parliamentary Committee on Environment Protection, and there are good provisions in environmental assessment. Establishment of an Environmental Fund and collection of Environmental Tax are some provisions for mainstreaming, but in the absence of a clear policy and mechanisms to operate this fund, pollution control remains ineffective.

Coordination in Pollution Control

It is necessary to have a mutual understanding and coordination among the sectoral agencies to work on pollution. A good harmony needs to be established through legal provisions and inter-agency collaboration. Limitations of Environmental Protection Law and Environmental Pollution Control Regulations are very often discussed as it alone cannot deal with present day pollution issues. There is neither a single entity to look after all aspects of pollution, nor an existing organizational structure with a specific pollution control act to tackle with intersectoral pollution issues.

Accountability in Pollution Control

The major weakness in pollution control lies in the absence of clear public accountability towards the sectoral agencies related to pollution. The costs of pollution are often not charged back from the polluters that are responsible. This means that communities are subsidizing or indirectly paying a part of the costs of the industry. It is therefore indispensable for a central agency to enhance the responsibilities of sectoral agencies by developing additional legal provisions. Mainstreaming pollution control into sectoral strategies shall be a shared responsibility of all concerned.

PART II

NATIONAL POLLUTION CONTROL STRATEGY AND ACTION PLAN WITH VISION TO 2030

II. National Pollution Control Strategy

II.1. Background

Pollution is considered as the contamination of the atmosphere, hydrosphere and lithosphere to such an extent that normal environmental processes are adversely affected. Pollution causes undesirable changes in the environment. Nature has its own pollution assimilating capacity. Once it is disturbed, nature's original capacity to assimilate certain level of pollution also goes down. Consequently, the amount of unassimilated pollution becomes higher than the added pollution resulting into further reduction of nature's capacity to assimilate pollution. Finally, nature's capacity goes to zero making it completely unusable.

The impact of pollution is viewed as its negative effects on human health, comfort, convenience, efficiency, aesthetics, as well as the balance of the ecosystem and natural resources and processes.

Pollution can be natural – the result, for example, of volcanic eruptions or forest fires or the by-product of human action, such as solid wastes, industrial and urban slurries. It can be deliberate, or it may be accidental.

Pollution control is taken as the control of pollutants (emissions and effluents) into air, water or soil. Without control, the waste products from overconsumption, heating, agriculture, mining, manufacturing, transportation and other human activities, whether they accumulate or disperse, will degrade the environment.

Pollution control involves strong social decisions such as not allowing any harmful substances or energy to escape into the environment, but, rather, recycling and reusing those substances which may be harmful if released into the environment in excess quantities. Nevertheless, pollution control will not be taken as an abandonment of existing productive human activities; rather, it will be taken as their reordering so as to guarantee that their side effects do not outweigh their advantages.

The pollutants of concern for a specific location will be based on observed health effects and the severity of the environmental quality problems in that area. As steps to develop control strategy, priority pollution sectors should be determined, and the present strategy has identified air, water, soil, noise, and solid waste management as the major sectors.

Minimizing or avoiding the creation of pollutants and wastes can be less costly and more effective in protecting the environment than treating them, or cleaning them up after they have been created. Environmental pollution prevention and control activities can be seen as a hierarchy of practices, arranged in order of preference, with pollution prevention at the top. Approaches that anticipate and prevent the creation of pollutants and waste are preferred to other methods such as treatment, re-use and recycling. While these methods are still important elements in our overall environmental protection efforts, even the best waste management practices are not the same as avoiding its creation in the first place.

The national strategy should then identify measures to control sources of pollution, develop a control strategy and plan that incorporates the control measures. The written plan should include implementation dates. The plan should include reference to the requirements that owners or operators of emission sources will need to undertake to reduce pollution that adversely affects the environmental quality.

Compliance and enforcement programs are also very important to include. Such programs help owners or operators of sources understand the requirements, as well as the actions that environmental authorities can take if the sources do not comply. Public, including community and general public should be involved when developing the control strategy. Such initial stage consultation reduces later challenges and can help streamline implementation. Government accountable for pollution control should focus first on known sources of pollutants and the quickest means of controlling such pollutants.

Complex and comprehensive strategies can be developed over time. The goal for all control strategies should be to achieve real and measurable pollution reductions. Control strategies to meet and maintain the environmental quality (including ambient air quality, water quality, noise) standards should be developed, monitoring and the control measures included in action plans.

II.2 Guiding Principles

Pollution control shall base on the bellow principles:

Minimizing waste generation and reduction sources of pollution: Pollution control is primarily focusing on prevention, then reduction, and restoration by reducing or eliminating waste at the source. Minimization and reduction of the amount of any hazardous substance, pollutant, or contaminant entering any waste stream or otherwise released into the environment (including fugitive emissions); prior to recycling, treatment or disposal.

Law compatibility and enforcement: development of a pollution management mechanism should be compatible with national, provincial and local needs. Application of administrative measures, such as: timely monitoring, inspection and assessment of pollution sources and pollution load from development activities, and its impacts on environment will be promoted to increase validity and efficiency of State management, regulations and standards on environmental pollution control.

Integrated approach: adoption of an integrated approach including prevention, control and monitoring of adverse impacts of pollution, health and education.

Applying market approach: market mechanisms should be applied wherever possible. Criminal sanctions should be applied gradually while market economic mechanisms applied flexibly in order to enforce legal stipulations, requirements, regulations and standards on environment.

Polluters pay: Organizations and individuals must pay for benefits from resources and values of the environment; if they cause pollute environment, deteriorate resources and degrade biodiversity, they must compensate for improvement, recovery and damages.

Integrated approach: Adoption of an integrated approach including prevention, control and monitoring of adverse impacts of pollution into each period of national Socio-Economic Development Plan, health

and education; Development must be friend with the environment; economic development should produce a minimum of waste, especially carbon, and strive for a green economy.

Compatibility: development of a pollution management mechanism should be compatible with national, provincial and local needs.

Coherence in legislative mechanisms: legislative mechanisms should be coherent with the neighboring stakeholders towards a common objective regarding national and transboundary pollution issues.

Use of best practices: application of best available technology and best environmental practice will be ensured.

Cost-effectiveness: the management approach should be cost efficient (minimum cost but high effectiveness).

Access to information: provisions shall be made to all stakeholders to have access to information regarding pollution.

Achieving equity: fair and equal protection of citizens from pollution and consideration of individual vulnerability.

Awareness raising: all stakeholders shall be made aware about the seriousness of pollution and its management.

II.3. Vision, Mission, Goal, Purpose, Targets and Benefits

Vision: The people of the Lao PDR strive/commit to a pollution free, clean and healthy environment by preventing and pushing back environment pollution to create fundamental conditions for a green economy, with low waste and low carbon, for the sake of the country's prosperity and sustainable development.

Mission: To provide overall guidance to ensure pollution prevention and control for sustainable development in Lao PDR.

Goal: To contribute in achieving clean and healthy environment for social and economic well being

Purpose: To promote and integrate pollution prevention and control measures in all development efforts

This purpose shall be attained through the achievement of the results of the ten sub-pillars grouped under two main strategic pillars.

Targets until 2025

To prevent, control and reduce unavoidable pollution generated from hazardous substances and timely reduce the impact to be under Environmental Quality Standards and/or National Pollution Control Standard and avoid the environmental condition changes in Lao PDR.

Major Targets Toward 2030

To basically halt environmental pollution acceleration, remedy degraded areas and improve the environment quality and ensure sustainable development of the country be achieved; guarantee that all the people are entitled to live in the environment, landscapes and other environmental components with the good quality of air, land, and water measuring up to standards stipulated by the State;

Benefits

Pollution prevention is particularly beneficial, when effectively applied, because it:

- minimizes or avoids the creation of pollutants;
- prevents the transfer of pollutants from one medium to another;
- accelerates the reduction and/or elimination of pollutants;
- minimizes health risks;
- promotes the development of source reduction technologies;
- uses energy, materials and resources more efficiently;
- reduces the need for costly enforcement;
- limits future liability with greater certainty;
- recognizes that waste is a cost that can be reduced;
- avoids costly clean-up in the future; and
- promotes a more competitive economy.

II.4. National Pollution Control Strategy

II.4.1. Overall Strategy

The Strategy on Environment Pollution Control is an indispensable component of the Socio-economic Development Strategy and the Sustainable Development Strategy; environment pollution control must promote sustainable development to meet demands of current generations while preserving potentials and opportunities for future generations; investment in environment pollution control is the investment in sustainable development.

The pollutants of concern for a specific location will be based on observed health effects and the severity of the environmental quality problems in that area. As steps to develop control strategy, priority pollution sectors should be determined, and the present strategy has identified air, water, soil, noise, and solid waste management as the major sectors. The national strategy should then identify measures to control sources of pollution, develop a control strategy and plan that incorporates the control measures. The written plan should include implementation dates. The plan should include reference to the requirements that owners or operators of emission sources will need to undertake to reduce pollution that adversely affects the environmental quality.

Compliance and enforcement programs are also very important to include. Such programs help owners or operators of sources understand the requirements, as well as the actions that environmental authorities can take if the sources do not comply. Public, including community and general public should be involved when developing the control strategy. Such initial stage consultation reduces later challenges and can help streamline implementation.

Government accountable for pollution control should focus first on known sources of pollutants and the quickest means of controlling such pollutants. Complex and comprehensive strategies can be developed over time. The goal for all control strategies should be to achieve real and measurable pollution reductions. Control strategies to meet and maintain the environmental quality (including ambient air quality, water quality, noise) standards should be developed, monitoring and the control measures included in action plans.

II.4.2 National Strategic Brief Log-frame and Pillars

This strategy has considered pollution prevention and pollution control as the two pillars of:

Strategic Pillar (SP) 1: Pollution Prevention Strategy, and Strategic Pillar (SP) 2: Pollution Control Strategy

With 10 sub-pillars under them, activities for integrating environmental pollution prevention and control into all development processes have been covered according to these pillars and sub-pillars as shown in the below brief log-frame.

Table 5: National environment Pollution Control log-frame

Narrative summary	Indicators	Means of verification	Assumptions
Goal: To contribute in achieving clean and healthy environment for social and economic well being	Status of environmental parameters presented in Annual Report on State of Environment	<ul style="list-style-type: none"> Annual Report on State of Environment of the Ministry of Natural Resources and Environment (MONRE); Annual reports of sectoral ministries and provinces. 	<ul style="list-style-type: none"> National Government will give priority to developing clean and healthy environment as envisaged by the National Assembly of Lao PDR and SEDPs
	Percentage change in respiratory and gastro- enteric patients	Annual report of the Ministry of Health	
Purpose: To integrate pollution prevention and control measures in all development efforts	Specific provisions on pollution control measures mainstreamed in sectoral development efforts	Sectoral strategy, policy, plan and programme documents	<ul style="list-style-type: none"> National policy shall give priority to integration of pollution control measures in all development efforts Adequate resources are arranged for pollution control activities
	Allocation of resources for pollution prevention and control	Annual sectoral budget in the Red book	

Strategic Pillar 1: Pollution Prevention Strategy			
SP 1-1: Strengthening institutional mechanism Expected Results: Institutional mechanism and legal framework strengthened; capacity required in sectoral focal units dealing with pollution and the focal persons identified and required facilities for pollution control (also for monitoring) in such units established	Forming and operationalisation of the Steering Committee and Coordination Committee for National Environment Pollution Control	Meeting records and minutes	<ul style="list-style-type: none"> Government is willing form NEPPC SC All concerned ministries and departments, and provinces and districts will identify a Focal Unit and a person to support the implementation of NPCSAP
	Identification of Focal units and persons in the concerned ministries, departments, agencies, provinces, districts	Organisational structure of the concerned ministries, departments and agencies	
	Number of facilities (e.g., nationally accredited lab and equipment) at different levels	Institutional inventory	
	Number of qualified human resources in concerned ministries, departments, and agencies at different levels	Long- and short-term training records	
SP 1-2: Mainstreaming pollution prevention measures into all development efforts Expected result: Pollution control measures mainstreamed in all sectoral development plans and programmes	Pollution control measures in the sectoral and local policies and strategies	Sectoral and local policies and strategies	<ul style="list-style-type: none"> All sectoral ministries and local agencies will adopt the NPCSAP as a national guideline for pollution prevention and control Relevant ministries and agencies
	Preparation and implementation of agreed guidelines on mainstreaming pollution control measures	Periodic and annual planning guidelines of MPI and concerned ministries	
	Pollution control measures in the periodic and annual development	Periodic and annual plans	
SP 1-3: Minimisation/Reduction at source Expected result: Pollutants reduced through the reduction of wastes at source.	Waste collection and segregation in municipalities and towns in rural areas	Local government waste management report	<ul style="list-style-type: none"> Communities and enterprises will cooperate by segregating the wastes Government policy on managing wastes by involving private sector will not change
	Segregation, recycling and/or treatment of domestic and industrial wastes	MONRE/PCD Environment monitoring report	
	Use of green vehicles	Ministry of Public works and Transport Management report	
	Percentage of cleaner energy	Economic survey	

	Number of enterprises adopting Best Environmental Technique (BET), Best Available Practices (BAP), CP - Cleaner Production, EMS-Environment Management System (EMS),	Environmental Monitoring report of Ministry/Departments of Natural Resources and Environment	<ul style="list-style-type: none"> Government provides land for waste management
	Number of municipalities and Villages People's Committee) declaring as Open Defecation Free (ODF) zone	Ministry of Public Works and Transport annual report; City/Town Office management and Services annual report	
SP 1-4: Raising public awareness Expected result: Peoples' awareness on pollution and its consequences increased	Level of environmental protection and environmental pollution control and awareness	Peoples' opinion poll Media reports and coverage	<ul style="list-style-type: none"> Environment awareness raising policy will not change National literacy improvement will get priority
	Number of clean public places (litter-free zone)	Waste collection bins, toilet facilities, signage materials, etc in public places	
	Number of pollution control projects operated under Public Private Partnership (PPP) model	MONRE report	
Strategic Pillar 2: Pollution Control Strategy			
SP 2-1: Ensuring compliance to legal provisions. Expected result: Level of compliance to the provisions of laws and regulations improved; environmental and social audit effectively conducted	Percentage of public and private enterprises complying with the legal provisions regarding pollution control	MONRE/PCD Environmental Monitoring Reports	<ul style="list-style-type: none"> MPI will revise its monitoring guideline and include pollution control indicators in its national level monitoring and evaluation programme
	Number of enterprises operating with pollution control devices and/or treatment plant	Environmental Monitoring and Surveillance Reports	
	Percentage of cases being rewarded and penalised from the surveillance	Environmental Monitoring and surveillance report of MONRE/PCD, line ministries and relevant agencies	
SP 2-2: Comprehensive	Percentage of public	MONRE/PCD Environment Monitoring report	<ul style="list-style-type: none"> Government will give priority to PPP model

waste (pollutants) management Expected result: Environment friendly solid waste management practiced, ; liquid wastes and leachates treated prior to release in the environment; safe storage from industrial and hazardous wastes established	institutions and private enterprises segregating wastes into four categories at the source		for waste management. • There shall be meaningful participation of the private sector in pollution prevention and control
	Percentage of households segregating household wastes in to two categories (bio- degradable, and non degradable)	MONRE survey report and municipality	
	Percentage of solid wastes received by the Waste Management Entity	Annual report of Waste Management Entity	
	Percentage of enterprises operating waste water treatment plant	MONRE/PCD Environmental Monitoring Report	
	No of decentralized wastewater treatment plants and fecal sludge management system in municipalities	Report of Ministry/Department of Public Works and Transport	
	Length of sewer networks in municipalities	• Ministry/Department of Transport and Public Works Report; Municipality report Transport Municipality report	
	Number of municipalities adopting integrated waste management practices	• Ministry/Department of Transport and Public Works Report; • Municipality report	
SP 2-3: Enhancing accountability (through legal measures) Expected result: Enhanced accountability of the decision makers realised by the people	Number of harmonised overlapping and contradicting regulatory clauses regarding pollution control	Specific acts and regulations amended	• Government adopts a new mechanism to trace back the decision makers for the consequence of their decision
	Number of decisions, that contributed to pollute the environment, traced back and action taken	PCD decisions	
	Number of pollution monitoring stations established in the provinces and districts	MONRE/PCD Annual Environment Reports	

SP2-4: Making polluters pay Expected result: Cost of waste management internalised in the cost of produce. Pollution victims are compensated for the damage caused to them by the polluter. Polluters bearing the cost of environmental rehabilitation as decided by the public authorities.	Number of cases where pollution victims were paid by the polluters	MONRE/PCD Environmental Monitoring Reports	<ul style="list-style-type: none"> Public authorities are capacitated For assessing environmental impact and estimation of the value of damage Potential pollution victims are aware of the compensation provisions and mechanisms
	Number of enterprises entering to WCP (wastewater charge programme)	Monitoring report of MONRE/PCD and Ministry/Department of Public Works and Transport	
	Number of sites where environmental restoration activity has been carried- out	Environmental Monitoring Report of MONRE/PCD	
SP 2-5: Addressing trans-boundary pollution issues. Expected result: Trans-boundary pollution control collaboration mechanism established and operationalised.	Functioning of the trans-boundary collaboration mechanism	Joint statements of involved parties	<ul style="list-style-type: none"> Neighbouring country will cooperate Existing regulations are harmonized with the international and regional conventions
	Number of decisions of the joint meetings	Report of the focal unit	
	Number of joint decisions implemented	Report of the focal unit	
	Number of monitoring stations	Joint report of involved parties	
	Number of independent monitoring reports	Independent monitoring	
	Number of approvals issued for transport of hazardous wastes/materials	MONRE decision	
SP 2-6: Enhancing government preparedness to respond environmental accidents Expected result: Environmental trust/fund will be strengthened, institutional mechanism	Adding of the environmental accident management task in the TOR of Disaster Relief Committee	Revised TOR	<ul style="list-style-type: none"> Existing provisions in the environmental regulations regarding the formation of environmental trust fund will not change
	Amount of fund released from the trust	Fund release report	

II.4.3. Strategic Pillars

The two pillars of *pollution prevention* and *pollution control* with nine sub-pillars under them in this strategy as well as activities for integrating pollution prevention and control into all development processes are presented as follow.

II.4.3.1. Pollution Prevention Strategy (SP 1)

Pollution prevention emphasises efficient utilisation of raw materials, water, energy and other resources, substituting harmful substances with less hazardous ones, and eliminating toxic substances from the production process. In order to curtail pollution before it happens, strategies are shaped to utilize raw materials and manufacturing technologies which minimize emissions, discharges and wastes. Pollution prevention through waste minimization is the preferred approach because, as it reduces waste management expenses, it also minimizes potential future liabilities and provides greater protection of public health and the environment.

SP 1-1: Strengthening the institutional mechanism

Approach: In order to prevent pollution at the source, an effective institutional mechanism for coordinating existing institutions and harmonizing conflicting legislations amongst sectors, will be established.

The Ministry of Natural Resources and Environment (MONRE) shall be responsible for formulating the policy, serving as a focal point and coordinating with line ministries, environmental agencies and local government for pollution control, environment protection and ecological balance. MONRE will be supported by a high-level Steering Committee for policy formulation and coordination, and a coordinating committee for smooth implementation and monitoring of pollution control plans and programmes. A focal unit and a focal person will be identified in each concerned ministry and department for inter-ministerial cooperation.

Expected result: Institutional mechanism and legal framework strengthened; resources allocated for sectoral focal units dealing with pollution, the focal persons identified, and required facilities for pollution control (also for monitoring) in such units established.

SP 1-2: Mainstreaming pollution prevention measures into all development efforts

Approach: Mainstreaming pollution prevention measures into all development efforts, weaknesses faced in mainstreaming shall be addressed by analyzing prevailing policies, regulations, plans, directives, guidance, organizational structures, human resources (number and capacity) and investments in pollution control. Efforts will be made to strengthen the capacity of government and local institutions by fostering inter-agency cooperation, and improving planning processes by adopting joint planning and targeting. As a part of a dynamic and cross-cutting process, these aspects shall be revised by conducting periodic reviews.

Expected Result: Pollution control measures mainstreamed in all sectoral development policies, strategies, plans and programmes.

SP 1-3: Minimization/Reduction at the source

Approach: Priority will be given to utilize raw materials, processes and manufacturing technologies which minimize emissions, discharges and wastes so that pollution is curtailed before it happens. Waste

minimization will be emphasized to reduce the expense of waste(s) management, minimize potential future liabilities and provide greater protection of public health and the environment. Further efforts will be made to reduce the use of hazardous substances, and promotion of low-polluting means of transport and environment-friendly energy.

Once all source reduction and recycling options have been addressed, various treatment processes and technologies shall be employed to reduce the amount of pollutants/waste(s) to acceptable levels, or remove them entirely.

Expected result: Pollutants reduced through the reduction of wastes at source.

SP 1-4: Raising public awareness

Approach: The information exchange mechanism among various stakeholders and targeted groups within the country shall take place through outreach, meetings, seminars/workshops, distribution of educational materials, and by establishing cooperation with local organizations. In the Ministry of Agriculture and Forestry (MOAF), there is a unit named “**Agriculture Information Division**” responsible for awareness raising on agriculture issues including pesticide problems. Similar units in other organizations will be established to raise public awareness on pollution prevention and control measures, including compensation provisions and mechanisms.

Government will give further emphasis on environmental education at the school level by introducing the subject “Environmental Management” through National Education System (NES). Apart from basic studies, school children and students shall be encouraged to actively participate in environment clubs and environment camps. Provisions shall be made for spending a certain portion of revenue generated from natural resources for environmental education, research and pollution control.

Involvement of private sectors and NGOs in environmental awareness shall be increased to support the government to formulate a policy to encourage private sector participation in environmental issues. Schools and universities shall be encouraged in the development of human resources required for pollution prevention and control.

Expected results: People’s awareness on pollution and its consequences increased

II.4.3.2. Pollution Control Strategy (SP2)

Pollution control strategy is to limit and mitigate damage done to the environment by the discharge of harmful substances and energies into air, water and land. It covers the following sub-strategies.

SP 2-1: Ensuring compliance to legal provisions

Approach: Conflicting clauses in various acts and regulations will be identified and harmonised. Compliance surveillance will be regularly conducted. Priority will be given to pollution book-keeping. Regular monitoring and evaluation will be conducted with emphasis on reward and punishment system.

Expected result: Level of enforcement and compliance to the provisions of laws and regulations improved; environmental and social audit effectively conducted

SP 2-2: Comprehensive waste (pollutants) management

Approach: A waste management entity (having a system comprising collection, segregation, treatment, reuse, recycle, transfer, and disposal (sanitary landfill site)) will be established to manage general wastes. Segregation of wastes at source will be made mandatory. An integrated waste management approach will be promoted by promoting private sector participation as per the provision of Public Private Partnership (PPP) policy. For hazardous wastes, regional level disposal plants will be established.

Expected result: Environment friendly solid waste management practiced, liquid wastes, leachates, faecal sludge and gases treated prior to release into the environment; safe storage for nuclear wastes established.

SP 2-3: Enhancing accountability (through legal measures)

Approach: Accountability will be enhanced by enhancing ownership through the involvement of local representatives and communities in decision making process. A new approach will be adopted to trace back decision-makers and make them responsible in cases where significant environmental damage has occurred.

Expected result: Accountability of the decision makers enhanced.

SP 2-4: Making polluters pay

Approach: As stated by the Law on Environmental Protection of the Constitution of Lao PDR, the principle of polluter pays will be adopted. This will be achieved by making polluters pay the external/social (including emission tax) costs of pollution. A new deposit system approach will be adopted, where deposits included in prices of commodities can be reimbursed upon the return of the used/packaging material. Pollution control fund will be activated and mobilised. A levy on hazardous environmental accidents as well as industrial pollution that exceed emissions standards shall be introduced.

Expected Result: Cost of waste management internalised in the cost of products. Pollution victims are compensated for the damage caused by polluters. Polluters bearing the cost of environmental rehabilitation as decided by the public authorities.

SP 2-5: Addressing trans-boundary pollution issues

Approach: Trans-boundary pollution issues will be addressed through collaboration with neighbouring countries. Priority will be given to transboundary air, water, electro-magnetic/radioactive and food-chain pollution issues through joint planning and monitoring.

Expected results: Trans-boundary pollution control collaboration mechanism established and operationalised.

SP 2 - 6: Enhancing government's preparedness to respond environmental accidents

Approach

Environmental tax will be created and strengthened, institutional mechanism to respond such accidents established and capacitated, people made aware of government preparedness.

Expected result: Environmental trust/fund is in good operation, based on a strengthened, institutional mechanism to respond to environmental accidents.

II.4.4. Reduction of Potential Risks

Analysis of the risks of these assumptions and reduction measures taken by the strategy are presented as follows.

- Past experience shows that there has been significant disobedience in the implementation of standards like environmental assessment, lingering in adoption of legal remedial procedures,
- Weak implementation of compliance with legal provisions, etc. The MONRE from now on will monitor such issues through the National Environment Protection and Pollution Control Steering Committee (NEPPCSC).
- Even though all sectoral agencies need to adopt NPCSAP, there is a risk that this may not happen and sectoral agencies will have followed their regular practices. Hence, guidelines will be provided in an approach paper that gives directives for the formulation of periodic and annual plans
- MONRE will play coordinating role to integrate pollution control measures in sectoral development strategies being formulated in future and during the review period in the existing strategies in accordance with the concept of this NPCSAP. In order to ensure that this happens, NPCSAP will assist MPI and concerned agencies to mainstream pollution control measures in the sectoral development policies and strategies during their periodic review.
- It seems that agencies with conflicting jurisdiction and duplication are not in a position to accept that their jurisdiction has narrowed down. Therefore, the MONRE will take the initiative to solve these problems through NEPPCSC and NPCSAP Implementation Coordination Committee.
- Every agency believes that it has a major role to play and others have a subordinate role to play. It is then assumed that agencies with a subordinate role should coordinate with agencies with a major role leading to a poor coordination amongst these agencies. Therefore, the MONRE will take initiative to clarify the pollution control role of agencies concerned through meetings of the high-level Steering Committee or Coordination Committee.
- All the sectoral ministries do not have environment division which could be identified as focal units. For those ministries and departments where there are no already identified divisions/ sections, NEPPCSC will require them to identify Focal Units and persons.
- It might take quite sometimes to complete state restructuring and conduct local elections.
- Hence, NPCSAP has considered local bodies such as DDC, VDC and Municipality as important institutions. After restructuring completes, DDC's roles will be adjusted with the provinces and Municipalities and Village Institutions.
- In order to ensure that priority is given to PPP model for waste management, NPCSAP has given high priority to public awareness about NPCSAP and areas for peoples' participation.
- In order to ensure that MPI will revise its monitoring guideline and include pollution control indicators in its national level monitoring and evaluation programme, MONRE will raise this issue in NEPPCSC.
- The MONRE will monitor the responsibilities of all sectoral agencies by duly considering these matters in the implementation of this NPCSAP.

II.5. Action Plan for National Environment Pollution Control

Background

Despite the fact that this strategy will be a framework (umbrella) strategy to provide overall guidance to all other sectoral development strategies, this strategy has set its own target for 2030. For this reason, some specific action plans are also designed in this strategy that will be implemented under the leadership of various ministries/agencies and local government at provincial and district level to contribute to achieve these targets. These action plans were designed based on the triangulated conclusions drawn from the recommendations of the stakeholders' meetings, findings of secondary information review and team members' expertise.

Action Plan for National Environment Pollution Control

These action plans are grouped as short-term (2018-2020), medium-term (2021-25), and long-term (2026-30) based on their nature and importance. For each action, principle responsible agency and supporting agencies are also identified.

Table 6: Action Plan for National Environment Pollution Control

Strategy and Activities	Indicators	Term	Responsibilities	
			Principal agency	Supporting agency/ies
Strategic Pillar 1: Pollution Prevention Strategy				
SP 1-1: Strengthening institutional mechanism				
Institution				
Activity 1: Promote synergy and harmonization among various legislations and standards; and remove contradictory provisions on pollution control	Revised/amended acts, regulations with specific provisions on pollution control	S,M	MONRE	MoPWT, MoAF, MOJ, and concerned agencies
Activity 2: Implement decisions made by the judiciary for pollution control	Number of implementation reports submitted to the court	L	MONRE	MOJ, MoAF and concerned agencies
Activity 3: Revise the existing institutional structure under MONRE, MoPWT and concerned agencies considering the new constitutional framework and responsibility of various level of government based on the constitutional power sharing for environmental protection	Restructuring of the institution in line with the constitution	M	Cabinet	MONRE, MOPWT,
Activity 4: Revise the Law on Water and Water Resources (1996) with adequate legal provision in protection and controlling the quantity and quality aspect of water resources	Adequate provisions made in Law	M	MOPWT	MOIH, MOPWT

Activity 5: Revise National Environmental Standards (2009) linking with quality standards for drinking water and effluents				
Activity 6: Revise/develop Environment Protection regulation with provision for regulatory arrangement for small industries, WWTPs and removing overlapping regulatory roles in pollution control	Adequate provisions made in Act	M	MOPWT	MOIH, MONRE
Activity 7: Revise National Drinking Water Quality Standards 2005 with linkage to sanitation, waste management and water safety, revisiting parameters, as needed	NDQWS revised	M	MOPWT	DOH, MOPWT
Activity 8: Allocate sufficient resources, competent arrangement to provide services and support to pollution affected people at all levels human resource and technical	Sufficient resources and competent human resources at place	L	MOF	MONRE, MPI and line agencies
Activity 9: Strengthen capacity of relevant local authorities for the law enforcement and resolve pollution control related conflicts at local level	Record of trainings and number of decisions made for	L	MOPWT	MONRE, local government
Activity 10: Coordinate and cooperate amongst government law enforcement agencies and other stakeholders as well as affected communities	Frequency of meetings of Steering Committee s	L	MONRE	Line agencies
Activity 11: Strengthen and mobilize EFLG committees at local levels under MOPWT	Committee meetings	L	MOPWT	Local governments
Activity 12: Strengthen the capacity of existing agencies and human resource (such as environmental inspectors) for the effective implementation of pollution control standards	Trained and skilled human resources and increase recruitment of environmental inspectors	L,M,S	MONRE	PCD, line agencies
Activity 13: Develop human resource for monitoring pollution control in specific sector	Number of human resources for monitoring	S,M,L	MONRE	Line agencies
Activity 14: Conduct training and capacity building activities for government agencies, stakeholders and affected communities	Number of trainings	S,M,L	MONRE	PCD
Activity 15: Review implementation status of existing pollution control standards and revise, if necessary	Standards reviewed	S,M	MONRE	Line agencies
Air				
Activity 16: Redefine emission standards for vehicle and industries based on baseline assessment of monitoring parameters	Emission standards with specific and uniform parameters defined/described	S	MONRE	MOPWT/MOIH/ PCD
Update motor vehicle inspection and emission testing system (MVIETS)	MVIETS indicators (PM ₁₀ , PM _{2.5} , CO ₂ , CO, NO _x , SO _x , Hydrocarbons, temperature) set	S	MOPWT	MONRE/ Traffic Police PCD, MOPWT
Strengthen vehicle emission enforcement capabilities with gradual improvement in implementation of MVIETS for all vehicles	Increase in numbers of skilled human resource	S	MOPWT	MONRE

Strengthen traffic control office and traffic engineering capabilities to reduce traffic congestion (including the road discipline programs)	Reduced traffic congestions	M,L	Traffic Police,	MOPWT
Promote mass public transport and put restriction on entry of non-destined commercial vehicles inside core urban areas	Mass transport vehicles increased and commercial vehicle restriction zones established	S	MOPWT/ Traffic police	Municipalities
Establish a database of all criteria pollutants and effects of the pollution generated from point sources	Database centers at national and provincial levels	S	MONRE	MOST, <u>CBS</u>
Establish the accredited organization/institution for the inspection of the vehicle exhaust emissions and implement strictly the green sticker provisions	Accredited institution established	M	Ministry of Transport,	MOPWT, Private institutions, Transport Federation
Water				
Enforce and implement the water pollution control related provision of Water Strategy and Water Action Plan	Level of enforcement and implementation	M, L	MONRE	Line ministries
Revise existing water law and water quality standards and effluent standards of all kinds of domestic and industrial wastes	Revision of rules and standards	S, M	MONRE	MOPWT, MOIH,
Develop Institutional and Regulatory framework for Faecal sludge management	Adequate Institutional & Regulatory framework in place	S	MOPWT	MOPWT
Develop river health monitoring framework, indicators and guidelines	RH monitoring framework, indicators, guidelines in place	S	MOPWT	MOPWT, River basin authority,
Establish at least one equipped water quality testing laboratory in each province	WQ testing laboratory is set up	M	MOPWT	MOF,MPI
Noise				
Develop national policy statement on noise	National policy statement on noise prepared	S	MOLSW	MONRE, MOIH, MOH
Provide facilities and trainings to enhance institutional capacity	Database on noise And number of trained human resources	S, M	MOLSW	MONRE, MOIH, MOH, CBS
Soil				
Upgrade the existing soil lab into accredited system at each province	Number of laboratories	S,M, L	MOAF	MONRE, MOAF, Academia
Develop capacity for effective laboratory functioning	Number of trained human resources	S,M,L	MOAF	MOAF,
Develop Fertilizer Recommendation based on the existing cropping systems and soil status of different agro-ecological zones for the optimal use of fertilizers	Recommendations revised	S, M,L	MOAF	SSD/
Solid Waste Management				

Develop necessary policy and legislation on Extended Producer Responsibility (EPRs) for national and multinational industries who produces/imports goods/products that bear environmental	Policy and legislation on EPR will be developed	S, M	PCD	, MONRE, LNCCI, Chamber of Commerce, concerned stakeholders
Strengthen local institutions through establishment of separate unit on SWM in local bodies with necessary human resources at provinces and local level	Increase in number of established units with human resources	M, L	MOPWT, Municipalities and VDCs	, concerned stakeholders, private sectors
Build capacity and infrastructure for preparing strategy and action plan, SWM segregation, collection and transportation, processing and final disposals	Capacity and Infrastructure for SWM will be developed	S, M, L	Municipalities and VDCs	MOPWT, MONRE, line agencies/stakeholders, private sectors
Generate revenue from establishment of material recovery facilities (MRF) and recycling business	Improved in revenue generation through MRF and recycling business	S, M, L	Municipalities/VDCs, private sectors	MOPWT, PCD, MOPWT, LNCCI, Chamber of Commerce, private sectors, NGOs/INGOs
Occupational Health and Safety				
Amend existing Labor Law specific to OHS	OHS issue address in Law	S	MOLSW	Parliament, Line agencies
Develop National OHS policy	OHS policy endorsed	S	MOLSW	Line agencies
Strengthen and capacitate OSH Centre/LOs/MOLSW	OHS center equipped with monitoring facilities	ST	MOLSW	MONRE/MoF/MOIH /MoH/MPI
Set up OHS service centre at Zonal level integrated with existing Labor offices	OHS service center established at each LO	M	MOLSW	MoF/MPI
Radioactive Wastes & Electromagnetic waves				
Strengthen existing setup to manage RA wastes efficiently	Existing setup strengthened	S	MOST	MOH, MOIHC, responsible HCI
SP 1-2: Mainstreaming pollution prevention measures in all development efforts				
Institution				
Integrate pollution control provision in, policies, strategies, plans and programs of all agencies at all levels	Provisions incorporated	S, M	Relevant agencies	MONRE, MOJ, MPI
Mainstream pollution control provisions in the periodic development plans	Provisions included in periodic plans	M, L	MPI	Line agencies
Promote best practices and cultures for pollution control by identifying more sources of revenue (e.g., import of polluting substances, construction materials)	Pollution control activities practiced		<u>Relevant agencies</u>	<u>Line agencies</u>
Air				

Categorize the industries in terms of the very significant, significant and non-significant air pollutant emitting industries and target the very significant and significant air pollutant emitting industries for the environmental compliance implementation	Report on Categorization of industries No. of complying industries	S	MONRE	MOLSW, MoH, MOIH, LNCCI
Develop national environmental management information system	National EMIS database is established and updated	S, M	MONRE	PCD, CBS
Prepare the Air Pollution Monitoring guidelines	guidelines prepared	M	MONRE	MoH, MOIH,
Set air quality standards based on the geographical area	set Standards	M	MONRE	MoH, MOIH,
Water				
Activate and Strengthen implementation of integrated water resource management systems as envisaged by Water Plan	No. of functional IWRM	L	WECS	MOPWT, MOIH, MOP, MOPWT
Classify water resources based on water quality requirements for a particular use.	No. of water sources under each category	M	WECS	MPI, MOIH, MOPWT
Prepare and implement city-wide sanitation plan and guidelines for municipalities	No. of municipalities Implementing plan and guidelines	M	Municipalities	MOPWT
Design and implement appropriate measures to protect water resources from human activities and potential climate change impact	No. of water resources protected	S,M,L	MOPWT	WUA, Service providers
Coordinate to incorporate water safety plan in project planning, design and operation phases in water supply	No. of projects incorporating WSP	S	MOPWT	WUA, Utility
Prepare and implement river basin master plans of major rivers (Risk with high chances of pollution)	No. of Master Plan is in place	M	WECS	MOPWT, MoFCS, MoHA, MOPWT, PCD
Monitor sewage and industrial effluent discharge to water bodies	No. of monitoring reports	S	MONRE	MOPWT, Water & sanitation utility, Management board
Monitor the status of water quality management plan of drinking water projects	No. of monitoring reports	S,M,L	MOH	MOPWT, MONRE, Water utility operator
Develop the self-monitoring and waste water audit guidelines for the industries.	Guidelines in place	M	MOIH,	MOPWT, MONRE, PCD
Develop the environmental compliance guidelines for industries having the effluent discharge standard	Compliance Guidelines in place	M	MONRE	MOIH, <u>MOPWT</u>
Strictly monitor in compliance with building code (particularly recharge and septic tank construction)	Percentage of Household compliance with building code	S, M, L	Municipalities	MOPWT

Noise				
Revise and set situation specific standards, prepare and implement enforcement plan	No. of updated standards No. of enforcement plans implemented	M	MONRE	MoH, MoHA, MOLSW, MOPWT
Soil				
Conduct exploratory type of soil survey in the polluted areas and prepare soil pollution map	Number of soil pollution maps	L	MOAF	SMSD/MOAF,
Set standards for soil pollution assessment	standard in place	S,M	MOAF	MOAF, , AFU
Design and implement polluted soil reclamation plan (including revival of the Banana Plantation Industry)	No. of reclaimed sites;	S,M,L	MOAF	MOAF, MOIH, MONRE
Identify and promote carbon sequestration in soil by using appropriate agricultural production technology	Area coverage under the programme	S,M, L	MOAF	MONRE
Solid waste management				
Coordinate with to ensure the inclusion of solid waste management (Municipal waste, Industrial waste, E-waste, hazardous waste, disaster waste, construction and demolition waste etc) component in forth coming SWM National Policy, Strategy and Action Plan	National strategy and action plan on SWM will be prepared and updated	S	MONRE	MOPWT, PCD, Municipalities and other stakeholders
Prepare baseline data of various wastes (like municipal waste, health care waste, industrial waste, e-waste, household hazardous waste, agriculture waste, construction and demolition waste, disaster waste)	Baselines data on various types of wastes	S, M	MONRE	<u>HCI, MOPWT, MOAF, lines</u> agencies, NGOs, <u>Municipalities/VD Cs, and</u> stakeholders
Prepare and update solid waste management strategy and action plan at local level and allocate necessary budget for timely implementation	Local level solid waste management strategy and action plan	S , M, L	MOPWT,	Municipalities/VDC s, MOAF, MONRE HCI, lines agencies, NGOs, and stakeholders
RA Wastes & EM waves				
Prepare nationwide inventory of terrestrial radioactive hot-spots to safeguard the public and biodiversity	Radioactive hotspot inventory	L	MOST	MONRE, MOH, MOAF, MOIH, MOLRM
SP 1-3: Minimization/Reduction at the source				
Air				
Monitor gasoline sale to ensure that it is not adulterated; and has low emissions of benzene	Percentage of Clean fuel sold	S	MOIH	MOIH, <u>MONRE</u>
Monitor diesel fuel to ensure that it has low sulfur content and gasoline has low emissions of benzene	Level of sulfur and benzene in fuels	S	MOIH	MONRE. MOAF
Promote the use of alternative energy	Percentage of renewable energy	S	MOIH	<u>MONRE</u>

Develop and implement a policy to discourage to ply the EURO1, EURO 2 vehicles and encourage importing only the EURO 3 and 4 standard vehicles.	Notices published in gazette	M	MOPWT	<u>MONRE, MOST</u>
Promote widely Cleaner Production, Environment Management System and Energy Management system in the very significant and significant air polluting industries. Target first large and medium scale industries	At least 20 large and Medium industries Participate in the program every year	S, M, L	MOIH, MOP, E	<u>MOPWT, LNCCI</u>
Introduce trolley buses and low emission vehicles	Operating trolley buses	L	Municipalities	<u>MOPWT, MPI, MOF</u>
Monitor to ensure that industries have installed pollution control, smoke and dust control and/or gas control devices	Industries complying With legal requirements	M, L	MOPWT,	<u>MOIH, MONRE, LNCCI</u>
Initiate and "Pilot Green Industrial Fund" to promote innovative green industrial technologies that can out-perform conventional methods (emission reduction devices, fuel saving devices and conversions from conventional to alternative fueled machines)	"Pilot Green Industrial Fund" and fiscal support tools announced by the government and functional	M, L	MOIH	<u>MOPWT, MOF, LNCCI</u>
Water				
Improve existing system or develop new systems to prevent disposal of hazardous waste including waste oil and untreated effluents into aquatic environment	System in operation	S, M	Local govt	Service providers
Adopt proper zoning and control measures to keep drinking water sources free from contamination	Drinking water sources free from contamination	M, L	Local govt	<u>MOPWT, MOH, MONRE, MOAF</u>
Keep the watersheds clean that yield water for drinking water supply projects	Number of clean watersheds	M, L	Local govt	<u>MOAF, MOPWT</u>
Design and implement schemes to reduce fertilizer leaching and eutrophication in the upstream of water sources.	Percentage reduction. Area covered	M	MOAF	Local govt, Farmers association
Promote the use of biological/compost fertilizer	Area covered	S	MOAF	Farmers association
Design and implement 3R technology on faecal sludge management (FSM)	Number of FSM units installed	S	Local govt	Municipalities
Introduce water saving/reusing, recycling devices	Number and types of water saving techniques used.	S	Water Utilities	Municipalities
Design and implement schemes for drainage and handling of wastewater from farming and food processing	Volume of waste water handled. Number of processing plants	L	Local Govt	Farmers association
Support small and medium scale polluting industries to adopt cleaner production programme	At least 20 industries participated in the program	S	MOIH	

Noise				
Develop and implement guidelines to limit noise level from different sources (transport, machines, equipment, recreation)		S, M	MOPWT	MOIH, MONRE
Identify and relocate high noise producing industries from highly sensitive to less sensitive areas, if no other issues e.g. air pollution, are concerned unfavorably	High noise polluting industries far from sensitive areas	S, M	MOIH,	Concerned industry, MONRE
Design and implement schemes to enclose the noise source in industries	Industries with noise pollution control Cubicles and existence of noise controlling barriers	M, L	MOIH,	MOPWT, MONRE
Install obstructions/barriers within propagation path to reduce the noise exposure in sensitive areas or buildings	Number of noise control barriers installed	M, L	MOPWT	MOIH, MONRE
Solid waste management				
Design and implement capacity building programme to raise awareness level at national, regional and local level on waste segregation (into various category of General and Hazardous waste) and waste minimization	Number of people Participated in the capacity building programme	S, M L	Municipalities/VDCs and concerned stakeholders	CBOs, NGOs, private sectors, associations
Monitor to ensure that all households, institutions and commercial and industrial sectors mandatorily follow waste segregation and minimization practices	No. of waste segregation practices At source in all sectors	S, L	Line Ministries	District offices Municipalities/VDCs, concerned stakeholders, HCLs, Industries
SP 1-4: Raising public awareness and environmental education				
Academic programme				
Design and conduct special courses at universities regarding pollution control	Number of persons attending courses	M	Academia	
Air				
Conduct regular clean-up activity of the road and roadside areas and prohibit littering habit of people	Number of roads and lengths covered clean-up activity Enrolled Cleaners and educative flyers to prohibit littering	M	Municipalities	MOPWT, MOPWT Ward offices <u>Communities</u>
Conduct studies on health impact of air pollution in urban areas by providing research grants	Number of research reports and journal publications	S, M, L	MOH	MOF, MONRE, MOH
Conduct need-based public awareness raising programme including awareness to staff of industries on pollution control monitoring	No. of environmentally sensitive citizens	M	MOIH,	<u>MONRE, MOPWT</u>

Water				
Raise public awareness regarding surface and ground water pollution and its consequences on human and ecosystem health	Percent increase of Raising public awareness	S	MoH	MOAF, MOPWT, MOSC, MONRE
Educate public and other stakeholders on wastewater and sewerage management practices	No. of persons educated	M,L	MOPWT	Municipalities and communities
Provide training to environment inspectors to enhance supervisory knowledge	No. of persons received training	S	MONRE	MOIH, MOPWT, <u>Concerned agencies</u>
Continuously provide the customized training on the cleaner production, EMS and OHS for the small and medium polluting industries	No. of industries received training	S	<u>MONRE</u>	<u>MOIH</u> LNCCI, and districts Chambers of industries
Noise				
Design and implement public awareness Activities for disseminating detrimental effects of sound pollution	Increased sensitization	S,M,L	MOPWT	MONRE, MOIH, University, School, Traffic Police, Local Government bodies, CBOs, NGOs
Soil				
Conduct awareness program for farmer on soil pollution induced by agricultural practices (irrigation water, application of inorganic fertilizers and chemical pesticides)	Number of awareness programmes	L	MOAF	MONRE
Solid waste management				
Raise awareness through cleaning campaigns at national, provincial and local level with community participation and social mobilization	people will be aware of not to dispose waste in public or private places	S, M, L	DDC, Municipalities /VDCs,	Concerned stakeholders including CBOs, NGOs, civil society
Conduct programmes to raise awareness on impacts of open burning of waste including prohibition of open burning of waste	Percentage of households practicing open burning of wastes	S, M, L	DDC, Municipalities /VDCs,	Concerned stakeholders including CBOs, NGOs, civil society
Awareness raising on hazardous waste (e-waste, pesticides, nuclear waste, radioactive waste, industrial waste) at national , regional and local level	Percentage of people trained on hazardous waste management	S, M, L	PCD,	MOPWT, MOAF LNCCI, Local Chamber of Commerce, Municipalities, VDCs, civil society

Occupational Health and Safety				
Conduct pre job and on the job training on pollution and its consequences in work place	Number of trainings	S,L,M	MOLSW	Line a g e n c i e s , Stakeholders
Establish National OHS information centre at OSH Centre and linked national CIS centre	Flow of Information practices	S,M,L	MOLSW	MOIH, ILO, LNCCI.Trade Union
Radioactive Wastes & Electromagnetic waves				
Design and implement awareness programme to protect general public from the ill effects of radiation	Number of facilities complying with the recommended standards	L	Responsible HCI	MOST, MOH, MOLSW
Strategic Pillar 2: Pollution Control Strategy				
SP 2-1: Ensuring compliance to legal provisions				
Institution				
Amend the existing EPA and EPR to incorporate specific chapters on pollution control and formulate separate Pollution Control Regulation	Amended clauses in EPA & EPR Pollution Control Regulations	S,M	MONRE	MOJ, Line ministries
Create central database of all pollutants: air, water, soil and noise level	Pollution database available	S,M,L	PCD,	CBS, Line Agencies and Academia
Update international instruments regarding pollution control	Communication reports submitted by the government	S,M,L	MONRE	MOFA
Monitor to ensure compliance of legal provisions on pollution control	Number of compliance reports	S,M,L	MONRE	MOPWT, MOAF, Line agencies
Air				
Introduce age limit regulations based on emission testing results and comply with regulations	Emission load of CO, Hydrocarbon and particulates(black carbon)	S	Traffic police	MOPWT, MONRE
Make clear legislative provision to close and/or relocate heavily polluting industries (based on emission monitoring results) from settlement areas or protected and environmentally sensitive areas, implement it and comply with it	Industries complying With legal requirements	M	MOPWT,	Municipality, MONRE
Develop the compliance guidelines for the very significant air polluting industries	No. of Compliance guidelines	M	MOIH	MOPWT, MONRE, INGO
Water				
Establish regular monitoring system of effluent from domestic sewerage and industrial WWTP	Monitoring system in place	M	MOPWT	MONRE, Municipalities, MOIH
Establish regular water quality monitoring system	Monitoring system in place	S	MONRE	MOPWT, MoH, MOAF

Identify and make mandatory the preparation and implementation of compliance plan for water polluting industries	No. of wastewater discharging industries implementing compliance plan	S, M	MONRE	MOIH, LNCCI
Take legal actions against industries which do not comply with legal requirements of the WCP	Number of cases filed against industries	M	MONRE	MOPWT, MOIH
Noise				
Monitor and control the noise generating industrial sources as per the prescribed standards	Decrease sound level	S,M	MONRE	MOPWT, MOIH
Solid waste management				
Monitor and ensure to compliance of SWM Act and regulation; policy, strategy and action plan	Monitoring reports	S, M L	MOPWT	Municipalities, ECCDA, VDCs, industries, HCI, NGOs
Monitor and ensure to compliance of Health Care Waste Management guidelines	Monitoring reports	S, M, L	MOH,	HCIs, DPHO, Laboratory, Pharmaceutical companies
Occupational Health and Safety				
Ratify ILO convention 155	Convention ratified	S,M	MOLSWW	Parliament
Introduce certification and audit system on OHS	System functional and accreditation to certification body	S, M, L	MOLSW	MONRE/MOIH/LNCCI
Prepare inventory and database on OHS parameters	OHS parameters available	S	MOLSW	MOIH/MOF/MPI/ MONRE/LNCCI/ CBS
Establish a system of work permit for hazardous work	Permit System in place	S, M,L	MOLSW	Line agencies
Monitor and ensure the implementation of OHS in public and private enterprises	Number of enterprises	S, M, L	MOLSW	Line agencies
SP2-2: Comprehensive waste (pollutants) management.				
Institution				
Develop exclusion criteria and detail design manual of sanitary landfill site suitable for low land, mountain, hill and terrain regions	Criteria and manuals developed	S		MOPWT, MPI, ECCDA Municipalities, private sectors, professional experts
Develop policy and program on construction and operation of regional sanitary landfill site where more than one municipalities /VDCs can jointly use facilities	policy and program on regional sanitary landfill site will be developed and prioritized	S, M	MOPWT,	MPI, Municipalities, MONRE, ECCDA

Develop necessary procedural guidelines on municipal solid waste management	guidelines will be developed	S & M		MOPWT, Municipalities, VDCs, private sectors, ECCDA
Develop necessary standard of leachate generated from Sanitary landfill site	standard will be developed and enforced	S	DoE	MOPWT, MoE, Municipalities, ECCDA, VDCs, private sectors
Develop and enforce necessary policy and legislation on Extended Producer Responsibility (EPRs) for national and multinational industries who produces/imports goods/products that bear environmental cost	Policy and legislation on EPR will be developed	S, M	PCD	MONRE, LNCCI, Chamber of Commerce, concerned stakeholders
Infrastructure				
Develop infrastructure with suitable means of collection and transportation for SWM in Municipalities and VDCs in mountain, hill and terrain regions	Number of collection and transportation infrastructure	M, L	Municipalities and VDCs	MOPWT, MONRE Provinces/Districts, ECCDA Private Sectors, development partners
Establish infrastructure such as sorting station including Material Recovery Facilities (MRF) and its implementation with PPP approach or franchise system in municipalities	Number of waste processing facilities	S, M, L	Municipalities	MOPWT, PCD, Provinces/Districts, ECCDA Private Sectors, development partners
Construct and operate environment friendly and cost effective sanitary landfill site suitable for mountain, hill and terrain regions	Numbers of sanitary landfill sites	S, M, L	Municipalities/ VDCs	MOPWT, PCD, ECCDA Provinces/Districts, Private Sectors, development partners
Construct and operate regional sanitary landfill site with facilities for industrial and hazardous waste	Number of regional sanitary landfill sites	M, L	Municipalities/ VDCs	MOPWT, PCD, ECCDA Provinces/Districts, Private
Develop exclusion criteria and detail design manual of drainage and wastewater treatment system suitable for low land, mountain, hill and terrain regions	Criteria and manuals developed	S		MOPWT, MPI, PCD, ECCDA, Municipalities, private sectors, professional experts
Construct and operate environment friendly and cost effective drainage and wastewater treatment plans suitable for mountain, hill and terrain regions	Numbers of sanitary landfill sites	S, M, L	Municipalities/ VDCs	MOPWT, PCD, ECCDA Provinces/Districts, Private

Technology and system				
Develop suitable solid waste collection and processing system based on regions (mountains, hills, terrain) by local bodies	Improvement of waste collection system at local level	M, L	Municipalities and VDCs	MOPWT, MPI, PCD, ECCDA, private sectors, professional experts
Establish medium/ large scale central health care waste management system facilities at local level through promotion of private sector participation	numbers of central health care waste management system facilities established	M, L	MoH	Concerned Ministries, Municipalities departments, local bodies, ECCDA
Develop suitable wastewater treatment technologies (on site/off site) for different treatment levels (household, village, community, municipality, town, city) by local bodies	numbers of wastewater treatment facilities established in major towns, cities, village and sanitary toilet at household	S, M	Municipalities/ VDCs	PCD, private sectors, professional experts
Develop effective monitoring mechanism with participation of environment committee and community representatives for waste collection and transportation	Monitoring mechanism in place	M, L	Municipalities and VDCs	ECCDA, private sectors, ward level committee
Private sector participation				
Develop effective monitoring mechanism with participation of environment committee and community representatives for waste collection and transportation	Monitoring mechanism in place	M, L	Municipalities and VDCs	ECCDA, private sectors, ward level committee
Establish infrastructure for effective waste collection and transportation services through private sectors participation (CBOs / NGOs / Companies)	Number of private sectors involved in SWM infrastructure	S, M, L	Municipalities and VDCs	MOPWT, MPI, Provinces/Districts, ECCDA, Private sectors, development
Establish small and medium scale environmental friendly technologies for organic waste management (composting/ biogas production/electricity generation) in	No. of plants established	S, M, L	Municipalities	MOPWT, ECCDA, private sectors, development
Strengthen household and community level organic waste management (composting/ biogas production/bio-briquette production) in VDCs	Percentage of HH and communities	S, M, L	VDCs	ECCDA, Districts, Private Sectors, communities, NGOs, development partners

Establish recycling plants through PPP approach (glass, plastic, paper, textile, rubber and leather, metal)	numbers of recycling plants will be established	M , L	MOPWT	MOIH, LNCCI, ECCDA Chamber of Commerce, MOPWT, Municipalities, Private sectors, development partners
Solid Waste-based enterprise				
Strengthen household and community level organic waste management (composting/ biogas production/bio-briquette production) in VDCs	Percentage of HH and communities	S, M, L	VDCs	Districts, Private Sectors, communities, ECCDA, NGOs, development partners
Establish recycling plants through PPP approach (glass, plastic, paper, textile, rubber and leather, metal)	Numbers of recycling plants will be established	M , L	MOPWT	MOIH, LNCCI, Chamber of Commerce MOPWT, ECCDA, Municipalities, Private sectors, development partners
Develop and increase green belt areas and start greenery development programs in the bare ground and open spaces	Percentage of green cover (especially in urban areas)	M	Municipalities	MOPWT, Municipalities, Private sectors, development partners
Water				
Provide wastewater treatment facilities in populated urban and semi-urban areas	No. of WWTP installed and augmented	M	MWSS	Municipalities, MOPWT
Provide public and Institutional toilets	No of units constructed	S,M	Local govt	MOPWT, Municipalities
Lay sewer networks in urban areas	Km of sewer networks	S, M, L	MWSS	Local govt, MOPWT
Install faecal sludge management system with treatment plant facilities	Number of facilities	S	MWSS	Local govt, MOPWT
Monitor and make mandatory construction of wastewater treatment plants for medium and large polluting industries	Percentage of industries with waste water treatment plants	L	<u>MOIH</u>	<u>MONRE</u> , <u>MOPWT</u>
Establish Combined Effluent Treatment Plant in industrial corridor	Number of CEPT	S, M, L	<u>MOIH</u>	<u>LNCCI</u> , <u>MONRE</u> , <u>MOPWT</u>
Occupational Health & Safety				
Include OHS in HCWM and municipal waste management system	OHS parameters in place	S,M,L	MOLSW	MOPWT, MOH

Establish Health Safety and Environment service center in each municipality	Number of HSE centers	S,M,L	Municipalities	MOPWT, MOPWT, MOH, MOLSW, MONRE
Food Chain				
Monitor and restrict the use of toxic chemicals in food items (preservatives, ripening & coloring chemicals and growth stimulants)	Monitoring reports and research papers	S, M, L	DFTQC, PCD	MOAF, MOAF,
SP 2-3: Enhancing accountability				
Institution				
Design and implement a pollution-related decision making process that involve local representative and enhance ownership of the decision outcomes	Procedure in place	M,L	MONRE	Line ministries
Strengthen punishment and reward system	System in operation	M,L	MONRE	MOJ, MOHA
Strengthen the law enforcement and compliance	Number of cases	M	Line agencies	Line agencies
Install environmental quality monitoring stations and widen ambient and stack pollution inventory in urban and rural centers	Increase number of Monitoring stations with database	S, M	PCD	MONRE, MOPWT, Universities,
Introduce and operate fiscal support tools (e.g. an air quality management fund). Provide tax breaks to companies that introduce efficient pollution control equipment	Tax information and tax subsidy or tax breaks provide to companies	M	MONRE, MOF	DOC, MOPWT
Establish system to reward industries adopting efficient technologies (e.g., energy efficient technologies) and practices	'Best performer award' to industries	S	MOIH	MOPWT, LNCCI
Regular Cross checking of the green-sticker vehicles and their emission test with green sticker and	Number of vehicles inspected	M	Traffic police	MOPIT, MOPWT, MONRE
Establish the penal systems for the vehicles not complying with the emission test	Penal systems are in place	M	Traffic Police	MOHA, MOF, MOPWT
Strengthen water quality surveillance and conduct direct assessment based on random sampling	At least 5percent water supply systems are tested annually	S, M, L	MONRE	MOH, MOAFMOPWT, Service providers

Continuous monitoring of neighbourhood noise, entertainment noise and noise nuisance to comply with standards	Monitoring data and publicly available e-records	S, M, L	PCD	MONRE
Solid waste management				
Develop the standard for leachates from SLF site	Standard in place	S	MoPWT	MONRE, MoH
SP 2-4: Making polluters pay.				
Institution				
Formulate and implement a new approach of deposit system for commodities and returning the deposit upon the return of the used/packaging material	No. of schemes in operation under the new approach	S,M,L	MOIH, MOC,	MONRE, MOHA
Activate and mobilize pollution control fund	Pollution control fund operational	S	MONRE	MOF, MPI, MOPWT, MOIH
Introduce a levy on hazardous environmental accidents as well as industrial pollution that exceed emissions standards	No. of industries levied	S,M	MOIH	MONRE, <u>MOF</u> , <u>PCD</u>
Monitoring				
Monitor the pollution compensation programme	No. of pollution victims being compensated	S	MONRE	MOHA, <u>MONRE</u> , <u>MOF</u>
Monitor the environmental rehabilitation programme	Number of environmental rehabilitation activities conducted	M,L	MONRE	MOPWT, <u>MOIH</u>
Air				
Strictly enforce "polluters pay principle" and fines for violations and clarify obligations to submit emission monitoring reports	Monitoring report and database on fines	M,L	PCD	MONRE, Line agencies
Water				
Amend the existing Act to accommodate Waste water Charge Programme (WCP)	CWP amended	S	MONRE	MPI, MOIH, MOJ
Formulate and implement guidelines for waste water charge programme	Regulations drafted	M,L	MONRE	MPI, MOIH, MOJ
Prepare the clear procedures of tax exemption on the water pollution protection mechanism for the industries adopting the pollution control equipment	Procedure of water pollution protection subsidy in place	S, M	MOIH, MOPWT, MOF	MOIH, PCD

Design and implement tax exemption program on "Pollution control equipment" among the most water polluting industries medium and large size (effluent standard promulgated industry)	No. of application and No. of pollution Control equipment installed in the industries and compliance of the environment standards by the industry	M	MOPWT,	MONRE, MPI, MOF, MOAF
Solid waste management				
Extensively expand the waste collection by private sector participation at household level	No. of private entities involved No. of households participating in the programme and paying fees	S, M, L	Municipalities and VDCs	MOPWT, private sectors, civil society, associations
Expand waste collection from enterprises scheme	No. of enterprises participating and paying fees	S	MOPWT	MOIH, MONRE
SP 2-5: Addressing trans-boundary pollution issues.				
Compile and share Baseline information on Air and water quality Monitoring and Management in the participating countries.	Baseline information on ambient air quality compiled	S	MONRE	MOPWT, MOFA INGOs, Development Partners
Support with expertise, equipment and information, needed for the quantitative monitoring	Equipment and expertise identified and procured and experts engaged.	S	MONR/ MPI	MOIH, MOH, MOAF
Formulate policy for transboundary prevention/control of air and water pollution and hazardous waste	Policy developed	S	MONRE	MOFA, INGO, Development Partners
Collect reliable baseline data jointly and share information	Guidelines prepared	L	WECS	Line agencies
Design and implement joint programme to reduce the air and water pollution	Percentage of pollution decreased	L	Basin Authority	Line agencies
Develop inventory of hazardous waste in line with international Conventions (MEAs) to address trans-boundary pollution	Inventory of hazardous waste	M	MONRE	MOIH, MOPWT, MOFA concerned ministries, NGOs/INGOs
SP 2-6: Enhancing government preparedness to respond environmental accidents				
Strengthen environmental protection fund	Fund	M, L	MONRE	MOHA, MOST, MOPWT, MOIH
Establish institutional mechanism to respond to environmental accidents	Institutional mechanism in place	M, L	MONRE	MOHA, MOST, MOPWT, MOIH
Conduct awareness of general public about the government preparedness	Peoples' awareness level	M, L	MONRE	MOHA, MOST, MOPWT, MOIH, MOH
Prepare sector-wise onsite emergency preparedness plan for toxic emission	Emergency plan with indicators	S, M, L	MOLSW	MOIH, MONRE, MoHP, MoH
Note: S = Short-term; M = Medium-term; and L = Long-term				

PART III

ARRANGEMENTS FOR IMPLEMENTATION OF THE STRATEGY AND ACTION PLAN

This National Pollution Control Strategy and Action Plan (NPCSAP) provides overall guidance for the efficient integration of pollution prevention and control measures in all development efforts, policies and procedures. To achieve the target set forth for 2030.

This Strategy serves as a framework strategy to integrate pollution prevention and control measures into other sectoral development policies, strategies and plans, the respective sectoral strategies will have their own action plans to implement to contribute to achieve the target set by this NP C S . This is known as implementation of the National Pollution Control Strategy (NPCS).

Some specific action plans to be implemented and/or coordinated by the NPCSAP implementing agency were designed for this strategy. This procedure is known as implementation of the National Pollution Control Action Plan (NPAP).

III.1. Implementation of the National Pollution Control Strategy (NPCS)

This Strategy shall be implemented mainly in three ways.

- a) Pollution prevention and control measures shall be integrated in all official development policies, strategies and plans that will be formulated in future. In case of existing sectoral policies, strategies and plans, pollution control measures will be integrated during their periodic review.
- b) Implementation will proceed through periodic plans. For this, guidelines shall be provided in an approach paper to be prepared for the formulation of periodic plans. This is done to ensure the incorporation of pollution control measures in sectoral development programmes prepared by the concerned agencies.
- c) Periodic plans shall be implemented through annual plans. Guidelines shall also be provided for the integration of pollution control measures in annual development plans.

In order to ensure that this NPCSAP is implemented as envisaged, short-term, medium-term and long-term implementation plans have been designed as follows.

III.1.1. Short-term Implementation Plan

The short-term implementation plan is envisaged to contribute to achieve the 8th five – year national Socio-Economic Development Plan (2018–2020) from pollution control perspectives.

Table 7. Short-term implementation plan (3 years)

Activities	Year		
	1st	2nd	3rd
Institutional Arrangements			
2 Constitute National Pollution Control Strategy Implementation Coordination Committee			
3 Establish a NCPSP Implementation Unit in the MONRE and PCD			
4 Identify Pollution Control Focal Units in each related Ministries and Departments and define their roles and responsibilities for pollution control (relation with works of environmental divisions or section of each ministry/department)			
5 Establish provincial EPC under relevant agency at province			
Capacity Building			
6 Arrange human and financial resources at the NCPSP Implementation Units in MONRE and PCD and relevant agencies			
7 Build the capacity of human resources of the Implementation Units in MONRE, PCD and focal units of relevant agencies			
8 Prepare IEC about the NCPSP and other important pollution control measures			
9 Conduct orientation to Units at central and district levels			
10 Orient on preparation of future planning guidance at central, province and local levels			
11 Build pollution control monitoring capacity of sectoral ministries and departments			
12 Facilitate the implementation of all thematic and sectoral strategies in order to include pollution control measures in all sectoral plans and programmes			
13 Coordinate with the Ministry of Finance for allocation of required budget and technology arrangements in order to implement sectoral strategies with pollution prevention and control perspectives			
Pollution Control Measure Integration Activities			
14 MPI to guide the concerned ministries and agencies to prepare annual programming guidelines to include pollution control measures in their sectoral plans			
15 Prepare pollution prevention and control monitoring guidelines for the implementation of annual programme			
16 Ensure that all plans, projects and programmes have incorporated pollution prevention and control measures			
17 Prepare guidelines for inclusion of pollution prevention and control measures in the existing policies, strategies and plans			
Monitoring and evaluation			
18 Assist MPI to assess annual programmes of the sectoral ministries from pollution control perspectives			
19 Monitor the implementation of sectoral policies, strategies and plans in accordance with pollution control monitoring guidelines			
20 Provide guidelines to the sectoral ministries to ensure mainstreaming of pollution prevention and control measures in the annual plans			
21 Coordinate and monitor, as required, to ensure the implementation of all projects by conducting their detailed environmental assessment, identifying their possible adverse impacts on environment, and determining measures to reduce such impacts			

22 Assist MPI to evaluate annual and periodic progress reported by sectoral ministries and agencies from pollution control perspective			
23 Publish periodic assessments and progress reports on pollution control			

III.1.2. Medium-term Implementation Plan (5 years)

The medium-term implementation plan, for the period of 2020 to 2025 is envisaged to contribute to achieve the pollution control objectives from pollution prevention perspectives.

In the medium-term, relevant activities of the short-term will be continued and other specific activities of medium-term nature are proposed. During this period, the following activities shall be additionally conducted by giving continuity to the short-term programmes:

- Monitor and evaluate the state of pollution issues in the implementation of sectoral development strategies
- Prepare guidelines for the mainstreaming of pollution control measures in new policies and strategies.
- During periodic monitoring and evaluation of the sectoral policies and strategies, ensure that the pollution control parameters are included, and measures for pollution prevention and control measures are recommended.
- Based on the results of the periodic monitoring and evaluation of the sectoral policies and strategies, revise the annual programme planning guidelines and conduct orientation from central to lower (district, and later province) levels.
- Evaluate the usefulness and effectiveness of the NPCSAP to control pollution in the final year of each periodic plan.
- Based on the results of evaluation, revise the NPCSAP to address contemporary issues and needs.
- Assist MPI to assess the degree to which learning and suggestions received from monitoring and evaluation have been employed by the sectoral ministries and agencies.

III.1.3. Long-term Implementation Plan (5 years)

The long-term implementation plan is envisaged to contribute to achieve the Outcome 3 of the 8th Five-Year National Socio-economic Development Plan (2016–2020) “8th SEDP”, reflecting the Socio-economic Development Strategy until 2025 and Vision 2030, making Lao PDR Green, Clean and Beautiful.

During this period, short- and medium-term programmes shall be given continuity. The long-term implementation plans shall be formulated again in such a way that they are consistent with the government’s periodic plans. Such consistency shall be harmonized at the time of governmental periodic planning.

III.2. Organisational Structure

The key organization is the Ministry of Natural Resources and Environment (MONRE)- Department of Pollution Control (PCD) at the national level; Provincial Department of Natural Resources and Environment (PDONRE) and District Office of Natural Resources and Environment (DONRE) are responsible for pollution control matters at provincial and district level.

There are Environment Divisions in most of the Ministries. These Divisions are headed by Joint Secretaries. In many ministries and departments under them, there are environment sections/units.

As there are already several institutional set-ups in various forms, this NPCSAP has attempted to build on and make best use of existing organisational structures rather than suggest separate parallel structures for pollution control/ management.

After reviewing the organisational structure, strengths and weaknesses of the existing organizations, it is proposed here that a new "Environment Protection and Pollution Control Steering Committee " be formed so that also pollution control functions and responsibilities be vested on it.

III.2.1. National Environment Protection and Pollution Control Steering Committee (NEPPCSC)

Formation

NEPPCSC should have representation from all agencies and stakeholders important to environmental pollution control and environmental protection. In addition, as the merged structure is envisioned to include pollution control functions, there should be representation of stakeholders related to pollution control issues. Considering all these aspects, the composition of 41-member NEPPCSC is proposed as presented in Table 8.

Table 8. Proposed composition of 41-member NEPPCSC

Description	Position
Prime Minister	Chairperson
Minister, Ministry of Natural Resources and Environment	Vice
Minister, Ministry of Public Works and Transport	Member
Minister, Ministry of Industry and Commerce	Member
Minister, Ministry of Agriculture and Forestry	Member
Minister, Ministry of Health	Member
Minister, Ministry of Planning and Investment	
Minister, Ministry of Law and Justice	Member
Minister, Ministry of Finance	Member
Minister, Ministry of Foreign Affairs	Member
Minister, Ministry of Interior	Member
Minister, Ministry of Labor and Social Welfare	Member
Minister, Ministry of Culture, Tourism and Sport	Member
Minister, Ministry of Education	Member
Chairperson, Environment Committee of National Assembly	Member
Chief Secretary, Office of Prime Minister	Member
One professor nominated by the government from among the professors of Environment Department of universities in Lao PDR	Member
Seven members – one from each province – including three women, nominated by the government from among the personalities who have significantly contributed in the field of environmental protection	Member
Chairperson, Lao PDR Chamber of Commerce	Member
Chairperson, NGO Union	Member
Chairperson, Transport Entrepreneurs Association	Member
Chairperson, Hotel Association	Member
Chairperson, Tourism Association	Member
Chairperson, Federation of Laos Journalists	Member
Secretary, Ministry of Natural Resources and Environment	Member

Note: In addition to the above members, the Steering Committee may invite other individuals and/or representatives from various fields such as UNDP, UNEP, GIZ, ICIMOD, ADB, WB, IUCN, etc, as required, to participate in Steering Committee meetings as invitees.

The Steering Committee may form different thematic groups or sub-committees. An informal core working group of 4 to 6 Steering Committee members including a member secretary is recommended. The work should comprise beforehand preparation of pollution control issues to be presented at the Steering Committee.

Responsibilities of NEPPCSC

- Advice government of Lao PDR on environmental protection and pollution control policies
- Provide guidance to the government on environmental protection and pollution issues and suggest measures to address them
- Guide the government to implement environment assessments, strategic environment assessments, and social impact assessments
- Facilitate inter-ministerial coordination for harmonising policy and institutional issues
- Provide guidelines to the government for effective mobilisation of an environment protection fund for conservation of nature, pollution control, and protection of cultural heritage
- Promote environment and pollution control research
- Promote public awareness on environment and pollution issues
- Promote development and introduction of clean-tech solutions together with private sector partners
- Ensure green recovery in the reconstruction and rehabilitation programmes
- Guide in policy-making and implementation for the integration of pollution prevention and control measures into all development efforts
- Guide all ministries concerned to mainstream the issues of pollution prevention and control measures in their agencies' policies and strategies as specified by this NPCSAP framework
- Take the initiative to arrange financial resources for the mainstreaming of pollution prevention and control
- Ensure compliance of environmental regulations and participation of thematic ministries and agencies, non-governmental organisations and the private sector in implementation of the NPCSAP
- Make necessary provisions for the representation of Provinces in the Steering Committee and the Implementation Coordination Committee after the provincial government has been restructured
- Arrange Provincial Steering Committee s as required after the provinces have been restructured
- Do additional work as and when required

The Secretariat of this Steering Committee shall be in the Ministry of Natural Resources and Environment and its meeting shall be held at least once a year.

III.2.2. NPCSAP National Implementation Coordination Committee (NICC)

Formation

For successful implementation of this NPCSAP, a high-level NPCSAP National Implementation Coordination Committee comprising the following members shall be formed.

Table 9. NPCSAP Implementation Coordination Committee

S.N.	Organization	Level	Position
1	Ministry of Natural Resources and Environment	Secretary	Chairperson
2	Ministry of Public Works and Transport	Joint Secretary	Member

3	Ministry of Industry and Commerce	Joint Secretary	Member
5	Ministry of Agriculture and Forestry	Joint Secretary	Member
6	Ministry of Health	Joint Secretary	Member
7	Ministry of Planning and Investment	Joint Secretary	Member
8	Ministry of Finance	Joint Secretary	Member
9	Ministry of Labor and Social Welfare	Joint Secretary	Member
10	Ministry of Culture, Tourism and Sport	Joint Secretary	Member
11	Ministry of Education	Joint Secretary	Member
12	Department of Pollution Control (PCD)	Director General	Member
13	Environment Conservations and Community Development Association (ECCDA)	CEO	Member
14	Lao PDR National Journalists Association		Member Secretary

Responsibilities of NICC

- Provide overall direction and guidance for implementation of the NPCSAP in the country, Provide overall guidance to NPCSAP Implementation Committee
- Implement decisions and guidance of the Steering Committee
- Assist in organising Steering Committee meetings
- Review progress achieved, discuss challenges faced and their strategic solutions
- Ensure the implementation of the NPCSAP through all sectoral ministries, agencies, non-governmental organisations and the private sector
- Ensure the mainstreaming of pollution control measures in sectoral development policies and strategies as specified by the NPCSAP
- Ensure networking of public sector with private sector clean-tech companies.
- Ensure budget allocation and use in development programmes and projects for the implementation of pollution control measures
- Monitor the implementation, progress and effectiveness of the NPCSAP
- Conduct additional work as and when required

The Secretariat of this Committee shall be in the Ministry of Natural Resources and Environment

III. 2.3. NPCSAP National Implementation Unit (NIU)

Formation

Implementation of NPCSAP will be the overall responsibility of the Department of Pollution Control (PCD). Hence, PCD will establish the NPCSAP Implementation Unit (NIU) within the PCD.

Responsibilities

- To enhance the capacity of the NPCSAP Implementation Unit in the PCD and Focal Units in the relevant ministries and provinces.
- Work as a technical unit of the Steering Committee and the Coordination Committee to implement
- NPCSAP
- Keep record of the minutes of the Steering Committee and Coordination Committee meetings
- Provide support for the NPCSAP for at least five years, using the Government of Lao PDR's own resources or donor support. Raise public awareness about the NPCSAP and ensure its effective implementation

- Provide pollution control related organisational support for thematic agencies
- Oversee pollution control monitoring system
- Coordinate with different organisational focal units and individuals, as well as private companies regarding pollution control issues.

Local-level Coordination Committee

PDONRE and DONRE are responsible for pollution control at provincial and district level. With proper coordination with the MONRE and PCD, NPCSAP will be implemented at the local level through the PDONRE and DONRE.

Provision of Focal Units and Focal Persons in Sectoral Ministries

The divisions/sections/units as well as sectoral and other agencies nominating representatives in NEPPCSC and/or Coordination Committee will be designated as NPCSAP implementation Focal Units. This is done in consultation with the unit and the person concerned.

Roles and Responsibilities of the major Stakeholders

Different agencies shall have a specific role to play in achieving the objectives determined by NPCSAP. The Ministry of Natural Resources and Environment, Department of Pollution Control shall be responsible for monitoring the strategy implementation.

Thematic and sectoral agencies shall be responsible for addressing pollution-related issues while formulating their sectoral annual programmes, whereas local bodies shall be responsible for earmarking budget for pollution control while preparing local development programmes and plans.

The private sector shall mandatorily contribute to pollution prevention and control through reduction at source, recycling and reusing when operating their business. Another important role of private sector is to make use of the new facilities to create innovations for starting companies with a profile on clean-tech and other environmental issues.

The NGO sector shall enhance the pollution control efficiency of governmental and non-governmental organisations, private sector, community organisations and community groups involved in pollution control.

Local communities shall make local experience and knowledge available to make local development activities environment friendly in development programme planning.

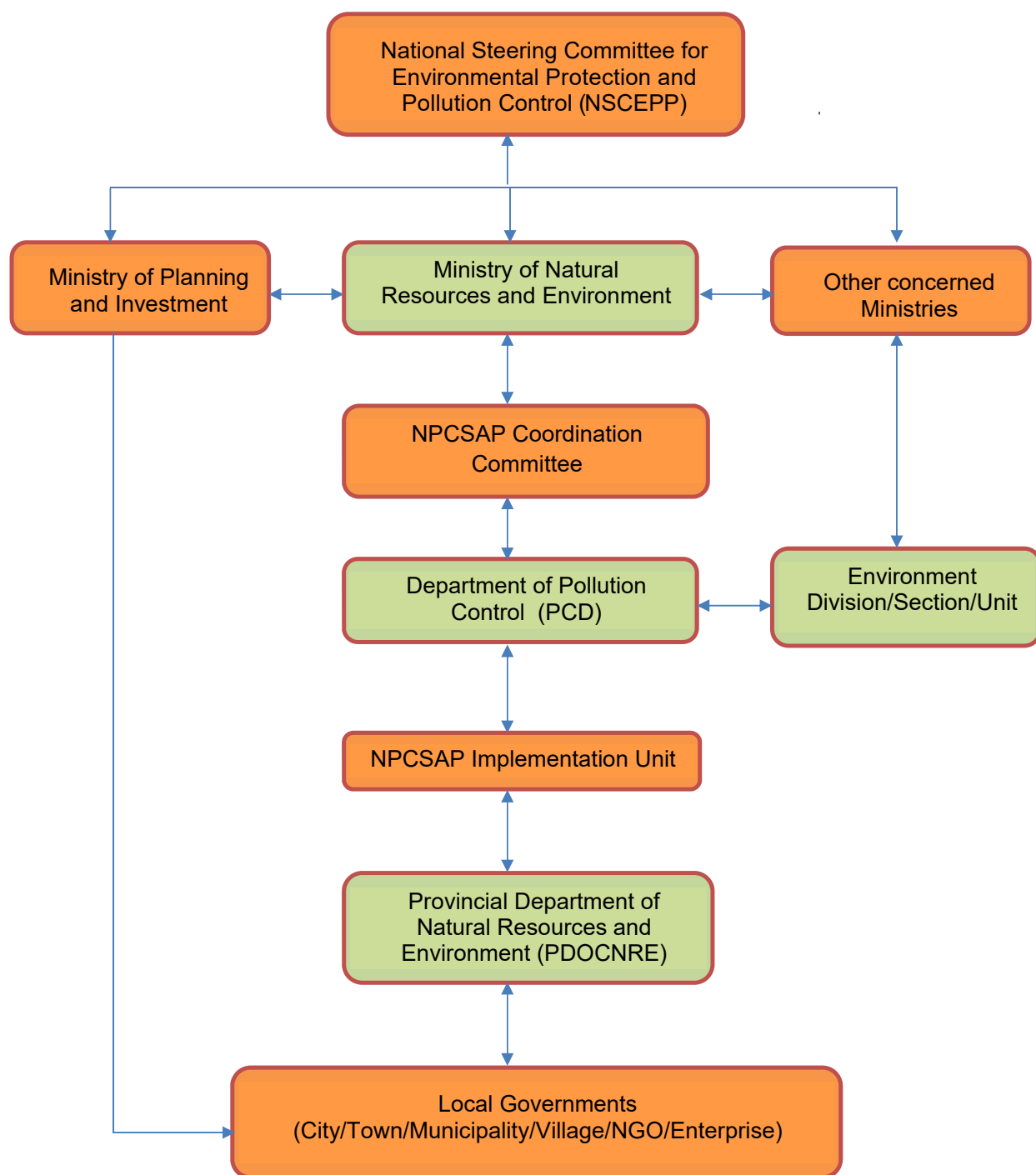
Development partners shall mandatorily also arrange budget for pollution management by ensuring that pollution control activities have been included during project design, and required budget has been earmarked for those activities.

Table 10. Responsible sectoral agencies and their roles in pollution management

Organisation	Role
Sectoral agencies	<ul style="list-style-type: none"> • Every concerned sector to include pollution control-related activities while formulating its annual programme, other programmes and projects • Make pollution control an integral part of public-private partnership programmes • Mandatorily earmark pollution control-related programmes and budget during construction of large physical infrastructure like roads and buildings, real estate and urban development • Design development programmes in such a way that they do not eliminate or conflict with sites that are important from heritage and cultural perspective • Every concerned ministry to inform its division, department, and regional and district offices and provide instructions on designing programmes accordingly • For building capacity on environment-friendly programme planning, provide training especially to office chiefs, planning officers and accountants • Build pollution management capacity of private entities in their relevant sectors
Local bodies	<ul style="list-style-type: none"> • While designing local development programmes and projects, ensure that they are environment-friendly • Earmark pollution control-related activities and budget while working on development projects • While designing and implementing development action plans (e.g. roads, mining), adopt procedures that minimize adverse impacts on environment • Design development programmes in such a way that they do not eliminate or conflict with sites that are important from heritage and cultural perspective
Private sector	<ul style="list-style-type: none"> • Mandatorily include pollution management activities and budget in industry/business development programmes • Operate industries only in places that are not close to social institutions and human settlements and environmentally sensitive areas • Even industries that have been established before the provision of environmental management plan (EMP) and environmental impact assessment (EIA) came into force to comply with the provisions of EMP and EIA • Foster the private sector to spend a part of net benefit on mass awareness raising on pollution management • Include pollution control as part of the social responsibility agendas of industries and businesses • Utilise new possibilities to start companies with business ideas in the field of clean technology and environmental consultation

Non-governmental organisations	<ul style="list-style-type: none"> • Mandatorily arrange pollution management activities and budget in projects and annual programmes • While conducting development activities, adopt measures that reduce pollution • Design development programmes in such a way that they do not eliminate or conflict with sites that are important from heritage and cultural perspective • Enhance pollution management efficiency of governmental and non-governmental organisations, community organisations and self-help groups involved in pollution management • Monitor integration of pollution control measures in public and private sector development activities • Utilise new possibilities to start companies with business ideas in the field of clean technology and environmental consultation
Community organisations, self-help groups and co-operatives	<ul style="list-style-type: none"> • Make local information available in order to make development programmes environment friendly • Adopt caution to avoid adverse impacts on environment by participating in development programmes • Pay attention to making development programmes environment friendly • Make local experience and environmental friendly traditional knowledge available in order to promote environment friendly development programme planning • Monitor integration of pollution management measures in public and private sector development activities
Academic sector	<ul style="list-style-type: none"> • Collect data on pollution status through research • Provide data on pollution control for development programmes • Make science, technology and current curriculum-related knowledge available to the Government of Lao PDR and civil society • Disseminate pollution management knowledge at national and international levels through different media • Help policy makers formulate scientific policies by making science-based data available to them • Utilise new possibilities to start companies with business ideas in the field of clean technology and environmental consultation
Development partners	<ul style="list-style-type: none"> • Ensure inclusion of pollution management activities during project design and earmarking required budget for those activities. • Mandatorily arrange budget for pollution management actions with projects • Make financial arrangements to develop human resource in environment friendly programme development

Institutional framework for NPCSAP



III.2.4. Resource Requirements

This Strategy covers also those of sectoral agencies and facilitates effective implementation of them; no additional demands shall be made for separate budget and other financial arrangements for the implementation of programmes and action plans under sectoral strategies. Programmes and action plans under sectoral strategies shall have to be carried out within the budget ceiling determined by the strategies.

It is desirable that the programmes (and projects) would be proposed in accordance with planning process and submitted to Ministry of Planning and Investment (MPI) for approval; the financial mechanism to support such approved projects should comply with the prevailing government system as guided by Public Procurement Law and Regulations, i.e. from MOF through concerned ministry and disbursed to different projects/programmes.

It shall be desirable that the development partners comply with Lao PDR's financial mechanism and provide fund through government's established mechanism. This would provide the government an overview of the size of the budget for the projects it is executing. The tentative budget that may be required for the implementation of the NPCSAP is provided in Table 11.

Table 11. Budget for the NPCSAP Implementation

Strategic activities	Amount (in USD)
<i>SP1: Pollution Prevention Strategy</i>	
SP1-1: Strengthening institutional mechanism	611,850
SP1-2: Mainstreaming pollution prevention measures	986,500
SP1-3: Minimization/Reduction at the source	1,292,500
SP1-4: Raising public awareness and environmental education	809,000
Sub- total to implement pollution prevention activities	3,699,850
<i>SP2: Pollution Control Strategy</i>	
SP2-1: Ensuring compliance to legal provisions	522,500
SP2-2: Comprehensive waste (pollutants) management	6,138,000
SP2-3: Enhancing accountability (through legal measures)	609,000
SP2-4: Making polluters pay	177,500
SP2-5: Addressing trans-boundary pollution issues	582,800
SP2-6: Enhancing government preparedness to respond environmental accidents	828,000
Sub-total to implement pollution control activities	8,857,800
Grand Total	12,557,650

III. 2.5. Financing Arrangement

Potential Sources of Financing

Environmental tax and Environmental Protection Fund is an important and responsible source of financial resources for environmental protection including pollution control in Lao PDR. According to The Environmental Protection Law (Revised) 2013, the main source of funding for the Environmental Protection Fund is as follows:

- State Budget;
- Environment tax;

- Environmental rehabilitation fees from investment projects or activities;
- Payment for ecological services;
- Contribution by investment projects, enterprises and ordinary persons
- Grant aids from both local and international organizations;
- Fines and indemnities of environmental damages
- Interest and profits generated from capital investments of the Environmental Protection Fund

The Environmental Protection Fund has an important role in implementing the actions necessary to reduce environmental impacts of pollution. Some of the following legal provisions have been made to facilitate collection of financial resources for environmental funds as well as pollution control activities at different levels.

Based on the above mentioned legal provisions, there are other funds related to environmental protection at different level. The legal frameworks have given authority to the government and local government to generate financial resources including environmental pollution control tax. The donors and development partners have also provided funding for environmental protection and pollution control under various support mechanisms to achieve the goals and objective define by the Multilateral Environmental Agreements (MEAs).

Financing mechanism

For the implementation of this strategy, budget shall be allocated as a national priority programme through the central budget system (on-budget on-treasury) of the Government of Lao PDR Government. For the action plans of the sectoral agencies, a system of sectoral agency investment in pollution control-related activities shall be developed and implemented by establishing an environment friendly budgeting and review system. Likewise, investments in pollution control shall be increased and arrangements made to effectively monitoring their use in pollution control in line with existing policy and legal provisions of sectoral agencies.

In addition, to conduct the required programmes and projects for mainstreaming pollution control in all thematic/sectoral strategies, the GOL shall take the initiative to arrange funds from external sources. This Strategy shall be used as a reference paper in discussions with different development partners in accordance with global campaigns on pollution control, chemical management, and implementation of international conventions (MEAs). Lao PDR can also expect to receive aid as guided by the Paris Declaration on Aid Effectiveness 2005, established by developed and developing countries in Paris. Various countries in the Asia- Pacific Region have developed their own declarations on aid effectiveness and fitted Paris Declaration to their circumstances.

Different development partners have exercised different models of financial support; some are providing funds through on-budget off-treasury, whereas others are doing it through on- budget on-treasury, which is managed by PPA of GOL.

PART IV

MONITORING, EVALUATION AND KNOWLEDGE MANAGEMENT

IV.1. Monitoring

Aspects to be monitored

In view of the cross-cutting nature of pollution control, this monitoring framework focuses on the following aspects.

- a) **Monitoring of expected outputs:** The expected outputs in this PCSAP are the national environmental standards (revised in 2017) on air, water, and soil that the state aims to achieve. Achievement on these standards will be monitored and feedback provided to the concerned ministries/agencies periodically. These standards can be achieved only by cross-sectoral coordination and joint efforts. The monitoring results will be presented and discussed in the NEPPCSC and NPCSAP Implementation Coordination Committee.
- b) **Monitoring of the implementation of NPCSAP implementation plan:** This will be more of activity monitoring. Yet, it is very important because the NPCSAP is planned to be implemented during over 13 years' time in short-term (3 years), medium term (5 years), and long-term (5 years) time span. These activities are not specific to any specific themes of pollution. Instead, they are general management activities to get the NPCSAP implemented by concerned agencies. Hence, monitoring will be based on the completion of articulated activities to implement NPCSAP on time as planned.
- c) **Monitoring of the implementation of pollution control action plans:** There are a set of specific pollution control action plans with activities to achieve the prescribed standards under various pollution themes. As per the nature of the action, these plans are presented as short-term, medium-term and long-term plans. Implementation of these action plans will be monitored through the completion of those actions on time as envisaged.
- d) **Monitoring of the assumptions made and risk reduction measures taken:** NPCSAP is designed with certain assumptions in the brief logframe (Table 3). In view of the unstable political situation in the country, some of the assumptions are perceived risky to hold. For those assumptions, there are some risk reduction measures taken to ensure that the implementation of NPCSAP is not affected. If in case, these assumptions do not hold and the reduction measures are overlooked, the aim to achieve the prescribed standards will be also affected. Hence, this NPCSAP has proposed monitoring of such assumptions and risk reduction measures as well.
- e) **Monitoring of cross-sectoral coordination for pollution control:** Despite the fact that pollution control is the responsibility of MONRE, the nature of proposed action plans indicates that implementation of the plans cannot be led by MONRE alone. As proposed in The Action Plan (Table 4), there are different ministries/agencies leading the

implementation of various activities. For this reason, there is a need to have inter-ministerial coordination. NPCSAP has already presented NEPPCSC to address this need. With the same analogy, this strategy alone cannot achieve the national environment standards. Sectoral development strategies also need to mainstream pollution prevention and control measures in their strategies and include pollution control related indicators in their performance monitoring framework.

However, sectoral development strategies do not seem to have been responsive to pollution prevention and control issues. Many sectoral strategies have not included any indicators for monitoring pollution being caused by the sectoral development activities. There were only a few strategies found to have included pollution related indicators in their performance monitoring framework. Therefore, NPCSAP needs to guide all sectoral development strategies to mainstream pollution prevention and control measures in their strategies, and include pollution control indicators in their performance monitoring framework. This should be done while conducting the periodic review of the sectoral strategies in a process to be monitored by NPCSAP.

At provincial/district level, the roles and responsibilities for the monitoring and evaluation of the status and performance on pollution control has not been explicitly defined. The Provincial, Capital Natural Resources and Environment Department level will be responsible for the monitoring and evaluation of pollution control activities, which have been defined in NPCSAP for provincial/district level. This is because some environmental rights and responsibilities are given to province by the Constitution of Lao PDR.

Monitoring Period There are three agencies involved in pollution monitoring - MONRE, sectoral ministries, and MPI depending upon the substance to be monitored. These agencies do have their regular monitoring mechanisms. However, for various reasons including budgetary and human resource constraints, monitoring of environmental issues is weak. Hence, monitoring of this strategy will be carried-out annually.

IV.2. Evaluation

Conduction of evaluation: Relevant ministries, agencies, and programme or projects should carry out evaluation by engaging internal or external parties as appropriate. The results of goal, purpose and strategic pillars should be evaluated as follows:

Goal: The attainment of the goal shall be monitored and evaluated by a third party.

Purpose: Sectoral agencies themselves shall monitor and evaluate the attainment of purposes.

Outputs of strategic pillars: The results of strategic pillars should be monitored and evaluated as per the regular monitoring, and evaluation process as per the evaluation form.

Evaluation period: implementation of the strategy shall be monitored and evaluated as per the regular monitoring, and evaluation schedule in line with MPI.

First evaluation of this strategy shall be done after three years (at the end of short-term implementation plan) and after that in the mid-term. Based on the results of evaluation, this strategy shall be revised as required.

IV.3. Monitoring and Evaluation Report

A monitoring and evaluation report shall be based on the 2 pillars and 9 sub-pillars of this strategy. Based on the results of M&E, the monitor and evaluator shall provide clear recommendations on what the sectoral agency shall have to do to integrate pollution control measures with development efforts. The NPCSAP Implementation Unit shall take necessary actions on such monitoring reports and present details for policy decisions in the meetings of the Implementation Coordination Committee and NEPPCSC.

IV.4. Information Management

Department of Pollution Control with the support from NPCSAP Implementation Unit shall collect and manage required information and data by coordinating with the Focal Units (division or section) of the sectoral agencies. The Unit shall coordinate with the local level Environment Friendly Local Governance Coordination Committee through local governments to collect local level information on pollution control status.

IV.5. Knowledge Management and Use

As an NPCSAP implementing unit, PCD will be responsible for documentation, communication, dissemination, replication and promotion of knowledge obtained from the implementation of NPCSAP. As the concerned sectoral agencies are equally contributing to pollution control, they will be also responsible for knowledge management. Department of Pollution Control shall ensure that replication and promotion of knowledge has been included in its future plans and programmes. Based on the lessons learned from implementation of this strategy and action plans, feedback shall be provided at the NEPPCSC and NPCSAP Implementation Coordination Committee and the plan to address trans-boundary air pollution and water pollution issues developed for joint actions with neighbouring countries. Feedback shall also be included in the agenda of regular monitoring to be carried out by the National Planning Commission.

IV.6. Amendment of the Strategy and Action Plan

This Strategy and Action plan shall be revised by reviewing it in the final year of each periodic plan to fit into the national development requirements. However, it may also be revised by reviewing/evaluating it in the mid-term and other time as required.

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ANNEX: Lao PDR National Environmental Standards (Revised 2017)



Lao People's Democratic Republic
Peace Independence Democracy Unity Prosperity

Ministry of Natural Resources and Environment

No. 0832/MONRE
Vientiane, 3 March 2017

Decision on National Environmental Standards

- Pursuant to the Law on Environment Protection No. 29/NA, dated 18 December 2012, article 27 and article 32,

The Minister issues:

Chapter 1 General Provisions

Article 1 Purpose

This Decision determines parameters and levels of pollutant concentrations in the national environmental standards as scientific reference in the monitoring of the environmental quality and controlling of pollutions emitted to air, or discharge to soil and water including disturbance that may have impact on human and animal life, health and environment.

Article 2 National Environment Standards

The national environment standards determine parameters of chemical concentration levels and any pollutant contaminated in the air, soil, water and disturbance that include ambient environment standards and pollution control standards that are scientific and technical tools as well as reference for all to apply as common standards in the pollution prevention and pollution control.

Article 3 Terminology

Terms applied in this decision have following meanings:

1. **Ambient environment standards** mean levels of concentration of the indicators in any environmental condition of the air, soil and water quality standards including disturbance defined as common standards for the promotion and maintenance of ambient environment quality;
2. **Pollution control standards** mean the levels of concentration of indicators specified in the control of amount of contaminated chemicals and pollutants from point-sources emitted to the air or discharge to soil and water including disturbance;
3. **Concentration** means numeric amount of chemicals contaminated in air, soil and water including disturbance, calculated according to measurement unit;
4. **Parameters** means determining factors for verification of each type of pollutants that requires monitoring, inspecting and controlling in order to measure the concentration level according to chemical symbols specified in the national environment standards;
5. Indicators mean standard in scientific number that specifies concentration amount of the indicators in the national environment standard.

For the meaning interpretation of chemicals specified in this decision (see annexes).

Article 4: Scope

This decision applies to individual, juristic person and organization for implementation of the pollution control emitted to environment in the Lao PDR.

Chapter II

Air quality Standards

Article 5 Ambient air quality standard

The ambient air quality standard is indicator that specifies concentration amount of chemicals and pollutants contaminated in the air which are defines as ambient standard in the safe level as follows:

Table 5: Ambient air quality standard

Parameters	Symbols	Average	Standard Limit	Unit
Carbonmonoxide	CO	1 hour	30	ppm
		8 hours	9	ppm
Nitrogendioxide	NO ₂	1 hour	0.11	ppm
		1 year	0.02	ppm
Sulfurdioxide	SO ₂	1 hour	0.13	ppm
		24 hours	0.05	ppm

Total Suspended < 100 micron	TSP	24 hours	0.33	mg/m ³
		1 year	0.10	mg/m ³
Particulate Matter < 10 micron	PM-10	24 hours	0.12	mg/m ³
		1 year	0.05	mg/m ³
Particulate Matter 2.5	PM-2.5	24 hours	0.05	mg/m ³
		1 year	0.015	mg/m ³
Ozone	O ₃	1 hour	0.20	mg/m ³
		8 hours	0.14	mg/m ³
Lead	Pb	1 year	0.00015	mg/m ³

Article 6 Air pollution control standards

Air pollution control standards are indicators that determine maximum concentration of chemicals and contaminants emitted to air from activities of each type, size, pollution point-source type and pollutants from pollution point-source that cannot be exceeded the standard limit of air pollution control as specified below:

Table 6: Air Pollution Control Standard from industries in general

Parameters	Symbols	Point-sources of air pollution	Air Pollution Standard limit(cannotbe exceeded)		Unit
			Without fuel burning	With fuel burning	
Total Suspended Particulate	TSP	Boiler and Kiln			
		Used oil	Unspecified	240	mg/m ³
		Coal		320	mg/m ³
		Biomass		320	mg/m ³
		Other fuels		320	mg/m ³
		Melting, pressing, pulling of metals (steel	300	240	mg/m ³

		and aluminum)			
		General manufacturing	400	320	mg/m ³
Sulfurdioxide	SO ₂	Boiler and kiln			
		Used oil	Unspecified	950	ppm
		Coal		700	ppm
		Biomass		60	ppm
		Other fuels		60	ppm
		General manufacturing	500	Unspecified	ppm
Nitrogendioxide	NO _x as NO ₂	Boiler and kiln			
		Used oil	Unspecified	200	ppm
		Coal		400	ppm
		Biomass		200	ppm
		Other fuels		200	ppm
		General manufacturing		Unspecified	ppm
Carbonmonoxide	CO	General manufacturing	870	690	ppm
Hydrogen sulfide	H ₂ S	General manufacturing	140	110	mg/m ³
Hydrogen chloride	HCl	General manufacturing	200	160	mg/m ³
Sulfuric acid	H ₂ SO ₄	Sulfuric acid production	100	unspecified	mg/m ³
Xylene	C ₈ H ₁₀	General manufacturing	870		
Cresol	C ₇ H ₈ O	General manufacturing	5		

Tin	Sn	General manufacturing	20	16	mg/m ³
Asenic	As	General manufacturing	20	16	mg/m ³
Copper	Cu	General manufacturing	30	24	mg/m ³
Lead	Pb	General manufacturing	30	24	mg/m ³
Chlorine	Cl	General manufacturing	30	24	mg/m ³
Mercury	Hg	General manufacturing	3	24	mg/m ³

Table 6.1: Air Pollution Control Standard from Thermal Power Plant

Parameters	Symbols	Standard Value			Unit
Sulfurdioxide		Coal	Oil	Gas	
Plant Output >500 MW	SO ₂				
Plant Output 300 – 500 MW		320	320	20	ppm
Plant Output < 300 MW		450	450	20	ppm
		640	640	20	ppm
Notrogendioxide	NO _x as NO ₂	350	180	120	ppm
Total Suspended Particulate	TSP	120	120	60	mg/m ³

Table 6.2: Air Pollution Control Standard from Metallurgy

Parameters	Symbols	Standard Value	Unit
Total Suspended Particulate	TSP	120	mg/m ³
Sulfurdioxide	SO ₂	180	ppm
Nitrogendioxide	NO _x as NO ₂	120	ppm

Table 6.3: Air Pollution Control Standard from Cement Factory

Pollution point-sources	Standard		
	Total Suspended Particulate (TPS) mg/m^3	Sulfurdioxide (SO_2) ppm	Nitrogendioxide (NO_x as NO_2) ppm
<ul style="list-style-type: none"> Common kiln Kiln for White Cement Cool cement grinder and coal grinder 	Not exceed 120 Not exceed 120 Not exceed 120	 Not exceed 50 Not exceed 500	 Not exceed 500 Not exceed 500

Table 6.4: Air pollution control standard from stone breaker/gravel breaker activities

Parameters	Total Suspended Particulate (mg/m^3)	Opacity (20%)
Without particulate absorber	unspecified	20
With particulate absorber	400	20

Table 6.5: Air Pollution Control Standard from Incinerators

Parameters	Symbols	Standard		Unit
		Incinerator Capacity		
		1 – 50 tons/day	Exceed 50 tons/day	
Total Suspended Particulate	TSP	400	120	mg/m ³
Sulfurdioxide	SO ₂	30	30	ppm
Nitrogendioxide	NO _x as NO ₂	250	180	ppm

Opacity	Opacity	20	10	%
Hydrogen chloric	HCl	203	37	mg/m ³
Dioxins	Dioxin	30	30	mg/m ³

Table 6.6: Air Pollution Control Standard for infectious waste incinerator from hospital

Parameters	Symbols	Standard	unit
Sulfurdioxide	SO ₂	30	ppm
Nitrogendioxide	NO _x as NO ₂	180	ppm
Hydrogen chloric	HCl	37	mg/m ³
Hydrogen Fluoride	HF	16	mg/m ³
Total Suspended Particulate	TSP	120	mg/m ³
Opacity	Opacity	10	%
Mercury	Hg	0.05	mg/m ³
Cadmium	Cd	0.05	mg/m ³
Lead	Pb	0.5	mg/m ³

Note: In case of an Industrial zone or many factories are located in the same location, standard is defined specifically.

Article 7 Air pollution control standard from vehicles

Air pollution control from vehicles is permitted indicator for maximum concentration of chemicals and contaminants emitted to air from each application, type of machine and vehicles within the pollution control standard which determines as such:

Table 7.1: Air pollution control standard for new vehicles

Types of Vehicles	Carbonmonoxi de (CO)	Hydro Carbon (HC)	HC+NO_x	Nitrogen Oxide (NO_x)	Particulate Matter (PM)	Smoke	Unit
Petrol Vehicle							
Passenger bus	1	0.1	-	0.08	-	-	g/km
Vehicle weight less than 1305 kg	1	0.1	-	0.08	-	-	g/km
Vehicle weight from 1305-1760 kg	1.81	0.13	-	0.1	-	-	g/km
Vehicle weight more than 1760 kg	2.27	0.16	-	0.11	-	-	g/km
Diesel Vehicle							
Passenger bus	0.5	-	0.3	0.25	0.025	-	g/km
Vehicle weight less than 1305 kg	0.5	-	0.3	0.25	0.025	-	g/km
Vehicle weight from 1305-1760 kg	0.63	-	0.39	0.33	0.04	-	g/km
Vehicle weight more than 1760 kg	0.74	-	0.46	0.39	0.06	-	g/km
Heavy Duties Diesel trucks	1.5	0.45	-	3.5	0.02	0.5	g/kwh

Table 7.2 : Air pollution control standard for used vehicles

Types of Vehicle	Parameters	Standard	Meter	Measurement Methods
Diesel fuelled Vehicles	Black Smoke	50%	Paper filter system	Measuring while vehicle is parking , empty by acceleration at maximum round per minute /RPM
		45%	Opacity Meter system	
		40%	Paper filter system	Measuring while vehicle is running by acceleration at 60% of maximum round per minute / RPM
		35%	Opacity Meter system	

Petrol fuelled Vehicles	Carbonmonoxide	4.5%	Non-Dispersive Infrared Detection	Measuring while vehicle is parking without load
	Hydro Carbon	600 mg/km		
Motorcycle	Carbonmonoxide	4.5%	Non-Dispersive Infrared Detection	Measuring while vehicle is parking without load
	Hydro Carbon	10000 mg/km		
	White Smoke	30%	Smoke Meter, Full Flow Opacity System	Measuring while vehicle is parking without load by acceleration at 75% of maximum round per minute / RPM

Chapter 3 Soil Standard

Article 8 Soil Quality Standard

Soil quality standard is indicator that determines concentration load of chemicals and contaminants permitted to be in the soil without causing harm and impact to human, animal life, health and environment that in direct and indirect contact with soil is not exceeded the soil quality standard.

Table 8.1: Soil quality standard for housing and agricultural production

Parameters	Chemical Formula	Standard	Unit	Analytical Methods
Volatile Organic Compounds (VOCs)				
Benzene	C ₆ H ₆	Not exceed 6.5	mg/kg	
Carbon Tetrachloride	CCl ₄	Not exceed 2.5	mg/kg	
1,2-Dichloroethane	CH ₂ Cl-CH ₂ Cl	Not exceed 3.5	mg/kg	
1.1-Dichloroethylene	CCl ₂ =CH ₂	Not exceed 0.5	mg/kg	
Cis-1.2-Dichloroethylene	Cis-C ₂ H ₂ Cl ₂	Not exceed 43	mg/kg	

Trans-1.2-Dichloroethylene	Trans – C ₂ H ₂ Cl ₂	Not exceed 63	mg/kg	Gas Chromatography (GC) or Gas Chromatography/Mass Spectrometry (GC/MS)
Dichloromethane	CH ₂ Cl ₂	Not exceed 89	mg/kg	
Ethylbenzene	C ₆ H ₅ -C ₂ H ₅	Not exceed 230	mg/kg	
Styrene	C ₆ H ₅ -CH=CH ₂	Not Exceed 1,700	mg/kg	
Tetrachloroethylene	Cl ₂ C=CCl ₂	Not exceed 57	mg/kg	
Toluene	C ₆ H ₅ -CH ₃	Not exceed 520	mg/kg	
Trichloroethylene	Cl ₂ C=CHCl	Not exceed 28	mg/kg	
1,1,1-Trichloroethylene	Cl ₃ C-CH ₃	Not exceed 630	mg/kg	
1,1,2-Trichloroethane	Cl ₂ CH-CH ₂ Cl	Not exceed 8.4	mg/kg	
Xylene	<i>o, m, p</i> (CH ₃ -C ₆ H ₄ -CH ₃)	Not exceed 210	mg/kg	Gas Chromatography (GC) or Gas Chromatography/Mass Spectrometry (GC/MS)
Heavy Metals				
Arsenic	As	Not exceed 3.9	mg/kg	Inductivity Coupled Plasma-Atomic Emission Spectrometry (ICP/AES) or Inductivity Coupled Plasma-Mass Spectrometry (ICP/MS) or Atomic Absorption (AA)/Furnace Technique or Gaseous Hydride or Borohydride Reduction
Cadmium compound	Cd	Not exceed 37	mg/kg	ICP/AES or ICP/MS or AA/Direct Aspiration or

				AA/Furnace Technique
Chromium Hexavalent	Cr ⁺⁶	Not exceed 300	mg/kg	Co-Precipitation or Colorimetric or Chelation/Extraction
Lead	Pb	Not exceed 400	mg/kg	ICP/AES or ICP/MS or AA/Direct Aspiration or AA/Furnace Technique
Manganes compound	Mn	Not exceed 1,800	mg/kg	
Mercury compound	Hg	Not exceed 23	mg/kg	AA/Cold Vapor Technique
Nickel	Ni	Not exceed 1,600	mg/kg	ICP/AES or ICP/MS or AA/Direct Aspiration or AA/Furnace Technique
Selenium	Se	Not exceed 390	mg/kg	ICP/AES or AA/Furnace Technique or AA/Gaseous Hydride or AA/Borohydride Reduction
Other Chemicals				
Benzo (A) pyrene	C ₂₀ H ₁₂	Not exceed 0.6	mg/kg	GC/MS or TE/GC/MS, or GC/FT-IR
Cyanide compound	CN	Not exceed 11	mg/kg	Distillation or Total Amenable Cyanide (Automated Colorimetric, with offline Distillation) or Cyanide Extraction Procedure for Solids and Oils
Polychlorobiphenyls	PCBs	Not exceed 2.2	mg/kg	GC or GC/MS

Vinyl Chloride	$\text{CH}_2=\text{CHCl}$	Not exceed 1.5	mg/kg	GC or GC/MS
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Table 8.2: Soil Pollution Control Standard for other application purpose

Parameters	Chemical Formula	Standard	Unit	Analytical Methods
Volatile Organic Compounds (VOCs)				
Benzene	C_6H_6	Not exceed 15	mg/kg	GC/ or GC/MS
Carbon Tetrachloride	CCl_4	Not exceed 5.3	mg/kg	
1,2-Dichloroethane	$\text{CH}_2\text{Cl}-\text{CH}_2\text{Cl}$	Not exceed 7.6	mg/kg	
1.1-Dichloroethylene	$\text{CCl}_2=\text{CH}_2$	Not exceed 1.2	mg/kg	
Cis-1.2-Dichloroethylene	$\text{Cis}-\text{C}_2\text{H}_2\text{Cl}_2$	Not exceed 150	mg/kg	
Trans-1.2-Dichloroethylene	$\text{Trans} - \text{C}_2\text{H}_2\text{Cl}_2$	Not exceed 210	mg/kg	
Dichloromethane	CH_2Cl_2	Not exceed 210	mg/kg	
Ethylbenzene	$\text{C}_6\text{H}_5-\text{C}_2\text{H}_5$	Not exceed 230	mg/kg	
Styrene	$\text{C}_6\text{H}_5-\text{CH}=\text{CH}_2$	Not Exceed 1,700	mg/kg	

Tetrachloroethylene	Cl ₂ C=CCl ₂	Not exceed 190	mg/kg	
Toluene	C ₆ H ₅ -CH ₃	Not exceed 520	mg/kg	
Trichloroethylene	Cl ₂ C=CHCl	Not exceed 61	mg/kg	
1,1,1-Trichloroethylene	Cl ₃ C-CH ₃	Not exceed 1,400	mg/kg	
1,1,2-Trichloroethane	Cl ₂ CH-CH ₂ Cl	Not exceed 19		
Xylene	<i>o, m, p</i> (CH ₃ -C ₆ H ₄ -CH ₃)	Not exceed 210		
Heavy Metals				
Arsenic	As	Not exceed 27	mg/kg	ICP/AES or ICP/MS or AA/Furnace Technique or AA/Gaseous Hydride or AA/Borohydride Reduction
Cadmium compound	Cd	Not exceed 810	mg/kg	ICP/AES or ICP/MS or AA/Direct Aspiration or AA/Furnace Technique

Chromium Hexavalent	Cr ⁺⁶	Not exceed 640	mg/kg	Co-Precipitation or Colorimetric or Chelation/Extraction
Lead	Pb	Not exceed 750	mg/kg	ICP/AES or ICP/MS or AA/Direct Aspiration or AA/Furnace Technique
Manganes compound	Mn	Not exceed 32.000	mg/kg	
Mercury compound	Hg	Not exceed 610	mg/kg	AA/Cold Vapor Technique
Nickel	Ni	Not exceed 41,000	mg/kg	ICP/AES or ICP/MS or AA/Direct Aspiration or AA/Furnace Technique
Selenium	Se	Not exceed 10,000	mg/kg	
Pesticides				
Atrazine	C ₈ H ₁₄ ClN ₅	Not exceed 110	mg/kg	GC
Chlordane	C ₁₀ H ₆ Cl ₈	Not exceed 110	mg/kg	GC/MS
2,4-Dichlorophenoxyacetic acid	2,4-D (C ₁₄ H ₉ Cl ₅)	Not exceed 12,000	mg/kg	GC or HPLC or TE/GC/MS
Dichlorodiphenyltrichloroethane	DDT (C ₁₄ H ₉ Cl ₅)	Not exceed 120	mg/kg	

Dieldrin	$C_{12}H_8Cl_6O$	Not exceed 1.5	mg/kg	GC or GC/MS
Heptachlor	$C_{10}H_5Cl_7$	Not exceed 5.5	mg/kg	
Heptachlor epoxide	$C_{10}H_5Cl_7O$	Not exceed 2.7	mg/kg	
Lindane	$ClCH(CHCl)_4CHCl$ or $C_6H_6Cl_6$	Not exceed 29	mg/kg	
Pentachlorophenol	Cl_5C_6OH	Not exceed 110	mg/kg	GC or GC/MS or GC/FT-IR
Other Chemicals				
Benzo (A) pyrene	$C_{20}H_{12}$	Not exceed 2,9	mg/kg	GC/MS or TE/GC/MS or GC/FT-IR
Cyanide compound	CN^-	Not exceed 35	mg/kg	Distillation or Total Amenable Cyanide (Automated Chlorimetric, with off-line Distillation) or Cyanide Extraction Procedure for Solids and Oils
Polychlorbiphenyls	PCBs	Not exceed 10	mg/kg	GC
Vinyl Chloride	$CH_2=CHCl$	Not exceed 8.3	mg/kg	Purge and Trap GC or Purge and Trap GC/MS

Chapter 4 Water Standards

Article 9 Ambient water quality standards

Ambient water quality standard is permitted indicator that determines concentration load of chemicals and contaminants in surface water and groundwater as ambient water quality standard for the utilization and consumption without any harmful impact on human and animal life, health and environment.

Article 10 Surface water quality standard

Quality standard of surface water is permitted indicator of maximum concentration of chemicals and contaminants in the surface water without harm or impact on human, animal life, health and environment within standard limit of each type of water source as specified as follows:

Table 10: Classification of surface water quality

Parameters	Symbols	Standards for each quality criteria					Unit	Analytical Methods
		1	2	3	4	5		
Color, Oder and Taste	none	n	n'	n'	n'	none	unspecified	unspecified
Temperature	t °C	n	n'	n'	n'	unsp ecifi ed	°C	Thermometer
Potential of Hydrogen	pH	6-8	6-8	5-9	5-9	unsp ecifi ed	unspecified	Electrometric pH Meter
Dissolved Oxygen	DO	>7	6.0	4.0	2.0	<2	mg/L	Azide Modification
Electro-conductivity	Ec	<500	≤1000	≤2000	≤4000	>4000	μS/cm	Ec meter
Chemical oxygen demand	COD	>5	5 - 7	7-10	10-12	<12	mg/L	Potassium Dichlormate

								Digestion; or Closed Reflux
Total coliform bacteria	un specified	n	5,00 0	20,0 00	unsp ecifi ed	unsp ecifi ed	MPN/100 ml	Multiple Tube Fermentation Technique
Fecal coliform bacteria	unspecifi ed	n	1,00 0	4,00 0	unsp ecifi ed	unsp ecifi ed	MPN/100 ml	Multiple Tube Fermentation Technique
Total Suspended Solid	TSS	>10	≥25	≥40	≥60	<60	mg/L	Glass Fiber Filter Disc
Phosphate	PO ₄	>0.1	0.5	1	2	<2	mg/L	Ascorbic acid
Ammonium ion	NH ₄ ⁺	>0.5	≥1.5	≥3	≥4	<4	mg/L	Kjeldahl
Nitrate-Nitrogen	NO ₃ -N	n	0.5			unsp ecifi ed	mg/L	Cadmium Reduction
Parameters	Symbols	Standards of each category					Unit	Analytical Methods
		1	2	3	4	5		
Ammonia- Nitrogen	NH ₃ -N	n	0.5			unsp ecifi ed	mg/L	Distillation Nesslerization
Phenol	C ₆ H ₅ OH	n	0.005			unsp ecifi ed	mg/L	Distillation, 4- Amino antipyrène
Copper	Cu	n	1.5			unsp ecifi ed	mg/L	
Nickel	Ni	n	0.1			unsp ecifi ed	mg/L	

Manganese	Mn	n	1.0	unspecified	mg/L	AA-Direct Aspiration
Zinc	Zn	n	1.0	unspecified	mg/L	
Cadmium	Cd	n	0.003	unspecified	mg/L	
Chromium Hexavalent	Cr ⁺⁶	n	0.05	unspecified	mg/L	
Lead	Pb	n	0.01	unspecified	mg/L	
Mercury	Hg	n	0.001	unspecified	mg/L	AA-Cold Vapour Technique
Asenic	As	n	0.01	unspecified	mg/L	AA-Direct Aspiration, ICP
Cyanide	CN ⁻	n	0.07	unspecified	mg/L	
Radioactive					Becquerel/L	GC
-Alpha	-α	n	0.1	unspecified		
-Beta	-β		1.0			
Organochlorine pesticide		n	0.05	unspecified	mg/L	
Dichlorodiphenyltrichloroethane	DDT	n	1.0	unspecified	μg/L	

Alpha-Benzene hexachloride	α -BHC (C ₆ H ₆ Cl ₆)	n	0.02	unspecified	µg/L	GC
Dieldrin	C ₁₂ H ₈ Cl ₆ O	n	0.1	unspecified	µg/L	
Aldrin	C ₁₂ H ₈ Cl ₆	n	0.1	unspecified	µg/L	
Heptachlor and heptachlor epoxide	C ₁₀ H ₂ Cl ₇ and C ₁₀ H ₅ Cl ₇ O	n	0.2	unspecified	µg/L	
Endrin	C ₁₂ H ₂ Cl ₆ O	n		unspecified	µg/L	

Note:

- Category 1:** Water source with naturally good quality, without production process or contamination with any chemical and free of waste water from any kind of activity.
- Category 2:** Water source utilizing for consumption which has undergone disinfection process. This water category is suitable for conservation for aquatic animals, fisheries, water sports etc....
- Category 3:** Water source for consumption that requires disinfection. This water category is suitable for agriculture, livestock etc...
- Category 4:** Water source for consumption that requires disinfection. This water category is suitable for industrial purpose and catchment for receive waste water treatment.
- Category 5:** Water source utilizing for water communication and transport, suitable for utilizing as catchment and treatment of urban waste water.

Article 11 Quality Standards for Groundwater

Quality standards of groundwater is allowable indicative value determining maximum concentration of chemicals and pollutants in groundwater that causes no harm and impacts on

human, animal life, health and environment according to quality standards for groundwater as specified below:

Table 11: Standards for ambient groundwater

Parameters	Symbols	Maximum Standard	Unit	Method of Measurement
Volatile Organic Compounds (VOCs)				
Benzene	C ₆ H ₆	0.005	mg/L	Purge and Trap GC or Purge and Trap GC/
Carbon Tetrachloride	CCl ₄	0.005	mg/L	
1,2-Dichloroethane	CH ₂ Cl-CH ₂ Cl	0.005	mg/L	
1,2-Dichloroethylene	CCl ₂ =CH ₂	0.007	mg/L	
Cis-1,1-Dichloroethylene	Cis-C ₂ H ₂ Cl ₂	0.070	mg/L	
Trans-1,1-Dichloroethylene	Trans-C ₂ H ₂ Cl ₂	0.1	mg/L	
Dichloromethane	CH ₂ Cl ₂	0.005	mg/L	
Ethylenebenzene	C ₆ H ₅ -C ₂ H ₅	0.7	mg/L	
Styrene	C ₆ H ₅ -CH=CH ₂	0.1	mg/L	
Tetrachloroethylene	Cl ₂ C=CCl ₂	0.005	mg/L	
Toluene	C ₆ H ₅ -CH ₃	1	mg/L	
Trichloroethylene	Cl ₂ C=CHCl	0.005	mg/L	
1,1,1-Trichloroethane	Cl ₃ C-CH ₃	0.2	mg/L	
1,1,2-Trichloroethane	Cl ₂ CH-CH ₂ Cl	0.005	mg/L	
Xylene	<i>o, m, p</i> (CH ₃ -C ₆ H ₄ -CH ₃)	10	mg/L	
Lead	Pb	0.01	mg/L	

Manganese	Mn	0.5	mg/L	AA-Direct Aspiration or ICP/AES
Nickel	Ni	0.02	mg/L	
Zinc	Zn	5	mg/L	
Arsenic	As	0.01	mg/L	AA-Hydride Generation or ICP/Plasma Emission Spectroscopy
Selenium	Se	0.01	mg/L	
Mercury	Hg	0.001	mg/L	AA- ColdVapour/Plasma Emission Spectroscopy
Other Chemicals				
Benzo (A) pyrene	C ₂₀ H ₁₂	0.0002	mg/L	Liquid-Liquid Extraction Chromatography or Liquid-Liquid Extraction Gas Chromatography/Mass Spectrometry
Cyanide	CN ⁻	0.07	mg/L	Pyridine Barbituric Acid or Colorimetric or Iron Chromatography
Polychlorophenyls	PCBs	0.0005	mg/L	Liquid-Liquid Extraction Gas Chromatography
Vinyl Chloride	CH ₂ =CHCl	0.002	mg/L	Purge and Trap Gas Chromatography or Purge and Trap Gas Chromatography/Mass Spectrometry
Heavy Metals				
Cadmium	Cd	0.003	mg/L	AA-Direct Aspiration or ICP/AES
Chromium Hexavalent	Cr ⁶⁺	0.05	mg/L	

Copper	Cu	1.5	mg/L	
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Table 11.1: Ground water standard for consumption

Parameters	Symbols	Maximum Standard	Unit
Color	-	15	-
Turbidity	-	20	NTU
Potential of Hydrogen	pH	6.5-9.0	-
Iron	Fe	1.0	mg/L
Manganese	Mn	0.5	mg/L
Copper	Cu	1.5	mg/L
Chromium Hexavalent	Cr 6 ⁺	0.05	mg/L
Zinc	Zn	15.0	mg/L
Sulphate	SO ₄ ²⁻	250	mg/L
Chloride	Cl ⁻	600	mg/L
Fluoride	F ⁻	1.0	mg/L
Nitrate	NO ₃ ⁻	45	mg/L
Total Hardness	Non-carbonate as CaCO ₃	250	mg/L
Total Suspended Solid	TSS	1,200	mg/L
Arsenic	As	0.01	mg/L
Cyanide	CN ⁻	0.07	mg/L
Lead	Pb	0.01	mg/L
Mercury	Hg	0.001	mg/L
Cadmium	Cd	0.003	mg/L
Selenium	Se	0.01	mg/L

Bacteria (Standard Plate Count Method)	-	500	Colonies/cm ³
Coliform Bacteria	-	2.2	MPN/100 cm ³
<i>E.coli</i> Bacteria	-	Must don't have	-

Article 12 Drinking water Quality Standard

Drinking water quality standard is parameter determines maximum concentration of chemicals and ingestion in the water that be able to drink without danger and impact to life, health of the consumer as mention in drinking water quality standard as bellowed:

Table 12: Drinking water quality standards

Parameters	Symbols	Maximum Standard	Unit
Color	-	10	Platinum-Cobalt (Pt-Co)
Taste	-	-	-
Odor	-	-	-
Turbidity	-	15	NTU
Potential of Hydrogen	pH	6.5-8.5	-
Total Solid	TS	1000	mg/L
Aluminium	Al	0.2	mg/L
Ammonia	NH ₃	1.5	mg/L
Iron	Fe	1.0	mg/L
Manganese	Mn	0.5	mg/L
Sodium	Na	250	mg/L
Iron and Manganese	Fe & Mn	1.0	mg/L
Copper	Cu	1.5	mg/L
Zinc	Zn	15	mg/L
Calsium	Ca	150	mg/L
Magnesium	Mg	100	mg/L

Sulphate	SO ₄ ²⁻	250	mg/L
Hydrogen Sulfide	H ₂ S	0.1	mg/L
Sodium Chloride	NaCl	320	mg/L
Chloride	Cl ⁻	250	mg/L
Fluoride	F ⁻	1.0	mg/L
Nitrate	NO ₃ ⁻	45	mg/L
Alkylbenzenesulfonate	C ₁₈ H ₂₉ NaO ₃ S	1.0	mg/L
Phenol compound	C ₆ H ₆ O	0.002	mg/L
Mercury	Hg	0.001	mg/L
Lead	Pb	0.01	mg/L
Arsenic	As	0.01	mg/L
Selenium	Se	0.01	mg/L
Chromium Hexavalent	Cr ⁺⁶	0.05	mg/L
Cyanide	CN ⁻	0.07	mg/L
Cadmium	Cd	0.003	mg/L
Barium	Ba	1.0	mg/L
Resident Chlorine (Disinfection)	Cl ₂	Less than 0.2	mg/L
SPC Bacteria (Standard Plate Count Method)	-	500	Colonies/cm ³
Coliform bacteria	-	Less than 2.2	MPN/100 cm ³
<i>E.coli</i> Bacteria	-	Must don't have	MPN/100 cm ³

Article 13: Drinking Water in Container Quality Standard

Drinking water in container quality standard is a parameter determines maximum concentration of chemicals and ingestion in the water that be able to drink without danger and impact to life, health of the consumer as mention in drinking water quality standard as bellowed:

Table 13: Drinking water in container quality standard

Parameter	Symbol	Standard	Unit
Color	-	15	Platinum-Cobalt (Pt-Co)
Odor	-	-	-
Turbidity	-	5	NTU
Potential of Hydrogen	pH	6.5-8.5	-
Total Solid	TS	500	mg/L
Arsenic	As	0.01	mg/L
Barium	Ba	1.0	mg/L
Boron	B	0.5	mg/L
Cadmium	Cd	0.003	mg/L
Chloride	Cl ⁻	250	mg/L
Chromium	Cr	0.05	mg/L
Copper	Cu	1.5	mg/L
Iron	Fe	1.0	mg/L
Lead	Pb	0.01	mg/L
Manganese	Mn	0.5	mg/L
Mercury	Hg	0.001	mg/L
Nitrate-Nitrogen	NO ₃ -N	4.0	mg/L
Phenol	C ₆ H ₆ O	0.001	mg/L
Selenium	Se	0.01	mg/L
Silver	Ag	0.05	mg/L
Sulphate	SO ₄ ²⁻	250	mg/L
Zinc	Zn	15	mg/L
Fluoride	F ⁻	1.0	mg/L

Aluminium	Al	0.2	mg/L
Alkylbenzenesulfonate	C ₁₈ H ₂₉ NaO ₃ S	0.2	mg/L
Cyanide	CN ⁻	0.07	mg/L
Coliform Bacteria	-	2.2	MPN/100 cm ³
<i>E.coli</i> Bacteria	-	Must don't have	MPN/100 cm ³
Pathogen Bacteria	-	Must don't have	MPN/100 cm ³

Article 14: Water Pollution Control Standard

Water Pollution Control Standard is a parameter determines maximum concentration of chemicals and ingestion in waste water passing the treatment process and dilution discharge to the public water source of natural water source and to guarantee the non-danger and non-impact to life, health of people, animals and environment according to the parameter of water pollution control standard as mentioned bellowed:

Table 14: Water Pollution Control Standard from general industries

Parameter	Symbol	Maximum Standard allowed	Unit	Method of Measurement
Potential of Hydrogen	pH	6-8.5	-	pH Meter
Total Dissolved	TDS	Not more than 2,500 mg/L according to the type of industry and receiver but not more than 5,000 mg/L	mg/L	Dry evaporation at temperature 103-105°C, 1 hour
Total Suspended Solid	TSS	Not more than 50 mg/L according to the type of industry and receiver but not more than 150 mg/L	mg/L	Glass Fiber Filter Disc
Temperature	t	Not more than 40	°C	Temperature Meter

Color and Odor	-	Must not occurred	-	General
Hydrogen Sulfide	H ₂ S	Not more than 1.0	mg/L	Titration
Cyanide	CN ⁻	Not more than 0.2	mg/L	Distillation and Pyridine Barbituric Weight
Fat, Oil and Grease	FOG	Not more than 0.5 mg/L according to the type of industry and receiver but not more than 15.0 mg/L	mg/L	Solvent Extraction by Weight
Formaldehyde	CH ₂ O	Not more than 1.0	mg/L	Spectrophotometry
Phenol	C ₆ H ₅ OH	Not more than 1.0	mg/L	Distillation and Aminoantipyrine Method 4
Chlorine	Cl ⁻	Not more than 1.0	mg/L	Iodometric Method
Pesticide	-	Must not have	mg/L	GC
Biological Oxygen Demand 5 Days	BOD ₅	Not more than 30 mg/L according to the type of industry and receiver but not more than 60 mg/L	mg/L	Azide Modification at 20°C, 5 days
Total Nitrogen	TKN	Not more than 100 mg/L according to the type of industry and receiver but not more than 200 mg/L	mg/L	Kjeldahl

Chemical Oxygen Demand	COD	Not more than 120 mg/L according to the type of industry and receiver but not more than 400 mg/L	mg/L	Potassium Dichromate Digestion; Open Reflex or Closed Reflux
Heavy metals				
Zinc	Zn	Not more than 5.0	mg/L	AA/AES; ICP
Chromium Hexavalent	Cr ⁺⁶	Not more than 0.25	mg/L	
Chromium Trivalent	Cr ⁺³	Not more than 0.75	mg/L	
Copper	Cu	Not more than 2.0	mg/L	
Cadmium	Cd	Not more than 0.03	mg/L	
Barium	Ba	Not more than 1.0	mg/L	
Lead	Pb	Not more than 0.2	mg/L	
Nickel	Ni	Not more than 1.0	mg/L	
Manganese	Mn	Not more than 5.0	mg/L	
Arsenic	As	Not more than 0.25	mg/L	AA-Hydride Generation or ICP
Selenium	Se	Not more than 0.02	mg/L	
Mercury	Hg	Not more than 0.005	mg/L	AA-Cold Vapour Technique

Table 14.1: Type and size of building must control water pollution

Type	Size				
	A	B	C	D	E
Condominium	500 rooms or more	100 rooms but not more than 500 rooms	Less than 100 rooms	-	-
Hotel	200 rooms or more	60 rooms but not more than 200 rooms	Less than 60 rooms	-	-
Dormitory	-	more than 250 rooms	50 rooms but not more than 250 room	10 rooms but not more than 50 room	-
Massage parlor (or similar)	-	More than 5,000 m ²	1000 m ² bit not more than 5,000 m ²	-	-
Hospital	30 beds or more	10 beds but not more than 30 beds	-	-	-
School, Academic, institute	25,000 m ² or more	5,000 m ² but more than 25,000 m ²	-	-	-
Office	55,000 m ² or more	10,000 but not more than 55,000 m ²	5,000 but not more than 10,000 m ²	-	-
Commercial Center	25,000 m ² or more	5,000 but not more than 25,000 m ²	-	-	-
Flesh market	2,500 m ² or more	1,500 but not more than 2,500 m ²	1,000 but not more than 1,500 m ²	500 but not more than 1,000 m ²	-
Restaurant, Food center	2,500 m ² or more	500 but not more than 2,500 m ²	250 but not more than 500 m ²	100 but not more than 250 m ²	Less than 100 m ²

Table 14.2: Water pollution control standards from building

Parameter	Symbol	Maximum permit for each type					Unit	Method of Measurement
		A	B	C	D	E		
Potential of Hydrogen	pH	5.5-8.5	5.5-8.5	5.5-8.5	5.5-8.5	5.5-8.5	-	pH Meter
Biological Oxygen Demand 5 Days	BOD ₅	20	30	40	50	60	mg/L	Azide Modification at 20°C, 5 days
Total Suspended Solid	TSS	30	40	50	50	60	mg/L	Glass Fiber Filter Disc
Sediment Solid	SS	0.5	0.5	0.5	0.5	-	mg/L	Imhoff Cone 1,000 cm ³ 1hour
Total Dissolved Solid	TDS	500	500	500	500	-	mg/L	Dry Evaporation 103-105°C 1 hour
Sulfide	S ²⁻	1.0	1.0	3.0	4.0	-	mg/L	Titration
Nitrogen	TKN	35	35	40	40	-	mg/L	Kjeldahor colormatric
Fat, Oil and Grease	FOG	20	20	20	20	100	mg/L	Solvent Extraction by Weight

Table 14.3: Water pollution control standard for housing estate

Parameter	Symbol	Maximum permit for each type		Unit	Method of Measurement
		(A) 100 units but not exceed 500	(B) Exceed 500 units		
Potential of Hydrogen	pH	5.5-8.5	5.5-8.5	-	pH Meter

Biological Oxygen Demand 5 Days	BOD ₅	30	20	mg/L	Azide Modification at 20°C, 5 days
Total Suspended Solid	TSS	40	30	mg/L	Glass Fiber Filter Disc
Sediment Solid	SS	0.5	0.5	mg/L	Imhoff Cone 1,000 cm ³ 1 hour
Total Dissolved Solid	TDS	500	500	mg/L	Dry Evaporation 103-105°C 1 hour
Sulfide	S ²⁻	1.0	1.0	mg/L	Titration
Nitrogen	TKN	35	35	mg/L	Kjeldahor colormatric
Fat, Oil and Grease	FOG	20	20	mg/L	Solvent Extraction by Weight

Table 14.4: Water pollution control standard for toilet

Parameter	Symbol	Standard	Unit	Method of Measurement
Potential of Hydrogen	pH	6-9	-	pH Meter
Biological Oxygen Demand 5 Days	BOD ₅	30	mg/L	Azide Modification at 20°C, 5 days
Chemical Oxygen Demand	COD	125	mg/L	Potassium Dichromate Digestion; Open Reflux or Close Reflux

Total Suspended Solid	TSS	50	mg/L	Glass Fiber Filter Disc
Total Nitrogen	TKN	10	mg/L	Kjeldahl
Phenol	C ₆ H ₅ OH		mg/L	Distillation and Aminoantipyrine Method 4
Fat, Oil and Grease	FOG	5.0	mg/L	Solvent Extraction by Weight
Total Dissolved Solid	TDS	400	MPN/ml	Dry Evaporation 103-105°C 1 hour

Table 14.5: Water pollution control standard to public drainage

Parameter	Symbol	Standard	Unit	Method of Measurement
Potential of Hydrogen	pH	5.5-8.5	-	pH Meter
Electro-Conductivity	Ec	2,000	μS/cm	
Total Dissolved Solid	TDS	1,200	mg/L	Dry Evaporation 103-105°C 1 hour
Biological Oxygen Demand 5 Days	BOD ₅	30	mg/L	Azide Modification at 20°C, 5 days
Total Suspended Solid	TSS	30	mg/L	Glass Fiber Filter Disc
Per-manganese	MnO ₄ ⁻	6.0	mg/L	Titration
Hydrogen Sulfide	H ₂ S	1.0	mg/L	Titration
Cyanide	CN ⁻	0.2	mg/L	Distillation and Pyridine Barbituric Acid

Fat, Oil and Grease	FOG	5.0	mg/L	Solvent Extraction by Weight
Formaldehyde	CH ₂ O	1.0	mg/L	Spectrophotometry
Phenol and Cresol	C ₆ H ₅ OU	1.0	mg/L	Distillation and Aminoantipyrine
Resident Chlorine	Cl ⁻	1.0	mg/L	Lodometric Method
Radioactive	-	none	mg/L	General
Color and Odor	-	Cannot be observed	mg/L	General
Tar	-	none	mg/L	General
Heavy Metals				
Zinc	Zn	5.0	mg/L	Atomic Absorption (AA)
Chromium Hexavalent	Cr ⁺⁶	0.3		
Arsenic	As	0.25		
Copper	Cu	1.0		
Mercury	Hg	0.005		
Cadmium	Cd	0.03		
Selenium	Se	0.02		
Lead	Pb	0.1		
Nickel	Ni	0.2		
Manganese	Mn	0.5		

Table 14.6: Water pollution control standard from pig farm

Parameter	Symbol	Maximum permit for each type		Unit	Method of Measurement
		Standard A	Standard B		

Potential of Hydrogen	pH	5.5-8.5	5.5-8.5	-	pH Meter
Biological Oxygen Demand 5 Days	BOD ₅	Not exceed 60	Not exceed 100	mg/L	Azide Modification at 20°C, 5 days
Chemical Oxygen Demand	COD	Not exceed 300	Not exceed 400	mg/L	Potassium Dichromate Digestion; Open Reflux or Close Reflux
Total Suspended Solid	TSS	Not exceed 150	Not exceed 200	mg/L	Glass Fiber Filter Disc, Dry Evaporation 103-105°C
Total Nitrogen	TKN	Not exceed 120	Not exceed 200	mg/L	Kjeldahl, Colorimetric or Ammonia Selective Electrode

Note:

Standard A

- Big farm raising exceed 400 animal unit
- Medium farm raising exceed 60-400 animal unit

Standard B

Small farm raising 6 but not exceed 60 animal unit

- 1 animal unit = 500 kg
- Pig breed average weight = 170kg/unit
- Pork average weight = 60kg/unit
- Piglet average weight = 12kg/unit

Table 14.7: Water pollution control standard for car care and petrol station

Parameter	Symbol	Duration and Maximum permit	Unit	Method of Measurement
Potential of Hydrogen	pH	5.5-8.5	mg/L	pH Meter

Chemical Oxygen Demand	COD	Not exceed 200	mg/L	Potassium Dichromate Digestion
Total Suspended Solid	TSS	Not exceed 60	mg/L	Glass Fiber Filter Disc
Fat, Oil and Grease	FOG	Not exceed 15	mg/L	Extract with solvent after solvent evaporation the oil and grease content

Note: For Industrial zone or various factories located in the same area particular standard would be issued.

Chapter 5 Noise and Vibration Standards

Article 15 Ambient noise standards

Ambient noise standards is indicator identifying noise level permitted to produce from noise point sources without interference and affecting to life, human and animal health and environment which must be controlled in general noise standards as bellowed:

Table 15: Ambient noise standards

Standards	Method of Measuring the Volume
Highest noise (L_{max}) not exceed 115 dB (A)	Measure volume (L_{eq}) during the changes of the volume
24 hours average volume (L_{eq24}) not exceed 70 dB (A)	Measure volume (L_{eq}) continuously

Table 15.1: Interference noise control standard

Volume standard	Method of Measuring Volume
Volume differences in interfered duration with basic volume (L_{90}) not exceed 10 dB (A)	If the duration of Interfered noise is not exceeded 1 hour, use 1 hour volume measurement (L_{eq} 1 hr)
	If the duration of Interfered noise is exceeded 1 hour, conduct volume measuring in the place
	If the duration of interfered noise is not continued in 1 hour, conduct the volume measuring for 1 hour (L_{eq} 1 hour)

	For the place that need the quietness such as: hospital, school and gexceednment office and etc. or in duration from 22:00 to 6:00, conduct the 5 mins average volume (L_{eq} 5 min) and plus 3 dB (A)
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Table 15.2: Noise control standards for engines and vehicles

Standards	Method of Measuring
1. Engine for maritime	
Measure 0.5m from the tip pipe, not exceed 100 dB (A)	Diesel engine: accelerate until the maximum round of the engine per minutes
Test for 2 times by using the highest value. If there is exceeded 2 dB (A) differences, redo the test	Benzene engine: accelerates $\frac{3}{4}$ of the maximum round of the engine
2. Engine for general vehicle	
Measure 7.5m from the tip pipe, not exceed 85 dB (A)	Diesel engine: accelerate until the maximum round of the engine per minutes
Measure 0.5m from the tip pipe, not exceed 100 dB (A)	Benzene engine: accelerates $\frac{3}{4}$ of the maximum round of the engine
Engine for motorbike	
Measure 0.5m from the tip pipe, not exceed 95 dB (A)	accelerates $\frac{3}{4}$ of the maximum round of the engine, if the engine round is not exceeded 5,000 round per minute
	accelerates $\frac{1}{3}$ of the maximum round of the engine, if the engine round is exceeded 5,000 round per minute

Table 15.3: Noise control standards for mining activities and rock explosion

Standard	Volume measuring
The Maximum volume must not exceed 115 dB (A)	Maximum volume measuring is Sound pressure Level (SPL) during rock explosion
Continued volume (L_{eq}) for 8 hours not exceed 75 dB (A)	Average 8 hours volume measuring conducted measuring standard during 8 hours of stone crushing

Continued volume (L_{eq}) for 8 hours not exceed 70 dB (A)	Average 24 hours volume measuring conducted measuring standard during 24 hours
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Article 16 Vibration control standards

Vibration control standards is indicator determines vibration level permitted which not affect to components or structure of the building as vibration control standards bellowed:

Table 16: Vibration control standards for engines and vehicles

Frequency (Hertz)	Velocity (mm/s)	Displacement (mm)
1	4.7	0.75
2	9.4	0.75
3	12.7	0.67
4	12.7	0.51
5	12.7	0.40
6	12.7	0.34
7	12.7	0.29
8	12.7	0.25
9	12.7	0.23
10	12.7	0.23
11	12.7	0.20
12	13.8	0.20
13	15.1	0.20
14	16.3	0.20
15	17.6	0.20
16	18.8	0.20
17	20.1	0.20
18	21.4	0.20
19	22.6	0.20

20	23.9	0.20
21	25.1	0.20
22	26.4	0.20
23	27.6	0.20
24	28.9	0.20
25	30.2	0.20
26	31.4	0.20
27	32.7	0.20
28	33.9	0.20
28	35.2	0.20
30	36.4	0.20
31	37.7	0.20
32	39.0	0.20
33	40.2	0.20
34	41.5	0.20
35	42.7	0.20
36	44.0	0.20
37	45.2	0.20
38	46.5	0.20
39	47.8	0.20
40	50.8	0.20

Table 16.1: Method of measuring vibration

Measuring equipment installation	Method of measuring
Install the vibration measuring equipment on the ground	Use object-tools to stabilize vibration measuring equipment and without moving

Install the vibration measuring equipment on the concrete ground outside the building	Measure on the concrete located in the same level as the ground which is not higher than 0.5 m from the ground and stabilize the equipment from moving.
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Chapter 6

Final Provision

Article 17 Implementation

Ministry of Natural Resources and Environment gives right to Pollution Control Department to directly responsible and collaborate with concern sectors and local authorities to effectively disseminate, expand and implement the decision.

Article 18 Entry into Force

This Decision enter into force of the date of signature and after 15 days of registering into the periodic of the government. Concerned sectors can develop standards for particular activities to control pollution but the parameter must under this National Environmental Quality Standards.

Any terms or conditions inaccurate to this Decision must be invalid.

This Decision replaces the Decision on National Environmental Quality Standards No. 2734/PO-WREA, dated 7 December 2009.

Minister

Sommath Polsena