THE KINGDOM OF CAMBODIA
MINISTRY OF ENVIRONMENT

THE PROJECT FOR EFFECTIVE IMPLEMENTATION OF EIA AND POLLUTION CONTROL THROUGH THE CAPACITY DEVELOPMENT OF MOE

ANNEX VOLUME II

DECEMBER 2021

JAPAN INTERNATIONAL COOPERATION AGENCY
CTI ENGINEERING INTERNATIONAL CO., LTD.
ENVIRONMENT AND SOCIAL INFRASTRUCTURE CONSULTANT CO., LTD.
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Annex 15 Guideline on Snack Foods Factory Inspection

Factory Inspection and Water Pollution Control Guidelines
SNACK FOODS INDUSTRY

Factory Inspection and Water Pollution Control Guidelines
SNACK FOODS INDUSTRY

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1. INTRODUCTION

1.1 Rationale

This factory inspection and industrial (water) pollution control guideline for the central kitchen or commissary industry was prepared under the ***Project for Effective Implementation of EIA and Pollution Control through Capacity Development of Ministry of Environment in the Kingdom of Cambodia*** to enhance the enforcement capacity of environmental inspectors and officers by providing industry specific technical information on (water) pollution sources, characteristics, and treatment methods in the central kitchen or commissary industry.

1.2 Snack Foods Industry in Cambodia

Snack foods are small servings of food consumed between main meals. Snack foods are often pre-cooked and packaged in convenient sizes for individual consumption. Street food such as traditional Cambodian delicacies that are consumed after main meals or between meals can be classified as snack foods. Since these street food native delicacies are often prepared in the street food stalls, they are generally small scale.

These guidelines are prepared for industrial size, snack foods production operations. At present, many of the processed and pre-packed snack foods available in supermarkets, grocery stores, and even street-side stores are produced outside Cambodia and are imported to meet the demand. It is expected the local facilities for the production of snack foods will increase as the market for processed and pre-packaged snack foods continues to expand.

2. PROCESSED SNACK FOODS PRODUCTION OPERATIONS

2.1 Introduction

Snack foods produced in industrial factories may be broadly classified as baked and fried snack foods. Baked snack foods include cookies, breads, and (cup) cakes. Fried snack foods include potato chips, nachos (corn chips), and doughnuts.

2.2 Baking Snack Foods

Baking involves the combining of dry raw materials such as flour, sugar, and salt and blending or mixing with liquid raw materials, kneading, aging or maturing, and cooking with dry heat as in an oven. As such, the baking operations themselves do not generate any process wastewater.

In industrial scale snack foods production, the baked products are packaged for distribution and to wholesale or retail sales outlets. While suitable for direct sale and consumption after baking, only snack foods from small scale operations are sold directly to consumers.

2.3 Fried Snack Foods

Fried snack foods undergo a more water intensive production process. For corn chips (such as nachos and tortillas), the corn is first steeped or soaked in lime solution, then cooked (usually with mixing and agitation). This breaks down the corn kernels and allow the separation of the hulls from the kernels. The kernels are then ground into flour and the corn flour meal is then molded into the desired shape, fried, and seasoned before packing. In some cases, the molded corn flour meal is baked instead of fried to reduce oil or calorie content.

In the case of French fries or potato chips production, potatoes are peeled, sliced into thin strips, then washed, blanched (briefly soaked in hot water), dried, then fried. Salt and other seasoning or flavors may be added before packaging.

3. WASTEWATER GENERATION

3.1 Sources of Wastewater

While both types of snack food products generate wastewater with high organic matter content (measured as BOD and/or COD), wastewater generated in the production of fried snack foods also contain a high concentration of fats, oils, and grease.

The production of baked snack foods itself does not generate any process wastewater. Most of the wastewater from the baking process comes from washing of pots, pans, vats, and utensils. At the end of a work shift, the tables, floors, and walls are also washed cleaned, generating more wastewater.

In the production of fried snack foods, process wastewater is generated from washing of the raw or semi-processed materials (such as potato chips) and soaking and cooking of corn. Frying adds oil in the process wastewater. Even when baked, process wastewater of snack foods based on corn contain oil from the corn raw materials.

3.2 Characteristics of Wastewater from Snack Foods Production

3.2.1 Wastewater Volume

The specific wastewater volume generation from **baking operations** typically ranges from **4 to 9 liters per kg of raw materials (mainly flour)** with an **average** of **6 liters per kg of raw materials (mainly flour)**.

The specific wastewater volume generation from **conventional cooking operations** typically ranges from **50 to 90 liters per kg of raw materials (meat, vegetables, and others)** with an **average** of **75 liters per kg of raw materials (meat, vegetables, and others)**.

3.2.2 Quality of Wastewater from Central Kitchen or Commissary Operations

Parameter	Bakery Only	Combined Operations
Biochemical Oxygen Demand, BOD_5	1,200 – 2,000 mg/l	600 – 3,000 mg/l
Chemical Oxygen Demand, COD	2,000 – 3,000 mg/l	2,000 – 7,000 mg/l
Total Suspended Solids, TSS	500 – 1,000 mg/l	1,000 – 2,000 mg/l
pH	pH 4.0 – pH 6.5	pH 4.5 – pH 6.0
Fats, Oil, and Grease	200 –400 mg/l	250 -3,500 mg/l
Ammonia-Nitrogen	10 –50 mg/l	40 -120 mg/l
Nitrate- Nitrogen	<1.0 – 5.0 mg/l	<1.0 – 5.0 mg/l
Phosphates	20 – 100 mg/l	50 – 120 mg/l
Total Coliforms, MPN/100 mL	Up to 1.2 x 10^6	Up to 1.2 x 109

4. WASTEWATER TREATMENT

4.1 Introduction

Wastewater from the food industry such as central kitchens or commissaries is characterized by high concentrations of organic matter, measured as BOD_5 and/or COD, FOG (fats, oil, & grease), and nutrients (phosphates, nitrates, and ammonia)

The schematic process flow diagram shown in **Figure 1** below shows a typical, conventional treatment processes suitable for the treatment of central kitchen or commissary wastewater.

4.2 Physical Treatment Processes

Physical treatment processes rely on physical properties of contaminants to effect treatment. Physical treatment processes are best suited for the removal of discrete solids from water because they are effective and very economical, especially in terms of cost per unit quantity of pollutant removed.

4.2.1 Screening

Wastewater from a bakery or central kitchen may contain a high concentration suspended solids mostly flour. Conventional cooking or kitchen operations likewise generate significant amounts of large suspended solids. These suspended solids, which are mostly organic, contribute significantly to the BOD and COD and must be removed as soon as possible. Suspended solids may be removed by sedimentation or flotation or by screening. Screening is advisable because it is the most cost effective method for removing BOD or COD due to the suspended solids

The size of screening equipment is based on the flow rate, size of openings, and solids load. The effectiveness or degree of removal of solids is also dependent on these factors and varies considerably from less than 30% to more than 70%.

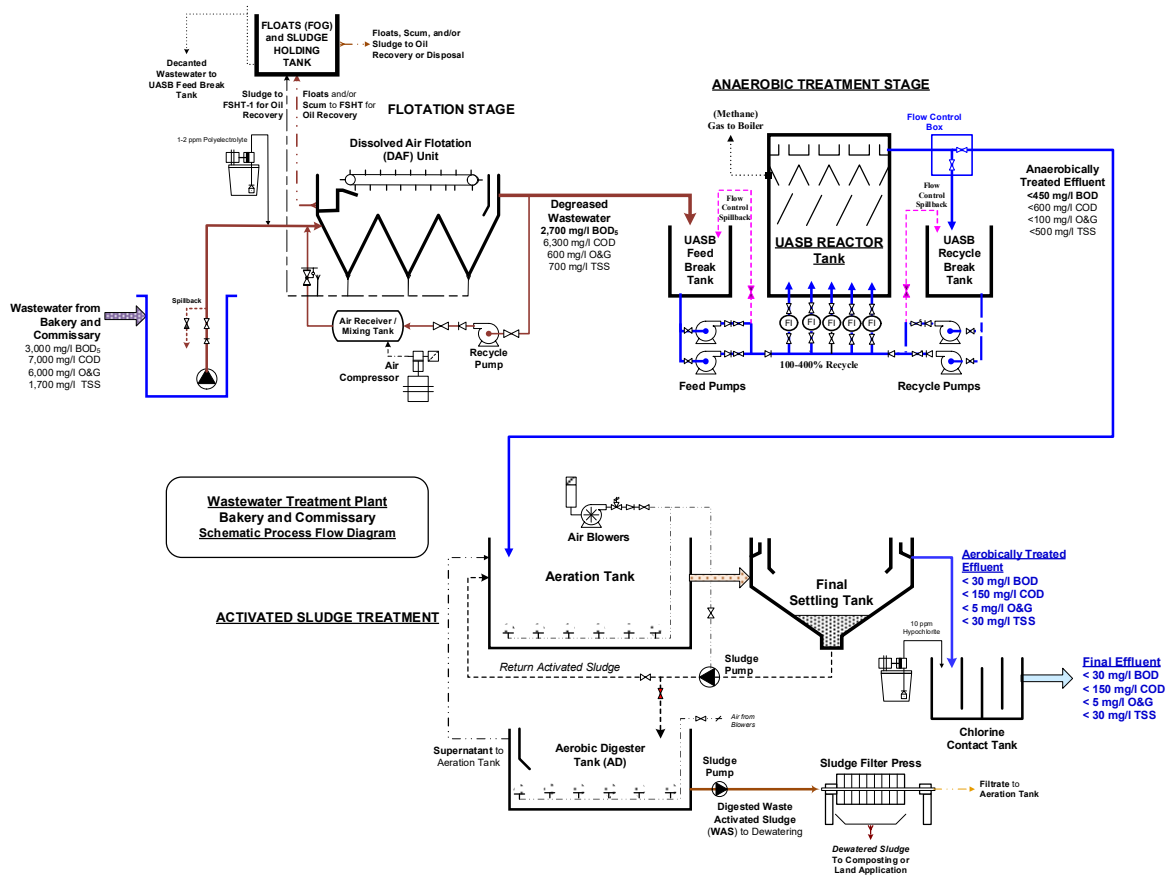

Figure 1 Typical Wastewater Treatment Plant for Central Kitchen Wastewater

4.3 Biological Treatment Processes

4.3.1 Anaerobic Treatment

Anaerobic treatment is generally applied on high BOD strength wastewater and organic sludges. Anaerobic processes take place in the absence of oxygen. In biochemical reactions, oxygen generally acts as electron receptor in the process of extracting energy from the organic material. In the absence of free oxygen, other chemical species such as nitrates and sulfates can serve as oxygen donors in *anoxic* reactions. In the absence of even such oxygen donors, other compounds, generally complex organic compounds, serve as electron receptors.

One major advantage of anaerobic treatment systems is the low energy consumption, or in many cases, net energy yield (from the methane gas generated). Their disadvantage is the much slower reaction rates which generally translates to longer reaction (holding) times and larger tanks.

In general, anaerobic treatment processes are cost effective when the influent BOD concentration is 2,000-3,000 mg/l or higher. Anaerobic treatment processes can attain BOD reduction efficiencies of more than 75-90%. However, due to the high BOD concentration of the influent, the effluent of anaerobic treatment systems needs polishing treatment (usually by aerobic processes) to attain compliance with discharge standards.

The biochemical oxygen demand (BOD) of raw wastewater from bakeries and even from conventional kitchens often exceeds 2,000-3,000 mg/l. Hence, anaerobic treatment systems are often used as the first biological treatment stage in treating wastewater from central kitchens or commissaries.

Upflow Anaerobic Sludge Blanket (UASB) Reactors: UASB reactors have been successfully applied in the treatment of central kitchen or commissary wastewater. UASB reactors can attain high reduction efficiencies of 80%-95% at high organic loading which results in a compact system. Due to the tendency of suspended solids in the influent wastewater to displace the UASB granules and sludge, it is critically important to reduce the suspended solids content of the influent to the UASB reactors. Fats, oil, and grease are inhibitory to biological processes and promote loss of biosolids (microorganisms responsible for treating wastewater).

It should also be noted that anaerobic microorganisms are more aggressive. Coupled with the long hydraulic retention times, this results in the breakdown of organic substances which are otherwise difficult to biodegrade by aerobic microorganisms. This results in lower COD concentrations in the anaerobically digested or treated wastewater but higher BOD:COD ratios. This increase in the aerobically biodegradable fraction must be taken into account in designing the subsequent aerobic biological polishing treatment stage.

4.3.2 Aerobic Biological Treatment: Activated Sludge Process

While anaerobic treatment can attain BOD and COD reduction efficiencies exceeding 90%, the high BOD and COD concentration of central kitchen or commissary wastewater results in BOD and COD concentrations in the anaerobically treated central kitchen or commissary wastewater to exceed effluent standards. Hence, further treatment is required to polish the anaerobically treated effluent in order to comply with effluent standards.

The *activated sludge* treatment process is an aerobic, suspended-growth system. It is the most common biological treatment process because of its high BOD reduction efficiency, stability, reliability, and ease of operation.

The activated sludge treatment process consists of an aeration tank and a (final or secondary) settling tank. Wastewater flows into the aeration tank where biologically active sludge recycled from the (final or secondary) settling tank is mixed with the influent wastewater. The activated sludge microorganisms consume the organic pollutants (measured as BOD_5 and COD) which serve as their food or substrate, and convert them to harmless carbon dioxide, water, and additional cell mass. An aeration system provides the oxygen required for the degradation of the organic pollutants and the mixing energy to keep the activated sludge flocs in suspension.

Activated sludge treatment process can reduce BOD by over 90-95% and suspended solids by 80-90%.

While many factors affect the performance of an activated sludge treatment system, one of the most important is the ratio of food (BOD) to microorganism or food to mass (F:M) ratio. A food to mass (F:M) ratio of 0.05 – 0.15 kg BOD_5/day/kg microorganisms will consistently produce treated effluent BOD_5 concentrations below 20 - 30 mg/l and effluent suspended solids concentrations below 30 – 50 mg/l.

4.3.3 Alternative Aerobic Biological Treatment Processes

Alternative aerobic biological treatment processes include sequencing batch reactors (SBR), trickling filters, rotating biological contactors (RBC), and membrane bioreactors (MBR).

Sequencing batch reactors (SBR) are a variation of the conventional activated sludge system. Treatment takes place in a single tank, unlike the two-tank arrangement of the conventional activated sludge system. Treatment is undertaken in batches going through the different stages of filling, aeration / reaction, settling or solids separation, and discharge or decanting of the treated effluent. Provisions must be made to accommodate the influent wastewater during the different stages (except filling). In most cases, a holding or equalization tank is used, or a twin tank arrangement is provided wherein one tank cycles through the treatment while the other reactor tank accumulates the influent raw wastewater. SBRs attain similar treatment efficiencies as activated sludge treatment plants. Although they can be operated manually, SBRs usually require automation and motorized or pneumatically operated valves. SBRs consume more energy than activated sludge treatment plants of the same capacity.

Trickling filters are a form of attached growth or fixed film biological treatment systems. In fixed film processes, microorganisms that consume the organic material (food or BOD) grow as *slime* on fixed media. As the wastewater flows over the slime or biomass, (soluble) organic wastes are adsorbed and consumed by the microorganisms. Oxygen from air diffuses through the thin layer of wastewater to the microorganisms.

As the slime layer builds up, clumps slough off or detach from the media. The material that sloughs off, called *humus*, flows with the wastewater and is separated from the treated wastewater in the secondary clarifier or settling tank (or filter). The main advantage of trickling filters (and other fixed film treatment systems) is their low operating costs.

Rotating biological contactors (RBC) are another type of attached growth biological treatment with low operating energy consumption. In contrast to trickling filters wherein the media do not move, the media in RBCs are discs partially submerged in the wastewater that rotate around a shaft. The rotation alternately exposes the slime layer to the food (organic wastes) when submerged and oxygen when exposed to the air to effect treatment.

It is important to note that attached growth treatment processes, such as trickling filters are more effective on soluble organic pollutants and less so on particulate or suspended solid pollutants. For this reason, trickling filters need primary clarifiers or similar pre-treatment units to be effective. Since initial anaerobic treatment of central kitchen or commissary wastewater reduces the concentration of suspended solids, attached growth treatment systems are well suited for the polishing treatment of anaerobically treated central kitchen or commissary wastewater.

Properly sized and operated, attached growth treatment systems can attain BOD reduction efficiencies of 80-90%. The suspended solids concentrations of the treated effluent of attached growth treatment processes like trickling filters are often higher than those of the effluent of suspended growth treatment processes like activated sludge process.

Membrane bioreactors (MBR) are aerobic, suspended growth treatment systems similar to activated sludge treatment plants where the secondary clarifier or settling tank is replaced with a (semi-permeable) membrane such as ultrafiltration or microfiltration membranes which are usually installed in the aeration tank. This system eliminates the secondary settling tank resulting in a more compact system. The membrane is also several times more effective in removing suspended solids (mainly the activated sludge flocs) than settling tanks to produce very low suspended solids concentrations in the effluent. The membrane system also allows the retention of higher concentrations of biomass or activated sludge, further improving BOD reduction efficiencies.

MBRs can produce effluents with less than 10 mg/l BOD_5 and less than 10 mg/l TSS (total suspended solids). Depending on the type and material of the membrane, it may also be able to remove some of the color of the wastewater.

The membranes in MBRs are sensitive to fouling from mineral and biological deposits which reduce flux and increases the pressure required to maintain the desired flux. This results in higher energy requirements to operate and the need for frequent cleaning. As a result, MBRs are more costly operate than the more conventional biological treatment systems as well as being more costly to construct.

Aerobic Lagoons are large, shallow ponds where oxygen required to meet the oxygen demand of the wastewater comes from the oxygen in the atmosphere that diffuses into the water. In some cases, aquatic plants such as water hyacinths may be grown in the aerobic lagoon to supplement the oxygen supply. In other cases, the aerobic lagoon is mechanical aerated to hasten the biodegradation of organic pollutants.

Facultative Lagoons are deeper than aerobic lagoons. Since the oxygen that diffuses from the air is unable to reach the deeper portions of the lagoon, the lower layers become anaerobic. Biodegradation of organic substances takes place in both the oxygenated, aerobic upper layer and the anaerobic lower layer. With proper balance, foul smelling gases from the anaerobic lower layer are treated and counteracted in the aerobic upper layer, thereby preventing the escape of foul odors.

Aerobic and Facultative Lagoons may be sufficiently effective as polishing post treatment following anaerobic digesters or lagoons if required land area is economically available. This condition may not apply to central kitchens or commissaries which are often located in urban areas.

4.4 Nutrient Removal Treatment Processes

4.4.1 Introduction

Wastewater from the central kitchen or commissary industry may contain high concentrations of nutrients (various compounds of nitrogen and phosphorus) because high concentrations of nutrients are desirable in raw materials for food production and preparation in central kitchens or commissaries. Oftentimes, primary treatment (physical and chemical treatment processes) and secondary treatment (biological treatment processes) may be inadequate to attain full compliance with discharge standards, especially for nutrients when treating wastewater from central kitchens or commissaries. To further improve effluent quality to attain compliance, nutrient removal treatment methods may be used.

4.4.2 Biological Nutrient Removal

Biological treatment using both anaerobic and aerobic treatment processes will remove significant amounts of nutrients. However, the residual concentrations of ammonia, nitrates, and phosphates may still exceed the effluent standards. Recycling some of the aerobic activated sludge to the anaerobic digester at a balanced rate may suffice in reducing phosphate concentrations to meet the effluent standards.

Extended aeration to achieve nitrification followed by denitrification may be adequate to remove both ammonia and nitrate forms of nitrogen to meet effluent standards.

4.4.3 Chemical Nutrient Removal

If biological nutrient removal is inadequate or impractical to implement, nutrients may be removed by chemical treatment. For wastewater from the central kitchens or commissaries, chemical treatment may be used to remove or reduce phosphate through precipitation (with or without pH adjustment), coagulation, and sedimentation. Ammonia may be removed by chemical oxidation reactions.

Adjustment of pH, precipitation, and coagulation may take place in separate reaction tanks or simultaneously in a single reactor tank. Flocculation normally takes place in a separate reaction tank. After precipitation, coagulation, and flocculation, the pollutants, now in insoluble, solid floc form, are separated by gravity settling or sedimentation in conventional settling tanks or clarifiers or in inclined, parallel plate or tube settlers. The sludge which now contains the (phosphate) pollutants removed from the wastewater is discharged and dewatered prior to ultimate disposal as solid wastes. Chemical treatment can be very effective in removing or reducing inorganic pollutants including food coloring but has a less effect on BOD or COD.

Alum is often the most effective precipitating agent for phosphates but other chemicals such as ferric chloride and (slaked) lime are also effective. Polyelectrolytes are used as flocculant aids. The correct types and combinations of treatment chemicals and their optimum dosages are best determined by conducting jar tests on the actual wastewater streams.

Ammonia may be removed by breakpoint chlorination. Enough amounts of chlorine (or hypochlorite) are added to the wastewater to exceed the chlorine demand (due to reducing inorganic and organic compounds, including ammonia) until a free residual chlorine concentration is attained. At this point, the ammonia will have been converted to chloramines and effectively removed.

4.5 Tertiary Treatment Processes

4.5.1 Post Disinfection

Coliform count is an indirect measurement of the possible contamination of wastewater with wastes from animal or human sources. If these animal or human sources of wastes are sick and/or carry pathogens (disease causing organisms), exposure to the wastewater may cause people or animals to get sick. While aerobic biological treatment processes such as the activated sludge process can attain 3-log (1,000 times) coliform reduction, the concentration of coliforms (total and/or fecal) in the influent raw wastewater from central kitchens or commissaries can be very high. Thus, the effluent of biological treatment needs to be disinfected to prevent the spread of contagious diseases.

The effluent of the biological treatment (activated sludge process) may be treated with hypochlorite solution at approximately 10 ppm available chlorine dosage to ensure destruction and/or inactivation of pathogens and coliforms which may be present in wastewater from animal and/or human sources. The clarified effluent flows to a chlorine contact tank providing at least 30 minutes of contact time at average flow and equipped with baffles or other device to promote mixing of the chlorine solution with the clarified (activated sludge process) effluent. The chlorine dosage may be increased to ensure consistent compliance with the statutory limits for coliforms.

If breakpoint chlorination is used to remove ammonia, it will suffice to reduce and control to coliform concentrations to well below effluent standards.

4.6 Effectiveness of Various Treatment Processes

- Screening
  - TSS <500 mg/l
- Anaerobic (Conventional)
  - BOD5 ~300 mg/l
  - COD ~700 mg/l
  - TSS ~150 mg/l
  - Coliform ~64,000 MPN/100 mL
- Anaerobic (UASB)
  - **B**OD5 ~200 mg/l
  - COD ~600 mg/l
  - TSS ~150 mg/l
  - Coliform ~64,000 MPN/100 mL
- Activated Sludge, SBR
  - BOD5 <30 mg/l
  - COD <150 mg/l
  - TSS <50 mg/l
  - Coliform ~6,400 MPN/100 mL
- Aerobic Lagoon
  - BOD5 <60 mg/l
  - COD <250 mg/l
  - TSS <150 mg/l
  - Coliform ~64,000 MPN/100 mL
- Facultative Lagoon
  - BOD5 <120 mg/l
  - COD <300 mg/l
  - TSS <150 mg/l
  - Coliform ~64,000 MPN/100 mL
- Post Disinfection
  - Coliform ~6,400 MPN/100 mL

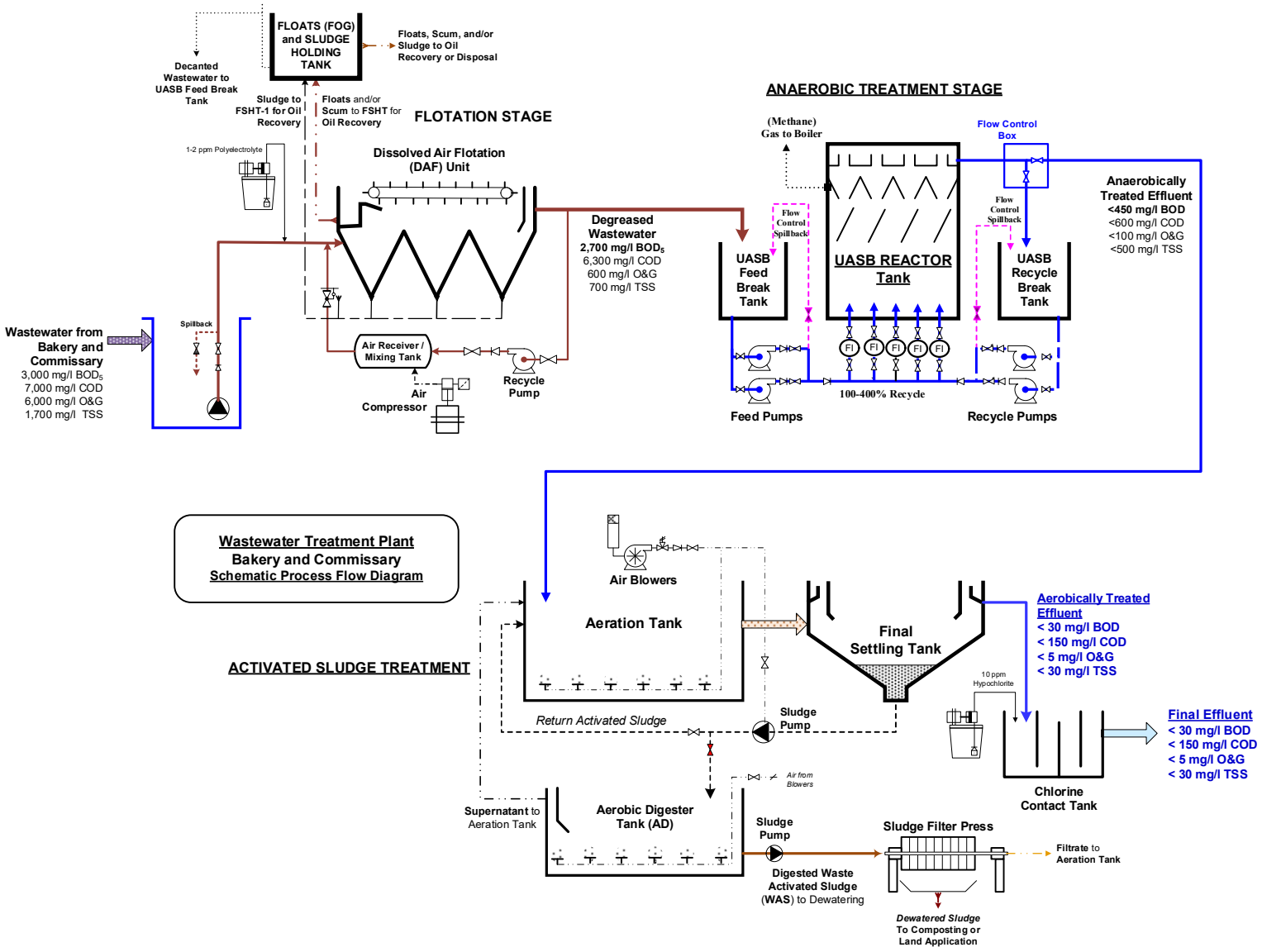

Figure 2 Typical Wastewater Treatment Plant for Central Kitchen or Commissary Wastewater

Annex 16 Guideline on Slaughterhouse and Meat Packing Factory Inspection

Factory Inspection and Water Pollution Control Guidelines for SLAUGHTERHOUSE and MEAT PACKING INDUSTRY

Factory Inspection and Water Pollution Control Guidelines for SLAUGHTERHOUSE and MEAT PACKING INDUSTRY

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1. INTRODUCTION

1.1 Rationale

This industrial (water) pollution control guideline for the slaughterhouse and meat packing industry was prepared under the ***Project for Effective Implementation of EIA and Pollution Control through Capacity Development of Ministry of Environment in the Kingdom of Cambodia*** to enhance the enforcement capacity of environmental inspectors and officers by providing industry specific technical information on (water) pollution sources, characteristics, and treatment methods in the slaughterhouse and meat packing industry.

1.2 Livestock Industry

The livestock industry sector contributes approximately 16% to the agricultural value added and over 4% of GDP. The recent rise in the GDP per capita to middle income level and the (food preference) influence of the younger generation which constitutes over 50% of the population has led to a rapid increase in meat consumption. Tourists also add to the increase in meat consumption. This has led to a corresponding increase in livestock production. Nevertheless, a large proportion of the meat and poultry supply is imported since the local livestock industry is unable to meet the domestic demand. This shows a great potential for increasing domestic livestock industry. This has attracted many multinational firms to establish their presence in Cambodia where most of the livestock production is small scale, such as farmer households raising 1-3 pigs only in their backyards.

1.3 Slaughterhouses

Since much of the meat and poultry supply is imported and most livestock raising operations are small scale, there are relatively few industrial size slaughterhouses and meat processing plants in Cambodia. The increasing demand for meat products and corresponding livestock production to meet domestic demand for meat and poultry products are likely to result in an increase in industrial size slaughterhouses and meat processing plants.

Most slaughtering of livestock takes place in public markets. Due to its small scale and small number of industrial size operations, slaughterhouses are not so well regulated in terms of environmental protection and pollution control.

2. SLAUGHTERHOUSE AND MEAT PACKING OPERATIONS

The following descriptions apply to mechanized, line-type slaughterhouse (or abattoir) and meat packing operations. They do not apply to manual or booth type slaughterhouse and meat packing operations.

2.1 Slaughtering

2.1.1 Reception and Lairage

Live hogs (pigs) are received and may be temporarily kept at the lairage (holding and resting area before slaughtering). The lairage may be provided with slotted floors through which solid and liquid waste as well as wash water pass into a digester pit. The hogs are washed in the reception area or lairage prior to further processing. Delivery trucks or vans may also be washed in the reception area or at a separate place.

Water used to wash the hogs (and trucks) and liquid animal wastes constitute the main wastewater stream from the reception and/or lairage area. The lairage pit may also be a source of wastewater. The wastewater from this area contains solid animal wastes, feed stuff, mud, and dirt. The suspended solids and organic matter (measured as BOD and COD) contents of this wastewater stream is high due to the presence of animal wastes.

2.1.2 Stunning and Sticking

Slaughtering starts with stunning of the hogs (to avoid disruptive behavior among others). The stunned hogs are then hooked up to shackles of a conveyor system or a hoist followed by sticking and bleeding to drain the blood. Blood is collected and processed into blood meal.

The stunning and bleeding area is usually washed only at the start and end of the slaughterhouse operations. The wastewater from the stunning and bleeding area contains blood, feeds, and dirt.

2.1.3 Scalding and Dehairing

The carcass (of the pig) is then scalded in a hot water bath to loosen the hair before it passes through the dehairing machine. After dehairing, the carcass may be singed with blow torches and polished to remove any remaining fine hair.

Wastewater from the scalding and dehairing area comes from overflow from the scalding tanks, water dragged out with the carcass, and spray water from the dehairing machines. It contains hair, blood, and pieces of meat.

2.1.4 Evisceration

The carcass is then slit open for evisceration. The offal and internal organs are removed from the carcass for separate processing. The carcass is then washed, ready for release to customers or for further processing in the meat packing plant. If refrigeration is needed, the carcass may be rapidly cooled (blast chilling) prior to storage in freezers before shipment to customers.

Wastewater from the evisceration area comes from water used to wash the carcass. It contains hair, blood, and pieces of meat.

2.2 Meat Packing

2.2.1 Meat Packing

If the carcass is not shipped to customers as whole or half carcass, the bones are removed and the carcass is carved into specific meat cuts, washed as needed, then packed, and placed in cold storage, ready to shipment to customers.

Wastewater from the meat packing area comes from washing of the cut meat and general cleaning for sanitation to maintain hygienic conditions.

2.2.2 Offal Processing

The offal is segregated into white and red offal and washed, processed, and stored separately. Paunch manure is removed and dumped into a pit or digester. The liver, kidney, heart, and other valuable parts are also washed and packed prior to cold storage and sale.

Wastewater from the offal processing and packing area comes from washing of the cut meat and general cleaning for sanitation to maintain hygienic conditions.

3. WASTEWATER GENERATION

3.1 Wastewater Sources

The wastewater sources in a slaughterhouse and meat packing plant are the following:

a. Reception, Lairage, and Truck Washing Areas (*Please refer to* , *below*) and Desludging of Pit under Lairage
b. Mechanized Slaughterhouse and Meat Packing Plant, combined wastewater streams from the following sections or stages (*Please refer to* , *below*):
    - Hanging, Stunning, and Sticking Section (*Please refer to* , *below*)
    - Scalding, Dehairing, and Singeing Section (*Please refer to* , *below*)
    - Evisceration and Dressing Section (*Please refer to* , *below*)
    - Splitting, Washing, Carving / Cutting / Deboning, Weighing, Grading, and Packing Section of the Meat Packing and Offal Processing Lines (*Please refer also to Figure 2 and Figure 3 below).*
c. Blowdown from the following:
    - Cooling Tower (for air conditioning and refrigeration)
    - Boiler (for steam and hot water supply)
    - Water (Supply) Treatment Plant
d. (Biological and Chemical) Laboratory
e. Cleaning and sanitation of processing facilities, utensils, tools, and equipment before and after production run.

Wastewater streams from the reception, lairage, and truck washing areas, the slaughterhouse and meat packing plant, and the laboratories are combined before conveyance to the wastewater or effluent treatment plant.

Blowdown from the cooling towers, boilers, and water supply treatment plant are usually deemed clean enough to comply with the discharge standards; hence, these streams are not treated.

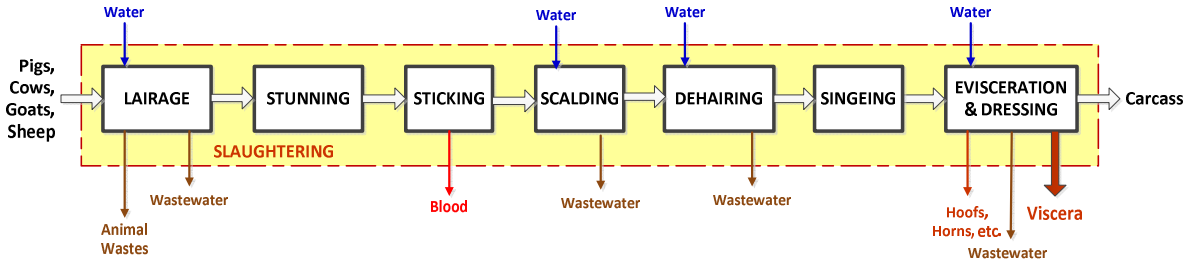

Figure 1 Schematic Process Flow Diagram of Slaughtering

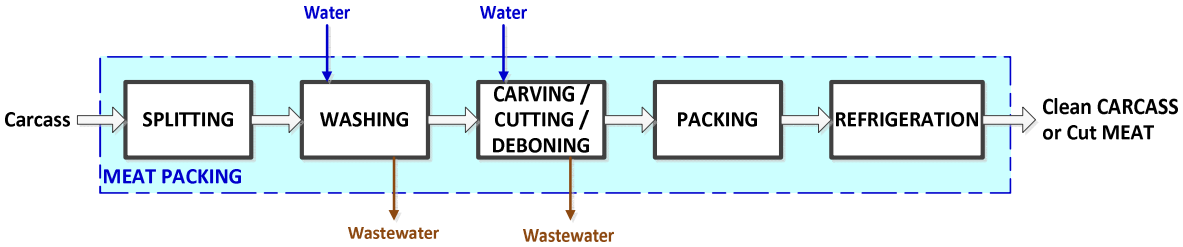

Figure 2 Schematic Process Flow Diagram of Meat Packing

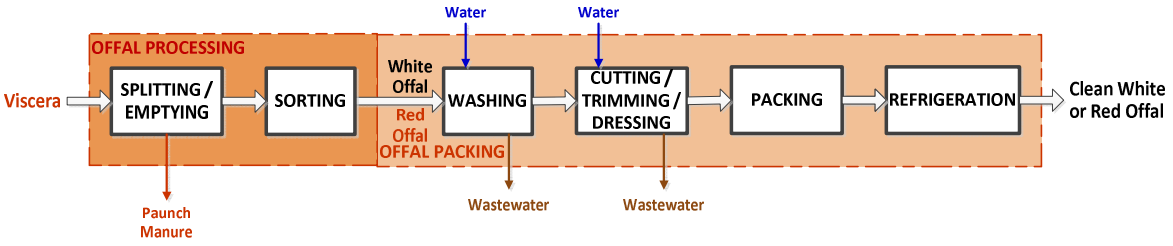

Figure 3 Schematic Process Flow Diagram of Offal Processing

3.2 Wastewater Characteristics

N.B. The following data on the characteristics of wastewater from slaughterhouse and meat packing are derived from Philippine (hog or pig) livestock industry. The data have to be validated to determine if they are valid to the Cambodia livestock industry.

Table 1 Specific Wastewater Generation Rates

- **Quantity:**
  - **Average: 390 Liters per Head (mostly Hogs)**
  - **Maximum: 1,300 Liters per Head (mostly Cows)**
  - **Minimum: 230 Liters per Head (mostly Hogs)**
  - **Benchmark: 200 Liters per Head (mostly Hogs)**
- **Quality:**
  - **Average: 1,500 gm BOD_5 per Head (mostly Hogs)**
  - **Maximum: 2,700 gm BOD_5 per Head (mostly Cows)**
  - **Minimum: 700 gm BOD_5 per Head (mostly Hogs)**
  - **Benchmark: 200 Liters per Head (mostly Hogs)**

Table 2 Significant Pollution Parameters in Slaughterhouse and Meat Packing Operations

- **pH**
- **5-day Biochemical Oxygen Demand (BOD_5)**
- **Chemical Oxygen Demand (COD)**
- **Total Suspended Solids (TSS)**
- **Oil & Grease**
- **Fecal Coliform**
- **Nutrients (Phosphates, Nitrates, Ammonia)**

3.3 Waste(water) Minimization

- **Re-Use Treated Effluent for Washing:**
  - **Trucks and Crates and Livestock and Lairage**
- **Optimize Scalding Water Temperature.**
- **Use High Pressure Washers for Cleaning**
- **Use Trays and Suitable Containers for:**
  - **Collection of Blood and Transport of Carcass, Viscera, Offal**

3.4 Typical Effectiveness of Water Pollution Control Measures

- **Screening**
  - **TSS <250 mg/l**
- **Flotation**
  - **O & G <100 mg/l**
- **Activated Sludge, SBR**
  - **TSS <30 mg/l**
  - **BOD5 <30 mg/l**
  - **COD <150 mg/l**
  - **Coliforms ~64,000 MPN/100 mL**
- **Nutrient Removal**
  - **Phosphate <0.5 mg/l**
  - **Nitrates <10 mg/l**
  - **Ammonia <0.5 mg/l**
- **Post Disinfection**
  - **Coliform ~6,400 MPN/100 mL**

4. WASTEWATER TREATMENT

4.1 Introduction

The contaminants in wastewater from slaughterhouse and meat packing industry are mainly organic matter amenable to biological treatment processes. The slaughterhouse and meat packing wastewater also contains solids and oil & grease which can interfere with or inhibit biological treatment. The slaughterhouse and meat packing wastewater needs to undergo primary treatment to ensure effective biological treatment that will produce effluents complying with the standards for discharge of industrial effluents. The schematic process flow diagram shown in *Figure 4 below* shows a range of conventional treatment processes suitable for slaughterhouse and meat packing and packing industry wastewater.

4.2 Physical Treatment Processes

Physical treatment processes rely on physical properties of contaminants to effect treatment. Physical treatment processes are best suited for the removal of discrete solids from water because they are effective and very economical, especially in terms of cost per unit quantity of pollutant removed.

4.2.1 Flow Equalization

Slaughterhouse and meat packing plants typically start operations at night and finish in the early morning so that the carcasses and packed meat products can be brought to the market or sales outlet in the early morning. During the day time, operation is minimal if at all. If it is desired to size and operate the wastewater or effluent treatment plant on a 24 hour per day basis, it is necessary to retain in a retention or equalization tank the wastewater generated during the shorter operating hours. This will allow the wastewater to be fed to wastewater or effluent treatment plant at the 24-hour average daily flow rate. This arrangement will reduce the sizes of the treatment units. If a retention or equalization tank is not feasible, the treatment units should be sized in accordance with the peak or pump flow rate. The working capacity of the retention or equalization tank may be determined from the instantaneous flow rates and flow patterns. In the absence of reliable, actual flow rate data, the working capacity of the equalization tank should be equal to the average daily flow rate, if feasible, or at least 80% of the average daily flow rate.

Due to the high concentration of organic matter, fats, oil, & grease, and the presence of suspended organic matter solids, the retention or equalization tank is usually aerated to minimize putrefaction of the organic pollutants which causes odor problems. Aeration also serves to mix the contents of the equalization tank to attain uniform conditions.

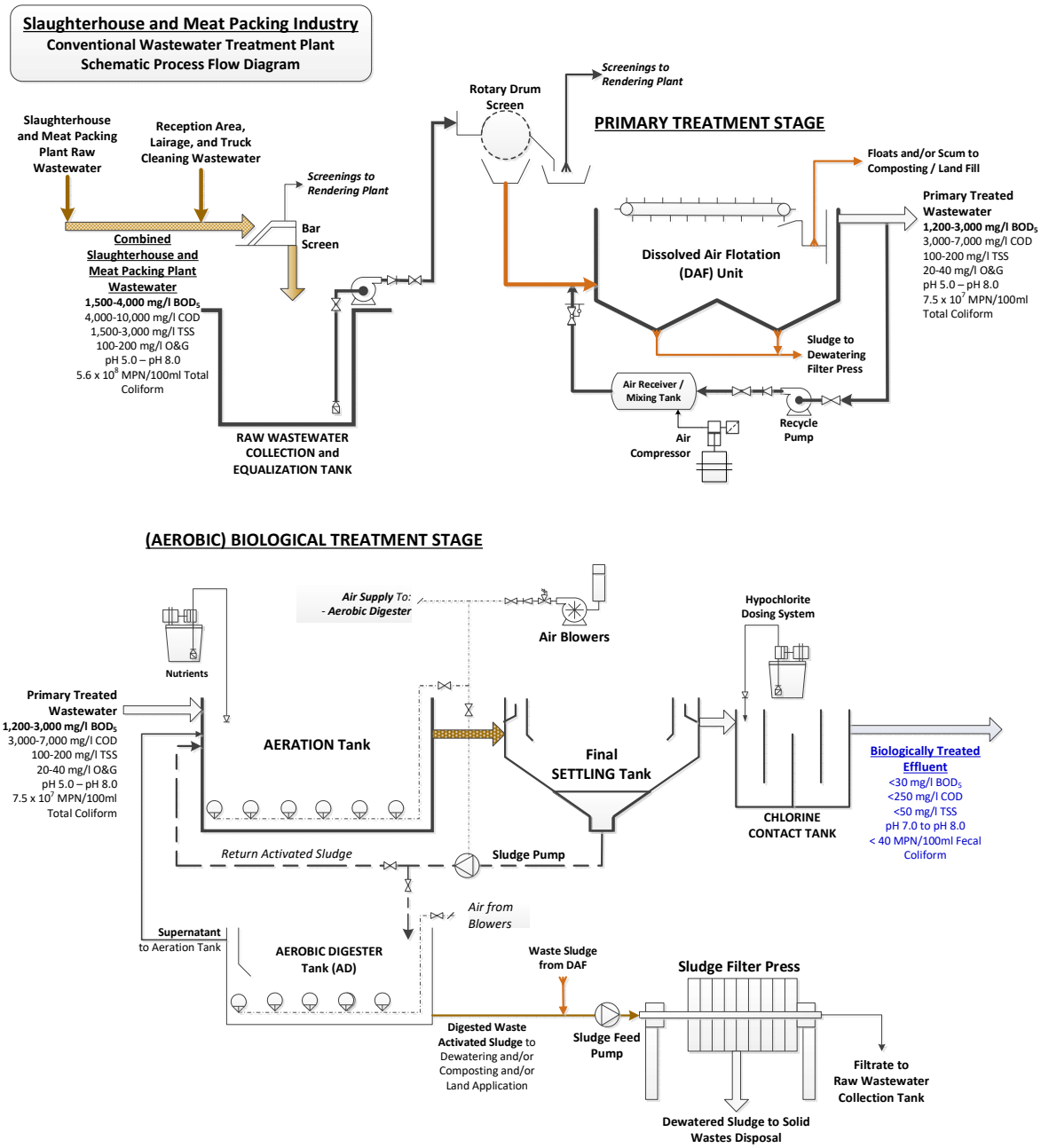

Figure 4 Conventional Treatment Plant for Slaughterhouse and Meat Packing Industry Wastewater

4.2.2 Screening

Although the dehairing equipment is provided with screens to capture most of the feathers and large solids prior to discharge, the slaughterhouse and meat packing plant wastewater may still contain fine hair, (paunch) manure, undigested feeds, bits of meat, and other solids. These suspended solids may interfere with the operation or function of downstream treatment units or increase the pollution load. Of special concern are the hair and bits of skin and meat which tend to form strings which wrap around equipment.

Rotary drum screens are the most appropriate type even though mesh type screen have higher capture efficiency. Rotary drum screens are less prone to blinding or plugging from strings and are self-cleaning. Alternatively, static hyperbolic screens with slotted openings are also reasonably effective and more resistant to blinding than mesh screens. Unlike rotary drum screens, static screens are not self-cleaning and thus, need to be manually scraped for effective removal of screened solids. Screenings from slaughterhouse and meat packing wastewater are best processed in a rendering plant to recover the fat and protein value of the screened solids.

As a safety precaution, the raw wastewater canal should be provided with bar screens to remove large solids such as hoofs and horns which may inadvertently be dumped in the wastewater drainage system.

The size of screening equipment is based on the flow rate, size of openings, and solids load. The effectiveness or degree of removal of solids is also dependent on these factors and varies considerably from less than 30% to more than 70%.

4.2.3 Flotation (Oil and Grease Removal)

The use of hot water for scalding extracts some amount of fats to the extent that the fat content in the wastewater may inhibit biological treatment processes. For slaughterhouse and meat packing wastewater, dissolved air flotation (DAF) is required to effectively remove fats, fine hair, and other solids not caught by screening to a level that is no longer inhibitory to biological treatment processes. Other forms of flotation (plain or induced by fine air bubbles) may be inadequate in lowering the concentration of fats, oil, and grease (FOG) to a level that is no longer inhibitory to biological treatment processes. Aside from the conventional method of dissolving compressed air in recirculated clarified water, dissolved air mixture may be formed by cavitation. Cavitation air flotation simplifies the dissolved air system by replacing the recirculation pump, air compressor, air-water mixing tank, and pressure reducing and flow control valves with a single mixer-like cavitation air flotation unit.

Flotation systems typically include dosing of coagulating agents to promote agglomeration of the fats, feathers, and suspended solids into flocs. The size of the flotation area is dependent on the instantaneous feed flow rate which is usually the pump flow rate and rise rate of the solids. The rise rate of flocs in DAF systems is typically 3-5 m/hr. Flotation can remove more than 80% of suspended solids and approximately 30-50% of BOD.

4.3 Biological Treatment Processes

4.3.1 Activated Sludge Process

Biological treatment processes make use of living organisms (mostly microorganisms) to effect treatment. The *activated sludge* treatment process is an aerobic, suspended-growth system. It is, by far, the most common biological treatment process because of its high BOD reduction efficiency, stability, reliability, and ease of operation.

The activated sludge treatment process consists of an aeration tank and a (final or secondary) settling tank. Wastewater flows into the aeration tank where biologically active sludge recycled from the (final or secondary) settling tank is mixed with the influent wastewater. The activated sludge microorganisms consume the organic pollutants (measured as BOD_5) which serve as their food or substrate, and convert them to harmless carbon dioxide, water, and additional cell mass. An aeration system provides the oxygen required for the degradation of the organic pollutants and the mixing energy to keep the activated sludge flocs in suspension.

Activated sludge treatment process can reduce BOD by 90-95%, suspended solids by 80-90%, and oil by 50-80%.

While many factors affect the performance of an activated sludge treatment system, one of the most important is the ratio of food (BOD) to microorganism or food to mass (F:M) ratio. A food to mass (F:M) ratio of 0.05 – 0.15 kg BOD5/day/kg microorganisms will consistently produce treated effluent BOD_5 concentrations below 20 - 30 mg/l and effluent suspended solids concentrations below 30 – 50 mg/l.

4.3.2 Alternative Aerobic Biological Treatment Processes

Alternative aerobic biological treatment processes include sequencing batch reactors (SBR), trickling filters, rotating biological contactors (RBC), and membrane bioreactors (MBR).

Sequencing batch reactors (SBR) are a variation of the conventional activated sludge system. Treatment takes place in a single tank, unlike the two-tank arrangement of the conventional activated sludge system. Treatment is undertaken in batches going through the different stages of filling, aeration / reaction, settling or solids separation, and discharge or decanting of the treated effluent. Provisions have to be made to accommodate the influent wastewater during the different stages (except filling). In most cases, a holding or equalization tank is used or a twin tank arrangement is provided wherein one tank cycles through the treatment while the other reactor tank accumulates the influent raw wastewater. SBRs attain similar treatment efficiencies as activated sludge treatment plants. Although they can be operated manually, SBRs usually require automation and motorized or pneumatically operated valves. SBRs consume more energy than activated sludge treatment plants of the same capacity.

Trickling filters are a form of attached growth or fixed film biological treatment systems. In fixed film processes, microorganisms that consume the organic material (food or BOD) grow as *slime* on fixed media. As the wastewater flows over the slime or biomass, (soluble) organic wastes are adsorbed and consumed by the microorganisms. Oxygen from air diffuses through the thin layer of wastewater to the microorganisms. As the slime layer builds up, clumps slough off or detach from the media. The material that sloughs off, called *humus*, flows with the wastewater and is separated from the treated wastewater in the secondary clarifier or settling tank. The main advantage of trickling filters (and other fixed film treatment systems) is their low operating costs.

Rotating biological contactors (RBC) are another type of attached growth biological treatment with low operating energy consumption. In contrast to trickling filters where the media do not move, the media in RBCs are disc-like and rotate around a shaft. The rotation alternately exposes the slime layer to the food (organic wastes) when submerged and oxygen when exposed to the air to effect treatment.

It is important to note that attached growth treatment processes, such as trickling filters are more effective on soluble organic pollutants and less so on particulate or suspended solid pollutants. For this reason, trickling filters need primary clarifiers or similar pre-treatment units to be effective. The presence of hair, skin, meat, and other solids which can form strings in the wastewater from the slaughterhouse and meat packing industry can contribute to clogging of the trickling filter media or the RBC discs. Properly sized and operated, attached growth treatment systems can attain BOD reduction efficiencies of 80-90%. The suspended solids concentrations of the treated effluent of attached growth treatment processes like trickling filters are often higher than those of the effluent of suspended growth treatment processes like activated sludge process.

Membrane bioreactors (MBR) are aerobic, suspended growth treatment systems similar to activated sludge treatment plants where the secondary clarifier or settling tank is replaced with a (semi-permeable) membrane such as ultrafiltration or microfiltration membranes which are usually installed in the aeration tank. This system eliminates the secondary settling tank resulting in a more compact system. The membrane is also several times more effective in removing suspended solids (mainly the activated sludge flocs) than settling tanks to produce very low suspended solids concentrations in the effluent. The membrane system also allows the retention of higher concentrations of biomass or activated sludge, further improving BOD reduction efficiencies.

MBRs can produce effluents with less than 10 mg/l BOD_5 and less than 10 mg/l TSS (total suspended solids). As such, the treated effluent of MBRs may be suitable to re-use in washing crates and trucks and the reception area.

The membranes in MBRs are sensitive to plugging by stringy solids such as those present in wastewater from the slaughterhouse and meat packing industry. Hence, effective primary treatment to remove suspended solids is necessary if MBRs are to be used in treating wastewater from the slaughterhouse and meat packing industry.

The membranes in MBRs are sensitive to fouling from mineral and biological deposits which reduce flux and increases the pressure required to maintain the desired flux. This results in higher energy requirements to operate and the need for frequent cleaning. As a result, MBRs are more costly operate than the more conventional biological treatment systems as well as being more costly to construct.

4.3.3 Anaerobic Treatment

Anaerobic treatment is generally applied on high BOD strength wastewater and organic sludges. Anaerobic processes take place in the absence of oxygen. In biochemical reactions, oxygen generally acts as electron receptor in the process of extracting energy from the organic material. In the absence of free oxygen, other chemical species such as nitrates and sulfates can serve as oxygen donors in *anoxic* reactions. In the absence of even such oxygen donors, other compounds, generally complex organic compounds, serve as electron receptors.

One great advantage of anaerobic treatment systems is the low energy consumption, or in many cases, net energy yield (from the methane gas generated). Their disadvantage is the much slower reaction rates which generally translates to longer reaction (holding) times and larger tanks.

In general, anaerobic treatment processes are cost effective when the influent BOD concentration is 2,000-3,000 mg/l or higher. Anaerobic treatment processes can attain BOD reduction efficiencies of 75-90%. However, due to the high BOD concentration of the influent, the effluent of anaerobic treatment systems needs polishing treatment (usually by aerobic processes) to attain compliance with discharge standards.

The biochemical oxygen demand (BOD) of raw wastewater from slaughterhouse and meat packing industry may or may not exceed 2,000 mg/l after primary treatment (screening and flotation). Dissolved air flotation is required to reduce fats, oil, and grease concentration to below inhibitory limits. Hence, the use of anaerobic treatment systems in treating wastewater from the slaughterhouse and meat packing industry should be considered on a case to case basis.

4.4 Tertiary Treatment Processes

4.4.1 Post Disinfection

Coliform count is an indirect measurement of the possible contamination of wastewater with wastes from animal or human sources. If these animal or human sources of wastes are sick and/or carry pathogens (disease causing organisms), exposure to the wastewater may cause people or animals to get sick. While aerobic biological treatment processes such as the activated sludge process can attain 3-log (1,000 times) coliform reduction, the concentration of coliforms (total and/or fecal) in the influent raw wastewater can be very high. Thus, the effluent of biological treatment needs to be disinfected to prevent the spread of contagious diseases.

The effluent of the biological treatment (activated sludge process) may be treated with hypochlorite solution at approximately 10 ppm available chlorine dosage to ensure destruction and/or inactivation of pathogens and coliforms which may be present in wastewater from animal and/or human sources. The clarified effluent flows to a chlorine contact tank providing at least 30 minutes of contact time at average flow and equipped with baffles or other device to promote mixing of the chlorine solution with the clarified (activated sludge process) effluent. The chlorine dosage may be increased to ensure consistent compliance with the statutory limits for coliforms.

Annex 17 Guideline on Poultry Dressing Industry

Factory Inspection and Water Pollution Control Guidelines for POULTRY PROCESSING (DRESSING) INDUSTRY

Industrial Pollution Control Guidelines
POULTRY PROCESSING (DRESSING) INDUSTRY

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1. INTRODUCTION

1.1 Rationale

This industrial (water) pollution control guideline for the poultry processing (dressing) industry was prepared under the ***Project for Effective Implementation of EIA and Pollution Control through Capacity Development of Ministry of Environment in the Kingdom of Cambodia*** to enhance the enforcement capacity of environmental inspectors and officers by providing industry specific technical information on (water) pollution sources, characteristics, and treatment methods in the poultry processing (dressing) industry.

1.2 Poultry Processing (Dressing) Industry

Number and size or capacity of poultry dressing plants

2. POULTRY PROCESSING (DRESSING) OPERATIONS

The following descriptions apply to mechanized poultry processing (dressing) operations. They do not apply to manual poultry processing (dressing) operations.

2.1 Slaughtering

2.1.1 Transport and Reception

Live chicken are hauled from the (poultry) farms and delivered to the poultry processing (dressing) plant or facility in crates or modules consisting of stacks of open top crates. At the reception area of the poultry processing (dressing) plant, the live chicken are unloaded (manually or automatically) from the crates and loaded on the conveyor system of the processing plant.

The empty crates (and modules) are washed, either manually or in automatic washing machines. Used wash water from crate washing contains chicken droppings, feathers, and miscellaneous dirt or mud from the farm or roads. The cleaned crates are loaded back to the trucks.

2.1.2 Hanging, Stunning, and Killing

The live chickens (birds) are hanged on shackles connected to an overhead conveyor system. The chickens are stunned while their heads are partially immersed in a water bath. The chickens are then killed / slaughtered by cutting the neck. Blood drains from the dead chickens through the neck cut and may be collected for various uses.

Drips and spills from the water bath generate a small amount of wastewater at this process stage.

2.1.3 Defeathering and Trimming

After the chickens are fully bled, they are immersed in hot water (scalding) in order to loosen the feathers for easier plucking. The scalded chickens are then conveyed through the mechanized pluckers or pickers where a combination flexible fingers and water spray jets gently remove the feathers without bruising the meat. Special mechanisms remove feathers from hard to reach areas such as the joints.

After removal of feathers, the head and trachea are removed. This is followed by the cutting of the hock (leg joint) and unloading of the legs (which were previously hanged on the shackles). The chickens then proceed to the evisceration stage.

Wastewater from this process stage comes from the scalding and water used to spray on the chickens and to wash the tools, shackles, and other implements and parts of the conveyor and processing equipment. The wastewater from this area contains feathers, dirt (droppings, feed, etc.), and blood from the chickens.

2.1.4 Evisceration and Dressing

At the evisceration stage, a vent is first cut in the posterior portion of the chicken and opened. An eviscerating spoon or fork removes the intestines and other internal organs. The gizzard and cropper are also removed and the neck is broken.

The giblets (gizzard, heart, and liver and sometimes, also part of the neck) are collected and sorted on the sorting tables, either for inclusion in the whole chicken package or for separate packing.

After evisceration, the chicken carcasses are subjected to final inspection. Residues are removed by suction. Then, the chicken carcasses are washed inside and outside for a final time before being unloaded to the packing stage.

The vent cutting units, eviscerating spoons and/or forks, shackles, and other processing equipment and implements are cleaned by water spray jets. The various wash water streams constitute the wastewater from this process stage and may contain some blood, chicken flesh, fine feathers, and other residues.

2.2 Weighing, Grading, and Packing

2.2.1 Whole Chicken Packing

The whole chicken carcasses are chilled in cold water baths or in air chillers. The chilled whole chicken carcasses are then weighed, graded, sorted, and finally packed, with or without the giblets package.

Wastewater from the whole chicken packing section comes mainly from drippings, leaks, and overflow and drained water from the water chillers. This wastewater stream contains mostly residues.

2.2.2 Cut Chicken Packing

Depending on the market demand, the chilled chicken carcasses are cut up into various portions such as halves or quarters, breast, wings, legs, thigh, and drumsticks. The various cuts are then weighed, graded, and sorted prior to packing.

Aside from the wastewater stream from the water chillers, wastewater from the cut chicken packing section comes from drippings, leaks, and wash water for the cutting tools. This wastewater stream contains mostly blood, chicken flesh, and residues.

2.2.3 Giblets Packing

The giblets are usually chilled in separate chillers from the whole or cut chicken lines. The various parts are then weighed, graded, and sorted prior to packing. The giblets packs may be incorporated in the whole chicken package or sold separately.

Aside from the wastewater stream from the giblets chillers, wastewater from the giblets packing section comes from drippings, leaks, and wash water for the sorting tables. This wastewater stream contains mostly blood, chicken flesh, and residues.

2.2.4 Refrigeration and Freezing

After packing, the packs of whole chickens, cut portions, and giblets are then refrigerated (especially if to be sold fresh) and/or frozen, either in blast or conventional freezers.

The refrigeration and freezing stage does not normally generate any wastewater except when defrosted for cleaning and maintenance.

3. WASTE GENERATION

3.1 Wastewater

3.1.1 Wastewater Sources

The wastewater sources in a poultry processing (dressing) plant are the following:

a. Reception and Crate (and Trucks) Washing Areas (*Please refer to Figure 1 below*)
b. Integrated Poultry Processing Plant, combined wastewater streams from the following sections or stages (*Please refer also to Figure 1, below*):
    - Hanging, Stunning, and Killing Section (*Please refer also to Figure 1, below*)
    - Defeathering and Trimming Section (*Please refer also to Figure 1, below*)
    - Evisceration and Dressing Section (*Please refer also to Figure 1, below*)
    - Weighing, Grading, and Packing Section (*Please refer also to Figure 2, Figure 3, and Figure 4 below).*

c. Blowdown from the following:
    - Cooling Tower (for air conditioning and refrigeration)
    - Boiler
    - Water (Supply) Treatment Plant
d. (Biological and Chemical) Laboratory
e. Cleaning and sanitation of processing facilities, utensils, tools, and equipment before and after production run.

Wastewater streams from the reception and crate washing areas, the integrated poultry processing (dressing) plant, and the laboratories are combined before conveyance to the wastewater or effluent treatment plant.

Blowdown from the cooling towers, boilers, and water supply treatment plant are usually deemed clean enough to comply with the discharge standards; hence, these streams are not treated.

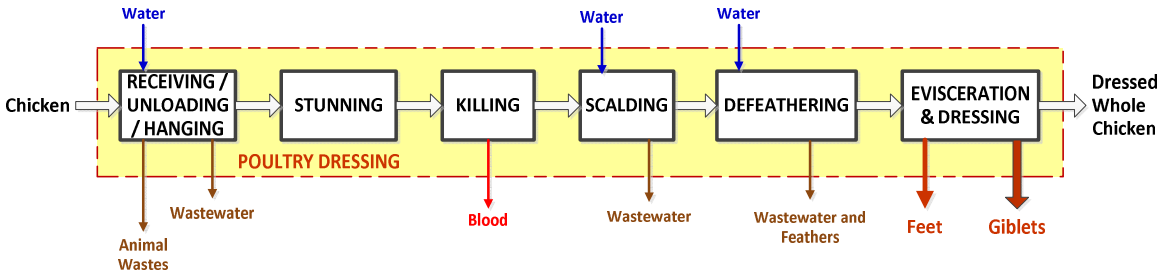


Figure 1 Schematic Process Flow Diagram of Poultry Processing (Dressing)

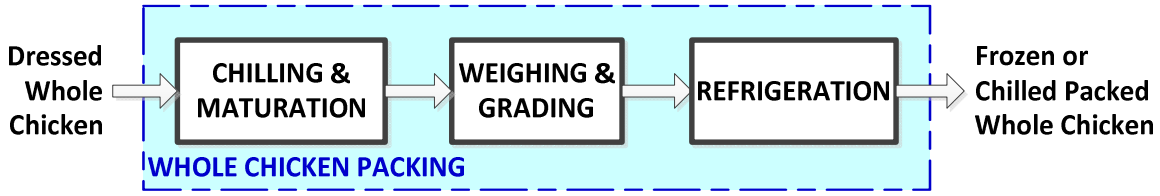


Figure 2 Schematic Process Flow Diagram of Whole Chicken Packing

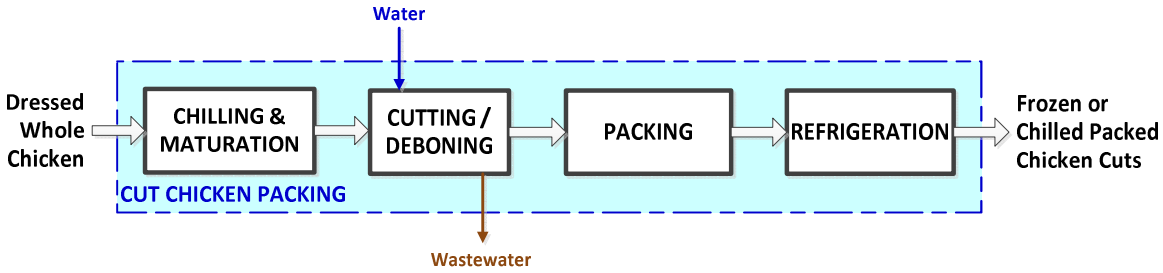


Figure 3 Schematic Process Flow Diagram of Cut Chicken Packing

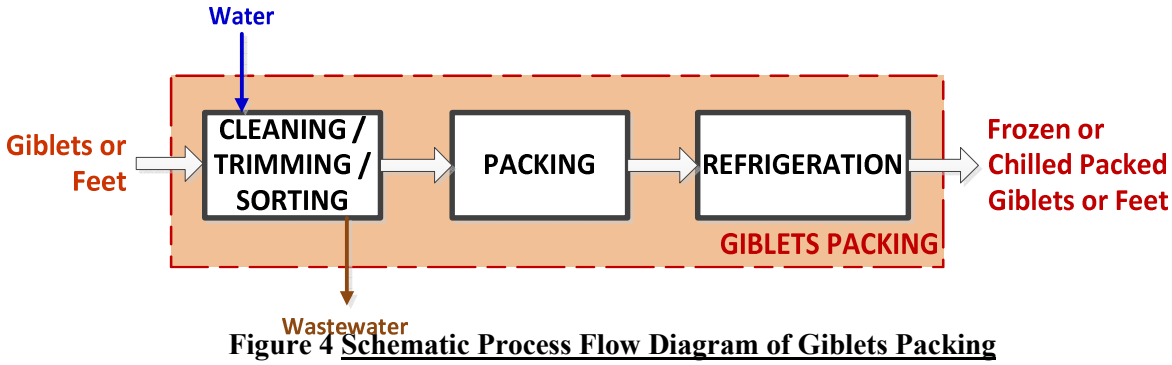


Figure 4 Schematic Process Flow Diagram of Giblets Packing

3.1.2 Wastewater Characteristics

N.B. The following data on the characteristics of wastewater from poultry processing (dressing) are derived from Philippine livestock industry. The data have to be validated to determine if they are applicable to the Sri Lanka livestock industry.

Table 1 Specific Wastewater Generation Rates

- **Quantity:**
  - **Average: 23 Liters per Chicken**
  - **Maximum: 33 Liters per Chicken**
  - **Minimum: 18 Liters per Chicken**
  - **Benchmark: 10 Liters per Chicken**
- **Quality:**
  - **Average: 30 gm BOD_5 per Chicken**
  - **Maximum: 55 gm BOD_5 per Chicken**
  - **Minimum: 15 gm BOD_5 per Chicken**
  - **Benchmark: 10 gm BOD_5 per Chicken**
  - **Average: 20 gm TSS per Chicken**
  - **Maximum: 40 gm TSS per Chicken**
  - **Minimum: 10 gm TSS per Chicken**
  - **Benchmark: 10 gm TSS per Chicken**
  - **Average: 2.0 gm Oil & Grease per Chicken**
  - **Maximum: 4.0 gm Oil & Grease per Chicken**
  - **Minimum: 0.4 gm Oil & Grease per Chicken**
  - **Benchmark: 0.3 gm Oil & Grease per Chicken**

Table 2 Significant Pollution Parameters in Poultry Processing (Dressing) and Packing Operations

- **pH**
- **5-day Biochemical Oxygen Demand (BOD_5)**
- **Chemical Oxygen Demand (COD)**
- **Total Suspended Solids (TSS)**
- **Oil & Grease**
- **Fecal Coliform**

4. WASTE MANAGEMENT

4.1 Waste Minimization

- **Re-Use Treated Effluent for Washing:**
  - **Trucks and Crates**
- **Optimize Scalding Water Temperature**
- **Use Trays and Suitable Containers for:**
  - **Collection of Blood**
  - **Transport of Chicken and Giblets**
- **Provide Workers with Continuing Training and Skills Enhancement**

5. WASTEWATER TREATMENT

5.1 Introduction

The contaminants in wastewater from poultry processing (dressing) industry are mainly organic matter amenable to biological treatment processes. The poultry processing (dressing) wastewater also contains solids and oil & grease which can interfere with or inhibit biological treatment. The poultry processing (dressing) wastewater needs to undergo primary treatment to ensure effective biological treatment that will produce effluents complying with the standards for discharge of industrial effluents. The schematic process flow diagram shown in Figure 5 below shows a range of conventional treatment processes suitable for poultry processing (dressing) and packing industry wastewater.

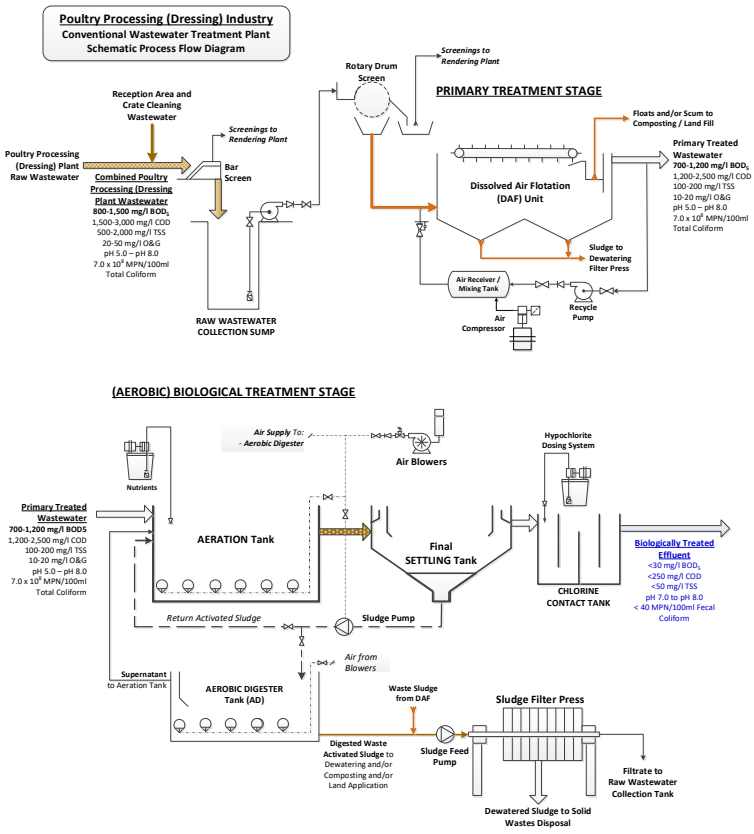


Figure 5 Conventional Treatment Plant for Poultry Processing (Dressing) and Packing Industry Wastewater

5.2 Physical Treatment Processes

Physical treatment processes rely on physical properties of contaminants to effect treatment. Physical treatment processes are best suited for the removal of discrete solids from water because they are effective and very economical, especially in terms of cost per unit quantity of pollutant removed.

5.2.1 Screening

Although the defeathering equipment is provided with screens to capture most of the feathers and large solids prior to discharge, the poultry processing (dressing) plant wastewater may still contain fine feathers, chicken manure, undigested feeds, fine pebbles and other solids. These suspended solids may interfere with the operation or function of downstream treatment units or increase the pollution load. Of special concern are the fine feathers, skin, and meat which tend to form strings which wrap around equipment. Rotary drum screens are the most appropriate type even though mesh type screen have higher capture efficiency. Rotary drum screens are less prone to blinding or plugging from strings and are self-cleaning. Alternatively, static hyperbolic screens with slotted openings are also reasonably effective and more resistant to blinding than mesh screens. Unlike rotary drum screens, static screens are not self-cleaning and thus, need to be manually scraped for effective removal of screened solids. Screenings from poultry processing (dressing) wastewater are best processed in a rendering plant to recover the fat and protein value of the screened solids.

The size of screening equipment is based on the flow rate, size of openings, and solids load. The effectiveness or degree of removal of solids is also dependent on these factors and varies considerably from less than 30% to more than 70%.

5.2.2 Flotation (Oil and Grease Removal)

Although chickens have relatively lower fat content than other meat sources, the use of hot water for scalding extracts some amount of fats to the extent that the fat content in the wastewater may inhibit biological treatment processes. Dissolved air flotation (DAF) or other forms of flotation (plain or induced by fine air bubbles) can be effective in removing fats, fine feathers, and other solids not caught by screening. Aside from the conventional method of dissolving compressed air in recirculated clarified water, dissolved air mixture may be formed by cavitation. Cavitation air flotation simplifies the dissolved air system by replacing the recirculation pump, air compressor, air-water mixing tank, and pressure reducing and flow control valves with a single mixer-like cavitation air flotation unit. Since DAF systems are expensive, flotation is not usually appropriate or cost effective for the treatment of poultry processing (dressing) industry wastewater.

Flotation systems typically include dosing of coagulating agents to promote agglomeration of the fats, feathers, and suspended solids into flocs. The size of the flotation area is dependent on the instantaneous feed flow rate which is usually the pump flow rate and rise rate of the solids. The rise rate of flocs in DAF systems is typically 3-5 m/hr. Flotation can remove more than 80% of suspended solids and approximately 30-50% of BOD.

5.3 Biological Treatment Processes

5.3.1 Activated Sludge Process

Biological treatment processes make use of living organisms (mostly microorganisms) to effect treatment. The *activated sludge* treatment process is an aerobic, suspended-growth system. It is, by far, the most common biological treatment process because of its high BOD reduction efficiency, stability, reliability, and ease of operation.

The activated sludge treatment process consists of an aeration tank and a (final or secondary) settling tank. Wastewater flows into the aeration tank where biologically active sludge recycled from the (final or secondary) settling tank is mixed with the influent wastewater. The activated sludge microorganisms consume the organic pollutants (measured as BOD_5 and COD) which serve as their food or substrate, and convert them to harmless carbon dioxide, water, and additional cell mass. An aeration system provides the oxygen required for the degradation of the organic pollutants and the mixing energy to keep the activated sludge flocs in suspension.

Activated sludge treatment process can reduce BOD by over 90-95%, suspended solids by 80-90%, and fats, oil, & grease (FOG) by 50-80%.

While many factors affect the performance of an activated sludge treatment system, one of the most important is the ratio of food (BOD) to microorganism or food to mass (F:M) ratio. A food to mass (F:M) ratio of 0.05 – 0.15 kg BOD5/day/kg microorganisms will consistently produce treated effluent BOD_5 concentrations below 20 - 30 mg/l and effluent suspended solids concentrations below 30 – 50 mg/l.

5.3.2 Alternative Aerobic Biological Treatment Processes

Alternative aerobic biological treatment processes include sequencing batch reactors (SBR), trickling filters, rotating biological contactors (RBC), and membrane bioreactors (MBR).

Sequencing batch reactors (SBR) are a variation of the conventional activated sludge system. Treatment takes place in a single tank, unlike the two-tank arrangement of the conventional activated sludge system. Treatment is undertaken in batches going through the different stages of filling, aeration / reaction, settling or solids separation, and discharge or decanting of the treated effluent. Provisions have to be made to accommodate the influent wastewater during the different stages (except filling). In most cases, a holding or equalization tank is used or a twin tank arrangement is provided wherein one tank cycles through the treatment while the other reactor tank accumulates the influent raw wastewater. SBRs attain similar treatment efficiencies as activated sludge treatment plants. Although they can be operated manually, SBRs usually require automation and motorized or pneumatically operated valves. SBRs consume more energy overall than activated sludge treatment plants of the same capacity.

Trickling filters are a form of attached growth or fixed film, aerobic biological treatment systems. In fixed film processes, microorganisms that consume the organic material (food or BOD) grow as *slime* on fixed media. As the wastewater flows over the slime or biomass, (soluble) organic wastes are adsorbed and consumed by the microorganisms. Oxygen from air diffuses through the thin layer of wastewater to the microorganisms. As the slime layer builds up, clumps slough off or detach from the media. The material that sloughs off, called *humus*, flows with the wastewater and is separated from the treated wastewater in the secondary clarifier or settling tank (or filter). The main advantage of trickling filters (and other fixed film treatment systems) is their low operating costs.

Rotating biological contactors (RBC) are another type of attached growth biological treatment with low operating energy consumption. In contrast to trickling filters wherein the media do not move, the media in RBCs are discs partially submerged in the wastewater that rotate around a shaft. The rotation alternately exposes the slime layer to the food (organic wastes) when submerged and oxygen when exposed to the air to effect treatment.

It is important to note that attached growth treatment processes, such as trickling filters are more effective on soluble organic pollutants and less so on particulate or suspended solid pollutants. For this reason, trickling filters need primary clarifiers or similar pre-treatment units to be effective. The presence of feathers and other solids which can form strings in the wastewater from the poultry processing (dressing) industry can contribute to clogging of the trickling filter media or the RBC discs. Properly sized and operated, attached growth treatment systems can attain BOD reduction efficiencies of 80-90%. The suspended solids concentrations of the treated effluent of attached growth treatment processes like trickling filters are often higher than those of the effluent of suspended growth treatment processes like activated sludge process.

Membrane bioreactors (MBR) are aerobic, suspended growth treatment systems similar to activated sludge treatment plants where the secondary clarifier or settling tank is replaced with a (semi-permeable) membrane such as ultrafiltration or microfiltration membranes which are usually installed in the aeration tank. This system eliminates the secondary settling tank resulting in a more compact system. The membrane is also several times more effective in removing suspended solids (mainly the activated sludge flocs) than settling tanks to produce very low suspended solids concentrations in the effluent. The membrane system also allows the retention of higher concentrations of biomass or activated sludge, further improving BOD reduction efficiencies.

MBRs can produce effluents with less than 10 mg/l BOD_5 and less than 10 mg/l TSS (total suspended solids). As such, the treated effluent of MBRs may be suitable to re-use in washing crates and trucks and the reception area.

The membranes in MBRs are sensitive to plugging by stringy solids such as those present in wastewater from the poultry processing (dressing) industry. Hence, effective primary treatment to remove suspended solids is necessary if MBRs are to be used in treating wastewater from the poultry processing (dressing) industry.

The membranes in MBRs are sensitive to fouling from mineral and biological deposits which reduce flux and increases the pressure required to maintain the desired flux. This results in higher energy requirements to operate and the need for frequent cleaning. As a result, MBRs are more costly operate than the more conventional biological treatment systems as well as being more costly to construct.

5.3.3 Anaerobic Treatment

Anaerobic treatment is generally applied on high BOD strength wastewater and organic sludges. Anaerobic processes take place in the absence of oxygen. In biochemical reactions, oxygen generally acts as electron receptor in the process of extracting energy from the organic material. In the absence of free oxygen, other chemical species such as nitrates and sulfates can serve as oxygen donors in *anoxic* reactions. In the absence of even such oxygen donors, other compounds, generally complex organic compounds, serve as electron receptors.

One great advantage of anaerobic treatment systems is the low energy consumption, or in many cases, net energy yield (from the methane gas generated). Their disadvantage is the much slower reaction rates which generally translates to longer reaction (holding) times and larger tanks.

In general, anaerobic treatment processes are cost effective when the influent BOD concentration is 2,000-3,000 mg/l or higher. Anaerobic treatment processes can attain BOD reduction efficiencies of more than 75-90%. However, due to the high BOD concentration of the influent, the effluent of anaerobic treatment systems need polishing treatment (usually by aerobic processes) to attain compliance with discharge standards.

The biochemical oxygen demand (BOD) of raw wastewater from poultry processing (dressing) very rarely exceeds 2,000 mg/l. As such, anaerobic treatment systems are rarely used in treating wastewater from the poultry processing (dressing) industry. It is, however, technically feasible to use a simple anaerobic digester as pre-treatment prior to aerobic treatment. A hydraulic retention time of one (1) day can reduce BOD and COD concentrations by 15-20%. An anaerobic digester also removes fats, oils, and grease (FOG) due to the long retention period. Thus, anaerobic digesters may replace the flotation stage. Since suspended solids may settle in the anaerobic digester tank, settled sludge and the floating scum layer of fats and solids need to be regularly removed for proper disposal.

Anaerobic digesters produce methane gas. The gas should be properly vented to avoid risks of fire or explosion.

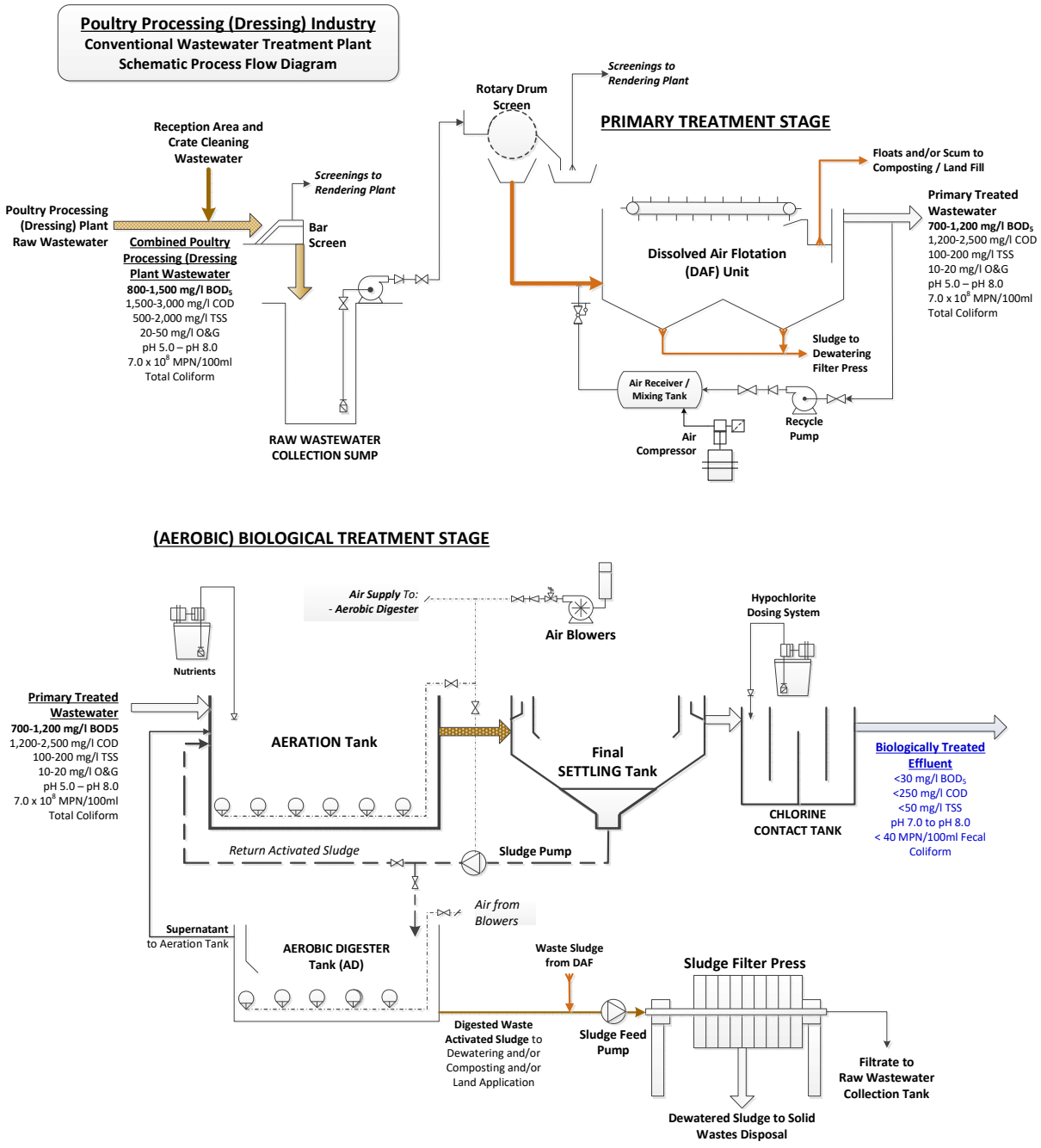
5.4 Tertiary Treatment Processes

5.4.1 Post Disinfection

Coliform count is an indirect measurement of the possible contamination of wastewater with wastes from animal or human sources. If these animal or human sources of wastes are sick and/or carry pathogens (disease causing organisms), exposure to the wastewater may cause people or animals to get sick. While aerobic biological treatment processes such as the activated sludge process can attain 3-log (1,000 times) coliform reduction, the concentration of coliforms (total and/or fecal) in the influent raw wastewater can be very high. Thus, the effluent of biological treatment needs to be disinfected to prevent the spread of contagious diseases.

The effluent of the biological treatment (activated sludge process) may be treated with hypochlorite solution at approximately 10 ppm available chlorine dosage to ensure destruction and/or inactivation of pathogens and coliforms which may be present in wastewater from animal and/or human sources. The clarified effluent flows to a chlorine contact tank providing at least 30 minutes of contact time at average flow and equipped with baffles or other device to promote mixing of the chlorine solution with the clarified (activated sludge process) effluent. The chlorine dosage may be increased to ensure consistent compliance with the statutory limits for coliforms.

6. APPENDIX: SCHEMATIC PROCESS FLOW DIAGRAM OF CONVENTIONAL WASTEWATER TREATMENT PLANT FOR POULTRY DRESSING INDUSTRY WASTEWATER



Annex 18 Guideline on Piggery Farm Inspection

Factory Inspection and Water Pollution Control Guidelines for PIGGERY (HOG RAISING) INDUSTRY

Factory Inspection and Water Pollution Control Guidelines
PIGGERY (HOG RAISING) INDUSTRY

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1. INTRODUCTION

1.1 Rationale

This industrial (water) pollution control guideline for the piggery (hog raising) industry was prepared under the ***Project for Effective Implementation of EIA and Pollution Control through Capacity Development of Ministry of Environment in the Kingdom of Cambodia*** to enhance the enforcement capacity of environmental inspectors and officers by providing industry specific technical information on (water) pollution sources, characteristics, and treatment methods in the piggery (hog raising) industry.

1.2 Piggery (Hog Raising) Industry in Cambodia

The livestock industry sector contributes approximately 16% to the agricultural value added and over 4% of GDP. The recent rise in the GDP per capita to middle income level and the (food preference) influence of the younger generation which constitutes over 50% of the population has led to a rapid increase in meat consumption. Tourists also add to the increase in meat consumption. This has led to a corresponding increase in livestock production. Nevertheless, a large proportion of the meat and poultry supply is imported since the local livestock industry is unable to meet the domestic demand. This shows a great potential for increasing domestic livestock industry. This has attracted many multinational firms to establish their presence in Cambodia where most of the livestock production is small scale, such as farmer households raising 1-3 pigs only in their backyards.

Considering that domestic consumers have a preference for pork, the piggery or hog raising industry is expected to continue to grow rapidly and small, backyard operations will grow larger in scale and capacity. While the environmental impact such as water pollution of small scale, backyard hog raising may be within the assimilative capacity of the farm, larger scale operations will require positive enforcement action to ensure compliance with environmental regulations in order to prevent adverse environmental impacts.

2. PIGGERY (HOG RAISING) PRODUCTION

2.1 Introduction

The piggery industry sector may be sub-divided into swine breeding and swine growing and finishing; although, there are integrated piggeries which breed, grow, and finish pigs (hogs or swine), most of which are large facilities.

2.2 Piggery (Hog Raising) Operations

2.2.1 Swine Breeding, Growing, and Finishing

Swine (pig) breeding involves impregnation of sows and proper care until the litter is born. Piglets are then raised until around 70 days old at which point, they may be delivered to (third party) swine growing or hog raising farms or transferred to the growing and finishing pens. The piglets are then raised until they attain marketable weights.

In addition to feeding them, raising pigs (hogs or swine) also involves bathing them, cleaning the pens, and collecting and disposing of solid wastes. It also involves vaccination and other activities to care for their health.

While commercial piggeries often have populations of hundreds or even thousands of pigs housed in buildings, there are also numerous small (backyard) piggeries. Small scale or backyard piggeries may predominate due to their large number.

3. WASTEWATER GENERATION

3.1 Sources of Wastewater in Swine Breeding, Growing, and Finishing

Most of the wastewater from piggeries comes from washing of the pens for cleaning and sanitation, urine from pigs, and spills from water dispensers. Pen cleaning is usually done according to a certain schedule. Hence, wastewater flow from pen cleaning is not continuous. "Dry" sweeping of pig manure may be done before the pens are cleaned, depending on pen design. In other cases, pig manure becomes part of the wastewater stream.

The pigs are also bathed, usually while their pens are washed. The buildings and walkways are also washed and cleaned and sanitized.

In some cases, fine mist spray is used to cool the pigs during hot season. The spray water joins the urine from pigs, and spills from water dispensers to form the relatively continuous but low flow of wastewater.

Where evaporative cooling / ventilation systems are used to cool the pig pens, blowdown from cooling systems may be polluted (usually with suspended solids from airborne dust) and may need treatment to comply with effluent standards before discharge. Cooling system blowdown should be checked by the inspector.

In many smaller piggeries, the wastewater drainage or sewerage may also serve as storm or rain water drainage system. This needs to be checked by the inspector since the combined wastewater and rain water volume during rainy season will hydraulically (water volume) overload the wastewater or effluent treatment plant.

3.2 Characteristics of Wastewater from Piggery (Hog Raising) Operations

3.2.1 Volume of Wastewater from Piggery (Hog Raising) Operations

The specific wastewater volume from **swine breeding and growing** typically ranges from **150 to 450 liters/day/sow** or **15 to 45 litters/day/head**, with an **average** of **200 liters/day/sow** or **20 liters/day/head**.

The specific wastewater volume from **swine growing and finishing** typically ranges from **8 to 15 liters/day/head**, with an **average** of **10 liters/day/head**.

3.2.2 Quality of Wastewater from Piggery (Hog Raising) Operations

Parameter	Breeding & Growing	Growing & Finishing
Biochemical Oxygen Demand, BOD_5	2,000 – 4,000 mg/l	2,000 – 5,000 mg/l
Chemical Oxygen Demand, COD	3,000 – 6,000 mg/l	3,500 – 12,000 mg/l
Total Suspended Solids, TSS	1,000 – 4,000 mg/l	1,000 – 6,000 mg/l
pH	pH 6.5 – pH 8.0	pH 6.5 – pH 8.0
Color, Pt-Co units	750 – 1,500 PCU	750 – 1,500 PCU
Ammonia-Nitrogen	250 – 350 mg/l	400 -1,200 mg/l
Nitrate- Nitrogen	<1.0 – 5.0 mg/l	<1.0 – 5.0 mg/l
Phosphates	200 – 300 mg/l	150 – 300 mg/l
Total Coliforms, MPN/100 mL	Up to 1.2×10^9	Up to 1.5×10^8

4. WASTE MANAGEMENT

4.1 Waste Minimization

- Spring loaded drinking water nozzles and improved feeding troughs to reduce waste.
- Modified feed components with more digestible ingredients and reduced nutrient content
- Dry sweeping and collection of manure prior to pen washing
- Deep bedding or litter system for management of manure as solid wastes
- Use of high-pressure sprays for washing of pens
- Use of evaporative mist spray for cooling instead of bathing pigs

5. WASTEWATER TREATMENT

5.1 Introduction

Piggery or hog raising is a traditional rural farm, backyard or small-scale activity that has since been undertaken in large commercial facilities. Wastewater from small scale piggeries usually is not treated or at best, is treated in anaerobic ponds. Wastewater from commercial piggeries is usually treated, often also using anaerobic treatment processes as the first stage of treatment.

The schematic process flow diagram shown in **Figure 1** below shows a typical, conventional treatment processes suitable for the treatment of piggery wastewater.

5.2 Physical Treatment Processes

Physical treatment processes rely on physical properties of contaminants to effect treatment. Physical treatment processes are best suited for the removal of discrete solids from water because they are effective and very economical, especially in terms of cost per unit quantity of pollutant removed.

5.2.1 Screening

Wastewater from a piggery may contain a high concentration suspended solids mostly manure with a smaller amount of feeds. These suspended solids contribute significantly to the BOD and COD and must be removed as soon as possible. Suspended solids may be removed by sedimentation or, preferably, by fine screening. Screening is preferred because it avoids the formation of obnoxious odors and produces a relatively dry output which may be handled as a solid. The relatively small size of the suspended solids tends to plug fine screens. A vibratory screen or dewatering screw press is preferred to separate the solids from the liquid.

The size of screening equipment is based on the flow rate, size of openings, and solids load. The effectiveness or degree of removal of solids is also dependent on these factors and varies considerably from less than 30% to more than 70%.

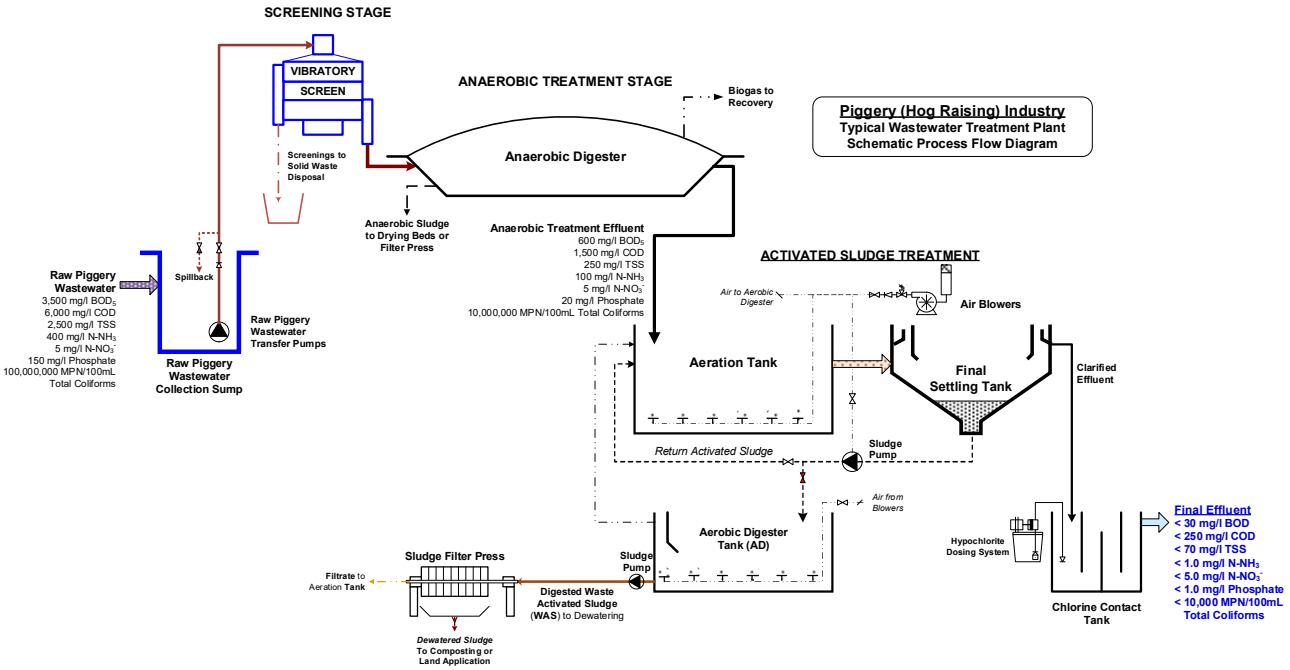

Figure 1 Typical Wastewater Treatment Plant for Piggery Wastewater

5.3 Biological Treatment Processes

5.3.1 Anaerobic Treatment

Anaerobic treatment is generally applied on high BOD strength wastewater and organic sludges. Anaerobic processes take place in the absence of oxygen. In biochemical reactions, oxygen generally acts as electron receptor in the process of extracting energy from the organic material. In the absence of free oxygen, other chemical species such as nitrates and sulfates can serve as oxygen donors in *anoxic* reactions. In the absence of even such oxygen donors, other compounds, generally complex organic compounds, serve as electron receptors.

One great advantage of anaerobic treatment systems is the low energy consumption, or in many cases, net energy yield (from the methane gas generated). Their disadvantage is the much slower reaction rates which generally translates to longer reaction (holding) times and larger tanks.

In general, anaerobic treatment processes are cost effective when the influent BOD concentration is 2,000-3,000 mg/l or higher. Anaerobic treatment processes can attain BOD reduction efficiencies of more than 75-90%. However, due to the high BOD concentration of the influent, the effluent of anaerobic treatment systems needs polishing treatment (usually by aerobic processes) to attain compliance with discharge standards.

The biochemical oxygen demand (BOD) of raw wastewater from piggeries often exceeds 2,000-3,000 mg/l. Hence, anaerobic treatment systems are often used as the first biological treatment stage in treating wastewater from piggeries.

Anaerobic Ponds / Anaerobic Digesters: Traditionally, anaerobic ponds have been used to treat piggery wastewater due to their low capital and operating costs. However, anaerobic ponds produce foul odors while unable to meet effluent standards, often due to improper design and sizing. Anaerobic digesters usually equipped with flexible synthetic covers prevent the release of foul odors while allowing collection of the biogas for energy recovery. Properly designed especially in terms of organic loading, anaerobic digesters can attain high treatment efficiencies exceeding 90%. However, this requires hydraulic retention times of 15-30 days.

Upflow Anaerobic Sludge Blanket (UASB) Reactors: UASB reactors have been successfully applied in the treatment of piggery wastewater. UASB reactors can attain high reduction efficiencies of 80%-95% at high organic loading which results in a compact system. Due to the tendency of suspended solids in the influent wastewater to displace the UASB granules and sludge, it is critically important to reduce the suspended solids content of the influent to the UASB reactors.

It should also be noted that anaerobic microorganisms are more aggressive. Coupled with the long hydraulic retention times, this results in the breakdown of organic substances which are otherwise difficult to biodegrade by aerobic microorganisms. This results in lower COD concentrations in the anaerobically digested or treated wastewater but higher BOD:COD ratios. This increase in the aerobically biodegradable fraction must be taken into account in designing the subsequent aerobic biological polishing treatment stage.

5.3.2 Aerobic Biological Treatment: Activated Sludge Process

While anaerobic treatment can attain BOD and COD reduction efficiencies exceeding 90%, the high BOD and COD concentration of piggery wastewater results in BOD and COD concentrations in the anaerobically treated piggery wastewater to exceed effluent standards. Hence, further treatment is required to polish the anaerobically treated effluent in order to comply with effluent standards.

The *activated sludge* treatment process is an aerobic, suspended-growth system. It is the most common biological treatment process because of its high BOD reduction efficiency, stability, reliability, and ease of operation.

The activated sludge treatment process consists of an aeration tank and a (final or secondary) settling tank. Wastewater flows into the aeration tank where biologically active sludge recycled from the (final or secondary) settling tank is mixed with the influent wastewater. The activated sludge microorganisms consume the organic pollutants (measured as BOD_5 and COD) which serve as their food or substrate, and convert them to harmless carbon dioxide, water, and additional cell mass. An aeration system provides the oxygen required for the degradation of the organic pollutants and the mixing energy to keep the activated sludge flocs in suspension.

Activated sludge treatment process can reduce BOD by over 90-95% and suspended solids by 80-90%.

While many factors affect the performance of an activated sludge treatment system, one of the most important is the ratio of food (BOD) to microorganism or food to mass (F:M) ratio. A food to mass (F:M) ratio of 0.05 – 0.15 kg BOD_5/day/kg microorganisms will consistently produce treated effluent BOD_5 concentrations below 20 - 30 mg/l and effluent suspended solids concentrations below 30 – 50 mg/l.

5.3.3 Alternative Aerobic Biological Treatment Processes

Alternative aerobic biological treatment processes include sequencing batch reactors (SBR), trickling filters, rotating biological contactors (RBC), and membrane bioreactors (MBR).

Sequencing batch reactors (SBR) are a variation of the conventional activated sludge system. Treatment takes place in a single tank, unlike the two-tank arrangement of the conventional activated sludge system. Treatment is undertaken in batches going through the different stages of filling, aeration / reaction, settling or solids separation, and discharge or decanting of the treated effluent. Provisions must be made to accommodate the influent wastewater during the different stages (except filling). In most cases, a holding or equalization tank is used, or a twin tank arrangement is provided wherein one tank cycles through the treatment while the other reactor tank accumulates the influent raw wastewater. SBRs attain similar treatment efficiencies as activated sludge treatment plants. Although they can be operated manually, SBRs usually require automation and motorized or pneumatically operated valves. SBRs consume more energy than activated sludge treatment plants of the same capacity.

Trickling filters are a form of attached growth or fixed film biological treatment systems. In fixed film processes, microorganisms that consume the organic material (food or BOD) grow as *slime* on fixed media. As the wastewater flows over the slime or biomass, (soluble) organic wastes are adsorbed and consumed by the microorganisms. Oxygen from air diffuses through the thin layer of wastewater to the microorganisms.

As the slime layer builds up, clumps slough off or detach from the media. The material that sloughs off, called *humus*, flows with the wastewater and is separated from the treated wastewater in the secondary clarifier or settling tank (or filter). The main advantage of trickling filters (and other fixed film treatment systems) is their low operating costs.

Rotating biological contactors (RBC) are another type of attached growth biological treatment with low operating energy consumption. In contrast to trickling filters wherein the media do not move, the media in RBCs are discs partially submerged in the wastewater that rotate around a shaft. The rotation alternately exposes the slime layer to the food (organic wastes) when submerged and oxygen when exposed to the air to effect treatment.

It is important to note that attached growth treatment processes, such as trickling filters are more effective on soluble organic pollutants and less so on particulate or suspended solid pollutants. For this reason, trickling filters need primary clarifiers or similar pre-treatment units to be effective. Since initial anaerobic treatment of piggery wastewater reduces the concentration of suspended solids, attached growth treatment systems are well suited for the polishing treatment of anaerobically treated piggery wastewater.

Properly sized and operated, attached growth treatment systems can attain BOD reduction efficiencies of 80-90%. The suspended solids concentrations of the treated effluent of attached growth treatment processes like trickling filters are often higher than those of the effluent of suspended growth treatment processes like activated sludge process.

Membrane bioreactors (MBR) are aerobic, suspended growth treatment systems similar to activated sludge treatment plants where the secondary clarifier or settling tank is replaced with a (semi-permeable) membrane such as ultrafiltration or microfiltration membranes which are usually installed in the aeration tank. This system eliminates the secondary settling tank resulting in a more compact system. The membrane is also several times more effective in removing suspended solids (mainly the activated sludge flocs) than settling tanks to produce very low suspended solids concentrations in the effluent. The membrane system also allows the retention of higher concentrations of biomass or activated sludge, further improving BOD reduction efficiencies.

MBRs can produce effluents with less than 10 mg/l BOD_5 and less than 10 mg/l TSS (total suspended solids). Depending on the type and material of the membrane, it may also be able to remove some of the color of the wastewater.

The membranes in MBRs are sensitive to fouling from mineral and biological deposits which reduce flux and increases the pressure required to maintain the desired flux. This results in higher energy requirements to operate and the need for frequent cleaning. As a result, MBRs are more costly operate than the more conventional biological treatment systems as well as being more costly to construct.

Aerobic Lagoons are large, shallow ponds where oxygen required to meet the oxygen demand of the wastewater comes from the oxygen in the atmosphere that diffuses into the water. In some cases, aquatic plants such as water hyacinths may be grown in the aerobic lagoon to supplement the oxygen supply. In other cases, the aerobic lagoon is mechanical aerated to hasten the biodegradation of organic pollutants.

Facultative Lagoons are deeper than aerobic lagoons. Since the oxygen that diffuses from the air is unable to reach the deeper portions of the lagoon, the lower layers become anaerobic. Biodegradation of organic substances takes place in both the oxygenated, aerobic upper layer and the anaerobic lower layer. With proper balance, foul smelling gases from the anaerobic lower layer are treated and counteracted in the aerobic upper layer, thereby preventing the escape of foul odors.

Aerobic and Facultative Lagoons may be sufficiently effective as polishing post treatment following anaerobic digesters or lagoons if required land area is economically available. This condition may be valid for piggeries located in rural areas.

5.4 Nutrient Removal

5.4.1 Introduction

Wastewater from the piggery industry contains high concentrations of nutrients (various compounds of nitrogen and phosphorus). Sometimes, primary treatment (physical and chemical treatment processes) and secondary treatment (biological treatment processes) may be inadequate to attain full compliance with discharge standards, especially for nutrients when treating wastewater from piggeries. To further improve effluent quality to attain compliance, nutrient removal treatment methods may be used.

5.5 Nutrient Removal Treatment Processes

5.5.1 Biological Nutrient Removal

Biological treatment using both anaerobic and aerobic treatment processes will remove significant amounts of nutrients. However, the residual concentrations of ammonia, nitrates, and phosphates may still exceed the effluent standards. Recycling some of the aerobic activated sludge to the anaerobic digester at a balanced rate may suffice in reducing phosphate concentrations to meet the effluent standards.

Extended aeration to achieve nitrification followed by denitrification may be adequate to remove both ammonia and nitrate forms of nitrogen to meet effluent standards.

5.5.2 Chemical Nutrient Removal

If biological nutrient removal is inadequate or impractical to implement, nutrients may be removed by chemical treatment. For wastewater from the piggeries, chemical treatment be used to remove or reduce phosphate through precipitation (with or without pH adjustment), coagulation, and sedimentation. Ammonia may be removed by chemical oxidation reactions.

Adjustment of pH, precipitation, and coagulation may take place in separate reaction tanks or simultaneously in a single reactor tank. Flocculation normally takes place in a separate reaction tank. After precipitation, coagulation, and flocculation, the pollutants, now in floc form, are separated by gravity sedimentation in conventional settling tanks or clarifiers or in inclined, parallel plate or tube settlers. The sludge which now contains the (phosphate) pollutants removed from the wastewater is discharged and dewatered prior to ultimate disposal as solid wastes. Chemical treatment can be very effective in removing or reducing inorganic pollutants including food coloring but has a less effect on BOD or COD.

Alum is often the most effective precipitating agent for phosphates but other chemicals such as ferric chloride and (slaked) lime are also effective. Polyelectrolytes are used as flocculant aids. The correct types and combinations of treatment chemicals and their optimum dosages are best determined by conducting jar tests on the actual wastewater streams.

Ammonia may be removed by breakpoint chlorination. Enough amounts of chlorine (or hypochlorite) are added to the wastewater to exceed the chlorine demand (due to reducing inorganic and organic compounds, including ammonia) until a free residual chlorine concentration is attained. At this point, the ammonia would have been converted to chloramines and effectively removed.

5.6 Tertiary Treatment Processes

5.6.1 Post Disinfection

Coliform count is an indirect measurement of the possible contamination of wastewater with wastes from animal or human sources. If these animal or human sources of wastes are sick and/or carry pathogens (disease causing organisms), exposure to the wastewater may cause people or animals to get sick. While aerobic biological treatment processes such as the activated sludge process can attain 3-log (1,000 times) coliform reduction, the concentration of coliforms (total and/or fecal) in the influent raw wastewater from piggeries can be very high. Thus, the effluent of biological treatment needs to be disinfected to prevent the spread of contagious diseases.

The effluent of the biological treatment (activated sludge process) may be treated with hypochlorite solution at approximately 10 ppm available chlorine dosage to ensure destruction and/or inactivation of pathogens and coliforms which may be present in wastewater from animal and/or human sources. The clarified effluent flows to a chlorine contact tank providing at least 30 minutes of contact time at average flow and equipped with baffles or other device to promote mixing of the chlorine solution with the clarified (activated sludge process) effluent. The chlorine dosage may be increased to ensure consistent compliance with the statutory limits for coliforms.

If breakpoint chlorination is used to remove ammonia, it will suffice to reduce and control to coliform concentrations to well below effluent standards.

5.7 Effectiveness of Various Treatment Processes

- **Screening**
  - **TSS <1,500 mg/l**
- **Anaerobic (Conventional)**
  - **BOD_5 ~300 mg/l**
  - **COD ~700 mg/l**
  - **TSS ~150 mg/l**
  - **Coliform ~64,000 MPN/100 mL**
- **Anaerobic (UASB)**
  - **BOD_5 ~200 mg/l**
  - **COD ~600 mg/l**
  - **TSS ~150 mg/l**
  - **Coliform ~64,000 MPN/100 mL**
- **Activated Sludge, SBR**
  - **BOD_5 <30 mg/l**
  - **COD 3150 mg/l**
  - **TSS <50 mg/l**
  - **Coliform ~6,400 MPN/100 mL**
- **Aerobic Lagoon**
  - **BOD_5 <60 mg/l**
  - **COD <250 mg/l**
  - **TSS <150 mg/l**
  - **Coliform ~64,000 MPN/100 mL**
- **Facultative Lagoon**
  - **BOD_5 <120 mg/l**
  - **COD <300 mg/l**
  - **TSS <150 mg/l**
  - **Coliform ~64,000 MPN/100 mL**
- **Post Disinfection**
  - **Coliform ~6,400 MPN/100 mL**

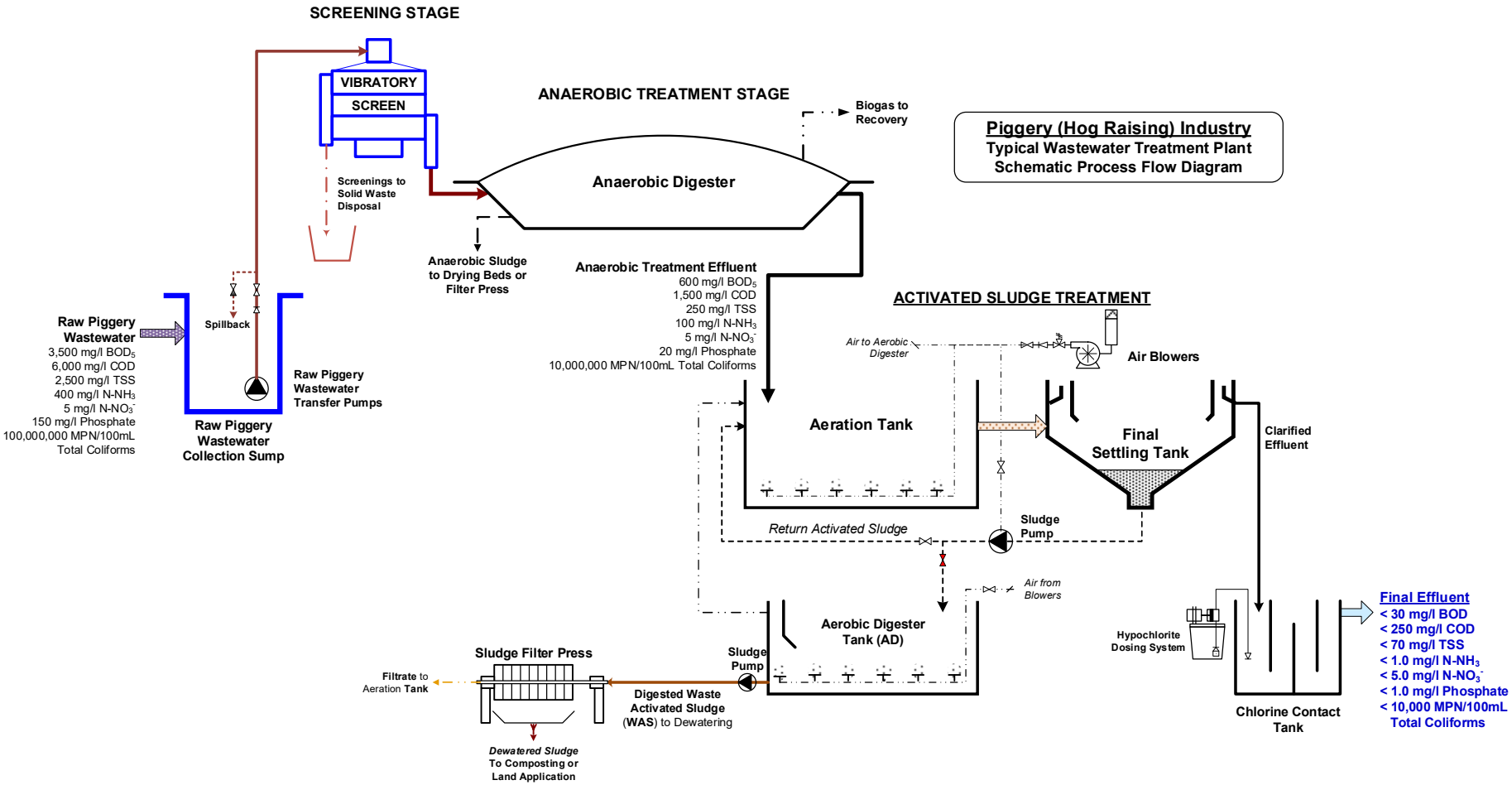

Figure 2 Typical Wastewater Treatment Plant for Piggery Wastewater

Annex 19 Guideline on Central Kitchen Commissary Inspection

Factory Inspection and Water Pollution Control Guidelines for CENTRAL KITCHEN / COMMISSARY INDUSTRY

Factory Inspection and Water Pollution Control Guidelines
CENTRAL KITCHEN / COMMISSARY INDUSTRY

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1. INTRODUCTION

1.1 Rationale

This factory inspection and industrial (water) pollution control guideline for the central kitchen or commissary industry was prepared under the ***Project for Effective Implementation of EIA and Pollution Control through Capacity Development of Ministry of Environment in the Kingdom of Cambodia*** to enhance the enforcement capacity of environmental inspectors and officers by providing industry specific technical information on (water) pollution sources, characteristics, and treatment methods in the central kitchen or commissary industry.

1.2 Central Kitchen or Commissary Industry in Cambodia

With approximately 40% share, the service sector has the largest contribution to the GDP of Cambodia. The food service sector, which includes regular and dining restaurants and quick service or fast food outlets and serves both the domestic and tourism markets contributes more than half of the GDP from the service sector. Food tourism is highly promoted in Cambodia and will continue to increase demand for quality food service. At the same time, franchises from both local mom-and-pop operations to international companies have expanded their presence in major cities of the kingdom.

While there are many independent restaurants with their own kitchen, the large and growing number of fast food franchises require their own central kitchen or commissary to ensure consistent quality. Since central kitchens or commissaries are medium to large scale operations, their operations need to be regulated for the protection of the environment and prevention of water pollution.

2. CENTRAL KITCHEN OR COMMISSARY OPERATIONS

2.1 Introduction

The central kitchen or commissary industry sector may be sub-divided into baked goods and regular food items such as meat and vegetable dishes even as many central kitchens or commissaries combine both in their facilities. The main difference from the pollution control and wastewater treatment point of view is the quality of the raw wastewater which defines the treatment requirements.

While the operations in a central kitchen or commissary are basically the same as in a home kitchen, the difference is in the scale, period or duration of operation, and the availability of services such as potable water production and supply and wastewater treatment.

2.2 Baking Operations

Baking involves the combining of dry raw materials such as flour, sugar, and salt and blending or mixing with liquid raw materials, kneading, aging or maturing and cooking with dry heat as in an oven.

While many baked products such as breads and cookies are suitable for sale and consumption after baking, others may be further processed by the addition of fillings and icing or frosting for enhancement of appearance and/or taste. Since many fillings and frosting or icing menus involves the use of fats and oils, FOG (fats, oil, and grease) are major pollutants in the raw wastewater from baking operations.

2.3 Central Kitchen Operations

Conventional central kitchen operations may involve washing of the raw materials such as meats and vegetables, cutting, grinding, mixing, and cooking itself.

In addition, central kitchen has proper, large scale facilities for the storage of raw materials and finished products. Central kitchens also provide a higher level of sanitation and hygiene than home kitchens.

3. WASTEWATER GENERATION

3.1 Sources of Wastewater

The baking process itself does not generate any wastewater. Most of the wastewater from the baking process comes from washing of pots, pans, vats, and utensils. At the end of a work shift, the tables, floors, and walls are also washed cleaned, generating more wastewater.

In the meat processing and conventional dish preparation, raw materials are washed to maintain the highest level of hygiene and sanitation. Meat processing and cooking operations themselves do not generate any wastewater. Most of the wastewater from meat processing and conventional cooking operations comes from the washing of pots, pans, vats, and utensils. At the end of a work shift, the tables, floors, and walls are also washed cleaned, generating more wastewater.

3.2 Characteristics of Wastewater from Central Kitchen or Commissary Operations

3.2.1 Wastewater Volume

The specific wastewater volume generation from **baking operations** typically ranges from **4 to 9 liters per kg of raw materials (mainly flour)** with an **average** of **6 liters per kg of raw materials (mainly flour)**.

The specific wastewater volume generation from **conventional cooking operations** typically ranges from **50 to 90 liters per kg of raw materials (meat, vegetables, and others)** with an **average** of **75 liters per kg of raw materials (meat, vegetables, and others)**.

3.2.2 Quality of Wastewater from Central Kitchen or Commissary Operations

Parameter	Bakery Only	Combined Operations
Biochemical Oxygen Demand, BOD_5	1,200 – 2,000 mg/l	600 – 3,000 mg/l
Chemical Oxygen Demand, COD	2,000 – 3,000 mg/l	2,000 – 7,000 mg/l
Total Suspended Solids, TSS	500 – 1,000 mg/l	1,000 – 2,000 mg/l
pH	pH 4.0 – pH 6.5	pH 4.5 – pH 6.0
Fats, Oil, and Grease	200 –400 mg/l	250 -3,500 mg/l
Ammonia-Nitrogen	10 –50 mg/l	40 -120 mg/l
Nitrate- Nitrogen	<1.0 – 5.0 mg/l	<1.0 – 5.0 mg/l
Phosphates	20 – 100 mg/l	50 – 120 mg/l
Total Coliforms, MPN/100 mL	Up to 1.2 x 10^6	Up to 1.2 x 109

4. WASTEWATER TREATMENT

4.1 Introduction

Wastewater from the food industry such as central kitchens or commissaries is characterized by high concentrations of organic matter, measured as BOD_5 and/or COD, FOG (fats, oil, & grease), and nutrients (phosphates, nitrates, and ammonia)

The schematic process flow diagram shown in **Figure 1** below shows a typical, conventional treatment processes suitable for the treatment of central kitchen or commissary wastewater.

4.2 Physical Treatment Processes

Physical treatment processes rely on physical properties of contaminants to effect treatment. Physical treatment processes are best suited for the removal of discrete solids from water because they are effective and very economical, especially in terms of cost per unit quantity of pollutant removed.

4.2.1 Screening

Wastewater from a bakery or central kitchen may contain a high concentration suspended solids mostly flour. Conventional cooking or kitchen operations likewise generate significant amounts of large suspended solids. These suspended solids, which are mostly organic, contribute significantly to the BOD and COD and must be removed as soon as possible. Suspended solids may be removed by sedimentation or flotation or by screening. Screening is advisable because it is the most cost effective method for removing BOD or COD due to the suspended solids

The size of screening equipment is based on the flow rate, size of openings, and solids load. The effectiveness or degree of removal of solids is also dependent on these factors and varies considerably from less than 30% to more than 70%.

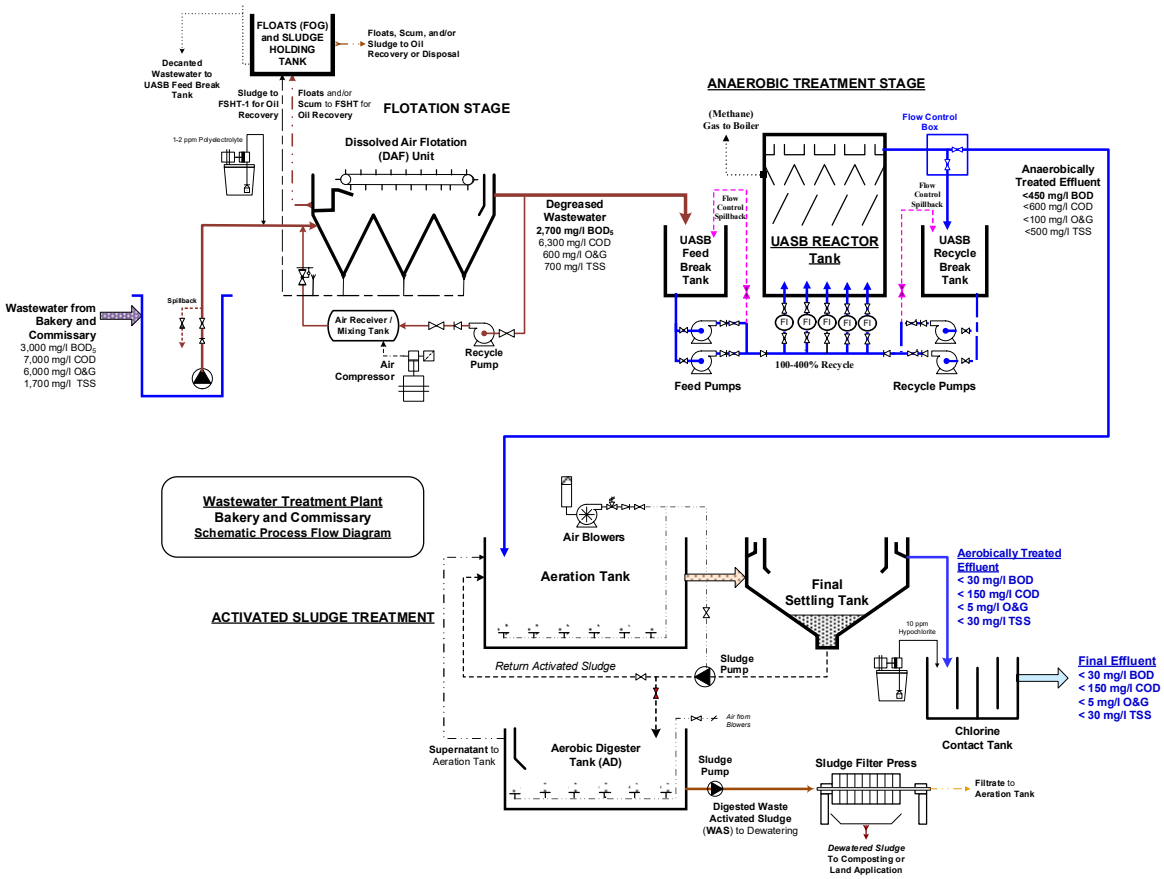

Figure 1 Typical Wastewater Treatment Plant for Central Kitchen Wastewater

4.3 Biological Treatment Processes

4.3.1 Anaerobic Treatment

Anaerobic treatment is generally applied on high BOD strength wastewater and organic sludges. Anaerobic processes take place in the absence of oxygen. In biochemical reactions, oxygen generally acts as electron receptor in the process of extracting energy from the organic material. In the absence of free oxygen, other chemical species such as nitrates and sulfates can serve as oxygen donors in *anoxic* reactions. In the absence of even such oxygen donors, other compounds, generally complex organic compounds, serve as electron receptors.

One major advantage of anaerobic treatment systems is the low energy consumption, or in many cases, net energy yield (from the methane gas generated). Their disadvantage is the much slower reaction rates which generally translates to longer reaction (holding) times and larger tanks.

In general, anaerobic treatment processes are cost effective when the influent BOD concentration is 2,000-3,000 mg/l or higher. Anaerobic treatment processes can attain BOD reduction efficiencies of more than 75-90%. However, due to the high BOD concentration of the influent, the effluent of anaerobic treatment systems needs polishing treatment (usually by aerobic processes) to attain compliance with discharge standards.

The biochemical oxygen demand (BOD) of raw wastewater from bakeries and even from conventional kitchens often exceeds 2,000-3,000 mg/l. Hence, anaerobic treatment systems are often used as the first biological treatment stage in treating wastewater from central kitchens or commissaries.

Upflow Anaerobic Sludge Blanket (UASB) Reactors: UASB reactors have been successfully applied in the treatment of central kitchen or commissary wastewater. UASB reactors can attain high reduction efficiencies of 80%-95% at high organic loading which results in a compact system. Due to the tendency of suspended solids in the influent wastewater to displace the UASB granules and sludge, it is critically important to reduce the suspended solids content of the influent to the UASB reactors. Fats, oil, and grease are inhibitory to biological processes and promote loss of biosolids (microorganisms responsible for treating wastewater).

It should also be noted that anaerobic microorganisms are more aggressive. Coupled with the long hydraulic retention times, this results in the breakdown of organic substances which are otherwise difficult to biodegrade by aerobic microorganisms. This results in lower COD concentrations in the anaerobically digested or treated wastewater but higher BOD:COD ratios. This increase in the aerobically biodegradable fraction must be taken into account in designing the subsequent aerobic biological polishing treatment stage.

4.3.2 Aerobic Biological Treatment: Activated Sludge Process

While anaerobic treatment can attain BOD and COD reduction efficiencies exceeding 90%, the high BOD and COD concentration of central kitchen or commissary wastewater results in BOD and COD concentrations in the anaerobically treated central kitchen or commissary wastewater to exceed effluent standards. Hence, further treatment is required to polish the anaerobically treated effluent in order to comply with effluent standards.

The *activated sludge* treatment process is an aerobic, suspended-growth system. It is the most common biological treatment process because of its high BOD reduction efficiency, stability, reliability, and ease of operation.

The activated sludge treatment process consists of an aeration tank and a (final or secondary) settling tank. Wastewater flows into the aeration tank where biologically active sludge recycled from the (final or secondary) settling tank is mixed with the influent wastewater. The activated sludge microorganisms consume the organic pollutants (measured as BOD_5 and COD) which serve as their food or substrate, and convert them to harmless carbon dioxide, water, and additional cell mass. An aeration system provides the oxygen required for the degradation of the organic pollutants and the mixing energy to keep the activated sludge flocs in suspension.

Activated sludge treatment process can reduce BOD by over 90-95% and suspended solids by 80-90%.

While many factors affect the performance of an activated sludge treatment system, one of the most important is the ratio of food (BOD) to microorganism or food to mass (F:M) ratio. A food to mass (F:M) ratio of 0.05 – 0.15 kg BOD_5/day/kg microorganisms will consistently produce treated effluent BOD_5 concentrations below 20 - 30 mg/l and effluent suspended solids concentrations below 30 – 50 mg/l.

4.3.3 Alternative Aerobic Biological Treatment Processes

Alternative aerobic biological treatment processes include sequencing batch reactors (SBR), trickling filters, rotating biological contactors (RBC), and membrane bioreactors (MBR).

Sequencing batch reactors (SBR) are a variation of the conventional activated sludge system. Treatment takes place in a single tank, unlike the two-tank arrangement of the conventional activated sludge system. Treatment is undertaken in batches going through the different stages of filling, aeration / reaction, settling or solids separation, and discharge or decanting of the treated effluent. Provisions must be made to accommodate the influent wastewater during the different stages (except filling). In most cases, a holding or equalization tank is used, or a twin tank arrangement is provided wherein one tank cycles through the treatment while the other reactor tank accumulates the influent raw wastewater. SBRs attain similar treatment efficiencies as activated sludge treatment plants. Although they can be operated manually, SBRs usually require automation and motorized or pneumatically operated valves. SBRs consume more energy than activated sludge treatment plants of the same capacity.

Trickling filters are a form of attached growth or fixed film biological treatment systems. In fixed film processes, microorganisms that consume the organic material (food or BOD) grow as *slime* on fixed media. As the wastewater flows over the slime or biomass, (soluble) organic wastes are adsorbed and consumed by the microorganisms. Oxygen from air diffuses through the thin layer of wastewater to the microorganisms.

As the slime layer builds up, clumps slough off or detach from the media. The material that sloughs off, called *humus*, flows with the wastewater and is separated from the treated wastewater in the secondary clarifier or settling tank (or filter). The main advantage of trickling filters (and other fixed film treatment systems) is their low operating costs.

Rotating biological contactors (RBC) are another type of attached growth biological treatment with low operating energy consumption. In contrast to trickling filters wherein the media do not move, the media in RBCs are discs partially submerged in the wastewater that rotate around a shaft. The rotation alternately exposes the slime layer to the food (organic wastes) when submerged and oxygen when exposed to the air to effect treatment.

It is important to note that attached growth treatment processes, such as trickling filters are more effective on soluble organic pollutants and less so on particulate or suspended solid pollutants. For this reason, trickling filters need primary clarifiers or similar pre-treatment units to be effective. Since initial anaerobic treatment of central kitchen or commissary wastewater reduces the concentration of suspended solids, attached growth treatment systems are well suited for the polishing treatment of anaerobically treated central kitchen or commissary wastewater.

Properly sized and operated, attached growth treatment systems can attain BOD reduction efficiencies of 80-90%. The suspended solids concentrations of the treated effluent of attached growth treatment processes like trickling filters are often higher than those of the effluent of suspended growth treatment processes like activated sludge process.

Membrane bioreactors (MBR) are aerobic, suspended growth treatment systems similar to activated sludge treatment plants where the secondary clarifier or settling tank is replaced with a (semi-permeable) membrane such as ultrafiltration or microfiltration membranes which are usually installed in the aeration tank. This system eliminates the secondary settling tank resulting in a more compact system. The membrane is also several times more effective in removing suspended solids (mainly the activated sludge flocs) than settling tanks to produce very low suspended solids concentrations in the effluent. The membrane system also allows the retention of higher concentrations of biomass or activated sludge, further improving BOD reduction efficiencies.

MBRs can produce effluents with less than 10 mg/l BOD_5 and less than 10 mg/l TSS (total suspended solids). Depending on the type and material of the membrane, it may also be able to remove some of the color of the wastewater.

The membranes in MBRs are sensitive to fouling from mineral and biological deposits which reduce flux and increases the pressure required to maintain the desired flux. This results in higher energy requirements to operate and the need for frequent cleaning. As a result, MBRs are more costly operate than the more conventional biological treatment systems as well as being more costly to construct.

Aerobic Lagoons are large, shallow ponds where oxygen required to meet the oxygen demand of the wastewater comes from the oxygen in the atmosphere that diffuses into the water. In some cases, aquatic plants such as water hyacinths may be grown in the aerobic lagoon to supplement the oxygen supply. In other cases, the aerobic lagoon is mechanical aerated to hasten the biodegradation of organic pollutants.

Facultative Lagoons are deeper than aerobic lagoons. Since the oxygen that diffuses from the air is unable to reach the deeper portions of the lagoon, the lower layers become anaerobic. Biodegradation of organic substances takes place in both the oxygenated, aerobic upper layer and the anaerobic lower layer. With proper balance, foul smelling gases from the anaerobic lower layer are treated and counteracted in the aerobic upper layer, thereby preventing the escape of foul odors.

Aerobic and Facultative Lagoons may be sufficiently effective as polishing post treatment following anaerobic digesters or lagoons if required land area is economically available. This condition may not apply to central kitchens or commissaries which are often located in urban areas.

4.4 Nutrient Removal Treatment Processes

4.4.1 Introduction

Wastewater from the central kitchen or commissary industry may contain high concentrations of nutrients (various compounds of nitrogen and phosphorus) because high concentrations of nutrients are desirable in raw materials for food production and preparation in central kitchens or commissaries. Oftentimes, primary treatment (physical and chemical treatment processes) and secondary treatment (biological treatment processes) may be inadequate to attain full compliance with discharge standards, especially for nutrients when treating wastewater from central kitchens or commissaries. To further improve effluent quality to attain compliance, nutrient removal treatment methods may be used.

4.4.2 Biological Nutrient Removal

Biological treatment using both anaerobic and aerobic treatment processes will remove significant amounts of nutrients. However, the residual concentrations of ammonia, nitrates, and phosphates may still exceed the effluent standards. Recycling some of the aerobic activated sludge to the anaerobic digester at a balanced rate may suffice in reducing phosphate concentrations to meet the effluent standards.

Extended aeration to achieve nitrification followed by denitrification may be adequate to remove both ammonia and nitrate forms of nitrogen to meet effluent standards.

4.4.3 Chemical Nutrient Removal

If biological nutrient removal is inadequate or impractical to implement, nutrients may be removed by chemical treatment. For wastewater from the central kitchens or commissaries, chemical treatment may be used to remove or reduce phosphate through precipitation (with or without pH adjustment), coagulation, and sedimentation. Ammonia may be removed by chemical oxidation reactions.

Adjustment of pH, precipitation, and coagulation may take place in separate reaction tanks or simultaneously in a single reactor tank. Flocculation normally takes place in a separate reaction tank. After precipitation, coagulation, and flocculation, the pollutants, now in insoluble, solid floc form, are separated by gravity settling or sedimentation in conventional settling tanks or clarifiers or in inclined, parallel plate or tube settlers. The sludge which now contains the (phosphate) pollutants removed from the wastewater is discharged and dewatered prior to ultimate disposal as solid wastes. Chemical treatment can be very effective in removing or reducing inorganic pollutants including food coloring but has a less effect on BOD or COD.

Alum is often the most effective precipitating agent for phosphates but other chemicals such as ferric chloride and (slaked) lime are also effective. Polyelectrolytes are used as flocculant aids. The correct types and combinations of treatment chemicals and their optimum dosages are best determined by conducting jar tests on the actual wastewater streams.

Ammonia may be removed by breakpoint chlorination. Enough amounts of chlorine (or hypochlorite) are added to the wastewater to exceed the chlorine demand (due to reducing inorganic and organic compounds, including ammonia) until a free residual chlorine

concentration is attained. At this point, the ammonia will have been converted to chloramines and effectively removed.

4.5 Tertiary Treatment Processes

4.5.1 Post Disinfection

Coliform count is an indirect measurement of the possible contamination of wastewater with wastes from animal or human sources. If these animal or human sources of wastes are sick and/or carry pathogens (disease causing organisms), exposure to the wastewater may cause people or animals to get sick. While aerobic biological treatment processes such as the activated sludge process can attain 3-log (1,000 times) coliform reduction, the concentration of coliforms (total and/or fecal) in the influent raw wastewater from central kitchens or commissaries can be very high. Thus, the effluent of biological treatment needs to be disinfected to prevent the spread of contagious diseases.

The effluent of the biological treatment (activated sludge process) may be treated with hypochlorite solution at approximately 10 ppm available chlorine dosage to ensure destruction and/or inactivation of pathogens and coliforms which may be present in wastewater from animal and/or human sources. The clarified effluent flows to a chlorine contact tank providing at least 30 minutes of contact time at average flow and equipped with baffles or other device to promote mixing of the chlorine solution with the clarified (activated sludge process) effluent. The chlorine dosage may be increased to ensure consistent compliance with the statutory limits for coliforms.

If breakpoint chlorination is used to remove ammonia, it will suffice to reduce and control to coliform concentrations to well below effluent standards.

4.6 Effectiveness of Various Treatment Processes

- Screening
  - TSS <500 mg/l
- Anaerobic (Conventional)
  - BOD_5 ~300 mg/l
  - COD ~700 mg/l
  - TSS ~150 mg/l
  - Coliform ~64,000 MPN/100 mL
- Anaerobic (UASB)
  - BOD_5 ~200 mg/l
  - COD ~600 mg/l
  - TSS ~150 mg/l
  - Coliform ~64,000 MPN/100 mL
- Activated Sludge, SBR
  - BOD_5 <30 mg/l
  - COD <150 mg/l
  - TSS <50 mg/l
  - Coliform ~6,400 MPN/100 mL
- Aerobic Lagoon
  - BOD_5 <60 mg/l
  - COD <250 mg/l
  - TSS <150 mg/l
  - Coliform ~64,000 MPN/100 mL
- Facultative Lagoon
  - BOD_5 <120 mg/l
  - COD <300 mg/l
  - TSS <150 mg/l
  - Coliform ~64,000 MPN/100 mL
- Post Disinfection
  - Coliform ~6,400 MPN/100 mL

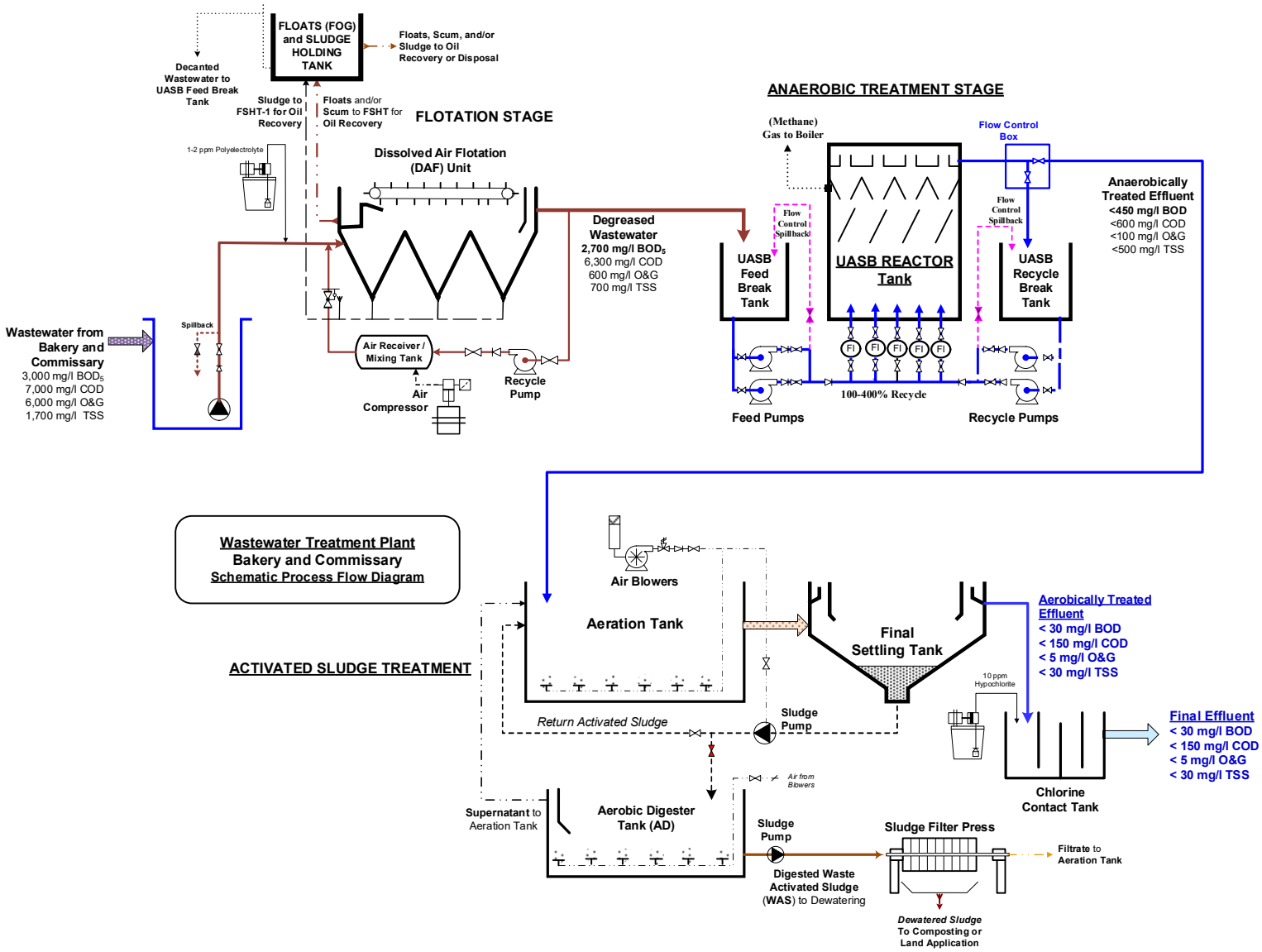

Figure 2 Typical Wastewater Treatment Plant for Central Kitchen or Commissary Wastewater

Annex 20 Guideline on Groundwater Protection by Industrial Chemical

Guideline for Groundwater protection

by industrial chemicals

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ANNEX 1 Japanese case on groundwater contamination by Industrial chemicals
ANNEX 2 Guidance on Storage and Handling of Chlorinated Solvents Fifth Edition", ECSA - European Chlorinated Solvents Association, September 2016

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Figure 3 Storage containment
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1. Purpose and background

This Guideline is related to Artcile 8 of Water Pollution Control sub-decree (revised version), to provide management guidance for storage and handling of target chemicals which are used by the factory/industry.

Organic solvent, specially chlorinated solvent, can cause serious contamination is soil and groundwater and affect environment and human health, if not properly handled and stored. Below diagram illustrate how such contamination occurs and affect the environment. Also once contaminated, complete remediation of soil and groundwater would be very difficult and costly, if not impossible. Thus prevention of such contamination is of utmost importance.

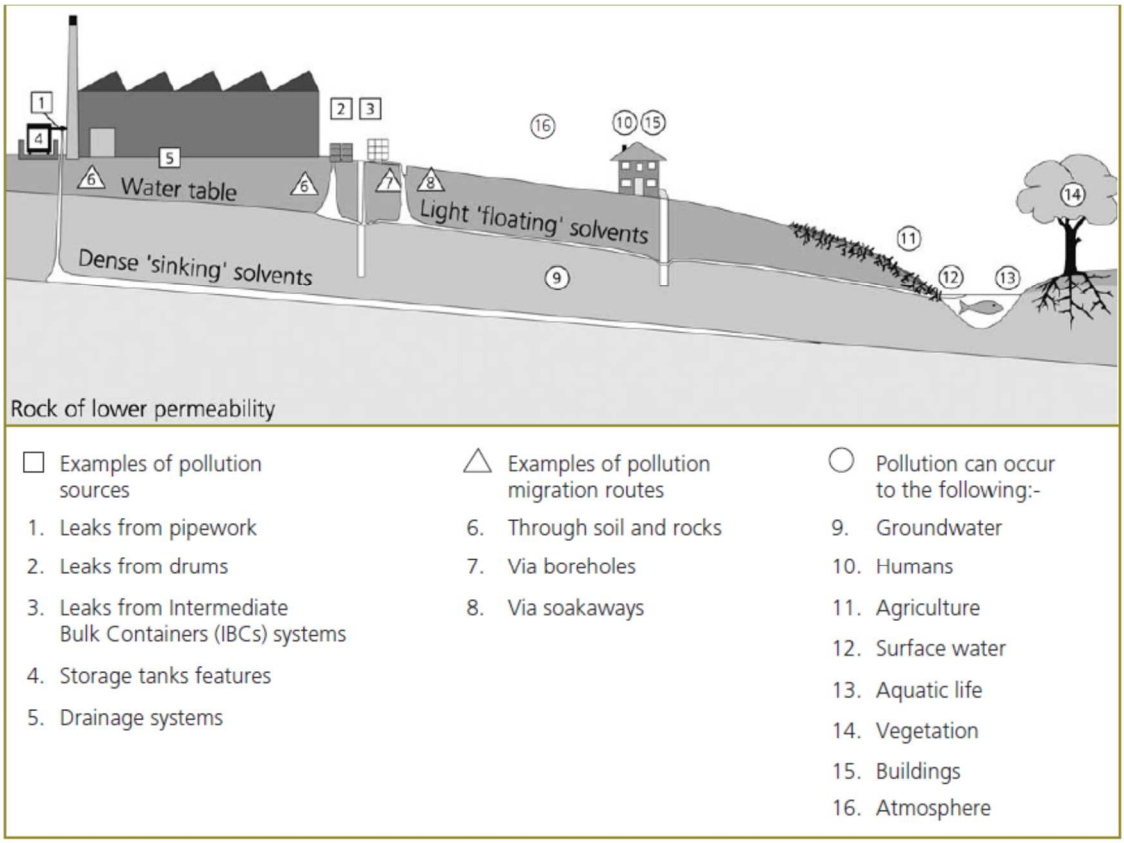


Figure 1 Concept of groundwater contamination (from "Groundwater protection code – Solvent use and storage –" by Department for Environment, Food and Rural affairs, United Kingdom 2004)

2. Target chemicals

This Guideline is prepared for the following target chemicals which are the group of chlorinated solvents (hereunder called CHC = Clorinated Hydro Carbon).

Effluent standard and Environmental Quality standard are set for these chemicals in Water Pollution Control sub-decree.

Table 1 Target Chemicals

Name	CAS No.	Effluent standard			Environmental Quality standard
		Protected public water area	Public water area	Sewer	
Perchloroethylene (or Tetrachloroethylene) (PCE)	127-18-4	0.5 mg/l	1 mg/l	2 mg/l	10ug/l
Trichloroethylene (TCE)	79-01-6	0.5 mg/l	1 mg/l	2 mg/l	10ug/l
Dichloromethane (or Methylene chloride) (DCM)	75-09-2	0.1mg/l	0.2mg/l	0.4mg/l	20ug/l

In Cambodia, import volume of target chemicals (CHCs) are shown in the graph below. As shown, the import of these chemicals are increasing rapidly with industrialization and thus it is needed to introduce this guideline.

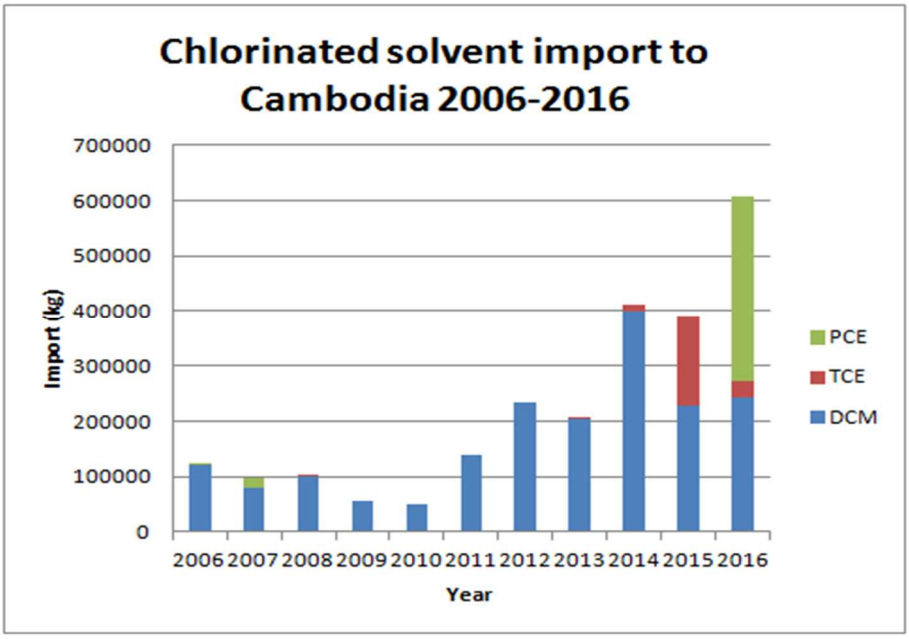


Figure 2 Import of target chemicals to Cambodia

These chemicals are used widely in industry as degreasing purpose. Following industrial sectors commonly use them for this.

- Dry cleaning
- Metal fabrication
- Precision machinery
- Electronics/semiconductor
- Electoronics
- Auto parts manufacturing

Another concern in the context of Cambodian industry is textile industry. In the textile industry, trichloroethylene and perchloroethylene have been used as a carrier solvent for spotting fluids and as a solvent in dyeing and finishing. Their main use in the textile industry is to clean cotton, wool and other fabrics. It is also used as a solvent for waterless dyeing

3. Characteristic of target chemicals

3.1. Physical and chemical

Physical and chemical properties of the target chemicals are summarized in the following table.

Table 2 Physical and chemical characteristic

Properties	Unit	Dichloromethane	Trichloroethylene	Perchloroethylene
Chemical formula		CH2Cl2	C2HCl3	C2Cl4
Vapor pressure at 20 degree C	Mbar	476	99	25
Boiling point at 1013 mbar	Degree C	39.7	87	121.1
Freezing point	Degree C	-95	-87.6	-22.8
Specific gravity at 25 degree C		1.32	1.456	1.619
Vapor density at 20 degree C		2.93	4.53	5.76
Viscosity at 25 degree C	mPa s	0.41	0.54	0.75
Solubility to water at 25 degree C	g/kg	17.0	1.0	0.15

It should be noted that these chemicals have higher specific gravity than water and low viscosity. It indicates they can easily penetrate through small cracks or porous media of the floor or surface and reach to groundwater table. Also they may further penetrate deeper even after they reach groundwater table. Their low solubility to water indicated they stay in groundwater for long time and continue to contaminate groundwater for long period of time.

3.2. Health impact

Health related properties of the target chemicals are summarized in following table. Two technical sources cited are from IARC (International Agency for Research on Cancer, part of World Health Oragnization) and US. EPA IRIS (Integrated Risk Information System).

Table 3 Health Impact

Source		Dichloromethane	Trichloroethylene	Perchloroethylene
IARC	Classification	Group 2A Probably carcinogenic to humans	Group 1 Carcinogenic to humans	Group 2A Probably carcinogenic to humans
US EPA IRIS	Cancer assessment	Likely to be carcinogenic to humans	Carcinogenic to humans	Likely to be carcinogenic to humans
	Non cancer assessment	RfD (mg/kg-day) $6x10^{-3}$	RfD (mg/kg-day) $5x10^{-4}$	RfD (mg/kg-day) $6x10^{-3}$

(RfD = REFERENCE DOSE (RfD) FOR CHRONIC ORAL EXPOSURE is maximum acceptable oral dose of a toxic substance by US EPA)

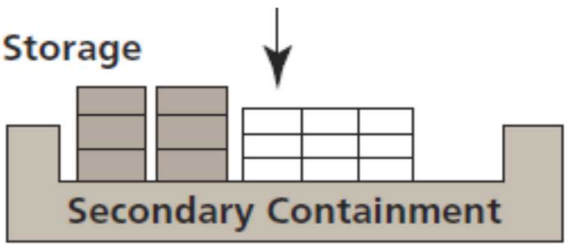
As shown above, these chemicals are either confirmed carcinogen or probable carcinogen to human. Thus their contamination to groundwater shall be avoided.

4. Technical guideline for proper management

4.1. Storage

Target chemicals shall be stored to prevent any leakage to contaminate groundwater. For this reason, below described design features shall be followed.

- Any underground tank for storage should be avoided.
- The tanks shall be in place for easy inspection. It should not be place on roof.
- The storage area shall be protected from any weather condition.
- Materials for tank shall be of proper metal. Plastic materials should not be used.
- The tank shall be of double wall design or constructed with protective wall to contain any leakage with adequate design, material and retention capacity.



(from "Groundwater protection code – Solvent use and storage –" by Department for Environment, Food and Rural affairs, United Kingdom 2004)

Figure 3 Storage containment

Recommended materials for the storage tank is an appropriate grade of stainless steel. Carbon

steel of welded construction can be used if rust contamination is tolerated. Hot-dip galvanized steel is also suitable. The individual product quality of the CHCs will determine the materials of construction to be used. Freshly produced, stabilized, and dry CHCs are not corrosive and require less material investments than contaminated CHCs. In case of regenerated substances, the quality of the product will determine the materials of construction to be used. All parts of plants and protective installations have to be able to endure the projected mechanical, thermal and chemical stresses. They have to meet the following basic standards:

-Containers and pipelines must be designed to endure the static fluid pressures as well as over and under pressures encountered during operations. They have to be resistant to external mechanical stresses. Adequate structural design and resistance qualifications are required.
-The materials must be impervious against and resistant to the liquid chlorinated hydrocarbons and their vapors.

In contact with water some CHCs tend to hydrolyze slowly, causing formation of acid (HCl) and thus corrosion of metals.

Aluminium, magnesium and their alloys should not be used in chlorinated solvents service. Reconditioned metal drums are not recommended for use.

Plastics as materials for tanks are generally not suitable because they do not meet certain basic requirements, such as vapor tightness (permeability) and resistance to chemicals, under continuous exposure to CHCs. Plastics are not generally suitable for bulk chlorinated solvents service, but may be acceptable for very small one-way containers as long as their suitability has been specially proven (most of today's generally used plastic containers are regarded as not suitable).
For containment of concrete construction, a concrete of minimum BII quality according to EN 1992 is needed. The concrete needs to be liquid tight. The choice of surface protection for the concrete can be referred in later section 2.3.

For detail, please refer to the following table.

Table 4　Materials for storage

(from "Guidance on Storage and handling of Chlorinated Solvent　Fifth edition 2016" by European Chlorinated Solvents Association).

Material Type (referenced EN standard	Material No. (EN 10027-2 [1])	Designation (EN 10027-1 [2])
General purpose construction steels (EN 10025-1 [3])	1.0036	S235JRG1
	1.0038	S235JRG2
	1.0038/1.0116	S235JRG2/G3
	1.0553/1.0570	S355JO/J2G3
Weather-resistant construction steels (EN 10025-5 [3])	1.8960 (#)	S235JRW (#)
(#) these materials have been part of the original standard SEW 087 but have not been taken over into the replacing EN standard	1.8961	S235J2W
	1.8963	S355J2G1W
Boiler steel sheets (EN 10028-2 [5])	1.0345	P235GH
	1.0425	P265GH
Weekable fine grain steels (EN 10028-3 [6])	1.0461	S255N (*)
	1.0505	P315N (*)
Corrosion resisting steels (EN 10088-3 [7])	1.4541	X6CrNiTi18-10
	1.4306	X2CrNi19-11
	1.4404	X2CrNiMo17-12-2

4.2. Piping

Leaks from piping containing target chemicals can arise from corrosion, physical damage, or poor maintenance. Below described design features shall be followed.

- Piping from storage to processing area shall be above the ground. It should be placed for easy inspection.
- Piping shall not be in a position where it can be accidentally damaged by vehicles.
- Piping shall be made of proper materials.
- Piping should be of minimum number of joints.
- Piping should be sited away from surface water drain.
- It is better to sited over impermeable surface.

Steel types suitable for pipeline are shown in following table.

Table 5　Meterials for pipeline

(from “Guidance on Storage and handling of Chlorinated Solvent　Fifth edition 2016” by European Chlorinated Solvents Association).

Steel types			
		Material #	Designation
Seamless pipes	EN 10216 [1)]	10254 10421	P235 TR1 P355T1
	EN 10088-3 [2)]	1.0405 1.0305 (#) 1.4541 1.4571	P255 G1 TH P235 G1 TH (#) X6CrNiTi18-10 X6CrNiMo Ti17- 12-2
Welded pipes	EN 10217 [3)]	1.0254 1.0256 1.0421 1.0315 (*) 1.0498	P235TR1 P275T1 P355T1 P235G2TH (*) P255G2TH
	ISO 1127	1.4541	X6CrNiTi18-10

Since pipe connections are one of the weak points of pipelines, they should be reduced to a minimum, although this should not unnecessarily obstruct maintenance. Connections between pipe sections are usually either welded or flanged. Slip-on socket and soldered connections are not acceptable for service with CHCs. Sealing materials for flanged connections are given in Table 3 at later section.

Pipelines for CHCs made of plastics are only suitable for above-ground installation and in any case have limited durability. Chemically resistant against CHCs and to be used under certain conditions are:

PTFE (polytetrafluoroethylene)

PFEP (polyfluoroethylenepropylene)

PCTFE(polychlorotrifluoroethylene)

ECTFE (ethylene-chlorotrifluoroethylene-fluorocopolymer)

PVDF (polyvinylidenefluoride)

As plastic materials tend to lose mechanical properties at elevated temperatures, it is generally not recommended to use any sort of plastic piping for Chlorinated Solvents above ambient temperature.

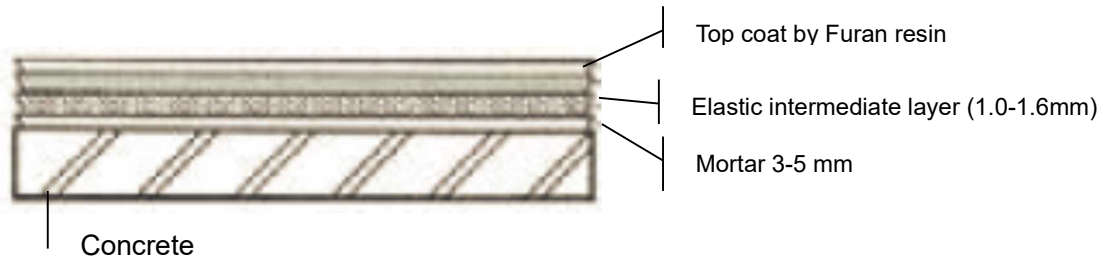
4.3. Handling site

For location with possible spill or leak such as valve and outlet, manual transfer point of chemicals, shall have protective pan or tray made of proper materials, so that spill will not penetrate into the ground.

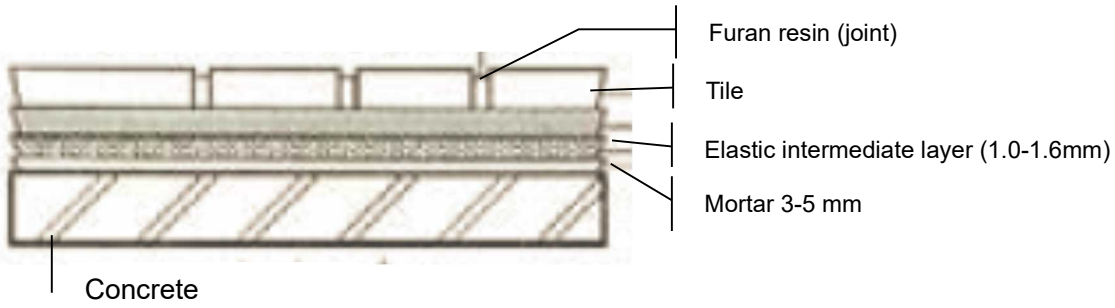
Floor surface protection, following note shall be observed.

- Floor surface of storage area or containment area as well as solvent handling area shall be protected with linings of sheet metals or coated with impermeable laminates as described in following section (The section have citation from “Guidance on Storage and handling of Chlorinated Solvent Fifth edition 2016” by European Chlorinated Solvents Association) .
- Laminates shall be based on phenolic resins or furan resins. Furan resin laminates may contain chemical modifiers to overcome cracking by improving their plasticity. However modifiers reduce chemical durability; this is of special importance with Methylene Chloride.
- Elastic intermediate layers are required to cover and fill cracks in the concrete, e.g. layers of elastomers (e.g. polyisobutylene, several rubber products); layers on a bituminous basis; so-called liquid foils, which are poured on the concrete and when hardened will form an elastic layer (e.g.polyurethane). Then phenolic or furan resin shall be applied on the top of the elastic intermediate layer. If resistance to considerable mechanical wear is required of this laminate, then a cover must be applied, e.g. of tiles in a mortar bed. Duroplastics should be processed in coordination with the manufacturer and installed.

  Following figures show example of surface coating (from “Manual for structure and inspection/operation to prevent groundwater contamination” by Ministry of Environment, Japan)



Example of surface coating when no mechanical wear is expected



Example of surface coating when mechanical wear is expected

Figure 4　Surface coating

- Table in following page summarizes the resistant properties of various coating materials Use of non-resistant materials should be avoided.

Table 6 Resistance of plastic laminates and sealing to chlorinated solvents (from "Guidance on Storage and handling of Chlorinated Solvent Fifth edition 2016" by European Chlorinated Solvents Association).

Duroplastics		Thermoplastics		Natural & synthetic elastomers	
Resistant	**Non-resistant** [2]	**Resistant**	**Non-resistant** [2]	**Resistant**	**Non-resistant** [2]
Furan resins Phenol resins Ccresol resins	Most EP-resins (epoxy resins) cold/hot harde-ned	PTFE (poly-tetrafluoroethy-lene)	PIB (poly-iobutylene)	FCM (fluororubber)	NR (polyisoprene)
Phenol resins Dresol resins					
		PFEP (poly-fluoroehtylene propylene	PVC (poly-vinylchloride)		SBR (styrene butadiene copo-lymer)
	PUR resins (polyurethane resins)	PVDF (poly-vinylidene)			NBR (acrylonitrile-buatadiene-copolymer)
	UP resins (unsaturated polyester resins)				CR (poly-chloridebuta-diene)
					IIR (isobutylene-isoprene copo-lymer)
Exception					
Vinyl-ester re-sins [3])					Rubber
TRI					CSM (chloro-sulfonated po-lyethylene)
Range of application					
Concrete lami-nates		Metal laminates			
Sealing of clay-concrete pipes		Sealings, linings			
Joint sealings				Joint sealings	

4.4. Waste

Waste from process containing the target chemicals should not be mixed with any wastewater flow. Chlorinated solvents are very well suited for recycling, which is simply done by fractional distillation. As recycling significantly increases the eco-efficiency of the chlorinated solvents, spent solvents should as much as possible be sent to recycling for re-use, and only residues (= solvent heavily contaminated with oils, grease, dust and other dirt) should be disposed off, if no recycling is possible (such wastes are usually destroyed by high temperature incineration. Alternative is use of Cement Kiln for treatment.). As of early 2019, there is no such incineration facility in Cambodia, waste shall be kept in containers and stored until such facility is developed.

The waste shall be separated and kept as controlled waste. Waste storage area shall have same protective measure as storage area of the target chemicals.

4.5. Training and inspection

Staff engaged in the use of the CHCs shall be trained for the content of this guideline, e.g., risk of groundwater contamination, physical, chemical properties as well as health impact of the target chemical and technical issues to prevent the spill and leakage. Then the handling of the CHCs shall be done with utmost care.

Routine inspection program of the facilities for its condition shall be prepared and executed.

Reference

Many of the technical content in this guideline were cited and referred from the below listed technical document. Especially, “Guidance on Storage and Handling of Chlorinated Solvents Fifth Edition”, ECSA - European Chlorinated Solvents Association, September 2016” has more detail description and strongly recommended for reference.

1. Guidance on Storage and Handling of Chlorinated Solvents Fifth Edition”, ECSA - European Chlorinated Solvents Association, September 2016

2. “Groundwater protection code - Solvent Use and Storage-“ , Department for Environment, Food and Rural Affairs, United Kingdom, 2004

3. “Manual for structure and inspection/management to protect groundwater contamination Ver.1.1 (in Japanese)”, Ministry of Environment, Japan, 2012

4. “Agents Classified by the IARC Monographs, Volumes 1–123”, International Agency for Research on Cancer, https://monographs.iarc.fr/agents-classified-by-the-iarc/

5. “IRIS Integrated Risk Information System”, US EPA, https://www.epa.gov/iris

ANNEX 1 Japanese case on groundwater contamination by Industrial chemicals

- Pollutant type and sources

  Ministry of Environment summarize the cases of groundwater contamination in Japan as of 2016. Total number of cases were 7,993. Result was summarized in following table.

Pollutant type	Number of cases	Sources
VOCs (Volatile Organic Compounds)	2,544	94% of the contamination were caused by industrial pollution.
Heavy metals	2,153	Major pollutant is Arsenic. 84% of the contamination were of natural, geologic origin.
Nitrate, Naitrite	3,148	93% of the contamination were caused by agricultural activity, e.g., fertilizer use.
Mix	148	
total	7,993	

Among the pollutant type, VOCs (Volatile Organic Compounds) are group of organic compounds which has high volatility. They are mostly in the group of solvent. Most common pollutants were Chlorinated solvents, namely, Trichloroethylene (TCE), Perchloroethylene (PCE) and Dichloromethane (DCM).

Following table summarized the source of contamination for each pollutant types.

Sources	Total cases	VOC	Heavy Metals	Nitrate Nitrite	Mix
Factory/ Industrial site	1,462	1,218	157	0	87
Waste	211	169	33	3	6
Livestock manure	664	0	0	664	0
Fertilizer	1,531	0	1	1,530	0
Domestic wastewater	666	0	2	664	0
Natural origin	1,149	0	1,127	20	2
Others	69	41	23	5	0
Total case	4,353	1,289	1,335	1,638	91

- Cases by type of industry

Following table shows the more detailed data for specific industry type as pollutant sources.

Industry type	Number of cases	VOCs	Heavy Metals	Nitrate, Nitrite	Mix
Agriculture	6	4	1	0	1
Textile	36	31	3	0	2
Chemical	65	44	9	0	12
Rubber	16	14	1	0	1
Non-ferrous metal	36	25	8	0	3
Metal	178	120	43	0	15
General machinery	64	54	6	0	4
Production machinery	32	28	3	0	1
Business machinery	35	30	1	0	4
Electronics and device	90	77	9	0	4
Electric machinery	75	61	6	0	8
Communication equipment	41	34	2	0	5
Transportation machinery	111	88	12	0	11
Gas	19	3	9	0	7
Other retail business	191	187	1	0	3
Laundry and spa	364	359	0	0	5
Waste management	8	8	0	0	0
Others	115	72	37	0	6
Total	1,403	1,166	151	0	86

"Other retail business" is gasoline station which causes Benzene contamination. "Lasundry and spa" is dry cleaning which uses Perchloroethylene.

- Cause of contamination

Out of 1,462 cases where Industrial facilities were identified pollution source, followings were summarized as the cause of contamination.

- 138 cases were due to deterioration of facility and subsequent leakage,
- 252 cases were due to miss handling of chemicals
- 120 cases were due to effluent discharge containing chemicals
- 33 cases were related to waste management
- 964 cases had unknown reason

Annex 21 Plan of Operation

Project Monitoring Sheet II (Revision of Plan of Operation)

Project Title: THE PROJECT FOR EFFECTIVE IMPLEMENTATION OF EIA AND POLLUTION CONTROL THROUGH THE CAPACITY

Dated 28th November 2021

Inputs	Plan/Actual	2017 (7–12)	2018 (1–12)	2019 (1–12)	2020 (1–12)	2021 (1–12)	Remarks	Monitoring: Issue	Monitoring: Solution
Expert									
Team Leader/Environmental Management 1	Plan								
	Actual								
Deputy Team Leader/Environmental Management 2	Plan								
	Actual								
EIA	Plan								
	Actual								
Pollution Control and Regulations 1	Plan								
	Actual								
Pollution Control and Regulations 2	Plan								
	Actual								
Training Planner 1	Plan								
	Actual								
Water Environment/ Training Planner 2/Coordinator	Plan								
	Actual								
Water Environment (Inspection)	Plan								
	Actual								
PRTR Training Specialist	Plan								
	Actual								
Pollution Control History in Japan	Plan								
	Actual								
Air Pollution and Noise Control	Plan								
	Actual								
Solid Waste Management Training	Plan								
	Actual								
Equipment									
Multiparameter water quality checker	Plan								
	Actual								
Spectrophotometry	Plan								
	Actual								
Hot plate	Plan								
	Actual								
Water bath	Plan								
	Actual								
pH meter	Plan								
	Actual								
Mobile PM monitor	Plan								
	Actual								
Current Meter	Plan								
	Actual								
Water Sampler	Plan								
	Actual								
Training in Japan									
Training in Japan	Plan								
	Actual								
In-country/Third country Training									
Training in Thailand	Plan								
	Actual								
Training in Vietnam	Plan								
	Actual								

Activities / Sub-Activities	Plan/Actual	2017 (7–12)	2018 (1–12)	2019 (1–12)	2020 (1–12)	2020 (1–12)	Responsible: GOJ	Responsible: GOC	Monitoring: Achievements	Monitoring: Issue & Countermeasu
Output 1: Legal documents related to EIA and pollution control focusing on water are organized.										
1.1 Develop task force to review laws and regulations	Plan									
	Actual									
1.2 Finalize items for output 1	Plan									
	Actual									
B 1.2.1. Develop strategy and approach.	Plan									
	Actual									
B 1.2.2. Identify key issues to develop a long list	Plan									
	Actual									
B 1.2.3 Prioritize issues and develop a road map	Plan									
	Actual									
1.3 Review and draft revised laws and regulations	Plan									
	Actual									
B 1.3.1 Deliberate key issues	Plan									
	Actual									
B 1.3.2 Deliberate key issues	Plan									
	Actual									
1.4 Consultation with stakeholders	Plan									
	Actual									
B 1.4.1 Convene 1st consultation with stakeholders	Plan									
	Actual									
B 1.4.2 Convene 2nd consultation with stakeholders	Plan									
	Actual									
B 1.4.3 Convene 3rd consultation with stakeholders	Plan									
	Actual									
1.5 Finalize draft revised laws and regulations	Plan									
	Actual									
B 1.5.1 Draft legal documents	Plan									
	Actual									
B 1.5.2 Finalize Draft Laws and Regulations	Plan									
	Actual									
1.6 Prepare summary report for output 1	Plan									
	Actual									
Output 2: Technical issues and procedures related to EIA and pollution control focusing on water are clarified and shared with GDEP staff and other stakeholders.										
2.1 Develop task force to develop guideline and procedure	Plan									
	Actual									
2.2 Finalize items for output 2	Plan									
	Actual									
2.3 Develop draft guidelines and procedures	Plan									
	Actual									
2.4 Consultation with stakeholders	Plan									
	Actual									
2.5 Finalize draft guidelines and procedures	Plan									
	Actual									
2.6 Disseminate the finalized and/or draft guideline and procedure to stakeholders	Plan									
	Actual									
2.7 Prepare summary report for output 2	Plan									
	Actual									
Output 3: Capacity of GDEP and related departments under GDEP in the field of Environmental Management is enhanced.										
3.1 Review the institutional arrangements of GDEP to clarify the scope of the training	Plan									
	Actual									
3.2 Prepare the syllabus including contents/subjects of training program	Plan									
	Actual									
3.3 Organize seminars	Plan									
	Actual									
3.4 Conduct study tours	Plan									
	Actual									
3.5 Develop training programs reflecting the obtained results from seminars and study tours	Plan									
	Actual									
3.6 Implement the developed training program	Plan									
	Actual									
3.7 Evaluate the implemented training program and prepare the next training	Plan									
	Actual									
3.8 Prepare summary report of output 3	Plan									
	Actual									
Duration / Phasing	Plan									
	Actual									

Monitoring Plan	Plan/Actual	2017 (7–12)	2018 (1–12)	2019 (1–12)	2020 (1–12)	2020 (1–12)	Remarks	Monitoring: Issue	Monitoring: Solution
Monitoring									
Joint Coordinating Committee	Plan								
	Actual								
Set-up the Detailed Plan of Operation	Plan								
	Actual								
Submission of Monitoring Sheet	Plan								
	Actual								
Monitoring Mission from Japan	Plan								
	Actual								
Joint Monitoring	Plan								
	Actual								
Post Monitoring	Plan								
	Actual								
Reports/Documents									
Inception Report	Plan								
	Actual								
Project Progress Report	Plan								
	Actual								
Project Completion Report	Plan								
	Actual								
Public Relations									
Information Dissemination	Plan								
	Actual								
Web site manageemnt	Plan								
	Actual								

Annex 22 Assignment Record of JICA Team Members

Service	Position	Name	Firms	Plan / Actual	FY 2017 Cambodia	FY 2017 Japan	FY 2018 Cambodia	FY 2018 Japan	FY 2019 Cambodia	FY 2019 Japan	FY 2020 Cambodia	FY 2020 Japan	FY 2021 Cambodia	FY 2021 Japan	M/M Total Cambodia	M/M Total Japan
Service in Cambodia	Team Leader/Environmental Management 1	Yasuhiko Muramatsu	CTII	Plan	1.40		1.80		0.90		0.07		0.00		4.17	
				Actual	1.40		1.80		0.90		0.07		0.00		4.17	
	Deputy Team Leader/ Environmental Management 2	Akira Yamashita	ESIC	Plan	1.23		1.30		1.97		0.47		0.00		4.97	
				Actual	1.23		1.30		1.97		0.47		0.00		4.97	
	EIA	Takayuki Htatano	CTII	Plan	3.33		1.20		0.00		0.00		0.00		4.53	
				Actual	3.33		1.20		0.00		0.00		0.00		4.53	
	Pollution Control and Regulations 1	Munehiro Fukuda	CTII (Contract)	Plan	4.27		2.20		0.53		0.00		0.00		7.00	
				Actual	4.27		2.20		0.53		0.00		0.00		7.00	
	Pollution Control and Regulations 2	Taisuke Watanabe	EX	Plan	2.00		1.47		0.00		0.00		0.00		3.47	
				Actual	2.00		1.47		0.00		0.00		0.00		3.47	
	Training Planner 1	Yusuke Nakayama	CTII (Contract)	Plan	2.70		0.93		0.00		0.00		0.00		3.63	
				Actual	2.70		0.93		0.00		0.00		0.00		3.63	
		Masatoshi Chiba	CTII	Plan	0.00		0.00		1.73		0.00		0.00		1.73	
				Actual	0.00		0.00		1.73		0.00		0.00		1.73	
	Water Environment/ Training Planner 2/Coordinator	Zenjiro Egawa	CTII	Plan	4.07		2.63		0.00		0.00		0.00		6.70	
				Actual	4.07		2.63		0.00		0.00		0.00		6.70	
		Takashi Onuma	CTII	Plan	0.00		0.00		1.43		0.00		0.00		1.43	
				Actual	0.00		0.00		1.43		0.00		0.00		1.43	
	Water Environment (Inspection)	Manuel I. Gloria, Jr.	CTII (Contract)	Plan	1.00		2.77		1.90		0.00		0.00		5.67	
				Actual	1.00		2.77		1.90		0.00		0.00		5.67	
	PRTR Training Specialist	Munehiro Fukuda	CTII補強	Plan	0.33		1.17		0.00		0.00		0.00		1.50	
				Actual	0.33		1.17		0.00		0.00		0.00		1.50	
		Takashi Onuma	CTII	Plan	0.00		0.00		0.50		0.00		0.00		0.50	
				Actual	0.00		0.00		0.50		0.00		0.00		0.50	
	Pollution Control History in Japan	Taisuke Watanabe	EX	Plan	0.00		0.23		0.23		0.00		0.00		0.47	
				Actual	0.00		0.23		0.23		0.00		0.00		0.47	
	Air Pollution and Noise Control	Tsuyoshi Osawa	CTII (Contract)	Plan	0.00		0.20		0.00		0.00		0.00		0.20	
				Actual	0.00		0.20		0.00		0.00		0.00		0.20	
		Masatoshi Chiba	CTII	Plan	0.00		0.00		0.33		0.00		0.00		0.33	
				Actual	0.00		0.00		0.33		0.00		0.00		0.33	
	Solid Waste Management Training	Ikuo Mori	EX	Plan	0.00		0.23		0.27		0.00		0.00		0.50	
				Actual	0.00		0.23		0.27		0.00		0.00		0.50	
				Plan	20.33		16.13		9.80		0.53		0.00		46.80	
				Actual	20.33		16.13		9.80		0.53		0.00		46.80	
Service in Japan	Team Leader/Environmental Management 1	Yasuhiko Muramatsu	CTII	計画 (変更後)		0.00		0.00		0.00		0.60		0.58		1.18
				実績		0.00		0.00		0.00		0.50		0.68		1.18
	Deputy Team Leader/ Environmental Management 2	Akira Yamashita	ESIC	計画 (現時点)		0.00		0.00		0.00		1.50		0.53		2.03
				実績		0.00		0.00		0.00		1.50		0.53		2.03
	EIA	Takayuki Htatano	CTII	計画 (現時点)		0.00		0.00		0.00		0.70		0.67		1.37
				実績		0.00		0.00		0.00		0.70		0.67		1.37
	Pollution Control and Regulations 1	Munehiro Fukuda	CTII (Contract)	計画 (現時点)		0.10		0.00		0.00		0.00		0.00		0.10
				実績		0.10		0.00		0.00		0.00		0.00		0.10
	Pollution Control and Regulations 2	Taisuke Watanabe	EX	計画 (現時点)		0.00		0.00		0.00		0.30		0.23		0.53
				実績		0.00		0.00		0.00		0.30		0.23		0.53
	Training Planner 1	Masatoshi Chiba	CTII	計画 (現時点)		0.00		0.00		0.00		0.75		0.73		1.48
				実績		0.00		0.00		0.00		0.75		0.73		1.48
	Water Environment/ Training Planner 2/Coordinator	Zenjiro Egawa	CTII	計画 (現時点)		0.00		0.00		0.00		0.00		0.00		0.00
				実績		0.00		0.00		0.00		0.00		0.00		0.00
		Takashi Onuma	CTII	計画 (現時点)		0.00		0.00		0.00		1.05		3.12		4.17
				実績		0.00		0.00		0.00		1.05		3.12		4.17
	Pollution Control History in Japan	Taisuke Watanabe	EX	計画 (現時点)		0.00		0.00		0.00		0.30		0.23		0.53
				実績		0.00		0.00		0.00		0.30		0.23		0.53
	Air Pollution and Noise Control	Tsuyoshi Osawa	CTII (Contract)	計画 (現時点)		0.00		0.20		0.00		0.00		0.00		0.20
				実績		0.00		0.20		0.00		0.00		0.00		0.20
		Masatoshi Chiba	CTII	計画 (現時点)		0.00		0.00		0.00		0.00		0.33		0.33
				実績		0.00		0.00		0.00		0.00		0.33		0.33
	Solid Waste Management Training	Ikuo Mori	EX	計画 (現時点)		0.00		0.20		0.00		0.30		0.00		0.50
				実績		0.00		0.20		0.00		0.30		0.00		0.50
				Plam		0.10		0.40		0.00		5.50		6.43		12.43
				Actua		0.10		0.40		0.00		5.40		6.51		12.41

Reporting: IC/R, P/R1 (FY 2017); P/R2, P/R3 (FY 2018); P/R4, P/R5 (FY 2019); P/R6, P/R7 (FY 2020); Completi on Report (FY 2021)

Total (Plan)	59.2
Total (Actual)	59.2

CTII: CTI Engineering International Co., Ltd. ESIC:ENVIRONMENT AND SOCIAL INFRASTRUCTURE CONSULTANT CO., LTI EX: EX RESEARCH INSTITUTE LTD.

Annex 23 Details of Overseas Training

Thailand Study Tour

1.1 Purposes of the Third Country Training

This training is designed to expose the training participants to the approaches of pollution control that may be readily applicable to Cambodia. It mainly focuses on leaning the experiences in EIA and pollution control in Thailand.

1.2 Participants from Cambodia

A total of eighteen (18) persons participated. They included sixteen (16) officers of the General Directorate of Environmental Protection (GDEP) under the Ministry of Environment (MOE) and two (2) experts of the JICA project team. They were divided into two team; (A) management team and (B) technical team as described in the table below.

(A) Management Team

No	Name	Position	Department[1]
1	Mr. Phin Rady	Director	DoWQM
2	Mr. Pak Vannly	Deputy Director	DoNAQM
3	Mr. Dek Vimeanreaksmey	Deputy Director	DoSWM
4	Mr. Sophal Laska	Deputy Director	DoHSM
5	Mr. Sarun Sambo	Director	DoLEI
6	Mr. Chuop Sivutha	Deputy Director	DoEIA
7	Mr. Tea Thyro	Deputy Director	DoAPF
8	Ms. Meas Chanthyda	Director	Labo
9	Mr. Munehiro Fukuda	JICA Expert	JICA Project

(B) Technical Team

No	Name	Position	Department
1	Mr. Him Chandath	Deputy Director	DoWQM
2	Mr. Sam Sokyimeng	Officer	DoAQNM
3	Ms. Ngan Sansreypov	Officer	DoSWM
4	Ms. Phann Daneth	Officer	DoHSM
5	Ms. Thorng Sopanhara	Chief Office	DoLEI
6	Mr. Chea Panharith	Chief Office	DoEIA
7	Ms. Eung Sokunmoniroth	Deputy Director	DoAPF
8	Mr. Nath Dyveasna	Officer	Labo
9	Mr. Zenjiro Egawa	JICA Expert	JICA Project

1.3 Period of the Training

Management Team:10th September 2018 - 15th September 2018 (Total 6 days)

Technical Team :10th September 2018 - 18th September 2018 (Total 9 days)

1.4 Location

Management team will visit Bangkok and Rayong from 10th to 15th of September and Technical team visit Bangkok, Rayong, Pathumthani and Sakeo from 10th to 18th of September.

[1] DoWQM: Department of Water Quality Management
DoNAQM: Department of Noise and Air Quality Management
DoSWM: Department of Solid Waste Management
DoHSM: Department of Hazardous Substance Management
DoLEI: Department of Law Enforcement and Inspection
DoEIA: Department of Environmental Impact Assessment (EIA)
DoAPF: Department of Administration, Planning and Finance
Labo: Laboratory

1.5 Itinerary of Thailand study tour

Date	Description	Subject for study/visit	Visiting site/ Accommodation
Sept.10 (Mn)	Phnom Penh to Bangkok (all) by airplane (TG 2587 PNH-BKK 09:40 - 10:50)		Bangkok/ Bangkok (President Park Hotel)
Sept.11 (Tu)	9:00AM: Visit to ONEP (Office of Natural Resources and Environment Policy and Planning, MONRE)	1. General EIA system in Thailand 2. EIA on Building construction project. Review guideline, check list and training tool. 3. EIA on Sky train project	Bangkok/ Bangkok (President Park Hotel)
	02:00PM: Site Visit to the Mass Transit System Project in Bangkok (Red Line) (State Railway of Thailand: SRT)	1. Implementation/construction of the Mass Transit System in Bangkok (Red Line) 2. Environment management and EIA practices during the construction	
Sept.12 (Wd)	9:00AM: Visit to PCD (Pollution Control Department, MONRE)	1. General role of PCD 2. PRTR pilot 3. Industrial waste water management 4. Odor management	Bangkok/ Bangkok (President Park Hotel)
	1:30PM: Visit to DIW (Department of Industrial Works, MOI)	1. Eco Industrial Town Program 2. Green Industry Program	
Sept.13 (Th)	11:00AM Map Taphut IEAT office (All day: Visit to Map Taphut)	Industrial estate and EMCC	Rayong/ Bangkok (President Park Hotel)
Sept.14 (Fr)	9:00AM: Visit to IEAT HQs. (Industrial Estate Authority of Thailand)	Overview of IEAT environmental management IEAT operation center	Bangkok/ Bangkok (President Park Hotel)
	2:00PM: Report to JICA Thailand		
Sept.15 (St)	Bangkok to Phnom Penh (Management team) by airplane (TG 584 BKK-PNH 18:45- 19:55)	Weekend	Bangkok/ Bangkok (President Park Hotel)
Sept.16		Weekend	Bangkok/ Bangkok (President Park Hotel)
Sept.17 (Mn)	9:00AM: Visit to ERTC and ETI Environmental Research and Training Center & Environmental Training Institute, Department of Environmental Quality Promotion, MONRE	1. Environmental research 2. Human resource development for environment	Pathumthani/Sakeo (Chantra Hotel)

Date	Description	Subject for study/visit	Visiting site/ Accommodation
	1:00PM：Visit to Automotive emission laboratory, PCD Move to Sakeo	Automotive emission testing	
Sept.18 (Tu)	Visit to Sakeo Industrial Esate	Sakeo Industrial Estate as Thailand 4.0 model	Sakeo
	Bangkok to Phnom Penh (TG 584 BKK-PNH 18:45 19:55)		

Vietnam Study Tour

1.1 Purposes of the Third Country Training

to learning of the legal system and enforcement system related to environmental management and pollution source management in Vietnam. Training program was participated total 10 personnel from 12th January to 18th January in 2020.

1.2 Participants from Cambodia

A total of ten (10) persons participated. They the representatives of the General Directorate of Environmental Protection (GDEP) under the Ministry of Environment (MOE). They are accompanied by one (1) experts of the JICA project team.

Participant list in Training in Vietnam

	Name	Designation	Organization
1	Sarun Sambo	Director	Inspection and Law Enforcement
2	Kin Kheangly	Deputy Director	Solid Waste Management
3	Ou Kongphal	Deputy Director	Administration Planning and Finance
4	Chin Chamroeun	Chief Officer	Air Quality and Noise Management
5	Dek Vimean Pheakdey	Chief Officer	Inspection and Law Enforcement
6	Prach Mariya	Vice-Chief Officer	Environmental Impact Assessment
7	Huot Syradeth	Vice-Chief Officer	Water Quality Management
8	Tem Sokchann	Vice-Chief Officer	Hazardous Substance Management
9	Mey Sithin	Vice-Chief Officer	Environmental Impact Assessment
10	Nuon Rydo	Officer	Laboratory
11	Takashi Onuma	JICA Expert	JICA Project

Note: JICA Team

1.3 Period of the Training

Training was conducted from 12th January to 18th January in 2020 (Total 7days).

1.4 Location

Training participants visited in Bac Ninh and Bac Giang provinces and Hnaoi.

The detail program of training tour is described in next chapter.

1.5 Itinerary of Thailand study tour

Training program in Vietnam

Date	Description	Subject for study/visit	Visiting site/ Accommodation
Jan.12 (Sun)	Phnom Penh to Hanoi by airplane (Flight VN920 Phonm Penh to Vienchan (17:45 to 19:05) VN920 Vienchan to Hanoi (19:05 to 21:05))		Hanoi/ Victor Hanoi Hotel
Jan. 13 (Mon)	9:30AM: Visit to EPA (Office of Ministry of Natural Resources and Environment, MONRE)	- The regulations on river water management" - The Environmental Standard" - The Advantages and Disadvantages, Lessons learned.	
	13:30 PM: Visit to MONRE	Legal system and enforcement on Pollution source management "Effluent Standard", "EIA and Registration", "Discharge permit"	
Jan.14 (Tue)	10:00AM: Site visit on the Actual Monitoring point (Central level)	CEM (Center for Environmental Monitoring) "Site visit on Automatic monitoring station (Ha Nam province)"	
	14:00PM: Site visit on laboratory on CEM	Introduction on usual activities in central laboratory	
	15:30 PM: Lecture on CEM by Environmental Monitoring	Environmental Monitoring "Purpose of environmental monitoring in Vietnam", "Demarcation during Central and Provincial", "Monitoring in costal area, sea and End of Mekong"	
Jan. 15 (Wed)	9:45AM: Lecture on MONRE	Lecture on Control/ Management of industry "Inspection (Purpose and Frequency)", "Penalty and evidence of violation", "White list and Black list on Industry"	
	14:00 PM: CEID (Center for Environmental Information and Data)	Lecture on Data management "Purpose and Usage", "Difficulty of management" "Cost and staff (technical requirement, number, etc.)"	
Jan. 16 (Thu)	9:45AM: Visit to Bac Giang DONRE	Environmental Awareness "Experience of Environmental Awareness"	
	10:30AM: Tour for EPA and Monitoring system of industry	Introduction of monitoring system of industrial discharge.	

Date	Description	Subject for study/visit	Visiting site/ Accommodation
	11:00AM: Visit to private industry	Treatment system of Private sector (Industrial Zone) and the monitoring by Government (Smart mobile).	
	14:00 PM: Visit to Bac Ninh DONRE	Lecture on Air Monitoring "Regulation on ambient air", "Mobile Air monitoring station", "Monitoring results and usage of air monitoring data"	
	15:30PM: Visit Laboratory in Bac Ninh, and Automatic Ambient Air monitoring station	Introduction of visualisation on air monitoring data. Management on laboratory equipment.	
Jan. 17 (Fri)	9:45AM: Visit to ESI	Lecture for Solid waste management "Law and regulation", "Responsibility of each organization/ administration", "Current condition of Solid waste incinerator, landfill…etc"	
	11:00AM: Visit to ESI	Hazardous waste management "Law and regulation" "Approach of POPs management in Vietnam"	
	13:30PM: Site visit to Hanoi URENCO (Urban Environment Company)	Site visit of specific treatment facility "Hanoi URENCO (Urban Environment Company)" Waste treatment method in Vietnam.	
Jan. 18. (Sat)	Back to Cambodia Flight VN921 Hnoi to Vientian (10:15 to 11:25) VN921 Vientian to Phom Pehn (12:10 to 13:15)	-	

Note: JICA Team

Annex 24 Mobilization of Cambodian Consultants and other resources

Contract with Local experts

Name of contractors	Position	Total MM / Day	Activities undertaken
Mr. Rinna Tharo	Website Development hosting and Maintenance Staff	From 26 January 2018 for one month	· Designing the website · Website hosting and maintenance
Mr. Rinna Tharo	Website Development and Maintenance Staff	From 6 August 2018 to 5 August 2019	· Designing the website · Website Maintenance
Mr. Sour Sethy	EIA Specialist 1	from 9 January 2018 to 31 May 2018 20 Days	· Reviews EIA and/or IEIA report in Cambodia · Analyze the contents and makes reports in accordance with the Employer's guidance
Mr. Sour Chheang You	Senior EIA Specialist	from 9 January 2018 to 31 May 2018 20 Days	· Reviews EIA and/or IEIA report in Cambodia · Analyze the contents and makes reports in accordance with the Employer's guidance
Mr. Sour Sethy		Intermittently	· Coordination with GDEP in preparing the EIA manual and guidelines.
Mr. Sour Chheang You		Intermittently	· Coordination with GDEP in preparing the EIA manual and guidelines.
Sustinat Green	Staff	For 3 months from February 2019 until April 2019)	· Coordination with GDEP in preparing the EIA manual and guidelines.
Nhean Suy Bros	Project Support Staff	from 12 July 2019 to 12 December 2021	Assistance on EIA activities including: (1) Translation of relevant documents including slides for training course from English to Khmer and vice versa. (2) Interpretation at meetings and training courses on EIA (3) Report correction for EIA sectoral guidelines and EIA report review manual (4) Other works including logistics of events related to EIA
ITC University Ms. Chheang Pothiphimean Mr. Choon Pidao Ms. Haing Chinda Mr. Heng Darong. Mr. Kan Rithy Mr. Orn Dydanak Ms. Taing Chanreaksmey Mr. Tou Chanseyha	PM Monitoring Support Staff	From 20 November 2018 to19 November 2019	· PM monitoring in Phnom Penh
Mrs. Leang Chakrya	Data Input Staff		
Mr. Nop Lihour	Data Input Staff		

Subcontract Works

Title of subcontract work	Contractor	Contract amount	Period	Works
Support for task force members and EIA sector guidelines and Review manual development	Sustinat Green Co. ltd	USD 18,975	from 9 January 2018 to 30 April 2019	Task 1: Assist the Task Force members in operating and managing the Task Force on EIA Task 2: Assist the Task Force members in developing and finalizing EIA sector-specific guideline Task 3: Assisting the Task Force in developing and finalizing an EIA review manual
Support for data integration and pollution source survey	BMSH Environment & Construction Co. Ltd	USD 36,335	from 25 January 2019 to 4 December 2019	Task 1 Combine following four types of data and make a draft database ・ Factory Registration data under the Ministry of Industry and Handicraft (hereinafter referred to as "MIH"), ・ Discharge Permit data under DWQM/MoE, ・ Inspection Report data under DILE/MoE, ・ Water Supply data under Phnom Penh Water Supply Authority (hereinafter referred to as "PPWSA") Task 2 Implement Pollution Source Survey Task 3 Finalize the database and make a report

Annex 25 Minutes of Meeting of the Joint Coordination Committee

MINUTES OF THE FIRST JOINT COORDINATION COMMITTEE MEETING
ON
THE PROJECT FOR EFFECTIVE IMPLEMENTATION OF
EIA AND POLLUTION CONTROL
THROUGH THE CAPACITY DEVELOPMENT OF MOE

The first Joint Coordination Committee (JCC) for the Project for Effective Implementation of EIA and Pollution Control through the Capacity Development of MOE (the Project) was convened on 29th August 2017 from 9:00 A.M. to 12:00 P.M. at the conference hall of HOTEL CAMBODIANA located at 313 Sisowath Quay, Phnom Penh.
The meeting was opened by the remarks of H.E Eang Sophalleth, Under Secretary of State of the Ministry of Environment, and Mr. Kotaro Tanaka, Deputy Chief Representative of JICA Cambodia; and chaired by H.E. Sao Sopheap, Advisor to Ministry of Environment and Director of Cabinet. The participants agreed to make these Minutes of Meeting in order to confirm the mutual understanding reached through the discussions during the meeting.

Presentation of the Inception Report

1. Having discussed and analyzed all the issues in the Inception Report as itemized numbered 6 through 13 below, the participants approved the report which described the approach, methodology and the work plan.
2. It was affirmed that the project will be executed to strengthen the capacity of the General Directorate of Environmental Protection (GEDP) in implementing and enforcing relevant legislation on Environmental Impact Assessment and Water Pollution Prevention and Control with participation of diverse stakeholders.
3. The participants agreed on the following general plan and reaffirmed their commitment to the smooth and effective implementation of the project.
   i. Preparation of draft legal documents, guidelines and manuals completed before the end of June 2018.
   ii. Finalization of the documents through appropriate authorization process completed before the end of August 2019.
   iii. The trainings will proceed in parallel in a step-by-step manner.
4. The participants agreed that the current situation does not rationalize any changes of the Project Design Matrix (PDM) Version 1.0 signed on 15th December 2016. Therefore, the participants approved the PDM Version 1.0 as the consensus among the members on the framework of the Project.
5. The participants further agreed to review the PDM when the situation has changed and when it is deemed necessary during Joint Coordination Committee Meeting.
6. It was proposed and agreed by the participants that the project deliverables should also be harmonized with the National Environment Strategy and Action Plan (NESAP) and the Cambodia Climate Change Strategic Plan.
7. The participants discussed integration of such issues as ambient water quality standards, effluent standards, noise and vibration. These issues will be further discussed and to be integrated into the project with due consideration on the feasibility and project strategy.
8. The issues of laboratory strengthening are recognized as an important element to ensure enforceability of standards. It will be further discussed.

9. The timeline above was also discussed to allow flexibility. The Participants, however, agreed to retain it as a provisional target. With elaboration of the project activity, it will be further adjusted.
10. The participants discussed and agreed that the lectures and training opportunity provided under the project are open to the members of the JCC and other relevant officers at the national and sub-national levels.
11. For the training in Japan, Vietnam and Thailand, the participants will be selected according to the content of the training in close consultation with the GDEP-MoE.
12. The issues of project sustainability were also discussed, particularly on commitment and participation of the line ministries and institutions in project implementation. Moreover, the participants discussed and raised the issue of incentive in consultation with the Ministry of Economy and Finance. The project sustainability will be discussed when the project activities are elaborated.
13. The issue of developing a technical guideline on ground water and surface water protection was raised. They will also be discussed in the course of the project.

Approval of the Terms of Reference for the Joint Coordination Committee

14. The National Council for Sustainable Development was proposed to be co-opted and adopted as a member of the JCC.
15. It was confirmed that the membership of the JCC will be formalized immediately after the first JCC meeting.
16. After deliberations, the participants of the JCC agreed on and adopted the Terms of Reference (TOR) of the JCC membership of the Project.
17. All the participants appreciated the importance of participating in the JCC meetings and understood their functions of the JCC as set forth in the TOR; and agreed to playing key roles as the members of the JCC.
18. The participants of the JCC, especially the counterpart officers of the project, agreed to sharing the project information and the project outputs with other ministries at the earliest period possible for mutual cooperation to promote effective implementation of EIA and pollution control.

Annex 1: List of participants in the first JCC meeting

Annex 2: Terms of Reference for the JCC

Annex 3: Presentation material at the first JCC meeting

Phnom Penh, Cambodia, 29th August 2017

Mr. Kotaro Tanaka
Deputy Chief Representative
Japan International Cooperation Agency Cambodia

H.E. Sao Sopheap
Advisor to Ministry and Director of Cabinet
Ministry of Environment of Cambodia

LIST OF PARTICIPANTS OF THE FIRST JOINT COORDINATION COMMITTEE MEETING

No.	Name	Institution
1	H.E Eang Sophalleth	Under Secretary of State of Ministry of Environment
2	H.E Sao Sopheap	Advisor to Ministry of Environment and Director of Cabinet
3	H.E Heng Nareth	Director General of GDEP, MoE
4	H.E Choup Paris	Deputy Secretary General, NCSD, MoE
5	Mr. Pak Sokharavuth	Deputy Director General of Environmental Protection
6	Mr. Chea Sina	Deputy Director General, GDEP, MoE
7	Mr. Meun Meakara	Deputy Director General of General Directorate of Local Community, MoE
8	Mr. Dy Kiden	Director of Department of Solid Waste Management
9	Mr. Sarun Sambo	Director of Department of Law Enforcement and Inspection
10	Mr. Chreang Phollak	Deputy Director of Ministry of Public Works and Transport
11	Mr. Seng Sochinda	Director of Department, Cambodia Development Council
12	Mr. Chhim Sukun	Deputy Director General, Ministry of Land Management, Urban Planning and Construction
13	Mr. Bou Chanserey	Deputy Director General, Ministry of Tourism
14	Mr. Seang Sotham	Deputy Director General, Ministry of Mines and Energy
15	Mr. Song Sophal	Deputy Director General, Ministry of Rural Development
16	Mr. Pech Veasna	Deputy Director General, Ministry of Water Resources and Meteorology
17	Mr. Phin Narong	Director of Department of Administration Planning and Finance
18	Mr. Phet Pichhara	Director of Department of Hazardous Substances Management
19	Ms. Meas Chanthida	Director of Laboratory, GDEP
20	Mr. Thiv Sophearith	Director of Department of Air Quality and Noise Management
21	Mr. Say Bora	Program Officer, JICA
22	Mr. Kotaro Tanaka	Deputy Chief Representative, JICA
23	Mr. Kohei Hori	Second Secretary of Embassy of Japan
24	Mr. Danh Serey	Director of EIA, GDEP
25	Mr. Tim Sipha	DDG of GDANCP. MoE
26	Mr. Ke Vongwattana	Deputy Director General, DGAF, MoE

27	Mr. Phin Rady	Director of Department of Water Quality Management, MoE
28	Mr. Sok Bunheng	Officer of Ministry of Economy and Finance
29	Mr. Roath Sith	DDG of GDEKI, MoE
30	Ms. Chhun Monita	DoWQM, MoE
31	Mr. Chea Leng	Deputy Director of EIA,GDEP
32	Mr. Takayuki Hatano	JICA expert team/EIA
33	Mr. Yasuhiko Muramatsu	JICA expert team
34	Mr. Munehiro Fukuda	JICA expert team
35	Mr. Chhoeun Raksmey	Chief office of Ministry of Industry and Handicraft
36	Ms. San Dana	Officer of Department of Air Quality and Noise Management
37	Mr. Meng Kro	Project Coordinator, JICA
38	Ms. Sophan Phaty	Project Coordinator, JICA

TERMS OF REFERENCE FOR THE JOINT COORDINATION COMMITTEE THE PROJECT FOR EFFECTIVE IMPLEMENTATION OF EIA AND POLLUTION CONTROL THROUGH THE CAPACITY DEVELOPMENT OF MOE

1. A Joint Coordination Committee (hereinafter referred to as JCC) is hereby established as a body of major stakeholders at the national level to ensure effective and efficient implementation of the project.

2. The JCC shall be composed of representatives of the following Cambodian and Japanese parties and headed by the Minister of the Ministry of Environment (MOE), or their designees, as the Project Director who will be responsible for the overall administration and implementation of the Project.

Cambodian Side

1. The Ministry of Environment
2. The General Directorate of Environmental Protection (GDEP), MOE
3. The National Council for Sustainable Development, MoE
4. General Directorate of Administration and Finance, MoE
5. General Directorate of Administration for Natural Conservation and Protection, MoE
6. General Directorate of Administration Environmental Knowledge and Information, MoE
7. General Directorate of Community Base, MoE
8. The Council for the Development of Cambodia
9. The Ministry of Agriculture, Forestry and Fisheries
10. The Ministry of Mines and Energy
11. The Ministry of Industry and Handicraft
12. The Ministry of Water Resources and Meteorology
13. The Ministry of Public Works and Transport
14. The Ministry of Land Management, Urban Planning and Construction
15. The Ministry of Tourism
16. The Ministry of Economy and Finance
17. The Ministry of Rural Development

Japanese Side

1. Japanese Experts
2. JICA Cambodia Office
3. Others concerned as appointed by JICA

3. Other Ministries and directorate may be invited as needed depending on the issues deliberated.

4. The functions of the JCC shall include, *inter alia*:
   1. Approving the annual work plan of the project;
   2. Reviewing overall progress;

3. Sharing opinions on major issues that arise during the implementation of the Project;
4. Taking necessary actions that are required for smooth implementation of the project;
5. Facilitating the avoidance and settlement of disputes; and
6. Promoting inter-institutional co-ordination of project related activities.
7. Responsible for participating activities related to implementation of EIA and pollution control as knowledge based in decision-making and encourage the participation of implementation to be effective.
8. Proposing the national policy or national plan to implement the EIA and pollution control for relevant stakeholder reviewed and approved.
9. Provide opinion or idea on agreement of law, regulation, national action plan related to the project of implementation the EIA and pollution control.
10. Monitoring and evaluation of the problem and weakness of the project implementation of EIA and pollution control and report to relevant stakeholders about the necessary need for achieving the effective implementation of EIA and pollution control
11. Coordinate the communication between stakeholders' institution and share information to the team for all issues that related to the project for EIA and Pollution Control.
12. Coordinate the projects and other research activities in national level that related to the implementation of EIA and pollution control.

5. The following general procedures are proposed and may be adjusted by the JCC when deemed necessary:
    1. The meetings of JCC shall be held once a year or whenever deemed necessary;
    2. The decisions of the Committee shall be taken by consensus;
    3. The JCC may establish and delegate responsibilities to ad hoc and standing committees or working groups, and seek the advice of nongovernmental persons or groups;
    4. The Secretariat of JCC will be with the head of the GDEP; and;
    5. Each Party shall designate an office to serve as the contact point with regard to this Agreement. That office shall receive official correspondence related to the activities of the JCC.

MINUTES OF THE SECOND JOINT COORDINATION COMMITTEE MEETING
ON
THE PROJECT FOR EFFECTIVE IMPLEMENTATION OF
EIA AND POLLUTION CONTROL
THROUGH THE CAPACITY DEVELOPMENT OF MOE

The Second Joint Coordination Committee (JCC) of the Project for Effective Implementation of EIA and Pollution Control through the Capacity Development of MOE (the Project) was convened on 10th January 2018 from 9:00 A.M. to 12:00 P.M. at the Conference Hall of HIMAWARI HOTEL located at 313, Sisowath Quay, Phnom Penh.

The meeting was opened by the remarks of Mr. Kotaro Tanaka, Deputy Chief Representative of JICA Cambodia and H.E Eang Sophalleth, Under Secretary of State of the Ministry of Environment; and chaired by Mr. Pak Sokharavuth, the Deputy Director General of the General Directorate of Environmental Protection. The participants agreed to make these Minutes of Meeting in order to confirm the mutual understanding reached through the discussions during the meeting.

Presentation of the Progress Report

1. On behalf of the Project Team consisting of the Ministry of Environment and the JICA Team, Mr. Yasuhiko Muramatsu gave a presentation on the Progress Report 1. The salient points of the presentation are as follows:
    1.1 Two Task forces were formally established separately for EIA and Water Pollution Control in September 2017.
    1.2 The sector issues that need to be addressed in the project were elaborated through the Task Force meetings, policy dialogues with the relevant departments and various consultation meetings with public sectors as well as private sectors.
    1.3 Consultation meetings on water sector were convened for 1) academe and 2) the industry.
    1.4 Eleven (11) tutorial classes and workshops/fielded exercises were organized with a total number of participants of two hundred two (202).
    1.5 To capture and identify the organizational capacity and the needs for training, a series of meeting were convened with the technical departments under GDEP.
    1.6 As for the implementation schedule, some delay in the activities on the EIA sub-sector is observed; though, it is still manageable level to complete the project activities within the scheduled period which was agreed in the first Joint Coordination Committee meeting.
    1.7 In the past months in operation of the project, it was often observed that scheduling and coordinating for convening a Task Force meeting required significant effort and support by the JICA Team despite the fact that the technical cooperation project

requires high commitment and engagement of the project counterpart. It is said that the ownership of the project is a key factor making project success and bringing positive results.

2. Upon the completion of the presentation, Mr. Pak Sokharavuth opened the floor for any comments or questions on the presentation.

On Groundwater protection,

2.1 Emphasizing the importance of the groundwater resources as a source of drinking water, Mr. Song Sophal, the Deputy Director General, Ministry of Rural Development, expressed an interest in participating in the Task Force meeting.

2.2 The Project Team responded that the Task Force Members especially on the water pollution sub-sector will consider co-optation of the ministry as an observer especially at the occasions of the Task Force Meeting and/or consultation meeting in February 2018.

For Harmonization with other laws and regulation,

2.3 Mr. Mak Soeun, the Deputy Director General, Ministry of Agriculture Forestry and Fisheries (MAFF), discussed the needs of harmonization with other relevant laws and regulations by referring the potential impacts on fertilizer and pesticides use and control.

2.4 The Project Team responded that MAFF will be consulted when the revision of the effluent standards and the ambient water quality guidelines have impacts on the fertilizers and pesticides through a formal communication from the Ministry of Environment.

With regard to Small and Medium Enterprises,

2.5 Emphasizing the importance of the Small and Medium Enterprises in the Cambodian Economy, Mr. Ven Keahak, the Deputy Director General, the Ministry of Industry and Handicraft, inquired how the project handles them in the amendments of the relevant Prakas.

2.6 The Project Team responded that an exemption clause of SME from application of uniform rules and regulations will be integrated with due consideration on constraints in financial and technical capacity of SMEs.

On Participation of JCC members in the training,

2.7 Mr. Seng Sochinda, the Director of Department, The Council for the Development of Cambodia, inquired about the participation of the JCC members in the training programme, which was also proposed in the first JCC meeting.

2.8 The Project Team admittedly informed that the participation of other line ministries have not yet realized. The Project Team recognize the importance of participation of the line ministries and make efforts to inform in advance the schedule of the forth coming training courses.

For General Directorate of Environmental Knowledge and Information (GDEKI) the Ministry of Environment as a member of JCC

2.9 Mr. Roath Sith, the Deputy Director General of GDEKI, expressed an interest to participate in the Task Force meeting with due consideration on the needs as the department in policy formulation process.

2.10 The Project Team responded that the Task Force Members of the MoE will consider co-optation of the department as an observer.

3. Having discussed and analysed all the issues of the progress, the participants approved the report on the parts describing the progress since the first JCC meeting on 29th August 2017.

Approval of the Modification of the Project Design Matrix

4. It is found that the Project Design Matrix needs to be reviewed and modified as a result of the actual progress and significant findings during the past months.
5. The participants agreed to adopt the proposed changes in the Project Design Matrix after the deliberations.

Annex 1: List of participants in the first JCC meeting
Annex 2: Project Design Matrix Version 2
Annex 3: Presentation material at the second JCC meeting

Phnom Penh, Cambodia, 10th January 2018

Mr. Kotaro Tanaka
Deputy Chief Representative
Japan International Cooperation Agency Cambodia

H.E Eang Sophalleth,
Under Secretary of State
Ministry of Environment of Cambodia

Mr. Yasuhiko Muramatsu
Team Leader
JICA Project Team

LIST OF PARTICIPANTS OF THE SECOND JOINT COORDINATION COMMITTEE MEETING

No	Name	Institution
1	H.E Eang Sophalleth	Under Secretary of State of Ministry of Environment
2	Mr. Kotaro Tanaka	Deputy Chief Representative, JICA
3	Mr. Kohei Hori	Second Secretary of Embassy of Japan
4	Mr. Pak Sokharavuth	Deputy Director General of GDEP, MoE
5	Mr. Chea Sina	Deputy Director General of GDEP, MoE
6	Mr. Roath Sith	Deputy Director General of GDEKI, MoE
7	Mr. E Vuthy	Deputy Director General of NCSD, MoE
8	Eng Kimsan	Deputy Director General of GDFA, MoE
9	Mr. Chhim Sokun	Deputy Director General, Ministry of Land Management, Urban Planning and Construction
10	Mr. Ven Keahak	Deputy Director General, Ministry of Industry and Handicraft
11	Touch Chan Kresna	Deputy Director General of Ministry of Economy and Finance
12	Lay Nara	Ministry of Public Works and Transport
13	Lim Panga	Ministry of Mines and Energy
14	Seng Sochinda	Director, CDC
15	Mak Soeun	Deputy Director General, Ministry of Agriculture Forestry and Fisheries
16	Phan Sopheak	Chief Office of Ministry of Tourism
17	Song Sophal	Ministry of Rural Development
18	Mr. Prom Kanthel	Deputy Department, Ministry of Water Resource and Meteorology
19	Thiv Sophearith	Director of Department of Air Quality and Noise Management
20	Sarun Sambo	Director of Department of Inspection and Law Enforcement
21	Chea Leng	Deputy Director of Department of EIA
22	Dek Vimeanreaksmey	Deputy Director of Solid Waste Management Department
23	Him Chandath	Deputy Director of Department of Water Quality Management
24	Chea Nara	Deputy Director of Department of Air Quality and Noise Management
25	Oum Borath	Deputy Director of MoE
26	Meas Sokun	Chief Officer, MoE

27	Keo Vanthoeun	Chief Office, MoE
28	Nishikawa Masashi	JICA Cambodia Office
29	Say Bora	Program Officer, JICA
30	Yasuhiko Muramatsu	JICA Expert
31	Taisuke Watanabe	JICA Expert
32	Zenjiro Egawa	JICA Expert
33	Sophan Phaty	Project Coordinator, PEPC
34	Meng Kro	Project Coordinator, PEPC

Project Design Matrix (2018/1/10) Ver.2.0
Project Name: Technical Cooperation Project for Better Implementation of EIA and Pollution Control through the Capacity Development of MoE
Duration of Project: 3 years
Target Group: GDEP (General Department of Environmental Protection), Ministry of Environment
Target area: Phnom Penh

Narrative Summary	Verifiable Indicators	Means of Verification	Important assumption
[Overall goal] MoE's institutional and technical capacity is developed to implement the mission of ensuring environmental protection effectively and efficiently.	MoE's work on environmental protection received better evaluation from related stakeholders, compared to the level that of the starting point of the project.	Organizing a seminar to report the progress after the project and obtaining questionnaire answer from related participated stakeholders.	Present national policy and environment regulation in Cambodia is maintained and improved. Manpower and budget to be provided by the government,
[Project purpose] GDEP capacity to prevent, reduce and mitigate environmental pollution focusing on EIA and water is strengthened.	1. GDEP's work on EIA and water pollution control received **20 percent** increased confidence from government offices related to the above mentioned fields compared to the level that of the starting point of the project 2. Transparency of GDEP is increased through **regular** information disclosure 3. **EIA review and water pollution control related works are carried out in accordance with the development of technical guidelines and procedures**	1. Questionnaire answer from the related government offices 2. Information disclosure materials such as Annual report of MoE, Website that contains information related to EIA and environmental pollution **3. Result of the interview** **4. Work record**	Present national policy and environment regulation in Cambodia is maintained and improved. Manpower and budget to be provided by the government,
[Output] 1. Legal documents related to EIA and pollution control focusing on water are organized	1-1 Prakas/Joint Prakas: Documents are submitted to Minister(s) for approval 1-2 Sub-decrees: Documents are submitted to the Council of Ministers for approval	**Copy of legal documents approved or under approval process**	
2. Technical issues and procedures related to EIA and pollution control focusing on water are clarified and shared with GDEP staff as well as other stakeholders.	**Developed technical guidelines and procedures are understood by the stakeholders**	**2-1 Printed Technical guidelines and procedures**	

			2-2 Minutes of consultation meetings **2-3 Questionnaire answer of the stakeholders**	
3. Capacity of GDEP and related departments under GDEP in the field of Environmental Management is enhanced	3-1 **Result of water quality monitoring is opened to the public by GDEP** 3-2 **Quality of the comments on EIA/IEIA reports made by staffs of EIA Department and other members of EIA review committee is improved compared to the level at the starting point of the Project**		3-1 **Water quality monitoring reports including** Pollution source mapping in Phnom Penh area **3-2 Compiled water quality monitoring data** **3-3 Compiled comments on EIA reports** **3-4 Interview results from staffs of EIA Department and EIA review committee**	
[Activity of the project] Output 1: Law and regulation revised and updated 1.1 Develop task force to review laws and regulations 1.2 Finalize items for output 1 1.3 Review and draft revised laws and regulations 1.4 Consultation with stakeholders 1.5 Finalize draft revised laws and regulations 1.6 Prepare summary report for output 1 Output 2: Technical guideline and procedure developed 2.1 Develop Task Force to develop guideline and procedure 2.2 Finalize items for output 2 2.3 Develop draft guidelines and procedures 2.4 Consultation with stakeholders 2.5 Finalize draft guidelines and procedures 2.6 **Disseminate the finalized and/or draft guideline and procedure to stakeholders** 2.7 Prepare summary report for output 2		[Input] Japanese Side Japanese Experts 7-10 short term experts (2) Training Study tour to Japan and other countries (3) Local Cost Local costs for experts' activities Sub-contract for EIA Sub-contract for data collection and Database input Local consultant to assist legal document drafting Small funding for research (4) Machinery, Equipment and Materials Portable water quality monitoring unit and accessory, reagent Portable air quality monitoring unit (PM) Laboratory common apparatus (hot plate, water bath, pH meter)	

Output 3: Capacity development of MoE staff **3.1 Review the institutional arrangements of GDEP to clarify the scope of the training** **3.2 Prepare the syllabus including contents/subjects of training program** 3.3 Organize seminars **3.4 Conduct study tours** **3.5 Develop training programs reflecting the obtained results from seminars and study tours** **3.6 Implement the developed training program** **3.7 Evaluate the implemented training program and prepare the next training** 3.8 Prepare summary report of output 3	Cambodia side (1) Counterpart personnel including administrator (2) Office space, meeting room (3) Local costs (see Minutes of Meeting)"	

Note:

- "Task force" mentioned in activity 1.1 and 2.1 means working team within GDEP and JICA team for respective task, i.e, preparation of legal document, technical guideline and materials. Persons from outside may be selected to join the team.
- "Summary report" mentioned in activity 1.6, 2.6 and 3.8 means reports to be prepared by GDEP and JICA team to summarize the activity/achievement in each output area, and will be used to report to others in GDEP, JICA and other stakeholders.

MINUTES OF THE THIRD JOINT COORDINATION COMMITTEE MEETING
ON
THE PROJECT FOR EFFECTIVE IMPLEMENTATION OF
EIA AND POLLUTION CONTROL
THROUGH THE CAPACITY DEVELOPMENT OF MOE

The Third Joint Coordination Committee (JCC) of the Project for Effective Implementation of EIA and Pollution Control through the Capacity Development of MOE (the Project) was convened on 13th June 2018 from 8:00 A.M. to 12:00 P.M. at the Conference Hall of CAMBODIANA HOTEL located at 313 Sisowath Quay, Phnom Penh.

The meeting was opened by the remarks of Mr. Kotaro Tanaka, the Deputy Chief Representative of JICA Cambodia and H.E Eang Sophalleth, the Under Secretary of State of the Ministry of Environment; and chaired by H.E. Sao Sopheap, Director of Cabinet Minister and Advisor to the Ministry of Environment. The participants agreed to make these Minutes of Meeting in order to confirm the mutual understanding reached through the discussions during the meeting.

Presentation of the Progress Report

1 On behalf of the Project Team consisting of the Ministry of Environment and the JICA Project Team, the leader of the JICA Project Team, Mr. Yasuhiko Muramatsu, gave a presentation on the Progress Report. The salient points of the presentation are as follows:

1.1 Overall, the project has been implemented as designed and scheduled. However, some parts of the implementation schedules were modified to focus on critical issues and thus remove key bottlenecks at an earlier stage of the project. By this way, the implementation plan was aligned in a phased manner to optimize efficiency of the intervention.

1.2 It is also noteworthy that the members of the Task Forces have engaged and participated consistently in the relevant activities, which would help achieve the project objectives for developing capacity in an effective manner. This also demonstrates an improved sense of ownership of the key project stakeholders and would have a positive institutional development impact.

1.3 The officers of other ministries including MoIH, CDC, MoAFF, MoWRM, MoRD and GDEKI of MoE[1] also participated in the fourth Task Force meeting on Water Pollution Subsector. The expansion of the membership in the Task Force would enhance the transparency in decision making process.

1.4 The Department of EIA (DEIA) organized a briefing session on preparation of Environmental Management Plan to support members of the Japanese Business Association of Cambodia. Although it was an ad-hoc activity of the project, it would

[1] The Ministry of Industry and Handicraft, the Council for the Development of Cambodia, the Ministry of Agriculture, Forestry and Fisheries, the Ministry of Water Resources and Meteorology, the Ministry of Rural Development and the General Directorate of Environmental Knowledge and Information of the Ministry of Environment

contribute to building trust between the government and the business sector.

1.5 Based on the findings in the review of the past IEIA/EIA reports, a preliminary EIA review manual has been drafted in English, which is currently under scrutiny by the JICA team. Upon the completion of the scrutiny, a Khmer version will be immediately prepared for further consultation and examination with the Task Force members.

1.6 The Task Force members have developed a draft guideline on infrastructure sector (road). A Khmer version of the guidelines was also prepared and submitted to DEIA for their review and feedback.

1.7 The members of Task Force on Water Pollution Sub-sector have concentrated on the revision of Sub-Decree of water pollution control. The revised sub-decree is now under final review process. A key issue in finalizing the sub-decree lies in the threshold value of wastewater volume to exempt Small-Scale Enterprises from a uniform regulation.

1.8 The first international training tour will be organized in September 2018 to send 16 officers to Thailand.

1.9 A total of one hundred sixty-three (163) officers participated in the eleven tutorial classes organized in the past months since the last JCC meeting.

1.10 It was proposed to convene the next JCC meeting one year later unless any emerging issues arise before the JCC meeting.

2 During the presentation, the participants discussed issues and challenges in the project as follows;

On the EIA sub-sector,

2.1 Mr. Yim Sothan, Chief Office of the Department of EIA raised an issue of the language barrier and communication in preparing the review manuals and the EIA guidelines by referring the fact that there is an additional step to prepare an English version before developing a Khmer Version.

2.2 The JICA Team Leader acknowledged the language barrier between the MoE and the JICA team. Meanwhile, he also reminded that the development process of the sector guidelines would become smoother and faster once the EIA sector guidelines on road is complete. However, he also acknowledged that there were some issues that may have been overlooked in the relevant meetings due to the language barrier, which would require settlement after the Khmer version is developed.

For the Water Pollution Control sub-sector,

2.3 Mr. Chea Sina, Deputy Director General of GDEP argued that 1) water quality index and water quality standards on biodiversity are deemed important for management of water quality; 2) the water quality index, however, should be desirably developed under a separate and independent activity from the process for amendment of the Sub-decree on water pollution control; and 3) the water quality standards on Biodiversity would require scientific research and development process for collecting and analysing data.

2.4 The JICA Project Team Leader concurred with the view of Mr. Chea Sina by emphasizing the fact that establishing toxicological data of chemical substances on endemic species is

desirable to develop plausible water quality standards on biodiversity.

2.5 The JICA Project Team Leader further acknowledged that there is a mountain of environmental problems which require prioritization and strategic planning to solve them in a step-by-step manner.

With regard to the Training components,

2.6 Mr. Puth Sorithy, Deputy Director General of GDEKI of the Ministry of Environment inquired about the number of the participants of the training in Thailand and inquired if the number of participants could be expanded. He then emphasized that the sub-national governments have a compelling need for capacity development.

2.7 The JICA Project Team Leader informed that the sixteen is the maximum number of the participants of the training in Thailand. He subsequently requested the GDEP to coordinate with other ministries and prioritize the participants as necessary.

2.8 In addition, the JICA Project Team Leader discussed that the training components of the project should be desirably integrated into the regular government program by allocating the Ministry's budget in the future; it is however necessary to prioritize and re-design the training components to make them in an implementable manner and affordable scale.

2.9 The JICA Team Leader reminded that a set of training for the sub-national government officers were already programmed in the current training plan. He then referred that the training for the sub-national government officers should take a train the trainers approach by nominating and supporting officers in providing lectures and tutorial classes.

At the end of the meeting, H.E. Sao Sopheap concurred on the proposed schedule of the next JCC meeting to take place in the middle of the year 2019.

Annex 1: List of participants in the third JCC meeting
Phnom Penh, Cambodia, 13th June 2018

Mr. Kotaro Tanaka
Deputy Chief Representative
Japan International Cooperation Agency Cambodia

H.E. Sao Sopheap
Director of Cabinet Minister and Advisor to
the Ministry of Environment

Mr. Yasuhiko Muramatsu
JICA Project Team Leader

LIST OF PARTICIPANTS OF THE SECOND JOINT COORDINATION COMMITTEE MEETING

No	Name	Institution
1	H.E Eang Sophalleth	Under Secretary of State of the Ministry of Environment
2	H.E Sao Sopheap	Director of Cabinet Minister and Advisor to the Ministry of Environment
3	H.E Chea Sam Ang	Director General of GDANCP, MoE
4	Mr. Kotaro Tanaka	Deputy Chief Representative of JICA Cambodia
5	Mr. Pak Sokharavuth	Deputy Director General of GDEP, MoE
6	Mr. Chea Sina	Deputy Director General of GDEP, MoE
7	Mr. Ke Vongwattana	Deputy Director General of GDAF, MoE
8	Mr. Puth Sorithy	Deputy Director General of GDEKI, MoE
9	Mr. Touch Chan Kresna	Deputy Director General, Ministry of Economy and Finance
10	Mr. Sieng Sotham	Deputy Director General, Ministry of Mines and Energy
11	Mr. Lay Nara	Ministry of Public Works and Transport
12	Mr. Uy Sambath	Ministry of Public Works and Transport
13	Mr. Chhoeun Raksmey	DTST, Ministry of Industry and Handicraft
14	Mr. Y Bunlean	DTST, Ministry of Industry and Handicraft
15	Mr. Thiv Sophearith	Director of Department of Air Quality and Noise Management
16	Mr. Sarun Sambo	Director of Department of Inspection and Law Enforcement
17	Mr. Phin Narong	Director of Department of Administration Planning and Finance
18	Mr. Phin Rady	Director of Department of Water Quality Management
19	Mr. Taing Meng Eang	Director of Department of Green Economy, NCSD-MoE
20	Mr. Chea Nara	Deputy Director of Department of Air Quality and Noise Management
21	Mr. Dek Vimeanreaksmey	Deputy Director of Department of Solid Waste Management
22	Mr. Oum Borath	Deputy Director of Laboratory Department
23	Mr. Yim Sothan	Chief Office of Department of EIA
24	Mr. Uon Sokunthea	Vice-Chief Office of DHSM-MoE
25	Mr. Bou Sinratanak	Officer, MoE
26	Mr. Sath Sitak	Officer, MoE
27	Mr. Sam Sokyimeng	Officer, MoE
28	Ms. San Dana	Officer, MoE
29	Ms. Lim Keamean	Officer, MoE
30	Mr. Yasuhiko Muramatsu	Team Leader JICA Project
31	Mr. Akira Yamashita	Deputy Team Leader JICA Project
32	Mr. Zenjiro Egawa	JICA Expert
33	Mr. Taisuke Watanabe	JICA Expert
34	Mr. Yusuke Nakayama	JICA Expert

35	Mr. Nishikawa Masashi	Project Formation Advisor, JICA
36	Mr. Say Bora	Senior Program Officer, JICA
37	Ms. Ma Sopheavin	Program Officer, JICA
38	Mr. Meng Kro	Project Coordinator, PEPC
39	Mr. Sam Sochea	BTV
40	Mr. Kakthan Sokhery	First Class/ Interpreter

MINUTES OF THE FOURTH JOINT COORDINATION COMMITTEE MEETING
ON
THE PROJECT FOR EFFECTIVE IMPLEMENTATION OF
EIA AND POLLUTION CONTROL
THROUGH THE CAPACITY DEVELOPMENT OF MOE

The Fourth Joint Coordination Committee (JCC) of the Project for Effective Implementation of EIA and Pollution Control through the Capacity Development of MOE (the Project) was convened on 10th June 2019 from 8:00 A.M. to 12:00 P.M. at the Conference Hall of HIMAWARI HOTEL located at 313 Sisowath Quay, Phnom Penh 12007, Cambodia.

The meeting was opened by the remarks of H.E Eang Sophalleth, the Secretary of State of the Ministry of Environment; Mr. Yuichi Sugano, the Chief Representative of JICA Cambodia; and chaired by Mr. Chea Sina, Deputy Director General of the General Department of Environmental Protection, the Ministry of Environment. The participants agreed to make these Minutes of Meeting in order to confirm the mutual understanding reached through the discussions during the meeting.

1 H.E Eang Sophalleth warmly welcomed all the participants to the fourth Joint Coordination Committee meeting in his opening remark. Looking back the recent important events under the project, he expressed thanks for the cooperation especially for developing the fundamental framework for water quality management and crucial guidelines for environmental impact assessment.

2 Mr. Yuichi Sugano emphasized, in his opening remark, the needs for prudent management of the subsequent process for finalization and authorization of the Sub-Decree on Water Pollution Control and relevant guidelines. In this context, he further encouraged GDEP/MOE to take full leadership to expedite the process.

3 After a short break, Mr. Chea Sina provided an outline of the project with a brief historical background by highlighting significance of the deliverables of the project. He then handed over the microphone to Mr.Yasuhiko Muramatsu to give a presentation on the project.

Presentation of the Progress Report

4 On behalf of the Project Team consisting of the Ministry of Environment and the JICA Project Team, Mr. Yasuhiko Muramatsu, the leader of the JICA Project Team, gave a presentation on the Progress Report. The salient points of the presentation are as follows:

4.1 He initially presented and discussed a desirable state of policy and legislative framework for water quality management to illustrate the current status and the way ahead. The conceptual illustration in his presentation began with the use of surface water quality monitoring to identify water bodies which do not meet the water quality targets/objectives as proposed in the Amended Sub-Decree on Water Pollution Control. He also emphasized that such waterbodies not meeting the criteria require immediate actions for improving water quality.

4.2 He then discussed the on-going activity for developing an inventory of pollution sources. He explained that the inventory would be designed to allow identification of geographical location of pollution sources and intensity of pollutants discharge. However, he also reminded that the inventory in the project should be seen as a prototype of pollution source database because the data set currently available does not allow such detailed analysis of location, quality and quantity of pollution discharge. He also noted that the project is supporting the GDEP in collecting, assembling and evaluating present existing, available baseline data of pollution sources. At this point, he mentioned the Guidelines on Wastewater Treatment Processes, the Manual of Inspection may be used for the survey of the pollution sources.

4.3 He also underlined the needs of planning process for water quality management in a coordinated manner with relevant authorities to address the problems of point sources (PS) and non-point sources (NPS).

4.4 Based on the presentation, he discussed how far the GDEP has reached and where the GDEP is heading. He expounded that GDEP will have developed by the end of the project: 1) A framework and minimum tools for WQ management which includes Water Quality Standards; Effluent Standards; and IEE and EIA; 2) Fundamental skills on Inspection and surface WQ monitoring; and 3) A prototype of Pollution Source Inventory (PSI).

4.5 He further discussed that GDEP will still need after the completion of the project: 1) Field Experience in applying the skills/tools in real problems; 2) Setting up institutional arrangements for WQ Planning using PSI and proceeding to legal actions;3) Building stronger linkage with private sectors to promote environmentally sound investment.

5 After a quick review of the activities performed until the end of May 2019, he then moved to the presentation on 1) Status and Major Achievement, 2) Key Issues and Challenges and 3) Way Ahead.

5.1 He initially reviewed the overall status of the project, in which he emphasized two major achievements: launching of a new website of GDEP and enhanced collaboration among the Ministry of Industry and Handicraft (MIH), Phnom Penh Water Supply Authority (PPWSA) and MOE in developing a prototype of pollution source inventory.

5.2 Then he presented the progress of the activities in the EIA sector with a focus on the Public Consultation meeting convened on 19th March 2019 to discuss the Sector Guidelines on Road and Railway.

5.3 On Water Pollution Sector, he sought attention of the participants on the finalization process for authorization of the Sub-decree on Water Pollution Control, which was further reminded that all the authorization procedure should be completed in one year.

5.4 As an exit strategy of the project, he briefly discussed the "Project for Promoting Environmentally Sound and Sustainable Investment in Cambodia" which is being proposed by GDEP.

5.5 For the finalization process, he reminded that GDEP is supposed that a public consultation on the Sub-decree on Water Pollution Control have to be completed before January 2020 at the latest to reach the final signing by the Minister by the end of the project.

6 At the end of the presentation, he proposed the next JCC meeting to take place on 16th January 2020.

Open Discussion on the Presentation

7 After the presentation, Mr. Chea Sina discussed and reviewed the issues and challenges from the viewpoints of overall environmental management of the country. In the discussion, he underscored, among others, the future needs of water quality guidelines on biodiversity; integration of classification scheme in water quality management and Water Quality Index; and strengthening Sub-national level government in environmental management.

8 Mr. Ven Keahak, the representatives of the Ministry of Industry and Handicraft, discussed the challenges in the pollution management in the industrial sector. In his discussion, he shed light on the needs of multi-environmental media approach recognizing that the factories are facing diverse environmental problems such as solid waste management, chemical management etc. in addition to water pollution issues. He further reminded that other small pollution sources such as vehicle garage are also contributing the overall pollution of the environment. He further discussed the diversity of pollution nature by referring the fact that the dying factories, poultry, garment factories are causing major pollution.

9 Mr. Mak Sopheaktra, the representative of the Ministry of Mine and Energy, discussed the issues of operation licenses of mining sector by acknowledging the fact that there are unauthorized miners in the country.

10 Mr. Ho Puthea, the representative of the Ministry of Agriculture, Forestry and Fisheries discussed the pollutions generated by agricultural sector by focusing on potential contamination by chemical fertilizers and pesticides.

11 Mr.Yasuhiko Muramatsu then reacted to the discussions by firstly appreciating all the comments and expounding the approach and positions of the project as follows:

11.1 Recognizing the value and government's policy on the delegation of powers to sub-national level, the organizational and institutional settings for environmental management have to be reviewed over the years to maximize the performance of the government intervention to achieve the sustainable development goals. He admits that the project is viewed as its very initial stage wherein such reformation be designed and structured.

11.2 He fully concurred with the opinion of the representatives of the Ministry of Industry and Handicraft on the needs of settling diverse environmental problems and emphasized that the environmental problems on the ground always requires cross-cutting approach. He reminded that the proposed project by GDEP as the exit strategy is designed to address real problems in the field.

11.3 He appreciated the comments and information by the Ministry of Mine and Energy and the Ministry of Agriculture, Forestry and Fisheries. At this point, he 1) briefly discussed the potential needs of formation of inter-ministerial body for solving specific water pollution problems to address Point Source and Non-Point Source pollution, 2) spelled out the needs of collaboration with extension officers for controlling fertilizer and pesticides, 3) referred some of the project components proposed by GDEP to address environmental problems in the field.

11.4 In the last discussion, he encouraged GDEP to develop basic scientific data for developing the water quality guidelines on biodiversity.

12 At the end of the meeting, Mr. Chea Sina concurred on the proposed schedule of the next JCC meeting to take place in the January 2020.

Annex 1: List of participants in the fourth JCC meeting

Phnom Penh, Cambodia, 10th June 2019

Mr. Yuichi Sugano
Chief Representative
Japan International Cooperation Agency Cambodia

Mr. Chea Sina
Deputy Director General of the General
Department of Environmental Protection

Mr. Yasuhiko Muramatsu
JICA Project Team Leader

Annex 1: List of participants in the fourth JCC meeting

LIST OF PARTICIPANTS OF THE FOURTH JOINT COORDINATION COMMITTEE MEETIN

No	Name	Institution
1	H.E Eang Sophalleth	Secretary of State of the Ministry of Environment
2	H.E Khieu Borin	Director General of Local Community, MoE
3	Mr. Sugano Yuichi	Chief Representative of JICA Cambodia Office
4	Mr. Tosikazu Tokioka	First Secretary of Japan Embassy in Cambodia
5	Mr. Chea Sina	Deputy Director General of GDEP, MoE
6	Mr. Ngoun Kong	Deputy Director General of GDEKI, MoE
7	Mr. Ven Keahak	Deputy Director General, Ministry of Industry and Handicraft
8	Mr. Mork Sopheaktra	Deputy Director General, Ministry of Mines and Energy
9	Mr. Touch Chan Kresna	Deputy Director General, Ministry of Economy and Finance
10	Mr. Ho Puthea	Deputy Director General, Ministry of Agriculture Forestry and Fisheries
11	Mr. Seng Sochinda	Director of the Council for the Development of Cambodia
12	Mr. Noun Savy	Ministry of Tourism
13	Mr. Uy Sambath	Ministry of Public Works and Transport
14	Mr. Heang Sophea	Ministry of Land Management, Urban Planning and Construction
15	Mr. Phin Narong	Director of Department of Administration Planning and Finance, MoE
16	Mr. Phin Rady	Director of Department of Water Quality Management, MoE
17	Mr. Sarun Sambo	Director of Department of Inspection and Law Enforcement, MoE
18	Ms. Meas Chanthyda	Director of Laboratory, MoE
19	Mr. Chea Leng	Deputy Director of Department of Environmental Impact Assessment
20	Mr. Pak Vannly	Deputy Director of Department of Air Quality and Noise Management
21	Mr. Sophal Laska	Deputy Director of Department of Hazardous Substance Management
22	Ms. Lim Keamean	Officer, MoE
23	Mr. Muramatsu Yashiko	Team Leader JICA Project
24	Mr. Yamashita Akira	Deputy Team Leader JICA Project
25	Mr. Chiba Masatoshi	JICA Expert
26	Mr. Tomoyuki Yamada	Project Formation Advisor, JICA Cambodia
27	Mr. Hirano Satoshi	JICA Cambodia
28	Mr. Say Bora	Senior Program Officer, JICA Cambodia
29	Mr. Hor Saray	JICA Project
30	Ms. Sophan Phaty	Project Coordinator, PEPC Project
31	Mr. Meng Kro	Project Coordinator, PEPC Project
32	Mr. Kakthan Sokhery	First Class/Interpreter

MINUTES OF THE FIFTH JOINT COORDINATION COMMITTEE MEETING
ON
THE PROJECT FOR EFFECTIVE IMPLEMENTATION OF
EIA AND POLLUTION CONTROL
THROUGH THE CAPACITY DEVELOPMENT OF MOE

The Fifth Joint Coordination Committee (JCC) of the Project for Effective Implementation of EIA and Pollution Control through the Capacity Development of MOE (the Project) was convened on 8th January 2020 from 9:00 A.M. to 12:00 P.M. at the Cambodiana Hotel located at 313 Preah Sisowath Quay, Phnom Penh, Cambodia.

The meeting was opened by the remarks of Mr. Yuichi Sugano, the Chief Representative of JICA Cambodia Office and H.E Sao Sopheap, the Secretary of State, of the Ministry of Environment and chaired by Mr. Pak Sokharavuth, Deputy Director General of the General Directorate of Environmental Protection (GDEP), of the Ministry of Environment. The participants agreed to make these Minutes of Meeting in order to confirm the mutual understanding reached through the discussions during the meeting.

1 Mr. Yuichi Sugano warmly welcomed all the participants to the fifth Joint Coordination Committee meeting in his opening remark. He subsequently reviewed the process of the project to accentuate the fact that the project is scheduled to be complete at the end of the year 2020. He further reminded the participants of MoE that the approval and finalization of the proposed amendment of the Sub-decree on Water Quality Control require accelerated commitment and collaboration to ensure the target of the project.

2 H.E Sao Sopheap also welcomed all the participants to the fifth JCC meeting, and briefly reviewed the recent development of the projects by referring the internal meeting of MoE for amendment of the Sub-decree on Water Pollution Control on 03 December 2019, the institutional arrangement for measurement of Particulate Matter in collaboration with the Institute of Technology of Cambodia to encourage the collaboration and facilitation.

3 After the delivery of the opening remarks, the participants took part in the group photo, which was followed by a brief coffee break. Mr. Pak Sokharavuth, then has taken on the task as the chair of the meeting. He then handed over the microphone to Mr. Yasuhiko Muramatsu to give a presentation on the project.

Presentation of the Progress Report

4 On behalf of the Project Team, Mr. Yasuhiko Muramatsu, the leader of the JICA Project Team, gave a presentation on the Progress Report. The salient points of the presentation are as follows:

4.1 He initially informed that the Pollution Source Inventory has been completed in the last month and emphasized the following new aspects of the pollution management: GDEP will become capable of 1) identifying the location of major point pollution sources; 2) quantifying pollution intensity if the database is integrated with information on the quality of discharge wastewater. The current database contains a limited range of information on the wastewater quality. He

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also reminded that the pollution source inventory may be used for planning of factory inspection.

4.2 He then moved to the presentation and review of the Project Design Matrix. In his presentation, the participants recognized that some of the Verifiable Indicators in the PDM have been accomplished including those on pollution source mapping for the Output 3; and the Sub-decree for Output 1. However, they also understood that there are some other activities to be pursued in the year to accomplish the project, which include: training on the EIA guidelines to realize the improvement of quality of the comments on EIA/IEIA; disclosure of information on water quality monitoring. He then articulated that the followings are the major indicators for achieving the project output; and reminded that the participants are supposed to collarbone the realization of the target.

4.2.1 GDEP's work on EIA and water pollution control received 20 percent increased confidence from government offices related to the above-mentioned fields compared to the level that of the starting point of the project

4.2.2 Transparency of GDEP is increased through regular information disclosure

4.2.3 EIA review and water pollution control related works are carried out in accordance with the development of technical guidelines and procedures

4.3 He briefly presented the deliverables of each sector on EIA and water quality control on their status and progress.

4.4 In the final section of the presentation, he informed the tentative schedule of the next JCC meeting to take place on 17th June 2020.

5 Mr. Pak Sokharavuth, then, opened its discussions to the participants on the presentation.

5.1 Mr. Y Bunlean, the Ministry of Industry and Handicraft inquired about the area zoning of pollution sources.

5.1.1 The Team Leader informed that the graphic of the area zoning was provided to present the conceptual illustration of inspection planning process; and the graphic was prepared and used in the presentation of the previous JCC meeting in June 2019 when the Pollution Source Inventory was still incomplete. It therefore does not indicate any intention of potential intervention of MoE for industry at the moment.

5.2 Mr. Mak Soeun, Deputy Director General, the Ministry of Agriculture, Forestry and Fisheries discussed the importance of the management of fertilizer and pesticides which also need to further discuss to prevent water pollution from non-point sources.

5.2.1 The Team Leader indicated his concurrence on the discussion. He then informed to the participants that the Pollution Source Inventory contains a set of information on one single fertilizer factory, by which he emphasized the significance of the database for pollution management. However, he reminded a relative smaller contribution of nutrient pollution by a single factory.

5.2.2 He further agreed with the representative on the importance of controlling non-point sources such as farming activity; meanwhile, he recognized that it requires inter-agency coordination and long-term planning.

5.3 Mr. Bou Chan Serey, Deputy Director General, the Ministry of Tourism inquired discussed the needs of environmental management in tourism industry by emphasizing the rapid growth of the sector. He further inquired about the potential intervention of the project in the tourism sector.

5.3.1 The Team Leader agreed on his discourse on the growing needs on environmental management in the tourism sector. He informed that the management of environment in the sector requires a cross-cutting approach as it include road development, construction of accommodation and other types of physical investment. He then expounded that the Road Sector EIA guidelines and the guidelines on wastewater treatment process may be used in an integrated manner in the tourism sector's environmental management.

5.4 Dr. Loeung Kesaro, Director Department of Heritage Area, the Ministry of Environment, raised a question on the adequacy of the project approach which has focused on the pollution by factories. He further draws attention on the management of heritage and protection of ethnic minority by emphasizing the status of deprivation.

5.4.1 The Team Leader appreciated the comments and the view. He then discussed the brief history of pollution in Japan to shed light to the existence of many victims arisen in the course of economic development of Japan. He reminded the potential death and disability caused by pollution in the coming decades in the country.

6 Affirming that the participants have discussed the issues thoroughly, Mr. Pak Sokharavuth requested Mr. Phin Rady, the Director of the Water Quality and Management Department of GDEP to give the presentation on the issues in the approval of the Sub-decree on Water Quality Control. Upon the completion of his presentation, the participants proceeded to open discussion on the presentation. The followings are the salient points of the discussion.

6.1 Mr. Sophal Laska, the Director Department of Hazardous Substance Management stated that Article 3 section a.1 Protected public water areas refer to public water areas within the protected nature conservation areas which are designated by the Ministry of Environment under a Ministerial regulation, or any other areas which are designated by the Ministry of Environment. It should not use the word ***any other areas*** because it is not clear.

6.2 Mr. Y Bunlean, Ministry of Industry and Handicraft mentioned that Article 22: The owner or responsible person of pollution sources may ask to have his/her effluent sample tested in other public or private laboratories which shall be registered by the Ministry of Environment. He thinks that the other Ministries also have laboratory such as Ministry of Agriculture, Ministry of Industry and Handicraft…etc. Therefore, he suggested to change ***public or private laboratories which shall be registered by the Ministry of Environment to registered by authorized Institution of laboratory.***

6.3 Mr. Uy Kamal, Deputy Director General of General Directorate of Environmental Information and Knowledge (GDKEI) the Ministry of Environment stated that he supports Mr. Laska's idea about *any other area* in Article 3. It should specify the areas to be clear. The definition of wastewater should specify the level of water content because some factories could condense the wastewater lower than 40 cubic meter or 20 cubic meter per day. He added that the Ministry of Environment has two departments of Inspection and Law Enforcement. One department is under the General Directorate of Administration for Nature Conservation and Protection and another one is under General Directorate of Environmental Protection. For this sub-decree should specify the Department of Inspection and Law Enforcement under General Directorate of Environmental Protection.

6.4 Mr. Song Sophal, Deputy Director General, the Ministry of Rural Development stated that Article 3 should add wastewater from residence.

7 After the presentation, Mr. Pak Sokharavuth called for comments and feedbacks. The major issues raised in the discussion is summarised in the attachment.

8 After the thorough discussion on the amendment of the Sub-decree on Water Pollution Control, Mr. Pak Sokharavuth move to adjourn the meeting, which was seconded by the participants.

Annex 1: List of participants in the Fifth JCC meeting

Phnom Penh, Cambodia, 8th January 2020

Mr. Sugano Yuichi
Chief Representative
JICA Cambodia Office

H.E. Sao Sopheap,
Secretary of State,
Ministry of Environment

Mr. Yasuhiko Muramatsu
JICA Project Team Leader

Annex 1: List of participants in the Fifth JCC meeting

No	Name	Institution
1	H.E Sao Sopheap	Secretary of State of the Ministry of Environment
2	H.E Heng Nareth	Director General, General Directorate of Environmental Protection
3	H.E Meas Sophal	Director General, General Directorate of Natural Conservation and Administrative Protection
4	H.E Chin Sokha	Director General, General Directorate of Administration and Finance
5	Mr. Sugano Yuichi	Chief Representative of JICA Cambodia Office
6	Mr. Pak Sokharavuth	Deputy Director General of GDEP, MoE
7	Mr. Thiv Sophearith	Deputy Director General of GDEP, MoE
8	Mr. Uy Kamal	Deputy Director General of GDEIK, MoE
9	H.E Ngin Lina	Deputy Director General of NCSD, MoE
10	Mr. Mak Soeun	Deputy Director General of Ministry of Agriculture, Forestry and Fisheries
11	Mr. Bou Chan Serey	Deputy Director General of Ministry of Tourism
12	Mr. Song Sophal	Deputy Director General of Ministry of Rural Development
13	H.E Chhim Sokun	Deputy Director General of Ministry of Land Management, Urban Planning and Construction
14	Mr. Y Bunleang	Ministry of Industry and Handicraft
15	Mr. Touch Chan Kresna	Ministry of Economy and Finance's Advisor
16	Mr. Leng Kimhon	The Council of the Development of Cambodia
17	Mr. Kong Sitha	Director Department of Ministry of Mines and Energy
18	Mr. Loeung Kesaro	Director Department of Heritage Area, MoE
19	Mr. Phin Narong	Director Department of Administration Planning and Finance, MoE
20	Mr. Phin Rady	Director Department of Water Quality Management, MoE
21	Mr. Sophal Laska	Director Department of Hazardous Substance Management, MoE
22	Mr. Chea Nara	Director Department of Air Quality and Noise Management, MoE
23	Mr. Chap Yuthy	Deputy Director of Inspection and Law Enforcement, MoE
24	Mr. Lim Say	Deputy Director of Water Quality Management, MoE
25	Mr. Siv Kung	Deputy Director of Laboratory, MoE
26	Mr. Touch Chantha	Deputy Director of Solid Waste Management, MoE
27	Mr. Kun Ty	Chief Officer, Department of Water Quality Management, MoE
28	Mr. Chrin Narong	Chief Officer, Department of Environmental Impact Assessment, MoE
29	Phon Sopheak	Chief Officer, The Ministry of Environment
30	Huot Syradeth	Vice-Chief Officer, Department of Water Quality and Management, MoE
31	Mr. Muramatsu Yasuhiko	Team Leader JICA Project
32	Mr. Onuma Takashi	JICA Expert
33	Mr. Tomoyuki Yamada	Project Formulation Advisor, JICA Cambodia Office
34	Mr. Say Bora	Senior Program Officer, JICA Cambodia Office
35	Mr. Hirano Satoshi	JICA Project

36	Mr. Hayashi Takaaki	JICA Project
37	Mr. Hor Saray	JICA Project
38	Mr. Meng Kro	Project Coordinator, PEPC Project
39	Ms. Sophan Phaty	Project Coordinator, PEPC Project
40	Mr. Kakthan Sokhery	First Class/Interpreter

MINUTES OF THE FINAL JOINT COORDINATION COMMITTEE MEETING
ON
THE PROJECT FOR EFFECTIVE IMPLEMENTATION OF EIA AND
POLLUTION CONTROL THROUGH THE CAPACITY DEVELOPMENT OF MOE

The Final Joint Coordination Committee (JCC) of the Project for Effective Implementation of EIA and Pollution Control through the Capacity Development of MOE (the Project) was convened on 22nd November 2021 from 8:30 A.M. to 10:15 A.M. (Cambodia Standard Time). The meeting was held online[1] due to the COVID-19 pandemic.

The meeting was opened by the remarks of Ms. KAMEI Haruko Chief Representative, JICA Cambodia Office; and H.E Sao Sopheap, the Secretary of State, of the Ministry of Environment. The participants agreed to make these Minutes of Meeting in order to confirm the mutual understanding reached through the discussions during the meeting.

1 Ms. KAMEI Haruko expressed her appreciation to MOE and all the participants of the Final JCC meeting. She then underlined the challenges during the COVID-19 pandemic; and acknowledged the achievements of the Project, especially the formalization of the revised Sub-decree on Water Pollution Control, in spite of the difficulties caused by the pandemic. She further emphasized the needs of official utilization of the project outcomes such as guidelines and manuals. She marked that the completion of the project is another beginning of a long journey for MOE to tackle the environmental issues. In conclusion, she encouraged active participation in reviewing the achievement, identifying current, future challenges, and strategic solutions.

2 H.E. Sao Sopheap warmly welcomed all participants of the Final JCC meeting. He briefly reviewed the project achievement by citing the followings: GDEP and the JICA team 1) revised the Sub-Decree No.27 on Water Pollution Control, 2) developed EIA Sectoral Guideline on Road, Railway, Heavy Industry and SEZ, Guideline on Wastewater Treatment Process and Facility, Inspection Manual, and Groundwater Protection, 4) provided a series of trainings to GDEP officials on EIA and Pollution Control and 5) conducted study tours in Thailand and Vietnam to understand environmental pollution management. He suggested the technical officer of GDEP and the relevant Ministries to continue the review of the guidelines and other deliverables in order to ensure the project effectiveness.

<u>Presentation on the Project Completion Report</u>

3 On behalf of the Project Team, Mr. Yasuhiko Muramatsu, the leader of the JICA Project Team, gave a presentation on the Completion Report. The salient points of the presentation are as follows:

3.1 He initially reviewed the project activities by projecting some snapshots taken during the activities.

3.2 He then moved to the presentation on the project's achievements. With a brief review of the

[1] The meeting was technically co-hosted by First-Class Solutions Ltd.

Project Design Matrix, he presented the outputs and deliverables in water pollution sub-sector. He emphasized that the members of the Task Force prepared three (3) Policy Discussion Papers accompanied by some Support Documents, which constitutes the fundamentals in water pollution control in Cambodia. For the EIA sub-sector, he reviewed the background with emphasis on the social changes took place since 2005 to rationalize the preparation of the EIA review manual and relevant sector guidelines. He further reminded development of a Pollution Source Inventory and a field work on water quality monitoring as part of activity for generating Output 3. He then reaffirmed that the members of the Task Force actively engaged in the decision-making process in preparing the relevant documents, which has ensured development of capacity of GDEP.

3.3 He proceeded to the presentation and discussion on the achievement of project purpose. He informed that a questionnaire survey by using a five-rating scale was conducted to assess the improvement of confidence on GDEP's service. He discussed that the survey found that 1) six (6) out of mine (9) respondents evaluated that the improvement was observed from the level 4 to level 5; and the rest (3) responded to have observed the changes from level 3 to 4, which has thus found that the overall evaluation of each respondent reached 20% improvement in the perception of the service quality by GDEP. In addition to the achievement of the numerical target, he noted that important suggestions and recommendation were gained: 1) Some respondents recognized that the coordination among institutions were strengthened as a result of the project. However, it was further encouraged to improve the institutional capacity with enhanced participation of the private sector; 2) An emphasis is also given to provincial level to support monitoring process and actions for water pollution control.

3.4 In his presentation on key issues and lessons learned, he discussed 4 major issues among fifteen (15) in total as reported in the report. He emphasized the importance on 1) inter-agency coordination among the relevant ministries by recalling the significant benefit generated by developing the pollution source inventory with the participation of MISTI and PPWSA; 2) an open, inclusive and constructive dialogue in a continuous manner to develop a common ground on how governments, industry, and civil society can work together in pollution control, among others.

3.5 In the last section of his presentation, he discussed the following key recommendations for achieving the overall goal.

(1) Apply the sub-decree, the guidelines and manuals in the daily business of GDEP.

(2) Maintain and strengthen the links with other government agencies developed through the implementation of the project especially with MISTI and PPWSA for maintenance and update of the pollution source inventory.

(3) Promote dissemination of the sub-decree, the guideline and manuals to the provincial departments and the general public.

(4) Support the provincial departments in implementing the activities on water pollution and assessment of environmental impact with due consideration on the lessons learned.

(5) Pursue a constructive relationship with private sector by providing the information on its policy to support their decision on environmental investment.

(6) Encourage the officers to continue self-development process especially the younger officers. It is also recommended for those of DEIA that a periodical training should be organized on EIA-Sector Guidelines and EIA-Review Manual.

(7) Resume the activities to finalize or modify as necessary the ENR Code to streamline all the activities related to the management of environment and natural resources thus to contribute to improving efficiency and efficacy.

Open Forum 1

4 The meeting proceeded to an open forum on the presentation on the project.

4.1 H.E. Pich Veasna, Under Secretary of State of the Ministry of Water Resource and Meteorology recognized that any guidelines on reservoir and irrigation system was not prepared in this project; and asked the reason of not developing such guidelines.

4.2 Mr. Muramatsu emphasized that the sectoral guidelines on water resource development is also important, but he mentioned that there was resource limitation of the project which necessitated prioritization to the sectors selected by the Department of Environmental Impact Assessment (DEIA).

4.3 Mr. Danh Serey, Director Department of EIA reacted to the question raised by H.E. Pich Veasna. He informed that the EIA Department screened key sectors in collaboration with the JICA team to prioritize sectors with due consideration on the economic development. He then discussed that DEIA developed the guideline on industry both heavy industry and SEZ accordingly. He emphasized that the past experience in settling issues in SEZ development; and rationalized the prioritization of the sectoral guideline on SEZ. He also noted that heavy industry such as steel factories and many other heavy industries have more impacts on physical and biological resource as well as public health.

4.4 For sectoral guideline on road and railway, DEIA was also aware that JICA has good experience on road and railway infrastructure and thus had strong confident with Japan on road and railway infrastructure. We requested the JICA team to produce 10 sectoral guidelines, but the JICA team helped develop 4 sectoral guidelines to maximize the project benefit under the given constraints.

4.5 DEIA observed that the officers need to spent almost equal level of work load for EIA and IEIA reports. Then, DEIA developed a checklist for IEIA report to improve work procedure and save time. The checklists were those related to the small-medium enterprise (SME), all building project, animal raising and aquaculture, fuel/gasoline station, and ecotourism. Our officers got knowledge from the JICA team and the officers could develop the checklists for IEIA report.

4.6 DEIA will check again the sectoral guideline on road and railway (IEIA) developed by the JICA team. We can modify the sectoral guideline on road and railway (IEIA) to make the

checklist improved. For full EIA guidelines, he mentioned that they do not have any issues. He noted that DEIA will keep all full EIA guidelines. DoEIA thanks the JICA team which helped enhancing the capacity of the DEIA official to know more about EIA.

4.7 Mr. Danh Serey further suggested 1) need for development of other sector guidelines noting that the JICA team assisted the development of 4 sector guidelines among 170 sectors; 2) material and equipment for implementation of the project, 3) dissemination of the documents to investors, EIA consultant company and involved stakeholders, and 4) provision of trainings to DEIA official about 3 or 6 months in Japan to study related to EIA.

4.8 Mr. Mak Soeun, Ministry of Agriculture Forestry and Fisheries, recalled that the MAFF is pursing the strategy on safe agricultural products and Good Agricultural Practice (GAP) to enhance export farm products to EU. He then requested development of guidelines on such aspects. He agreed with the report. He suggested two things to GDEP and the JICA team to 1) share the approved sectoral guidelines to Ministry of Agriculture Forestry and Fisheries, and 2) help to consider about the sectoral guideline on agricultural activities and land use.

4.9 H.E. Sao Sopheap, Ministry of Environment, informed that MOE would share all the guidelines to the involved ministries and stakeholders; and MoE has concerned about using chemical fertilizer and pesticide for farming as well.

4.10 Mr. Muramatsu reminded the participants about the importance of inter-agency collaboration; and encouraged to have coordination with General Directorate of Agriculture on the matters related to GAP promotion and safe use of chemicals in agriculture.

<u>Presentation on the Recent Progress and Future Plans</u>

5 Mr. Mr. Phin Rady, Director Department of Water Quality Management, gave a presentation the Recent Progress and Future Plans.

5.1 He began with a brief project overview from the viewpoint of GDEP. He highlighted the amendment of Sub-Decree No.27 on "Water Pollution Control" as one key output of the project. He then recalled that an online meeting with the Council of Ministers as part of its legislative procedure was an important milestone of the project.

5.2 He discussed and identified one (1) manual and four (4) guidelines in the EIA sub-sector and eleven (11) guidelines in the water sub-sector. He noted that further improvement and customization is necessary for the sector guidelines on wastewater treatment facility.

5.3 He further discussed the training components comprising more than 30 courses on environmental management for enhancement of skill and knowledge. He reaffirmed that the training in Thailand and Vietnam provided opportunities to many of GDEP officers to acquire knowledge on environmental control in neighbouring counties; the training in Japan, however, was replaced with a handover of a sampling devise and a current meter essential for surface water quality nonrioting.

5.4 He then proceeded to the actions of GDEP to achieve and sustain the overall goals. He

expounded that GDEP planned some activities as follows:

(1) Finalize the Environmental Code and other legislations related environmental protection
(2) Strengthening cooperation with concerned institutions, civil societies and private sectors to identify barriers/gaps and solution regarding the pollution prevention related issues
(3) Strengthening the cooperation with development partners/donors to ensure sustainable project implementation after the project completion,
(4) Development and implementation of policy, and legal instrument to minimize/prevent pollution in the Kingdom of Cambodia, to sustainable development and investment,
(5) Strengthening of EIA process and reviewing to make sure the approved projects are sustainable and not harm to environment
(6) Young officials are invite/encourage to participate in the training program, seminar, workshop, meeting for their capacity improvement.
(7) Dissemination policies, legislation, guideline and related legal instrument to concerned stakeholders, private sectors and local authorities enable them to understand clearly on the ways forward they need to be obligated and complied,
(8) Public and private sectors can access to all data and information that GDEP have been conducted
(9) Pollution sources with GIS database will be maintenance for UpToDate data information; which is the important tools for pollution control and inspection,
(10) Conduct training to the official of GDEP, concerned stakeholders, private sectors and local authorities on pollution control and inspection to ensure their capacity are UpToDate for catching up the development situation in the countries and globally.

5.5 His presentation then proceeded to the proposal of the Phase 2 with recognition of the enormous challenges ahead. He prioritized the following three major issues to be addressed in the project. Additionally, he emphasized two key aspects of the project: Training to promote the implementation of Sub-Decree 103 (amended from Sub-Decree 27) to sub-national level and promote public awareness; and the study area to include to Stueng Prek Tnoat of Kampong Spue and Coastal Provinces (Sihanouk Ville, Kampot etc.).

(1) Limited Capacity for effective implementation of the Sub-Decree on Water Pollution Control: May not efficiently implemented without supplementary policy/guideline and/or collaboration of inter-departments.
(2) Limited Accuracy and reliability of Environmental Laboratory Testing Results: Lacking of technical and management procedure which lead to weakness of laboratory performance.
(3) Limited support instruments to enable implementation of GDEP Policies: May need to improve access to private sector, management of household wastewater, and include wider sources of pollution (e.g air, solid waste pollution etc.).

5.6 He concluded his presentation by recalling the challenges in translating and interpreting the

documents from English to Khmer and from Khmer to English to elaborate and enrich the deliverables, which has unexpectedly taken time than GDEP initially expected.

6 After the presentation, H.E. Chea Sina, Director General of GDEP highly appreciated the result of project Phase I, and the capacity development of GDEP official, taskforce activities on EIA, revision of sub-decree No.27 on Water Pollution Control and Guideline on Wastewater Treatment Process and Facility, Inspection Manual and Groundwater Protection. He then acknowledged that these documents were important to protect the environmental pollution. He then reassured that GDEP will share all the documents to the relevant Ministries and stakeholders in order to implement them for environmental protection after finishing all guidelines. He agreed with the recommendation by Mr. Muramatsu that continuing capacity development of sub-national administration, especially Provincial Department of Environment and Involved Department as well and capacity development of young officer are important because they will continue their work on environmental protection more effective in the future. Finally, he suggested Ms. KAMEI Haruko, Chief Representative, JICA Cambodia Office to review and coordinate for the JICA project phase II which would contribute to protecting and preventing environmental pollution. He noted that the project will help Cambodia in achieving the Sustainable Development Goals.

7 H.E. Sao Sopheap, Secretary of State, requested Ms. KAMEI Haruko to give a remark.

8 In response, Ms. Ms. KAMEI Haruko gave a brief remark, in which she appreciated all the participants in the discussion by providing suggestions and recommendations for further actions. Then she expounded the consultation process in the Japanese Government of the proposed project Phase II; and affirmed the awareness of the issues in other ministries. She concluded with the special thanks to H.E. Sao Sopheap for his leadership and engagement in the implementation of the project; and congratulated again the successful completion of the of the project.

9 H.E. Sao Sopheap expressed sincere thanks to Ms. KAMEI Haruko for bringing the MoE's suggestion to JICA Headquarter for implementation of project phase II. He reemphasized that, despite the full impact of COVID-19 pandemic, MOE implemented the project as planned and got a fruitful achievement. He then reiterated that the revision of the Sub-decree on Water Pollution Control was approved by Royal Government of Cambodia in June 2021 and Sectoral Guidelines on EIA and Guideline on Water Pollution Control have been developed. He reaffirmed that MOE got the comments and recommendation from involved Ministries to add some EIA sectoral guidelines such as agriculture, irrigation system…etc to ensure the environmental protection. He suggested JICA to continue the capacity development of MoE officials and dissemination of the legal documents to public for effective implementation.

Annex 1: List of participants in the Fifth JCC meeting

Phnom Penh, Cambodia, 22nd November 2021

Ms. KAMEI Haruko
Chief Representative
JICA Cambodia Office

H.E. Sao Sopheap,
Secretary of State,
Ministry of Environment

Mr. Yasuhiko Muramatsu
JICA Project Team Leader

Annex 1: List of participants in the Final JCC Meeting

No	Name	Institution
1	H.E. Sao Sopheap	Secretary of State of the Ministry of Environment
2	H.E. Heng Nareth	Under Secretary of State of the Ministry of Environment
3	H.E. Pich Veasna	Under Secretary of State of Ministry of Water Resource and Meteorology
4	H.E. Chea Sina	Director General, General Directorate of Environmental Protection
5	H.E. Kim Nong	Director General, General Directorate of Natural Conservation and Administrative Protection
6	H.E. Chea Chan Thou	GS-NCSD, MoE
7	Mr. Uy Kamal	GDEKI, MOE
8	Mr. Pak Sokharavuth	Deputy Director General of GDEP, MoE
9	Mr. Thiv Sophearith	Deputy Director General of GDEP, MoE
10	Mr. Srey Sunleang	The Ministry of Environment
11	Mr. Ngourn Sep	The Ministry of Environment
12	Mr. Touch Vina	The Ministry of Environment
13	H.E. Chhim Sokun	Deputy Director General of Ministry of Land Management, Urban Planning and Construction
14	H.E Seng Sochinda	Director Department, The Council for the Development of Cambodia
15	Mr. Bou Chan Serey	Deputy Director General of Ministry of Tourism
16	Mr. Song Sophal	Deputy Director General of Ministry of Rural Development
17	Mr. Touch Chan Kresna	Deputy Director General of Ministry of Economy and Finance
18	Mr. Kong Sitha	Deputy Director General of Ministry of Mines and Energy
19	Mr. Mak Soeun	Deputy Director General of Ministry of Agriculture Forestry and Fisheries
20	Mr. Heng Eang	GD/IND-MISTI
21	Mr. Phin Rady	Director Department of Water Qualtiy Management, MoE
22	Mr. Sarun Sambo	Director Department of Inspection and Law Enforcement, MoE
23	Mr. Phin Narong	Director Department of Administration Planning and Finance,MoE
24	Mr. Chea Nara	Director Department of Air Quality and Noise Management, MoE
25	Mr. Danh Serey	Director Department of Environmental Impact Assessment, MoE
26	Mr. Dy Kiden	Director Department of Solid Waste Management, MoE
27	Mr. Sophal Laska	Director Department of Hazardous Substance Management, MoE
28	Mr. Chhek Roth	Director of Laboratory, MoE
29	Mr. Tea Thyro	Deputy Director Department, GDEP
30	Mr. Ou Kongphal	Deputy Director Department, GDEP
31	Mr. Leng Kimsrong	Deputy Director Department, GDEP
32	Ms. Thlork Serey Pagna	Deputy Director, Laboratory, GDEP
33	Mr. Chea Leng	Deputy Director Department, GDEP
34	Mr. Kun Ty	Chief Officer, Department of Water Quality Management, MoE
35	Mr. Vorng Say	Chief Officer, Department of Water Quality Management, MoE
36	Mr. Sim Vichet	Chief Officer, Department of Hazardous Substance Management, MoE
37	Mr. Dork Hakk	Vice-Chief Officer, Department of Water Quality Management, MoE
38	Mr. Aing Haypheng	Vice-Chief Officer, Department of Laboratory, MoE
39	Mr. Phoeuk Sophorn	Officer, Department of Water Quality Management, MoE
40	Ms. Nai Rathana	Officer, Department of Water Quality Management, MoE
41	Ms. KAMEI Haruko	JICA Cambodia Office, Chief Representative
42	Ms. TOKUMOT Aya	JICA Cambodia Office
43	Mr. SHIMODAIRA Takayuki	JICA Cambodia Office
44	Mr. Say Bora	Senior Program Officer, JICA Cambodia Office
45	Mr. Muramatsu Yasuhiko	Team Leader of JICA Project
46	Mr. Yamashita Akira	Deputy Team Leader of JICA Project
47	Mr. Hatano Takayuki	JICA Expert
48	Mr. Watanabe Taisuke	JICA Expert
49	Mr. Chiba Masatoshi	JICA Expert
50	Mr. Meng Kro	Project Coordinator, PEPC Project
51	Mr. Kakthan Sokheng	First Class/Interpreter
52	Ms. Vat Seangly	First Class/Zoom Hosting

Annex 26 TOR and Task Force members

Task Force on EIA
Proposed TOR, Membership and Operation

Terms of Reference

To implement the project activities related to EIA including the followings, but not limited to:

1. Review and discuss the proposed Environmental Code to ensure guidelines and manuals on EIA developed under the Project is consistent with the pertinent provisions of the Environmental Code;
2. Advise and propose measures as necessary on the matters arising from the review of the Environmental Code;
3. Review and identify major challenges in the safeguard mechanism;
4. Prepare necessary guidelines and manuals related to EIA;
5. Collect, assemble, evaluate and analyze relevant data necessary for the above;
6. Build consensus among the stakeholders for contents of the proposed pertinent guidelines and manuals;
7. Provide guidance for training program in area of EIA, and coordinate when necessary for implementation of the training program; and
8. Deliver actionable recommendations by the end of their mandate.

The Task Forces run for a limited period of time, with a maximum of 30 months until the end of 2019.

Proposed members

The Task Force is constituted as follows:

1	Deputy Director General of GDEP	Chair
2	Director of EIA Department	Deputy Chair (Secretariat)
3	Deputy director of EIA Department	Deputy Chair
4	Representative from MIH	Member
5	Representative from CDC	Member
6	Staff of EIA Department	Member
7	JICA expert	Adviser

- ✓ The Chair oversees its activities and makes sure the recommendations are delivered, actionable, reviewed, approved and implemented.
- ✓ Other members may be invited as needed depending on the issues deliberated.
- ✓ The Tasks Force may establish and delegate responsibilities to working groups or sub-Task Forces on specific issues.

Operation

The Task Forces accomplish most of their work either through physical meetings or virtually. In between physical meetings, it is recommended to use SNS as a closed discussion group or any other appropriate means to facilitate the deliberation. When the chairman is not able to attend a meeting physically, his delegate(s) shall report to him orally and/or in a written form to keep him informed on important issues.

Task Force on Water Environment
Proposed TOR, Membership and Operation

Terms of Reference

To implement the project activities related to water environment including the followings, but not limited to:

9. Design and develop new sub-decree or amend existing sub-decrees in the areas of industrial wastewater control;

10. Prepare necessary guidelines and manuals related to industrial wastewater control;

11. Collect, assemble, evaluate and analyze relevant data necessary for the above;

12. Build consensus among the stakeholders for contents of the proposed new sub-decree or amendment, guidelines and manuals;

13. Provide guidance for training program in area of water environment, and coordinate when necessary for implementation of the training program; and

14. Deliver actionable recommendations by the end of their mandate.

The Task Forces run for a limited period of time, with a maximum of 30 months until the end of 2019.

Proposed members

The Task Force is constituted as follows:

1	Deputy Director General of GDEP	Chair
2	Director of water quality management	Deputy Chair (Secretariat)
3	Director of inspection and law enforcement	Deputy Chair
4	Deputy director of EIA	Member
5	Staff of water quality management	Member
6	Staff of inspection and law enforcement	Member
7	JICA expert	Adviser

- ✓ The Chair oversees its activities and makes sure the recommendations are delivered, actionable, reviewed, approved and implemented.

- ✓ Other members may be invited as needed depending on the issues deliberated.

- ✓ The Tasks Force may establish and delegate responsibilities to working groups or sub-Task Forces on specific issues.

Operation

The Task Forces accomplish most of their work either through physical meetings or virtually. In between physical meetings, it is recommended to use SNS as a closed discussion group or any other appropriate means to facilitate the deliberation. When the chairman is not able to attend a meeting physically, his delegate(s) shall report to him orally and/or in a written form to keep him informed on important issues.

Annex 27 Record of the meetings on Water Pollution Task Force

1st Task-Force Meeting on Water Pollution Control

MEETING MEMO

Date & Time:	Date: 02 October 2017 Time: 14:30-16:00 PM
Place	Kreal Meeting Room, 1st floor of Ministry of Environment
Attendees:	1. Mr. CHEA Sina, Deputy Director General, GDEP 2. Mr. PHIN Rady, Director of Department of Water Quality Management 3. Mr. SARUN Sambo, Director of Department of Inspection and Law Enforcement 4. Mr. CHEA Leng, Deputy Director of Department of EIA 5. Mr. SIV Kung, Deputy Director of Department of Laboratory
Project Team:	1. Mr. MURAMATSU Yasuhiko, Team Leader of JICA 2. Mr. FUKUDA Munehiro, JICA Expert 3. Mr. EGAWA Zenjiro, JICA Expert 4. Mr. MENG Kro, Project Coordinator, PEPC
Agenda / Discussion Points:	1. Confirmation of Task Force ToR 2. Review of legal document on water quality control 3. Selection of target area in water field for JICA project work 4. Review of the preliminary work before official set up of task force 5. Work schedule of 2017-2018

The meeting was started by the chair of Mr. Chea Sina

1. TOR of the task force was reviewed and all participants agreed (Document #1).
2. Review of legal document was explained by JICA expert MF as per attached paper (Document #2). Review work was agreed by all participants.
3. All participants agreed that JICA work shall be in "Revision of Water Quality Control sub-decree 1999" focusing on industrial wastewater management.

3.1. Then Mr. Munehiro Fukuda proposed the document to be prepared under the JICA project (Document #2). Mr. Chea Sina proposed to add following points into the revision and document to be prepared. 1) Some guideline is needed in case of central wastewater treatment system was developed such as sewage system or at SEZ central system. 2) Fine for the pollution violation shall be reviewed to increase the burden of violator in such a way that fine can be cumulated by number of violation days. Mr. Munehiro Fukuda replied to the point 1), that in Japan and other countries, effluent standard to sewage system or the central wastewater treatment system is set by the treatment system operators such as local municipalities or SEZ Industrial Estate operator. This is due to the fact that the design and the performance requirement of treatment system are varied depending on local condition. Therefore, Ministry of Environment will not set the nationwide standard. Mr. Chea Sina agreed the principle, however currently no operator is capable of developing such standard and thus Ministry need to provide technical support. Mr. Munehiro Fukuda replied proposed "Wastewater treatment facility guideline" may be able to contain some section regarding treatable/non treatable pollutants in different treatment system. YM noted that

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the expert of wastewater treatment shall review the possibility, but at this stage JICA team can not commit for this matter. Mr. Yasuhiko Muramatsu and Mr. Munehiro Fukuda agreed to consider the point 2).

4. Work done so far was summarized as per attached papers (Document #3, 4, 5). All participants agreed and approved the work as official activities.

4.1. Mr. Chea Sina suggested having consultation meeting with GMAC (Garment Manufacturers Association in Cambodia). All participants agreed the suggestion.

5. Work plan till next June was discussed and all participants agreed in principle.

5.1. The 2nd consultation meeting in December shall be before December 8th, otherwise all become busy for end of the year period.

5.2. To make consultation more effective, Khmer document shall be prepared.

5.3. In the course of revision work, input to policy maker is necessary for the smooth approval of the work. Reporting the progress at Joint Coordination Meeting can be considered.

-The End-

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THE 2nd TASK FORCE MEETING MEMO

Date & Time:	Date: 24 October 2017 Time: 08:30-10:30 AM
Place	Department of Water Quality Management, 1st floor, Ministry of Environment
Attendees:	Mr. CHEA Sina, Deputy Director General of GDEP Mr. PHIN Rady, Director of Water Quality Management Department Mr. SARUN Sambo, Director of Inspection and Law Enforcement Department Mr. CHAP Yuthy, Deputy Director of Inspection and Law Enforcement Dept. Mr. SIV Kung, Deputy Director of Laboratory Department
Project Team:	Mr. MANUEL I. Gloria. JR, JICA Expert/Inspection Mr. Zenjiro EGAWA, JICA Expert Mr. Yusuke NAKAYAMA, JICA Expert Mr. Takayuki HATANO, JICA Expert Mr. MENG Kro, Project Coordinator, JICA
Agenda / Discussion Points:	1. Identification and confirmation of current decrees, sub-decrees, and procedures for Inspection and Sampling, including Enforcement 2. Clarification and confirmation of extent of authority and powers of MoE inspection groups 3. Observations on actual inspection 4. Initial Outline of Factory Inspection Manual for revision, and approval 5. Initial Outline of Wastewater Treatment Facility Guideline for discussion, revision, and approval 6. Procurement of equipment for GDEP 7. Confirmation of the schedule for 3rd Task force meeting

Key Points:

1. Mr. Manuel I. Gloria JR showed about the purpose of JICA team, planning to create the **Factory Inspection Manual and Wastewater Treatment Facility Guideline**.

1.1 He recommended that the Inspection team should be included technical staff from various departments in GDEP such as Department of Water Quality Management, Air Quality and Noise Management, Solid Waste Management, Hazardous Substance Management Department, especially Department of EIA due to EIA officers have to inspect the construction site before the project start and evaluate something.

1.2 Mr. Chea Sina agreed with Mr. Manuel I. Gloria JR. about creating the factory inspection manual and wastewater treatment facility guideline. Mr. Phin Raday mentioned that currently our inspection team have included various department in GDEP, but we do not include the department of EIA. Mr. Chea Sina added that we exclude the EIA department for inspection team because EIA Department just go to monitor the site and it is not inspection image.

1.3 Mr. Chea Sina suggested to add more in the wastewater guideline related to effluent standard of wastewater discharge from factory. Sub-degree on water pollution control should add the restriction of principle polluter by sharing resources with government when wastewater overload discharged into sewage system.

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1.4 Should sub-decree on Water Pollution Control include primary discharge? Industry estate should create their own guideline of primary wastewater discharge (please consider).

2. Mostly in Southeast Asia focus on **big factory discharge of wastewater**, but Cambodia has small and medium scale of enterprise/factory. Some factories are small, but discharge more toxic due to the chemical substances of raw materials. According to your experiences, how can you categorize about small/medium and large scale of factory? (Said by Mr. Chea Sina). Please consider about this and develop it in factory manual or guideline.

3. **Monitoring pollution sources:** related to wastewater sampling, some factories have 2-3 outlet and sometime have underground discharge. Inspectors are difficult to inspect wastewater discharged from factory. In the factory manual should mention about how to inspect effectively related to above problem.

4. **Requirement sample:** currently Cambodia has many private laboratories. Mr. Chea Sina said in Sigapore follow the USEPA standard. Hence, all laboratories have the same guideline or manual. We should consider about this. Mani mentioned MoE should develop the guideline for factory and also for private laboratory.

5. **Case of complaint:** how can we show the trust to the factory about wastewater sample? some complaints from factory because factory does believe the result. They consider that MoE change the result and then provide punishment.

5.1 Mr. Chea Sina mentioned that in Cambodia, Inspectors have no auto right, if we stop the factory, people may have the demonstration. Mr. Mani added that we could not stop the factory, but we put the fine for the day by day if the factory overload discharged of wastewater.

6. Mr. Mani showed that the inspection should have 3 to 4 people in group such as one for moderator with factory owner by asking some questions/information, one for inspection/taking wastewater sample, and one more for taking photo.

6.1 The problem of inspectors works many purpose. For example, their boss assign to work another work. Therefore, it will effect on inspection work. Therefore, the inspection team should arrange the schedule very well before going to inspect at factory.

7. Mr. Egawa confirmed about the equipment with the team. Please make sure with department of Laboratory related to some equipment and Mr. Egawa can go with Mr. Kro to discuss more detail about the equipment.

8. Mr. Chea Sina stated that in order to be easy for work, JICA team can contact as following:
   - Related to Lab, contact to Mr. Siv Kung
   - Related to Water Quality Management, contact to Mr. Phin Rady
   - Related to Inspection, contact to Mr. Sarun Sambo
   - Mr. Chea Sina, his room is next to JICA room

9. The 3rd task force meeting will invite MIH and CDD to join and the 2nd consultation meeting will invite CCC and GMAC and one more consultation meeting will conduct with Institutes of Technology of Cambodia (ITC)

   9.1 The 3rd Task Force Meeting confirm to help on **29 November 2017**

   9.2 The consultation meeting for both will discuss later between JICA and team on Date and Time.

- The End -

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THE 3rd TASK FORCE MEETING MEMO on WPC

Date & Time:	Date: 29 November 2017, Time: 08:30-11:00 AM
Place	Mok Mareth Meeting Room, 5st floor, Ministry of Environment
Attendees:	H.E HENG Nareth, Director General of GDEP Mr. CHEA Sina, Deputy Director General of GDEP Mr. PHIN Rady, Director of Water Quality Management Department Mr. SARUN Sambo, Director of Inspection and Law Enforcement Department Mr. CHONG BOU, Deputy Director, Department of Technique Science and Technology, Ministry of Industry and Handicraft Mr. HIM Chandath, Deputy Director of Water Quality Management Dept. Mr. CHAP Yuthy, Deputy Director of Inspection and Law Enforcement Dept. Mr. NGOUN Kimtry, Chief Office of Laboratory Department Mr. UN Bunhoeurn, Officer of Council for the Development of Cambodia (CDC)
Project Team:	Mr. Munehiro FUKUDA, JICA Expert Mr. MENG Kro, Project Coordinator, JICA
Agenda / Discussion Points:	1. Review/confirmation of previous work on revision of Water Quality Control Sub-decree 2. Collaborate between MIH/CDC/MoE for effective enforcement 2.1 Information sharing 2.2 Coordination penalty 3. Policy Discussion Paper#2 3.1 General/Overall issues 3.2 Support Document#1-1 Revision of target facilities/business Annex 3 3.3 Support Document#2 Removal of prohibited substances from standard 3.4 Support Document#3 Clarification of Method of analysis 3.5 Support Document#4 Addition of groundwater protection 4. The 2nd Consultation meeting with stakeholders (CCC, GMAC, and ITC)

Key Points:

1 **Review/confirmation of previous work on revision of Water Quality Control Sub-decree**

1.1 Mr. Fukuda has introduced about the project for effective implementation of EIA and Pollution Control through the Capacity Development of MoE. The project supported by JICA cooperated with General Directorate of Environmental Protection, Ministry of Environment. He showed about the output of the project 1) legal documents related to EIA and pollution control focusing on wastewater, 2) Technical issues and procedure related to EIA and pollution control shared with GDEP staff and other stakeholder, 3) capacity development the related departments.

2 Collaborate between MIH/CDC/MoE for effective enforcement

2.1 Two taskforce groups have been set up under this project. One is TF on Water Pollution Control and another one is TF-EIA. The group has a meeting every month related to current law, sub-decree and regulation related to water pollution control and also EIA guideline. We would like to inform our project activities to participants from MoIH and CDC as they are the first time in task force meeting.

2.2 After Mr. Fukuda presented about the project achievement within few months of implementation, Mr. Chong Bou, representative from MoIH suggested that JICA Experts with MoE staff should review the

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law and prakas issued by MoIH which those law and prakas have mentioned about environment and wastewater management.

2.3 H.E Heng Nareth briefly about the JICA project cooperate with MoE to all participants especially representative from MoIH and CDC. The project has been started the implementation in July 2017. The project has two task force groups as TF-EIA and TF-WPC. The purpose of 3rd TF-WPC is to review the sub-decree No. 27 on Water Pollution Control. If it has many changes, we will create a new one for sub-decree on Water Pollution Control. JICA has revived some annex in sub-decree and plan to add three things 1) Wastewater Treatment Facility Guidelines, 2) Factory Inspection Manual, and 3) considering about groundwater due to the rapid industrial development in Cambodia. We have a meeting today for getting opinion and idea from stakeholder ministries and agencies for effective work implementation and to avoid the duplicated work with stakeholder ministries.

2.4 Mr. Phin Rady suggested to MoIH and CDC that we can share the information each other related to water environmental and other fields for effective implementation. Sharing information is important.

2.5 Mr. Chong Bou has responded for the information sharing that MoE can contact to the top management of MoIH for information that MoE want and the purpose. He thinks that it is not a problem with sharing information. MoIH also issued some information in the ministry website.

2.6 MoIH also has problems with industry establishment registration data because current work has separated from centralize to decentralize system. Factories and enterprise at province will be registered by provincial department of industry and handicraft. Therefore, MoIH could not control all area. Some data are missed as well. MoIH just collected the data from provincial and municipal department and also collect it from CDC. MoIH has a department to manage all the data.

2.7 Mr. Fukuda asked for the industry establishment registration data from MoIH and also the Format of Application Form for Establishment Factory. He is not sure that they will transfer all pile of documents to computer or not and some factories or enterprises did not register, the solution is that the top management should have agreed on JCC meeting about the problem and have to set up the data format in computer. JICA has proposal for sub-contract with company for entering data from documents to computer program. It is easy to manage and analyses the data for basic use.

2.8 Mr. Chong Bou agree to send the Format of Application Form for Establishment Factory to JICA expert and if they need for more information, they can contact him via email or Telegram.

2.9 JICA expert team should create network with MoIH and CDC for sharing information, H.E Heng Nareth said.

3 Policy Discussion Paper#2

3.1 H. E Heng Nareth agreed with the issues that JICA experts has found in the current sub-decree and also agreed with the work procedure that JICA plan to do such as CAS no., ISIC code Rev.4, IPPS system, wastewater treatment facility guidelines, factory inspection manual and groundwater management. Everything follow the international standard and clear. It is acceptable.

3.2 Mr. Sarun Sambo raised the problem with inspection because some factories and enterprises do not have sign. Therefore, it is difficult for inspection team and they do not cooperate with MoE.

3.3 As MoIH guideline all factories and enterprises have to put the sign in front of their facility, but we still have problem with this issue because some enterprises show that they just test their production system for small scale without sign. Some enterprises extend to operate up to 2 or 3 years without sign.

3.4 In the scope showed that Industrial means that business activities which is separated from domestic or household. How about small scale of enterprises? Do they need to create a wastewater treatment

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plant? and how about the medium scale of factory that do not have much toxic pollutant also need it?

3.5 The project will investigate on the volume of the wastewater discharged from factory. Under the tentative idea, If the factories/enterprises discharge less than 1 ton/day, we will not consider about wastewater treatment plant. He also showed the support document #3 Revision of Pollution Sources showed about the toxic factory categories and the threshold or minimum size of industry. We will use ISIC Code Rev.4 for studying the BOD loading compare with number of workers in the factories/enterprises, responded by Mr Fukuda.

3.6 Mr. Chea Sina mentioned that

Annex 1: Hazardous Substances. Cambodia was ratified by Basel convention. Basel convention will develop Cambodia hazardous substances. Annex 1 Should be removed. Hazardous mostly focus on solid substances.

Annex 2: Chemical substance banned by International Stockholm convention on Persistent Organic Pollutants (POPs). He agreed some effluent standard parameters should be removed from Annex 2. Import PCB statistic, it is amazing that in year 2008 and 2014, Cambodia has much amount of imported PCB. ADB and World Bank try to prohibit the PCB import. I can give you the paper of survey related to PCB using, said by Mr. Chea Sina. Moreover, He asked Mr. Fukuda for the source of VOC import to Cambodia. Mr. Fukuda mentioned the source from United Nations Comtrade Database-International Trade Statistic Import/Export https://comtrade.un.org/data

3.7 If we look only volume of wastewater discharged from factories, it is not enough because Cambodia has many small and medium scale of enterprises/factories. Some factories discharge small amount of wastewater, but contain more toxic due to the chemical substances of raw materials.

3.8 Mr. Fukuda stated that SME is difficult to control everywhere. In Japan, they try not only regulatory enforcement but also promotion of voluntary activities. Simplified EMS system such as Eco-action 21 and Green Industry in Thailand can be mixed in addition to enforcement to SMEs.

3.9 H.E Heng Nareth asked that VOCs effect on air or ground water? What type of equipment do we used to measure the TCE, PCE and DCM?

3.10 Mr. Fukuda replied that VOCs may affect both air quality and ground water, especially it stays long time in underground. GC-ECD can measure VOCs such as TCE, PCE and DCM, responded by Mr. Fukuda. Also there are more simple method. He will provide H.E Heng Nareth for more information related to the equipment.

3.11 For TOC application, If we measure BOD and COD, no need to measure TOC because they will all give measurement value for organic pollutants

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THE 4th TASK FORCE MEETING MEMO on WPC

Date & Time:	Date: 13 February 2018, Time: 08:30-11:00 AM
Place	Tradork Thom Meeting Room, 3rd floor, Ministry of Environment
Attendees:	H.E HENG Nareth, Director General of GDEP Mr. CHEA Sina, Deputy Director General of GDEP Mr. RATH Sith, Deputy Director General of GDEKP Mr. PHIN Rady, Director of Water Quality Management Department Mr. SARUN Sambo, Director of Inspection and Law Enforcement Department Mr. PROM Konteal, Deputy Director, Ministry of Water Resource and Meteorology Mr. OUCH Many, Director, Ministry of Industry and Handicraft Mr. SOK Chea, Deputy Director, Ministry of Industry and Handicraft Mr. SIV Kong, Deputy Director of Laboratory Department. Mr. SOK Oror, Deputy Director of EIA Department. Mr. KUN Ty, Chief Office of Water Quality Management Department Mr. SAY Bora, Program Officer, JICA Mr. MAO Vanchan, Vice Chief Office, Administration Department Mr. VORNG Say, Vice Chief Office, Water Quality Management Department Ms. HUOT Syradeth, Officer, Water Quality Management Department Mr. DORK Hakk, Officer, Water Quality Management Department
Project Team:	Mr. Munehiro FUKUDA, JICA Expert Mr. MENG Kro, Project Coordinator, PEPC
Agenda / Discussion Points:	1 Self-introduction of participants 2 Review of the previous activities of the Task Force 3 Explanation of proposed revision of WPC sub-decree (first draft) 3.1 Support Document #5 3.2 Support Document #6 3.3 Support Document #7 3.4 Support Document #8

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	3.5 Support Document #9 3.6 Current – Proposed revision of sub-decree 4 Schedule for development of final proposal for revision

Key Points:

1. Review of the previous activities of the Task Force

1.1 Mr. Fukuda has briefly introduced the project for effective implementation of EIA and Pollution Control through the Capacity Development of MoE. JICA team and GDEP has already discussed about Policy Discussion Paper#1 which Identified the Issues in current sub-decree, Policy Discussion Paper#2 which described approach and criteria for revision as well as the support document#1, 2, 3, and 4 during the 3rd Task Force Meeting on Water Pollution Control on 29 November 2017 at Ministry of Environment. Task Force meeting then will discuss the Policy Document Paper#3 which presents draft proposal for revision of Water Pollution Control Sub-Decree (for Industrial Wastewater Management) at the meeting today. Following papers will be also presented:

- Support Document#5: Review of effluent and environmental quality standard (Justification of Parameters)
- Support Document#6: Review of Environmental quality standard and effluent standard (concentration level)
- Support Document#7: Threshold water volume to define SMEs
- Support Document#8: Technical requirements for laboratory registration
- Support Document#9: Discussion on Charging fine on violation against sub-decree on WPC

Mr. Fukuda presented comparison of the current sub-decree on water pollution control and the new revision by article.

1.2 Summarize and suggestion from H.E Heng Nareth

- H.E Heng Nareth mentioned that some articles in sub-decree shall be revised by adding or changing some words. Some articles shall be deleted such as Article 9 on the discharge of sewage from dwelling and public buildings into public water areas with passing through public sewerage system or other treatment system. This article shall be deleted because Cambodian government recently has approved on the separate Sub-Decree No.235 on sewerage system and

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wastewater treatment system management. We shall add a new Article 19: *the owner or responsible person of pollution sources shall monitor the discharge or transport of effluent and shall record monitoring data including effluent concentration of the regulated parameters as well as discharge or transport volume and shall submit the record to the Ministry of Environment during inspection or whenever requested*. We will add this article because according to previous experience, when inspector inform the company before factory inspection, the factory operates the wastewater treatment plant during inspection, and after inspector is back to MoE, the factory stops operating wastewater treatment. Problems normally happen with people living around factory. MoE plans to establish the control center to connect all automatic monitoring data from factories. We will request big industries to equip automatic monitoring equipment but inexpensive CCTV for small industries. We shall have Prakas of pollution source definition and effluent standards for support some articles in Sub-decree on water pollution control because it is easy to revise and update as condition changes.

- H.E Heng Nareth suggested to representative from MIH to inform their management team and help to consider about this sub-decree revision and then send the comments or suggestions back to JICA team
- JICA team should create group for sending documents to MIH and other involved institutions so that they can review and comment the revision document.
- Effluent standard for temperature is currently set at not more than 45 ^{o}C. We should consider again for the industry such as coal power plants which discharges very large volume of hot wastewater to environment. It should have separate standard for those industries which discharges very large volume of wastewater, i.e., by setting the temperature not more than 35 ^{o}C.
- H.E suggested, after finalizing the sub-decree revision, to have a meeting between MoE and Standard Institution (Ministry of Industry and Handicraft) in order to review and approve the national standard.

1.3 Mr. Ouch Many, Director Department of Techniques, Science and Technology, Ministry of Industry and Handicraft mentioned that 1) he agreed with JICA experts to delete some chemical substances which were banned by international convention, 2) Effluent standard and environmental quality standard should follow to ASEAN Countries, especially neighboring countries, 3) Related to all standard should inform to Standard

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Institution at Ministry of Industry and Handicraft because MIH will create standard as the national standard of Cambodia.

1.4 Mr. Ouch Many also asked the deadline for review and comments from MIH. Mr. Fukuda mentioned that MIH could send back to **JICA team by the end of March 2018 by email**. In addition, he wants to invite JICA experts to have a meeting with management team at MIH for detail discussion about the revision. Mr. Fukuda agreed to have a meeting with MIH management team, but the date should be before 27 February 2018 because he will back to Japan on that day. MIH will arrange the meeting and inform to JICA expert later about the exact date.

- Mr. Sok Chea, Deputy Director of Department of Techniques, Science and Technology, Ministry of Industry and Handicraft mentioned that Article 8*: "The Ministry of Environment shall establish the guidelines for storage and handling of specific hazardous substances to prevent groundwater pollution".* MIH is working on technical guidelines for storage and handling of specific hazardous substances. MIH has also created handbooks for technical guidelines. MIH also trains private sector and share the information with related Ministries by workshops and seminars. MIH suggested MoE guideline and MIH guideline should be well coordinated.
- H.E Heng Nareth mentioned that If MIH doesn't mind, both ministries can cooperate work together for this technical guidelines. He also suggested to representative from MIH inform his suggestion to MIH management team.
- Mr. Fukuda stated that technical guideline focuses to only three chemical substances. They are Trichloroethylene (TCE), Perchloroethylene (PCE) and Dichloromethane (DCM) which often leaks from industrial site into the ground. They were the most popular chemical substances causing the groundwater pollution in Japan. The prevention is by keeping pipes and tanks above the ground, not underground, placing tray or sealing the concrete surface by impermeable/chemical resistance or metal around solvent handing location. If these chemical substances are already covered by MIH guideline, probably MoE does not need. MoE can use MIH guideline instead. If these substances are not yet included, MoE can make a simple guideline for this issue.
- Mr Fukuda has concerned about effluent standard. If we set as national standard by Standard

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Institution in Cambodia, it will become difficult to revise because the procedure is more than sub-decree revision. In Prakas, it is easy to revise, but if you put it into national standard, it will take long time to revise.

- H.E Heng Nareth stated that first JICA expert to finish the draft of sub-decree on water pollution control and then we will have a meeting with Standard Institute (MIH). If both sides agree with this standard, we will issue in the Prakas. Therefore, he suggested to have a meeting with Standard Institute.
- Mr. Fukuda announce that MoE will have the consultation meeting with private sector and academy as Cambodia Chamber of Commerce, Garment Manufacture Association of Cambodia (GMAC) and Institute of Technology of Cambodia (ITC) to get their comments and opinion about the revision.

1.6 Mr. Fukuda mentioned that MoE plan to finish the draft of sub-decree revision by June 2018.

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THE 5th TF-WPC MEETING MEMO

Date & Time:	Date: 19 October 2018, Time: 09:00 AM-12:00 PM
Place	Tradork Thom Meeting Room, 3rd floor, Ministry of Environment
Attendees:	Mr. CHEA Sina, Deputy Director General of GDEP Mr. PHIN Rady, Director of Water Quality Management Department Mr. Sarun Sambo, Director of Inspection and Law Enforcement Mr. Him Chandath, Deputy Director of Water Quality Management Department Mr. SIV Kung, Deputy Director of Laboratory Department of GDEP Mr. Kon Ty, Chief of Office, Water Quality Management Department Ms. HUOT Syradeth, Officer, Water Quality Management Department
Project Team:	Mr. Muramatsu Yasuhiko, JICA Expert Mr. Mani, JICA Expert Mr. MENG Kro, Project Coordinator, PEPC
Agenda / Discussion Points:	1. Review of the draft wastewater treatment facility (WTF) guideline 2. Revie of draft factory inspection manual 3. Training schedule of WTF guideline

Key Points:

1. Re: presentation slides are too small especially in handouts; use large, full scale slides
   a. Clarification: The comment on small slides was referring to small images on the slides / printout of slides of presentation used for the 5th TF-WPC meeting
   b. The slides in the presentation file proposed to be used for actual training seminar on Wastewater Treatment Processes and Facilities (WTP&F) guidelines will be larger or full size slides.
2. English language (used in WTP&F guidelines) is difficult to understand, made worse by technical nature of subject matter. About 1 week is needed for proper review.
   a. Upon finalization of the English version of the WTP&F guidelines, it will be translated to Khmer. Please refer to item 12 below

3. Clarify difference between “Training” and “Seminar”

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a. The operational term should be TRAINING. Training is teaching and/or imparting knowledge and skill to improve or enhance the capacities, capabilities, and performance of the trainees. The proposed training may be understood as consisting of two (2) parts: *seminars* and *workshops*
b. *Seminars* are essentially lectures designed to impart theoretical knowledge and skills without actual or hands-on application or practice. The proposed training to be conducted in November to December 2018 are strictly speaking, seminars.
c. *Workshops* present opportunities to apply the knowledge and practice the skills learned from the seminars, under the guidance of a trainer or resource person. The workshop portion of the training will consist of pilot testing of the WTP&F guidelines and the Inspection Manual / Guidelines under the guidance of resource persons. Pilot testing provides opportunities for direct interaction between the trainees and resource persons on actual and specific observations and experiences.

4. Three (3) levels of training - basic, advanced, more advanced – were cited in the original proposal. Clarify
   a. The first level (*basic*) of training on the WTP&F guidelines pertains to the morning sessions of the seminars to be conducted in November to December 2018 wherein the basic principles and theoretical aspects of wastewater treatment processes and facilities will be discussed.
   b. The second (*advanced*) level of training on the WTP&F guidelines pertains to the afternoon sessions of the seminars to be conducted in November to December 2018 wherein the specific wastewater characteristics and treatment processes and facilities used or applied by specific industry sectors will be discussed.
   c. The third (*more advanced*) level of training on the WTP&F guidelines pertains to the pilot testing (workshop) of the Factory Inspection Manual wherein there is actual opportunity to inspect and assess the specific wastewater treatment processes and facilities used or applied by specific industries or facilities. This will involve out-of-town visits to actual, operating large wastewater treatment facilities (WTF). To allow for travel time, this site visits will include overnight stay near the WTF sites.
5. Focus on Inspection

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a. The main focus of the WTP&F guidelines is indeed to assist and/or provide support for the inspection functions of GDEP.

6. Include private industries and (local) consultants or designers of wastewater treatment facilities or plants
   a. In addition to the officers and staff from pertinent departments (DILE, DEIA, DWQM, Laboratory, etc.) of GDEP, a seminar is proposed to be conducted in the first quarter of 2019 for participants from other relevant ministries such as Ministry of Industry and Handicrafts, Ministry of Commerce, and Private Industry, especially Small and Medium Enterprises (SMEs). Consultants and/or designers of wastewater treatment plants or facilities will also be invited.
7. Industry Sectors – The focus of the Cambodian government is on agro-industrial promotion and development
   a. The selection of industry sectors for the preparation of Industry Sector Specific Guidelines will prioritize on agro-industrial sectors.
8. Industry Sector Specific Guidelines
   a. Textile Industry – There are numerous textile mills in the country and they are major contributors to the Cambodian economy
      ✓ The Industrial Water Pollution Control Guidelines for the Textile Processing Industry Sector is retained.
   b. Poultry Dressing – The slaughtering and dressing of chickens are mostly done manually at market. There is no large mechanized poultry dressing plant.
      ✓ The Industrial Water Pollution Control Guidelines for the Poultry Dressing Industry is deleted.
   c. Slaughterhouse and meat packing – no data on number of slaughterhouses and meat packing plants
      ✓ The Industrial Water Pollution Control Guidelines for the Slaughterhouse and Meat Packing Industry Sector is provisionally retained until it can be ascertained if other industry sectors have higher priority.

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d. Proposed: Brewery (~ 4 large breweries)
   - ✓ No actual, first-hand data directly obtained from operating breweries is available. The decision to include the brewery sector is deferred until actual data is obtained.

e. Proposed: Sugar (cane?) mill
   - ✓ The JICA Expert on wastewater treatment has designed wastewater treatment facility for only one (1) sugar cane mill. The available data from this case is deemed insufficient for a comprehensive guideline for this industry sector.

f. Pharmaceuticals: The concern is related to the presence of antibiotics in rivers and other bodies of water (and perhaps, its potential effect on increasing antibiotic resistance of pathogens).
   - ✓ The JICA Expert on wastewater treatment has designed wastewater treatment facility for only four (4) pharmaceutical plants, only one of which packaged antibiotics among its product lines. The available data from this pharmaceutical plant is deemed insufficient for a comprehensive guideline for this industry sector.

9. Key Parameters for monitoring – specific for industry sector
   a. An important feature of the specific industry sector guidelines is the list of key (pollution) parameters of the industry sector. The WTP&F guidelines will also include in the appendix a table of key (pollution) parameters for selected industry sectors. The industry sectors to be selected for inclusion in this table will be based on the recommendations of the members of the TF-WPC.
10. BOD vs. COD – discussion on differences between Biochemical Oxygen Demand (BOD) and Chemical Oxygen Demand (COD)
   a. Significance, effect on environment – environmental management
      - ✓ The impact of oxygen demanding substances (present in the wastewater and measured as BOD and/or COD) on the receiving body of water is to decrease or deplete the dissolved oxygen in the water body. This deprives fishes and other aquatic animals of oxygen and may then cause fish kills.

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- ✓ My opinion and observation are that BOD correlates better and more directly with the amount of decrease in dissolved oxygen concentration compared to COD. In fact, the procedure for determining BOD concentration closely mimics (imitates) what happens in the water body when BOD is discharged into it.
- ✓ Thus, if the purpose of regulating the amount of oxygen demanding substances is to prevent depletion of dissolved oxygen in the water body (and consequent fish kills), BOD is a better parameter to use.
- ✓ Various types of industries generate wastewater with differing BOD: COD ratios and the BOD: COD ratio of a wastewater stream can also be different before and after treatment. Thus for the same effluent BOD concentration (and potentially, the same impact on oxygen depletion in the receiving body of water), the COD concentrations may be different for different sources (industry sectors). Determining the appropriate COD limit in the effluent standards would be problematic because a single effluent COD value will not have the same effect or impact if the treated effluent comes from different industries.

b. Clarify that BOD, COD not toxic per se (only indirectly harmful to the environment)
   - ✓ This will be emphasized in the revision of the WTP&F guidelines.

c. Ease of determination (BOD > 5 days; COD = 2 hours)
   - ✓ The determination of COD is much faster than that of the standard 5-day BOD. There are also instruments for online COD determination. These make COD a more convenient parameter to monitor and regulate.

d. International trend to favor the use of COD
   - ✓ Internationally, there is trend to favor the use of COD over (5-day) BOD. The decision to use COD as the main regulated parameter instead of BOD requires extensive deliberation and discussion.
   - ✓ Using COD as the primary regulated parameter will most likely require most factories to incur significant expenses to upgrade their wastewater treatment facilities to comply.

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11. Other comments on WTP&F guidelines:
    a. Nutrient removal processes (biological and chemical) will be included in the revision of the WTP&F guidelines.
    b. Appropriate design parameters will be included in the revision of the WTP&F guidelines as a guide to designers and/or consultants in their WTF design projects and to inspectors to allow rapid assessment of WTF performance during inspections.
12. Translation into Khmer of documents / handouts
    a. Deadline for receipt of comments, suggestions, and requests for revision on WTP&F guidelines – 26 October 2018
    b. Target completion of English version of WTP&F guidelines considering comments, suggestions, and requests for revision received by 26 October 2018 - 30 October 2018
    c. Period for translation of WTP&F guidelines from English to Khmer – 30 October – 19 November 2018
    d. Target distribution of Khmer version of WTP&F guidelines – from 19 November 2018 onwards.
13. Training Participants -We need to know how many participants will attend the training, in particular, the seminars in November – December 2018 in order to prepare the necessary resources. We intend to limit who may join the (out of town) site visits to actual wastewater treatment facilities only to those who have attended the initial 1-day seminars.
    a. Department of Water Quality Management - 15
    b. Department of Inspection and Law Enforcement - ??
    c. Department of Environmental Impact Assessment - ??
    d. Department of Laboratory - ??
    e. Department of Hazardous Substance Management - ??

-The End-

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THE 6th TF-WPC MEETING MEMO

Date & Time:	Date: 04 March 2019, Time: 09:00 AM-12:00 PM
Place	Cambodian Hotel, Phnom Penh
Attendees:	Mr. CHEA Sina, Deputy Director General of GDEP Mr. PHIN Rady, Director of Water Quality Management Department Mr. Sarun Sambo, Director of Inspection and Law Enforcement Mr. Chap Yuthy, Deputy Director of Inspection and Law Enforcement Mr. Him Chandath, Deputy Director of Water Quality Management Department Mr. SIV Kung, Deputy Director of Laboratory Department of GDEP Mr. Kon Ty, Chief of Office, Water Quality Management Department Mr. Lieng Vuthy, Deputy Director of MIH Ms. Chhay Vouchnea, Officer of MIH
Project Team:	Mr. Munehiro Fukuda, JICA Expert Mr. Manuel I. Gloria. Jr, JICA Expert Mr. MENG Kro, Project Coordinator, PEPC
Agenda / Discussion Points:	1. Review the revision of Water Pollution Control Sub-Decree 2. Prakas on Official Methods of Water Quality Measurement 3. Prakas on Registration of the Laboratory for Water Quality Measurement 4. Guideline for Protection of Chemical Leakage to Underground 5. Proposed procedure for development and adoption of the factory inspection manual

Key Points:

Mr. Chea Sina

Introduce about the history of Sub-decree on Water Pollution Control. This sub-decree was established in 1999. There are 2 categories in the sub-decree

1) High pollution source (all factory need to ask for discharge permit)
2) Small pollution source (wastewater effluent volume more than 10m3/day need to ask discharge permit).

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As previous time, only heavy industries such as textile, dye, beverage, sugar…etc. were asked for the discharge permit while many small factories or SME were not.

Currently, the Ministry of Interior assigns some work to provincial sub-government office by 2020. The Ministry of Environment also follows the policy of MoI by preparing the work for provincial level. The ministry of Environment needs to modify the level of work for ministry and Provincial Department of Environment(PDE). SEM should be managed by provincial Department of Environment while heavy industries to be managed by Ministry of Environment for a while. When provincial Department of Environment developed the ability and resource to implement the work, MoE will provide works to PDE.

Comment from Mr. Chea Sina

The revision of sub-decree on water pollution control has classified as 3 categories below:

- Category I: More than 45 m3/day of wastewater
- Category II: High pollution source is more than 25 m3/day of wastewater
- Category III: Discharge Hazardous/toxic substance (all sources regardless of wastewater volume)

1. How different between category II: high pollution source and category III: hazardous substance? (Mr. Fukuda clarified definition of each category will be provided in the sub-decree.)
2. JICA team should arrange the interpreter in the TF meeting because our technical officers do not understand well in English. They cannot understand all issues in the meeting. Interpreter can translate all technical things we discuss in the meeting.
3. TSS it is not a target parameter for pollution. We should consider about BOD, COD and heavy metal which can provide hazardous substances to destroy biodiversity, environment and human health. For TSS, river water also high TSS.
4. Please review again about table of pollution source category by Industrial classification (ISIC Rev. 4)
   - Mining of chemical and fertilizer mineral is in category I. Chemical such as gold, heavy metal. It may discharge the hazardous substance. The problem is created mining acid. Gold contain with sulfur and they will develop sulfuric acid. It is a big problem with water pollution. Why do you put it into Category I? (Mr. Fukuda replied that originally it was in category III, but previous TF meeting proposed to change to Category I. Detail definition “mining of chemical” will be provided in the table.)
   - Manufacture of Wearing apparel and Manufacture of knitted and crocheted apparel. They are sometime dying.

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- When you put printing into Category I, printing use chemical. When they clean up, they will use chemical such as heavy metal. Why do you put into Category I?
- (Mr. Fukuda replied it will be changed to Category III)
- Manufacture of Cement, you put into Category I. Some clinker, they bring hazardous waste for burning. Some bottom asks, fly ash still keep in the factory sometime outside the roof. When rain coming, it will run-off heavy metal into the river. Why you put it into category I? Many countries classify cement as heavy industry. They produce a lot of pollutant. I was surprise that this part put into Category I.
- (Mr. Fukuda replied that cement industry will generate large wastewater so that it will be under regulation anyway. However, it will be changed to Category III)
- Rubber products put into category III, I could not accept with your proposal. I think that manufacture of rubber products is in category II. They just use some acid to freeze the rubber.
- (Mr. Fukuda clarified some language error. It is manufacturing of "Rubber tire". So it will be kept as Category III. On the other hand, manufacturing of "other rubber product "will be category I)
- Repair of machinery. You classify into Category I. They need to use some solvent during the repairing to clean the machine. Where will they dispose the wastewater contain with oil. I propose to consider again.
- (Mr. Fukuda replied two small categories within the industry type will be changed to Category III. Other repair shops were very small (2-3 employee in average) and should not be regulated under the sub-decree)
- Manufacture of machinery for mining, Manufacture of machinery for food, beverage, Manufacture of machinery for textile and manufacture of other special purpose machinery. You should combine together because these manufacture perhaps produce machinery. It is too more detail.

  Pleaser review again for the table of pollution source. (Mr. Fukuda replied that we used ISIC ver.4 code in conformity with Ministry of Industry and handicraft. It is not recommended to develop our own category system. However, this industry type will be changed to Category III)

Mr. Fukuda mentioned that previous pollution source category was come from International Finance and Cooperation Guideline. For each industrial sector has a benchmark value of effluent. Some of effluent such as BOD and COD is not a toxic and for something others such as cyanide, arsenic, cadmium, chromium is a toxic substance.

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Mr. Phin Rady suggested that:

1. Draft of Sub-decree on water pollution control translate into Khmer Language in March 2019
2. JICA project team and Water Quality Department should have a meeting 1 time per week to discuss about Khmer translation because some words are technical and law term. Therefore, we need to discuss about the correct words. As JICA expert is not available for such weekly meeting, Mr. Kro will participate on behalf of the JICA team.
3. The draft revision of sub-decree on water pollution control is difficult to read because JICA team mix all revision with the current sub-decree. JICA team should divide document in two columns. Column 1 for old version and column 2 for revision. In the column 2 no need to mix the comment in the old version. They just keep old version and write what they want to add.
4. Please consider about the marine water standard. Our current sub-decree on water pollution control has only one category of marine water quality standard. We should divide it to 2 or 3 categories such as protected area, entertainment or tourist area, and port area. For parameter, we can adapt from Thailand. (Mr. Fukuda replied that the issue has been discussed for long time. JICA expert is not capable to discuss standard for biodiversity conservation. I was already agreed that 1) JICA team to provide technical information from Japan, Thailand and Vietnam, 2) Based on this information, Water Quality Department shall develop)
5. Water quality index should put in sub-decree or Parkas? (Mr. Fukuda replied the issue has been discussed for long time. Water Quality Index is not for regulatory purpose but for communication purpose. JICA team provided special training opportunity to learn from Thailand during study tour. Water Quality Department shall develop Prakas with their effort. JICA expert will help to draft such Prakas)
6. The technical term in the revision of sub-decree should follow the technical term in the sub-decree on the Management of Drainage and Wastewater Treatment System.
7. He suggested that other departments shall help to discuss, especially Department of Laboratory and Department of Inspection and Law Enforcement.

Prakas on Laboratory Measurement and Registration

Mr. Fukuda mentioned that before we ask private sector to fulfil the registration of laboratory, the Ministry of Environment has to fulfill the requirement beforehand. MoE need at least 1 or 2 year to prepare the laboratory regulation before implementing. Laboratory basically request for 3 things 1) they should have

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proper equipment, instrument to analyze samples, 2) they secure to have technical person to handle the laboratory measurement and analysis, 3) they should have software how to manage the measurement. After registration, laboratory staff, MoE should audit the private laboratory and private lab should show how to analyze the sample, what is QA/QC and how they record the result.

Mr. Chea Sina comment below:

Prakas on Registration of the Laboratory of Water Quality Measurement in

Article 14 mention about suspended certificate from 6 months to 3 years.

- The laboratory made mistake as a result of neglecting/error on conducting and reporting water quality measurement.

If the pollution source prefer laboratory provide best result for them without analyzing, how to solve this problem?

Mr. Fukuda mentioned that for this problem will show in section 2 (the laboratory fails to provide QA/QC data whenever MoE requested, or such QA/QC data is false one.

Article 15 the certificate approves the laboratory shall be cancelled in case:

- The laboratory violates the provision of Article 14.
- The laboratory was punished of criminal offence. Mr. Chea Sina suggested that this point should not be here. It should be in the other article related to the punishment.

Mr. Fukuda mentioned that it is the point that we may consider. Basically, I used the same framework of Prakas on EIA consultation registration issued by MoE. JICA team will check again for this point.

Mr. Chea Sina stated that if you all have comments related to 3 things that we already discussed

1. Revision of Sub-decree on Water Pollution Control especially table of pollution sources
2. Prakas on Registration of the Laboratory for Water Quality Measurement
3. Prakas on Official Methods of Water Quality Measurement for Regulatory Purpose.

   TF members can provide more comments by email or letter to JICA team.

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Guideline on Groundwater Protection

Mr. Chea Sina mentioned that all important points have been raised in the guideline, but JICA expert should:

1. Technical guideline should be more detail for each point. You should not show only one or two line for one point. You should explain more detail about the materials to be used for pipe and tack, etc.
2. Comments for Technical guideline for proper management as follows.

   4.1 Floor surface protection

   (4.4 Handling site should move to section 4.2 Floor surface protection)

   4.5 Waste

   - What kind of tank to store the waste and how to manage a proper waste disposal?
   - How to destroy the waste?

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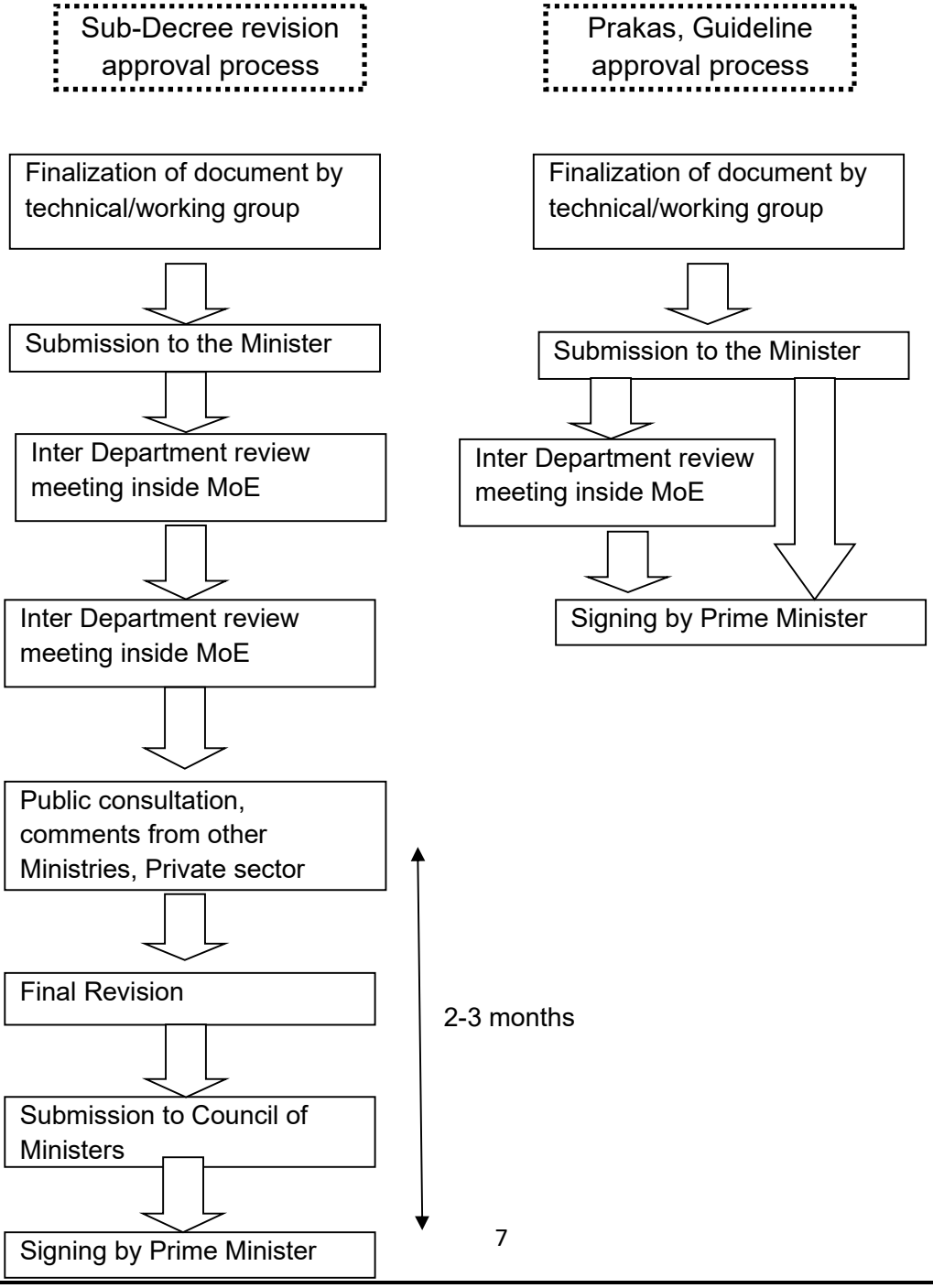
Approval process for revised sub-decree and Prakas/Guideline



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Annex 28 Policy Discussion Papers and Support Documents

Policy Discussion Paper #1

(Issues identification　Rev.1.1)

Revision of

Water Quality Control sub- decree

(for Industrial wastewater management)

September, 2017

Water Quality Management Department

GDEP/MoE

1 Purpose

Purpose of this paper is to review the existing rule and regulation on the area of industrial wastewater control and to identify the need of revision and amendment or to set up new sub-decree.

2 Scope

For the purpose of focused discussion, “Industrial” means “of business activities” which is separated from “Domestic” or “Household”, and “Industrial Wastewater” means those wastewater discharged from the pipe of point sources. Pollution from non-point source requires different approach to control, and hence we will not include them on this paper.

As first step, the paper will discuss the issues found in the current regulation and approach to solve them.

As second step, the paper will discuss the approach to involve stakeholders in preparing the revision/update or amendment to sub-decree.

3 Sub-decree reviewed

No. 27 ANRK. BK, Phnom Penh, April 06, 1999 “Water Pollution Control”

4 Issues identified

Issues identified for revision/update or amendment is categorized into following 4 aspects

4.1 Consistency

There are several inconsistencies in the current sub-decree as noted below.

- Article 8 of the sub-decree strictly prohibits disposal of hazardous substances (as listed in ANNEX 1) into public water bodies. Meanwhile, discharge of some of the hazardous substances specified in Annex 1 is permitted to discharge provided that the concentration is below allowable limits as set forth in Annex 2.

  For example, Arsenic is prohibited in ANNEX 1 but in ANNEX 2 effluent standard is1.0mg/l for public water area
- It was observed that there are 52 parameters regulated in the effluent standard in ANNEX 2. The parameters regulated in the ambient water quality standards in ANNEX 5 contain only 25 parameters. There are parameters regulated under the effluent standards but not regulated under the ambient water quality standards.
- Chemicals banned or severely restricted in most countries under pertinent international treaties remain in the effluent standards.

The parameters for effluent standard, environment standard, their concentration level, and if they are listed in ANNEX 1 as hazardous prohibited substance were summarized in attached table.

Parameters	Prohibited (ANNEX1)	Effluent standard (<mg/l)		Env. Standard (ug/l)	Prodcution Banned	Effluent std/env.std ratio	
		Protected area	Public and sewer			Protected area	Public and
Temperature		<45	<45				
pH		6-9	5-9				
BOD5 (5days at 20c)		30	80				
COD		50	100				
TSS		50	80				
TDS		1000	2000				
Grease and oil		5	15				
Detergents		5	15				
Phenols		0.1	1.2				
Nitrate (NO3)		10	20				
Chlorine (free)		1.0	2.0				
Chroride (ion)		500	700				
Sulphate (as SO4)		300	500				
Sulphide (as sulfur)		0.2	1.0				
Phosphate (PO4)		3.0	6.0				
Total-N							
Total-P							
Coliform							
Cyanide (CN)	Yes	0.2	1.5	0.005		40,000	300,000
Bariium (Ba)	Yes	4.0	7.0				
Arsenic (As)	Yes	0.1	1.0	10		10	100
Tin (Sn)	Yes	2.0	8.0				
Iron (Fe)		1.0	20				
Boron (B)		1.0	5.0				
Managanese (Mn)		1.0	5.0				
Cadmiunm (Cd)	Yes	0.1	0.5	1		100	500
Chromium (Cr-3)		0.2	1.0				
Chromium (Cr+6)		0.05	0.5	50		1	10
Copper (Cu)	Yes	0.2	1.0				
Lead (Pb)	Yes	0.1	1.0	10		10	100
Mercury (Hg)	Yes	0.002	0.005				
Organic mercury	Yes			0			
Nickel (Ni)	Yes	0.2	1.0				
Selenium (Se)	Yes	0.05	0.5	10		5	50
Silver (Ag)	Yes	0.1	0.5				
Zinc (Zn)	Yes	1.0	3.0				
Molybdenum (Mo)		0.1	1.0				
Ammmonia (NH3)		5.0	7.0				
DO		2.0	1.0				
PCB	Yes	0.003	0.003	10	Banned		
Calcium		150	200				
Magnesium		150	200				
Carbon tetrachloride	Yes	3	3	12	Banned	250	250
Hexachloro Benzene	Yes	2	2	0.03	Banned	66,667	66,667
DDT	Yes	1.3	1.3	10	Banned	130	130
Endrin	Yes	0.01	0.01	0.01	Banned	1,000	1,000
Dieldrin	Yes	0.01	0.01	0.01	Banned	1,000	1,000
Aldrin	Yes	0.01	0.01	0.005	Banned	2,000	2,000
Isodrin	Yes	0.01	0.01	0.005	Banned	2,000	2,000
Perchloro ethylene	Yes	2.5	2.5	10		250	250
Hexachloro butadien	Yes	3	3	0.1		30,000	30,000
Chloroform	Yes	1	1	12		83	83
1,2 Dichloro ethylene	Yes	2.5	2.5	10		250	250
Tricholoro ethylene	Yes	1	1	10		100	100
Tricholoro benzene	Yes	2	2	0.4		5,000	5,000
Hexachloro cyclohexene	Yes	2	2		Banned		

4.2 Ambiguity

- The parameters regulated in ANNEX 1, 2, 4 and 5 are not presented with identification numbers which may prevent effective implementation of the sub-decree
- Analytical methods are not specified for each parameter in ANNEX 2, 4 and 5, which may cause misapplication and misinterpretation of laboratory data.
- No assurance of quality of the measurement value of wastewater by private laboratory.
- The industry categories identified in Annex 3 are not associated with Standard Industrial Classification Code, which would lead to wrong categorization and resultant confusion among the industries.

4.3 Effective enforcement

- A broad list of industries is attached as Annex 3.. For efficient administration, it is better to place minimum size of industry. For example, all the restaurant needs permit at present. Such threshold value may be set at differently by industrial sector and its priority.
- No clear indication of "The guideline" in article 14 for criteria of discharge permit. And no technical procedure for inspection.
- No clear provision is in place to define the responsibility of industries for recording and keeping data of wastewater facility operation, i.e. type of data and length of keeping them.
- No provision is in place on continuous monitoring parameters..
- A mechanism to allow effective coordination among MoE, MoIH and CDC are not provided in the sub-decree. This would especially vital for effective discharge permitting system.

4.4 Review/update standard

The issues itemized above with numbers 4.1 through 4.3 may require overhauling of the ambient water quality standards and the effluent standards.

Practical review process may include if standard value is reasonable in comparison with industry benchmark and standard value in foreign countries. As for ambient standard value, focus will be on heath impact parameter to examine the risk level.

4.5 Measure for emerging issue

In the late 1980s and 1990s, Japan experienced extensive groundwater pollution by industrial solvent (Trichloroethylene and Tetrachloroethylene) at over 1,000 locations. Such chemicals are used in degreasing process in mechanical, electronics industry. In Cambodia, investment in diversified industrial sector other than garment sector may involve risk of such groundwater contamination. Once occurred, groundwater contamination is very difficult and expensive to remedy. Therefore prevention is the best measure. Hence, the sub-decree shall be amended to prohibit leak/penetration of such chemicals into soil/groundwater, just at this stage..

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5 Set up of task force

To implement the proposed revision/update of sub-decree, set up of the task force is recommended.

5.1 TOR of the task force

To implement the project components related to water environment, including but not limited to following task;

- Formulate new sub-decree or amendment to existing sub-decree in the area of industrial wastewater control.
- Formulate necessary guidelines and manuals related to industrial wastewater control.
- Study and collect the data necessary for the above.
- Develop consensus among the stakeholders for contents of the proposed new sub-decree or amendment, guidelines and manuals.
- Provide guidance for training program in area of water environment, and provide coordination if necessary for the training program,.

5.2 Proposed member

1	Deputy Director General of GDEP	Chair
2	Director of water quality management	Deputy Chair (Secretariat)
3	Director of inspection and law enforcement	Deputy Chair
4	Deputy director of EIA	Member
5	Representative of Laboratory	Member
6	Staff of water quality management	Member
7	Staff of inspection and law enforcement	Member
8	JICA expert	Adviser

Representative from Ministry of Industry and Handicraft (MoIH), and representative from The Council of Development of Cambodia (CDC) will be invited to participate in the task force when necessary.

6 Consultation with extended stakeholders

Stakeholder consultation shall be proceeded step by step such as “Issues identified ” “approach and criteria” and then “final design”. It is not recommended to start with final “document”.

Involvement of stakeholder shall also be step by step. Key stakeholders such as MoIH, CDC shall be involved for day-to-day discussion and operation within the above noted task force..

Then it is expected to organize stakeholder meetings inviting more extensive group (private sectors, academia, NGO, so on)

7 Schedule

Basic contents of the amendment to existing decree (or formulation of new sub-decree) will be finalized before June, 2018.

Policy Discussion Paper #2

(Approach and Criteria for Revision)

Revision of

Water Quality Control sub- decree

(for Industrial wastewater management)

November, 2017

Water Quality Management Department

GDEP/MoE

1. Purpose

Purpose of this paper is to review the existing rule and regulation on the area of industrial wastewater control and to identify the need of revision and amendment or to set up new sub-decree.

2. Scope

For the purpose of focused discussion, “Industrial” means “of business activities” which is separated from “Domestic” or “Household”, and “Industrial Wastewater” means those wastewater discharged from the pipe of point sources. Pollution from non-point source requires different approach to control, and hence we will not include them on this paper.

This paper is follow-up of Policy Discussion Paper #1 (Issues identification) of September 2017 to develop further revision work. The paper discusses the approach and criteria identified in the previous paper #1.

3. Sub-decree reviewed

No. 27 ANRK. BK, Phnom Penh, April 06, 1999 “Water Pollution Control”

4. Issues identified and need for revision

Issues identified for revision as discussed in Policy Discusion Paper #1 is summarized in the Table below.

Chapter & Article in question	Issues and need for revision
Chapter 2 Article 4 Annex 2 (Effluent standard)	• Some parameters are for chemical substance which already were banned /restricted for production and thus make no sense to include in effluent standard (also this is prohibited in NR&E code ver.8 Book 6 Waste and pollution management Book, Title 4 Management of Hazardous substances ARTICLE 9 PROHIBITION OF PERSISTENT ORGANIC POLLUTANTS)
	• Some parameter does not correspond to the environmental quality standard
	• CAS no. shall be attached to clarify substance identification
	• Method of measurement shall be attached
	• Concentration level of effluent standard has no common basis in relation to water quality standard.
	• Annex 2 has two columns, one is for protected area, another is for public water area/sewer. Effluent to sewage system shall be regulated by the authority who operates the sewage treatment facility.
	• Concentration level of the effluent standard shall be compared with 1) Standard in other countries 2) Industry benchmark value with BAT application
Chapter 2 Article 8 ANNEX 1	• Need more clarification for ANNEX 1 in relation to effluent standard.
	• Suggested to include prohibition of chemical penetration to underground to protect groundwater
Chapter 3 Article 11	• The industrial category shall be based on ISIC Ver.4 to avoid any

ANNEX 3 (Effluent discharge permit)	confusion. Listing of industrial category shall be based on pollution loading study of existing factory as well as those categories likely to be established in Cambodia.
	• In order to cover the factory more effectively, data/information sharing with MIH and CDC is essential. Administrative action such as granting QIP privilege by CDC as well as establishment permit and operating license by MIH should be closely coordinated. Such coordination shall be amended.
	• Current draft NR&E code specified the content of discharge permit. It should be revised to include them accordingly.
Chapter 3 Article 14	• Condition to grant discharge permit is not clear. Technical guideline mentioned in article does not exist. Such guideline may include not only hardware requirement but also human (operator) aspect.
Chapter 4 Article 21	• Qualification/approval/registration of laboratory shall be defined in Prakas or other document
Chapter 4 Article 23	• There should be more clarification of self monitoring, in terms of parameter as well as type of data for record keeping, and the period of keeping
Chapter 5 Article 25 ANNEX 5 (Environmental quality standard)	• Some parameters has no correspondence to effluent standard,
	• CAS no. shall be attached to clarify substance identification
	• Method of measurement also shall be attached.
	• Concentration level of environmental standard shall be reviewed.
Chapter 6 Article 30	• Shall link to the proposed Factory Inspection Manual. Owner's responsibility for taking and keeping record for inspection shall be further clarified..
Chapter 7 Article 34 (Penalty)	• Fine shall be adjusted to be more effective to industry.

5. Approach and criteria for revision and provisional work

5.1. Chapter 2 article 4 Annex 2 (Effluent standard)

- Parameters which were banned or restricted for production will be reviewed for its status under international treaty, and under domestic status for regulation and import record. If justified, it shall be removed from the list of effluent standard. **Provisional work was summarized in Support Document #2.**
- Effluent standard parameter which does not have corresponding environmental quality standard will be reviewed as follows.
  - Review with "Cambodia Drinking water quality standard" and "WHO Guideline for Drinking water guideline" . If the parameter exists as standard, then add it to Environmental Quality standard. If not, then delete it from effluent standard.
- CAS no. shall be attached to clarify substance identification.
- Method of measurement used in MoE laboratory will be summarized as reference method and will be attached. **Provisional work was summarized in Support Document #3**.

- Annex 2 has two columns; one is for protected area, another for public water area/sewer. Effluent to sewage system shall be regulated by the authority operates the sewage treatment facility. The issue shall be further discussed with the authority who will operates the sewage treatment facility.
- Concentration level of effluent standard will be reviewed as follows.
  - Comparison with standard in other countries.
  - Comparison with industry benchmark value with BAT application.
  - Logical relation to the environmental quality standard value.

5.2. Chapter 2 Article 8 Annex 1 (Hazardous substances)

- Article 8 shall be rewritten to clarify the regulation.
- Prohibition of penetration of chemical substance to underground shall be added to protect groundwater.
  Provisional work for justification was summarized as Support Document # 4

5.3. Chapter 3 Article 11 Annex 3 (Discharge permit)

- Pollution source requires Discharge permit shall be rewritten based on ISIC Rev.4 code and taking pollution load study of current industry as well as those likely to be developed in Cambodia.
  Provisional work was summarized as Support Document # 1
- Coordination with MIH and CDC is now under planning.
- Written content of Discharge permit shall be revised according to the NR&E code once approved.

5.4. Chapter 3 Article 14

- Technical guideline is now under preparation as “Wastewater treatment facility guideline”

5.5. Chapter 4 Article 21

- Technical requirement for registered laboratory is now under preparation. Prakas for registration of laboratory for wastewater examination will be prepared.

5.6. Chapter 4 Article 23

- Prakas for self monitoring is now under preparation to clarify the issue.

5.7. Chapter 5 Article 25 ANNEX 5

- Most of the issue was already discussed in section 5.1.
- Only one parameter (Benzene) is listed in Environmental quality standard but not in Effluent standard. It will be added to Effluent standard after considering appropriate concentration level.
- Concentration level of environmental standard shall be reviewed by
  - Risk assessment
  - Comparison with other countries
  - Comparison with WHO drinking water guideline value

5.8. Chapter 6 Article 30

- Factory Inspection Manual is now under preparation.

5.9. Chapter 7 Article 34

- Fine will be applied not only once, but applied in proportional to the period of violation.

6. Consultation with extended stakeholders

Stakeholder consultation shall be proceeded step by step such as “Issues identified ” “approach and criteria” and then “final design”. It is not recommended to start with final “document”.

Involvement of stakeholder shall also be step by step. Key stakeholders such as MoIH, CDC shall be involved for day-to-day discussion and operation within the above noted task force..

Then it is expected to organize stakeholder meetings inviting more extensive group (private sectors, academia, NGO, so on)

7. Schedule

Policy discussion paper #3 will be prepared before March 2018 for next consultation meeting. Basic contents of the amendment to existing decree (or formulation of new sub-decree) will be finalized before June, 2018.

Support Document # 1 Revision of Pollution Sources ANNEX 3

1. Justification to using ISIC Rev.4

   Current Sub-Decree ANNEX 3 defines the target facilities requires discharge permit. However the listing is by narrative description and thus it may cause ambiguous situation. Cambodian Economic Census 2011 used ISIC (International Standardized Industry Code) Rev.4 for the classification of economic activities. Thus using ISIC Rev. 4 for listing of ANNEX 3 is recommended.

2. Industry listing and grouping

   Using IPPS (Industrial Pollution Projection System) data for base pollution load per number of employee and Economic Census 2011 (Cambodia) data, BOD5 loading was studied. Resulted listing are economic activities actually exists and discharges pollution in Cambodia. Then listed industries were summarized at 31 Division level as follows.

   Division: 09- Mining support service activities
   Division: 10- Manufacture of food products
   Division: 11- Manufacture of beverages
   Division: 12- Manufacture of tobacco product
   Division: 13- Manufacture of textiles
   Division: 14- Manufacture of wearing apparel
   Division: 15- Manufacture of leather and related products
   Division: 16- Manufacture of wood and products of wood
   Division: 17-Manufacture of paper and paper products
   Division: 18- Printing and reproduction for recorded media
   Division: 19- Manufacture of coke and refined petroleum products
   Division: 20- Manufacture of chemicals and chemical products
   Division: 21- Manufacture of basic pharmaceutical products
   Division: 22- Manufacture of rubber and plastics products
   Division: 23- Manufacture of other non-metallic mineral products
   Division: 24- Manufacture of basic metals
   Division: 25- Manufacture of fabricated metal products
   Division: 26- Manufacture of computer, electronic and optical products
   Division: 27- Manufacture of electrical equipment
   Division: 28- Manufacture of machinery and equipment n.e.c.
   Division: 29- Manufacture of motor vehicles, trailers and semi-trailers

Division: 30- Manufacture of other transport equipment
Division: 31- Manufacture of furniture
Division: 32- Other manufacturing
Division: 33- Repair and installation of machinery and equipment
Division: 35- Electricity, gas, steam and air condition supply
Division: 38- Waste collection, treatment and disposal activities; meterial recovery
Division: 58- Publishing activities
Division: 59- Motion picture, video and television program production, sound recording and music publishing activities
Division: 80- Security and investigation activities
Division: 95- Repair of computers and personal and household goods

Then matching with current ANNEX 3 listing was done. Followings 15 divisions were added to the above listing.

Division 01 Group 014 Animal production
Division 03 Group 032 Aquaculture
Division 05 Mining of coal and lignite
Division 06 Extraction of crude petroleum and natural gas
Division 07 Mining of metal ore
Division 08 Other mining and quarrying
Division 35 Electricity, gas steam and air conditioning supply
Division 37 Sewerage
Division 46 Wholesale trade, except of motor vehicle and motorcycle
Division 47 Retail trade, except of motor vehicle and motorcycle
Division 55 Accommodation
Division 56 Food and beverage service activities
Division 71 Architectural and engineering activities; technical testing and analysis
Division 72 Scientific research and development
Division 86 Human health activities

Above listing covers all pollution sources in current Annex 3 except No.35 " Ship carrying liquid substance". Ship shall be controlled by other regulation related to shipping activity.

3. Prioritization

In addition to using ISIC code Rev.4, prioritization of industry category in view of pollution

load was considered. BOD5 was taken as pollution of concern. As a result following 7 Industrial categories (group under ISIC Rev.4) were identified as priority sectors which account for 98% loading of BOD 5 from total industry.

Division: 13- Manufacture of textiles
Division: 11- Manufacture of beverages
Division: 10- Manufacture of food products
Division: 16- Manufacture of wood and products of wood
Division: 17-Manufacture of paper and paper products
Division: 15- Manufacture of leather and related products
Division: 20- Manufacture of chemicals and chemical products

In addition to the individual study for BOD5 loading, ADB (Asian Development bank) report on "Estimating Industrial Pollution in Kingdom of Cambodia" (September 2016) was reviewed. ADB report use same IPPS system but based on different statistics by National Social Security Fund (NSSF). From ADB report following 6 industry categories were identified as priority pollution sources for TSS, Toxic metal and substance discharge.

Division: 21- Manufacture of basic pharmaceutical products
Division: 22- Manufacture of rubber and plastics products
Division: 24- Manufacture of basic metals
Division: 26- Manufacture of computer, electronic and optical products
Division: 27- Manufacture of electrical equipment
Division: 30- Manufacture of other trasport equipment

It is recommended to list them as Category II and apply smaller threshold as discussed below..

4. Threshold or Minimum size of Industry

For efficient administration, it is suggested to introduce minimum size of industry which shall be regulated. Under the current sub-decree, Category I has threshold at 10 ton/day volume of waste water, but no such threshold for Category II.

While keeping 10 ton/day threshold for Category I, smaller threshold may be introduced for Category II.

5. Issues to be considered

Enforceability

- Division 01 Group 014 Animal production
- Division 03 Group 032 Aquaculture

Above two type of pollution sources may not be point sources and hence End-of-pipe wastewater can not be examined.

Effluent to sewage system

Wastewater quality acceptable to sewage system shall be determined by the sewage operator based on local condition (type of wastewater treatment, etc.) The issue shall be discussed with those who may become sewage operator (i.e. PPPWT).

Minimum size or Threshold

Threshold value for Category I and II shall be reexamined. When wastewater volume is used as threshold, method to determine the volume shall be specified (i.e. Volume of tap water x 80%. Etc.)

Technology option

- Division 55 Accommodation
- Division 56 Food and beverage service activities

Above two types of pollution sources may not be able to install/operate own wastewater treatment facility. Capability to reduce pollution loading by septic tank or Jokaso shall be considered.

Special pollutant

- Division 86 Human health activities

Hospitals may have pollutants such as PCPP and infection substances which are not listed in Effluent standard Annex 2. Discussion with concerned Ministry may be needed.

Low level pollution sources

- Division: 58- Publishing activities
- Division: 59- Motion picture, video and television program production, sound recording and music publishing activities
- Division: 80- Security and investigation activities

Above three sources have only low level of pollution and thus may be deleted from Annex 3.

6. Revision proposed

As attached.

ANNEX 3 Pollution sources requires Discharge permit

Categories	**ISIC**	**Category**
Division 01 Group 014 Animal production	0141,0142,0144,0145, 0146, 0149	I
Division 03 Group 032 Aquaculture	0321,0322	I
Division 05 Mining of coal and lignite	0510,0520	I
Division 06 Extraction of crude petroleum and natural gas	0610,0620	I
Division 07 Mining of metal ore	0710,0721,0729	I
Division 08 Other mining and quarrying	0810,0891,0892,0893,0899	I
Division: 09- Mining support service activities	0910,0990	I
Division: 10- Manufacture of food products	1010,1020,1030,1040,1050,1061,1062,1071,1072,1073,1074,1075,1079,1080	II
Division: 11- Manufacture of beverages	1101,1102,1103,1104	II
Division: 12- Manufacture of tobacco product	1200	
Division: 13- Manufacture of textiles	1311,1312,1313,1391,1392,1393,1394,1399	II
Division: 14- Manufacture of wearing apparel	1410,1420,1430	I
Division: 15- Manufacture of leather and related products	1511,1512,1520	II
Division: 16- Manufacture of wood and products of wood	1610,1621,1622,1623,1629	II
Division: 17-Manufacture of paper and paper products	1701,1702,1709	II
Division: 18- Printing and reproduction for recorded media	1811,1812,1820	I
Division: 19- Manufacture of coke and refined petroleum products	1910,1920	I
Division: 20- Manufacture of chemicals and chemical products	2011,2012,2013,2021,2022,2023,2029,2030	II

Division: 21- Manufacture of basic pharmaceutical products	2100	II
Division: 22- Manufacture of rubber and plastics products	2211,2219,2220	II
Division: 23- Manufacture of other non-metallic mineral products	2310,2391,2392,2393,2394,2395,2396,2399	I
Division: 24- Manufacture of basic metals	2410,2420,2431,2432	II
Division: 25- Manufacture of fabricated metal products	2511,2512,2513,2520,2591,2592,2593,2599	I
Division: 26- Manufacture of computer, electronic and optical products	2610,2620,2630,2640,2651,,2652,2660,2670,2680	II
Division: 27- Manufacture of electrical equipment	2710,2720,2731,2732,2733,2740,2750,2790	II
Division: 28- Manufacture of machinery and equipment n.e.c.	2811,2812,2813,2814,2815,2816,2817,2818,2819,2812,2822,2823,2824,2825,2826,2829	I
Division: 29- Manufacture of motor vehicles, trailers and semi-trailers	2910,2920,2930	I
Division: 30- Manufacture of other transport equipment	3011,3012,3020,3030,3040,3091,3092,3099	II
Division: 31- Manufacture of furniture	3100	I
Division: 32- Other manufacturing	3211,3212,3220,3230,3240,3250,3290	I
Division: 33- Repair and installation of machinery and equipment	3311,3312,3313,3314,3315,3319,3320	I
Division: 35- Electricity, gas, steam and air condition supply	3510,3520,3530	I
Division 35 Electricity, gas steam and air conditioning supply	3510, 3520	I
Division 37 Sewerage	3700	I
Division: 38- Waste collection, treatment and disposal activities; material recovery	3811,3812,3821,3822,3830	I
Division 46 Wholesale trade, except of motor vehicle and motorcycle	4661	I
Division 47 Retail trade, except of motor	4730	I

vehicle and motorcycle		
Division 55 Accommodation	5510	I
Division 56 Food and beverage service activities	5610, 5629,5630	I
Division: 58- Publishing activities	5811,5812,5813,5819,5820	I
Division: 59- Motion picture, video and television program production, sound recording and music publishing activities	5911,5912,5913,5914,5920	I
Division 71 Architectural and engineering activities; technical testing and analysis	7120	I
Division 72 Scientific research and development	7210	I
Division: 80- Security and investigation activities	8010,8020,8030	I
Division 86 Human health activities	8610,8620,8630	I
Division: 95- Repair of computers and personal and household goods	9511,9512,9521,9522,9523,9524,9529	I

Support Document # 1-1　　Revision of Pollution Sources ANNEX 3

1. Basic idea and approach to revision of ANNEX 3

Revision will be made according to following basic idea and process

Basic idea

① Clarification of target facility/business by using standardized code

② Grouping by pollution load study

③ Preparation for future industrial development

.

Process

① Pollution sources will be defined using ISIC Rev. 4 code system.

② Using IPPS parameters and Economic Census 2011 data, current pollution load (BOD) will be estimated to identify important sources. The data will be used as basic listing.

③ Current listing in ANNEX 3 and those in ② will be compared and merged.

④ Additional categories of industry will be added in view of future industrial development in Cambodia . ADB study of IPPS application to Cambodia will be used to consider additional industrial categories.

⑤ Low level sources will be removed from the listing.

2. Justification to using ISIC Rev.4

Current Sub-Decree ANNEX 3 defines the target facilities requires discharge permit.
However the listing is by narrative description and thus it may cause ambiguous situation.
Cambodian Economic Census 2011 used ISIC (International Standardized Industry Code) Rev.4 for the classification of economic activities. Thus using ISIC Rev. 4 for listing of ANNEX 3 is recommended.

3. Examination of current pollution loading by Industry categories

Using IPPS (Industrial Pollution Projection System) data for base pollution load per number of employee and Economic Census 2011 (Cambodia) data, BOD5 loading was studied. Resulted listing are economic activities actually exists and discharges pollution in Cambodia.　Then listed industries were summarized at 31 Division level as follows.

Division: 09- Mining support service activities
Division: 10- Manufacture of food products
Division: 11- Manufacture of beverages

Division: 12- Manufacture of tobacco product
Division: 13- Manufacture of textiles
Division: 14- Manufacture of wearing apparel
Division: 15- Manufacture of leather and related products
Division: 16- Manufacture of wood and products of wood
Division: 17-Manufacture of paper and paper products
Division: 18- Printing and reproduction for recorded media
Division: 19- Manufacture of coke and refined petroleum products
Division: 20- Manufacture of chemicals and chemical products
Division: 21- Manufacture of basic pharmaceutical products
Division: 22- Manufacture of rubber and plastics products
Division: 23- Manufacture of other non-metallic mineral products
Division: 24- Manufacture of basic metals
Division: 25- Manufacture of fabricated metal products
Division: 26- Manufacture of computer, electronic and optical products
Division: 27- Manufacture of electrical equipment
Division: 28- Manufacture of machinery and equipment n.e.c.
Division: 29- Manufacture of motor vehicles, trailers and semi-trailers
Division: 30- Manufacture of other transport equipment
Division: 31- Manufacture of furniture
Division: 32- Other manufacturing
Division: 33- Repair and installation of machinery and equipment
Division: 35- Electricity, gas, steam and air condition supply
Division: 38- Waste collection, treatment and disposal activities; meterial recovery
Division: 58- Publishing activities
Division: 59- Motion picture, video and television program production, sound recording and music publishing activities
Division: 80- Security and investigation activities
Division: 95- Repair of computers and personal and household goods

Then matching with current ANNEX 3 listing was done. Followings 13 divisions were added to the above listing.

Division 01 Group 014 Animal production
Division 03 Group 032 Aquaculture
Division 05 Mining of coal and lignite

Division 08 Other mining and quarrying
Division 35 Electricity, gas steam and air conditioning supply
Division 37 Sewerage
Division 46 Wholesale trade, except of motor vehicle and motorcycle
Division 47 Retail trade, except of motor vehicle and motorcycle
Division 55 Accommodation
Division 56 Food and beverage service activities
Division 71 Architectural and engineering activities; technical testing and analysis
Division 72 Scientific research and development
Division 86 Human health activities

Above listing covers all pollution sources in current Annex 3 except No.35 " Ship carrying liquid substance" and No.22 "Business center". Ship shall be controlled by other regulation related to shipping activity. "Business center" category in ISIC Rev.4 could not be identified.

4. Addition of new category and prioritization

Considering the future industrial development of Cambodia, following categories were added as pollution sources.

Division 06- Extraction of crude petroleum and natural gas
Division 07 -Mining of metal ore
Division: 26- Manufacture of computer, electronic and optical products
Division: 28- Manufacture of machinery and equipment n.e.c.
Division: 29- Manufacture of motor vehicles, trailers and semi-trailers
Division: 30- Manufacture of other transport equipment
Division: 31- Manufacture of furniture
Division: 32- Other manufacturing
Division: 33- Repair and installation of machinery and equipment

In addition to using ISIC code Rev.4, prioritization of industry category in view of pollution load was considered. BOD5 was taken as pollution of concern. As a result following 7 Industrial categories (group under ISIC Rev.4) were identified as priority sectors which account for 98% loading of BOD 5 from total industry.

Division: 13- Manufacture of textiles

Division: 11- Manufacture of beverages
Division: 10- Manufacture of food products
Division: 16- Manufacture of wood and products of wood
Division: 17-Manufacture of paper and paper products
Division: 15- Manufacture of leather and related products
Division: 20- Manufacture of chemicals and chemical products

In addition to the individual study for BOD5 loading, ADB (Asian Development bank) report on "Estimating Industrial Pollution in Kingdom of Cambodia" (September 2016) was reviewed. ADB report use same IPPS system but based on different statistics by National Social Security Fund (NSSF). From ADB reports following 6 industrial categories were identified as priority pollution sources for TSS, Toxic metal and substance discharge.

Division: 21- Manufacture of basic pharmaceutical products
Division: 22- Manufacture of rubber and plastics products
Division: 24- Manufacture of basic metals
Division: 26- Manufacture of computer, electronic and optical products
Division: 27- Manufacture of electrical equipment
Division: 30- Manufacture of other transport equipment

It is recommended to list them (Division 21,22,24,26,27,30) as Category III and apply smaller or no threshold as discussed below..

5. Threshold or Minimum size of Industry

For efficient administration, it is suggested to introduce minimum size of industry which shall be regulated. Under the current sub-decree, Category I has threshold at 10 ton/day volume of waste water, but no such threshold for Category II.

Category II shall be set for Division 55 accommodation business with threshold at 30 ton/day.

While keeping 10 ton/day threshold for Category I, no threshold is applied for Category III who discharge hazardous substance. Category III will be as follows.
Division 05 Mining of coal and lignite
Division 06 Extraction of crude petroleum and natural gas
Division 07 Mining of metal ore
Division: 08 Other mining and quarrying

Division: 15- Manufacture of leather and related products

Division: 19- Manufacture of coke and refined petroleum products

Division: 20- Manufacture of chemicals and chemical products

Division: 21- Manufacture of basic pharmaceutical products

Division: 22- Manufacture of rubber and plastics products

Division: 24- Manufacture of basic metals

Division: 25- Manufacture of fabricated metal products

Division: 26- Manufacture of computer, electronic and optical products

Division: 27- Manufacture of electrical equipment

Division: 29- Manufacture of motor vehicles, trailers and semi-trailers

Division: 30- Manufacture of other transport equipment

.

6. Issues to be considered

Enforceability

- Division 01 Group 014 Animal production
- Division 03 Group 032 Aquaculture

Above two type of pollution sources may not be point sources and hence End-of-pipe wastewater can not be examined.

Effluent to sewage system

Wastewater quality acceptable to sewage system shall be determined by the sewage operator based on local condition (type of wastewater treatment, etc.) The issue shall be discussed with those who may become sewage operator (i.e. PPPWT).

Minimum size or Threshold

Threshold value for Category I and II shall be reexamined. When wastewater volume is used as threshold, method to determine the volume shall be specified (i.e. Volume of tap water x 80%. Etc.) The support document#7 discussed the issue.

Technology option

- Division 55 Accommodation
- Division 56 Food and beverage service activities

Above two types of pollution sources may not be able to install/operate own wastewater treatment facility. Capability to reduce pollution loading by septic tank or Jokaso shall be considered.

Special pollutant

- Division 86 Human health activities

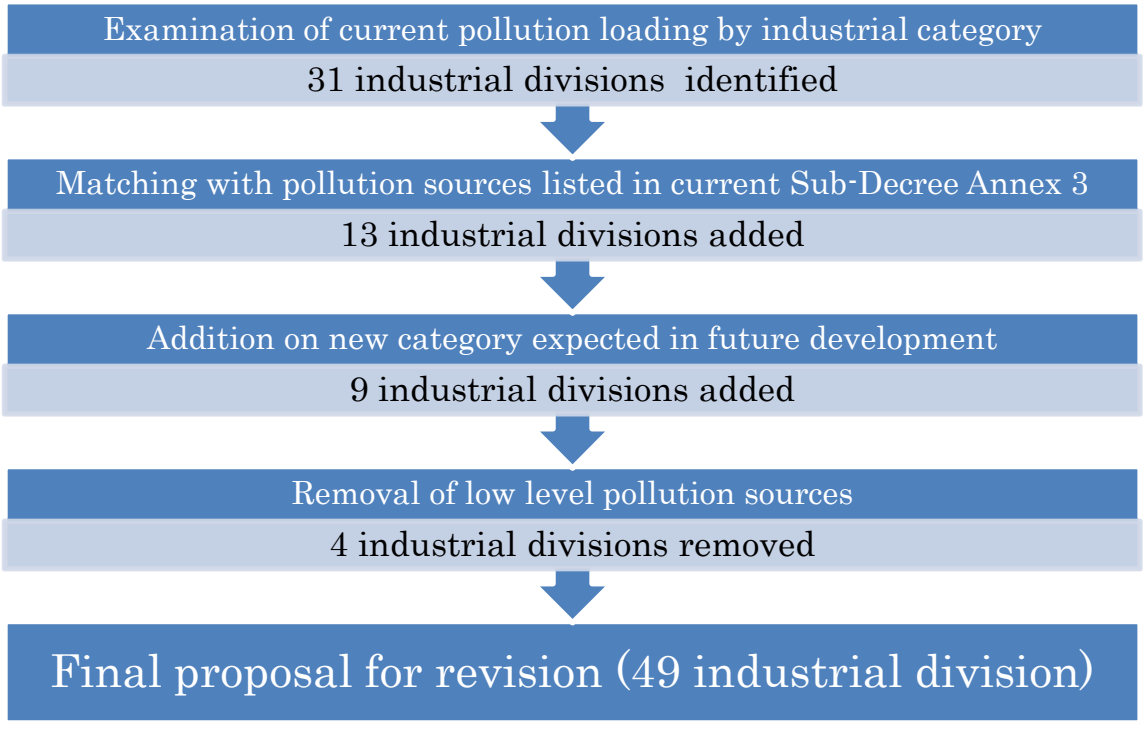
Hospitals may have pollutants such as PCPP and infection substances which are not listed in Effluent standard Annex 2. Discussion with concerned Ministry may be needed.

Low level pollution sources

- Division: 09- Mining support service activities
- Division: 58- Publishing activities
- Division: 59- Motion picture, video and television program production, sound recording and music publishing activities
- Division: 80- Security and investigation activities

Above three sources have only low level of pollution and thus may be deleted from Annex 3 (Above category were removed from proposed revision).

Work flow of ANNEX 3 revision



Support Document # 2　Deletion of Prohibited/Restricted Substance ANNEX 2

1. Justification

Following substances listed in ANNEX 2 as effluent standard are globally banned or restricted for production. Also some of them are pesticide prohibited in use in Cambodia. Import statistics showed almost all substances has no record of import in last 10 years. Therefore it is unlikely any industrial establishment to use such substances in their process. Accordingly it is not likely their effluent contains such substances. **More efficient and solid regulation would be to prohibit the use of such substances.** For example, draft NR&E code, Book 6 Waste and pollution management, title 4 Management of Hazardous substances prohibited the substance in POPs category.

2. Listing in international treaty

Substance	No. in ANNEX 2	Internationally regulated or listed	Action
PCB	36	Stockholm convention	Elimination
Carbon tetrachloride	39	Montreal protocol	Global production ban by 2015
Hexachloro Benzene	40	Stockholm convention	Elimination
DDT	41	Stockholm convention	Restriction
Endrin	42	Stockholm convention	Elimination
Dieldrin	43	Stockholm convention	Elimination
Aldrin	44	Stockholm convention	Elimination
Isodrin (Aldrin isomer)	45	Listed in WHO obsolete pesticide Listed in Helsinki convention	Minimize or ban if possible.
Hexachloro cyclohexene	52	Stockholm convention	Elimination

3. Pesticide banned for use in Cambodia

Ministry of Agriculture, Forestry and Fisheries banned 116 chemical substances (pesticide) by Declaration No.598 dated December 15, 2003.　6 substances are in the list of 116 and banned to be used in Cambodia. 6 substances are as follows.

Substance	No. in Annex 2 Effluent standard	No. in Appendix 1 Pesticide banned
Hexachloro Benzene	40	68
DDT	41	39
Endrin	42	53
Dieldrin	43	44
Aldrin	44	06
Isodrin (Aldrin isomer)	45	71

4. Import statistics

Import volume of the above noted substances are as follows (in Kg)

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	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
PCB	0	720	0	0	0	0	0	72,434	0	0
Carbon tetrachloride	0	0	0	0	0	0	0	0	0	0
Hexachloro Benzene	0	0	0	0	0	0	0	0	0	0
DDT	0	0	0	0	0	0	0	0	0	0
Endrin	0	0	0	0	0	0	0	0	0	0
Dieldrin	0	0	0	0	0	0	0	0	0	0
Aldrin	0	0	0	0	0	0	0	0	0	0
Isodrin (Aldrin isomer)	?	?	?	?	?	?	?	?	?	?
Hexachloro cyclohexene	0	0	0	0	0	0	0	0	0	0

PCB has two records of import, one in 2008 and others in 2014. Under what kind of situation they were imported in not known. However there is no constant and continuous import into Cambodia. Import of Isodrin could not be confirmed as it does not have unique HS code. Other substances have no record of import into Cambodia in during 2007 – 2016 periods.

5. Proposal

9 substances noted in section 2 of the report shall be deleted from ANNEX 2. Instead the use of such substances shall be prohibited to use in any establishment for business activity.

Support Document # 3 Method of analysis for standard parameters (interim summary)

No	Parameter	Unit	Effluent Standards (MoE)		Analytical Method	Method LDL	Reference Method
			Protected Area	Public Area			
1	pH	-	6-9	5-9	Method pH meter	4	Standard Method for Examination of Water and Wastewater (SMWW1995)
2	Temperature	°C	<45	<45	To be clarified	0	-
3	Total Dissolved Solid(TDS)	mg/l	<1000	<2000		0	-
4	Dissolved Oxygen(DO)	mg/l	>2.0	>1.0	To be clarified	0	-
5	Total Suspended Solid(TSS)	mg/l	<50	<80	Method 2540 D	NV	SMWW1995
6	Biochemical Oxygen demand (BOD)5	mg/l	<30	<80	Method 5210 B	4	SMWW1995
7	Chemical Oxygen demand (COD)Cr	mg/l	<50	<100	Method 5220.B	5	SMWW1955
8	Ammonia(NH3)	mg/l	<5.0	<7.0	To be clarified	0	SMWW1995
9	Cyanide(CN-)	mg/l	<0.2	<1.5	Method 4500 E	0.02	SMWW1995
10	Detergent(MBAS)	mg/l	<5.0	<15	Method 5540 C	0.02	SMWW199)
11	Oil and Grease	mg/l	<5.0	<15	Method 5520 D	0	SMWW1995
12	Phenol	mg/l	<0.1	<1.2	Method Spectrometry	0.02	France Standards
13	Chloride(Cl-)	mg/l	<500	<700	Method 4500-Cl F	0.1	SMWW1995
14	Residual Chlorine (Cl2)	mg/l	<1.0	<2.0	To be clarified	0-5.0	
15	Nitrate(NO3)	mg/l	<10	<20	Method 4500-NO3 C	0.1	SMWW1995
16	Phosphate [Ortophosphate(PO4)]	mg/l	<3.0	<6.0	Method ICS 90	0.1	SMWW1995
17	Sulphide(S)	mg/l	<0.2	<1.0	To be clarified		
18	Sulphate(SO4)	mg/l	<300	<500	Method 4500-$SO4^{2-}$ B	0.1	SMWW1995-
19	Total Nitrogen(TN)	mg/l	-	-	Method JIS K 0102 45	0.01	JIS HANDBOOK Environmental Technology(Japan Standards Association)
20	Total Phosphorus(TP)	mg/l	-	-	Method JIS K 0102 46	0.01	JIS HANDBOOK Environmental Technology(Japan Standards Association)-
21	Total Coli form	MPN/100ml	-	-	Method NF T90-413	0	France Standards
22	Arsenic(As)	mg/l	<0.1	<1.0	Method 3500-As D	0.0001	Standard Method for Examination of Water and Wastewater (1995)
23	Barium (Ba)	mg/l	<4.0	<7.0	Method 3500-Ba C	0.0002	SMWW1955
24	Boron (B)	mg/l	<1.0	<5.0	To be clarified		
25	Cadmium(Cd)	mg/l	<0.1	<0.5	Method 3500-Cd C	0.0002	SMWW1955
26	Calcium (Ca)	mg/l	<150	<200	Method 3500-Ca C	NV	SMWW1955-
27	Chromium Hexavalent(Cr6)	mg/l	<0.05	<0.5	Method 3060 A	0.005	EPA, France Standards
28	Chromium (Cr3)	mg/l	<0.2	<1.0	To be clarified	0	
29	Copper(Cu)	mg/l	<0.2	<1.0	Method 3500-Cu C	0.0003	SMWW1955
30	Iron(Fe-total)	mg/l	<1.0	<20	Method 3500-Fe C	NV	SMWW1955

No	Parameter	Unit	Effluent Standards (MoE)		Analytical Method	Method LDL	Reference Method
			Protected Area	Public Area			
31	Lead(Pb)	mg/l	<0.1	<1.0	Method 3500-Pb C	0.0002	SMWW1955
32	Manganese (Mn)	mg/l	<1.0	<5.0	Method 3500-Mn C	0.0003	SMWW1955
33	Magnesium (Mg)	mg/l	<150	<200	Method 3500-Mg C	NV	SMWW1955
34	Mercury(Hg-total)	mg/l	<0.002	<0.005	Method ICP-MS	NV	JIS HANDBOOK Environmental Technology(Japan Standards Association)
35	**Mercury(Organic)**	mg/l			**To be clarified**		
36	Molybdenum (Mo)	mg/l	<0.1	<1.0	Method 3500-Mo C	NV	SMWW1955
37	Nickel(Ni)	mg/l	<0.2	<1.0	Method 3500-Ni C	0.0004	SMWW1955
38	Selenium (Se)	mg/l	<0.05	<0.5	Method 3500-Se I	0.0004	SMWW1955
39	Silver (Ag)	mg/l	<0.1	<0.5	Method 3500-Ag C	NV	SMWW1955
40	Zinc(Zn)	mg/l	<1.0	<3.0	Method 3500-Zn C	0.0004	SMWW1955
41	PCB	mg/l	<0.003	<0.003	To be clarified		
	Carbon Tetrachloride	µg/L	<3.0	<3.0	To be clarified		
	Hexachloro Benzene	µg/L	<2.0	<2.0	To be clarified		
	DDT	µg/L	<1.3	<1.3	To be clarified		
	Endrin	µg/L	<0.01	<0.01	To be clarified		
	Aldrin	µg/L	<0.01	<0.01	To be clarified		
	Isodrin	µg/L	<0.01	<0.01	To be clarified		
	Perchloro ethylene	µg/L	<2.5	<2.5	To be clarified		
	Hexachloro butadiene	µg/L	<3.0	<3.0	To be clarified		
	Chloroform	µg/L	<1.0	<1.0	To be clarified		
	1.2 Dichloro ethylene	µg/L	<2.5	<2.5	To be clarified		
	Trichloro ethylene	µg/L	<1.0	<1.0	To be clarified		
	Trichloro benzene	µg/L	<2.0	<2.0	To be clarified		
	Hexachloro cyclohexene	µg/L	<2.0	<2.0	To be clarified		
	Benzene	µg/L	-	-	To be clarified		

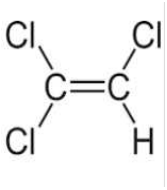
Support Document # 4　Prohibition of Chemical Penetration to underground

1. Industrial chemicals causing ground water pollution

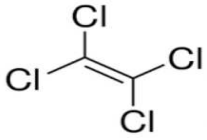
In most of the industrialized countries, Volatile Organic Chemicals (VOCs) caused many groundwater pollution cases. In 2015, Ministry of Environment of Japan had survey on groundwater pollution. Out of 7,589 cases, **2,489 cases were by Volatile Organic Chemicals (VOCs).** 95% of VOCs cases were by industrial pollution.

Typical VOCs are as followings.

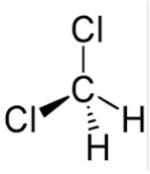
TCE　Trichloroethylene



PCE　Perchloroethylene



DCM (MC)　Dichloromethane,　Methylen Chlorid



They have following physical /chemical characteristics.

- Heavier than water (specific density > 1.0)
- Low viscosity
- Low solubility to water
- Slow degradation if exist in underground

Such characteristics make them easy to penetrate any crack or porous surface to underground. Then they penetrate into deep underground, stay on top of silt/clay layer and stay long time to gradually pollute groundwater. Once it happened, it is almost impossible to clean completely. Therefore prevention is the most important countermeasure.

These chemicals are used extensively as degreasing solvent in various industries such as Dry

cleaning, Metal fabrication, Precision machinery, Electronics/semiconductor, Electronics, Auto parts manufacturing.

2. Why it was happened. -Case study of Japan-

Ministry of Environment in Japan had studied why such pollution took places for 1,446 cases where industrial facilities were identified as pollution sources. Unfortunately 952 cases had unknown reasons due to the incident long time ago. However 494 cases had very few common reasons why it occurred as follows.

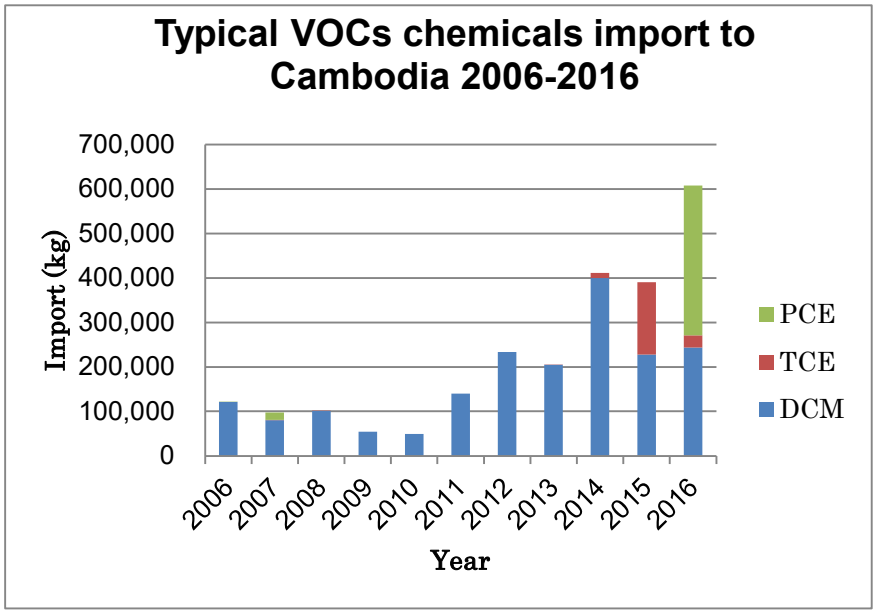
- Deterioration of facility (tank and pipe) and subsequent leakage (129 cases)
- Miss handling of chemicals (256 cases)
- Effluent discharge containing chemicals (120 cases)
- Wrong waste management (35 cases)

3. Current situation in Cambodia

Import statistics of typical VOCs were studied as following table and chart.

(unit: kg/year)

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
TCE		337	290					110	11,080	162,600	27,140
PCE	330	16,645									336,600
DCM	121,499	80,359	100,934	54,377	49,087	139,961	233,373	204,770	399,993	227,758	243,903
Total	121,829	97,341	101,224	54,377	49,087	139,961	233,373	204,880	411,073	390,358	607,643



From the study, it is obvious that the use of those VOCs chemicals are in upward trends and

requires cautions.

4. Measure to prevent groundwater pollution

As noted in the previous section of Japanese cases, groundwater pollution took place in few common reasons. In Japan, Water Pollution Control Law was amended in 1989 to include prohibition of underground penetration by hazardous chemicals.

Some of the cost effective measure to prevent the problems are as follows.

- Avoid underground storage and pipe.
- Place tray or seal the concrete surface by impermeable/chemical resistance resin around solvent handling location.
- Do not mix with domestic wastewater.
- Do not dump waste.

Thus it is proposed to amend the sub-decree for prohibition of underground penetration by hazardous chemicals.

Policy Discussion Paper #3

(Draft Proposal for revision)

Revision of

Water Pollution Control sub- decree

(for Industrial wastewater management)

February, 2018

Water Quality Management Department

GDEP/MoE

Policy Discussion Paper #3 (Draft Proposal for revision of Water Pollution Control Sub-Decree)

1. Purpose

Purpose of this paper is to review the existing rule and regulation on the area of industrial wastewater control and to identify the need of revision and amendment or to set up new sub-decree.

2. Scope

For the purpose of focused discussion, "Industrial" means "of business activities" which is separated from "Domestic" or "Household", and "Industrial Wastewater" means those wastewater discharged from the pipe of point sources. Pollution from non-point source requires different approach to control, and hence we will not include them on this paper.

3. Sub-decree reviewed

No. 27 ANRK. BK, Phnom Penh, April 06, 1999 "Water Pollution Control"

4. Work process and schedule

The draft proposal for revision of Water Pollution Control Sub-Decree presented in this paper has been prepared under the following process with due consideration to take the opinion of the stakeholders.

(1) To develop and discuss the Policy Discussion Paper #1 (Issues identification)

- 1st Task Force meeting of GDEP/ MoE (Oct. 2, 2017)
- 1st Consultation meeting with Institute of Technology, Cambodia (Sept. 7, 2017)
- 1st Consultation meeting with Cambodian Chamber of Commerce(Sept.28,2017)

(2) To develop and discuss the Policy Discussion Paper #2 (Approach and criteria for revision)

- 2nd Task Force meeting of GEDP/MoE with observers from MIH and CDC (Nov. 29, 2017)
- 2nd Consultation meeting with Institute of Technology, Cambodia, Cambodia Chamber of Commerce, Garment Manufacturer's Association of Cambodia (Dec.1,2017)

The draft presented in this paper will be discussed at 3rd Task Force meeting and 3rd Consultation meeting planned in February 2018. Opinion from the meetings will be used to revise the current draft revision and to prepare the final draft before July, 2018. Thereafter the revision will be proceeded to revise the current sub-decree according to the government procedures.

5. Support documents:

Justification and/or detail of the revision were discussed and elaborated in the separate documents as follows.

a. Support document #1 Revision of Pollution Sources ANNEX 3

The document discussed revision of pollution sources in the current sub-decree Annex 3. Major contents of the proposed revision are as follows.

- Define the business category by using International Standard Industrial Classification Revision 4.
- Include the real pollution sources identified by IPPS (industrial Pollution Projection System) by World Bank, and Cambodian Economic Census data 2011.
- Include the pollution sources not exist but expected in near future in Cambodia
- Categorize pollution sources into three for the threshold for SMEs

This will be attached as Annex to the sub-decree or established as separate Prakas.

b. Support document #2 Deletion of Prohibited/Restricted Substance ANNEX 2

The document clarifies the current status of 9 substances listed in effluent standards in the current sub-decree. As it is unlikely that the pollution sources use such substances, it is proposed to delete them from the list.

c. Support document #3 Method of analysis for standard parameters (interim summary)

The document is provisional status to define the analytical method for the parameters listed in effluent and environmental quality standard. Once finalized, this will be attached as Annex to the sub-decree or established as separate Prakas.

d. Support document #4 Prohibition of Chemical Penetration to underground

The document provided justification to include new regulation to protect groundwater. Japanese case study was cited as basis of justification. Separate guideline may be developed.

e. Support document #5 Review of effluent and environmental quality standard - Justification of parameters –

Current parameters were reviewed by comparing with WHO drinking water guideline, Cambodian drinking water standard and Japanese standard. Approach is to improve consistency between effluent standard and environmental quality standard, but not by simply expanding the list.

f. Support document #6 Review of environmental quality standard and effluent standard - Concentration level -

The document is continuation of the Support Document #5. The parameters revised in the Support Document #5 were reviewed for the concentration level by comparing with Japanese effluent standard, Industry benchmark value (from IFC (International Financial Corporation) Industrial sector guidebook). Logical relation between effluent standard and environmental quality standard was also take into consideration. Proposed list included identification of all parameters using CAS (Chemical Abstract Service) number. This will be attached as Annex to the sub-decree or established as separate Prakas

g. Support document #7 Threshold water volume to define SMEs

The document provided data of water used by business and its volume-wise distribution. The data were

analyzed to set the threshold value to define SMEs. The values considered for SMEs threshold were reflected in the list of pollution sources and categorization.

h. Support document #8 Technical requirement for laboratory registration
The document is to define the registration requirement for the private laboratories. This will be established as separate Prakas. The document is still under preparation

i. Support document #9 Guideline for charging fine for violation
The document elaborated more effective application of fine for the violation, this will be established as separate Prakas.

6. Proposed revision

Proposed revision of sub-decree as attached.

No: 27 ANRK.BK 1999

Sub-decree on Water Pollution Control

Sub-decree	Proposed revision
CHAPTER 1 General provisions	
Article 1 : The purpose of this sub-decree is to regulate the water pollution control in order to prevent and reduce the water pollution of the public water areas so that the protection of human health and the conservation of bio-diversity should be ensured.	
Article 2: This sub-decree applies to all sources of pollution and all activities that cause pollution of the public water areas.	
Article 3: Technical terms used in this sub-decree shall have the meaning ascribed there to: a. Public water areas refer to water areas that are for public use such as: tonle, stung (rivers), stream, gully, lake, pond, well, sea, peam (river mouth) and include canal irrigation system and other waterways that are for public use and ground water; b. Source of pollution refers to any type of places such as dwelling house, public administrative building, premise, transport facilities, business areas or service places from which effluent, pollutants or hazardous substances are directly or indirectly discharged into public water areas or public drainage systems; c. Wastewater refers to water discharged from any source of pollution into public water areas or public drainage systems either it is treated or untreated;	**Article 3**: Technical terms used in this sub-decree shall have the meaning ascribed there to: a. Public water areas refer to water areas that are for public use such as: tonle, stung (rivers), stream, gully, lake, pond, well, sea, peam (river mouth) and include canal irrigation system and other waterways that are for public use and ground water; b. Source of pollution refers to any type of places such as dwelling house, public administrative building, premise, transport facilities, business areas or service places from which effluent, pollutants or hazardous substances are directly or indirectly discharged into public water areas or public drainage systems; c. Wastewater refers to water discharged from any source of pollution into public water areas or public drainage systems either it is treated or untreated; d. Sewage refers to a contaminated water discharged from dwellings and

d. Sewage refers to a contaminated water discharged from dwellings and public building. e. Solid waste refers to disable used substances or objects that are disposed of from pollution source; f. Garbage refers to disable use substances or objects that are disposed of from dwellings and public buildings; g. Pollutant refers to solid or liquid or gaseous substances or all kind of wastes that cause any changes of component or characteristic of water such as physical, chemical or biological when it is intentionally or unintentionally released into the water (public water areas). h. Pollution load refers to the load or the content of pollutant and heat containing in wastewater released from any sources of pollution into public water areas or public drainage systems; i. Hazardous substances refer to any substances that cause danger to living organisms, damage or break down any objects or building or adversely impact and damage the environment. The type of hazardous substances are listed in the Annex 1 of this sub -decree.	public building. e. Solid waste refers to disable used substances or objects that are disposed of from pollution source; f. Garbage refers to disable use substances or objects that are disposed of from dwellings and public buildings; g. Pollutant refers to solid or liquid or gaseous substances or all kind of wastes that cause any changes of component or characteristic of water such as physical, chemical or biological when it is intentionally or unintentionally released into the water (public water areas). h. Pollution load refers to the load or the content of pollutant and heat containing in wastewater released from any sources of pollution into public water areas or public drainage systems; i. Hazardous substances refer to any substances that cause danger to living organisms, damage or break down any objects or building or adversely impact and damage the environment which is listed under ministerial regulation. j. Transport of wastewater refer to transport of night soil from septic tank by truck or piped transportation of wastewater to treatment facility.
CHAPTER 2 **Provisions on waste and hazardous discharge**	
Article 4 : Standards for effluent discharge from any sources of pollution shall be specified in the annex 2 of this sub-decree.	Standards for effluent discharge from any sources of pollution shall be specified in separate Prakas of the Ministry of Environment.
Article 5: In the necessary cases or in response to the requirement of each area for the purpose of human health protection and the conservation of bio-diversity, the Ministry of Environment shall set up separated standard for effluent discharge for sources of pollution, that are located around the public water area. The separated standard for effluent discharge as mentioned in the first paragraph of	

the article 5 of this sub-decree shall be specified by the Prakas of the Ministry of Environment.	
Article 6 : The discharge of waste water from any sources of pollution that is not consistent with the standards for effluent discharge as mentioned in the article 4 and article 5 of this sub-decree shall be strictly prohibited.	
Article 7 : In order to ensure the human health protection and bio-diversity conservation, the Ministry of Environment shall establish the standard of pollution load contained in liquid waste that could be allowed to be released from any sources of pollution into designated protected public water areas. The pollution load standard as mentioned in the paragraph 1 of the article 7 of this sub-decree shall be stated by the Prakas of the Ministry of Environment.	Article 7: In order to ensure the human health protection and bio-diversity conservation, the Ministry of Environment can establish the control measures of pollution load contained in liquid waste that could be allowed to be released from any sources of pollution into designated protected public water areas. The pollution load standard as mentioned in the paragraph 1 of the article 7 of this sub-decree shall be stated by the Prakas of the Ministry of Environment.
Article 8: The disposal of solid waste or any garbage or hazardous substances into public water areas or into public drainage system shall be strictly prohibited. The storage or disposal of solid waste or any garbage and hazardous substances that lead to the pollution of water of the public water areas shall be strictly prohibited.	**Article 8:** The disposal of solid waste or any garbage containing hazardous substances into public water areas or into public drainage system shall be strictly prohibited. The improper storage or disposal of solid waste or any garbage and hazardous substances that lead to the pollution of water of the public water areas shall be strictly prohibited. The Ministry of Environment shall establish the guidelines for storage and handling of specific hazardous substances to prevent groundwater pollution.
Article 9: The discharge of sewage from dwelling and public buildings in to public water areas without passing through public sewerage systems or other treatment systems shall be strictly prohibited.	To be removed. (as handled by another sub-decree of sewage management)
CHAPTER 3: Effluent discharge permit	
Article 10: The discharge or transport of wastewater from any sources of pollution to other places for any purpose is subject to prior permit from the Ministry of	**Article 10**: The discharge or transport of wastewater from any sources of pollution to other places for any purpose is subject to prior permit from the Ministry of

Environment. The application for this permit shall be copied to the concerned ministries or agencies.	Environment. The application for this permit shall be copied to the concerned ministries or agencies. The application procedure for this permit shall be specified by the Prakas of the Ministry of Environment.
Article 11: The types of any sources of pollution that shall be required to have a permit from the Ministry of Environment before discharging or transporting their effluent to other places as mentioned in the article 10 of this sub-decree shall be listed in the annex 3 of this sub-decree and are classified into two following categories: a. The sources of pollution of category I that are subject to the prior permit from the Ministry of Environment when the amount of their effluent exceed ten cubic meter per day (10 M^3 /day) but not including the amount of water volume used for cooling the engine. b. The sources of pollution of category II that shall be necessarily required to apply for the permission from the Ministry of Environment.	**Article 11**: The types of any sources of pollution that shall be required to have a permit from the Ministry of Environment before discharging or transporting their effluent to other places as mentioned in the article 10 of this sub-decree shall be listed in the Prakas are classified into two following categories: a. The sources of pollution of category I that are subject to the prior permit from the Ministry of Environment when the amount of their effluent exceed ten cubic meter per day (10 M^3 /day) but not including the amount of water volume used for cooling the engine. b. The sources of pollution of category III that shall be necessarily required to apply for the permission from the Ministry of Environment. Type of pollution sources required having a permission from the Ministry of Environment shall be specified by the Prakas of the Ministry of Environment.
Article 12: Permit requirement for discharge or transportation of effluent to other places as stipulated in the article 10 of this sub-decree shall apply to either the new sources of pollution project or to existing sources of pollution except any new project of pollution source that environmental impact assessment report of which has been approved may be exempt from the requirement of permit for discharge or transportation of effluent to other places.	**Article 12**: Permit requirement for discharge or transportation of effluent to other places as stipulated in the article 10 of this sub-decree shall apply to either the new sources of pollution project or to existing sources of pollution. ~~Deleted (except any new project of pollution source that environmental impact assessment report of which has been approved may be exempt from the requirement of permit for discharge or transportation of effluent to other places.)~~
Article 13: The owner or responsible person of the pollution source as mentioned in the article 11 of this sub-decree that intend to release or transport his/her effluent to other place shall be apply for permit to the Ministry of Environment: - Forty days (40 days), before the beginning of the functioning, for the new source	**Article 13:** The owner or responsible person of the pollution source as mentioned in the article 11 of this sub-decree that intend to release or transport his/her effluent to other place shall be apply for permit to the Ministry of Environment **with fully submitting the required application document and accepted by the Ministry of**

of pollution located in Phnom Penh, and sixty days (60 days) for the new source of pollution located in provinces and cities. - Within thirty days (30 days), after being required by the Ministry of Environment, for existing source of pollution located in Phnom Penh, and forty days (40 days) for the new source of pollution located in provinces and cities.	**Environment:**
Article 14: The effluent discharge or transportation permit from pollution source to other places could be provided if the application form meets the required technical guidelines determined by the Ministry of Environment.	**Article 14:** The effluent discharge or transportation permit from pollution source to other places could be provided if the application form meets the required technical guidelines determined by the Ministry of Environment. For those who constructed and is operating wastewater facility based on approved Environmental Impact Assessment report will be given the permit on preferential basis.
Article 15: The owner or person responsible for the source of pollution that is holder of permit from the Ministry of Environment for discharge or transportation of effluent to other places and that have intention to modify the effluent discharge system shall reapply for the new permit to the Ministry of Environment within thirty days (30 days) before beginning the modification.	**Article 15:** The owner or person responsible for the source of pollution that is holder of permit from the Ministry of Environment for discharge or transportation of effluent to other places and that have intention to modify the effluent discharge system shall reapply for the new permit to the Ministry of Environment within thirty days (30 days) before beginning the modification., with fully submitting the required application document and accepted by the Ministry of Environment.
Article 16: Person that take on lease or ownership of source of pollution from the previous owner or the previous responsible person who already obtained the discharge or transportation permit from the Ministry of Environment shall continue to comply with criteria points described in the application form that was submitted to the Ministry of Environment. The new owner or responsible person shall inform the Ministry of Environment about the lease or such possession within thirty days (30 days) after taking on lease or ownership.	**Article 16:** Person that take on lease or ownership of source of pollution from the previous owner or the previous responsible person who already obtained the discharge or transportation permit from the Ministry of Environment shall continue to comply with criteria points described in the application form that was submitted to the Ministry of Environment. The new owner or responsible person shall inform the Ministry of Environment about the lease or such possession within thirty days (30 days) after taking on lease or ownership with fully submitting the required document and accepted by the Ministry of Environment.
Article 17: The permit of the discharge or transportation of effluent that is	**Article 17:** The permit of the discharge or transportation of effluent that is provided

provided to the owner or responsible person of pollution source could be revoked temporarily or definitively by the Ministry of Environment after consultation with other concerned ministries or agencies, if they violate seriously the article14, 15 and 16 of this sub-decree.	to the owner or responsible person of pollution source could be revoked temporarily or definitively by the Ministry of Environment if they violate the article 6, or violate seriously the aricles 14, 15 and 16 of this sub-decree, or any condition specified in discharge permit, or cause pollution in public water area
CHAPTER 4 Monitoring of the pollution sources	CHAPTER 4 Monitoring and control of the pollution sources
Article 18: The monitoring on the discharge or transportation of effluent from any sources of pollution is the responsibility of the Ministry of Environment.	**Article 18:** The monitoring and control on the discharge or transportation of effluent from any sources of pollution is responsibility of the Ministry of Environment by the inspection procedures stipulated in article 30,31,32,33 and 34. Ministry of Environment shall specify the requirement for the recording as specified in Article 19.
	Article 19 The owner or responsible person of pollution sources shall monitor the discharge or transportation of effluent and shall record monitoring data including effluent concentration of the regulated parameters as well as discharge or transport volume and shall submit to the Ministry of Environment during inspection or whenever requested.
Article 19: The Ministry of Environment shall take sample at every discharge point of pollution sources. The owner or responsible person of pollution sources shall collaborate with and facilitate the environmental official to take sample while carrying out their technical task.	Article 20
Article 20: The analysis of effluent samples taken from any pollution sources during the monitoring or inspection shall be done in the Laboratory of the Ministry of Environment.	**Article 21:** The analysis of effluent samples taken from any pollution sources during the monitoring or inspection shall be done in the Laboratory of the Ministry of Environment, or in the Laboratory as stipulated in article 22.
Article 21: The owner or responsible person of pollution sources shall bear the cost of the analysis of his/her own wastewater sample following the tariff	**Article 22:** The owner or responsible person of pollution sources shall bear the cost of the analysis of his/her own wastewater sample following the tariff determined by

determined by the Ministry of Environment and the Ministry of Economy and Finance. This income shall be included into the national budget in order to allocate to the Environmental Endowment Fund Account.	the Ministry of Environment and the Ministry of Economy and Finance. The Ministry of Environment shall set the tariff in the separate Prakas. This income shall be included into the national budget in order to allocate to the Environmental Endowment Fund Account.
Article 22: The owner or responsible person of pollution sources may ask to have his/her effluent sample tested in other public or private laboratories which are recognized formally and such laboratories carry out the same analytical method those used in the Ministry of Environment.	**Article 23:** The owner or responsible person of pollution sources may ask to have his/her effluent sample tested in other public or private laboratories which shall be registered by the Ministry of Environment. The procedures for application and technical requirement for the registration of laboratory shall be specified by the Prakas of the Ministry of Environment.
Article 23: The owner or responsible person of the pollution sources as stipulated in the article 11 of this sub-decree shall: **a.** be responsible for determining the method of the treatment and the discharge of their effluent so that it responds to the effluent standard as stipulated in the article 4 and article 5 of this sub-decree as well as the standard of pollution load as stipulated in the article 7 of this sub-decree; **b.** have enough facilities and means to prevent the pollution of the public water area when there is eventual danger caused from his/her pollution source; c. hold the responsibility for installing an equipment for measurement of flow, concentration and amount of pollutant contained in his/her effluent and also keep the result for record keeping.	**Article 24:** The owner or responsible person of the pollution sources as stipulated in the article 11 of this sub-decree shall: **a.** be responsible to comply the effluent standard as stipulated in the article 4 and article 5 of this sub-decree as well as the standard of pollution load as stipulated in the article 7 of this sub-decree. **b.** be responsible for determining the method of the treatment and the discharge of their effluent so that it responds to the effluent standard in the article 4 and article 5 of this sub-decree as well as the standard of pollution load as stipulated in the article 7 of this sub-decree. **c.** have enough facilities and means to prevent the pollution of the public water area when there is eventual danger caused from his/her pollution source; d. hold the responsibility for installing an equipment for measurement of flow, concentration and amount of pollutant contained in his/her effluent and also keep the result for record keeping. The technical requirement for self-monitoring equipment and pollution source required self-monitoring shall be specified by the Prakas of the Ministry of Environment.
Article 24: Even if it is found out that the discharge of effluent from any pollution	**Article 25**: Even if it is found out that the discharge of effluent from any pollution

source do not respond to the effluent standard as stipulated in the article 4 and article 5 or is not in consistence with the pollution load standard as stipulated in the article 7 of this sub-decree, the Ministry of Environment shall: a. issue a written order requiring the owner or responsible person of such pollution source to correct the violation activities immediately within a specified time period, if that activity has not caused a harmful impact to human health or an adverse effect to the water quality yet; b. issue a written order requiring the owner or responsible person of such pollution source to stop his/her activities temporarily until the violation is corrected, if that activities cause an adverse impact to human health and water quality.	source do not respond to the effluent standard as stipulated in the article 4 and article 5 or is not in consistence with the pollution load standard as stipulated in the article 7 of this sub-decree, the Ministry of Environment shall: a. issue a written order requiring the owner or responsible person of such pollution source to correct the violation activities immediately within a specified time period, if that activity has not caused a harmful impact to human health or an adverse effect to the water quality yet; b. issue a written order requiring the owner or responsible person of such pollution source to stop his/her activities permanently or temporarily until the violation is corrected, if that activities cause an adverse impact to human health and water quality. c. issue a written order requiring the owner or responsible person of such pollution source to clean up the public water area polluted by the activities as prescribed in the article 20 of Law on Environmental Protection and Natural Resource Management. d. Take any other measures necessary to avoid/reduce water pollution in public water areas.
CHATER 5 Water Pollution Monitoring in Public Water Areas	
Article 25: The water quality standards of public water areas for the purpose of the conservation of the bio-diversity is stipulated in the Annex 4 of this sub-decree. The water quality standards of public water areas for the purpose of the protection of the public health is stipulated in the Annex 5 of this sub-decree.	**Article 26:** The water quality standards are target of environmental administration to be achieved by the measure prescribed in the sub-decree. The water quality standards of public water areas for the purpose of the conservation of the bio-diversity is stipulated in the Annex 4 of this sub-decree. The water quality standards of public water areas for the purpose of the protection of the public health is stipulated in the Prakas.
Article 26: The Ministry of Environment shall regularly control and monitor the situation of the water pollution at public water areas throughout the Kingdom of	**Article 27**: The Ministry of Environment shall regularly control and monitor the situation of the water pollution at public water areas throughout the Kingdom of

Cambodia in order to take measure to prevent and reduce the water pollution in public water areas.	Cambodia. The Ministry of Environment shall establish a water quality management plan if serious pollution were found in the specified public water areas in order to take measure to prevent and reduce the water pollution.
Article 27: The Ministry of Environment shall manage data relating result of the water quality testing and to assess the status of the quality of public water areas throughout the Kingdom of Cambodia.	Article 28
Article 28: The Ministry of Environment shall disseminate publicly the status of the water quality and the situation of the pollution of public water areas of the Kingdom of Cambodia.	**Article 29**: The Ministry of Environment shall disseminate publicly the status of the water quality and the situation of the pollution of public water areas of the Kingdom of Cambodia by publishing the annual report and by internet web disclosure using geographical information.
Article 29: Even if it is fount that any public water areas is suffering of pollution which could threaten human life or bio-diversity the Ministry of Environment shall immediately notify the public about this danger and shall take measure to prevent the water pollution and to restore the water quality of such public water areas.	**Article 30**: Even if it is fount that any public water areas is suffering of pollution which could threaten human life or bio-diversity the Ministry of Environment shall immediately notify the public about this danger and shall take measure to prevent the water pollution and to restore the water quality of such public water areas.
CHATER 6 Inspection Procedure	
Article 30: The Ministry of Environment's inspectors, while conducting environmental inspection, shall complied with the following procedures: a. To present his / her identity card and mission letter while entering into the premise or any site of point source of pollution for conducting inspection or taking sample or for checking record; b. Primary record and report of the inspection or sample taking shall be done at the site of inspection with participating from any witness if necessary; c. The inspectors may ask question and require the owner of the source of pollution to provide them with information and other relevant documents which are used for report making and for evidence;	Article 31

d. One copy of record or report shall be given to the owner or the responsible person of the source of pollution and one copy to the representatives of concerned ministries (who collaborate with) and other one copy shall be kept at the Ministry of Environment.	
Article 31: Where if there is complaint or report that any source of pollution discharges effluent containing substance which cause danger to animal or human health or public property or causes pollution to any public water area, the Ministry of Environment, in collaboration with concerned ministries, may enter the site of this source of pollution and conduct inspection and take sample for testing.	Article 32
Article 32: In the case of serious accident or imminent danger resulting from pollution at public water area, the Ministry of Environment shall make urgent inspection on the above problem and shall inform the concerned ministries and local authority.	**Article 33:** In the case of serious accident or imminent danger resulting from pollution at public water area, the Ministry of Environment shall make urgent inspection on the above problem and shall inform the concerned ministries and local authority.
Article 33: In the case of clear offense that cause water pollution, the inspector of the Ministry of Environment shall: a. take statement, collect and detain evidence of such offense and make an administrative fine, if the offense has not contaminated seriously water, human health, animal, plants or public properties yet; b. collect and detain evidence of such offense for making statement and forward the case file to the competent agency, if this violation causes serious pollution of water or injure to human health, animal, plants or public properties.	**Article 34:** In the case of clear offense that cause water pollution, the inspector of the Ministry of Environment shall: a. take statement, collect and detain evidence of such offense and make an administrative sanction including fine, if the offense has not contaminated seriously water, human health, animal, plants or public properties yet; b. collect and detain evidence of such offense for making statement and forward the case file to the competent agency, for criminal sanction, if this violation causes serious pollution of water or injure to human health, animal, plants or public properties. c. apply immediately the penalty stipulated in relevant law if this violation causes serious pollution of water or injure to human health, animal, plants or public properties Seriousness of pollution shall be judged by the comparison of water quality of surrounding area of the pollution source in question with

	the environmental quality standards.
CHAPTER 7 Penalty	
Article 34: Violations of this Sub-degree shall be fined and punished according to the articles 20, 21, 22, 23 and the article 25 of the chapter 9 of the Law on Environmental Protection and Natural Resource Management. (for reference) (Law on Environmental Protection and Natural Resource Management) ARTICLE 20: Any person who violates the rule of the Ministry of Environment as stated in the article 14 of this law, this Ministry shall issue a written order requiring such person to: - stop his/her/its activities, until the offence is corrected; or - correct his/he/its offending activities immediately or within a specified period; or - clean up immediately the pollution. ARTICLE 21: Any person who refuses to allow access or obstructs the inspection officials from entering to examine or carry out an inspection inside the premise as provided for in the para.1 of the article 15 of this law, shall be subject to an administrative fine in cash from 500,000 (five hundred thousand) to 1,000,000 (one million) riels. In case of repeated offenses, shall be penalized a fine of 1,000,000 (one million) riels to 5,000,000 (five million) riels or shall be punished to imprisonment from 1 month to 3 months or to both punishments.	**Article 35**: Violations of this Sub-degree shall be fined and punished according to the articles 20, 21, 22, 23 and the article 25 of the chapter 9 of the Law on Environmental Protection and Natural Resource Management.

Any person who violate the article 20 of this law, shall be subject to administrative fine in cash of 1000,000 (one million) riels to 10,000,000 (ten million) riels. In case of repeated offenses, shall be penalized a fine from 21,00,000 (twenty-one million) riels to 30,000,000 (thirty million) riels or shall be subject to punishment to imprisonment from 1 (one) month to 1 (one) year, or to both punishments. ARTICLE 22: If the commission of an offence causes harm to physical body or human life, private or public property, environment or natural resources of the State, shall be subject to a fine penalty of 10,000,000 (ten million) to 50,000,000 (fifty million) riels or shall be subject to punishment of 1 (one) year to 5 (five) years in prison or to both punishments. Any person who commits offence shall additionally be liable for repairing damage or compensation. ARTICLE 23: In case of an offence which causes serious dangers to the society, the court may consider on the circumstance of the gravity of the offence to combine with any of the offenses above to pronounce a sentence. ARTICLE 25: The Ministry of Environment shall comply with the provisions of the article 20 above, for any person who violates the Sub-decree and In case of recalcitrant, the provision of the article 21 of this law, shall be applied.	Article 36: Administrative fine as stipulated in article 21 and 22 of the Law on Environmental Protection and Natural Resources Management will be applied, a. as one time fine if the violation is temporally. b. as daily fine for the duration of violation period if the violation is continuous or repeated.
Article 35: The Ministry of Environment's official is responsible for making a report of prosecution for any person who violates any article of this sub-decree. The Ministry of Environment shall take legal action against any offense of this sub-decree.	Article 37
Article 36: Any environmental inspection official or agent who is negligent, fails to pay attention to, or fails to comply with the Ministry's regulations, or conspires	**Article 38**: Any environmental inspection official or agent who is negligent, fails to pay attention to, or fails to comply with any articles of this sub-decree, or conspires

with a violator or facilitates the commission of a violation, shall be subject to administrative sanction or face prosecution before the court.	with a violator or facilitates the commission of a violation, shall be subject to administrative sanction or face prosecution before the court.
CHAPTER 8 Final provisions	
Article 37: Any provision contrary to this sub-decree shall be annulled.	Article 39
Article 38: The minister in charge of the cabinet of the council of Ministers, Minister of Environment and concerned institutions shall implement this Sub-decree according to their duty.	Article 40
Article 39: This sub-decree shall be in force from the date of its signature.	**Article 41:** From the time after this Sub-decree is entering into force until the Prakas on the Article -----of this Sub-decree enters into force, the Royal Government may postpone the enforcement of this Sub-decree.
Annex 1 Type of the hazardous substances	To be deleted
Annex 2 Effluent standard for pollution sources discharging wastewater to public water areas or sewer ***Remark***: The Ministry of Environment and the Ministry of Agriculture, Forestry and Fishery shall collaborate to set up the standard of pesticides which discharged from pollution sources **(standards for Protected public water area and Public water area and sewer)**	**Annex 1 Effluent standard for pollution sources discharging wastewater to public water areas or sewer** (to be replaced by separate Prakas) ***Remark***: The Ministry of Environment and the Ministry of Agriculture, Forestry and Fishery shall collaborate to set up the standard of pesticides which discharged from pollution sources **(standards for Protected public water area and Public water area and sewer)** Method of analysis for water and wastewater (to be added as separate Prakas)
Annex 3 Type of pollution sources required having a permission from Ministry of Environment before discharging or transporting their wastewater	(Annex 3 to be replaced by separate Prakas)
Annex 4 Water Quality Standard in public water areas for bio-diversity conservation	To be kept or by separate Prakas
Annex 5 Water Quality Standard in public water areas for public health protection	(Annex 5 to be replaced by separate Prakas)

Following tables shall be set as separate Prakas.

Proposed new list of effluent standard as Annex 1

	Parameters (CAS No.)	Unit	Effluent standard		
			Protected public water area	Public water area	Sewer
1	Temperature	Degree C	<45	<45	<45
2	pH		6-9	5-9	5-9
3	BOD5 (5days at 20c)	mg/l	30	80	240
4	COD	mg/l	50	120	360
5	TSS	mg/l	50	80	240
6	Grease and oil	mg/l	5	15	50
7	Nitrate (NO3) (13797-55-8)	mg/l	50	100	300
8	Cyanide (CN) (57-12-5)	mg/l	0.1	0.5	1
9	Barium (Ba) (7440-39-3)	mg/l	4.0	7.0	14
10	Arsenic (As) (7440-38-2)	mg/l	0.1	1.0	2
11	Iron (Fe) (7439-89-6)	mg/l	1.0	20	40
12	Boron (B) (7440-42-8)	mg/l	1.0	5.0	10
13	Manganese (Mn) (7439-98-5)	mg/l	1.0	5.0	10
14	Cadmium (Cd) (7440-43-9)	mg/l	0.05	0.3	0.6
15	Chromium valent 6 (Cr+6) (18540-29-9)	mg/l	0.05	0.5	1
16	Copper (Cu) (744-50-8)	mg/l	0.2	1.0	2
17	Lead (Pb) (7439-92-1)	mg/l	0.1	1.0	2
18	Mercury (Hg) (7439-97-6)	mg/l	0.002	0.005	0.01
19	Nickel (Ni) (7440-02-0)	mg/l	0.2	1.0	2
20	Selenium (Se) (7782-49-2)	mg/l	0.05	0.5	1
21	Zinc (Zn) (7440-66-6)	mg/l	2.0	6	12
22	Ammonia (NH3) (7664-41-7)	mg/l	5.0	7.0	14
23	Perchloroethylene(127-18-4)	mg/l	1.0	1.0	2
24	Hexachloro butadien (87-68-3)	mg/l	0.01	0.01	0.02
25	Chloroform(67-66-3)	mg/l	1	1	2
26	cis 1,2 Dichloroethylene(156-59-2)	mg/l	2.5	2.5	5
27	Tricholoroethylene(79-01-6)	mg/l	1	1	2
28	Benzene (71-43-2)	mg/l	0.05	0.1	0.2
29	Dichoromethane (75-09-2)	mg/l	0.01	0.2	0.4

Proposed new list of Pollution sources requires Discharge Permit Annex 3

Categories	**ISIC**	**Category**	**No. current sub-decree**
Division 01 Group 014 Animal production	0141 Raising of cattle and buffaloes 0142 Raising of horses and other equines 0144 Raising of sheep and goats 0145 Raising of swine/pigs 0146 Raising of poultry 0149 Raising of other animals	I	19,20
Division 03 Group 032 Aquaculture	0321 Marin fishing 0322 Freshwater aquaculture	I	3,67
Division: 10- Manufacture of food products	1010 Processing and preserving of meat 1020 Processing and preserving of fish, crustaceans and molluscs 1030 Processing and preserving of fruit and vegetables 1040 Manufacture of vegetable and animal oils and fats 1050 Manufacture of dairy products 1061 Manufacture of grain mill products 1062 Manufacture of starch & starch products 1071 Manufacture of bakery products 1072 Manufacture of sugar 1073 Manufacture of cocoa, chocolate and sugar confectionery 1074 Manufacture of macaroni, noodles, couscous and similar farinaceous products 1075 Manufacture of prepared meals and dishes 1079 Manufacture of other food products n.e.c 1080 Manufacture of prepared animal feeds	I	1,2,4,5,6,11,12,13,14,
Division: 11- Manufacture of beverages	1101 Distilling, rectifying and blending of spirits 1102 Manufacture of wines 1103 Manufacture of malt liquors and malt 1104 Manufacture of soft drinks; production of mineral waters and other bottled water	I	7,9,10

Division: 12- Manufacture of tobacco product	1200 Manufacture of tobacco products	I	15
Division: 13- Manufacture of textiles	1311 Preparation and spinning of textile fibers 1312 Weaving of textiles 1313 Finishing of textiles 1391 Manufacture of knitted and crocheted fabric 1392 Manufacture of made-up textile articles, except apparel 1393 Manufacture of carpets and rugs 1394 Manufacture of cordage, rope, twine and netting 1399 Manufacture of other textile n.e.c	I	16,27,41
Division: 14- Manufacture of wearing apparel	1410 Manufacture of wearing apparel, except fur apparel 1420 Manufacture of articles of fur 1430 Manufacture of knitted and crocheted apparel	I	16,42
Division: 16- Manufacture of wood and products of wood	1610 Sawmilling and planning of wood 1621 Manufacture of veneer sheets and wood-based panels 1622 Manufacture of builders' carpentry and joinery 1623 Manufacture of wooden containers 1629 Manufacture of other products of wood; manufacture of articles of cork, straw and plaiting materials	I	32,66
Division: 17-Manufacture of paper and paper products	1701 Manufacture of pulp, paper, and paperboard 1702 Manufacture of corrugated paper and paperboard and of containers of paper and paperboard 1709 Manufacture of other articles of paper and paperboard	I	43
Division: 18- Printing and reproduction for recorded media	1811 Printing 1812 Service activities related to printing 1820 Reproduction of recorded media	I	44
Division: 23- Manufacture of	2310 Manufacture of glass and glass products	I	8,28,29,34

other non-metallic mineral products	2391 Manufacture of refractory products 2392 Manufacture of clay building materials 2393 Manufacture of other porcelain and ceramic products 2394 Manufacture of cement, lime and plaster 2395 Manufacture of articles of concrete, cement and plaster 2396 Cutting, shaping and finishing of stone 2399 Manufacture of other non-metallic mineral product n.e.c		
Division: 28- Manufacture of machinery and equipment n.e.c.	2811 Manufacture of engines and turbines, except aircraft, vehicle and cycle engines 2812 Manufacture of fluid power equipment 2813 Manufacture of other pumps, compressors, taps and valves 2814 Manufacture of bearings, gears, gearing and driving elements 2815 Manufacture of ovens, furnaces and furnace burners 2816 Manufacture of lifting and handling equipment 2817 Manufacture of office machinery and equipment (except computers and peripheral equipment) 2818 Manufacture of power-driven hand tools 2819 Manufacture of other general-purpose machinery 2821 Manufacture of agriculture and forestry machinery 2822 Manufacture of metal-forming machinery and machine tools. 2823 Manufacture of machinery for metallurgy 2824 Manufacture of machinery for mining, quarrying and construction 2825 Manufacture of machinery for food, beverage and tobacco processing 2826 Manufacture of machinery for textile, apparel and leather production	I	

	2829 Manufacture of other special-purpose machinery		
Division: 31- Manufacture of furniture	3100 Manufacture of furniture	I	
Division: 32- Other manufacturing	3211 Manufacture of jewellery, bijouterie and related articles 3212 Manufacture of imitation jewellery and related articles 3220 Manufacture of musical instruments 3230 Manufacture of sports goods 3240 Manufacture of games and toys 3250 Manufacture of medical and dental instruments and supplies 3290 Other manufacturing n.e.c	I	
Division: 33- Repair and installation of machinery and equipment	3311 Repair of fabricated metal products 3312 Repair of machinery 3313 Repair of electronic and optical equipment 3314 Repair of electrical equipment 3315 Repair of transport equipment, except motor vehicles 3319 Repair of other equipment 3320 Installation of industrial machinery and equipment	I	
Division 35 Electricity, gas steam and air conditioning supply	3510 Electrical power generation, transmission and distribution 3520 Manufacture of gas; distribution of gaseous fuels through mains	I	65
Division 37 Sewerage	3700 Sewerage	I	25
Division: 38- Waste collection, treatment and disposal activities; material recovery	3811 Collection of non-hazardous waste 3812 Collection of hazardous waste 3821 Treatment and disposal of non-hazardous waste 3822 Treatment and disposal of hazardous waste 3830 Materials recovery	I	40,60,61, 62,63
Division 46 Wholesale trade, except of motor vehicle and	4661 Wholesale of solid, liquid and gaseous fuels and related products	I	39

motorcycle	4669 Wholesale of waste and scrap and other products n.e.c		
Division 47 Retail trade, except of motor vehicle and motorcycle	4730 Retail sale of automotive fuel in specialized stores	I	39
Division 52 Warehousing and support activities for transportation	5221 Service activities incidental to land transportation	I	21
Division 71 Architectural and engineering activities; technical testing and analysis	7120 Technical testing and analysis	I	64
Division 72 Scientific research and development	7210 Research and experimental development on natural sciences and engineering	I	64
Division 86 Human health activities	8610 Hospital activities 8620 Medical and dental practice activities 8690 Other human health activities	I	23
Division 05 Mining of coal and lignite	0510 Mining of hard coal 0520 Mining of lignite	II	45
Division 06 Extraction of crude petroleum and natural gas	0610 Extraction of crude petroleum 0620 Extraction of natural gas	II	
Division 07 Mining of metal ore	0710 Mining of iron ores 0721 Mining of uranium and thorium ores 0729 Mining of other non-ferrous metal ores	II	
Division 08 Other mining and quarrying	0810 Quarrying of stone, sand and clay 0891 Mining of chemical and fertilizer mineral 0892 Extraction of peat 0893 Extraction of salt 0899 Other mining and quarrying n.e.c	II	30,31
Division: 15- Manufacture of leather and related products	1511 Tanning and dressing of leather; dressing and dyeing of fur 1512 Manufacture of luggage, handbags and the like, saddlery and harness 1520 Manufacture of footwear	II	37
Division: 19- Manufacture of coke and refined petroleum products	1910 Manufacture of coke oven products 1920 Manufacture of refined petroleum products	II	49,55
Division: 20- Manufacture of chemicals and chemical products	2011 Manufacture of basic chemicals 2012 Manufacture of fertilizers and nitrogen compounds	II	26,33,36,38,47,51,53,54

	2013 Manufacture of plastics and synthetic rubber in primary forms 2021 Manufacture of pesticides and other agrochemical products 2022 Manufacture of paints, varnishes and similar coatings, printing ink and mastics 2023 Manufacture of soap and detergents, cleaning and polishing preparations, perfumes and toilet preparations 2029 Manufacture of other chemical products n.e.c 2030 Manufacture of man-made fibers		
Division: 21- Manufacture of basic pharmaceutical products	2100 Manufacture of pharmaceuticals, medicinal, chemical and botanical products	II	52
Division: 22- Manufacture of rubber and plastics products	2211 Manufacture of rubber products 2219 Manufacture of other rubber products 2220 Manufacture of plastic products	II	24
Division: 24- Manufacture of basic metals	2410 Manufacture of basic iron and steel 2420 Manufacture of basic precious and other non-ferrous metals 2431 Casting of iron and steel 2432 Casting of non-ferrous metals	II	56,57
Division: 25- Manufacture of fabricated metal products	2511 Manufacture of structural metal products 2512 Manufacture of tanks, reservoirs and containers of metal 2513 Manufacture of steam generators, except central heating hot water boilers 2520 Manufacture of weapons and ammunition 2591 Forging, pressing, stamping and roll-forming of metal; power metallurgy 2592 Treatment and coating of metals; machining 2593 Manufacture of cutlery, hand tools and general hardware 2599 Manufacture of other fabricated metal	II	58,59

	products n.e.c		
Division: 26- Manufacture of computer, electronic and optical products	2610 Manufacture of electronic components and boards 2620 Manufacture of computers and peripheral equipment 2630 Manufacture of communication equipment 2640 Manufacture of consumer electronics 2651 Manufacture of measuring, testing, navigating and control equipment 2652 Manufacture of watches and clocks 2660 Manufacture of irradiation, electro medical and electrotherapeutic equipment 2670 Manufacture of optical instruments and photographic equipment 2680 Manufacture of magnetic and optical media	II	
Division: 27- Manufacture of electrical equipment	2710 Manufacture of electric motors, generators, transformers and electricity distribution and control apparatus 2720 Manufacture of batteries and accumulators 2731 Manufacture of fiber optic cables 2732 Manufacture of other electronic and electric wires and cables 2733 Manufacture of wiring devices 2740 Manufacture of electric lighting equipment 2750 Manufacture of domestic appliances 2790 Manufacture of other electrical equipment	II	46,48
Division: 29- Manufacture of motor vehicles, trailers and semi-trailers	2910 Manufacture of motor vehicles 2920 Manufacture of bodies (coachwork) for motor vehicles; Manufacture of trailers and semi-trailers 2930 Manufacture of parts and accessories for motor vehicles	II	

Division: 30- Manufacture of other transport equipment	3011 Building of ships and floating structures 3012 Building of pleasure and sporting boats 3020 Manufacture of railway locomotives and rolling stock 3030 Manufacture of air and spacecraft and related machinery 3040 Manufacture of military fighting vehicles 3091 Manufacture of motorcycles 3092 Manufacture of bicycles and invalid carriages 3099 Manufacture of other transport equipment n.e.c	II	

Proposed new list of environmental quality standard for public health protection as Annex 5

No.	Parameters (CAS No.)	Unit	Environmental Quality Standard
1	Carbon tetrachloride (56-23-5)	ug/l	4
2	Hexachloro benzene (118-74-1)	ug/l	0.03
3	DDT (50-29-3)	ug/l	1
4	Endrin (72-20-8)	ug/l	0.01
5	Dieldrin (60-57-1)	ug/l	0.01
6	Aldrin (309-00-2)	ug/l	0.005
7	Isodrin (465-73-6)	ug/l	0.005
8	Perchloroethylene (127-18-4)	ug/l	10
9	Hexachloro butadiene (87-68-3)	ug/l	0.1
10	Chlororform (67-66-3)	ug/l	300
11	cis 1,2 dichloroethylene (156-59-2)	ug/l	40
12	Trichlororethylnen (79-01-6)	ug/l	10
13	1,2,4 Trichlorobenzene (120-82-1)	ug/l	0.4
14	Hexachlorocyclohexane (58-89-9)	ug/l	0.05
15	Benzene (71-43-2)	ug/l	10
16	Cadmium (7440-43-9)	ug/l	3
17	Total mercury (Hg) (7439-97-6)	ug/l	0.5
18	Organic mercury (group of substances)	ug/l	Not Detectable
19	Lead (Pb) (7439-92-1)	ug/l	10
20	Chromium valent 6 (Cr+6) (18540-29-9)	ug/l	50
21	Arsenic (As) (7440-38-2)	ug/l	10
22	Selenium (Se) (7782-49-2)	ug/l	10
23	PCB (1336-36-3)	ug/l	Not Detectable
24	Cyanide (CN) (57-12-5)	ug/l	0.005
25	Dichloromethane (75-09-2)	ug/l	20

Support Document # 5 Review of effluent and environmental quality standard

- Justification of parameters -

Objective:

From policy formulation view point, environmental quality standard is the desired condition in ambient water and , is the target of environmental administration of various policy measures including industrial wastewater regulation such as effluent standard. However current effluent standard has more parameters(52) than environmental quality standard(32). Therefore it is necessary to coordinate the two standards to reduce the gap so that regulation will be more integrated. Also from practical view point, difficulty and work load of analyzing many parameters will be a serious bottleneck in implementing regulation. Therefore increasing the parameters of environmental quality standard to match with effluent standard is not desirable at this stage. As a first step, necessity and priority of each parameter in both effluent and environmental quality standard will be reviewed. Priority is to reduce the number of effluent standards if the parameter lacks justification. Addition or deletion of parameters of environmental quality standard will be kept as less as possible. All parameters will be defined by CAS (Chemical Abstract Service) number which is unique to each chemical substance.

Scope:

1) For the purpose of review, the environmental quality standard related to human health protection will be taken as major focus under the JICA cooperation. Parameters for biodiversity protection are area specific and related to biosphere nature of Cambodia for which experience from Japan or other countries should not be directly applied. Review of those parameters specific to Cambodian biosphere situation may be best taken care by the national expert team outside of the JICA cooperation. However under this review, concentration level of effluent standard for biodiversity protection such as BOD5, COD will be compared with international industry guideline values.
2) For the purpose of review of effluent standards, concentration level should be considered. Standard for pollution loading requires site specific studies where concentration level standard can't achieve the environmental quality standard.

Approach:

1) First, environmental quality standards will be reviewed for consistency and clarification.
2) As a second step, comparison of current effluent standards with various standards such as WHO drinking water guideline, Cambodian drinking water standard and Japanese environmental quality standard for hazardous substance will be done. Drinking water guideline or standard

value will be used because environmental quality standard for human health protection is directly linked to oral intake of water. For example, in Japan, environmental quality standard for human health is almost same as drinking water standard. The environmental quality standard is then the reason of setting effluent standard. If the parameter is not listed in such standards it is not of priority health concern and thus will be considered for deletion, unless importance of the parameters is clear. Environmental quality standard will be briefly reviewed to correct internal inconsistency and add a parameter discussed in Support Document #4. This paper, Support Document #5, will discuss the result of this step.

3) As a third step, concentration level of the standard will be compared with the standards noted in 1), and IFC industrial sector guideline value and Japanese effluent standard to consider the appropriate concentration level. Support Document #6 will discuss this step.

Note:

- In Japan, environmental quality standard are for following two categories.

1) For Human health protection 2) For Living environment protection (including water use).

Also effluent standard are for following two categories.

1) Hazardous substance 2) Others.

In Cambodia, current sub-decree for water pollution control defines following two categories.

1) Human health protection, 2) Biodiversity protection.

For the purpose of comparison, relation of each categories between Cambodia and Japan will follow the below table.

<table>
<tr><td></td><td colspan="2">Environmental quality standard</td><td colspan="2">effluent standard</td></tr>
<tr><td>Cambodia</td><td>Human health protection</td><td>Biodiversity protection</td><td colspan="2">effluent standard</td></tr>
<tr><td></td><td>↕</td><td>↕</td><td colspan="2">↕</td></tr>
<tr><td>Japan</td><td>Human health protection</td><td>Livingenvironment protection</td><td>Hazardous substance</td><td>Others</td></tr>
</table>

- WHO drinking water guideline is “Guidelines for Drinking-water Quality FOURTH EDITION INCORPORATING THE FIRST ADDENDUM” published in 2017. . It can be downloaded from below URL.
  http://www.who.int/water_sanitation_health/publications/drinking-water-quality-guidelines-4-including-1st-addendum/en/

- IFC industrial sector guideline is World Bank Group Environmental, Health, and Safety Guidelines (known as the "EHS Guidelines"). The EHS Guidelines are technical reference documents with general and industry-specific examples of Good International Industry Practice (GIIP). It can be downloaded from below URL.
  http://www.ifc.org/wps/wcm/connect/Topics_Ext_Content/IFC_External_Corporate_Site/Sustainability-At-IFC/Policies-Standards/EHS-Guidelines

Review of environmental quality standards for human health protection Annex 5

Current waterquality standards in public water area for public health protection have consistency and clarification problems as follows.

1. No.8 Perchloroehylene and No.16 Tetrachloroethylene are same chemical substances and overlapped. It is proposed to combine No.8 and No.16 and clarified it by using CAS Number.
2. No.11 1,2-dichlororethylene has two isomers in cis, and trans structure. The description in Annex 5 is not clear which chemical is listed. Both of them present in environment are mostly byproduct from decomposition of Trichloroehylene. From the monitoring result of Japan, cis isomer is often detected while trans isomer is detected in only limited case. It is proposed to list cis 1,2-dichlororethylene in Annex 5.
3. No.13 Trichlorobenzene has 3 isomers, 1,2,3 Trichlorobenzene, 1,3,5 Trichlorobenzene and 1,2,4 Tricholrorobenzene depending on the location of chlorine atoms attached. From environmental view point, 1,2,4 isomer is the most important as it is produced in large quantity and used widely as solvent. Thus it is proposed to list as 1,2,4 Trichlorobenzene.

Furthermore, as proposed in Support Document #4, Dichloromethane is proposed to be added in the list. Support Document #2 reported internationally banned or restricted substances. These substances were proposed to be deleted from effluent standards as there is no chance those substances are used in point sources. However they may present in environment as legacy of past activities and thus are proposed to be kept in environmental quality standard.

Consideration of necessity of parameters in effluent standard in Annex 1

Hereunder each parameter will be discussed based on the Table 5-1. In WHO guideline, if no guideline value for the parameter, WHO provided the comment why it is not included. Such comment is also discussed below in addition to the summary of the Table 5-1.

1. Temperature
   The parameter is not related to health risk and thus will not be considered for revision. .

2. pH

According to WHO guideline, it is “Not of health concern at level found in drinking water” and thus will not be considered for revision.

3. BOD5

The parameter is related to organic pollution and for biodiversity protection and thus will not be considered for revision to delete, but concentration level of effluent standard will be reviewed.

4. COD

The parameter is related to organic pollution and for biodiversity protection and thus will not be considered for revision to delete, but concentration level of effluent standard will be reviewed.

5. TSS

The parameter is for biodiversity protection and thus will not be considered for revision to delete, but concentration level of effluent standard will be reviewed.

6. TDS

According to WHO guideline, the parameter is “Not of health concern at level causing acceptability problems in drinking water”. Thus it is proposed to be deleted from effluent standard.

7. Oil and grease

It is not listed under WHO guideline, Cambodia drinking water standard, nor Japanese environmental quality standard for hazardous substance. The parameter is listed in Japanese effluent standard as “n-Hexane extracts”. Also it is separated into two category “mineral” and “vegetable”. It is useful to control petroleum handling facility such as gasoline station and restaurant who uses food oil. It will not be considered for revision to delete. However the concentration level of effluent standard will be reviewed.

8. Detergents

The parameter is sum of various substances and hence method to measure them as all does not exist. It is not listed under WHO guideline, Cambodia drinking water standard, nor Japanese environmental quality standard for hazardous substance. However LAS (Linear Alkyl Sulfonates), surfactant chemical in certain detergent, is listed under Japanese environmental quality standard for domestic item. Most of detergent composition also can be detected by

n-hexane extracts. Therefore, until LAS measurement capability is well developed in Cambodia, it is proposed to be deleted from effluent standard.

9. Phenol

It is not listed under WHO guideline, Cambodia drinking water standard, nor Japanese environmental quality standard for hazardous substance. According to WHO guideline, Chlorophenols will be generated by chlorination process of water treatment facility for water supply. However Chlorophenols causes acceptability problem so that actual health risk is unlikely. According to water supply authority, there is no such incident of acceptability by Chlorophenols in Phnom Penh. Furthermore there is no major phenols pollution source which is chemical plant who produces phenols. Under the situation, it is proposed to be deleted from effluent standard.

10. Nitrate (NO_3)

It is listed under WHO guideline, Cambodia drinking water standard, and Japanese environmental quality standard for hazardous substance. It will not be considered for revision to delete, but concentration level of effluent standard will be reviewed.

11. Chlorine (free)

It is listed under WHO guideline, Cambodia drinking water standard, but not in Japanese environmental quality standard for hazardous substance. The parameter is related to chlorination process of water supply treatment. The value is for acceptability aspect. Thus it is not relevant to surface water body. Under the situation, it is proposed to be deleted from effluent standard.

12. Chloride (ion)

It is not listed under WHO guideline, nor Japanese environmental quality standard for hazardous substance. In WHO guideline, it is noted as “Not of health concern at level found in drinking water”. Also excessive presence of Chloride ion will be detected by TDS parameters. The parameter is proposed to be deleted from effluent standard.

13. Sulphate (as SO_4)

WHO guideline noted as follows. “Not of health concern at levels causing acceptability problems in drinking water”. The parameter is proposed to be deleted from effluent standard.

14. Sulphide (as sulfur)

WHO guideline noted as follows. "Not of health concern at level found in drinking water". Also It is not listed under Japanese environmental and Cambodian drinking water standard. The parameter is proposed to be deleted from effluent standard.

15. Phosphate (PO_4)

    The parameter is not listed in any of the comparison standard. The parameter is proposed to be deleted from effluent standard.

16. Cyanide (CN)

    WHO guideline noted as follows. "Occurs in drinking water at concentration well below those of health concern, except in emergency situations following a spill of health concern". As some of the pollution sources may utilize the substance, and also considering the seriousness to health risk, the parameter is proposed to be kept in effluent standard.

17. Barium (Ba)

    Barium is listed under WHO guideline at 1.3mg/l and under Cambodian drinking water standard at 0.7mg/l. The parameter is proposed to be kept in effluent standard.

18. Arsenic (As)

    Arsenic is listed under all comparable standards for health risk. The parameter is proposed to be kept in effluent standard.

19. Tin (Sn)

    WHO guideline noted as follows. "Occurs in drinking water at concentration well below those of health concern". There is no listing in other standard. The parameter is proposed to be deleted from effluent standard.

20. Iron (Fe)

    WHO guideline noted as follows. "Not of health concern at levels causing acceptability problems in drinking water". The health risk is unlikely as acceptability issue for drinking water will take place beforehand. It is listed under Cambodian drinking water standard and Japanese effluent standard for domestic environment. The parameter is proposed to be kept in effluent standard parameters.

21. Boron (B)

    Boron is listed under WHO and Japanese standards for health risk. The parameter is proposed

to be kept in effluent standard.

22. Manganese (Mn)

WHO guideline noted as follows. "Not of health concern at levels normally causing acceptability problems in drinking water. However, there are circumstances where Mn can remain in solution at higher concentration in some acidic or anaerobic waters, particularly groundwater." It is listed under Cambodian drinking water standard and Japanese effluent standard for domestic environment. The parameter is proposed to be kept in effluent standard parameters.

23. Cadmium (Cd)

Cadmium is listed under WHO and Japanese standards for health risk. The parameter is proposed to be kept in effluent standard.

24. Chromium (Cr^{-3})

It is not listed in WHO guideline, Japanese environmental and effluent standard nor Cambodian drinking water standard. However WHO has guideline value for total Chromium. Cambodian drinking water standard and Japanese effluent standard also has total Chromium parameter. The parameter is proposed to be deleted Cr^{-3} as parameter, but total Chromium shall be considered as new parameter.

25. Chromium (Cr^{+6})

Chromium (Cr+6) is well known hazardous substance and listed in Japanese environmental and effluent standard. The parameter is proposed to be kept in effluent standard.

26. Copper (Cu)

Copper is listed under WHO guideline, Japanese effluent standards for domestic environment and Cambodian drinking water standard. The parameter is proposed to be kept in effluent standard.

27. Lead (Pb)

Lead is listed in all comparable standards. The parameter is proposed to be kept in effluent standard.

28. Mercury (Hg)

Mercury is listed in all comparable standards. The parameter is proposed to be kept in effluent

standard.

29. Nickel (Ni)

Nickel is listed in WHO guideline but not in Cambodian drinking water standard nor Japanese standard. However Nickel may be used in electro-plating industry which may increase in Cambodia future. The parameter is proposed to be kept in effluent standard.

30. Selenium (Se)

Selenium is listed in WHO guideline and Japanese environmental standard. . The parameter is proposed to be kept in effluent standard.

31. Silver (Ag)

WHO guideline noted as follows. "Available data in adequate to permit derivation of health based guideline value." There is no listing in other standard. The parameter is proposed to be deleted from effluent standard.

32. Zinc (Zn)

WHO guideline noted as follows. "Not of health concern at levels causing acceptability problems in drinking water." It is listed under Japanese standard and Cambodian drinking water standard. The parameter is proposed to be kept in effluent standard.

33. Molybdenum (Mo)

WHO guideline noted as follows. "Occurs in drinking water at concentration well below those of health concern". It is not listed under Japanese standard and Cambodian drinking water standard. The parameter is proposed to be deleted from effluent standard.

34. Ammonia (NH3)

WHO guideline noted as follows. "Occurs in drinking water at concentration well below those of health concern". It is listed in Japanese effluent standard for total of Ammonium, Nitrate and Nitrite under hazardous substance category. It is also listed in Cambodian drinking water standard. The parameter is proposed to be kept in effluent standard.

35. DO

DO is not listed in the standards studied. The parameter is proposed to be deleted from effluent standard.

36. PCB

The parameter is proposed to be deleted from effluent standard. Please refer the Support Document #2

37. Calcium

It is not listed in WHO guideline and Japanese standards. Cambodian drinking water standard has a parameter Hardness which is related to Calcium and Magnesium. However it is not a serious health issues. The parameter is proposed to be deleted from effluent standard.

38. Magnesium

The parameter is proposed to be deleted from effluent standard as same reason of Calcium..

39. Carbon tetrachloride

The parameter is proposed to be deleted from effluent standard. Please refer the Support Document #2.

40. Hexachloro Benzene

The parameter is proposed to be deleted from effluent standard. Please refer the Support Document #2.

41. DDT

The parameter is proposed to be deleted from effluent standard. Please refer the Support Document #2

42. Endrin

The parameter is proposed to be deleted from effluent standard. Please refer the Support Document #2

43. Dieldrin

The parameter is proposed to be deleted from effluent standard. Please refer the Support Document #2

44. Aldrin

The parameter is proposed to be deleted from effluent standard. Please refer the Support Document #2

45. Isodrin

    The parameter is proposed to be deleted from effluent standard. Please refer the Support Document #2

46. Perchloro ethylene

    It is listed in WHO guideline and Japanese standards. The parameter is proposed to be kept in effluent standard.

47. Hexachloro butadiene

    It is listed in WHO guideline. The parameter is proposed to be kept in effluent standard.

48. Chloroform

    It is listed in WHO guideline. The parameter is proposed to be kept in effluent standard

49. 1,2 Dichloro ethylene

    It is listed in WHO guideline and Japanese standards. The parameter is proposed to be kept in effluent standard.

50. Tricholoro ethylene

    It is listed in WHO guideline and Japanese standards. The parameter is proposed to be kept in effluent standard.

51. Tricholoro benzene

    It is not listed in the standards listed. The parameter is proposed to be deleted from effluent standard.

52. Hexachloro cyclohexene

    The parameter is proposed to be deleted from effluent standard. Please refer the Support Document #2

Table 6-1 Comparison of standard listed in Annex 2 of current sub-decree

○ = listed as health protection or hazardous substance.

△ = listed as biodiversity protection or domestic environment protection

No.	Parameters	WHO drinking water guideline	Japan environmental standard	Japan effluent standard	Cambodian drinking water standard	Current environmental quality standard
1	Temperature					
2	pH		△	△	○	△
3	BOD5 (5days at 20c)		△	△		△
4	COD		△	△		△
5	TSS		△	△		△
6	TDS				○	
7	Grease and oil		△ as n-hexane extracts	△ as n-hexane extracts		
8	Detergents		△ as LAS	△ as LAS		
9	Phenols		△	△		
10	Nitrate (NO3)	○	○	○	○	
11	Chlorine (free)	○			○	
12	Chroride (ion)				○	
13	Sulphate (as SO4)				○	
14	Sulphide (as sulfur)					
15	Phosphate (PO4)					
16	Cyanide (CN)		○	○		○
17	Barium (Ba)	○			○	
18	Arsenic (As)	○	○	○	○	○
19	Tin (Sn)					
20	Iron (Fe)			△	○	
21	Boron (B)	○	○	○		
22	Managanese (Mn)			△	○	
23	Cadmiunm (Cd)	○	○	○	○	○
24	Chromium (Cr-3)	○ as total Cr			○ as total Cr	
25	Chromium (Cr+6)		○	○		○
26	Copper (Cu)	○		△	○	

27	Lead (Pb)	O	O	O	O	O
28	Mercury (Hg)	O	O	O	O	O
29	Nickel (Ni)	O				
30	Selenium (Se)	O	O			O
31	Silver (Ag)					
32	Zinc (Zn)		△	△	O	
33	Molybdenum (Mo)					
34	Ammonia (NH3)			O	O	
35	DO					△
36	PCB		O	O		O
37	Calcium				O as Hardness	
38	Magnesium				O as Hardness	
39	Carbon tetrachloride	O	O	O		O
40	Hexachloro Benzene					O
41	DDT	O				O
42	Endrin	O				O
43	Dieldrin	O				O
44	Aldrin	O				O
45	Isodrin					O
46	Perchloroethylene	O	O	O		O
47	Hexachloro butadien	O				O
48	Chloroform	O				O
49	1,2 Dichloroethylene	O	O	O		
50	Tricholoroethylene	O	O	O		O
51	1,2,4 Tricholorobenzene					O
52	Hexachloro cyclohexene					O

LAS = Liner Alkyl Sulphonate

Addition of new parameters

Two parameters are proposed to be added in the effluent standard.

1. Benzene (CAS No. 71-43-2)

   Benzene is listed in current environmental Quality standard for human health protection, but not in effluent standard. It is important pollutant, and well known carcinogen. The parameter is proposed to be added.

2. Dichloromethane (CAS No. 75-09-2)

   Dichloromethane is used as cleaning solvent. It is one of the three common substances causing groundwater pollution. Please refer to the Support Document #4. The parameter is proposed to be added.

New list of proposed effluent standard parameters is listed in third left column in the attached Table 5-2.

Table 5-2 Revised list of parameters for effluent standard and comparison with other standards

○ = listed as health protection or hazardous substance.

△ = listed as biodiversity protection or domestic environment protection

New No.	Parameters	**Proposed new effluent standard**	environmental Quality standard	WHO drinking water guideline	Japan environmental standard	Japan effluent standard	Cambodian drinking water standard
1	Temperature	○					
2	pH	○	△		△	△	○
3	BOD5 (5days at 20c)	○	△		△	△	
4	COD	○	△		△	△	
5	TSS	○	△		△	△	
6	Grease and oil	○			△ as n-hexane extracts	△ as n-hexane extracts	
7	Nitrate (NO3)	○		○	○	○	○
8	Cyanide (CN)	○	○		○	○	
9	Barium (Ba)	○		○			○
10	Arsenic (As)	○	○	○	○	○	○

11	Iron (Fe)	O				△	O
12	Boron (B)	O		O	O	O	
13	Manganese (Mn)	O				△	O
14	Cadmium (Cd)	O	O	O	O	O	O
15	Chromium (Cr+6)	O	O		O	O	
16	Copper (Cu)	O		O		△	O
17	Lead (Pb)	O	O	O	O	O	O
18	Mercury (Hg)	O	O	O	O	O	O
19	Nickel (Ni)	O		O			
20	Selenium (Se)	O	O	O	O		
21	Zinc (Zn)	O			△	△	O
22	Ammonia (NH3)	O				O	O
23	Perchloroethylene	O	O	O	O	O	
24	Hexachloro butadien	O	O	O			
25	Chloroform	O	O	O			
26	cis 1,2 Dichloroethylene	O		O	O	O	
27	Trichloroethylene	O	O	O	O	O	
28	Benzene	O **added**	O	O	O	O	
29	Dichloromethane	O **added**		O	O	O	

Support Document #6 Review of environmental quality standard and effluent standard - Concentration level -

General:

The paper is follow up of the support document #5 and will discuss about the concentration level of standards.

Approach:

1) As a first step, concentration level of environmental quality standard will be compared with WHO guideline value, Japanese environmental standard for human health, and Cambodian drinking water standard. If the concentration level is different significantly, then the level is proposed to be revised. Deletion of parameters will not be considered as there is no sufficient monitoring data to conclude.
2) As a second step, environmental quality standard and effluent standard will be compared. If no environmental quality standard, then comparison will be with drinking water standard or WHO guideline value. Effluent standard shall be reasonable to achieve environmental quality standard. In Japan, effluent standards are 10 times of the concentration of environmental quality standard. In current sub-decree, some parameter of the current effluent standard has value as high as 300,000 times of environmental quality standards. Though there is no scientific reasoning about the ratio of 10 in Japan, there will be consistency problem if the ratio varies significantly. Therefore under the revision of this time, the effluent standard will be revised if such ratio with environmental quality standard is below 2 or over 100 to avoid too radical change. (Alternatively all parameters can be set at the ratio of 10 times of environmental quality standard)
3) Finally proposed effluent standard value will be compared with IFC guideline values of 22 industrial categories, for the parameter listed in IFC guideline. If the concentration level is different significantly, then the level is proposed to be revised taking Japanese effluent standard as benchmark.

Concentration level of environmental quality standard for human health protection

Few parameters were proposed to be revised for their concentration level as follows. Please refer to Table 6-1.

1. Carbontetrachloride

   Current standard is 12 ug/l while WHO guideline value is 4ug/l and Japanese standard is 2 ug/l. It is proposed to lower down to 4ug/l level.

2. DDT

   Current standard is 10 ug/l while WHO guideline value is 1ug/l. It is proposed to lower down to 1ug/l level.

3. Chloroform

   Current standard is 10 ug/l while WHO guideline value is 300ug/l. It is proposed to raise up to 300ug/l level.

4. cis 1,2-Dichloroethylene

   Current standard is 12 ug/l while WHO guideline value is 50ug/l and Japanese standard is 40ug/l. It is proposed to raise up to 40ug/l level.

5. Cadmium

   Current standard is 1 ug/l while WHO guideline value is 3ug/l and Japanese standard is 3ug/l. It is proposed to raise up to 3ug/l level.

6. Organic mercury and PCB

   The value is set at 0 ug/l. From laboratory view point, zero value is not appropriate. These values will be revised to "ND =not detected" with clear definition of analytical method..

7. Dichloromethane

   Standard is proposed to be set at 20 ug/l based on WHO guideline value and Japanese environmental standard.

Table 6-1 Comparison of concentration level of environmental quality standard

Value in ( ) is the proposed value.

No.	Parameters	Unit	Current Environmental Quality Standard (Proposed)	WHO guideline value	Japan Environmental Quality standard	Cambodia drinking water standard
1	Carbon tetrachloride	ug/l	12 (4)	4	2	
2	Hexachloro benzene	ug/l	0.03	Not of health concern at levels causing acceptability problems in		

				drinking water		
3	DDT	ug/l	10 (1)	1		
4	Endrin	ug/l	0.01	0.6		
5	Dieldrin	ug/l	0.01	0.03		
6	Aldrin	ug/l	0.005	0.03		
7	Isodrin	ug/l	0.005			
8	Perchloroethylene	ug/l	10	40	10	
9	Hexachloro butadiene	ug/l	0.1	0.6		
10	Chlororform	ug/l	12 (300)	300		
11	cis 1,2 dichloroethylene	ug/l	10 (40)	50	40	
12	Trichlororethylnen	ug/l	10	20	10	
13	1,2,4 Trichlorobenzene	ug/l	0.4			
14	Hexachlorocyclohexane	ug/l	0.05	Unlikely to occur in drinking water		
15	Benzene	ug/l	10	10	10	
16	Cadmium	ug/l	1 (3)	3	3	3
17	Total mercury	ug/l	0.5	6	0.5	6
18	Organic mercury	ug/l	0 (ND)		ND	
19	Lead	ug/l	10	10	10	50
20	Chromium valent 6	ug/l	50		50	
21	Arsenic	ug/l	10	10	10	50
22	Selenium	ug/l	10	40	10	
23	PCB	ug/l	0 (ND)		ND	
24	Cyanide	ug/l	0.005		ND	
25	Dichloromethane	ug/l	20	20	20	

Comparison of effluent standard with environmental quality standard

Table 6-2 is the summary of comparison of effluent standard with environmental quality standard. Two new parameter Benzene and Dichloromethane were added at 10 times of environmental quality standard concentration.

Below noted parameters are considered for revision at this stage. Discussion will focus on standards for public water area and sewer. For protected area, value will be lower than public and will be adjusted once final value for public water area is proposed..

1. Nitrate

   Current effluent standard is 20mg/l for public and sewer. On the other hand drinking water standard is set at 50mg/l. This is logically strange as effluent is cleaner than drinking water. Therefore it is proposed to revise to higher value than 50mg/l. Tentatively 100mg/l is proposed.

2. Cyanide

   Current effluent standard is 1.5mg/l for public and sewer. Environmental quality standard are 0.005mg/l. The ratio between effluent standard and environmental quality standard is 300. It is proposed to lower the effluent standard to 0.5mg/I (the ratio is 100).

3. Cadmium

   Current effluent standard is 0.5mg/l for public and sewer. Environmental quality standard (proposed revision) is 0.003mg/l (3ug/l). The ratio between effluent standard and environmental quality standard is 166. It is proposed to lower the effluent standard to 0.3mg/I (the ratio is 100).

4. Zinc (Zn)

   Current effluent standard is 3mg/l for public and sewer. On the other hand drinking water standard is also set at 3mg/l. This is logically strange as effluent is as clean as drinking water. Therefore it is proposed to revise to higher value than 3mg/l. Tentatively 6mg/l is proposed.

5. Perchloro ethylene

   Current effluent standard is 2.5mg/l for public and sewer. Environmental quality standard is 0.01mg/l. The ratio between effluent standard and environmental quality standard is 250. It is proposed to lower the effluent standard to 1mg/I (the ratio is 100).

6. Hexachloro butadiene

   Current effluent standard is 3mg/l for public and sewer. Environmental quality standard is 0.0001mg/l. The ratio between effluent standard and environmental quality standard is 30000. It is proposed to lower the effluent standard to 0.01mg/I (the ratio is 100).

Table 6-2 Comparison of effluent standard with environmental quality standard

(unit : mg/l)

	Parameters	Effluent standard under current Sub-Decree		Environmental Quality Standard under current Sub-Decree	Environmental Quality Standard proposed revision	Cambodia Drinking water standard or WHO guideline	Japanese effluent standard (National)
		Protected area (poposed)	Public and sewer (proposed)				
1	Temperature	<45	<45				
2	pH	6-9	5-9				5.8-8.6
3	BOD5 (5days at 20c)	30	80	10	10		160 (daily average 120)
4	COD	50	100	8	8		160 (daily average 120)
5	TSS	50	80	15	15		200(daily average 150)
6	Grease and oil	5	15				5 (mineral) 30 (vegetable)
7	Nitrate (NO3)	10 (50)	20 (100)			50	100
8	Cyanide (CN)	0.2 (0.1)	1.5 (0.5)	0.005	0.005		1
9	Barium (Ba)	4.0	7.0			0.7	
10	Arsenic (As)	0.1	1.0	0.01	0.01	0.05	0.1
11	Iron (Fe)	1.0	20			0.3	10
12	Boron (B)	1.0	5.0			2.4 (WHO)	10
13	Managanese (Mn)	1.0	5.0			0.1	10
14	Cadmiunm (Cd)	0.1 (0.05)	0.5 (0.3)	0.001	0.003	0.003	0.03
15	Chromium (Cr+6)	0.05	0.5	0.05	0.05		0.5
16	Copper (Cu)	0.2	1.0			2	3

17	Lead (Pb)	0.1	1.0	0.01	0.01	0.05	0.1
18	Mercury (Hg)	0.002	0.005			0.006	0.005
19	Nickel (Ni)	0.2	1.0			0.07 (WHO)	
20	Selenium (Se)	0.05	0.5	0.01	0.01		0.1
21	Zinc (Zn)	1.0 (2.0)	3.0 (6.0)			3	2
22	Ammmonia (NH3)	5.0	7.0			1.5	
23	Perchloroethylene	2.5 (1.0)	2.5 (1.0)	0.01	0.01		0.1
24	Hexachloro butadiene	3 (0.01)	3 (0.01)	0.0001	0.0001		
25	Chloroform	1	1	0.012	0.3		
26	cis 1,2 Dichloroethylene	2.5	2.5	0.01	0.04		0.4
27	Tricholoroethylene	1	1	0.01	0.01		0.1
28	Benzene	0.05	0.1		0.01	0.01 (WHO)	0.1
29	Dichoromethane	0.01	0.2		0.02	0.02(WHO)	0.2

Comparison of effluent standard with industrial sector specific IFC guideline value

Table 6-3 summarizes the comparison of current effluent standard with IFC guideline value from 22 industrial sectors. As noted in the Support Document #5, IFC guideline values are expected within reasonable treatment in developing countries context. The parameters listed do not cover all effluent standards, but only those parameters listed in IFC guideline for the industrial sector concerned. The comparison is to validate if the standard is reasonable without excessive treatment cost.

Few parameters of effluent standard for public water area and sewer are considered to be too strict, compared with IFC guideline values. They are following parameters.

1. COD

Effluent standard value is 100mg/l. Guideline values for the listed the industries are between 125-250mg/l. Japanese effluent standard is at 160mg/l with daily average at 120mg/l. It is proposed to revise to higher value of 120mg/l.

2. Mercury

Effluent standard value is 0.005mg/l. Guideline values for the listed industries are 0.01mg/l. However, Japanese effluent standard is at 0.005mg/l and Japanese industries keep the standard. It is proposed to maintain the value of 0.005mg/l.

Table 6-3 Comparison of Effluent Standard with industrial sector specific IFC guideline value

	Parameter	Units	Effluent standard			Semiconductors and Other Electronics Manufacturing	Foundries	Integrated Steel Mills	Board and Particle-Based Products	Aquaculture	Breweries	Fish Processing	Dairy Processing	Food and Beverage Processing	Glass Manufacturing	Meat Processing	Sugar Manufacturing	Tanning and Leather Finishing	Textile Manufacturing	Vegetable oil processing	Mammalian Livestock Production	Metal, Plastic, and Rubber Products Manufacturing	Poultry Processing	Poultry Production	Base Metal Smelting and Refining	Sawmilling and Manufactured Wood Products	Printing
			Protected area (Proposed)	Public and sewer (Proposed)	Japan (National standard)																						
2	pH	-				6-9	6-9	6-9	6-9	6-9	6-9	6-9	6-9	6-9	6-9	6-9	6-9	6-9	6-9	6-9	6-9	6-9	6-9	6-9	6-9	6-9	6-9
3	BOD5	mg/L	30	80	160 (Dairy average 120)	50	-	-	50	50	25	50	50	50	-	50	50	50	30	50	50	-	50	50	-	50	30
4	COD	mg/L	50	100 (120)	160 (Dairy average 120)	160	125	250	150	250	125	250	250	250	130	250	250	250	160	250	250	250	250	250	50	150	150
5	TSS	mg/L	50	80	200 (Dairy average 150)	50	35	35	50	50	50	50	50	50	30	50	50	50	50	50	50	50 25 (electroplating)	50	50	20	50	50
6	Oil and Grease	mg/L	5	15	5 (mineral) 30 (biological)	10	10	10	-	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	-	10	10
9	Cyanide	mg/L	0.2 (0.1)	1.5 (0.5)	1	1	-	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	0.2
10	Arsenic	mg/L	0.1	1	0.1	0.1	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	0.1	-	-	0.05	0.1	-
11	Iron	mg/L	1	20	10	-	5	5	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-	-	3
14	Cadmium	mg/L	0.1 (0.05)	0.5 (0.3)	0.03	0.1	0.01	0.01	-	-	-	-	-	-	-	-	-	-	0.02	-	-	0.1	-	-	0.05	-	0.1
15	Chromium (6+)	mg/L	0.05	0.5	0.5	0.1	-	0.1	-	-	-	-	-	-	-	-	-	0.1	0.1	-	-	0.1	-	-	-	0.1	0.1
16	Copper	mg/L	0.2	1	3	0.5	0.5	0.5	-	-	-	-	-	-	-	-	-	-	0.5	-	-	0.5	-	-	0.1	0.5	0.5
17	Lead	mg/L	0.1	1	0.1	0.1	0.2	0.2	-	-	-	-	-	-	0.1	-	-	-	-	-	-	0.2	-	-	0.1	-	1
18	Mercury	mg/L	0	0.005	0.005	0.01	-	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	0.01	-	-	0.01	-	-
19	Nickel	mg/L	0.2	1		0.5	0.5	0.5	-	-	-	-	-	-	-	-	-	-	0.5	-	-	0.5	-	-	0.1	-	-
20	Selenium	mg/L	0.05	0.5	0.1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
21	Zinc	mg/L	1 (2)	3 (6)	2	2	0.5	2	-	-	-	-	-	-	-	-	-	-	2	-	-	2	-	-	0.2	-	0.5
23	Ammonia	mg/L	5	7 (10)		10	5	5	-	-	-	-	-	-	-	-	-	10	10	-	-	10 20 (electoplating)	-	-	0.2	-	-

Proposed final list of environmental quality standard and effluent standard are attached as Table 6-4 and 6-5. All substances were clarified with CAS number.

Table 6-4 Proposed new list of environmental quality standard for public health protection as Annex 5

No.	Parameters (CAS No.)	Unit	Environmental Quality Standard
1	Carbon tetrachloride (56-23-5)	ug/l	4
2	Hexachloro benzene (118-74-1)	ug/l	0.03
3	DDT (50-29-3)	ug/l	1
4	Endrin (72-20-8)	ug/l	0.01
5	Dieldrin (60-57-1)	ug/l	0.01
6	Aldrin (309-00-2)	ug/l	0.005
7	Isodrin (465-73-6)	ug/l	0.005
8	Perchloroethylene (127-18-4)	ug/l	10
9	Hexachloro butadiene (87-68-3)	ug/l	0.1
10	Chlororform (67-66-3)	ug/l	300
11	cis 1,2 dichloroethylene (156-59-2)	ug/l	40
12	Trichlororethylnen (79-01-6)	ug/l	10
13	1,2,4 Trichlorobenzene (120-82-1)	ug/l	0.4
14	Hexachlorocyclohexane (58-89-9)	ug/l	0.05
15	Benzene (71-43-2)	ug/l	10
16	Perchloroehtylenen (127-18-4)	ug/l	10
17	Cadmium (7440-43-9)	ug/l	3
18	Total mercury (Hg) (7439-97-6)	ug/l	0.5
19	Organic mercury (group of substances)	ug/l	Not Detectable
20	Lead (Pb) (7439-92-1)	ug/l	10
21	Chromium valent 6 (Cr+6) (18540-29-9)	ug/l	50
22	Arsenic (As) (7440-38-2)	ug/l	10
23	Selenium (Se) (7782-49-2)	ug/l	10
24	PCB (1336-36-3)	ug/l	Not Detectable
25	Cyanide (CN) (57-12-5)	ug/l	0.005
26	Dichloromethane (75-09-2)	ug/l	20

Table 6-5 Proposed new list of effluent standard as Annex 2

	Parameters (CAS No.)	Unit	Effluent standard	
			Protected area	Public and sewer
1	Temperature	Degree C	<45	<45
2	pH		6-9	5-9
3	BOD5 (5days at 20c)	mg/l	30	80
4	COD	mg/l	50	120
5	TSS	mg/l	50	80
6	Grease and oil	mg/l	5	15
7	Nitrate (NO3) (13797-55-8)	mg/l	50	100
8	Cyanide (CN) (57-12-5)	mg/l	0.1	0.5
9	Barium (Ba) (7440-39-3)	mg/l	4.0	7.0
10	Arsenic (As) (7440-38-2)	mg/l	0.1	1.0
11	Iron (Fe) (7439-89-6)	mg/l	1.0	20
12	Boron (B) (7440-42-8)	mg/l	1.0	5.0
13	Manganese (Mn) (7439-98-5)	mg/l	1.0	5.0
14	Cadmium (Cd) (7440-43-9)	mg/l	0.05	0.3
15	Chromium valent 6 (Cr+6) (18540-29-9)	mg/l	0.05	0.5
16	Copper (Cu) (744-50-8)	mg/l	0.2	1.0
17	Lead (Pb) (7439-92-1)	mg/l	0.1	1.0
18	Mercury (Hg) (7439-97-6)	mg/l	0.002	0.005
19	Nickel (Ni) (7440-02-0)	mg/l	0.2	1.0
20	Selenium (Se) (7782-49-2)	mg/l	0.05	0.5
21	Zinc (Zn) (7440-66-6)	mg/l	2.0	6
22	Ammonia (NH3) (7664-41-7)	mg/l	5.0	7.0
23	Perchloroethylene(127-18-4)	mg/l	1.0	1.0
24	Hexachloro butadien (87-68-3)	mg/l	0.01	0.01
25	Chloroform(67-66-3)	mg/l	1	1
26	cis 1,2 Dichloroethylene(156-59-2)	mg/l	2.5	2.5
27	Tricholoroethylene(79-01-6)	mg/l	1	1
28	Benzene (71-43-2)	mg/l	0.05	0.1
29	Dichoromethane (75-09-2)	mg/l	0.01	0.2

Support Document #7 Threshold water volume to define SMEs

Objective:

SMEs are often difficult to comply with various regulations due to lack or manpower, financial resources and technical capability. While the number of SMEs is quite large, their impact to environment at individual level is relatively small. Therefore, enforcement effort of regulation to SMEs is not cost effective, and hence they are exempted from some regulation in many countries especially if they do not discharge hazardous substance for human health, but just ordinary organic pollutants or suspended solid.

The issue is how to define SMEs in this context. For the purpose of water pollution control, the best method to define SMEs is by the volume of waste water. In this document, threshold volume to define SMEs will be discussed.

Approach:

Volume of wastewater is often difficult to measure directly. Therefore, it is estimated by multiplying 0.8 to the volume of water supply (except for the factory where water is used as part of the product such as beverage factory).

1) As first step, Japanese example will be studied for the overall industry.
2) For next step, the data in Cambodia obtained from other water supply study in Preah Sihanouk province will be used to validate the result from 1). Hotel and restaurant business who discharge domestic wastewater will be studied to find if separate threshold is needed or not.

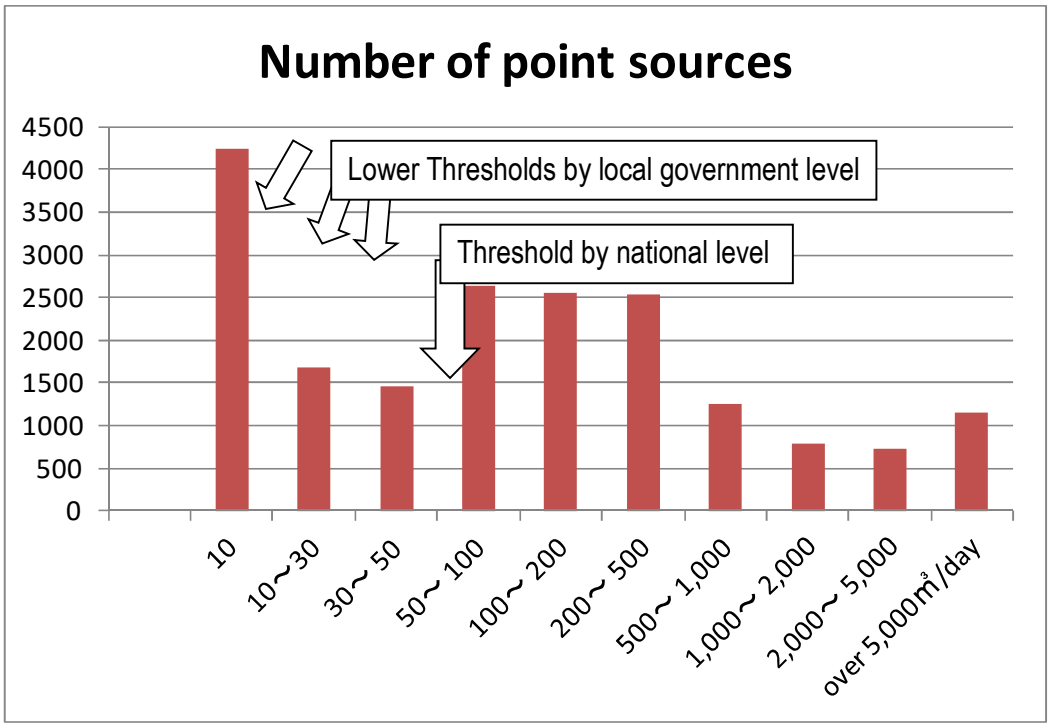
Japanese example

In Japan, threshold value for SMEs, who is not required follow water pollution control rule for domestic parameters such as COD, is set at 50m3/ton at national level. In Japanese system, local government can set more stringent standard than national level to meet the local situation (including threshold value for SME).

Figure 7-1 in next page is histogram showing volume of water used and distribution of point sources for each range of water volume. Number of point source using water less than 10 m3/day is significantly more than 10-30, or 30-50 m3/day range. From statistical view point, 10m3/day can be seen as another threshold though national threshold is at 50m3/day.

Many local prefectural governments set the lower threshold than national level as follows. Largest number of prefecture (seven) set the threshold value at 10m3/day.

Figure 7-1 Volume of water used in Japanese industry



(Source: Ministry of Environment Japan
http://www.env.go.jp/water/report/h28-02/index.html)

Table 7-1 Stringent value by local government

Threshold value for SMEs	Number of prefecture
5 m3/day	1
10 m3/day	7
15 m3/day	1
20 m3/day	4
25 m3/day	1
30 m3/day	3

(Source: Ministry of Environment Japan
https://www.env.go.jp/water/confs/fpwq/02/mat04_08-1.pdf)

From the Japanese case, threshold value can be 10m3/day or some value below 50m3/day.

Cambodia situation

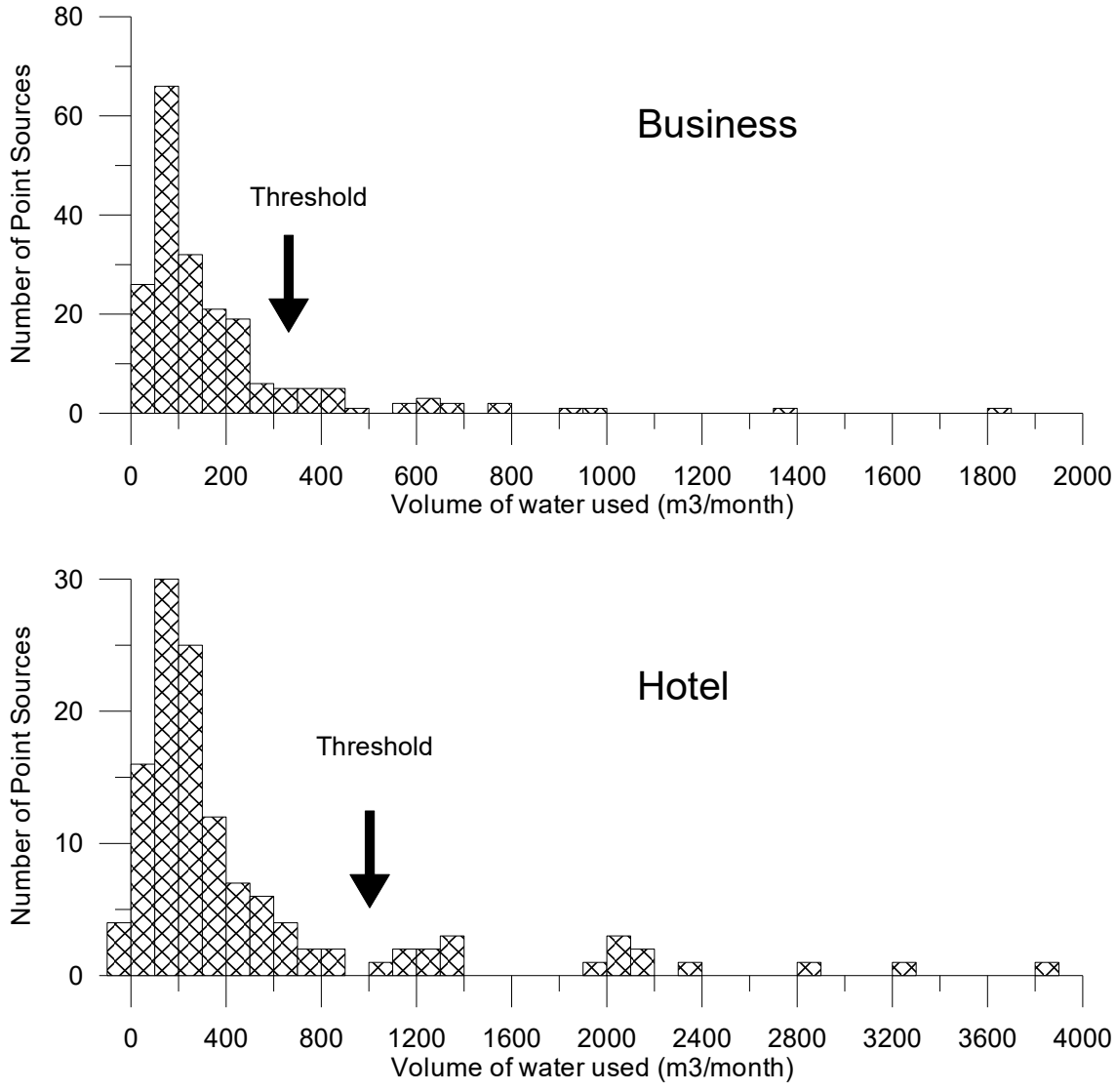
Data from water supply study in Preah Sihanouk province was used to validate the situation in Cambodia. The study area was small village and commune so that large business entities were limited in data. Figure 7-2 is the histogram showing volume of water used (m3/month) and number

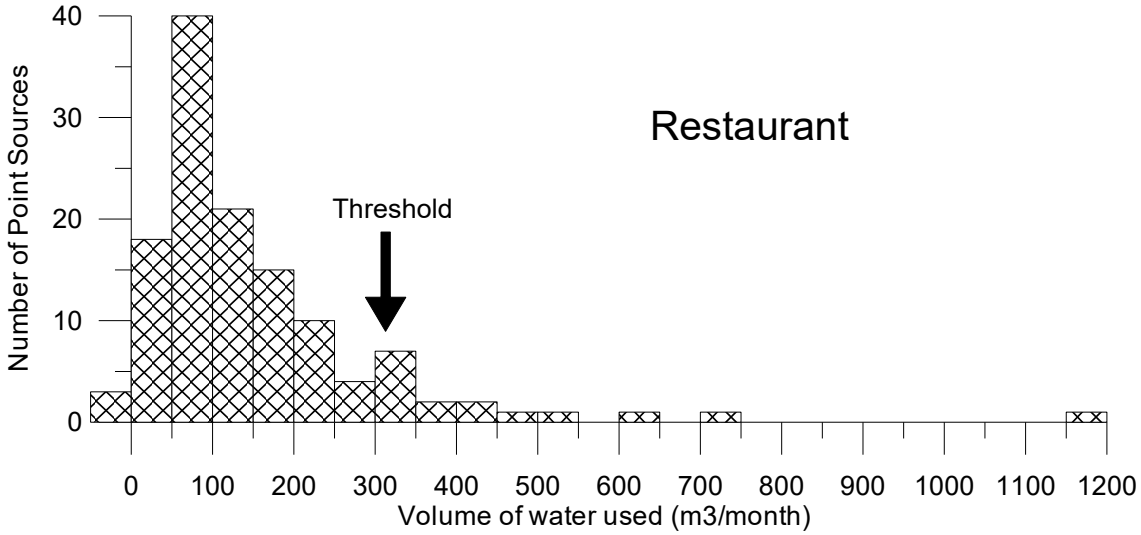
of point sources using water at each range. Histograms were prepared separately for Business, Hotel and Restaurant categories.

From the histogram, threshold can be as follows (please refer to Technical Note at the end of this document for the method to determine threshold).

Business:	300m3/month	=	10m3/day
Hotel	900m3/month	=	30m3/day
Restaurant	300m3/month	=	10m3/day

Figure 7-2 Histogram of volume of water used and number of point sources (Preah Sihanouk province)





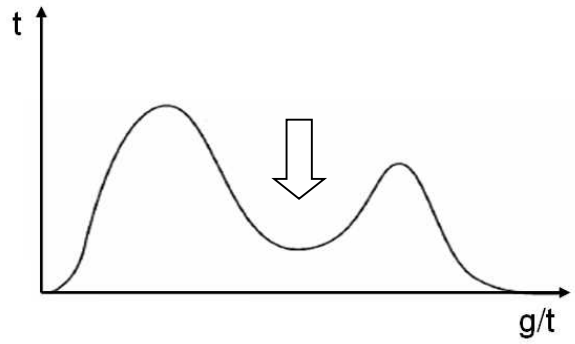
Proposal

Threshold for SMEs is proposed to be as follows.

- SMEs discharge hazardous waste water (Category II) No threshold
- SMEs not discharging hazardous waste water (Category I) 10m3/day
- SMEs in hotel business (Category III) 30m3/day

Technical Note - How to determine Threshold -:

Various items are distributed following normal distribution. Assuming two different groups exists (in the context of this discussion, SMEs and large enterprises), they will show bimodal distribution.



In the above chart, the best point to differentiate SMEs and others is the middle of valley between two mountains, or the mountain foot where slope is deviated from expected curve.

Support Document #8 Technical requirements for laboratory registration

Objective:

Reliable measurement in laboratory is essential in environmental management. Under the current sub-decree, wastewater can be tested in Ministry of Environment laboratory or recognized laboratory outside. To assure the quality of measurement by laboratories, registration system of the laboratories shall be developed. This document describes the technical requirement of the laboratories for such registration system.

Technical requirement at the time of application

Following items shall be included and be reviewed in the application for the registration. Registration of the laboratory shall be for only for the scope defined in the application. Measurement/analysis outside of the defined scope will not be considered as official measurement.

- Scope definition
  - Parameter
  - Media (water, soil, air, waste、etc.)
  - MDL (Data to be included)
  - Quantification range (Data to be included)
- Instrument (for each parameter)
  - Type of instrument
  - Specification
- Human resources (laboratory manager and operator)
  - Qualification
  - Training record
- SOPs
  - SOPs for each parameter applied.
  - QA/QC protocol to be included.
  - Sample handling/pretreatment to be included

Technical requirement during operation

Following items shall be audited by MoE during operation of the laboratory on periodical basis for renewal of registration.

- Audit by MoE
  - Operation log book
  - Chemical/reagent log book (procurement, storage, etc,)
  - Instrument maintenance log book
  - Raw data recording and storage

Support Document #9　Discussion on Charging fine on violation against Sub-decree on water pollution control

(For preparation of 4th TF meeting on water pollution control)

1. Background and objective

To implement and keep compliance with the regulation by Sub-decree on water pollution control, enforcement activities by the Ministry of Environment is critical. Especially utilization of penalties prescribed by the Law is important as forcing measures for the polluters to comply with the regulation.

We'd like to discuss the way of application of fine as the most probable measures among penalty measures.

2. Amount of fine (main discussion points)

(Article 22 of the Law)

If the violation causes danger to human bodies or lives, to private property, to public property, to the environment, [or] to natural resources, shall be fined from ten million Riel (l0,000,000 Riel) to fifty million Riel (50,000,000 Riel) or imprisoned from l year to 5 years, or both.

A person who commits a violation shall also be responsible for repairing damage and for compensation.

(Options for charging)

a. One-time fine (Charging fine one-time only)

Example: Charge the fine one time when violation to efflunet standard was found. When violation found another time later, charge the fine again.

Advantage: Easy to understand

Disadvantage: Amount of fine is limited. The polluter's attitude may not change as the polluter may think paying fine is not heavy burden.

b. Daily fine (daily amount of fine as cumulative fine)

Example: Amount of ten million Riel to fifty million Riel per day multiplies number of days of violation (for example, between the day when the violation was found first time and the day when the violation was found again).

Advantage: Amount of fine can be bigger based on the duration of violence and can influence the polluter's attitude

Disadvantage: Need to show the continuation of violation. (for example, MOE need to inspect pollution source two times and show the capacity of thewastewater treatment facility has contined

to be not enough).

3. Suggestion

3-1 Principle on charging through introduction of daily fine

Introduction of daily fine is suggested considering following points.

- Need to strengthen the enforcement power as the amount of fine shown in the Law is not high.
- Impressing pollution source owner by economic way is very effective way to improve compliance.
- Raising awareness among water pollution source is needed through inspection. For example, number of discharge permit issued is only 100-200.

(Principle)

The distinction of one-time fine and daily fine is as follows.

1) For temporal violation, one-time fine is applied.

(Example)

The violation of effluent standards was found at the inspection. The factory has waste water treatment facility but it is temporary stopped for the maintenance

→Apply one time fine, as far as waste water treatment facility can function.

2) For continued violation, daily fine is applied.

(Example)

- The violation of effluent standards was found at the inspection, then MOE issued the improvement order. Later, at the second inspection, the violation of effluent standards was found again and there is no waste water treatment facility/

→Apply one time fine. Number of days is between the first inspection and the second inspection as a inspector can say there was no waste water treatment between the inspection.

- Also, in the case that there is waste water treatment facility but there is no pump to flow waste water or no electricity supply (no wiring) for the pump to bring waste water to the treatment facility, a inspector can say there was no waste water treatment between the inspection.

3-2 Application of fine case by case

1) Any person who does not permit or refuses to allow an inspector to enter and conduct an examination or inspection

【Fine】

First time: One- time fine when pollution source does not permit or refuses to allow an inspector to enter [and] conduct an examination or inspection

2nd or more time : One-time fine for « In case of a repeat offense »

2) Not consistent with the standards for effluent dischage (Water Pollutuion Sub-decree Article 6)

【Fine】

- Dayly fine when no significant improvement (number of days is between first inspection and second inspection)
- One-time fine when project owner made significant improvement such as installation and operation of treatment facility

3) Disposal of solid waste, garbage or any hazardous substances (Water Pollutuion Sub-decree Article 8)

【Fine】

-One-time fine

4) Discharge of sewage without through public sewage system or other treatment systems (Water Pollutuion Sub-decree Article 9)

【Fine】

- Dayly fine when no significant improvement (number of days is between first inspection and second inspection)
- One-time fine when project owner made significant improvement such as installation of connecting pipe to the public sewer but need to adjust the gradient of the pipe

5) No permit before discharging effluent (Water Pollutuion Sub-decree Article 11)

【Fine】

- Dayly fine (number of days is between the day violation found and the day of starting operation)

6) Not bearing the cost of analysis of wastewater sample (Water Pollutuion Sub-decree Article 21)

【Fine】

One-time fine

7) Not a) have enough facilities and means to prevent the pollution of the public water area, b) installing the equipment of measuring flow, concentration and amount of pollutant and also keep the result for record keeping (Water Pollutuion Sub-decree Article 23)

【Fine】

- Dayly fine (number of days is between the day violation found and the day of starting operation)

3-3 Setting the provision for fine

Introduction of Prakas to notify the application of fine is suggested as the Water Pollution Sub-decree has the article on violation. We can stipulate the Prakas based on the Article 34 of the Water Pollution Sub-decree

Article 34: Violations of this Sub-degree shall be fined and punished according to the articles 20, 21, 22, 23 and the article 25 of the chapter 9 of the Law

(Reference)

Law on Environmental Protection and Natural Resource Management

ARTICLE 20:

Any person who violates the rule of the Ministry of Environment as stated in the article 14 of this law, this Ministry shall issue a written order requiring such person to:

- correct his/he/its offending activities immediately or within a specified period; or
- stop his/her/its activities, until the offence is corrected; or
- clean up immediately the pollution.

Article 21

Any person who does not permit or refuses to allow an inspector to enter [and] conduct an examination or inspection on the premises as stated in paragraph l, Article l5 of this law shall be fined administratively from five hundred thousand Riel (500,000 Riel) to one million Riel (l, 000,000 Riel).

In case of a repeat offense, shall be fined from one million Riel (1,000,000 Riel) to five million Riel (5,000,000 Riel) or imprisoned from 1 month to 3 months, or both.

Any person who commits a violation of Article 20 of this law shall be fined administratively from one million Riel (l, 000,000 Riel) to ten million Riel (l0,000,000 Riel). In case of a repeat offense, shall be fined from twenty one million Riel (2l,000,000 Riel) to thirty million Riel (30,000,000 Riel) or imprisoned from 1 month to 1 year, or both.

Article 22

If the violation causes danger to human bodies or lives, to private property, to public property, to the environment, [or] to natural resources, shall be fined from ten million Riel (l0,000,000 Riel) to fifty million Riel (50,000,000 Riel) or imprisoned from l year to 5 years, or both.

A person who commits a violation shall also be responsible for repairing damage and for compensation.

Article 23

In case of a violation that causes serious disaster to society, the court may consider the gravity of the circumstances of the offense connected with any other offenses above in order to pronounce the punishment.

Article 24

Any environmental inspection official or agent who is negligent, fails to pay attention to, or fails to comply with the Ministry's regulations, or conspires with a violator or facilitates the commission of a violation, shall be subject to administrative sanctions or face prosecution before the court.

Article 25

The Ministry of Environment shall apply the provisions of Article 20 above for any person who commits a violation of a Sub-decree and other regulations related to the provisions of this law.
In case of recalcitrance, shall apply the provisions stated in Article 21 of this law.

Sub-Decree on Water Pollution Control, 1999

Article 33: In the case of clear offense that cause water pollution, the inspector of the Ministry of Environment shall:

A. take statement, collect and detain evidence of such offense and make an administrative fine, if the offense has not contaminated seriously water, human health, animal, plants or public properties yet;
B. collect and detain evidence of such offense for making statement and forward the case file to the competent agency, if this violation causes serious pollution of water or injure to human health, animal, plants or public properties.

Article 34: Violations of this Sub-degree shall be fined and punished according to the articles 20, 21, 22, 23 and the article 25 of the chapter 9 of the Law on Environmental Protection and Natural Resource Management.

Article 35: The Ministry of Environment's official is responsible for making a report of prosecution for any person who violate any article of this sub-decree. The Ministry of Environment shall take legal action against any offense of this sub-decree.

Annex 29 Summary Report on Output 1

SUMMARY OF OUTPUT 1

Overview: The project is designed to assist GDEP in organizing the pertinent legal documents for controlling pollution. The two verifiable indicators to assess the achievement status at the time of project completion are: 1) Documents are submitted to Minister(s) for approval for Prakas/Joint Prakas[1]; and 2) Documents are submitted to the Council of Ministers for approval for Sub-decrees[2]. The intention of the project design was construed to review and analyse the existing laws and regulations on water pollution control and EIA to identify issues in its legislation to improve effectiveness and efficiency of environmental management; and to propose amendments to the existing laws and regulation; or to draw up new law(s) as needed to make them workable under the legislative hierarchy. The amended or proposed laws are father expected to be brought to a higher level authorities for approval.

When the Project was commenced in 2017, MOE had engaged in review process of the Law on Environmental Protection Natural Resources Management to prepare the Environment and Natural Resource Codes (ENR Code) under a project, Environmental Governance Reform, funded by UNDP. Therefore, the Project pursued all the activities in line with the draft ENR code to avoid potential deviation from the fundamental spirits of the Code. However it is noted that the finalization process of ENR code is suspended.

A Brief Historical Context

The Sub-decree on Water Pollution Control of Cambodia, No: 27 ANRK.BK, was signed on April 06, 1999. In the subsequent decades, Cambodia's economy continued high growth. Especially from 2004 until 2007, the country achieved GDP growth at 10 % or more each year. It has triggered increasing demand for housing and infrastructure, which was also accompanied by increased impervious cover. Stream self-purification enhanced by natural wetlands functions had previously absorbed the pollutants; though, the incremental pollution loads have gone beyond the capacity of such natural ecosystem. The changes of the environmental conditions caused by the rapid economic growth necessitated the review and an overhauling of the water sector.

The primary law related to water pollution control effective at the time of project commencement was the Sub-decree on Water Pollution Control of Cambodia, No: 27 ANRK.BK which was signed on April 06, 1999. The sub-decree is seen as a legislative framework to govern all the water pollution control activities in the country. Therefore, it was obvious that a focus of the review process should be given to the said Sub-decree.

The activity to produce the output was broken down into six (6) sub-activities, namely: 1) Develop task force to review laws and regulations, 2) Finalize items for output 1, 3) Review and draft revised laws and regulations, 4) Consultation with stakeholders, 5) Finalize draft revised laws and regulations and 6) Prepare summary report for output 1. Please note that this summary is the output of the sixth activity. The following part of the summary thus provides information on other five activities.

Develop task force to review laws and regulations: The review of legislation under Output 1 and the development of pertinent guidelines and manuals under Output 2 are a series of processes that are inseparable and should be implemented seamlessly by the same group of people who have common views and understanding on the issues and challenges. Two task forces were thus organized on 1) Water Quality and 2) EIA in September 2017.

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[1] Prakas or Ministerial Orders or Proclamations are executive regulations made at the ministerial level to implement and clarify specific provisions within higher-level legislative documents and give instructions.

[2] A Sub-decree (Anu-Kret) is used to clarify provisions within existing laws. It is drafted within relevant ministries, approved by the Council of Ministers and endorsed by the Prime Minister.

Finalize items for output 1: For the water subsector, it was decided to give a focus on the Sub-Decree on Water Pollution Control through a series of meetings of the Task Force on Water Pollution. The specific output of the activities included: 1) an amendment of the sub-decree on Water Pollution Control focusing on industrial wastewater control, 2) Registration system of Environmental Laboratory for Water Examination; 3) a Wastewater treatment facility Guideline; 4) a Factory Inspection Manual; and 5) a Guideline for prevention of underground leakage of chemicals. For the EIA subsector, the relevant Task Force reviewed past (I) EIA reports to identify key issues to prepare a Review Manual; and develop three sector guidelines on 1) Infrastructure, 2) industry and 3) Special Economic Zone/Land Development. The activities pertaining to EIA are described in the summary report on Output 2 because all the deliverables related to EIA are those not requiring authorization process. The subsequent sections thereby give focuses on those on the Water Pollution Subsector. The guidelines and manuals relevant to water quality control are integral part of developing/amending the Sub-decree and thus the development process of them are also presented in this section as far as the context requires. The figure below illustrates an overall structure of the laws and guidelines on water pollution control with a focus on the project activities.

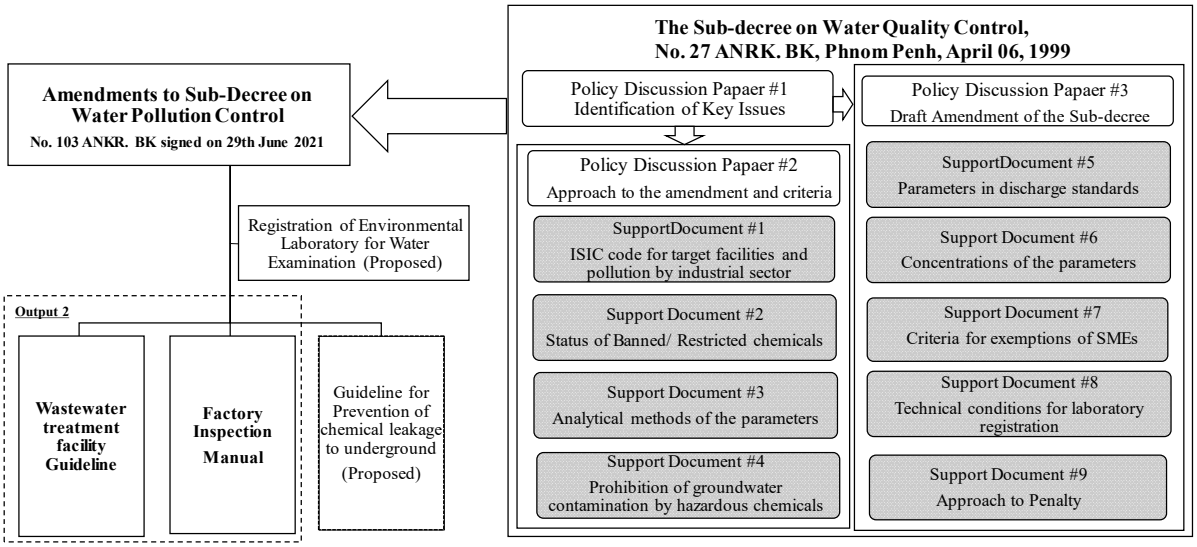

Figure 1 Legal Documents related Water Pollution Control Organized

Review and draft revised laws and regulations: The Task Force Meeting on Water Quality Control was convened six times over the project duration in the period from 2nd October 2017 until 4th March 2019. The Task Force members discussed a broad range of issues to include the amendment of the sub-decree and technical guidelines on inspection and wastewater treatment technology.

The series of activity started from a thorough review of the previous Sub-decree on Water Quality Control. It was found that the sub-decree contains ambiguities and conflicts among articles in the main text and its annexes, which may have prevented effective intervention into water quality control. The issues identified in the review process were then discussed for amendment of the sub-decree. For the purpose of building consensus among the participants of the Task Force, the summary of issues and key approaches were compiled as Policy Discussion Papers which were further supplemented by Support Documents. The Task force eventually three (3) Policy Discussion Papers accompanied by nine (9) Support Documents. They are illustrated in Figure 1.

Consultation with stakeholders: Two consultation meetings on water sector were convened for 1) academe and 2) the industry. The consultation meeting with academe took place on 7th September 2017 with Institute of Technology of Cambodia to acquire views and feedback on the activities for modification of the relevant legislation on water quality control. With the private sector, the meeting

took place on 28th September 2017 with the participation of Cambodian Chamber of Commerce (CCC). A key issue in the consultation meetings was the debate on the exemption of Small and Medium Scale Industries (SMEs) from the universal application of the effluent standards with due consideration on the financial impact of the regulation on the SME operation as it incurs additional cost for pollution control investment. GDEP acquired water supply data from PPWSA together with registration of industries from MIH to develop a histogram of Water Consumption of the Factories in Phnom Penh. The data was used to determine the threshold value to exempt the Small and Medium Scale Industry.

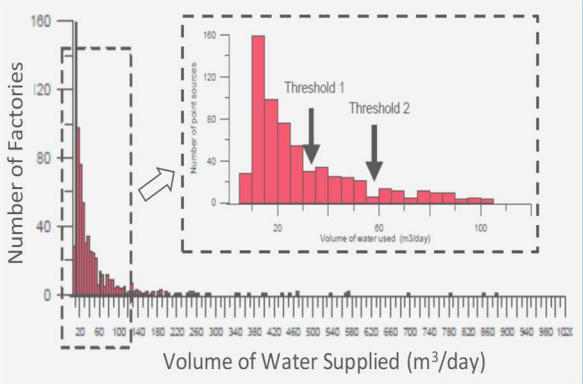

Figure 1 Histogram of Water Consumption of the Factories in Phnom Penh
Source: PPWSA, it was modified by the JICA Team

Other informal consultation meetings were also convened with private sectors: 1) Nidec Corporation on 26th July 2017, 2) JBAC on 26th July and 25th August 2017, 3) Phnom Penh Specialized Economic Zone on 29th September 2017, 4) Cambodia Suzuki Motor Co., Ltd. on 23rd November 2017.

Finalize draft revised laws and regulations: Upon completion of the sixth (6th) Task Force Meeting on 4th March 2019, the proposed amendment of the sub-decree was put into Khmer language before formalization and authorization process. The process for authorization was the most challenging part of the activities as it contains the actions which are not under the direct control of the project team. It was also significantly affected by the Pandemic. The Khmer version of the draft Sub-decree on Water Quality Control was submitted to the Minister of Environment for his initial review and approval in September 2019. The draft sub-decree was then brough to the Inter-department review meeting which was convened within MOE on 3rd December 2019. Among the articles in the sub-decree, Chapter 6 and 7 on Penalty was focused to be discussed on its validity and enforceability in the Inter-department review meeting. The GDEP brought the issue to the Ministry of Justice in 2020. A technical issue discussed in the meeting also included the harmonization of the standards with other standards set forth by the Ministry of Industry and Handicraft[3], the Ministry of Water Resources and Meteorology, the Ministry of Public Work and Transport. A public consultation meeting was further organized in February 2020. The details of the meeting is not available under the hand of the project team. The issues identified in the consultation meeting was integrated in the revised sub-decree before March 2020.

The revised draft Sub-decree was subsequently submitted to the Office of Council of Ministers which is now referred to as the Cabinet of Cambodia. At this stage, the office suggested to retain the original articles on penalty to make it consistent with the Law on Environmental Protection Natural Resources Management which is in a higher hierarchy of the laws. The sub-decree was eventually signed by Samdech Akka Moha Sena Padei Techo Hun Sen, Prime Minister of the Kingdom of Cambodia on 29th June 2021 as No. 103 ANKR. BK

Other guidelines and Manuals related to the water pollution control were subject to the final review process in the period from August 2021 by two Cambodian experts to modify and customize them to the local settings.

Key Issues and Lessons Learned: The key issues and lessons learned with regard to specifically to

[3] The Ministry of Industry and Handicraft is now called the Ministry of Industry, Science, Technology and Innovation (MISTI). However, the former name of MIH is used to make it consistent with the main report of the Project.

Output 1 include the following two aspects.

1. In designing the effluent standards, *ex ante* impact assessment was adopted, which has led to exemption of SMEs from uniform application of the effluent standards in the Sub-decree on Water Pollution Control. It is likely the first occasion in Cambodia to adopt *ex ante* impact assessment in pollution control. It is further desirable to adopt cost benefit analyses for policy formulation wherever data is available and applicable to assess the welfare impacts of regulation taking into account economic and social impacts over time.
2. *Ex post* impact analysis is also important to ensure that the articles and the standards in the amended sub-decree are effective and efficient. It is recommended that GDEP put in place a mechanism of periodic evaluation by which the public can also make recommendations to modify, as necessary, the sub-decree and other existing regulations.

Annex 30 Record of the meetings on EIA Task Force

1st Task-Force Meeting on EIA

MEETING MEMO

Date & Time:	Date: 29 September 2017 Time: 09:00-10:30 AM
Place	Kreal Meeting Room, 1st Floor of Ministry of Environment
Attendees:	1. Mr. CHEA Leng, Deputy Director of EIA 2. Mr. CHOUP Sivutha, Deputy Director of EIA 3. Mr. NGORN Mengly, Chief Officer of Infrastructure and Tourism Project, EIA 4. Mr. OU Sophorn, Chief Office of Mines and Energy Project Review, EIA 5. Mr. YIM Sothan, Chief Office of Research and Training, EIA 6. Mr. NGET Kdompea, Vice-Chief Office of Agriculture and Water Resources 7. Mr. MEY Sithin, Vice-Chief Office of Public Participant, EIA
Project Team:	1. Mr. HATANO Takayuki, JICA Expert/EIA 2. Mr. MENG Kro, Project Coordinator, JICA
Agenda / Discussion Points:	1. Member Introduction 2. Objectives and Activities 3. Roles of Member 4. Discussion 1. Priority Sectors 2. How to develop EIA Sector guidelines and review manual 5. EIA Training (Tentative) 6. Schedule (Tentative) 7. Task toward next meeting

Key Points:

1. **Priority sector for creating EIA Guideline**

Comment from DIEA Team

Department of EIA team suggest to JICA project to focus on the guideline as following:

- Infrastructure sector such sky train, sub-way from Phnom Penh to Phnom Penh Airport, road and bridge
- Metal Factory (heavy metal discharge from factory)
- Phnom Penh Special Economic Zone (PPSEZ) Guideline
- High building guideline (if applicable)

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Responses from Mr. HATAONO, JICA Expert

- JICA project will start reviewing the guideline with the priority sectors and the duration of the project is about 3.5 years. Therefore, if we still have time, we can think about other sectors that you need. Therefore, if you have any suggestion related to the required EIA guideline, please let us know. We will consider and start doing step by step.

Comment from DIEA Team

- As we mentioned above, we also want JICA Project creates an EIA guideline for high building because we are sure that Japan has a good technology for high building infrastructure development. We want to get an idea and guideline from Japan to help development our country.

2. How to develop the EIA sector guideline and review manual?

Comment from Mr. Chea Leng, Deputy Director of EIA Department

- It is really good thing that you show us about the EIA guideline and review manual from other countries such as Japan and Philippine. I think if you document all the guideline from other countries and synthesize as a book or report, our team can learn from your study achievement.
-

Responses from Mr. HATANO, JICA Expert

- I will send you the EIA guideline documents related to your required priority guideline from other countries. Therefore, you can know more about the guideline and review manual.

3. Basic course for EIA Training

Comment from Mr. Choup Sivutha, Deputy Director of EIA Department

- For basic training course that Mr. Hatano mentions related to 1) EIA system outside Cambodia (Japan and others) 2) Sector specific Guidelines and its necessity and 3) EIA review manual and its necessity. I want to request you about **study trip** because it is very important for member to know the real activities.

Responses from Mr. HATANO, JICA Expert

- Thank you for your comments. We will consider later about **Study Trip for members**.

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4. Applied course for EIA Training

Comment from Mr. Choup Sivutha, Deputy Director of EIA Department

- For applied training course related to 1) Major challenges/issues in creating IEIA/EIA reports (sector specific) 2) Major challenges/issues in reviewing IEIA/EIA reports (sector specific) 3) Practical training for IEIA/EIA screening/scoping 4) Practical training for IEIA/EIA reviewing and 5) Review training using model EIA report.
  I want to request you to add one more related to **Practical of EIA monitoring**.

Responses from Mr. HATANO, JICA Expert

- Thank you for your comments. We will add the practical of EIA monitoring.

5. Schedule (tentative)

Comment from Mr. Chea Leng, Deputy Director of EIA Department

- It is really good that you hire outsourcing expert for EIA taskforce and you can invite the outsource expert to join for the next taskforce meeting and he/she can start to review and finalize the task.

Responses from Mr. HATANO, JICA Expert

- For the taskforce of EIA plan to hire outsourcing expert, but we are not sure for the next taskforce meeting, we could find or not. Anyway, the experts will review the legal documents and then combine for the drafting of EIA guidelines. I suggest to the taskforce member help comments and share an idea with Drafting of EIA guideline in order to reach our target achievement.

Comment from Mr. Ngorn Mengly, Chief Officer of Infrastructure and Tourism Project Review

- After completing the EIA guideline (sector specific), Does JICA Project support the published documents for our team and if support, how many published copy documents provided by the JICA project?

Responses from Mr. HATANO, JICA Expert

- JICA Project will support the published documents after finishing the sector specific EIA guideline and for the number of copy documents we will consider later for the real need.

-The End-

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2nd Task Force on EIA MEETING MEMO

Date & Time:	Date: 24 October 2017 Time: 02:30-04:00 PM
Place	Kreal Meeting Room, 1st Floor of Ministry of Environment
Attendees:	Mr. CHEA Leng, Deputy Director of EIA Department Mr. DUONG Samkeat, Deputy Director of EIA Department Mr. OU Sophorn, Chief Office of EIA Mr. TOUCH RENA, Chief Office of Industry and Health Review Mr. CHRIN Narong, Chief Office of Public Participation Mr. NGET Kdomphea, Vice-Chief Office
Project Team:	Mr. Akira Yamashita, Deputy Team Leader Mr. Yusuke Nakayama, Training Planner I Mr. Takayuki Hatano, EIA Mr. MENG Kro, Project Coordinator, JICA
Agenda / Discussion Points:	1. Confirmation of the last Task Force Meeting on 29 September 2017 2. Identification of current issues/problems without specific guidelines 3. Advantages of developing sector specific guidelines 4. Ideal form for the EIA system in Cambodia 5. Draft of chapter for selection sectors 6. Schedule

Key Points:

- DEIA team agreed with the sectors for EIA guidelines:
    1. Infrastructure (road, sky train, bridge…)
    2. Industry (meter factory)
    3. PPSEZ + tall building (next candidate)
- The draft of chapter content for selected sectors should separate one by one in order to be easy to read and DEIA suggested that the draft should be in A4 file document which is easily to catch up more detail information. One document for road construction guideline and another documents for industry guideline and PPSEZ as well.
- The content of the chapter guideline should be separated as physical resources and biological resources and in physical resources part should be consist of soil contamination, noise and vibration, subsidence, sediment, soil erosion, ground water, and hydrology, topography &geology.
- Air quality and odor should be the same

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- Waste part should be mentioned in Chapter 7 Environmental Management Plan (EMP)
- In social environmental part should add more item such as water use, land use and infrastructure.
- Ecosystem should be clearly mentioned such as fishery resource, forest, wildlife and so on.
- Mr. Hatano responded the table of content was a proposal and basically agreed with the modification.
- DEIA suggested Mr. Hatano to get the document related to Check List by JICA that he showed during his presentation in order to know more detail. Mr. Hatano responded such check list was just shown as an example this occasion and would be shared later.
- Mr. Hatano requested the 3rd task force meeting for 1 day from 6-10 November 2017 which will be coordinated by Mr. Watanabe. Mr. Chea Leng will inform later for the date of the 3rd meeting. After being fixed the date & time, the JICA Team will issue an official letter to the DG.
- Mr. Chea Leng want to know about the purpose of the 3rd task force meeting, what JICA project want to show and talking about. He wants JICA show the draft of guideline and DEIA team can review and comment on the document. Moreover, he asked about the EIA consultant for the guideline review. When will JICA hire consultant for coordinating this task?
- Mr. Hatano showed the local consultant deadline of bidding on 26 October 2017, selection and negotiation by early November 2017 and start working around in the middle of November 2017. He will introduce the local consultant to DEIA after the candidate is selected by JICA team.
- Last but not least, Mr. Hatano informed about the local consultant work responsibilities 1) assist the task force members in operating and managing the task force on EIA 2) review and analyze EIA report in Cambodia which is 5 EIA cases are selected from 8 sectors including agriculture, water management, industry, mining, energy (oil, gas, and electricity), infrastructure, health and hygiene, and tourism sector 3) assist the task force in developing and finalizing and EIA sector specific guidelines 4) assisting the task force in developing and finalizing and EIA review manual.
- Mr. Chea Leng agreed with the local consultant work responsibilities and he is waiting for him/her start working as soon as possible.

-The End-

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The 3rd TF-EIA MEETING MEMO

Date & Time:	Date: 07 November 2017 Time: 04:00-06:00 PM
Place	Kreal Meeting Room, 1st floor, Ministry of Environment
Attendees:	Mr. CHEA Leng, Deputy Director, Department of EIA Mr. DUONG Samkeat, Deputy Director, Department of EIA Mr. CHEY Yuthearith, Deputy Director, Department of EIA Mr. CHRIN Narong, Chief Officer, Department of EIA Mr. OU Sophorn, Chief Officer, Department of EIA Mr. SAR Kosal, Chief Officer, Department of EIA Mr. TOUCH Rena, Chief Officer, Department of EIA Mr. MEY Sithin, Deputy Chief Officer, Department of EIA Mr. NGET Kdomphea, Deputy Chief Officer, Department of EIA
Project Team:	Mr. Taisuke Watanabe, JICA Expert Mr. MENG Kro, Project Coordinator, JICA
Agenda / Discussion Points:	1. Confirmation of the last TF meeting (October 24, 2017) 2. Discussion draft chapters and its contents 3. Next meeting 4. Others

Key Points:

1. Chapters and contents of sector GL
Watanabe explained the discussion points in PPT and briefed difference of 3 sectors
Comments from DEIA:
(Executive Summary)
- Insert TOC, abbreviation, etc. after Executive Summary.
(1. Introduction)
- For full EIA, separate methodologies and scope of the study by setting 2-1 Methodologies and 2-2 scope of the study
(2. Legal framework)
- Insert Prakas.
(3. Project description)
- more detailed description on Activities program of the project
- Work plan comes after "Activities program of the project" and describes schedule (not necessary to follow the General Guideline).

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(4.1.1 Physical Resources)
- Air and water is by pollutant.
(4.1.2 Biological resources)
- Includes biological corridor, food chain and fishery.
(4.2 Socio-economic Aspects)
- Revise "Aspects" to "Resources"
(5. Public participation)
- Includes steps and methodology
(6.4 Description ---)
- Move to before 7.
- Basically no mitigation measures.
(Items after 6.4)
- Separate the clause to pre-operation, operation and closure.
- "Environment" in Physical Environment etc. revised to Resources.
- Natural environment revised to Biological resources
- Order is, topography, soil erosion, soil quality, subisidence, air, water, hydrology, water quality (surface) and ground water quality
- Includes matters which detailed regulation does not exists.
- "Wastes" is covered by waste management plan and water
- Soil contamination revised to Soil quality
- On subsidence, please introduce Japanese regulation.
- Protected area revised to natural protected area
- Fishery resources revised to aquatic resources.
- Land use revised to Land use/rights.
- Delete Local Conflict of Interest
- Heritage revised to Heritage/culture.
- Insert Infrastructure after Heritage.
- The poor, ethnic minorities & IP revised to marginal group.
- Insert Public health after Hazard risks
(7. Environmental management Plan)
- Insert Institutional arrangement after Training.
- Insert Budget plan for EMP and environmental-social fund.
- Greivance mechanism stays here
(8. Economic analysis)
- Include cost-benefit analysis
- Comparison with alternative included here.

2. Selection of Cambodian consultants

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Watanabe explained the process is in re-bidding because of high cost proposal

- The End -

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The 4th Task Force Meeting on EIA

MEETING MEMO

Date & Time:	Date: 09 January 2018 Time: 09:00 -11:00 AM
Place	Kreal Meeting Room, 1st floor of MoE
Attendees:	1. Mr. CHEA Leng, Deputy Director of EIA Dept. 2. Mr. OU Sophorn, Chief Officer of EIA Department 3. Mr. CHRIN Narong, Chief Officer of EIA Department (consultants) 4. Mr. SOM Sokhamphou, CEO, Thurawadh Co., LTD (Sustinat Green team) 5. Mr. Sum Serey, CTO, Sustinat Green Co., LTD 6. Mr. SOM Piseth, Vice-Chief of Technical Officer, Sustinat Green Co., LTD 7. Mr. KONG Sopheak, EIA Consultant, Sustinat Green Co., LTD
Project Team:	1. Mr. Muramatsu Yasuhiko, JICA Expert 2. Mr. Watanabe Taisuke, JICA Expert 3. Mr. MENG Kro, Project Coordinator, JICA
Agenda / Discussion Points:	1. Introduction of local consultant 2. Looking back the last TF meeting on 7th November 2017 3. Discussion on the early draft of the infrastructure sector guideline (Full EIA) 4. Next meeting appointment

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Key Points:

Draft of the infrastructure sector guideline (Full EIA)

- Mr. Watanabe showed the draft of infrastructure sectoral guideline and asked any comments from EIA team and EIA consultant from Sustinat Green Co., LTD.

Objective

- Mr. Chea Leng, Deputy Director of EIA department and his team agreed to follow the (option 2: specific) To provide guidance on contents of EIA study process and EIA reports in infrastructure sector.

Target sector

- The infrastructure sectoral guideline (road and railway) are the first option to consider due to they are expected to be biggest in number of projects, Mr. Watanabe said.
- Mr. Chea Leng asked how about sky train and sub-way sector guidelines? Department of EIA also want to get the guideline related to these sectors. Sky train is very difficult for us to create the guideline and we want to know from Japanese expert because they are capable to construct the good quality of sky train.
- Mr. Watanabe mentioned that today we discuss only road and railway sectoral guideline. We will discuss about sky train and sub-way next time.
- EIA team suggested to JICA expert team should write the sector guidelines for Road and Railway in separate (changing the tile of the guideline) and guidebook for sky train and sub-way. Guidebook is a tip (get idea) and do not get approval from minister, while guideline need more details and also approved by minister. Also MPWT is planning highway. Mr. Watanabe agreed.
- **4-6 Alternative [discussion point],** for this section, Mr. Chea Leng asked about the meaning of alternatives and he suggested to JICA team should bullet the main points of alternatives and then we will consider later in the next meeting. Mr. Watanabe mentioned the alternatives should be location, design, and technology. He agreed to

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bullet all the important point for this section.

- **5.1.1 Physical Resource**
  - **Climate:**
    - Mr. Watanabe asked about the availability of meteorological data in Cambodia. Climate describes weather information including temperature, rainfall, wind speed and pattern, wind direction and relative humidity.
    - Mr. Chea Leng mentioned that for infrastructure have to consider about flood, climate change, disaster and sea level right. How long to identify the temperature, rainfall, wind speed and pattern, wind direction? At least 1 year, Mr. Watanabe responded.
    - Mr. Sokhamphou said that if the data is not available, we cannot do it. He never sees the sea level right data in Cambodia. Cambodia does not have our own data about see level.
  - **Air quality:**
    - Measurement data at project site is required or qualitative description is ok? Mr. Watanabe mentioned.
    - Mr. Chea Leng said that MoE has the laboratory to measure air quality and other companies also have their own. In the law identify that all construction companies have to have their own equipment or they can borrow from MoE for measurement.
  - **Hydrology:**
    - Mr. Chea Leng is not so clear about flow rate information? He suggested to JICA expert team should bullet the main point of hydrology and then we will consider later.
    - Mr. Watanabe mentioned that it is flow level that consider about volume, speed and so one. He agreed with Mr. Chea Leng to bullet the main point.

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- **Soil:**
  - Mr. Chea Leng said that in soil section should consider the location, strength of soil, earthquake and so on.
  - Mr. Piseth added that we should consider about soil profile and soil mechanic as well, normally existing JICA study data is used.

5.1.2 Biological Resources

- **Aquatic resources, if related:** Mr. Chea Leng and Mr. Ou Sophorn suggested to add protected area
- **Marginal group:** Mr. Chea Leng and his team showed that local authority will know about the ethnic minority and indigenous people.

6. **Public Participation:** Mr. Chea Leng suggested to write the step of public participation. JICA expert should write the draft and EIA department will revise later.
7. **Environmental Impacts and Mitigation Measures**
   - 7.1 What method to access it? (Matrix, checklist or others), Mr. Chea Leng asked.
     Mr. Watanbe mentioned that we will use checklist in 7.2 A summary of point 7.1 by copying the table in General Guideline Prakas.
   - 7.3 impacts and mitigation measures by project stage: in this section Mr. Chea Leng and his team suggested JICA expert to separate the project stage as following:
     - Before operation
       - Design stage
       - Construction stage
     - Operation stage

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  - Closure stage
- Impact and mitigation: JICA should separate impact with specific mitigation description.

  - Mr. Chea Leng shared about his experience to join the training in Japan in 2006. He showed that Japan has software related to impact and mitigation. We just type the impact and later on software will run for us. Mr. Watanabe responded that much background data is needed to run the software.
- 7.3.1 impacts and mitigation measure during design and construction phase

  <u>Physical Resources</u>
  - Mr. Chea Leng said should follow three stages as he mentioned above.
  - Please identify clearly between new and existing road
- Hazard (man-made hazards)
  - Should change the word Hazard to Risk and delete man-made, and move to social part
- Waste management: in this section should be deleted ~~from physical resource and put it in social environment section~~

  <u>Social Environment</u>
- Cumulative impacts: this section required for Full EIA and no need for IEIA, Mr. Chea Leng mentioned. The cumulative impact should add flooding (change water way).

- Mr. Chea Leng suggested to change the title of guideline to specific Road and Railway.
- Please invite Sustinat Green members to join in the EIA-JICA Telegram group.
- Mr. Watanabe try to finish the draft in the end of this month
- Mr. Chea Leng suggested that JICA expert can send to EIA department for revising

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the draft when they finish section by section. No need to finish all and then send to EIA Department.

- Mr. Sokhamphou mentioned how EIA consultant can assist? Mr. Watanabe said that JICA expert start to write the draft and EIA consultant to provide comment from their experience such as availability of information and collect comments from TF members.
- We will discuss the metal (heavy industrial) guideline as industry sector later after we finished the infrastructure (Road and Railway guidelines.
- Mr. Watanabe informed Mr. Hatano will come late January or early February.

–The End–

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The 5th Task Force Meeting on EIA

MEETING MEMO

Date & Time:	Date: 29 January 2018 Time: 02:30 PM - 05:00 PM
Place	Kreal Meeting Room, 1st floor of MoE
Attendees:	1. Mr. DANH Serey, Director of EIA Dept. 2. Mr. DUONG Samkeat, Deputy Director of EIA Dept. 3. Mr. CHEA Leng, Deputy Director of EIA Dept. 4. Mr. YIM Sothan, Chief Officer of EIA Department 5. Mr. CHRIN Narong, Chief Officer of EIA Department 6. Mr. CHEA Panharith, Chief Officer of EIA Department 7. Mr. ING Dy, Chief Officer of EIA Department 8. Mr. SUON Pagnasak, Chief Officer of EIA Department 9. Mr. SAY Bora, Program Officer, JICA Head Office (consultants) 10. Mr. SOM Sokhamphou, CEO, Thurawadh Co., LTD (Sustinat Green team) 11. Mr. Sum Serey, CTO, Sustinat Green Co., LTD 12. Mr. Arron SEXTON, STA Sustinat Green Co., LTD 13. Mr. SOM Piseth, Vice-Chief of Technical Officer, Sustinat Green Co., LTD 14. Mr. KONG Sopheak, EIA Consultant, Sustinat Green Co., LTD
Project Team:	1. Mr. Akira YAMASHITA, JICA Expert 2. Mr. Yusuke NAKAYAMA, JICA Expert 3. Mr. Takayuki HATANO, JICA Expert 4. Mr. Zenjiro EGAWA, JICA Expert 5. Mr. MENG Kro, Project Coordinator, PEPC
Agenda / Discussion Points:	1. Confirmation of the last TF meeting on 09 January 2018 2. Verification of revised guideline (road and railway)

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	3. Process for finalizing the guideline inside MoE 4. Preliminary draft of EIA review manual 5. Schedule

Key Points:

- Mr. Danh Serey discussed about work between DEIA and JICA team for both administration and EIA technical work. He suggested that JICA team should contact directly to DEIA about the information related to meeting appointment and documents needed or training sessions. JICA team does not need to contact the GDEP administration office because sometimes it is difficult for work coordination.
  Note: The expert team continues to submit official request letters to the DG for our information and keeping them as evidence.

- Please make sure between DEIA and JICA team, who are responsible for EIA work (for JICA team)? In previous time, DEIA confused the JICA experts due to they normally changed an expert from time to time. DEIA also has cooperation with serval projects including JICA project at Ministry of Public Works and Transportation as well. Therefore, we sometime confuse the team.
- Mr. Hatano stated that JICA team has two Japanese experts are Mr. Watanabe and Mr. Hatano (me).
- Mr. Danh Serey mentioned about the current EIA project with JICA project at Ministry of Public Works and Transportation. He suggested Mr. Hatano to discuss with Mr. Yamashita (MoPWT) about EIA work since some works are overlapped.
- Mr. Hatano agreed to talk more detail information with Mr. Yamashita about EIA project at MoPWT supported by JICA as well.
- For training supposed by JICA to conduct on 01st or 02nd February 2018. Department of EIA does not be available with this date. We are so busy with this period. Could we move to another date? Mr. Serey said.
- Mr. Hatano mentioned that he will back to Japan on 02 February and will be available in Cambodia again in March 2018. Please arrange the date for the training session.

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- Mr. Serey agreed to conduct the EIA review training on **06 March 2018.** Who are the participants for the training? Mr. Danh Serey added.
- Mr. Hatano stated that the participants are from officers at DEIA including EIA task force member as well. Mr. Hatano outlined the agenda of the meeting and reviewed the points in the last taskforce meeting (9 Jan. 2018), followed by the discussion points of revised guidelines both for full EIA and IEIA in road and railway sectors, respectively. Major discussions were as follows:

Executive summary

- Mr. Duong Samkeat stated that the volume of executive summary would be proper between 15 to 20 pages. 5 pages proposed by JICA team seem to be too short.
- Mr. Sokhamphou agreed with 15 to 20 pages for the executive summary session. The report should focus on the main idea for each chapter from the whole report.

1. Introduction

- Objective of the guidelines

- Mr. Samkeat suggested that objectives of the guideline should not be here. This section should put the objective of the study. Objectives of the guideline should cover all the guideline, he added. It should be in the preface of the report for the objective of the guideline said by Mr. Chea Leng.
- All participants agreed that the road guideline should include highways and bridges.
- Guidelines User should be deleted, Mr. Samkeat mentioned.

2. Methodology

- Mr. Samkeat suggested that methodology section should be more detail about how to collect the physical, biological and economic-social resources? How to collect primary and secondary data? How to analyze and interpret data? and so on. The methodology that JICA expert wrote here is too short. It is not clear. JICA expert please discuss more detail with Sustinat Green Consultant Company because their staff has more experiences with this work.
- JICA team mentioned the manner of the TOR Formats by Oxfam could be helpful and referred to.

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3. Legal Framework

- Some laws in the table do not relate with some study. Therefore, please mention clearly in case that is not relevant. Example: Royal Decree on Establishment and Management of Tonle Sap Biosphere Reserve. Some study does not across the Tonle Sap Lake. Hence, it does not need to mention in the report, Mr. Samkeat and Mr. Sokhamphou mentioned.
- Mr. Hatano responded the table is just an example, showing “Example of related Laws and Sub-decrees” in the title. EIA report developers shall input proper related laws/sub-decrees suitable for their project.

4. Project Description

- The project description should be rearranged again. Mr. Samkeat and Mr. Chea Leng proposed as following:

  2-1 Background and experiences of the project owner/company

  2-2 Project site

  2-3 Project types

  2-4 Alternatives

  2-5 Activities of the project

  2-6 Work plan/schedule
- JICA team agreed with the propose.

5. Description of Existing Environment

5.1.1 Physical resources

- Physical resources should be rearrange as following:
  - Climate
  - Air quality
    - Cambodia has air quality standard
    - In Air quality section, please descript more detail about parameters such as CO, NO2, SO2, TSP, Pb, PM10 and PM2.5. and clearly about the methods analyze for all parameters.

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- To describe baseline data with methodology, period and location with its characteristics and distance from sensitive areas such as community, school, hospital, temple/pagoda…etc.
- Mr. Samkeat suggested JICA expert to discuss directly with Department of Air Quality and Noise Management about air sector because their staff specialized with this field.

- Noise and vibration
  - Cambodia does not have vibration standard.
  - Currently, Cambodia use Japanese standard for vibration by dividing into 2 times period for investigation. 1) from 06:00 AM – 18:00 PM (standard 65 dB(A) and 2) from 18:00 PM – 06:00 AM (standard 60 dB(A)).
  - Mr. Samkeat suggested that for vibration standard, JICA expert should follow the standard in Japan. Ministry of Environment staff in Cambodia are happy to learn from Japanese expert.
  - Mr. Hatano agreed to review the Japan standard for vibration. He also identified that Japan does not have the national environmental standard in vibration, but for specific construction area and operating factories. Some municipalities in Japan set the standard by themselves. It has different standard depending on an area such as urban area, industrial area, rural area, sea area and so one.
- Hydrology
  - Mr. Samkeat suggested JICA expert to read not only the Mekong River Commission Website, but also the water quality monitoring project (JICA 2002) consist of several sectors such as hydrology, road, irrigation…etc. As he remembers, this data done by Ministry of Public Works and Transport.
- Water quality
  - Mr. Samkeat mentioned that it should be more detail about the procedure of water quality monitoring and analyzing and so on.
  - JICA experts please discuss more with Department of Water Quality Management
  - More detail about sampling point, parameters and so on.
  - JICA team showed possible parameters and both agreed with the 10 parameters in the table

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below. The DEIA requested to add detergent which would be often used in a construction area and give an adverse impact on the water environment.

- Task Force members tentatively eliminated heavy metals such as Pb, Hg, Cd, Cr from the parameters, and expressed acceptability of some when required through Task Force meetings or from stakeholders.
-

No	Parameters	Unit	Standards	Method/Material
1	pH	-		
2	Total Dissolved Solid (TDS)	mg/l		
3	Total Suspended Solid (TSS)	mg/l		
4	Dissolved Oxygen (DO)	mg/l		
5	Biological Oxygen Demand (BOD5)	mg/l		
6	Chemical Oxygen Demand (COD)	mg/l		
7	Total Phosphorus (TP)	mg/l		
8	Total Nitrogen (TN)	mg/l		
9	Detergent (propose to add)	mg/l		
10	Total Coliform	NPN/100ml		

- Soil
  - To describe soil profile of the alignment such as
    - Watershed
    - Topography
    - Geography
    - Soil Mechanique

- Mr. Samkeat suggested JICA expert to discuss more with Sustinat Green Consultant Company for the rest sections and documents.
- Other topics to be scheduled were postponed to the next task force meeting because of time limitation.

The meeting was adjourned at 5:00 PM.

- The End -

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6th TF-EIA
MEETING MEMO

Date & Time:	Date: 27 March 2018 Time: 09:00 -11:00 AM
Place	Kreal Meeting Room, 1st floor of MoE
Attendees:	1. Mr. CHEA Leng, Deputy Director of EIA Department 2. Mr. CHEY Yuthearith, Deputy Director of EIA Department 3. Mr. YIM Sothan, Chief Office of EIA Department 4. Mr. ING Dy, Chief Office of EIA Department 5. Mr. SUON Pagnasak, Vice-Chief Office of EIA Department
Project Team:	1. Mr. Taisuke WATANABE, JICA Expert 2. Mr. Takayuki HATANO, JICA Expert 3. Mr. MENG Kro, Project Coordinator, PEPC 4. Mr. SUM Sokhamphou, Team Leader/Sustinat Green 5. Mr. SUM Sirey, CTO/Sustinat Green 6. Mr. AARON Sexton, Technical Advisor/Sustinat Green 7. Mr. SOM Piseth, Vice-Chief/Sustinat Green
Agenda / Discussion Points:	I. Introduction of draft sector guidelines and review manual II. Development of sector guidelines and review manual 1. Process and schedule 2. Organizing stakeholder meeting 3. Next meeting and others

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Key Points:

- Mr. Watanabe showed as following points:

I. Introduction of draft sector guidelines and review manual

1) Common

- Divide the guideline in 2 parts, part 1 with objective of the guideline and part 2 with the guideline itself.
- Basic and common points are described in the Methodology and Scope of the EIA study section
- Executive summary is 15-20 pages for full EIA and 10-15 pages for IEIA
- Table of data on existing environment (air, noise, vibration and water) is included
- Area of the impact study is included
- Climate change and waste management is included in the impact and mitigation measures

2) Road and Railways sector (infrastructure sector)

- Road sector includes highways and bridges
- Railway sector includes bridge

3) Metal sector (industry)

- The guideline covers metal processing factories, not for metal refining
- Pollutants emitted in the air and water are sector-specific, including hazardous organic compounds.

4) SEZ and Industrial Zone

- For special economic zone (SEZ) and industrial zone to follow the Annex of EIA sub-decree
- This guideline does not cover factories to be located after the construction of the SEZ or industrial zone and a factory to be located subject to EIA separately.

- Mr. Chea Leng mentioned that parameter such as parameter of air, surface water, and groundwater. Department of EIA has finished 5 ToR include with parameters as well. JICA team can follow or adjust all parameters.

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II. Development of Sector Guidelines and Review Manual

- Mr. Watabe raised that JICA team is following the schedule below:

Schedule	Work
March 31, 2018	All guidelines and review manual (Expert draft)
After Khmer new year	Comment request to DEIA with Khmer translated version
May — (3 weeks after the comment request)	Comment from DEIA
2-4 weeks after receiving comment	Revising version of guidelines and review manual
June (tentative)	Progress reporting to JCC members
	Confirmation by DEIA and setting the schedule of consultation meeting
	Consultation meeting
	Revised version of guidelines and review manual
	1st Inter-Ministry meeting
	2nd Inter-Ministry meeting
	Approval by the Minister as Prakas

2. Organizing stakeholder meeting

- Basic points: 1 day with lunch and coffee break, around 100 participants, conference room at hotel by invitation.
- Agenda items are following:
  - Opening Address
  - Presentation of guidelines and review manual
  - Group discussion
  - Wrap-up

- Mr. Chea Leng asked that who is participant for consultation meeting?
- Mr. Watanabe mentioned that the stakeholder participants are from Ministries, private sector including consultant, NGO, academics…etc.

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- Mr. Chea Leng agreed to have a consultation meeting and JICA team try to be well-organized for the meeting.
- Mr. Chea Leng suggested that:
    - JICA team should submit the guideline one by one and both Khmer and English version to EIA Department because English language is limited for some staff. They need Khmer language to review in detail.
    - EIA Department need 15 copies for one guideline to review. After revising the draft of guidelines, Mr. Chea Leng suggested both of JICA expert and consultant team from Sustinat Green to join the meeting for final discussion about all guidelines and review manual.
    - 3 weeks is possible for EIA Department to review and comments, but start count the date after Khmer version submission.
- Mr. Sokhamphou asked the Possibility of EIA Department review the guidelines in English version first. After revising in English, Sustinat Green will translate into Khmer.
- Mr. Chea Leng responded that all guidelines in English version are difficult for some staff to review because their English proficiency is limited.
- Mr. Watabe said that JICA team will discuss with Sustinat Green about Khmer translation and we will inform EIA Department letter after discussion.

  After the TF meeting, JICA team had a meeting with SG:

  JICA team will send English draft for Khmer translation to SG early next week. SG will translate in one week, then will send Khmer version with comment format and showing the deadline to DEIA. SG will collect comments from DEIA when deadline comes and translate comments to English.

III. Training session on elevated railway

- After TF meeting, Mr. Watabe had a training session on elevated railway EIA case in Japan.

-The End-

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Meeting with EIA Department

Date & Time:	Date: 28 November 2018, Time: 03:30 PM-04:30 PM
Place	Kreal Meeting Room, 1st floor, the Ministry of Environment
Attendees:	Mr. CHEA Leng, Deputy Director of EIA Department Mr. Chey Yuthearith, Deputy Director of EIA Department Mr. Sar Kosal, Chief Office of EIA Department Mr. Chea Panharith, Chief Office of EIA Department Mr. Ou Sophorn, Chief Office of EIA Department Mr. Mey Sithin, Vice-Chief Office of EIA Department Mr. Nget Kdomphea, Vice-Chief Office of EIA Department Mr. Thanh Pisey, Vice-Chief Office of EIA Department Ms. Soun Panhasak, Vice-Chief Office of EIA Department
Project Team:	Mr. Muramatsu Yasuhiko, JICA Expert Mr. Yamashita Akira, JICA Expert Mr. MENG Kro, Project Coordinator, PEPC
Agenda / Discussion Points:	1. Progress report on EIA guidelines 2. Preparation for Public Hearing 3. Information on EIA/IEIA screening/scoping/reviewing

Key Points:

- Mr. Chea Leng introduced Ms. Thanh Pisey, Vice Chief Office of Research and Training Development under Department of EIA. She will work as assistant to Mr. Chea Leng to coordinate with JICA project work. Please contact her if JICA want to consult and discuss about the project.
- Mr. Yamashita proposed to conduct the public consultation meeting with both Road and Railway sector guideline (EIA/IEIA) because these guidelines are same linear infrastructure and the same participants to participate the meeting such as Ministry of Public Works and Transport, Ministry of Land Management, Urban Planning and Construction…etc.

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- EIA Taskforece Team agreed to conduct the consultation meeting both Road and Railway sector guideline together. Mr. Chea Leng suggested the meeting should conduct for the whole day because we have 2 guidelines and both IEIA and EIA and the venue should be at hotel. Please consider.

Procedure of Meeting to collect data from participants

- What is the procedure of the public consultation meeting? how to collect the data from participants? asked by Mr. Chea Leng.
- Mr. Yamashita mentioned that we will consider the hotel. It could be Cambodian or Himawari Hotel. For the meeting procedure, we will set the guideline for public consultation and provide the paper for the comment and after that we collect the comment paper from all participants.
- (said by Mr. Chea Leng) we should divide group discussion with the main questions or questions that we are not clear and want to consult with stakeholders. For the documents, we should provide to all participant in Microsoft Word both Khmer and English version with the whole guidelines about 1 week beforehand. We should not provide only PowerPoint documents. According to our previous consultation meeting on ToR, we used the World Coffee Method. It means that group 1 will discuss chapter 1, group 2 for chapter 2 and groups and chapters are follow. Then, group 1 change with group 2 to discuss about chapter 2 and change with all groups. This method is exhausted for participants, but fruitful result.
  Mr. Muramatsu confirmed for the group discussion, should we have one consultant to facilitate 1 group discussion? We should have 1 facilitator for one group discussion, Mr. Chea Leng responded.
- Department of EIA will identify the name of institution of participants and JICA team will process the documents and invitation letter (both sides agree). The participants will be from NGO Forum, DPA (Development Partnership Agency), Oxfam America, EIA consultant companies, World Bank, Ministry of Public Works and Transport, Ministry of Land Management, Urban Planning and Construction…etc. added by Mr. Chea Leng.

Khmer Translator

- Related to Khmer translation, could you please share any resource of appropriate translator in the field of EIA? asked by Mr. Yamashita.
- Mr. Chea Leng mentioned that he knows EIA expert with ADB project. He will find the name and contact and send to JICA team later.

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Chair of the meeting

- Mr. Yamashita asked the EIA taskforce team that "Who is the chair of the consultation meeting?"
- Mr. Chea Leng mentioned that we will consult with our director about who will be a chair. He asked the status of previous JCC meeting at Cambodiana Hotel. Mr. Kro stated that for the 1st JCC Meeting chaired by H.E Eang Sophallet. He provided the opening remark, then he came back to MoE and after opening remark, H.E Sao Sopheap coordinated the whole meeting with JCC members.

Mr. Chea Leng will inform JICA team about chair later. DEIA can help to coordinate the meeting.

Schedule

- DEIA will select appropriate participants in December 2018 and the consultation meeting should be conduct in the end of February or early March 2019.
- Mr. Chea Leng will inform the date of the meeting later.

-The End-

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Meeting with EIA Department

Date & Time:	Date: 17 December 2018, Time: 09:00 AM-10:00 AM
Place	Kreal Meeting Room, 1st floor, the Ministry of Environment
Attendees:	Mr. CHEA Leng, Deputy Director of EIA Department Mr. Mey Sithin, Vice-Chief Office of EIA Department Mr. Nget Kdomphea, Vice-Chief Office of EIA Department
Project Team:	Mr. Muramatsu Yasuhiko, JICA Expert Mr. Watanabe Taisuke, JICA Expert Mr. MENG Kro, Project Coordinator, PEPC
Agenda / Discussion Points:	1. Response on comment on Sectoral GLs 2. Step to finalize sectoral GLs 3. Information for public consultation

Key Points:

(Sector GLs) (Major points explained first)

- EIA taskforce team agreed to keep Chapter 2. Scope and Methods and Chapter 9. Economic Analysis and Environmental Value for railway guideline.
- Add the sentence to describe 1) timeline of the survey and 2) member of consultation composition in section 2.3. mentioned by TF-EIA team.
- One member among TF-EIA team suggested to omit the Expropriation Law (201) in SEZ guideline. TF-EIA team will discuss more about this law whether to keep or omit.
- Mr. Chea Leng mentioned that Sub-Decree on Land Acquisition and Involuntary Resettlement (2018) may be established in 2007 or 2008 by the Ministry of Economy and Finance. They may revise it in 2018. Please check this sub-decree again. Mr. Watanabe responded to share the Sub-decree,
- Omit the waste management in section 7.2 Impacts and Mitigation Measure by Project Stage. Mr. Kdomphea stated that waste management section is important, but it should not be under the environmental resources. JICA expert should check again to make sure this section is in the right column.

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- For the Price of Environmental and Social Fund will be set according to Inter-Prakas between Ministry of Economy and Finance and Ministry of Environment (draft), said by Mr. Chea Leng. Mr. Watabnabe responded to quote the Inter-Prakas.
- Mr. Watanabe explained that comment-response sheet and revised guideline of each sector will be sent later.

(Public consultation)

- The consultation meeting will be discussed for two guidelines are Road and Railway because these guidelines are same linear infrastructure and the same participants to participate the meeting such as Ministry of Public Works and Transport, Ministry of Land Management, Urban Planning and Construction…etc., mentioned by Mr. Watanabe.
- Mr. Watanabe explained the Team has started consultant selection by requesting a quotation to Sustinagreen.
- Mr. Watanabe suggested to Mr. Chea Leng to share 1) Translator and 2) Participants List.
- Mr. Chea Leng will inform JICA expert about translator and participants list. The list will not mention the name of participants, but the name of institute only will be listed.
- Mr. Watanabe asked the way of group discussion, for example, each group discuss specific Chapter of GL, as discussed in the last TF meeting. Mr. Chea Leng responded that way is not good and need to consider less people after lunch. Mr. Watanabe suggested that groups discuss all major chapters in AM and other chapters in PM.
- The meeting will be targeted to conduct in the end of February 2019.
- The Consultation Meeting will be chaired by H.E Sao Sopheap, Secretary of State of MoE and closed by H.E Tea Chup, under Secretary of State of MoE, mentioned by Mr. Chea Leng.

(Others: Phase 2 of the Project)

- Mr. Chea requested to include GPS and drone in the equipment for the DEIA.
- Mr. Muramatsu responded the request shall be submitted from GDEP and should be discussed in GDEP.
- Mr. Chea explained no activities are planned at the moment as future issue is not clear.
- Mr. Watanabe mentioned that justification is needed to provide equipment, such as some activity in DEIA.

-The End-

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Annex 31 Environmental Impact Assessment Reports Review

Environmental Impact Assessment Reports Review

I. Introduction

Cambodia is a developing country but it intends to develop rapidly with less consideration on environmental issues. Most of the development in Cambodia-especially private company does not highly intend to participate in the environmental safeguard management and social protection. The Ministry of Environment, Royal Government of Cambodia (RGC), has been established in 1993.

The project is implemented by the Ministry of Environment (MoE) with a technical and financial support of the Government of Japan through Japan International Cooperation Agency (JICA). The Project is designed to assist the General Department of Environmental Protection (GDEP) under the MoE in developing capacity for better management of the environment. This engagement focuses more specifically on the capacity development of the Department of Environmental Impact Assessment (DoEIA).

The project does not only support on the technical aspects and capacity building but also review the environmental impact assessment reports for improving quality of the EIA reports.

II. Methodology of the study

The study involves a significant part on a literature review on the existing Environmental and Social Impact Assessment (ESIA) reports and evaluates the report based on the experiences with EIA guideline of RGC's MoE and other international EIA guidelines including JICA, World Bank (WB) and Asian Development Bank (ADB).

a. Objectives of the study

(i) Collect and review the approved ESIA reports with different sectors,
(ii) Analyze the ESIA reports based on the MoE's EIA guideline of Cambodia, and
(iii) Compile the comments and recommendations into a survey report.

b. Scope of the study

The scope of the study is to review and analyse ESIA reports in Cambodia which provided and approved by the RGC's MoE. The ten ESIA reports were collected for this review and analysis, and they include several sectors as following: (1) Special Economic Zone (SEZ) in Sihanouk, (2) Tourism related to development of Siem Reap-Sokha Resort, (3) Industrial sector, and (4) Infrastructure sector (in the table 1).

III. Analysis of Existing EIA Report

In Cambodia, Sub-decree on Environmental Impact Assessment (EIA/ESIA) issued in August 11, 1999 that itrequires all types of projects, both private and public sectors, to study for IESIA or ESIA according to its scale of impacts. Again on 19 May 2014, Ministry of Environment (MoE) had the requirement to local consultant firms which reached the qualification of MoE to register at MoE for full right to work on ESIA or IESIA in Cambodia. In reality, those registered

consultancy firms have different qualifications to works on ESIA and IESIA referring to their expertizing but must follow the MoE guideline.

Table 3.1: Detail information of the reports

No	Name of report	Category (IESIA/ESIA)	Sector	Year (Report Approval)	Location	Project Owner
1	Special Economic Zone Project	ESIA	Industry	2017	Preah Sihanouk Municipality	Sihanoukville Special Economic Zone
2	Sokha Siem Reap Resort	ESIA	Tourism	2016	Siem Reap	Sokha Hotel Co., LTD
3	Reconstruction National Road No 58	EIA	Infrastructure	2015	Banteay Meanchey	Ministry of Public Works and Trasport
4	Skype Bridge and Underground Road Construction Project- Techno	IESIA	Infrastructure	2016	Phnom Penh	Overseas Cambodia Investment (OCIC), and Government of Cambodia
5	Cement Factory Project	ESIA	Industry	2017	Kampot	Chip Mong Insee Cement Coporation (CMIC)
6	Special Economic Zone	ESIA	Industry	2017	Sihanoukville	Sihanoukville Special Economic Zone
7	Copper Factory	ESIA	Industry	2017	Preah Sihanouk	Kinnrich Copper Smelting Co., LTD
8	Cement Factory Project	ESIA	Industry	2017	Kampot	Chip Mong Insee Cement Corporation (CMIC)
9	Rehabilitation of National Road # 5, Battambang – Serei Sorphoan	IEIA	Infrastructure	2015	Battambang & Banteay Meanchey	Ministry of Public Works and Transport

Based on reviewing the 9 ESIA reports approved by MoE, results are summarized in below.

Firstly, the results of the surveys and studies shall be complied with methodology of the survey. The results of the surveys shall mention for some reasons whenever it has something changed at the real condition at the sites. In general, the methodologies for surveys are a little different that some of them have not shown clear standard maps with source and clear legend.

Secondly, physical resources are so important for baseline information that reports must have clear description and analysis, if they found improper matter according to the results of testing or surveys by comparing to the national standard, the reasons and explanation must be stated clearly. Generally the reports stated on the physical resources including water, soil, air and climate but some of the reports are very limited data particularly on water quality, air pollution and noise. In addition, some reports were developed during construction and operational stages, however, all ESIA/IESIA reports must be completed before project start basing on regulation. In general, the reports are in medium quality. As for biological resources, the reports described in different ways on the flora, fauna and fisheries survey; some are good quality, but some others do not really understand on the biological resources and some do not use IUCN Red list, clear sources and dates.

Thirdly, for social section, two concepts need to be highlighted in the reports. For first idea, public consultation meetings with relevant stakeholders including local people and authorities, province,

and inter-ministries levels are required. Through meetings, stakeholders can provide feedback and comments to show concerned issues which can be impacted by the project implementation. However, some of the reports do not discuss all issues by concerned stakeholders and the data are also limited on target people income, occupation, education, nationality and religion, health and local existing infrastructural sectors. Generally the report stated in moderate quality on this section.

Fourthly, the anticipated impacts and mitigation measures are generally discussed on only small impacts for ESIA reports, but the ESIA reports are normally used for big projects which should have big impacts. Some of the reports intend to hide some significant impacts. The impacts including noise, dust, and erosion are normally included. As for the EMP, some of the reports provide clear and specific mitigation measures and some others have no section on institutional arrangement to work or monitor on the environmental issues. In general, the reports cover on issues, mitigation, and institutional responsibilities thus the reports identified as moderate quality.

Lastly, it is Economic Analysis, Environment Evaluation and Cumulative impacts. For Economic Analysis and Environment Evaluation, it shall add the cash flow of the project and the environment value from assessment of its impact to forest as the carbon stock and water storage forest or any from survey. While the cumulative impacts shall identify the similar types of the project that it can give the emission to pollute air, noise, vibration and discharge to pollute water source. Also, condition of residential area that it may be affected by those existing project.

All in all, it is limited for these ESIA reports for the methodology, physical, biological, social source, mitigation measure, EMP, economic analysis, environment evaluation and cumulative impacts. So, the quality of these reports still needs to improve according to the type of project as well.

Table 3.2: Improvement Assessment Matrix

Sector: SEZ Name of ESIA Report: SEZ in Sihanouk

Content of the General Guidelines	Summary of issues in EIA Report	Recommended Actions
1. Introduction Level: Moderate	- Cambodia is located in south-east Asia that it had faced long civil war. Under leading by Samdech Hun Sen, the country becomes a peaceful and rapid development. - Purpose of the study is to fulfil requirement of law on environmental protection (1996) and EIA sub-decree (1999). - Format report: (1) introduction, (2) methodology and scope of study, (3) Regulation Framework, (4) Description of Project, (5) Description of existing environmental resources, (6) public consultation, (7) impact assessment and mitigation measures, (8) EMP, (9) economic and environmental analysis, (10) conclusion and recommendation, and annex.	Follow EIA guideline for format report, but the report should include project overview.
2. Methodology of study Level: moderate	- Review on relevant regulation (law, sub-decree, and other policy) such as Cambodia constitution (1993), Law on environmental protection and natural resource management (1996), labor law (1997), investment law (1994), law on industrial management (2006), … - the study focuses on physical environment, biological environment, and social-economic environment.	The description of the relevant regulation seems overlapping to regulation framework in Chapter 3. In addition, only two points were selected for air quality analysis and only some parameters such as CO, NO2, SO2, TSP and PM10 were tested, while different kinds of factories will be constructed. The selected 6 parameters for air test are also not

	- Organizing public consultation meeting with relevant stakeholders (interview with key persons and focus group discussion (FGD)). - Tools such as matrices, overlay and checklist were used for environmental assessment. - Preparing EMP	clearly explained on reason.
3. Regulation framework Level: Good	- Summary of national existing law and regulation on Cambodia constitution (1993), Law on environmental protection and management (1996), labor law (1997), investment law (1994), law on industrial management (2006), …	Copy from the law and regulation, but covers on issues; however description and explanation are still limited.
4. Description of project Level: Moderate	- Background and project location: Description on share between Chinese and Cambodian investors and project land size (1113.96 ha) with showing map. Total investment budget is 371 940 000 US$. - Project legal document including land title, and investment license from Cambodia government. - Project five-year work plan which proposed to develop the SEZ since 2009 for 5 years plan (for first phase). - There are some discussion on wastewater, solid waste and air management.	In this section, an overall project plan/design is very important but there is no showing an overall design plan. There is also not so clear on how many and what kinds of factories yet planed for this SEZ.
5. Description of Existing Environment		
5.1 Natural Environment		
5.1.1 Physical Resources Level: Moderate	- For Physical sources: there are no description about: **1. Topography and Soil** - For topography, it is so important in order to prevent issues due to flood or storm, erosion, etc. which could impact on the project, but only few data was described in this section. - Only few data on soil quality described. No description on heavy metal such as As, Hg, Cr, ect and hazardous wastes	**1. Topography and Soil** - Properly manage on any accidental matter from flood or storm and other anticipated impacts, some information of flood and flood history (by interviewing with key informants) in this area shall be described. The project type is really concerned with

	(stated in the MoE's Sub-Decree on Solid Waste Management). **2. Air** For data on air quality, there is only data on CO, NO2, SO4 with no clear reason, while no data on Pb and PM-2.5. There is description on testing date and time, while no description on sampling location and weather condition; **3. Noise and Vibration** The project is next to the residential area, thus noise and vibration are very important to be cared properly but there are no reasons with the noise data over standard. Description of the source and location are needed. As for vibration, it is the same issues to the noise thus baseline date on vibration shall be conducted at some sites in and around the project. **4. Water System** Description of the water system is not so clear including source and distance. **5. Water Quality** Some water samplings are taken but there is no water test at upstream of the river and ground water.	the flood management. Also, soil texture shall be considered to take some samples in the SEZ where will build many factories in this SEZ. - Additional samples on soil quality shall be tested at different locations, particularly where a wastewater treatment plant located to ensure that the project will not pollute on soil quality. When an operation of the treatment plant will be implemented, wastewater and sludge pollution should be managed properly or will impact on ground water easily (if poor soil quality such as sand type). - Heavy metal such as As, Hg, Cr ect. should be tested, and hazardous wastes (mentioned in the MoE's Sub-Decree on Solid Waste Management should be described for baseline. **1. Air** - Because many types of factories will do operation in the area, baseline of air quality shall be widely studied including pollutants, location and ambient condition. The baseline data plays very important rule for monitoring activities. Moreover, TSP, Pb, PM-10 shall be added. If the project does not have the baseline data for existing, they will not have the data to compare in the operation stage. **2. Noise and Vibration**

		- Because many types of factories will do operation in the area, where are also close to residents, thus baseline of Noise and Vibration shall be widely studied at different locations of the project sites. In addition, the report shows on the noise data which is over standard, thus description of reasons of the over standard and accepted mitigation measures should be applied. **3. Water System:** - Water system and sources are very important for all developers and living conditions, thus clear description of all water sources including surface and ground water must be introduced. Because the water source will be easily affected by industrial operation, particularly un-proper management of wastewater and solid waste. **4. Water Quality** - Because many types of industries will do operation, baseline of water quality shall be studied widely including surface and ground water, which will be useful for monitoring stage.
5.1.2 Biological Resources Level: Moderate	-Biological source: In general: Map and standard of map are limited in this EIA book. **1. Tree species** - The table shows only species, while no referring to numbers, sources and remarks **2. Wildlife/Fauna/Birds** - Showing only data on transect for fauna survey, but no	**1. Tree Species** - So, the data can be taken from Red List of Ministry of Agriculture Forestry and Fisheries. This project location is next to the Khbal Chhay Protected Forest which should be described/studied clearly including distance. **2. Wildlife/Fauna/Birds**

	mention on date of survey, and date of retrieve of the red list from website of IUCN.	- The project location is not far from the Kbal Chay protected forest; so the times of survey shall be increased to ensure that baseline of the wildlife are widely studied. Also, an interview with key informants in the areas shall be conducted. - NGO shall be met for ideas related to the survey's results and asking some data from them according to the project site is near to the protected forest.
5.1.3 Social Economic Source Level: poor	Methodology of Site selection for targeted villages: - No clear map was used for the survey selection. Name of all villages in the cycle of this buffer map need to be selected for target villages of interview. - Lack of educational information of household head - Don't have the survey for traffic volume on some road next to/in front of the project site.	- All maps need to revise as the standard map (including project location and buffer area). - All target villages shall be shown in the report, especially on the right place. - Baseline data on socio-economic component needs to be studies widely, that it is very important for decision makers and monitoring stage. All projects should provide benefit to local people too. - Traffic survey should be conducted at the project sites that it will give ideas on impacts on local communities. If traffic will increase, road safety shall be strictly carried out. - Education of the household head shall be added; so project is able to consider for their workers.
:	:	:
7. Environmental Impacts and Mitigation Measures		
7.1 Description of the negative	- On the assessment of negative impacts and its proper mitigation measure on air quality, noise, soil	- There are many negative impacts raised, but proper mitigation measures are not applied.

environmental and socio-economic impacts…in construction stage Level: Moderate	contamination, and public health; the report says only minor impact, while no description on its reason and proper mitigation measures.	The Environmental Management Plan (EMP) is very important part which can avoid or mitigate impacts into acceptable level. Thus the EMP section should be improved to be consistent between the anticipated impacts and mitigation measures.
7.2 Description of the negative environmental and socio-economic impacts…in operation stage Level: Poor	- On the assessment of negative impacts and its proper mitigation measure on water quality and waste management; the report says only minor impact, while no description on its reason and proper mitigation measures.	- Location/site of water samplings should be clearly descripted and put into a map. - Because many industries will be operated, survey on solid waste management (SWM) should be studied to design for proper waste storage, and frequency of waste collection to avoid disturbances to workers' health, project's beauty, and run off into water body or sewerage system. Two types of wastes such as hazardous waste and non-hazardous wastes will be generated by the industries thus the wastes should be separated for waste collection companies (based on Cambodia's Regulation). It notes that two waste collection companies, CINTRI and SAROM TRADING, in Phnom Penh City. The CINTRI waste collection company has missioned to collect non-hazardous waste like Municipal Waste, while Sarom Trading has operated to collect only hazardous wastes from hospital and industry.

Table 3.3: Improvement Assessment Matrix

Sector: Resort Project Name of ESIA Report: Development of Siem Reap-Sokha Resort

Content of the General Guidelines	**Summary of issues in EIA Report**	**Recommended Actions**
1. Introduction Level: Good	-After Pol Pot regime in 1975-1979, Cambodia now has peace, development, and international cooperation. There are also rapid development in Siem Reap Province under Priminister Samdech Hun Sen. -Siem Reap is located at south-west of country, having 314 km from Phmom Penh through national road # 6. Siem Reap is very ancient city of Khmer empire during century 12-13. - Siem Reap is an area of cultural tourism that consists of 946,656 population. - The resort project covers 23 ha of land with its purpose to improve domestic and international tourism to visit Siem Reap. - Main purpose of the study is: (1) study on existing biological resources, (2) study on existing physical resource, (3) study on social-economic resource, (4) study on project master plan, (5) economic and environmental analysis, (6) analyse and assess environmental and social impacts, (7) analyse and assess impact on cultural resources, and (8) identify mitigation measures. - Scope and limitation: the study will be completed during 5 months period, 29 January 2015-31 May 2015. - Report content consists of: (1) introduction, (2) methodology of study, (3) Regulation Framework, (4) Description of Project, (5) Description of existing environmental resources, (6) public consultation, (7) impact assessment and mitigation measures, (8) EMP, (9) economic and environmental analysis, (10) conclusion and recommendation.	Follow MoE Report Format
2. Methodology	-Data collection: primary data collection through interview	There is no clear explanation and reason of selecting

Level: Moderate	with stakeholders, and secondary data collection from relevant line agencies. - For physical environment, only one sample of ground water was taken for water quality analysis with 20 parameters (pH, Alkalinity, TDS, Mg, Total Hardness, Residual chlorine, N03, Zinc, Ca, Phosphate, Cd, Al, Baron, Total Nitrogen, Total Phosphorus, Arsenic, Iron, Lead, and Mercury), and one site was selected for air test with 4 parameters (CO, NO2, SO2, TSP). As for noise and vibration, one site was selected for test too. -For biological resource, there is no wildlife and forest in the proposed project area thus the study of this resource is not required. - For social-economic resource, the study use questionnaire to interview for data collection, but don't describe on how to select household or village to be interviewed, and showing map of the study -Key tools for data analysis are: SPSS and Excel 2010 programs.	samples for ground water analysis, air pollution and noise. The development areas cover 23 ha thus the methodology of the physical resources study should be explained on how and why select only one site for the test. - Not clear method on the socio-economic survey is described.
3. Regulation Framework	Description on national relevant laws in following: -Law on environmental protection and natural resource management (1996).	Just copy from the law and sub-decree. Only this chapter is almost 100 pages which are too large. The report should just summarize on key relevant points from the law.

Level: Moderate	-Law on administration management (2001) -Law on road (2014). This law aims to manage infrastructural development (road), and transport. -Law on labor (1997). -Law on land management, urbanization and construction. -Law on tourism -Law on investment -Sub-decree on EIA….	
4.Descriptioin of project Level: Good	-The project is located in Sangkat Slorkram, Siem Rep municipality, with total land 23 ha of which 46,950 m2 is for building (20.4%), 30,000 m2 for pond (13%), 153,050 m2 for infrastructure and green garden (66.6%). The hotel will develop 716 rooms. -Description of legal documents for developing the project and showing clear master plan on land use for development. -The solid waste, waste water, and safety management during construction and operation are also proposed in this chapter.	Generally, the report is following the MoE format which should be acceptable.
5. Description of Existing Environment		
5.1 Natural Environment		
5.1.1 Physical Resources Level: Moderate	For Physical sources: there are no description about: 1. Topography; For topography, it is so important in order to prevent issues due to flood or storm, erosion, …etc. which could impact on the project. 2. Climate Description of the report use raw data without any analysis on reason and clear explanation. - Showing only general monthly temperature data from 2009-2014. - Humidity: Four years data of humidity in Siem Reap shown that an annual average record was 75.5 % while	**1. Topography** Proper management on flood or storm and other anticipated impacts due to topography, some information of flood and flood history (by interviewing with key informants) in this area shall be described. **2. Climate** Most of data is less than four-year monthly data while air pollution data is only one sampling point, which is hard to apply Air Modelling. The raw data should be converted into

	peak of the humidity was 96%. - Wind velocity existed only 4 years (2009-2012). - Rainfall: Annual average rainfall from 2010-2014 was described. - Only one test of air pollution was conducted at the project area. The parameters include Carbon Dioxide, Nitrogen Dioxide (NO2), Sulfur Dioxide (SO2), and total suspended particles (TSP). 3. Ground Water Quality There was one sampling test for ground water (well) in 2015 but did not clear mention at a sampling point, thus the point of the ground water sampling/test at a proposed treatment site should be conducted. 4. Noise and vibration: Only one day (24 hours) was conducted. There is description on season of testing but there is no description on clear location. No description on traffic which will also impact from the project. Traffic will be increased during project's operation. 5. General description of soil types, and no reference. 6. Water system: no description of the water system (surface water). 7. No proper reference and quotation. Most of data is secondary data.	a graphic chart which make more interested into audience. Also clear description with reason and explanation should be applied. As for air pollution data, there is only one point, but the total project is 23 ha, thus additional test at different location should be carried out.

		3. Ground Water Quality Additional ground water test particularly at a proposed treatment site should be conducted for baseline which should be useful for monitoring stage. During project operation, huge of wastewater and solid water will be generated thus possible impacts from the wastes would be harmful on ground water too (if un-proper waste management occurred). Also, clear description of the sampling points is necessary. The condition of wells shall be mentioned. The project shall have clear explanations of well, it will be good to give the reasons in case there are some parameters are over the standard or it may be changed in the monitoring time. 4. Because the project is resort and hotel, baseline on noise and vibration particularly clear location is necessary for monitoring activities during project's operation. Traffic survey should be conducted because it will accumulate impacts on the noise and vibration. 5. Description of source and location is needed. 6. Water system is also important to be known, however no description of the surface water system exists. Thus description of the water system should be studied. 7. In general, description of the report did not use references and proper data sources, thus proper reference should be applied.
5.1.2 Biological Resources	The results of the survey seems limited. So, more surveys around the project site shall be added.	**Identified for further: (Moderate)** This chapter is very important that environmental report

		must be studied; however, there is no any study or description on the biological resources. The biological resources therefore must be widely studied.
4.1. Socio-economic	There are some needing more: 1. Education of the household head is not included in this study 2. Don't have the survey for traffic volume on some road next to/in front of the project site. 3. For solid waste and wastewater, there is only few states on existing waste management in the village but there is no data or description of SWM and Wastewater generation from the resort and hotel.	**Identified for further: (Moderate)** Socio-economic is very useful data which is one indicator to show project sustainability and decision maker for consideration to approve on the project or not. Thus all project should not consider only on project benefit but also benefit to local people/communities too. 1. Education of the household head shall be added; so project is able to consider for their workers. 2. Baseline data on traffic should conducted because it will give us an idea on benefit and impact to local people too. Based on the test of noise at the project area, it is over MoE's standard thus it will accumulate impact into local community due to traffic increased too. In addition, if the traffic increased, it would give both negative and positive impacts for our consideration and take action. 3. Hotel and resort will generate number of solid waste and wastewater thus proper design of waste storage, transportation, and wastewater management are very important. Thus an estimation of wastes amount including solid waste and wastewater, and design of solid waste storage shall be studied. Based on the MoE's sub-decree, solid waste will not allow to dispose at any illegal site where is not approved by authority while wastewater shall be treated before discharging into a safe place.
7. Environmental Impacts and Mitigation Measures		

7.1 Description of the negative environmental and socio-economic impacts…	1. The EMP was classified into only two stages including construction and project completion. General the EMP should be classified into three stages which include: During Pre-construction (Project Design), During construction, and During Operation. 2. On the assessment of negative impacts and mitigation measures on erosion and soil quality, water quality, air quality, noise, traffic and public health, the report says impacts, while description on mitigation measures seems very general and not specific on the issues (during construction). 3. On the assessment of impacts during the project completion, report say only minimal impacts including soil contamination and loss of job, while no description on significant impacts such SWM and Wastewater.	**Identified for further: (Moderate)** 1. The EMP is very important stage but it relies on accurate findings of impacts too. If findings of impacts are incorrect, the EMP/mitigation measures will be proposed into wrong way too. Through the review of the impact and EMP, the report does not cover all impacts in the impacts chapter but the report says some impacts in EMP Chapter, an example on SWM and Wastewater. For EIA report, three stages such as Pre-construction, Construction, and Operation should be widely studies. Thus, clear mitigation measure MUST be added. If there is not clear mitigation measure, the project owner cannot carry out well by each stage of pre-construction, construction, operation and closure. 2/ Through review the EIA report, there is very limited on consistence between existing environment, impacts, and mitigation measures. The report therefore should be improved. 3/ Because large resort and hotel will be operated, survey on solid waste management (SWM) should be studied to design for appropriate waste storage, and frequency of waste collection to avoid disturbances to customers and

		run-off to pollute natural environment and community living around the project. As for wastewater, large amount will be generated too, thus proper wastewater management and treatment require.

Note: Evaluation criteria include Good, Moderate or Poor.

Table 3.4: Improvement Assessment Matrix

Sector: Infrastructure Name of IEIA Report: National Road #5 Improvement (Battambang-Serei Sophorn)

Content of the General Guidelines	Summary of issues in IEIA Report	Recommended Actions
Chapter-1: Introduction		
	- History background of development of national road #5.	- History background of development for national road #5 shall be mentioned as type of loan/its number or grand and its budget amount for this road improvement.
Chapter-2: Legal law	- Some laws shall be added.	- Some articles in Constitution of kingdom of Cambodia and Law of land traffic shall be used in this chapter.
Chapter-3: Project Description	- The project location shall be showed on standard map. - Work plan, number of workers, list of trucks, drawing, and the technical of the road need to describe in this chapter. - Safety programme, wastes management and workers' camp shall be added here. - Borrow pits for soils to fill this road shall be show on map in this chapter.	- Actually, location map and clear description of project location need to add in this chapter. - We need to put Work plan, number of workers, list of trucks, drawing, and the technical of the road in order to let EIA department in ministry of Environment can accept the mitigation during implementing work. - The project shall have the mitigation to manage the liquid/solid waste and safety work for project in this chapter. - According to Prakas of ministry of labour, it is 1 toilet

		for worker from 1 person to 15 persons in Workers' camp and site work. - Sometimes borrow pits for project may have high impacts to people/ social, physical, and biological sources, if the project does not have good mitigation in advance.
4. Description of Existing Environment		
4.1 Natural Environment		
4.1.1 Physical Resources	- For Physical sources: there are no description about: 1. Topography and Soil; No map on elevation and watershed. 2.For climate data on Temperature, rainfall, wind speed/direction and sunlight, there are only few years. 3. Air quality: For air quality data, there is only one parameter on TSS but it was over the MoE's standard. The report therefore shall explain on reason of this finding (over standard).	Identified for further: (Moderate) 1. **Topography** Because the road project will be improved, baseline of the topography and watershed are useful. Map of elevation and watershed shall be added in this part. 2. **Climate** Data: Because the road project will be improved, baseline data on temperature and rainfall are very important which shall have at least 5 years data with good conclusion. Through experiences, climate change particularly flood is significant impact on road condition, while rainfall are much related to plantation along roads for protecting erosion from flood and storm. 3. Because the road project will be constructed and operated, baseline of air ambient and quality shall be widely studied.
4.1.2 Biological Resources	-Biological source: 1. For standard map on biological resources, the report provided not sufficient. Map should be covered on issues below:	Identified for further: (Moderate) **Tree species:** Because the road project, good map should be clearly shown on forest cover and distance to avoid any

	-Map of protected area/forest shall be showed as the standard map. - For Tree species and other research of those species, the report shall be discussed here. The report used IUNC (of location), but no description of the species name and too general. Also no any description/data in the project site. **2. Wildlife/Fauna** included birds: - For fauna, the report shall discuss the methodology for transect for fauna survey and description on date of survey and date of retrieve the red list from website of IUCN shall be added too. For interviewing with villagers, no description on location and date. 3. Fisheries: For fisheries data, the report has only some data on some streams. Additional data including survey on fisheries and other researchers shall be added.	confusion of impact on forest by the project. GIS specialist therefore should support in this matter. The report should add methodology on Transact line and plots survey thus the data are more accurate. In addition, map of transection with showing the project location must be discussed. **2. Wildlife/Fauna/Birds:** For fauna study, description of methodology and target location on the transection map are not clear, thus improvement on the issues requires. Some evidences including survey's interviewing pictures and species pictures should be added, while description on data date of IUCN, sources and survey's date shall be clearly mentioned. For fisheries component, the report showed some data

		of fisheries where is far from project location. Additional data of fisheries where close or at project sites shall be highlighted. Fish species can be found at local market.
4.1.3 Social Economic Source	4. For methodology on socioeconomic survey, the report described unclear, particularly on selection of villages and affected people, and no description of village name of affected people.	Because road project, baseline on Socio-Economic data is very important; thus, the survey methodology on socio-economic should be well and clearly thus the interviewed data are accurate. This part will be also important for decision maker for decision making on the project.
:	:	:
7. Environmental Impacts and Mitigation Measures		
7.4 Description of the negative environmental and socio-economic impacts…in construction stage	5. For impact section, the report mentioned only two stages (phases) including pre-construction and construction without separation of the phases; while no description on during project operation.	Identified for further (Poor): 5.For EMP, impacts normally separate into three phases such as Pre-construction, During construction, and During Operation. We therefore recommend that EMP should be classified into above three phases. .
7.4 Physical resources	4. For physical resource, some impacts will be occurred too but report confused to cover on solid waste issues as physical resources.	Identified for further: (Poor) 4. Because the road project, solid waste is very important to be covered and solid waste is pollutant, not physical resource. The report described without understanding on physical resources. Solid waste or wastewater shall be considered into pollutants which generated by project implementation, particularly during project construction and operation.

Table 3.5: Improvement Assessment Matrix

Sector: Industry Name of Detail ESIA Report: Cement in Kampot Province

Content of the General Guidelines	Summary of issues in EIA Report	Recommended Actions
1. Introduction Level: Moderate	-Cambodia is rapid development on infrastructure, hotel, resort building, and other buildings and an investment of construction is increased 31%. -Purpose of the detail ESIA is: (1) identify analyse and introduce the cement factory, (2) study on physical, biological, and social resources, (3) organize public consultation meetings, (4) organize EMP and Monitoring Plan to ensue sustainability of the project and environmental management.	Report should discuss on project overview and needs. Why this project is important?
2. Methodology and scope of study Level: Good	-The study was started from 21 October 2015 to 15 May 2016. The project planned to start construction from November 2015-December 2017. The study will cover on air quality by modelling, community income, and existing traffic jam. -Three methodologies will be applied which are (1) secondary data collection, (2) primary data collection through quantitative and qualitative approaches, and (3) direct observation. - 4 sites were selected for air test with 4 parameters (including CO, NO2, SO2, and Total Suspended Particulate; 4 sites were selected for Noise Test and 3 sites were selected for vibration; 4 sties were selected for surface water samples for water quality analysis with 15 parameters, and one site was selected for ground water analysis. As for soil quality, 3 sites were tested for the soil quality.	Generally, it is acceptable
3. Law/regulation framework Level: Moderate	Summary of national existing law and regulation on Cambodia constitution (1993), Law on environmental protection and management (1996), Labour law (1997), investment law (1994), law on industrial management (2006),	Just copy from law and regulation, with some selections of articles.

	… (very similar to other report)	
4. Description of Project Level: moderate	-This is joint venture between CMIC of Cambodia and Siam City Cement Public Company Limited of Thailand. This company registered with Cambodia Government on 27 October 2015 for 99 years period. Total investment cost is 262 million US$ which owned 60% by CMIC and 40% by Siam City Cement Public Company. The capacity of factory produces 5000 tone per day. -Project scope covers as following: (1) the factory covers on 105 ha where is located at Preytaprit village, Sdech Kong Khang Lech commune, Banteay Meas district, Kampot Province; (2) site of Lime-Land concession (1040 ha); (3) site of clay soil covers on 61 ha where locates in Preytaprit, Sdech Kong Khang Lech commune, Banteay Meas district, Kampot Province; (4) site of laterite (18 ha); and (5) site of bauxite (20 ha). - There is no detail design/plan but only show workplan of factory construction. - Solid waste, waste water, and safety management are also proposed in this chapter. - The project will be developed/constructed only two years period in 2016-2017.	Whole project design/plan is very important to be known about area of production, office, worker camps/resident, toilet, road, security post, and so on thus a project detail design/master plan is recommended.
5. Description of Existing Environment		
5.1 Natural Environment		
5.1.1 Physical Resources	- For Physical sources, no description on wind speed, while noise and water quality were not clear description.	Identified for further: (Moderate) Because the industrial project will be operated, wind speed and direction must be clearly descripted. The type of industry will give risk to residents living around/nearby, particularly down steam of the wind. The particle in air as TSP, PM-10, PM-10, PM-2.5 and other as SO2 and NO2

		will generate significant impacts to people surrounding the project. It also recommends that public health shall be clearly explained too. Because the industrial project will be constructed and operated, clear description and sampling of noise shall be carried out. The noise is not only impact to people living around the project, but also industrial workers and staff too. Because the industrial project will be constructed and operated, clear description of the sampling point and well types including depth and location shall be widely discussed, an example of the open well which may be already impacted, thus different types of wells should be also tested.
5.1.2 Biological Resources	-Biological source: For Flora and Fauna Survey, methodology and times of the survey were described unclearly, while the report has no use IUCN Red list. In report, discussion on bat (bird) exists close to the project area; but the description is not wide studied.	Identified for further: Poor The methodology of flora and fauna survey shall be clearly designed while the IUCN Red List shall be applied too. In addition, Transaction Map should be added too. For bat, description on bat living, distance of bat habitat, and food shall be widely studied.
6. Public Consultation	For public consultation, the report is not clearly described on conclusion or result from the consultation.	**Identified for further: Moderate** Actually, the public consultation meeting with local people shall have the conclusion in order to identify that how many percentage of participants supported the project. This part will also give some ideas for decision making for the

		project.
7. Environmental Impacts and Mitigation Measures		
7.2 Description of the negative environmental and socio-economic impacts…in construction stage	For physical sources, it did overlap discussion in the existing environment, thus this chapter should do only summary on key impacts from the physical resources then consider for mitigation measures as well. For social environment part, environmental, health and safety (EHS) should be clearly discussed.	(Moderate): Key impacts should be discussed in this chapter with clear mitigation measures to void or reduce any impact to be accepted. Because the industrial project will be operated, the EHS must be prepared and trained to all workers, while safety equipment should be provided too.
7.2.4.2 Accumulative Impacts	For accumulative impacts, it shall consider for the impacts that may come from other projects surrounding the project area.	Identified for further (Moderate) All of existing projects surrounding shall be identified, especially some projects may give the negative impacts to Air, Noise and other similar pollution that it may concern to this project.
7.2.5 Matrix of negative impacts	In this matric table, impact assessment shall be strictly studied and evaluated, thus the mitigation measures will be provided effectively.	Identified for further: Poor Because the full EIA is applied for this project, assessment of impacts shall be modified. In impacts part, the report said only small and medium but some of them should be high impact which must be considered as priority.
Chapter 9: Economic Analysis and Environment Evaluation	Actually, cash flow of project is so important for this chapter, but project owner always rejected to provide. Not clear description on this matter.	(Moderate) If it is possible it shall add the cash flow for this chapter in this report.

Table 3.6: Improvement Assessment Matrix

Sector: Factory Name of Detail ESIA Report: Copper Smelting in Sihanouk

Content of the General Guidelines	Summary of issues in EIA Report	Recommended Actions
1. Introduction Level: Moderate	- Purpose of this detail ESIA includes: (1) understand on existing relevant law and regulation, (2) evaluate project activities, (3) study on existing physical and biological resources, (4) conduct public consultation meetings, (5) assess environmental and social impacts, (6) prepare EMP, and (7) financial analysis.	A lot of description on governmental strategic plan and country development, but there is no talk relevant to project or project overview.
2. Methodology Level: Moderate	- Scope of study is shown in following: (1) study on physical resource around the project area, (2) study on biological resource surrounding 5 kms distance to the proposed project site, and (3) study on social-economic resource surrounding 5 kms distance to the proposed project site. 4 villages will be selected for social-economic survey that they are located within 5 kms to the project. - For air quality, the study will use secondary data from MoE Department of Pollution Control for air quality in Sihanouk Ville in 2014, data from Sihanoukville Special Economic Zone (SSEZ) in 2015, and primary data near the proposed project site (6 parameters including CO, NO2, SO2, TSP, PM10, and PM2.5 are selected for this test). As for noise and vibration, only one site is selected for test.	There is no clear explanation on how to select on the 6 parameters for air test, while it is similar situation for noise and vibration site selection in 2.7 ha land size without clear master plan design. Thus, description of site selection reason for noise and parameter selection for air test should be taken.
3. Regulation framework	- In this section, a lot of existing law and regulation are described here that they are very the same and similar to report #1 (SEZ) and # 2 (Siem Reap resort).	Just copy from law and subdecree.
4. Description of project	- Total investment cost is 27,280,000 US$. - The factory is located in Sihanouk Special Economic Zone, covering land 2.7 ha.	There is no project design for factory construction. The description is focusing on only production activities.

Level: Moderate	- Key product of this factory is Copper Matte and Blister. Five years workplan for production is 160,000 tones (Y1), 350,000 tones (Y2), 600,000 Tones (Y3), 860,000 tones (Y4) and 1250,000 tones (Y5). Raw materials for this factory are Copper Ore (307,200 T), Copper Concentrate (307,200 T), and Low Copper Content Matte (409,600 T).	
5. Description of Existing Environment		
5.1 Natural Environment		
5.1.1 Physical Resources	- For Physical sources: there are no description about: 1. **Ambient Air:** - The project did the test only on CO, NO2, SO2, TSP, PM-10, PM-2.5, while the important parameters such as arsenic, cadmium, lead, mercury, and copper which can generate from the project are excluded. 2. **Noise and vibration:** No clear description on the location and reason of the over standard of the testing results.	Identified for further: (Moderate) 1. Air: The arsenic, cadmium, lead, mercury, and copper will have some emission from this work. So, the project shall test some of these parameters including arsenic, cadmium, lead, mercury, and copper for based line or comment to do in the monitor in the operation stage. Also, the tool or screen or methodology to reduce these maters shall be recommended. If the project does not test, it shall give some reason. 2. The description of the location that installed the station for testing noise. Also the reason that result of testing is over the standard shall be mentioned. It will help to find the mitigation measure in the Chapter of negative impacts and its mitigation measure. Also, PPE will be added in the mitigation as well. - **Noise**: in case that the level of noise measure is over the standard, it shall identify some reason in order to find the mitigation measure.

	3. **Topography and Soil;** - For topography, watershed and its level of the land in this report is missed. It shall be added even though this project located in the SEZ. 4. **Water system and water quality:** - Map of water system/body included the project location shall be showed. Also the location map of water sampling shall be showed. - For surface water quality, it shall be tested some more parameters as the heavy mental as As, Cd, Cu, Fe, Pb, Hg, Zn, total mental, and TSS as the hazard waste in the sub-decree of solid management, MoE, in order to keep for baseline.	- **<u>Vibration</u>** is so important during project construction and some activities of industries works, thus the reason of over standard shall be identified. 3. **Topography** - To properly manage any accidental matter from flood or storm and other matter, some information of flood and history of flood (by interviewing with key informants) in this area shall be described. The project type is really concerned with the flood management. - Soil type: actually the soil type map prepared by JICA-2002 shall be added and the condition of this soil type shall be mentioned according to the site observation. **4. Water system:** - It is so important in order to manage the any accidental matter from flood or storm…etc. The project type is really concerned with the flood management and some erosion matter. - Also the location map of water sampling shall be showed on the map that it may be easy to give the comment and its mitigation measure for further monitoring. The elevation of the project site and this river shall be described too. - It shall be mentioned some facilities of SEZ related to the waste water treatment plant (WWTP) and other that it may be able to reduce some impacts due to the project type.

5.1.2 Biological Resources	-Biological source: In general: Map and standard of map are limited in this EIA report. - The survey date, sources and remarks shall be added under or next to the table. Wildlife/Fauna included birds: - Map of the transection line shall be added during doing the survey. Also, Data from transect for fauna survey shall be added the date of survey and date of retrieve the red list from website of IUCN.	Moderate: **Wildlife/Fauna/Birds:** - It is so important to put the date and period of survey for wildlife. - The location is not far from the Kbal Chay protected forest; so the time of survey shall be increased. Also, the interview with key informants, shall be asked. - IUCN red list in website is always changed and updated, thus it will be not well if date of retrieve doesn't add. - Actually, responded NGO shall be met for some idea related to the results of survey and some data from them according to the project site is near to the protected forest.
5.1.3 Social Economic Source	Methodology of Site selection for targeted villages: - Map with the clear buffer area from project location shall be prepared. Name of all villages in the cycle of this buffer map need to be selected for target villages of interview. - Also, the survey shall add some questions related to the disease of Respiratory system and skin due to the project will have some emissions of As, Cd, Cu, Fe, Pb, Hg, Zn, total mental, and TSS in air that it will affect to people living at direction of the wind.	- The proposed map for survey with clear target villages shall be showed for this socio-economic survey with comparing of project location. It is important maps to be added. - All target villages shall be showed in the report, especially on the right place that may affect from project in term of air, noise, water and other disturbance from project activities. - In Socio-Economic, it is so import point for investor and relevant ministries to do the monitoring in the stage of monitoring. Also, local people shall get the positive or negative impact from project. - It is the baseline information, so the information of health related to Respiratory shall be asked.

7. Environmental Impacts and Mitigation Measures		
7.1 Check list (table)	- It shall have some remarks for level of impacts in this table according to the stages in term of negative or positive.	- Actually, this checklist will help a lot to find the mitigation measures, thus column of remarks with some identification is recommended to add after filed visit and some short screening.
7.1 Description of the negative environmental and socio-economic impacts…in construction and operation stage	I. Preconstruction - Phase of pre-construction shall be stated for some plan in advances of mitigation. II. In construction Stage: - It is really short and not clear for mitigation. Some concerned items shall be added: - Air quality: it is needing more mitigation. - Noise also needs the mitigation to avoid some work at night that may disturb to local people… - Health and Safety: personal protected equipment (PPE), and train workers "how to use" PPE during construction needs recommended to add. - Risk management shall be added during construction stage.	Identified for further: (Poor) - Phase of pre-construction shall be stated for some plans in advances of mitigation. It is only list some plans to mitigate the impacts and marks the plan for storage of construction materials… In construction Stage: - Mitigation measures with the clear mentioned in order to let contractor or project owner follow, thus all concerned items shall be listed. Clear mitigation shall be raised for contractor and project owner to follow. In construction stage, it also has some concerned to environmental due to the activities of project construction, so, in the report it shall also be detailed about mitigation clearly for purpose of well practise of project owner and contractor. - For Air quality: regularly spray water on using road in worksite, limited the speed of truck during transportation for project construction, all wastes are not allowed to burn….etc. - For Noise, Health & Safety: it has high impacts during the construction stage, so, the mitigation measure shall consider for this stage.

	III. In Operation stage: - Air, noise, vibration and water discharged from production need to do the monitor regularly.	- Risk management for project in construction stage is so important that the project have chance to make plan in advances for any accident made by project then it may have properly resolution. III. O&M: It is the type of heavy factory, Cupper Smelting. It is really concerned to the environment and people health, if the project owner does not have good technical work in the process of production. - The PPE for hot protection for workers are working at the hot places suggested to add in Safety and Health. Also, the air plug to protect with noise shall be provide to whom is working next to production work that has noise over 70dB. - Nurse or some medicine for emergency accident from hot places in factory and other matter need to apply in this factory.

Table 3.7: Improvement Assessment Matrix

Sector: Factory Name of ESIA Report: Cement Factory in Kampot

Content of the General Guidelines	**Summary of issues in EIA Report**	**Recommended Actions**
5. Description of Existing Environment		
5.1 Natural Environment		
5.1.1 Physical Resources	- For Physical sources: there are no description about: 1. **Ambient Air:** - Ambient Air for this type of project is really concerned.	Identified for further: (Moderate) 1. Ambient Air for this type of project is really

		concerned. - So, reasonable to select the place for installing the equipment for testing shall be on the right place for Air modelling. So, it is good that socio-economic survey included some questions related to disease of skin, eyes, and Respiratory for good baseline before project operating. - All the stations for air test shall be showed in the map with the season to select these locations. Ambient Air for this type of project is really needing to highly identify with reasonable explanation. - For this type of project, it is really concerned for Air quality and its direction for its impact area from project site. - Thus, Air modelling shall be recommended for this type of the project in order to know the level of these parameters flying in the air. It shall look for suitable place to add the result of modelling in this Chapter with the figures of results of model. According the Chapter 7, Negative impacts and mitigation measure, results of impact and its mitigation measurement for project owner to take activities whenever those parameters are able to affect/pollute air quality in this area. 2. **Noise and vibration**: The good location for installing the tool for noise and vibration is not only inside the factory, it shall be considered for some location as: entrance road for project, transportation roads for project, some places of factory that is next residents or pagoda or school or hospital…Thus, it is good for

	2. **Noise and vibration:** - Actually, the location of these testing shall be showed on the map. If the level of noise measure is over the standard, it shall identify some reason in order to find the mitigation measure. Vibration is so important during project construction and some activities of industries works, thus the reason of over standard shall be identified. 3. **Topography and Soil;** - For topography, watershed and its level of the land in this report is missed. It is very good information shall be added for suitable mitigation. - For soil type in the project area, it shall have some description. 4. **Water system and water quality:** - Google map or topography map for water system in/near the project location shall be showed. Also the sampling location of water need to identify on this map with comparing to the project site.	right mitigation activities that will practised by project. The description of the location that installed the station for testing. Also the reason that result of testing is over the standard shall be mentioned. 3. **Topography** - To properly manage any accidental matter from flood or storm and other matter, some information of flood and history of flood (by interviewing with key informants) in this area shall be described. The project type is really concerned with the flood management. - Soil type: actually the soil type map prepared by JICA-2002 shall be added and the condition of this soil type shall be mentioned according to the site observation. **4. Water system:** - It shall be mentioned some facilities related to the waste water treatment plant (WWTP) or septic tanks and other that it may be able to reduce some impacts due to the project type. - Map of water system/body included the project location shall be showed. Also the location map of water sampling shall be showed on the map that it may be easy to give the comment and its mitigation measure for further monitoring. Condition of the water quality in dry and wet season in the project area is recommended to describe.
5.1.2 Biological Resources	-Biological source: In general: Map and standard of map are limited in this EIA	Moderate: **3. Wildlife/Fauna/Birds:**

	report. - The survey date, sources and remarks shall be added under or next to the table. - The Red list from ministry of Agriculture, Forestry and Fisheries shall be recommended to add. 2. Wildlife/Fauna included birds: - Map of the transection line shall be added.	- It is so important to put the date and period of survey for wildlife. - Also, the national red list is so import to put in the report with the clear date of the survey. - Map of the transection line shall be added during doing the survey. Also, Data from transect for fauna survey shall be added the date of survey and date of retrieve the red list from website of IUCN. - The results of survey, interview and secondary data from concerned NGO or forest communities next to project location shall be discussed.
6. Public Consultation :	- The conclusion shall be separated between local and concerned departments in Province.	- Actually, local people feel not so good with the project and some time they have the reasons that do not support the project due to the project is operating. - List name and pictures of public consultation is recommended to add in the report or in appendix.
7. Environmental Impacts and Mitigation Measures		
7.1 Rapid Assessment Environmental (RAP) Check list	- Report of EIA shall recommend for this type of checklist for main concepts in order to identify the impact by project.	- This report does not have this tool for assessment. - It is so important as the indicator for mitigation and monitoring works.
7.1 Description of the negative environmental and socio-economic impacts…in construction and operation stage	In construction Stage: - For Air quality: the burning solid waste in worksite needs to avoid. Thus report shall be added. - Wrong standard for Noise: they shall use the standard for industry zone to compare, but the report use the standard of commercial area to compare. - Due to the safety work, it shall apply the PPE to all workers. Work at high, hot management, and norm of local people shall be trained regularly to workers.	In construction Stage: (Moderate) - In mitigation measurement, it shall add some items for Air: as waste is not allowed to burn in worksite. - For standard of noise, we recommend to use the standard of industry area, it is 75dB from 6AM to 6PM, it is 70 dB from 6PM to 10 PM, while it is 50 dB from 10PM to 6 AM for location tested inside the factory area. But if other location of testing for noise inside the residential area, they shall use the standard of residential area: it is 60dB from 6AM

	III. In Operation stage: - Air, noise, and vibration discharged from production need to do the monitor regularly. -	to 6PM, it is 50 dB from 6PM to 10 PM, while it is 45 dB from 10PM to 6 AM. Some concerned items shall be added: - Health and Safety: personal protected equipment (PPE), and train workers "how to use" PPE during construction needs recommended to add. - Room for nurses shall be prepared in the worksite. Also, the cooperation with local hospital MUST be done in advance for any emergency matter from work. - It is really confusing to use the term of septic tank as waste water treatment plant (WWTP), it is completely different. III. O&M: It is the factory project that it is really concern to the Environment and workers/local people health. - The project shall follow the standard of air pollution in Cambodia. - The PPE for hot protection for workers are working at the hot places suggested to add in Safety and Health. Also, the air plug to protect with noise shall be provide to whom is working next to production work that has noise over 70dB. - Nurse or some medicine for emergency accident from hot places in factory and other matter need to apply in this factory. - Labour law shall be applied for this project type.
7.2.4.2 Cumulative impacts	It shall identify some negative impacts that found during the surveys that we are able to have assessment that it may be from other projects around this project as well.	- It seems confusing to mention mainly on the impacts that this project affected or may affect to physical, natural and social nearby the project. So,

		some projects exist near or around this project shall be mentioned about some matter whenever we found something strange.
8. EMP	Institutional Arrangement shall be added to respond on some tasks of report implementation as board, organization chart for Environmental management.	- It will be helpful to carry out the work, whenever they have establish the organization to respond. - They will have the budget to do the monitor, if they have this organization for project.
9. Environmental Value and Economic Analysis	It is really short.	- The report shall add more about the environmental value in this chapter.

Table 3.8: Improvement Assessment Matrix

Sector: Infrastructure Name of IEIA Repor: Reconstruction National Road No. 58 of Cambodia

Content of the General Guidelines	Summary of issues in IEIA Report	Recommended Actions
1. Introduction	- Cambodia has an area of 181,035 square kilometres with population over 15 million that its landscape is characterized by a low-lying central plain at Tonle Sap subbasin. - This is loan project from Chinese government	In this section, the report should describe on General status of project, purpose and methodology of the study but there is nothing to describe on the above content.
2. Laws and regulation Level: good	- Description of relevant laws and regulation are: (1) constitution of Cambodia (1993), (2) Law on environmental protection ad natural resource management (1996), (3) law on natural protected areas (2008), (4) land law (2001), (5) Law on forest (2002), (6) Sub-decree on environmental impact assessment process	Copy from law and regulation

	(1999), (7) Sub-decree on water pollution control (1999), (8) Sub-decree on solid waste management (1999), (9) Sub-decree on air pollution and noise disturbance (2000).	
3. Project description	- Talking on project overview, the reconstruction project of national road, # 58, start from PK 399.9 of National Road # 5, at Stung Bat village, Poipet Town and ends at PK 101.5 of national road, # 68, at Phóng village, Samrong district, Banteay Meanchey. The total length is about 174.166 km, with designation of class III two lane road, with speed of 60 km/h, and upgrade width of 12 m. - Report shows construction contents and scale with detail design of road route, bridges, and culverts. It also shows relevant pictures by sections. - The construction will be completed in 39 months period based on the sketch of schedule.	Level: Good. It is acceptable
4. Description of Existing Environment		
4.1 Natural Environment		
4.1.1 Physical Resources	- For Physical sources: 1. Topography; The topography is too general without any clear reference such as map of topography, watershed or elevation. 2.There is no information on soil texture/type. 3.For climate data: Only little description on temperature and season (1 short paragraph). 4.Air quality: No data on air quality and noise. 4. Description on Engineering Condition about the bridges	Identified for further: (Poor) **1. Topography** Because the road project will be improved, baseline of the topography and watershed are useful. Map of elevation and watershed shall be added in this part. **2.** Because of the road project will be improved, the baseline of soil/soil texture need to be described. **3. Climate** Data: Because the road project will be improved, baseline data on temperature and rainfall are very important which shall have at least 5 years data with good conclusion. Through

	and culverts, which should not be discussed in the description of project.	experiences, climate change particularly flood is significant impact on road condition, while rainfall are much related to plantation along roads for protecting erosion from flood and storm. **4.** Because the road project will be constructed and operated, baseline of air ambient and quality shall be widely studied. **5.** This section should move to Project Description Section.
5.1.2 Biological Resources	-Biological source: 6. For description and standard map on biological resources, the report provided not sufficient information. **7.** For Tree species and other research of those species, the report is not used a red list of IUNC and also not having good references. The report described only very few and general without any good reference and proof. **8.** Information on terrestrial wildlife: Description is very limited. Only few data was showed in this report. **9.** There is no information on fish.	Identified for further: (Moderate) **Tree species:** 6. Because the road project, good map and clear description should be clearly shown on forest cover and distance to the project sites to avoid any confusion of impact on forest by the project. - A standard map of the protected area and forest should be showed clearly. 7. The red list from IUCN is recommended for this study thus the project will ensure any anticipated impact on dangerous or rare species. In addition, the report should add proper methodology on Transact line and plots survey thus the data is more accurate. Baseline information is very important thus all existing environment needs to be clarified, so that we will know clearly on an impact from the project or other project. This is very important for the monitoring activity and project operation phase. 8. Baseline information is very important thus all existing information need to be clarified, so that it will be easy to identify on impacts which generated by the project or other project.

		9. Fish data is also important but the report describes nothing. It is recommended to present a data on fish too because the road construct may also impact on water quality or flooded forest nearby which can be effect on the fish too. This is very important for local community livelihood.
4.1.3 Social Economic Source	10. For the socio-economic, it seems no survey. The report showed only secondary data.	Identified for further: (Poor) 10. Because road project, baseline on Socio-Economic data is very important; thus, the survey on socio-economic should be conducted. The methodology of the survey should be well and clearly prepared to get accurate data. Thus the survey and the existing secondary data are needed. This part will be also important for decision maker for decision making on the project.
Chapter 5: Public participation	11. The public consultation was conducted only one time on project launching by MoE with provincial and district level. However there is no any consultation with local villagers or affected people or local authority. The process of the public participation is non-compliant.	Identified for further: (Poor) 11. The consultation meeting with local, villager and affected people are very important thus the project must follow the requirement of public consultation and information disclosure. The participatory meeting should be conducted since project design.
6. Environmental Impacts and Mitigation Measures		
Anticipated Impact Assessment	12. In general, the format of impact assessment does not meet the EIA guideline of Cambodia MoE or ADB format. The report describes without separation of physical, biological or socio-economic impact sections thus the impacts are not so specific. 13. The description of the impact section is too general and also not so specific on the issues. The description focused	Identified for further (Poor): 12. For EMP, impacts normally separate into three phases such as Pre-construction, During construction, and During Operation but the report rose only two phases including pre-construction and during construction. The format of the report seems very different and confusion thus the report requires following the EIA

Pre-construction	on responsibility like a ToR. In addition the report mentioned only two phases including pre-construction and construction; while no description on during project operation. 14. For this section, the report describes very general and different format. The description is normally used formula like theory and copy of the design (from description of the project). In addition, some data were described but there is no reference.	format with the above three phases. 13. This section is very crucial but the description does not discuss relating to specific impacts and covering on the all issues. This phase shall be discussed on impacts connecting to design and site selection including borrow pit and Environmental health and safety manual and so on.
During Construction		14. This section is very crucial but the description does not discuss relating to specific impacts and covering on all specific issues. Hence specific issues should be discussed following the format of the environmental anticipated impacts and good reference shall be applied.
EMP and Monitoring Plan	15. The report is very confusion on format. The EMP section but the report talks about the Institutional Arrangement.	Identified for further (Poor): 15. The EMP is very important section but the report seems

	The mitigation measures were discussed but they seem not specific. In this section, they are not so consistent between the anticipated impact and this EMP.	confusion on this section. The format of EMP must be applied and followed. The impacts of the anticipated impact assessment section were not clearly assessed and the impacts in the mitigation measures seem different to the impact assessment section. The report requires to be consistent between the impact assessment section to EMP and Monitoring Plan.
Environmental Value and Economic Analysis	No section in this sector	

Table 3.9: Improvement Assessment Matrix

Sector: Instrastructure Name of IESIA Repor: Skype Bridge and Underground Road Construction Project at Techno, Phnom Penh.

Content of the General Guidelines	**Summary of issues in IEIA Report**	**Recommended Actions**
1.Introduction	- Because of increasing traffic jam day to day at the Techno traffic light, Phnom Penh city has proposed this skype bridge in 2014. The project will spend about 14502476 US$ under finance by Government of Cambodia. - Construction will spend 16 months from 09 September 2014 to 09 January 2016. - Purpose of ESIA is: (1) identify, analyse and introduce project process, plan and type of infrastructure, (2) study on physical, biological, and social resources, (3) organize public consultation meetings, (4) organize EMP and Monitoring Plan to ensue sustainability of the project and environmental management. - Two methods to be applied for data collection are: (1)	Level: moderate Generally, the report follows MoE EIA guideline

	secondary data collection, and (2) primary data collection such as observation and laboratory test. - For air quality test, two sites were selected and 6 parameters (including TSP, SO2, CO, Pb, and NO2) were tested. As for noise and vibration, two sites were selected. - Organizing public consultation meetings with stakeholders. - Report format consists of (1) Introduction, (2) Regulation, (3) Description of Project, (4) Description of existing physical, biological and social-economic resources, (5) Public consultation, (6) Impact assessment and mitigation measures, (7) EMP, (8) conclusion and recommendation.	
2.Regualtion	Summary of national existing law and regulation on Cambodia constitution (1993), Law on environmental protection and management (1996), Labour law (1997), investment law (1994), law on industrial management (2006), … (For this section, there are very similar to other reports too)	
3. Description of project Level: Moderate	- The project is located at connection between Russian Blvd and Mao Setong Blvd, Sangkat Teuk Lhaok 1, Phsa Depo 3, Khan Tulkork. - Description of detail design/plan of the bridge and underground road. The length of bridge is 382 m; width of bridge is 15.8 m with 4 lines. - Some description on solid waste and wastewater management, worker safety and health, - Construction will be started from 09 September 2014 for 20 months period in maximum.	Generally, the report is good but only some points particularly public safety is not discussed. In addition, the report does not discuss detail on environmental protection equipment such as glove, mask,...
4. Description of Existing Environment		
4.1 Natural Environment		
4.1.1 Physical Resources	- For Physical sources:	Identified for further: (Moderate)

	1. Topography; The topography is too general without any clear reference. No information on the watershed and hydrology. In Phnom Penh, flood is also a priority challenges but no information on this issue. 2. There is no information on soil texture/type. 3. The report does not discuss or test on ground water. 4. For climate data: description on temperature and rainfall and wind direction was described. As for Air quality: show some data on air quality, noise and vibration. Some of parameters such as 03 and TSS are higher than MoE's standard, but the reports give some explanation. However, the report focused on only primary data.	**1. Topography** Because the Skype Bridge and Underground Road Project will be constructed, baseline of the topography and watershed are useful. Map of watershed and flood shall be added in this part. In Phnom Penh, many complaints were made on flood issues during rainy season. Thus the report should discuss on this matter too. **2.** Because of the Skype Bridge and Underground Road Project will be newly constructed, the baseline of soil/soil texture need to be described. **3.** Because of the Skype Bridge and Underground Road Construction will be constructed, the ground water level stands very important that it may impact during an excavation (if level of ground water is high). Thus the study on ground water should be added. **4. Climate** and Air Quality Data: In general, the description is acceptable but only missed some of good reference and no discussion on secondary data for the air quality.
4.1.2 Biological Resources	-Biological source: 5. Only few description on site selection which already developed, thus there is no biological resources. However some impacts including black oil from vehicles and other pollutants during construction may also drain into wastewater system (if un-properly manage) then go to surface water directly which can impact on fish or water quality too.	Identified for further: (Moderate) **Tree species:** **5.** In case of the project is located in Phnom Penh City but some anticipated impacts may impact widely, so that fish resource from Mekong and Basac Rivers should be also discussed here.

4.1.3 Social Economic Source	6. For the socio-economic, the report discussed about the number of population in Cambodia and Phnom Penh, household status, economic and people livelihood, water use and electricity, existing infrastructure, traffic, education, and health. However some of them don't have good reference.	Identified for further: (Good) **6.** In general, this section is good description. However, some references need to be attached.
Chapter 5: Public participation	**7.** The report described about the public consultation with relevant department and with people. However, the public consultation with local community and people seems not clear references including date and list of participants.	Identified for further: (Moderate) **7.** The consultation meeting with local, villager and affected people are very important thus the project must organize to inform and disclose any relevant information on the project. Hence the report should describe clearly with references including date, report and some pictures.
5. Environmental Impacts and Mitigation Measures		
Anticipated Impact Assessment	**8.** For the assessment and mitigation measures, normally the environmental assessment should be evaluated on three phases such as Pre-construction, During Construction and During operation; however the report missed to include the Pre-construction Phase (project design). Thus, the report described only impact during the construction, operation and project completion.	Identified for further (Moderate): **8.** For this section, the report should consider on three main important phases such as Pre-construction, During construction, and During Operation. During the project design (pre-construction), it is also very important to avoid or reduce impacts through modifying the design that all projects need to be included and considered.

EMP and Monitoring Plan	**9.** As for the frequency of monitoring in the EMP, the report recommended only one time for project construction period which are not sufficient due to project will implement about or over 4 years period.	Identified for further (Moderate): 9. For monitoring frequency the monitoring activity should be conducted at least semi-annual to ensure that the EMP are implemented properly.
Environmental Value and Economic Analysis	No section in this sector	

Table 3.10: Improvement Assessment Matrix

Sector: SEZ Name of EIA Report: SSEZ in Sihanouk

Content of the General Guidelines	**Summary of issues in EIA Report**	**Recommended Actions**
Chapter-2	Methodology	

	The general map showing the condition of project location comparing with the forest, water and residential area shall be made for concept of methodology preparation.	Moderate If the existing condition of the project location is not clear, the survey methodology will not be well for its results. So, report writer cannot identify the real impacts from the project area. Also, the location for sampling water, air test, noise measurement, flora and fauna, socio-economic and public consultation, including other survey… for project are not well assessment.
Chapter-4	Project Description	
	For waste water treatment plant (WWTP) for project, it shall have the Risk management for some cases that this WWPT does not well work according to the standard of MOE. In this chapter, the project shall have the plan to let all factories that produce waste water MUST have individual waste water treatment plant (WWTP) in order to make sure that all waste water from those factories are already clean before discharging to the WWTP of this SEZ.	Moderate Risk management for WWTP is recommended due to the outlet of waste water after treated will discharge to Preak Teok Sap that is the only fresh water source for people living in Stueng Hav District of Sihanoukville province. So, it may be the heavy risk for water pollution from this project, if they have some improper treatment of their waste water. According to the concerned parameters in the plan of this WWTP are only pH, BOD5, CODCr, SS, NH3-N, TN, TP, while there are many different types of factories constructed and constructing. This SEZ shall have their internal standard to those factories inside of the SEZ.
5. Description of Existing Environment		
5.1 Natural Environment		
5.1.1 Physical Resources	In general: Map and standard of map are limited in this EIA	Identified for further: (Moderate)

	report. For Physical sources: 1. **Noise and vibration:** - Noise: it is a little bit over the standard for noise inside the factories. - Vibration: The standard of Japan or WHO shall be compared according to the results. 4. **Water system and water quality:** - . - Related to the results of testing of waste water from WWTP that Oil and Grease are over the standard after treated, it shall be from the capacity of WWPT or the facilities of WWPT does not work.	5. Noise: If the level of noise measure is over the standard, it shall identify some reason in order to find the mitigation measure. 6. Vibration is so important during project construction and some activities of industries works, thus the comparing of results and any standard shall be compared and identified. **7. Water system:** - Oil and Grease are also the main concerned parameters in water for waste water from industries. It is the pollutants for water source next to the project site, especially Preak Teok Sap that is the main source of fresh water supply for whole Stung Hav district.
5.1.2 Biological Resources	-Biological source: In general: Map and standard of map are limited in this EIA report. 1. Flora - The survey date, sources and remarks shall be added under or next to the table. - For trees and other plants, they missed the IUCN red list. 2. Wildlife/Fauna included birds: - Methodology for this section does not show well. - Map of the transection line shall be added during doing the survey. Also, Data from transect for fauna survey shall be added the date of survey and date of retrieve the red list from website of IUCN. 3. Social:	Moderate: **5. Flora:** - If the methodology is not clear, the results of the survey will be not good. - It is so important to put the date and period of survey for wildlife. - IUCN red list is so import to add for flora survey in the report with the clear date of the survey.

	- Results of some locations for Traffic survey shall be added.	3. Social: Traffic are really important during project construction and operation in order to solve whenever it is the peak time.
6. Public Consultation :	- The workshop for public consultation in order to share the results of the survey shall be done. - The conclusion with local people shall be added. All concerned and suggestion shall be also added. - List name and pictures of public consultation is recommended to add in the report or in appendix. - The results of survey, interview and secondary data from concerned NGO or forest communities next to project location shall be discussed.	Poor - It is important for this report to do the public consultation with local people. They will know well about the project; also, people have chance to share what they are concerned according to their living condition with project. - The percentage of supporting project from concerned departments in province, included their concerned and suggestion are really important that need to highlight.
7. Environmental Impacts and Mitigation Measures		
7.1 Rapid Assessment Environmental (RAP) Check list	- Checklist needs to highlight some information as remarks as the concepts of impacts by project.	Poor - If there is no any remarks or information about the project location, it does not have indicator to assess its impacts.
7.1 Description of the negative environmental and socio-economic impacts…in construction and operation stage	In construction Stage: - Noise standard: the report shall use the right standard for it mitigation, but report used all types of standard for mitigation measures. - For vibration, it shall be separated from Noise, while vibration does not have the national standard, but the standard of Japan is recommended.	Poor In construction Stage: - For standard of noise, we recommend to use the standard of industry area, it is 75dB from 6AM to 6PM, it is 70 dB from 6PM to 10 PM, while it is 50 dB from 10PM to 6 AM for location tested inside the factory area. But if other location of testing for noise inside the residential area, they shall use the standard

		of residential area: it is 60dB from 6AM to 6PM, it is 50 dB from 6PM to 10 PM, while it is 45 dB from 10PM to 6 AM. - Nosie has national standard, but report shall give the mitigation for vibration by any clear standard as standard of Japan… as the basic to follow. Mitigation shall not be missed this. - For mitigation of vibration and noise: it is really limited that it shall add more items as using PPE during operation works….etc. Training or toolbox talks for this matter shall be mentioned….
	- Health and Safety: The training for using personal protected equipment (PPE) needs to add. - It is missing the toiled for workers. - It is missing the Room for nurses.	- If the project does not train workers about safety and PPE use, workers will not be able to properly use. - If toilet for workers during the construction stage is not enough, the ministry of labour needs all projects to prepare the toilets for workers for construction and operation stage.
	Risk management is strongly needed for all stage.	If the project does not have the risk management will have with the some matters to delay of time to construct or it may affect to budget of project and its master plan as well.
	III. In Operation stage: - The mitigation noise for PPE use in operation over 80 dB is very high, if compare to the standard only 70dB for maximum. - The PPE for hot/work at high protection for workers are	III. O&M: It is really concern to the Environment and workers/local people health. - Also, the ear plug to protect with noise shall be provide to whom is working next to production work that has noise over 70dB, it is not 80dB.

	suggested to add in this item of Safety and Health. - Nurse or some medicine for emergency accident from hot places in factory and other matter need to apply in this factory. - Enough toilets for workers need to add due to the labour law. Matrix table for brief potential environmental impacts and mitigation measure: There are not few of strong impacts only for this full EIA report.	- The project shall follow the standard of air pollution in Cambodia. - Labour law shall be applied for this project type. This is really important to identify the negative impacts by project according to its categorization is A for full EIA study. But, there are only 4 items that identified as the heavy impact as: Waste water leakage in construction stage, Physical impacts n project closure stage, Economic condition in project closure stage. Actually, operation is really concerned, if the project does not have the proper management for all type of works.
8. EMP	Institutional Arrangement shall be added to respond on some tasks of report implementation as board, organization chart for Environmental management.	- It will be helpful to carry out the work, whenever they have established the organization to respond. - They will have the budget to do the monitor, if they have this organization for project.
9. Environmental Value and Economic Analysis	It is really short.	-
Note	• *Poor means that the report does not really follow the MoE Format/Guideline, lack of description and not so consistent between paragraph to next paragraph.* • *Moderate means that the report follow the MoE Format/Guideline, but lack of description and explanation of reason. Good means that the report follow the MoE Format/Guideline, good description and explanation of reason.*	

IV. Conclusion and Recommendation

4.1 Conclusion

All in all, there are some different weak and strong points of the reports. Some of those week matters happen at the beginning of the reports which include unclear methodology of the surveys and testing, unclear impact assessment and mitigation measures, but others are clear description on methodology, existing environment, impact assessment and mitigation measures.

Key issues of the report are unclear explanation on the data, data analysis, limited data, over standard and quotation of data source that all of the reports need to be improved.

In general, the reports cover on the content which provides in the MoE guideline on EIA (Annex A). The guideline of the ESIA shall consist of (i) introduction, (ii) law and regulation, (iii) project description, (iv) description of existing environment (including physical resource, biological resource, and socio-economic resource), (v) public participation, (vi) environmental impact and mitigation measure, (vii) environmental management plan (EMP), (viii) economic analysis and environmental value, (ix) conclusion and recommendation, Reference, and Annex.

4.2 Recommendation

Generally in Cambodia MoE established the guideline on ESIA for preparing ESIA/IESIA. The guideline also states clearly on each chapter/content that the report must follow them. In addition, each consultancy firm needs to submit MoE a ToR fo the study before field works to ensure that the reports will follow the guideline and have a good quality. However, the quality and above problems of the reports are still happening. It therefore recommends that all consultancy firms must be improved its quality and the format in the guideline must be strictly followed.

The MoE Department of EIA has many new and young staff who need to be improved their capacity as well to support the department more efficient and effective thus capacity building on EIA guideline, regulation, EIA theory and best EIA practices in other countries, i.e Japan cases, shall be offered.

V. References

1. EIA, 2015: Reconstruction National Road No 58 of Cambodia, Ministry of Public Works and Transport.
2. ESIA, 2017: Copper Factory, Kampot Province. Kinnrich Copper Smelting Co., LTD.
3. ESIA, 2017: Sihanouk Special Economic Zone, Preah Sihanouk Province, 2017.
4. ESIA, 2017: Cement Factory, CMIC, Banteay Meas District, Kampot Province.
5. ESIA, 2017: Siem Reap Sokha Report Development Project, Siem Reap Province. 2017.
6. IESIA, 2016: Skype Bridge and Underground Road Construction, OCIC, 2016.
7. IEIA, 2015: Rehabilitation of National Road No 5, Battambang-Serei Sorphorn, Ministry of Public Works and Transport.
8. MoE Prakas on the guideline on preparing initial environmental and social impact assessment (IESIA) and full environmental and social impact assessment (ESIA), Number 376, on 2 September 2009.
9. MoE sub-decree on water pollution control, number 27, in April 6, 1999
10. MoE sub-decree on environmental impact assessment process, number 72, in August 11, 1999.

11. Moe sub-decree on air pollution control, number 42, in July 10, 2000

12. MIME, 2004: Drinking Water Quality Standards, January 2004.

Annex 32 Report of Public meeting on EIA

Public Consultation Meeting (PCM):

Draft Initial and Full Environmental and Social Impact Assessment (ESIA) Sector-Specific Guidelines for Road and Railway

March 19th 2019

08:00 – 16:00

Sokha Hotel Phnom Penh, Cambodia

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Project Background

The Department of Environment Impact Assessment (DEIA) and the Japanese International Cooperation Association (JICA) have been working in partnership to develop sector guidelines (GLs) focused on environmental and social impact assessments (ESIA). The project is positioned within *Project for Effective Implementation of EIA and Pollution Control through Capacity Development of Ministry of Environment* that runs for a three-and-a-half-year period.

JICA has provided technical and financial support to 'develop capacity and for better management of the environment' and this particular engagement specifically focuses on building capacity within the DEIA. External investment interest linked with potential future road and railway projects has prompted a review of current practices and guidelines. Experts from JICA have worked alongside a technical working group of participants amalgamated from the Ministry of Environment and the DEIA in order to develop GLs. The overall aim of ten project is to provide support to those involved with the development and assessment of road and railway projects and to improve the effectiveness and efficiency of the practice.

Figure 1: Participants at the Public Consultation Meeting, Sokha Hotel.

Method, Objective and Purpose

A Public Consultation Meeting (PCM) was held on the 19th of March 2019 at the Sokha hotel, Phnom Penh. The overall objective of the PCM event was to gather and record participants opinions in

relation to the road and railway GLs. All participants were encouraged to comment upon each section of the GLs, both general and section specific comments were extracted during open table discussions facilitated by the DEIA and Sustinat Green.

The one-day consultation meeting, designed and facilitated by JICA and the DEIA, with support from Sustinat Green, was held to enable key stakeholders and interested parties to review, comment and respond to draft ESIA guideline's for road and railway projects. All comments were recorded and collated during the event and have been included within this report.

Participants invited to attend the PCM (see Appendix 1) were selected from a wide variety of different Royal Cambodian Government departments, ministries, national environmental consultancies, and non-government organizations (NGOs) based in Phnom Penh. A total of 48 invitations were distributed along with a copy of each of the draft GLs (initial and full). The attendance of such a diversity of participants was requested in order to generate a wide-variety of comments from experts, interested parties and government employees.

During the PCM comments were both written onto a white-board, to enable a summary of key concepts, as well as being recorded by Sustinat staff. All comments are presented within this document.

Participants

A total of 59 participants attended the morning session, with 31 of those representing ministries and 28 representing ESIA consulting companies sand NGOs. During the afternoon session there was a total of 34 participants, with 15 representing ministries and 19 representing ESIA consulting companies and NGOs. 17 staff were also in attendance from Sustinat Green to support the facilitation of the event. In respect of the invitations distributed only the *Ministry of Tourism* and *Environtech* were absent at the event.

The tables below show the breakdown of attendees during the morning and afternoon sessions.

No.	Ministries	AM	PM
1	Ministry of Environment	13	4
2	Ministry of Land Management Urban Planning and Construction	1	0
3	Ministry of Agriculture Forestry and Fishery	1	0
4	Ministry of Tourism	0	0
5	Council Development of Cambodia	1	1

6	Ministry of Water Resources and Meteorology	1	0
7	Ministry of Culture and Fine Arts	1	1
8	Ministry of Labour and Vocational Trainings	1	1
9	Ministry of Public Work and Transportation	2	2
10	Department of Environmental Impact Assessment, the Ministry of Environment	10	6
Total		**31**	**15**

Table 1: list of ministries that attended the PCM

No.	EIA consultants and NGOs	AM	PM
1	E & A Consultant Co., Ltd.	1	1
2	CES Co., Ltd.	1	1
3	PPIC Co., Ltd.	2	2
4	SBK Research and Development Co., Ltd.	2	1
5	Creative Green Design Co., Ltd.	1	1
6	Envirotech Service Co., Ltd.	0	0
7	SWAS Consultants (Cambodia) Co., Ltd.	2	2
8	RCBCC Co., Ltd.	1	1
9	Key Consultant (Cambodia) Co., Ltd.	2	1
10	Sustinat Green Co., Ltd.	1	0
11	GIGB Business Investment Cambodia Co., Ltd.	1	0
12	Prey Kdoch Development Consultancy Co., Ltd.	1	0
13	Beetle Environmental Solutions Co., Ltd.	1	1
14	Cambo Consultant International (CCI) Co., Ltd.	1	1
15	RTM Consultants Co., Ltd.	2	2
16	ERD Consultants Co., Ltd.	1	1
17	Development and Partner Agency	1	1
18	NGO Forum	2	1
19	Oxfam	1	0
20	JICA	4	2
Total		**28**	**19**

Table 2: list of key stakeholders from consultancies and NGOs that attended the PCM

Structure of Document

The results of the PCM have been set out in this report to reflect ten (10) sections that the GLs were separated into. This categorization was enforced enable readers to navigate through the document easily and to review the document more efficiently. Each section generally represents chapter sections within the road and railway GLs although some sections, summary and introduction for example, have been combined as it was assumed less analysis and review of such sections would occur.

The first section below discusses overall, general comments that were provided during the review period. Following the general comments section remarks become more specific and relate to the individual sections as discussed.

The document has been divided into Road and Railway sections. It should be noted that fewer comments were collected from the Railway GL due to similarities in the two documents and therefore the removal of repetition. As such, amendments or alterations in response to the comments below should be conducted across both documents simultaneously and not focus on any one GL.

PCM Results

In total, 196 comments were provided by participants covering both GLs during the event. Initially, 153 comments were provided by participants in relation to the Road GLs and 43 comments in relation to the Railway GLs. During a number of document review periods, and in consultation with the JICA team, it was agreed that comments deemed irrelevant, or which were not considered to support the objective of the project, were removed. After reviewing the document, a total of 175 comments remain

The comments listed below have been selected to highlight key remarks provided at the PCM that summarize important points of view and which should be prioritized during the revision of the draft. The remarks below represent the opinion of a number of participants, rather than individual views, and can be considered as a general reflection of key concepts and ideas that were provided during the PCM.

#	Summary of Key Comments
1	GL's do not clearly or comprehensively define impact assessment methods or standards. Participants repeatedly suggested the GLs would benefit from setting and providing clear

	standards and methods throughout the document;
2	GL's fail to clearly define terminology or technical terms and therefore may result in variance different project across assessments. GL should define all technical terms to enable all users to apply the same processes and practices across different projects
3	Many resources/references have been excluded, or are absent or out of date;
4	GLs would benefit from having English language and terms reviewed;
5	GLs should consider improving the layout and the content of each section. The GLs would benefit from including signposting and section introductions, tables and a more user-friendly design. Participants suggested that irrelevant standards should also be removed.
6	Generally, the GLs lack clear information, guidance and detail. The concern is that this will encourage too much variation when assessments are submitted and will not act to streamline assessments for the DEIA
7	Consider replacing the Terminology 'describe' with more supportive language to provide guidance;
8	GLs should ensure that impact description is standardized (i.e size, scale, magnitude, direct / indirect, permanent).

Road Comments

Comments in this section have been separated into 10 tables to reflect each of the predetermined sections used during the PCM event. This section presents the comments provided during discussion upon the Road GLs, the following section discusses the railway remarks. Please note that the same table design and application was used for both sections.

At the request of JICA, comments have been categorized by Sustinat Green Staff to reflect the how participants weighted the importance of the comments. Comments considered to improve the practice if impact assessment, improve the GLs, expediate the assessment process for the DEIA, and which will improve the standards compared to current practices. Comments have been categorized into:

i) Red - those considered the most valuable and important to improving the document and the GLs should be adapted to include red highlighted comments or the concept the comment being describing.

ii) Amber - are considered less important than red, but will largely benefit and improve the GLs if also included.

iii) Green - are not as important or valuable to improving the document compared to the other two categories and may not add much value to the overall revision of the GLs if included.

Figure 2: GL table discussions

Importantly, the column to the right of each table illustrates a 'thematic area' associated with each comment provided by participants. This column has been included to enable more efficient analysis of the GLs plus enable simple analysis. During analysis of the comments it became clear that many of the participants remarks and ideas could be grouped due to their 'thematic' likeness. To support and expediate the GLs review it was decided to include such groupings and to apply terms to link the comment to thematic areas. These are discussed further in the results section of this report.

General Road and Railway Comments		
#	Comment	Thematic Area of GL
1	Describe if the road is to be newly constructed or repaired and clearly detail the type and size of roads	
2	Define the scope of study clearly	Method
3	Appropriate methods of data collection are included in GLs	Method

4	Legal Framework should include information about the responsible ministries	Legal
5	The legal framework section should relate ONLY to relevant project laws and regulations and remove all unnecessary laws not relevant to the proposed project	
10	GL's should include engineering concepts in relation to road construction and discuss road alignment and elevation standards.	Standards
11	GL's should include description of required road standards and traffic signs	Standards
12	Lack of standardization – the GLs should encourage all consultants to use the same: sources, references, map scale, matrices, methods of assessing an impact etc.	Standards
13	A concern is the new GLs will not work to protect the environment any better than current practices.	Standard and method
14	Generally, the GLs lack clear information and guidance. The concern is that this will encourage too much variation when assessments are submitted and will not act to streamline assessments for the DEIA (size of area assessed, buffer zone, number of samples, need to collect primary and secondary data).	Method
15	Should clearly state and confirm the application of either Qualitative or Quantitative methods – currently confusing and should be revised.	Method
16	Sections should be combined to easily show the different phases of a project and the different potential impacts (Design, Construction, Operation, Decommissioning). Suggest not separating these.	
17	Consider replacing the Terminology 'describe' with more supportive language that provides instructions and guidance.	Terminology
18	Consider reformatting and sections and improving the chapters layout to support the user. The layout is not user friendly or clear and the document as a whole provides no signposts. It is difficult to navigate different sections.	Layout
19	No introduction is provided at the start of any section, no background, no sign posting throughout the document which makes it generally very unclear and difficult to understand.	Layout
20	Consider removing Japanese standards, practice and hazards.	Layout and add detail
21	Remove all repetition from GLs and conduct a spell check on English version.	
22	GL's should act to advise and provide support relating to quantitative and qualitative data collection methods – this is not	Methods

	clear in these GLs.	
23	Consider improving and defining the technical terms used. No definitions for key terms are provided throughout the GLs	Methods
24	No guidance included to discuss dividing the road into different sections to better describe the overall potential impacts. If the road is 80km in length is logical to discuss potential impacts within set sections (i.e. section a, b, d)?	
25	No advise within the GLs about the type of impact being described (size, scale, magnitude, direct / indirect, permanent) – no matrix exists. How will decision makers be able to compare projects and compare potential impacts across the country?	Methods / Standards
26	Mitigation is not practiced in Cambodia. Need to detail and formalize mitigation options and techniques more clearly and provide clear support for this process. Mitigation is a major failing of the EIA system at present	Mitigation
27	Provide examples from other countries to allow for a wider understanding and to support improvement.	Mitigation

Executive Summary		
#	Comment	Thematic Area of GL
1	Include an introduction in this section	Layout
2	Summary should not be limited to 15 to 20 pages as it based on project information which will vary depending on the size and scale of the project.	
3	Move the background information of the project owner to Project Background section.	
4	Summarize each chapter by selecting and discussing the most significant points	
5	The overview of the project should include a description of the drainage designs for road, bridge, and sewage systems	Design drawings
6	Will the document include a include preface or not? Document should include project recommendations in the executive summary	

Section 1 (Introduction)		
#	Comment	Thematic Area of GL
1	Add more description relating to local stakeholders	Add detail

2	The section should encourage a more general discussion of each project	
3	Change '*Repair*' to *'Rehabilitation'*.	Change term
4	Include a summary of the chapter and ensure terms and meanings are clearly explained.	Layout
5	An overview of the project should include a description of road drainage, bridges, and drainage	Design drawings
6	Does this guideline include a preface? Should add the chapter 10 of the Conclusion and Recommendations in Summary	Layout

Section 2 (Scope and Methodology)		
#	Comment	Thematic Area of GL
1	Page 3 Section 2.3: GL's should mention the buffer zone or distance from the alignment center line to support the determination of project impacts	Add detail / information
2	Must clearly state the right of way, e.g. distance and standards	Add standards
3	Mention the need to identify environmental issues and impacts for scoping study	
4	Section 2.3: Methodology should clearly distinguish between physical, biological resources and social economic resources, including samples, times and methods of analysis.	Design and include method
5	Must include each methodology and analytical methods in correctly for each section and assessment phase	Design and include method
6	The methodology for *Public Participation* should be defined and explained i.e. methodology for who needs to be consulted; identifying key institutions located near the project site, such as schools, hospitals, etc.	Design and include method
7	Study areas should study the corridor of impact rather than study of RoW.	
8	Impacts to corridors should be studied	
9	Define and state buffer zones (radius) for each environmental aspect.	Method
10	Analysis of surface and ground water quality should apply only the most important parameters in relation to the project.	

11	Limitations linked to the resources used in the social study should apply laws and regulations used by the *Ministry of Public Works and Transport* (which relate to rights of way).	Add law / regs
12	The GL's provide limited advice and support on physical and biological resources	
13	Edit the description and English in project location	Language
14	Study distance should be stated in the GLs as at least 100 meters.	
15	GL's should clearly state if the assessment has to determine the impact as a percentage or by the number of households affected.	Method
16	Consider reducing the scope of study and focus the assessment on the impacts at the center line	Method / standard
17	Economic-Social Resources: In terms of the resettlement assessment process the GLs do not suggest how to determine the *Taro Yamane* interview sample or 20% of the total population? (The formula must be clearly defined).	Method
18	GL's need to clearly state the duration of the climate data study	Method
19	Hydrological data collection methods should apply flow discharge at least the last 5 years of flow discharge data and discuss issues of sediment in both small/large waterways.	Method
20	Biological resources: study buffer area 500 meters from both sides of the road central line. How much will the impact on natural resources, forests and people with Right of way be determined? (Right of Way Study of the Road).	Method
21	GL's should suggest that the resource used should be: Forest Cover 2014 (Ministry of Environment)	Standard
22	Existing approaches and environmental descriptions within the GLs are inconsistent.	Inconsistencies
23	Methods of studying each resource should be discussed separately and in their own sub-section	
24	Water testing and analysis should be conducted in the field immediately at the collection point due to temperature fluctuations and exposure.	Method
25	This section is generally lacking detail and guidance the GLs should be specific and directly demonstrate the methods, quality and sources that should be applied to all assessments	Method

Section 3 (Legal Framework)		
#	Comment	Thematic Area of GL
1	Consider using / applying the latest sub-decrees and IRC collective agreement	Update and revise standards
2	GLs should discuss the Inter-Governmental Commission on Dispute Resolution (IRC) from the Ministry of Economy and Finance By complying with the Law on Expropriation	Standards
3	Edit the Road Traffic Law from 2006 to 2015 and the amendment of 2017.	Update law
4	Add a sub-decree on the determination of vehicle speed on the roads under the traffic law.	Review and add
5	The GLs should encourage the laws, sub-decrees and declarations should be separately classified and placed in order of the date.	Law
6	The GL's should include important rules regarding roads and should cite articles related to the use of public roads and rights right of way.	Add, review
7	Labor Law 1997-2007 & 2018.	Amend Law
8	Laws, sub-decrees and other legal document should also be based on the state of the study limit	Law
9	Add a sub-decree to encourage environmental protection	
10	GLs need to include Laws on compensation and the Laws or sub-decree (land, house).	Law
11	Insert sub-decree on Management of Exploration Licenses and industrial licenses on Mining Business, 2016.	Law
12	Law on the Management and Exploitation of Mineral Resources (Amendment of 2018)	Law
13	Annex relevant legal content in Annex	Layout
14	Law, Sub-Decrees and Declarations: Must be written in their full and original form where necessary	Law

Section 4 (Project Description)		
#	Comment	Thematic Area of GL
1	If the road requires any sewerage or drainage system installation or modification its construction should be described.	Include design drawings
2	4.1. Background and Experiences of the Project Owner/Company:	Revise and amend

	Project description should include the biography and background of investors, contractors and subcontractors and should include a description of the benefits from the project.	
3	In section 4.1. Background and Experiences of the Project Owner/Company. This section should specify project financing (BOT, BT, or BO) and specify whether the project has been invested by government or private company. If it is invested by private company, the law on expropriation will not be included into the EIA report.	
4	In section 4.2 Project Site. Adjust section 3. Geology, Topography and Connectivity, and point 4. The villages, settlement and land use, including demographics, culture, and socioeconomic, to Chapter 5: Existing Environmental Resources.	Layout change
5	In section 4.2 Project Site. GLs should clearly state that the road or railway construction site should not be located near any water source	Standards
6	In section 4.2 Project Site. The location of project should be detailed with maps and pictures in this section. The project description should also include structural drawing plans that clearly detail engineering and geometric designs and standards including: road alignment, profile and cross section. Furthermore, the GLs should list and discuss all heavy equipment, additional equipment and safety equipment.	Include design drawings
7	In section 4.2 Project Site. Coordinate Reference System should be WGS 1984.	
8	In section 4.2 Project Site. GLs should clearly encourage the description of the project location, the total length of road and/or railway, mention the province district and commune that the road or railway passes through.	Missing detail
9	In section 4.2 Project Site. The scale of the map should be determined according to the sectional length of road.	
10	In section 4.2 Project Site. The map scale should not be fixed and should be determined depend on the size of the project.	

11	In section 4.2 Project Site. The map scale of 1:10.000 is too small to be seen in A4 paper; hence, A3 paper should be used.	
12	In section 4.2 Project Site. Land use, demographic and socioeconomic aspects should not describe in this section because it will be described in Chapter 5 Existing environmental resources.	Layout
13	Section 4.2 Project Site. Connectivity should be omitted and replaced into soil type section.	
14	Section 4.3 Project types. Water & sewerage infrastructure designs should be included	Include design drawings.
15	Section 4.3 Project types. GLs need to promote soil testing during backfilling of road construction to protect from contamination	Method
16	Section 4.3 Projects Type GLs should encourage that the type of project should be specified whether it is a road rehabilitation project or new road construction project.	
17	In section 4.3 Projects Type. Technical construction processes of roads and railways should be described in the report.	
18	Section 4.5 Activities of the Project. Project description should clearly specify the source of backfill soil, stone and gravel and should specify the supplier / company.	Method and construction practice
19	Section 4.5 Activities of the Project. Description of the construction team / contractor construction site should be included.	
20	Section 4.5 Activities of the Project. GLs should promote the use of a table to demonstrate a cost estimation including: construction cost, ESIA cost, environmental management planning (EMP) cost, and environmental and social fund.	Method
21	In section 4.5 Activities of the Project. GLs should advise users to detail temporary access road and any temporary road construction	Method

22	Section 4.5 Activities of the project. Construction techniques, capital investment, construction planning, and equipment, and material and labor demands should be specified.	Method
23	Within the Project Description section there should be discussion and evidence of the iterations and evolution of different design alignments, evidencing why the road has hanged route and to prove that adverse impacts have been avoided, reduced or removed	Design stage

Section 5 (Description of Existing Environment)		
#	Comment	Thematic Area of GL
1	Section 2 Climate GLs should include a record of drought and flood events as it can cause impacts to road and railway projects (important for design phase)	Data and methods
2	Section 6 Hydrology. GLs currently missing the study on hydrological systems (flow discharge of river stream and cannel) and the study of climate change scenario affected should be added.	Data and methods
3	Section 5.1.1 Physical Resources. Studies discussing of topographic features and slope should be separated.	Layout change
4	Section 5.1.1 Environmental Resources, 1. Soil. Earthquake discussion should be moved to natural disaster.	Layout change
5	Section 5.2 Social and Economic Resources. The GLs should discuss the potential impact of climate change to each project (i.e. road erosion and landslide)	Climate Change
6	In case of constructing the bridge, crossing the protected area, should there be a separate EIA study?	
7	In section 5.2 Social and Economic Resources. Public health assessment within the buffer area of study should be conducted and included in socio-economic section.	Method
8	In section 4. Noise and Vibration. Should noise testing be conducted within a protected area? It is recommended that the noise testing should be conducted only at sensitive area. If the road development project crosses the	Method

	protected and conservative areas (National Parks and Vulnerable Areas), how should the noise standards be regulated?	
9	In section 4. Noise and Vibration. Should the result of Vibration be compared to the Standard from the Terminology of reference of Ministry of Environment or Japanese vibration standard?	Delete unnecessary standards
10	All sampling for laboratory testing should be conducted based on sampling techniques at the affected project site (at least 2 locations for sampling).	Method
11	The study within the buffer area shall be considered as at least 100 meters from the roads center alignment.	Method
12	Methodology of physical, biological, and socio-economic components should be included in section 2.	Method
13	Parameters that are not necessary to be analyzed or does not have equipment for testing should not be included into the report.	Method
14	In section 5.2 Social and Economic Resources. Applying a general population census as released by the national institute of statistics cannot be included in the actual study of affected households. It is necessary to conduct a resettlement action plan (RAP) study. Population census data should be collected first hand from the village/commune in the study area.	Method
15	Section 5.2 Social and Economic Resources. GLs do not discuss the resolving impact policy statement and grievance redress mechanism - include	Law / regs / methods
16	Review all hazard related comments and make relevant to the Cambodian context	

Section 6 (Pubic Participation)		
#	Comment	Thematic Area of GL
1	GLs need to promote the attendance of key stakeholders and representatives at the group meetings within a set proximity to the proposed project.	Method
2	GLs need to state that all construction must be in accordance to labor law/regulation and National Social Security Fund laws	Law and regulation
3	GLs should promote and support training to all employees/laborers with respect of health protection and work safety	H + S standards

4	GLs should clearly state the need for companies to provide all safety equipment to staffs/laborers	H + S standards
5	GLs should highlight that the consultant company is responsible for public participation events as well as informing local stakeholders about project information.	Method
6	GLs need to add a resource / reference Public participation should be based on Prakas and Sub-decree	Add resource / reference

Section 7 (Impacts and Mitigation Measures During Design and Construction Phase)		
#	Comment	Thematic Area of GL
1	Design phase and construction phase description should be separated	Layout
2	GLS need to provide a summary to discuss methods at the start of chapter 7.	Methods
3	Remove replication and repetition e.g solid waste and wastewater management are also included in economic / social section	
4	GLs should encourage a study on the project impacts relating to income during the operational phase	Method / standards
5	GLs need to add a list and discuss compensation policies	Method
6	Project operational phase must include specific methods to mitigate impacts	Method
7	GLs should request further clarification impact and mitigation methods during the design phase/construction phase	Method
8	Studying on Resettlement Action Plan should be placed in the appendix	Layout
9	Construction phase does not discuss road safety management plans	
10	The GLs do not discuss or request information relating to vulnerable ethnic minority groups and indigenous groups	Standards
11	The GLs should encourage discuss in about catchment wide benefits and adverse impact and discus in more detail potential mitigation options for road and railway project	
12	Change word “work condition” to “work safety”	Definition
13	Separate environmental impacts design stage and construction	Layout

	stage	
14	Move cumulative impacts to the end of closure stage	Layout
15	GLs should clarify and discuss the source and storage of stone	Standard / method
6	GLs should explain to users that there is a requirement to add a checklist table and matrix	Method / standard
17	Move table 10 *Summary of Impacts and Mitigation* to the end of chapter 7	Layout
18	Infrastructure mitigation does not mention the need to include the design and installation of a side-walk on both sides of sky walk.	Standards
19	Mitigation is not practiced in Cambodia. The GLs need to detail and formalize mitigation options and techniques more clearly and provide clear support for this process. Mitigation is a major failing of the EIA system at present	Mitigation

Section 8 (Environmental Management Plan (EMP))		
#	Comment	Thematic Area of GL
1	Change the Terminology in 8.1 from '*agency*' to '*function*' or '*position*'	Term
2	Replace text and lists in sections table in 8.3 training program 8.4 monitoring plan and method 8.7 monitoring plan into a series of tables support the user.	Layout
3	Change point 8.7 from '*monitoring report*' to '*monitoring plan*'	Terminology
4	GLs need to have a section discussing the 'social-environmental fund' and provide clarity of this requirement in the assessment process. GLs need to address what authority, company or investment is responsible for the social-environmental funds for road or railways sector projects	
5	Points 8.3 8.4 8.5 and 8.7 should be converted into a table format	Layout
6	GLs need to confirm which organizations are responsible for preparing environmental management plan (EMP) reports?	
7	GLs should verify if the environmental management plan (EMP) should be implemented by the project owner	
8	There should be specialized officials from the ministries and departments of water resources and meteorology to study, as it is easy to evaluate the benefits, impacts and protection measures for those impacts	

9	The GLs should explain government projects are not required to pay an environmental fund, but private projects must include such information in their assessment submission.	

Railway Comments

Section 1 (Summary and Introduction)		
#	Comment	Thematic Area of GL
1	GLs should encourage the inclusion of a section that discusses the overall objective of study	Layout
2	GLs should include an overview of the project and clearly define the project (i.e. single line track, modification to an existing line, or a sky train)	Layout
3	GLs should clearly state that a minimum buffer for assessment aspects should be 100m of the center alignment	Method
4	GLs should clearly state that a minimum buffer 30m both sides should be applied in rural areas (see: sub-decree on Right of Way of National Road Channels and Railway)	Method
5	Point 1.1 of the study objective should be placed below the project overview item 1.2	Layout

Section 2 (Scope and Method of Study)		
#	Comment	Thematic Area of GL
1	GLs should clearly explain to the user the important and inclusion of the detail relating to the source of data	Method
2	GLs should clearly define appropriate methods for each study	Method
3	GLs should support the user to detail impacts and provide standardization for such	Method / standard
4	GLs need to include policies and regulations associated with of national railway safety	Standard

Section 3 (Legal Framework)		
#	Comment	Thematic Area of GL

1	Change Law on Labor 1997 / 2007 to 2018	

Section 4 (Project Description)		
#	Comment	Thematic Area of GL
1	GLs should promote a better analysis of the development of alternatives project options and provide examples of this (different alignment, engineering solutions, avoiding sensitive areas at design stage) for the user.	Method
2	The GLs should discuss and advise on the possibility of a railway crossing roads and mountains? This is currently absent.	
3	GLs should suggest an approximation of pages to support users	
4	Remove '*train schedule table and frequency*' from Table 2	
5	Check English translation from 2- 5 (p.7)	Translation
6	Check English translation from 4- 7 (p.7 / 8)	Translation
7	Change reference Law on Labor 1997 2007 and 2018	Standard

Section 5 (Existing Environment)		
#	Comment	Thematic Area of GL
1	Point 5.1.1 Physical resources: Within the section on climate the GLs need to select an indicator to enable an assessment of potential impacts of the project on climate change	Method
2	Point 5.1.1 Physical resources: GLs should encourage and better standards and details in relation to: air, noise, and vibration	Standards and method
3	GLs need to encourage better scientific methods are used during data collection. Collecting two samples does not provide statistically significant information with which to make a decision on.	Method
4	Missing standards data in Table 6	Standards
5	In Table 5 (Source) delete word of "project" before ToR because ToR is Terminology of reference	
6	Delete other countries standards from the GLs unless they are explained or have relevance	Standards

Section 6 (Public Participation)		
#	Comment	Thematic Area of GL
1	GLs are incomplete and need to provide more information to support users. This should include: list and schedule of consultations, methods of information dissemination at the project site, the need to interview with related authorities and relevant departments through consultative seminars. Update and correct Table 9	Method
2	The GLs should encourage users to separate results from relevant institutions and stakeholders	Method

Section 7 (Impacts and Mitigation Measures)		
#	Comment	Thematic Area of GL
1	Ensure all the impacts and mitigation are correctly placed into the appropriate section. (i.e. take impact in the pre-operation stage and put in operating stage for 2) Air quality and 4) water)	Layout
2	GLs should provide more specific guidance and focus on each separate stage / phase of the project	
3	Check terms and English (i.e. "Cause" and "effect" of impact)	Term
4	Edit economic and social resources and include the following changes: 15) Working condition: In Mitigation measure – Compliance with Law on labor and Law on National Social Security Fund – Provide security measures such personal protective equipment (PPE) – Include a section to highlight the need to provide health and safety training to workers	H+S
5	In project design phase – GLs should discuss the need to have a barrier installed on each road / train crossing – GLs should promote the use of a fence to be installed along the railway tracks in urban environments	Standards

Section 8 (Environmental Management Plan (EMP))		
#	Comment	Thematic Area of GL
1	Change Terminology *"environmental protection plans*" to "*environmental management plans*"	Terminology
2	Change Terminology (p.38) "*review report*" to "*monitoring plan*"	Term
3	GLs need to add EMP table	Layout

Section 9 (Economic Analysis and Environmental Value)		
#	Comment	Thematic area
1	GLs need to provide an indicator	Method
2	Change Terminology 'Individual resources" to "Environmental resources" in the last section	Terminology

Conclusion

The PCM event achieved an attendance rate at over 95% of invited guests that generated a total of 196 comments in review of the road and railway sector GLs and therefore can be considered to have met set objectives to obtain public opinion on the draft GLs.

This report has illustrated that a variety of general and specific comments were offered by participants during the group discussions. Applying a basic analysis to the frequency of the themes extracted from comments (far right column in the tables above), it is clear that the majority of comments refer to or discuss the need to improve, insert and guide upon *methods* relating to the practice of impact assessment for road and railway projects. It can be suggested that during GL review period particular attention should be placed on providing clear guidance on methods and to ensure some form of standardization is applied for all users of the GLs.

The second most frequent discussion point connects to theme of *standards* in the GLs. Standards refers to issues with in the GLs linked to laws, regulations, policies, and general issues with standardization at different sections of the GL. The GLs should aim to address many of the highlighted issues relating to standards within the report as the GLs encourage, for example, the application of out of date laws and regulation, are lacking important construction standards, and may act to discourage standardization across all projects. Without being restricted to the same standards ESIA project reports are likely to be varied, require review, and encourage an ineffective and inefficient review process and therefore miss the key objectives of this project.

The third thematic area was in respect of the layout and ability for users to easily navigate the GL documents. Many participates requested an improved layout, better signposting, and boxes for terminology.

Other comments included numerous participants also requested the inclusion of design drawings to expedite the assessment process and to ensure the projects is complying with aforementioned standards. Many participants also requested that terminology and English was checked as it was at times incorrect or confusing.

Annex 33 Summary Report on Output 2

SUMMARY OF OUTPUT 2

Overview: The project is designed to assist GDEP in organizing the practical/technical guidelines for both EIA and pollution control. Developed guidelines through the activities belonging to the Output 2 are as shown in the following table.

Table 1 Developed Practical/Technical Guidelines (Verifiable Indicators for the Output 2)

Fields	Guidelines / Manuals
EIA	Sectoral guidelines (EIA-SGs) on Road Sector (EIA and IEIA separately)
	Sectoral guidelines on Railway Sector (EIA and IEIA separately)
	Sectoral guidelines on SEZ Sector (EIA Only)
	Sectoral guidelines on Industry (Metal) Sector (EIA Only)
	EIA Review Manual
Water Pollution	Wastewater Treatment Facility Guidelines
	Factory Inspection Manual
	Prevention of chemical leakage to underground
	Registration System of Environmental Laboratory for Water Examination

As emphasized in the previous sections, it was judged proper to provide the information on the development process of the guidelines and manuals related to water pollution control as part of the amendment of the Sub-decree. Therefore, the following sections of the report give focuses on the activities relevant to EIA unless otherwise noted. EIA related activities in MOE are handled by Department of EIA under GDEP which is composed of 10 offices with more than 80 officials (Figure 1).

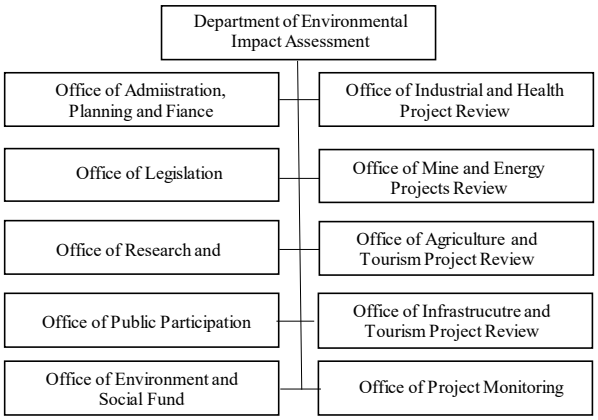


Figure 1 Organizational Structure of DEIA
(Source: Prakas No.445)

The observations in the Task Force meetings through the technical cooperation project indicated that the officers are now more aware about the temporal and spatial nature of potential impacts differing among the sectors, approaches to designing and analysing monitoring studies to assess chronic, local environmental impacts. The experience in attending the meetings and the exhaustive discussion on the environmental impact assessment would bring changes in the quality of the comments on each EIA report from implementing agencies (project proponent, etc.).

Develop task force to review laws and regulations: The development of pertinent guidelines and manuals under Output 2 are a series of processes that are inseparable and should be implemented seamlessly by the same group of people who have common views and understanding on the issues and challenges. Two task forces were thus organized on 1) Water Quality and 2) EIA in September 2017.

Finalize items for output 2: DEIA under GDEP is managing different sectors of development project including road, railway, dam, private development, and etc. Thus, necessary knowledge and experiences for their EIA reviewing also become wider and deeper. Based on discussion with DEIA / EIA-Task Force, several issues to be solved were confirmed as shown in the following table.

Table 2 Issues to be Solved in DEIA at the Beginning of the Project

Issued	Reasons	Support through the Project
Officials in DEIA are required to have general knowledge for different infrastructure sectors. On the other hand, sector specified knowledge and experiences are limited.	It is not able to prospect what sector would come next and officials must treat all kinds of sector according to the actual projects brought from implementing agencies.	Sectoral guidelines (SGs) may assist insufficient knowledge and experiences, especially for unmatured officials. Process to develop such SGs can be a good opportunity to enhance their understandings.
DEIA always treats many project documents, therefore, young officials don't have enough educational opportunity for EIA reviewing.	Lack of good reference for EIA reviewing and educational opportunities were confirmed.	EIA Review Manual (RM) may assist insufficient knowledge and experiences, especially for unmatured officials. Process to develop the RM can be a good opportunity to enhance their understandings.
Officials in DEIA are not familiar with good practices in other countries and they should learn efficient and effective methodology from them.	Lack of opportunity to learn EIA systems in other countries.	Training courses in both foreign and domestic may assist insufficient knowledge and experiences, especially for unmatured officials.

For the EIA-Sectoral Guidelines (EIA-SGs), it was agreed to develop three specific sectors, 1) Road and Railways, 2) Metal Industry, and 3) Special Economic Zone (SEZ). Major meetings on these activities are shown in the following table. In addition to the meetings mentioned in the table, discussion on section of the field of EIA-SGs were continuously done in the following Task Force meetings.

For the Wastewater Treatment Facility Guideline, it was agreed to design it to assist the officers in making decisions for wastewater discharge permit. This would provide information on the volume of wastewater generation, design of facility etc. On the other hand, the Inspection Manual sets forth procedures, technical key issues in inspection with due consideration on the Cambodian context. This will be developed through undertaking joint inspection exercise organized by the inspection department.

Develop draft guidelines and procedures: Determined documents as the products from Output 2 have been developed through the EIA-Task Force and relevant stakeholders. In addition to the English versions, Khmer versions were prepared for all EIA-SGs and EIA Review Manual (EIA-RM). Previously EIA-SGs were considered as the products under Output 1 which aims to develop legal documents. After the analysis and discussion on characteristics of EIA-SGs, however, these products are recognized as practical/technical document. Therefore, the Task Force decided that both EIA-SGs and EIA-RM are treated as the products under Output 2 finally.

The Task Force Meeting on Water Quality Control was convened six times over the project duration in the period from 2nd October 2017 until 4th March 2019. The Task Force members discussed a broad range of issues to include the amendment of the sub-decree and technical guidelines on inspection and wastewater treatment technology. The series of activity started from a thorough review of the previous Sub-decree on Water Quality Control. It was found that the sub-decree contains ambiguities and conflicts among articles in the main text and its annexes, which may have prevented effective intervention into water quality control. The issues identified in the review process were then discussed for amendment of the sub-decree. For the purpose of building consensus among the participants of the Task Force, the summary of issues and key approaches were compiled as Policy Discussion Papers which were further supplemented by Support Documents. The Task force eventually three (3) Policy Discussion Papers accompanied by nine (9) Support Documents.

Consultation with stakeholders: As a part of finalization process in MOE, several consultation meetings were implemented in order to update EIA-SGs based on their opinions and views. Image of officialization process including such consultation meetings is shown in the following figure.

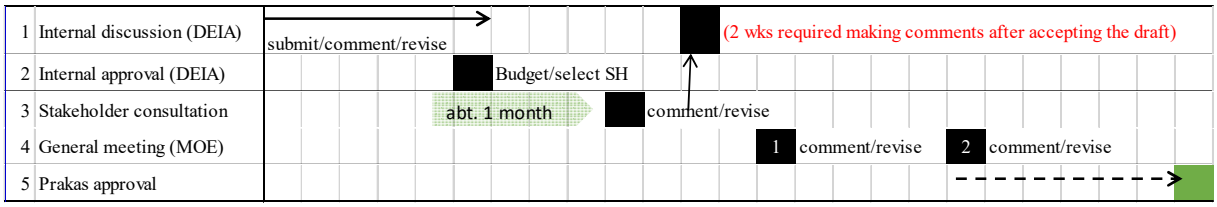


Figure 2 Finalization Process and Public Meetings

The first public consultation meeting was held on March 2019 to discuss draft EIS-SGs on road and railways. The meeting consisted of explanation on drafted documents followed by the other session of workshops to collect opinions from the participants. Comments from the meeting was reflected to draft documents. The revised documents were discussed again in the following another public meeting for the local consultant who registered as EIA survey firms under MOE on January 2020. Through this updating process, the draft documents of EIA-SGs were brushed up.

On the other hand, the 2nd Public Consultation and following meeting with local consultant for EIA-SGs on SEZ and Industry (Metal) was not able to organize as same as the 1st meeting because of restrictions of COVID-19. As an alternative way, the Project provided draft documents to relevant authorities and collect their comment through e-mail and/or other electrical measures to avoid face-to-face meeting. The following table shows outline of the public meetings for EIA activities.

Table 3 Public Meetings for EIA Activities

Date	Contents	Major Participants
19th MAR 2019	The 1st Public Consultation for EIA-SGs on road and railways	Relevant implementing agencies including JCC members as well as local consulting firms who registered as EIA survey organizations
28th JAN 2020	DEIA organized a meeting with certified local consultant firms on EIA to share the prepared guidelines (road and railway sectors) and to collect their opinions.	Private sectors, especially registered consulting firms to EIA survey, are called.
August-September 2021	The 2nd Public Consultation for EIA-SGs on SEZ and Metal Industry * Dute COVID-19, Public Consultation was replaced to e-mail based opinion collection.	Same as the 1st Public Consultation

Finalize draft revised laws and regulations: EIA-SGs and EIA-RM have been discussed and revised many times based on opinion exchanges between JICA experts and officials in DEIA. In addition, the other opportunities such as public consultation meetings gave further views and improvements on the documents. Training courses related to EIA during the Project also provided feedbacks on drafted documents from trainee who will use the guidelines and manual in the future. After the final review of the contents in both English and Khmer versions, all products of Output 2 were prepared for final officialization process in MOE. DEIA will continuously proceed necessary internal steps to approve them as Prakas in the near future.

Key Issues and Lessons Learned: The key issues and lessons learned with regard to specifically to Output 2 include the following two aspects.

1. Sectoral guidelines may help young officials of DEIA who haven't had experiences in different fields of infrastructure. On the other hand, Cambodia is facing many new fields with the latest technology such as urban tunnel construction, buildings, and so on. Continuous preparation of such guidelines with practical training opportunities are effective on their capacity development.

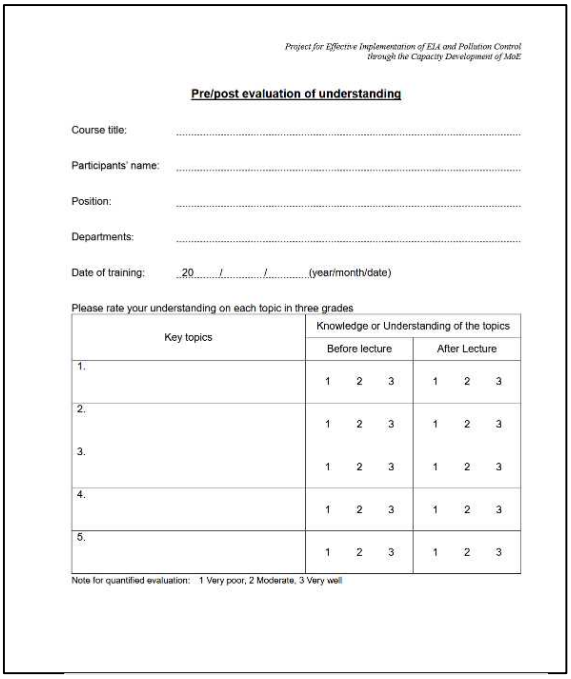
2. Capacity enhancement of EIA review is important for not only MOE, national level, but also for provincial sub-national level. DEIA have already started to provide trainings on EIA reviewing to provincial Department of Environment (DOE), and their training needs for sub-national level including trainers of training in MOE is still high.

Annex 34 Overall evaluation of Training

EVALUATION RESULTS OF TRAINING PROGRAM

Overview: For verification of the effectiveness of the training courses implemented in Output 3, the self-evaluation methodology by participants of the training course was adopted. The participants evaluated the level of their understanding for the themes/contents of the training course at three levels, 1) very poor, 2) moderate, and 3) very well, at the timing before and after each training session. From the comparison of the participants' self-evaluations between before and after attending the trainings, it can be said that the participants understanding regarding respective themes of the training was improved.

Methodology: For each training session, participants were requested to answer questionnaire sheet of pre/post evaluation of understanding, which were prepared by the lectures, as shown in Figure 1. This pre/post evaluation sheet includes several questions regarding the key topics that would be covered by the given training session. Each participant selected the level of their knowledge or understanding on these key topics in three-level evaluation: 1: very poor, 2: moderate, and 3: very well. The effectiveness of implemented training sessions was measured by the comparison between pre-evaluation and post-evaluation.



Project for Effective Implementation of EIA and Pollution Control through the Capacity Development of MoE

Pre/post evaluation of understanding

Course title: .....

Participants' name: .....

Position: .....

Departments: .....

Date of training: 20..../..../.... (year/month/date)

Please rate your understanding on each topic in three grades

Key topics	Knowledge or Understanding of the topics	
	Before lecture	After Lecture
1.	1 2 3	1 2 3
2.	1 2 3	1 2 3
3.	1 2 3	1 2 3
4.	1 2 3	1 2 3
5.	1 2 3	1 2 3

Note for quantified evaluation: 1 Very poor, 2 Moderate, 3 Very well

Figure 1 Evaluation Sheet Design

Result: The evaluation sheets for 43 training sessions covering 27 training courses with 584 participants total were collected and analysed. According to the evaluation results, it was found out that all fields of the training program implemented in Output 3 helped to improve the participants knowledge and understanding regarding the respective contents and issues.

The overall result of evaluation for the whole training program including 43 training sessions showed that the participant's knowledge and understanding improved from 1.54 to 2.54 in average. In addition, in all of 43 training sessions conducted in Output 3, post-evaluation was higher than pre-evaluation, which means that they were indeed effective to improve and enhance the knowledge of the participants.

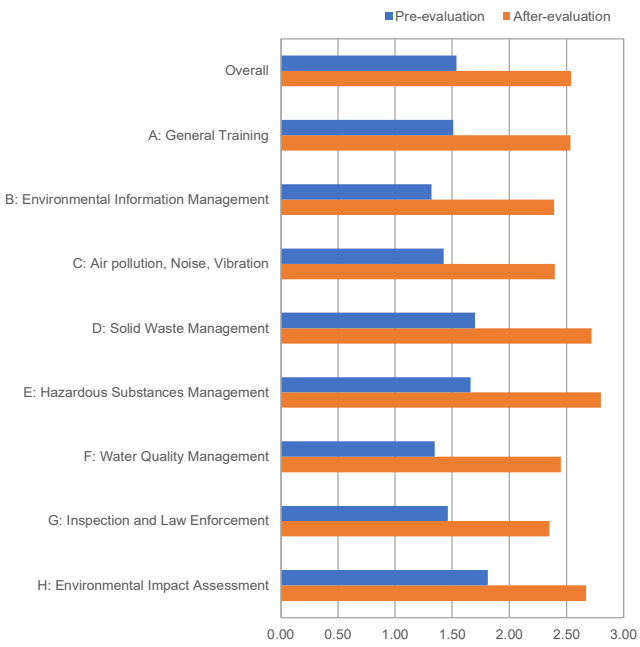
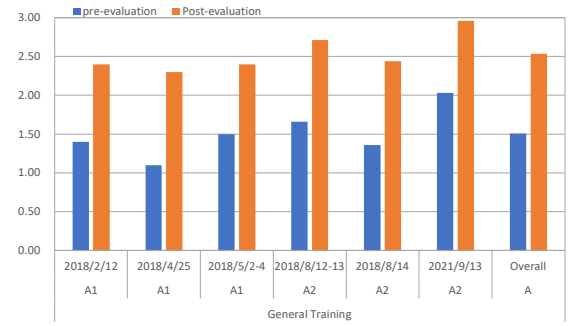


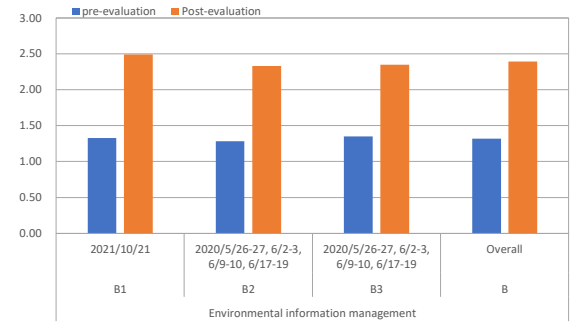
Figure 2 Summary of Evaluation Result of Training Courses

Table 1 Comparison of Pre and After Evaluation by Training Fields

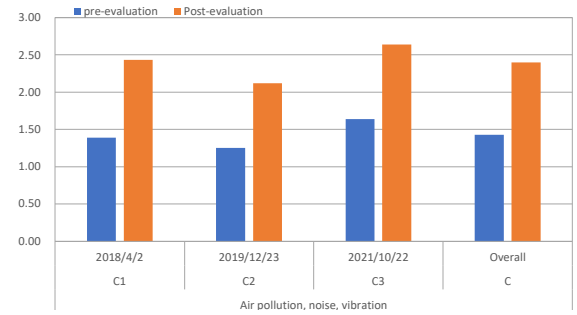
A: General Training



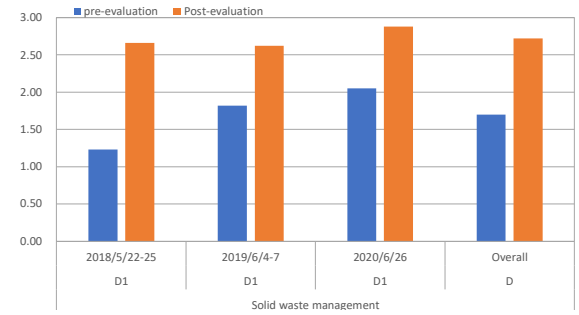
B: Environmental Information Management



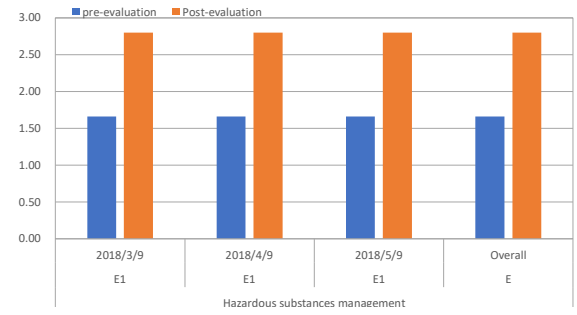
C: Air Pollution, Noise, Vibration



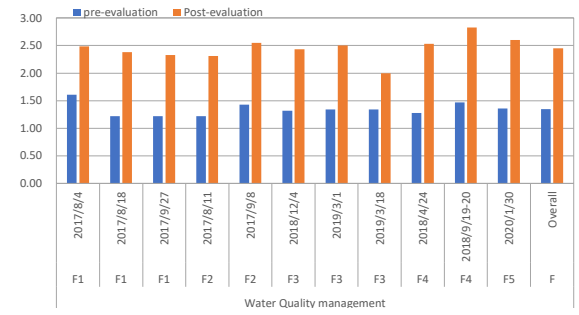
D: Solid Waste Management



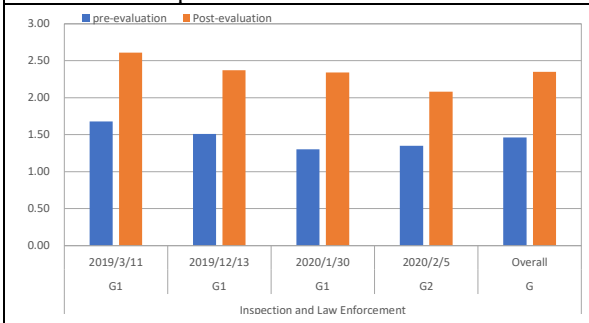
E: Hazardous Substances Management



F: Water Quality Management



G: Inspection and Law Enforcement



H: Environmental Impact Assessment

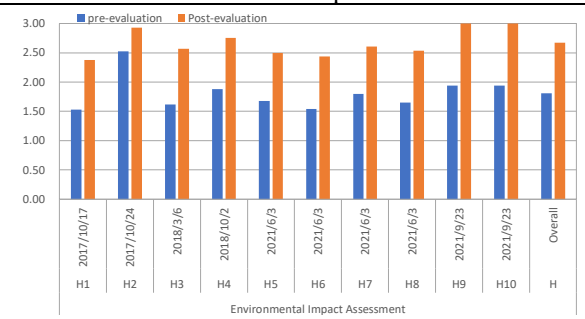


Table 2 Evaluation Result of Training Courses

No	Field	CODE	Training Courses	DATE	Number of Participants	Evaluation by Participants (Average)	
						Pre	After
1	General Training	A1	Seminar on environmental management	2018/2/12	12	1.40	2.40
2		A1		2018/4/25	15	1.10	2.30
3		A1		2018/5/2-4	9	1.50	2.40
4		A2	Japan's experience in pollution control	2018/8/12-13	6	1.66	2.71
5		A2		2018/8/14	5	1.36	2.44
6		A2		2021/9/13	7	2.03	2.96
7	Environmental information management	B1	Introduction to environmental information management	2021/10/21	10	1.33	2.49
8		B2	Environmental information management exercise 1 (GIS basic course)	2020/5/26-27 2020/6/2-3 2020/6/9-10 2020/6/17-19	26	1.28	2.33
9		B3	Environmental information management exercise 2 (GIS applied course)	2020/5/26-27 2020/6/2-3 2020/6/9-10 2020/6/17-19	26	1.35	2.35
10	Air pollution, noise, vibration	C1	Air pollution	2018/4/2	26	1.39	2.43
11		C2	Noise and vibration	2019/12/23	10	1.25	2.12
12		C3	Air pollution, noise control in other countries	2021/10/22	7	1.64	2.64
13	Solid waste management	D1	Basics on solid waste management	2018/5/22-25	12	1.23	2.66
14		D1		2019/6/4-7	7	1.82	2.62
15		D1		2020/6/26	5	2.05	2.88
16	Hazardous substances management	E1	Hazardous waste management	2018/3/9	8	1.66	2.80
17		E1		2018/4/9	9	1.66	2.80
18		E1		2018/5/9	7	1.66	2.80
19	Water Quality management	F1	Introduction to water quality management	2017/8/4	23	1.61	2.49
20		F1		2017/8/18	21	1.22	2.38
21		F1		2017/9/27	17	1.22	2.33
22		F2	Water quality management in other countries	2017/8/11	15	1.22	2.31
23		F2		2017/9/8	15	1.43	2.55
24		F3	Introduction to Wastewater Treatment Processes	2018/12/4	35	1.32	2.43
25		F3		2019/3/1	20	1.34	2.50
26		F3		2019/3/18	22	1.34	2.00
27		F4	Basic training on field water quality testing equipment	2018/4/24	23	1.28	2.53
28		F4		2018/9/19-20	10	1.47	2.83
29		F5	Water quality modeling	2020/1/30	6	1.36	2.60
30	Inspection and Law Enforcement	G1	Introduction to Inspection	2019/3/11	13	1.68	2.61
31		G1		2019/12/13	13	1.51	2.37
32		G1		2020/1/30	11	1.30	2.34
33		G2	Inspection field course	2020/2/5	12	1.35	2.08
34	Environmental Impact Assessment	H1	EIA system outside Cambodia (Japan and others)	2017/10/17	14	1.53	2.38
35		H2	Sector specific Guidelines and its necessity	2017/10/24	5	2.53	2.93
36		H3	EIA review manual and its necessity	2018/3/6	17	1.62	2.57
37		H4	Major challenges/ issues in creating IEIA/EIA reports (sector specific)	2018/10/2	9	1.88	2.76
38		H5	Major challenges/ issues in reviewing IEIA/EIA reports (sector specific)	2021/6/3	15	1.68	2.50
39		H6	Practical training for IEIA/EIA screening/ scoping (sector specific)	2021/6/3	15	1.54	2.44
40		H7	Practical training for IEIA/EIA reviewing (sector specific)	2021/6/3	15	1.80	2.61
41		H8	Review training using model EIA report	2021/6/3	15	1.65	2.54
42		H9	EIA course for provincial officers	2021/9/23	8	1.94	3.00
43		H10	EIA review practice for provincial officers	2021/9/23	8	1.94	3.00
Overall						1.54	2.54

Note: Workshop, fieldwork, and study tours were excluded

Annex 35 Summary Report on Output 3

SUMMARY OF OUTPUT 3

Overview: The activities of Output 3 aim to assist the capacity development of GDEP and related departments under GDEP in the field of Environmental Management by implementing a series of training courses designed to improve skills as well as knowledge relevant to the various aspects of environmental management by providing the learning opportunities from various means including lectures, seminars, hands-on training, fieldworks, and study tours.

Review the institutional arrangements of GDEP: The General Department of Environmental Protection (GDEP) consists of seven departments and a laboratory. Under GDEP, the responsible units to manage important environmental aspects or fields including air quality, water quality, waste, and environmental impact assessment were established as an independent department to maintain nationwide environmental quality from various forms of environmental degradation factors, such as pollutions and infrastructure development. The interviews with each department under GDEP were conducted to identify their status and needs to improve the capacity of environmental management and pollution control. The following issues were identified for the capacity building of the staff.

- Review/Reinforcement of basic knowledge on environmental conservation and management in general
- Improvement of IT knowledge and skills for efficient management and processing of environmental information
- Improvement of IT knowledge and technology for efficient management and processing of environmental information
- Improvement of expertise in the field of environmental management under the jurisdiction of each department of GDEP
- Strengthen understanding of environmental management initiatives in neighboring countries to achieve international cooperation with Southeast Asian countries on transboundary environmental issues (air and water quality-related).

Scope of Training: The scope of training aiming to overall capacity development of GDEP staff was defined by addressing the fields of the environmental management/pollution control that needed to be enhanced and the contents/aspects of the relevant fields that were desirable to be improved for promoting the adequate knowledge and skills of GDEP staff.

Table 1 Scape of Training

Aspect	Responsible Department	Scope of Training
General	All departments	1) Understand important environmental issues and approach of environmental management 2)Understand the methodologies of developing countermeasures to environmental problems/pollution 3) Understand the currently available information technologies such as GIS for efficient environmental information management
EIA	Department of Environmental Impacts Assessment	1) Understand efficient EIA system including overall procedure and step-by-step application such as scoping and screening 2) Understand the necessity of sector-specific guidelines and EIA manuals for better implementation of EIA 3) Understand challenges/issues of EIA implementation
Air Quality	Department of Noise and Air Quality Control	1) Understand the current status and challenges/issues of atmospheric environmental problems including air pollution, noise, and vibration problem. 2) Understand the importance of legal framework by learning from the experience of other countries 3) Understand possible as well as effective countermeasures to cope with atmospheric environmental problem

Aspect	Responsible Department	Scope of Training
Water Quality	Department of Water Quality Control	1) Understand the current status and challenges/issues of atmospheric environmental problems regarding public water quality 2) Understand effective management strategies of water quality including inspection and regulation as well as data management 3) Understand effective regulatory monitoring of public water area
	Department of Law, Enforcement, and Inspection	
	Laboratory	
Waste Management	Department of Solid Waste management	1) Understand the effective management strategy of solid waste/Hazardous materials 2) Understand the basic issues and solutions of waste management.
	Department of Hazardous Management	

Preparation of the training program: The syllabus describing the composition of seminars for each field in the design structure of the training program, objectives/expected results of each seminar, target groups, the number of training sessions, and tentative schedule of the seminars were organized with careful consultation of relevant departments of GDEP. A total of 9 fields consisting of 32 training courses was proposed, aiming at the six departments and laboratory of GDEP.

The styles of each training course are selected from a) lecture, b) seminar and c) fieldwork/hand-on exercise so that the participants of each course can learn effectively through the training by choosing the suitable means of training based on the consideration of the nature and characteristic of each training courses.

Study Tours: The study tours were designed and conducted as the third country training program in Output 3. Originally, three sets of the study tours were planned to provide the target groups the experience of the foreign countries in the relevant fields of environmental management by visiting three countries that implement the good practice of environmental management and pollution control and having opportunities of discussion with respective agencies. The following countries were selected as destinations for the study tours: Thailand, Vietnam, and Japan. However, the study tour of Japan, which was originally planned in 2020 was cancelled due to the international travel restrictions at both Cambodia and Japan; and thus, the two study tours including one to Thailand and another to Vietnam were conducted as the activities of Output 3.

Table 2 Summary of the Study Tours Conducted in Output 3

Destination	Objectives	Date	Participants[1]	Locations
Thailand	This training is designed to expose the training participants to the approaches of pollution control that may be readily applicable to Cambodia. It mainly focuses on learning the experiences in EIA and pollution control in Thailand.	10 SEP 2018 to 15 SEP 2018	Management Team: 18 officers from DoWQM, DoNAQM, DoSWM, DoHSM, DoLEI, DoEIA, DoAPF, Labo	Bangkok and Rayong
		10 SEP 2018 to 18 SEP 2018	Technical Team: 9 officers from DoWQM, DoAQNM, DoSWM, DoHSM, DoLEI, DoEIA, DoAPF, Labo	Bangkok, Rayong, Pathumthani, and Sakeo
Vietnam	This training is designed to expose the training participants to the approaches of environmental management with particular focuses on learning the experiences in Water quality management, pollution control, and waste management in Vietnam.	12 JAN 2020 to 18 JAN 2020	10 offices from DoLEI, DoSWM, DoAPF, DoAQNM, DoEIA, DoWQM, DoHSM, Lab	Hanoi

[1] DoWQM: Department of Water Quality Management, DoNAQM: Department of Air Qualityand Noise Management, DoSWM: Department of Solid Waste Management, DoHSM: Department of Hazardous Substance Management, DoLEI: Department of Law Enforcement and Inspection, DoEIA: Department of Environmental Impact Assessment (EIA), DoAPF: Department of Administration, Planning and Finance

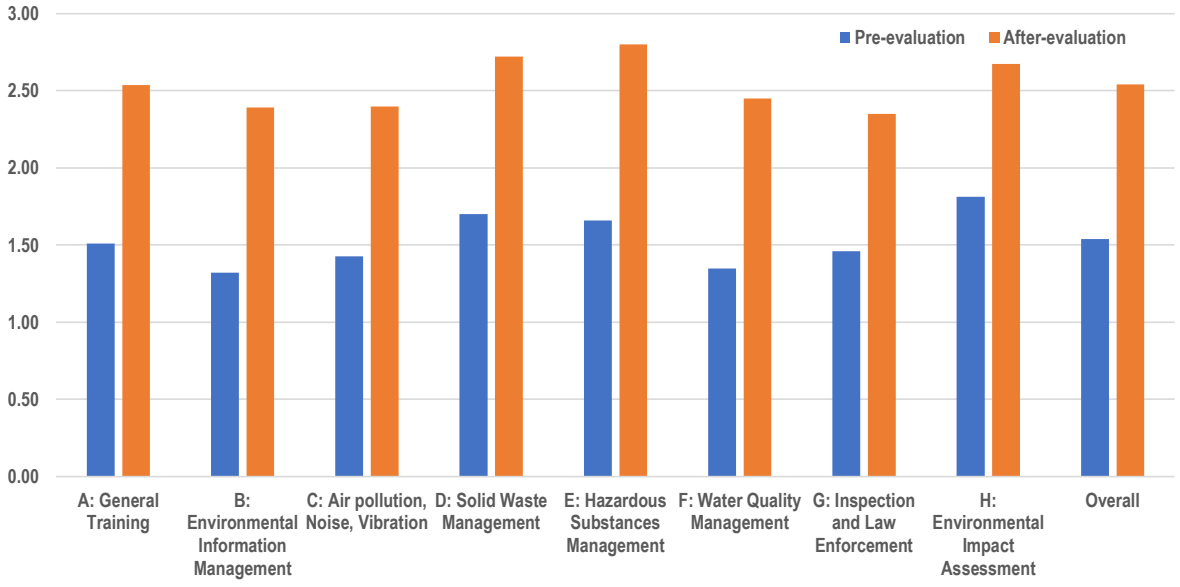
Implementation of the Training Program: The series of seminars in accordance with the finalized training plan were conducted from 2017 to 2021. Due to the travel restriction resulting from COVID-19 pandemic, the training courses that were held after March 2020 were basically conducted via the Internet by utilizing the online-meeting application such as Microsoft Teams.

Table 3 Implement Schedule of the Training Program

Field	Code	Training course	# of Sessions	2017	2018	2019	2020	2021
General Training	A1	Seminar on environmental management	4		2/12 ▲ 4/25 ▲ 5/2-4 ▲	PM Monitoring ▲ 10/18		9/13 ▲
	A2	Japan's experience in pollution control	3			8/12,13,14,16 ▲		
Environmental information management	B1	Introduction to environmental information management	1					▲ 10/21
	B2	Environmental information management exercise 1 (GIS basic course)	1					May 26-27, June 2-3, June 9-10, June 17-19 and June23-24
	B3	Environmental information management exercise 2 (GIS applied course)	1					
Air pollution, noise, vibration	C1	Air pollution	1		4/26 ▲			
	C2	Noise and vibration	1			12/23 ▲		
	C3	Air pollution, noise control in other countries	1					▲ 10/22
Solid waste management	D1	Basics on solid waste management	3		5/22-25 ▲	6/4-7 ▲		▲ 6/26
Hazardous substances management	E1	Hazardous waste management	3	8/4,8/18,9/27 ▲	3/9 ▲ 4/9 ▲ 5/9 ▲			
Water Quality management	F1	Introduction to water quality management	3	▲				
	F2	Water quality management in other countries	2	▲ ▲				
	F3	Introduction to Wastewater Treatment Processes	3	8/11 9/8	12/4 ▲	3/1,3/18 ▲▲	12/13 ▲	
	F4	Basic training on field water quality testing equipment	2		4/24 ▲ 9/19-20 ▲		1/30 ▲	
	F5	Water quality modeling	1					
	F6	Use of field water quality testing equipment for ambient water quality monitoring	Several (Field work)		11/27-30 ▲▲ 12/11-13	Hotspot Monitoring		
	F7	Pollution Source study course	Several			Pollution Source Survey (Inventory)		
Inspection and Law Enforcement	G1	Introduction to Inspection	3	10/10,11,12,17,26 ▲		3/11 ▲	12/13 ▲ 1/30 ▲	
	G2	Inspection field course	3(Field work)		12/5-6 ▲		2/5 ▲	
Environmental Impact Assessment	H1	EIA system outside Cambodia (Japan and others)	1	10/17 ▲	3/27 ▲ 8/30 ▲			
	H2	Sector specific Guidelines and its necessity	1	10/24 ▲				
	H3	EIA review manual and its necessity	1		3/6 ▲			
	H4	Major challenges/ issues in creating IEIA/EIA reports (sector specific)	1		10/2 ▲			
	H5	Major challenges/ issues in reviewing IEIA/EIA reports (sector specific)	2					6/3 ▲
	H6	Practical training for IEIA/EIA screening/ scoping (sector specific)	1 Seminor 1 Field work					
	H7	Practical training for IEIA/EIA reviewing (sector specific)	1 Seminor 1 Field work					6/3 ▲
	H8	Review training using model EIA report	1 or 2					
	H9	EIA course for provincial officers	1			▲		9/23 ▲
	H10	EIA review practice for provincial officers	1					
Training abroad	I1	Training in Japan	1					
	I2	Training in Thailand	1		9/10-18 ▲			
	I3	Training in Vietnam	1				▲ 1/12-18	

Evaluation of the Training Program: The overall evaluation, or verification of the effectiveness, of the implemented training program was examined based on the self-evaluation methodology by participants of the training courses. The participants evaluated the level of their understanding of the themes/contents of the training course at three levels, 1) very poor, 2) moderate, and 3) very well, at the timing before and after each training session. From the comparison of the participants' self-evaluations between before and after attending the trainings, it can be said that the participants' understanding regarding respective themes of the training was improved.

Figure 1 Overall evaluation of the Training Program



Promoting Motivation and Recognition of Further Efforts: Three additional activities were proposed and implemented for enhance the motivation and recognition of further efforts in environmental management by GDEP. They were 1) PM monitoring in the Phnom Penh area, 2) water quality monitoring at the concerned location of public water degradation, and 3) pollution source survey (pollution inventory development).

1. For the purpose of improving the pollution control capability of the Air Quality and Noise Management Department, the field observation to measure particulate matters (PM2.5 and PM10), which are the main concerned air pollutants in south-eastern Asia including Cambodia, in collaboration with the Institute of Technology of Cambodia. The field observation was conducted at a total of 10 sampling locations within the proximity of Phnom Penh for two windy seasons: Nov 2019-Dec 2019 and Jan 2020-Feb 2020. In addition, the seminar hosted by the Air Quality and Noise Management Department was held to present and share and discuss the findings of the PM monitoring in Phnom Penh. This attempt was significant in two points. First, by having experience in the field observation activity, the basic skills and understanding of the status of PM in the Phnom Penh area have been improved among the relevant officials of GDEP. Secondly, this attempt promoted the motivation and recognition of the fact that the environment cannot and, also, should not be managed by the Ministry of Environment alone in isolation from other stakeholders. An expectation is that the research collaboration between MOE and ITC should not terminate as research; it should be elevated as a policy formulation platform to facilitate collaboration between academe and policymakers. At this point of time, it is also noteworthy that the research collaboration would be subsequently pursued with an additional fund provided by UNDP.

2. As a part of hands-on training of water quality monitoring, a set of field samplings at the water-discharge outlets of factories with high concern for the water quality degradation. Three sampling locations called “hotspots” associating with three factories were selected for this practical training with the consideration of actual water pollution became a serious concern for the neighboring country, Vietnam. Various tasks of water quality monitoring were involved in this training including the development of the monitoring plan such as the site selection of possible pollution sources at the target drainage system and timing of sampling, actual fieldwork, analysis of sampling water, and evaluation of the pollution level. The experience in this hands-on training not only promoted further understanding of water quality monitoring by executing various tasks by themselves but also helped to initiate and motivate the responsible department to take preconscious actions toward pollution control.

3. As a part of trainings aiming to the responsible department for water quality management, namely Department of Water Quality Control, Department of Law, Enforcement, and Inspection, and Laboratory, two additional activities were proposed and implemented in Output 3: the Pollution Source Survey or Pollution Inventory development and development of GIS-based Pollution Inventory.

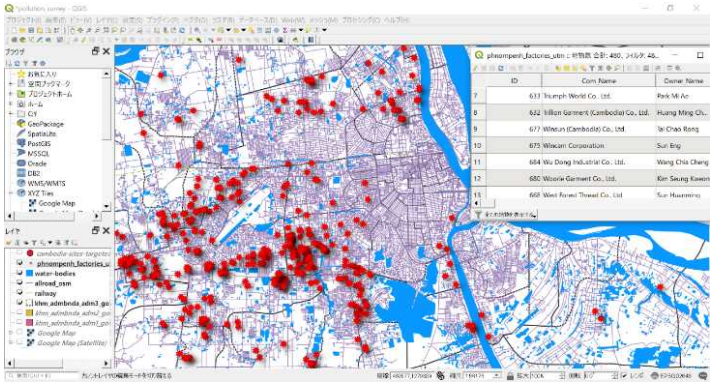


Figure 2 GIS based Pollution Inventory

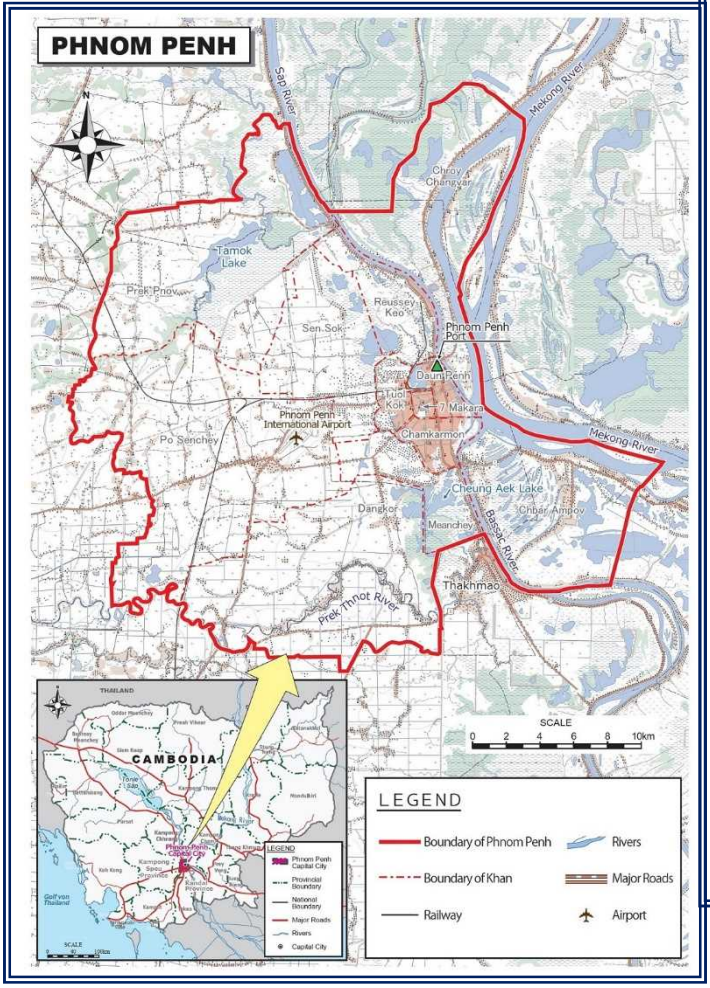
Annex 36 Project Brief Note

Project Brief Note (Cambodia)

THE PROJECT FOR EFFECTIVE IMPLEMENTATION OF EIA AND POLLUTION CONTROL THROUGH THE CAPACITY DEVELOPMENT OF MOE

-Development of Capacity in managing environment

December 2021



1. Strategic Context and Sector issues

Strategic context

The Kingdom of Cambodia (hereinafter "Cambodia") has experienced robust economic growth despite the impacts of the financial crisis of 2007–2008 swept over the entire region. The economy is projected to grow over 7 % per annum over the decades until the year 2020. The remarkable achievement in the economic development may be attributable to the inflow of official development assistance, the increasing foreign direct investment and resultant growth of international trade (Figure 1). The official development assistance consolidated the momentum of the Paris Peace Agreement in the early 1990's and continues to underpin the economic growth until now especially by means of promoting public infrastructure investment in transport, energy and water sectors. Investment in the land transport sector especially under the Southern Economic

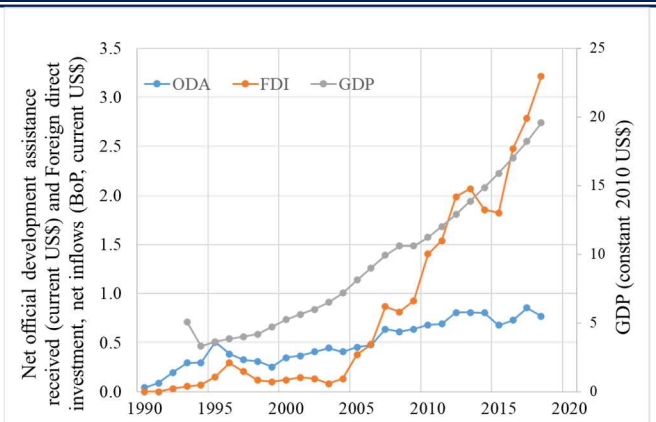


Figure 1 Changes in GDP, FDI and ODA

Source: WB

Corridor Development Scheme improves connectivity of the Greater Mekong Subregion and trade by linking the enterprises to the international markets. With improving regional network and integration, new industrial clusters are growing around border towns and in existing industrial hubs along the route of the corridor including Poipet, Phnom Penh and Bavet. In Poipet, a small Cambodian border town neighbouring with Thailand, automotive manufacturers,

predominately from Japan, are establishing factories. For Phnom Penh, it specializes in light labour-intensive industries such as garments and footwear, food and beverage, and consumer products. Aside from being a centre for the readymade garment (RMG) industry, Bavet is also becoming a cluster for the production of watches. Phnom Penh as the capital of Cambodia has attracted workers and

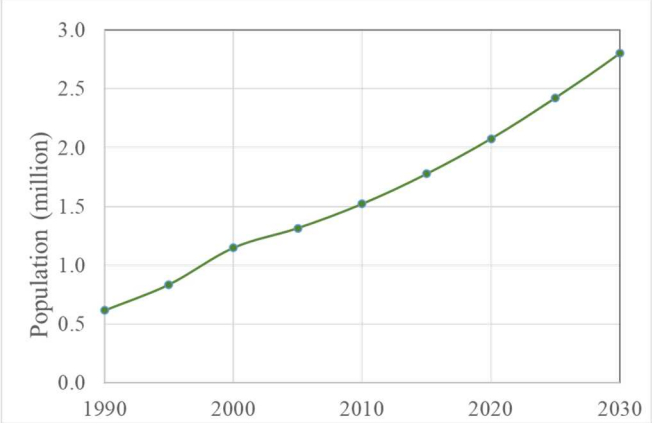


Figure 2 Changes in Phnom Penh Population
Source: United Nations

thereby gained in its concentration of population as the Cambodian overall economy grow. According to the World Urbanization Prospects[2], the population in Phnom Penh is projected to grow three-fold in the period from 1990 until 2020; and nearly four-fold by 2025 (Figure 2). The increased population in the urban parts has posed significant threats of flooding and water quality as a result of land use alterations accompanied by hydrological disruption and increased quantity of wastewater generation. The disposal of large quantities of insufficiently treated, or untreated, wastewater into rivers, lakes and aquifers continues to threaten human health, limiting food production, reducing ecosystem functions, and hindering economic growth.

The Rectangular Strategy-Phase IV, the major policy instrument of Cambodia, laid down four priority areas. The priority areas and tasks in the Phase IV include, among others: 1) vocational training to contribute to human resource development; 2) enhancing transport for economic diversifications; 3) Enhancing competitiveness to promote private sector development and employment; and 4) Strengthening sustainable management of natural and cultural resources, Strengthening management of

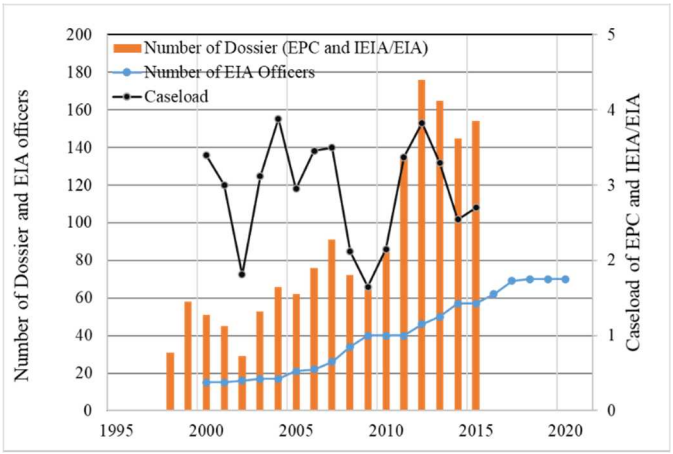


Figure 3 Changes in EIA department Performance and Capacity
Source: EIA Department, MOE

urbanization and Ensuring environment sustainability to achieve inclusive and sustainable development.

Sector issues to be addressed

The project strategically addresses three major issues in the environmental protection in Cambodia:

(a) ***Need for Faster and Consistent Environmental Decisions to facilitate Investment in Emerging and Growing Sectors.***

The number of investments has significantly increased both in the public and private sectors. As seen in the bar chart in Figure 3, the number of dossiers for Environmental Protection Certificate (EPC), Initial Environmental Impact Assessment (IEIA) and Environmental Impact Assessment (EIA) has accordingly risen since the middle of 2000s. The Ministry of Environment (MOE) increasingly recruited environmental officers to keep pace with the growing number of investments and holds seventy (70) EIA officers in the year 2020 as depicted in the blue line graph in Figure 3. As a result, the caseload, the number of cases assigned to an individual officer in a given time period, has been kept in a range from two (2) to four (4). However, the EIA department had to compromise on its performance due to limited readiness for flexible internal mobilization of staff and broader expertise required to respond to the expanding and fast-changing economy. Such personnel arrangement for environmental assessment in a short-term and temporal manner has often resulted in inconsistency in the assessment process and its outcome as well.

(b) Need for Overhauling the Water Quality Control Legislation

The Sub-decree on Water Pollution Control of Cambodia, No: 27 ANRK.BK, was signed on April 06, 1999. In the subsequent decades, Cambodia's economy continued high growth. Especially from 2004 until 2007, the country achieved GDP growth at 10 % or more each year. It has triggered increasing demand for housing and infrastructure, which was also accompanied by increased impervious cover.

Stream self-purification enhanced by natural wetlands functions had previously absorbed the pollutants; though, the incremental pollution loads have gone beyond the capacity of such natural ecosystem. The Sub-decree was found to contain ambiguities and conflicts among articles in the main text and its annexes, which has prevented effective intervention into water quality control.

(c) ***Limited Availability of Fundamental Tools and Mechanisms for Effective and Efficient Protection of Environment, and Needs for Refreshing Knowledge on Key Environmental Issues***

There are two key elements for designing and implementing any pollution control measures: 1) reliable information base on environmental degradation and 2) knowledgeable officers who are capable of translating the information into actions and implementing them. It is noted that pollution Source Inventory is often an essential tool for formulating pollution control intervention.

Pollution Source Inventory
A set of information on geographical location and relative intensity of point pollution sources. The inventory would include diverse information on water pollution parameters, their concentration and volume of discharge, which may be used to develop policies and approach and prioritize areas for intervention.

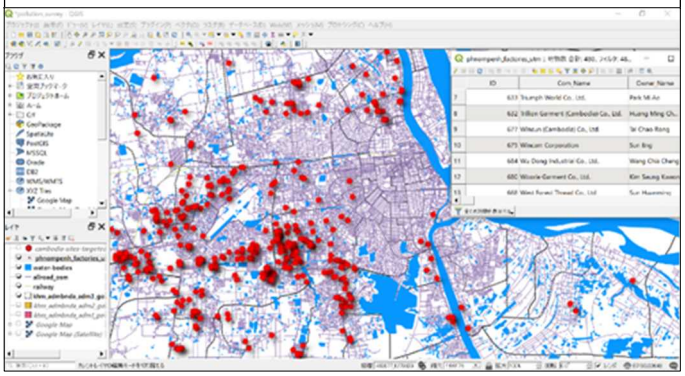


Figure 3 Pollution Source Inventory on GIS
Source: The JICA Team

Inaccessibility to such information base prohibits the officers from designing effective measures to control pollution. Relevant information on water pollution has been collected by the government but in a scattered manner by different departments and different ministries.

Meanwhile, the officers have had opportunities to participate in various training programmes offered by donors and by NGOs. But the topics covered, and the amount and depth of training varied widely depending on the purpose of the training programmes designed for different projects funded by different organization. Some scheduled more regular training sessions, and others held training more sporadically. There were limited opportunities within the Ministry for most of the officers to replenish their knowledge to implement their mandates in a formal and systematic manner.

It is also important to bear in mind that even with the tools and capable officers, environment management efforts by regulators alone would not always produce positive and productive results. It often requires contributions of academic research for tackling emerging issues, mutually beneficial partnering with other private and public entities.

2. Key Approaches of the Project

Setting up Task Forces to Deliberate Issues on EIA and Water Pollution:

Formation of Task Forces was adopted as one key approach of the project for pursuing all the project activities and supporting the decision-making process by the General Directorate of Environmental Protection (GDEP-MOE) on key technical matters. Task Forces were set up with the participation of competent and capable experts of the GDEP. Eight (8) and seven (7) officers were initially appointed as the formal members of the Task Forces on EIA and Water pollution Control respectively. Formation of a single Task Force was also considered to deliberate the two issues but rejected considering the incremental complexities arising from such arrangement. In addition to the original members, other officers of GDEP were subsequently co-opted as necessary depending on the issues to be discussed.

Active discussion in a Task Force Meeting on EIA

Formation of the Task Forces is expected to increase sense of ownership by delegating the process of deliberation and encouraging the officers in making decision, while the JICA team members remained as a provider of technical information and facilitator for deliberation. Especially at a later stage of deliberation in the Task Force meetings on the Water Quality, once the draft Sub-decree on Water Quality Control was complete, further engagement and intervention by the JICA members were minimized. The effluent standards in the Sub-decree, for instance, were amended repeatedly after the draft sub-decree was adopted by the Task Force. In such occasion, the JICA members remained to provide technical information and inquired the rationale;

but, did not lead the decision making process.

Progressive Elaboration of Key Deliverables

There were unique natures of the project *per se*. First, the project was designed to address two distinctive but broad sectors: namely EIA and water quality. There are many projects approaching to general and broad environmental issues. The Environmental Governance Reform for Sustainable Development funded by UNDP is a typical project which address broad environmental issues. On the other hand, there are also projects to focus on a single sector: for instance, those on air pollution, water quality or EIA. However, the project handling two distinctive but broad sectors are rarely found. The project was so designed to address the issues both in EIA and water quality control. The dual focuses have added complexity in managing the project as it required different expertise at different timing. Meanwhile, the poor definition of the project scope and targeting in the original project design document resultantly obstructed in pursuing a systematic and coordinated approach to addressing the problems. The project therefore adopted progressive elaboration to approach to the main issues of the two sectors.

Enhancing Inter-Departmental and Inter-Agency Coordination/Cooperation

In recognition of the facts that environment protection cannot be accomplished by the GDEP alone in isolation from other stakeholders, the project enhanced coordination and cooperation among the relevant departments and other government agencies. The project facilitated coordination between the Ministry of Environment and the Ministry of Industry & Handicraft (MIH) [1] by hosting a meeting between 1) the Director General of GDEP and 2) the Director General of the General Department of Industry who was concurrently the Board Chairman of Phnom Penh Water Supply Authority (PPWSA). In the meeting, an agreement was made that MIH and PPWSA would furnish the factory registration records and the data set on water supply to industrial operators respectively, both of which are those lying within the territory of Phnom Penh. The former contained 739 sets of data on the factories registered by MIH indicating names, address, and type of operation; while the latter is a set of records on the water volume supplied to each of the industries. The MIH's factory registration record was then integrated with an archive of factory information prepared by GDEP through filing application documents, records of inspection and other available information. It was further served as the basis for developing a prototype of a computerized pollution source inventory.

The water supply data or water consumption data was used as one of input data for of development of the Pollution Source Inventory and also for determining the threshold value to develop a structure in effluent standards for exemption of small scale industries (Figure 4).

> ***Development of Pollution Source Inventory***:
> GDEP completed the integration of the following data for developing a prototype of the Pollution Source Inventory: 1) 739 counts of Factory Registration data provided by the Ministry of Industry and Handicraft, 2) 696 counts of Discharge Permit data by the Department of Water Quality Management, Ministry of Environment, 3) 62 counts of Inspection Report data by the Department of Inspection and Law Enforcement, Ministry of Environment and 4773 counts of Water Supply data by Phnom Penh Water Supply Authority (PPWSA). GDEP searched and removed overlapping data to identify 739 points of individual pollution sources in Phnom Penh. By mobilizing a team of local consultants, GDEP further completed a field study consisting of questionnaire survey and semi-structure interview. Among the 739 point pollution sources, 418 sources, equivalent to 60 % of the total, was confirmed operational as recorded. The rest of the pollution sources were found as follows: 1) 95 sources are closed, 2) 136 sources are relocated, 3) 8 sources are not operational, and 4) 82 sources refused the survey. The original data was compiled in Microsoft Excel formatted, which was then be converted, by supplementing geometric location and associated attribute information, to shapefile format to allow analysis by using GIS programme.
> A citation from the Progress Report V (January 2020)

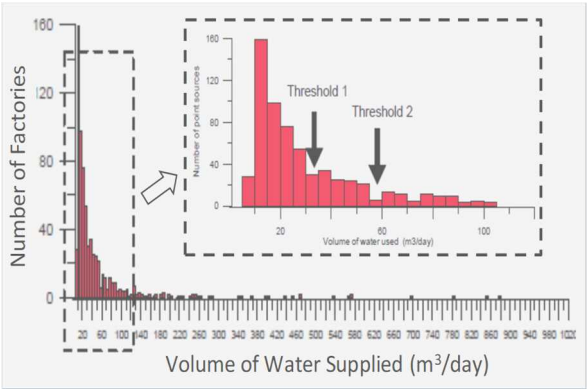


Figure 4 Histogram of Water Consumption of the Factories in Phnom Penh
Source: PPWSA, it was modified by the JICA Team

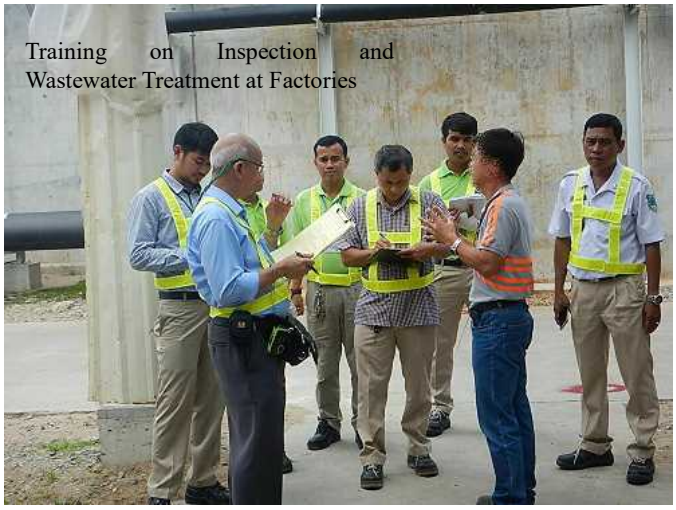
Partnering with Private Sectors and Academes

Throughout the implementation period, the project supported GDEP in establishing partnership with private sectors and academes for various purposes. At an early stage of the project, a series of consultation meetings were convened with the members firms of the Japanese Business Association of Cambodia (JBAC) and the Phnom Penh Special Economic Zone (PPSEZ).

For the academe, the project supported the GDEP in partnering with the Institute of Technology of Cambodia(ITC) in undertaking the monitoring of the Particulate Matter (PM) Pollution in Phnom Penh city.

1

Needs-based Programming of Comprehensive Training Courses: Provision of training on environmental management is also seen as the core of this project. The focus issues of the project remained EIA and water quality;


Training on Inspection and Wastewater Treatment at Factories

though, the training programme was so designed to respond to the diverse and growing needs on environmental protection. This is because EIA *per se* requires broad environmental knowledge, which should be often supported by other officers with other expertise such as noise and air quality control, solid and hazardous waste management; and the water quality control also frequently involves management of solid waste and hazardous waste management. In addition to the technical sides on environmental management, the officers are always required to look at legislative aspects as well; and social and economic impacts should also be considered. Global environmental issues were also a vital part in making decisions in addition to the conventional localized environmental issues.

Design Practical and Applicable Overseas Training: An overseas training programme was an integral part of the JICA's Technical Assistance, especially visiting Japan for capacity development is practically a vital part of the project. However it was eventually cancelled due to the Covid-19 which has affected from the first quarter of the year 2020. The project, instead, was designed to send the nominated officers of GDEP to Thailand and Viet Nam because the two countries are in comparable level with Cambodia in terms of their development stage(Figure 5).

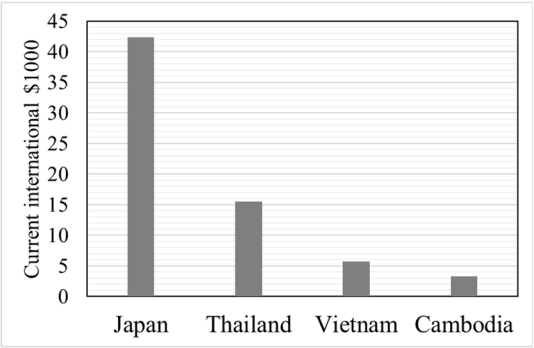


Figure 5 Comparison of GNI Per capita (2015)
Source: World Development Indicators (World Development Indicators)

The training and the field visit of Thailand was to expose the training participants to the approaches of pollution control that may be readily applicable to Cambodia. It mainly focused on leaning the experiences in EIA and pollution control in the country. On the other hand, the training in Viet Nam was designed to expose the training participants to the approaches of environmental management with particular focuses on leaning the experiences in Water quality management, pollution control, and waste management in Vietnam.

3. Key Outputs of the Project

The Task Forces continued its doggedly tenacious efforts to deliberate the key issues in water and EIA, which led to the signing by Prime Minister Hun Sen for the formal amendment of the Sub-decree on Water Pollution Control and development of a wide range of EIA guidelines.

The review and analysis of the Sub-decree on Water Pollution Control of Cambodia was commenced from the very early stage of the project, namely in July 2017, by the Task Force members on Water pollution Control. The members discussed target industries, exemption of Small and Medium Enterprises, parameters of discharge standards, among others.

The major issues discussed in the Task Force meetings were summarised as its Policy Discussion Paper together with the Support Documents as presented in Table 1 and schematically presented in Figure 6. In pursuance of the activities, it was found that effective enforcement of the Sub-decree on Water Pollution Control necessitates other guidelines and manuals which would include, among others, 1) Wastewater Treatment Facility Guideline, 2) Factory Inspection Manual, 3) Guidelines for prevention of chemical leakage to underground and 4) Registration system of Environmental Laboratory for Water Examination.

It was also noteworthy that GDEP maintained the Task Force for further deliberation of key issues in revising the sub-decree on water pollution control even after the completion of service by the JICA project team.

Under the auspices of His Excellency Mr. Chea Sina, the Director of GDEP, the members of the Task Forces comprising GDEP officers discussed and developed the Ambient Water Quality Guidelines, among others, to complete the Sub-decree.

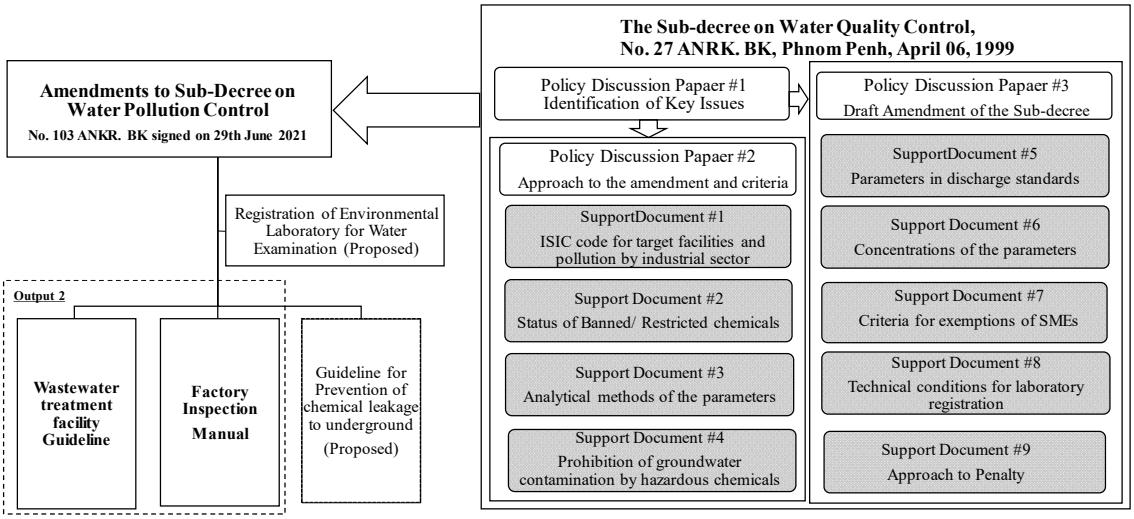


Figure 6 Legal Documents related Water Pollution Control Organized

Table 1 Record of Task Force Activity

Period		Major Activity
1	Jul. 2017 to Sept. 20217	Developed the Policy Discussion Paper #1 (Major issues were identified)
		Reviewed the relevant laws in force
		Convened Task Force meeting 1
		Consulted ITC and CCC for advice and guidance
2	Nov.2017 to Dec. 2017	Developed the following Support Documents
		- #1 for update of target industries
		- #2 for cleaning up of discharge standards
		- #3 on Methods of Analysis
		- #4 on Groundwater protection
		Convened Task Force meeting 2 with participation of MoIH and CDC as observers
		Consulted CCC, GMAC and ITC for advise and guidance
3	Feb.2018 to Mar.2018	Developed the following Support Documents
		-#5 on parameters in Discharge Standards
		- #6 on values of Discharge Standards
		- #7 on exemption of SMEs and its criteria
		- #8 on technical conditions for laboratory accreditation
		- #9 on fundamentals in penalties
		Convened Task Force meeting 3 with the participation of MoIH, CDC, MWR, MRD and MoA as observers
		Consulted CCC,GMAC and ITC for advise and guidance
4	May 2018 to Dec. 2018	Analysis of water supply to industry to determine the criteria for SME exemption
		Developed Support Documents #7-2 for exemption of SMEs
		Drafted a Prakas on Official Methods of WQ Analysis
		Drafted a Prakas on Accreditation of Environmental Lab.
		Revised the SME Exemption criteria to categories 3 groups of industries
		Drafted a guidelines for protection of groundwater quality
		Developed Khmer versions of the relevant documents
5	Feb.2019 to Mar. 2019	Convened Task Force meeting 6 with the participation of MoIH as observers
		Revised Support Document #1-1 on target industries
		Developed Khmer versions of the Sub-decree
		Developed Khmer version of Prakas on methods of Analysis and Lab. Accreditation

The proposed amendment of the Sub-decree was then submitted to the Environmental Minister. The followings are the major steps pursued for signing by the Prime Minister:

1. Deliberation at an Inter-department Review Meeting within MOE
2. Public Consultation with the participation of other Ministries and private sectors
3. Submission to the Council of Ministers
4. Signing by the Prime Minister

It is notable that GDEP consistently and tenaciously responded to various requests and settled issues during the process in the deliberation by the Council of Ministers.

The Sub-decree on Water Pollution Control of Cambodia was eventually signed by Samdech Akka Moha Sena Padei Techo Hun Sen, Prime Minister of the Kingdom of Cambodia on 29th June 2021 as No. 103 ANKR. BK.

Other guidelines and manuals developed under the Project are as follows:

On Water Pollution Control,

1. Guideline on Wastewater Treatment Process and Facilities
2. Guideline on Factory Inspection
3. Guideline on Beverage Factory Inspection
4. Guideline on Textile Factory Inspection
5. Guideline on Snack Foods Factory Inspection
6. Guideline on Slaughterhouse and Meat Packing Factory Inspection
7. Guideline on Poultry Dressing Industry
8. Guideline on Piggery Farm Inspection
9. Guideline on Central Kitchen Commissary Inspection
10. Guideline on Groundwater Protection by Industrial Chemical

For EIA,

1. Environment and Social Impact Assessment Report Review Manual (4th Edition)
2. Guidelines on Environmental Impact Assessment for Road Sector Projects (Full EIA case)
3. Guidelines on Environmental Impact Assessment for Road Sector Projects (IEIA case)
4. Guidelines on Environmental Impact Assessment for Railway Sector Projects (Full EIA case)
5. Guidelines on Environmental Impact Assessment for Railway Sector Projects (IEIA case)
6. Guidelines on Environmental Impact Assessment for Metal Industry Sector Projects (Full EIA case)
7. Guidelines on Environmental Impact Assessment for SEZ and Industrial Zone Sector Projects (Full EIA case)

Inter-Departmental and Inter-Agency

Coordination/Cooperation served as basis for development of crucial information in environmental management.

MIH furnished the factory registration records in the administrative territory of Phnom Penh which identifies all the records of industry within the area. PPWSA, meanwhile, provided the data set on water supply to industrial operators. The dataset on industry was further integrated with the information on geometric location which was collected by a field survey administered under the project.

The integrated dataset has thus become an excel formatted pollution source inventory. The inventory is a crucial tool in controlling water quality to allow environmental authority to perform an assessment and analysis of temporal and special pollution intensity; identification of key sectors; and designing feasible measures to control pollution.

The database was also used in the project to design the wastewater standards for industry especially to exempt small scale operators with consideration on their financial capacity for investment on environmental management.

PM monitoring in Phnom Penh

Partnering with Private Sectors and Academes led to increased sustainability and acceleration of international donor support.

The consultation meetings with JBAC and PPSEZ along with other business associations provided valuable information in designing the Sub-decree in Water Pollution Control. The industrial wastewater standards, among others, would not have been designed to allow an exemption of SMEs without the interaction with them. This will contribute to increasing the sustainability of the project benefit.

Meanwhile the study on particulate matter in Phnom Penh has led to a follow-up assessment with an additional fund by UNDP. It was undertaken under a title of "the Research of PM2.5 and PM 10 in Phnom Penh in the Windy Season 2019 -2020" as part of the Sustainable Urban Mobility for All Initiative (SUMAI) Project.

For the academe, the project supported the GDEP in partnering with the Institute of Technology of Cambodia in undertaking the monitoring of the Particulate Matter (PM) Pollution in Phnom Penh city.

A Comprehensive Training Course responding to the needs offered to the counterpart officer throughput the project

Table 2 provides the list of training course offered by the Project to the GDEP officers. They are broadly categorized into nine issues ranging from General training and Environmental Information Management to Environmental Impact Assessment (EIA).

Table 2 Training Programs designed under the Project

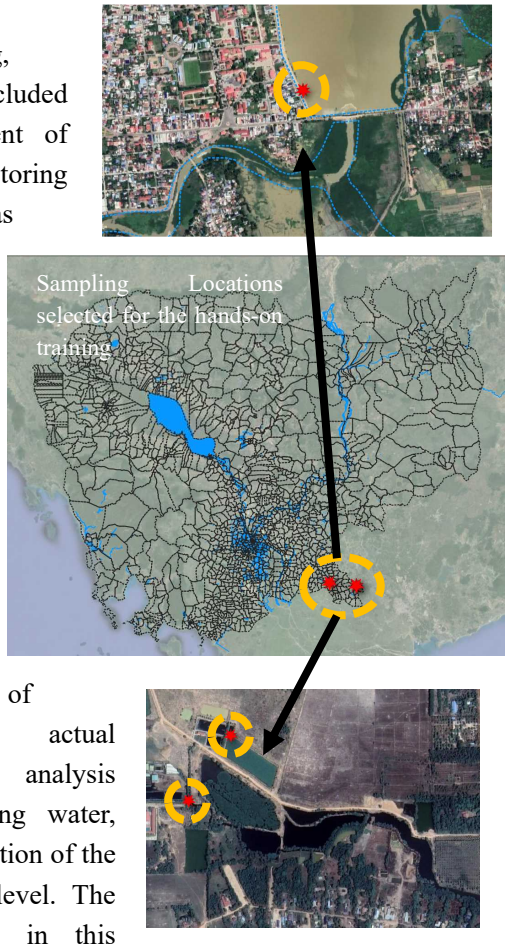
Course title
1. General training
- Seminar on environmental management - Japan's experience in pollution control
2. Environmental information management
- Introduction to environmental information management - Environmental information management exercise 1 (GIS basic course) - Environnemental information management exorcise 2 (GIS applied course)
3. Air pollution, noise, vibration
- Air pollution - Noise and vibration - Air pollution, noise control in other countries
4. Solid waste management
- Basics on solid waste management
5. Hazardous substances management
- Hazardous waste management
6. Water quality management
- Introduction to water quality management - Water quality management in other countries - Introduction to wastewater treatment technology - Basic training on field water quality testing equipment - Water quality modelling - Use of field water quality testing equipment for ambient water quality monitoring - Pollution Source study course
7. Inspection and Law Enforcement
- Inspection (introduction) - Inspection field course
8. Environmental Impact Assessment (EIA)
- EIA system outside Cambodia (Japan and others) - Sector specific Guidelines and its necessity - EIA review manual and its necessity - Major challenges/ issues in creating IEIA/EIA reports - Major challenges/ issues in reviewing IEIA/EIA reports - Practical training for IEIA/EIA screening/ scoping - Practical training for IEIA/EIA reviewing - Review training using model EIA report - EIA course for provincial officers - EIA review practice for provincial officers
9. Training abroad
- Training in Thailand - Training in Vietnam

As part of the training program, a wide range of hands-on training was designed and implemented. A Water Quality Monitoring at the Priority Area was an example of such training. A brief description of the activity is provided below.

- A set of the field samplings were undertaken at selected discharge points of factories for the water quality degradation. Three sampling locations called "hotspots" associating with three factories were selected for this

practical training because water pollution status became serious concern for the downstream country, Vietnam.

- The training included various tasks related to water quality monitoring, which included development of a monitoring plan such as the site selection of possible pollution sources at the target drainage system and timing of sampling, actual fieldwork, analysis of sampling water, and evaluation of the pollution level. The experience in this hands-on training not only promoted understanding of water quality monitoring by executing various tasks by themselves but also helped to initiate and motivate the responsible department to take preconscious actions toward pollution control.



4. Lessons Learned

Fifteen (15) key issues and lessons learned are drawn from the implementation of the project.

1. The Environment and Natural Resource Codes (ENR Code) was under development process in parallel in the early stage of the project implementation. However, it is seen that the finalization process of the ENR code has been suspended. Closer interaction with the team for preparing the ENR Code especially at the early stage of the project implementation ensured coordination and minimized the risks of potential deviation from the fundamental spirits of the ENR Code. However, in retrospect, it is argued that the Project would have produced a different level of deliverables especially in the EIA sub-sector to assist institutionalization of the Strategic Environmental Assessment if the development of the ENR Code was proceeded as scheduled. An earlier resumption of the finalization of the ENR code is desirable to streamline all the activities for sustainable management of environment and natural resources.
2. In implementation of the project, it was found that a set of vital information necessary for policy formulation was retained and held by various government agencies. GDEP in this project has coordinated with various government bodies to acquire crucial information for pollution control. It is often argued that compartmentalized structure of the government as well as limited transparent procedures constrain the inherent capacity of the public sector in Cambodia. There are occasions wherein the observations agreed with the general view as seen in the accessibility to the information held by other departments or ministries. However, it was also observed that such barriers could be removed through a relatively straightforward approach if the leaders were involved and played a role.
   - GDEP leveraged the network to acquire the information on factory registration held by MISTI which was then integrated with an archive of GDEP's factory information developed by filing application document, records of inspection and other available information. The information on water supply to factories also become available with the additional inclusion of PPWSA in the series of dialogue on pollution source inventory.
3. The experience in the project suggests that working in collaboration beyond the boundary of Ministries or departments can produce significant beneficial impacts as seen in the development process of the Pollution Source Inventory. Some of the respondents of the Questionnaire Survey on Project Purpose expressed their expectation for furtherance of inter-agency collaboration being aware of the value of collaboration. GDEP is thus encouraged to explore areas for collaboration with other Ministries and other public agencies to ensure effective management of environment in Cambodia including hazardous materials and solid waste in addition to water and EIA.
4. GDEP made its best efforts to coordinate and collaborate with the private sector by enhancing the participation of private sector representatives such as GMAC, JBAC and CCC at the early stage of the policy formulation process. The issue of collaboration with private sector, however, seems to remain an issue of GDEP despite the fact that delivering service to private sectors is an essential element for achieving the

government target to attain upper middle-income status by 2030. An open, inclusive and constructive dialogue should be sought in a continuous manner to develop a common ground on how governments, industry, and civil society can work together in pollution control because it is not such a simple problem that it can be solved by a single project.

5. It is undeniable that the information accessibility remains a challenge especially from the public and private sectors. It is however noted that GDEP is making a great effort to deliver technical information to the public in a plain manner by using indexes such as Water Quality Index and Air Quality Index. It is crucial to broaden a channel of information, in addition to such efforts, to the public and the private sectors for delivering information on the policy formulation and status of environment.
6. The website development of GDEP provided an avenue to enhance accountability and information accessibility to all stakeholders. However, as reported in Section 4-5, it is not accessible at the time of writing this report. The private sector activity has been sluggish on a temporary basis during the Covid-19 Pandemic. It is strongly recommended to reactivate the website before the full-fledged economic revival in the post-COVID-19 era.
7. In undertaking EIA in Cambodia, it is recognized that there are some documents referred to as "guidebook" and/or other form of documents applied in EIA administration and practice. These documents are those unauthorized yet as Prakas or any other instruments but provide general rules as same as official documents. The EIA Guidebook issued by NGO-Forum in Cambodia is an example of such documents. Use of such internal rules and procedural guidelines would limit the accountability; though, provides flexibility and practicability in the evaluation process especially in the fast-growing economy. It is likely, in contrast, that authorization of such documents would bring about inflexibility and unreadiness to changing industry structure. With due consideration on these two different aspects, it is recommended GDEP to consider authorization, at some point in time, of the EIA-SGs as Prakas or other appropriate instruments to ensure that the relevant guidelines are referred and used for investment planning and monitoring of other ministries and entities. Meanwhile the EIA-RM shall remain as an internal guidebook in DEIA without high-level approval process.
8. In designing the effluent standards, ex ante impact assessment was adopted, which has led to exemption of SMEs from uniform application of the effluent standards in the Sub-decree on Water Pollution Control. It is likely the first occasion in Cambodia to adopt ex ante impact assessment in pollution control. It is further desirable to adopt cost benefit analyses for policy formulation wherever data is available and applicable to assess the welfare impacts of regulation taking into account economic and social impacts over time.
9. Ex post impact analysis is also important to ensure that the articles and the standards in the amended sub-decree are effective and efficient. It is recommended that GDEP put in place a mechanism of periodic evaluation by which the public can also make recommendations to modify, as necessary, the sub-decree and other existing regulations.
10. GDEP intends to embark on formulating a strategy in selected areas for promoting pollution control intervention. The field application at provincial level would however require cautious learning-by-doing process because there may be a complex relationship at vertical and horizontal levels coupled with capacity challenges differing from the central level. The same holds true for ESIA/IESIA process of small-scale projects. Following national policy of decentralization, it is desirable to progressively devolve the mandate of the environmental assessment for the small-scale investment in the long run. The process of devolution, however, should be proceeded with a readiness assessment of manpower, institutional arrangement, and the financial resources. During the Project, it was found that some officers of Phnom Penh Municipality and Kandal Province who attended the training workshop had a prior exposure to the environmental assessment process, which is believed to constitute a core element of devolution process. It is strongly recommended that dissemination of the relevant guidelines on EIA should be expedited over the country.
11. The Pollution Source Inventory integrated with a GIS database developed as part of activity for generating Output 3 is seen a strong tool in controlling water pollution by allowing GDEP to identify and prioritize geographical areas and industrial sectors. Followings are recommendations to ensure that the database is used more effectively and efficiently for controlling water pollution.
    - Develop a mechanism for data entry and updates, which would be realized through inter-agency coordination with MISTI and PPWSA;
    - Improve the information system to allow faster data entry and effective analysis for intervention;
    - Develop a set of rules for information update by

identifying responsible officers; developing and agreeing on information security procedures; and determining the timing and the protocol for data entry and authorization;

- Setting up a structure to allow analysis of the information and thus to enable GDEP to revise the regulations, penalties, and other policy instruments.

12. In this project, rigorous technical assistance was not provided to the environmental laboratory as it was seen premature when the project was commenced. However, it was recognized that limited capacity of the laboratory would become a significant bottleneck for improvement of water quality especially in increasing accountable management of ambient and effluent control.
13. It was found that a systematic training program had not been developed in GDEP when the Project was commenced. To assist GDEP in developing individual skill and knowledge, the Project assisted the GDEP in implementing a broad range of training workshops/seminars throughout the entire project period. In implementing the training program, it was observed that there was a strong will among the individual officers to acquire new expertise and skills. The GDEP officers are relatively young and needs improvement in the knowledge, skills, and experience required to perform their duties. It is therefore recommended that the materials of the workshops/seminars should be used for constant self-improvement of the officers. The officer who participated in the training under the Project are encouraged to provide lectures and seminars in a systematic manner to the younger generation who did not have a chance to attend the training workshop
14. It was also observed that the past opportunities of training/capacity development offered by other donors were not fully and continuously used. For example, UNEP developed a training project for the MoE's Department of Geo-information Service under the General Department of Environmental Information and Knowledge in collaboration with ITC, in which a series of hands-on training was conducted. However, it was found that the training curriculum developed for the said training was not utilized after the completion of the project. This report therefore emphasizes the value and benefit of continuous education and training for professional skill development; and shed light on the needs for additional budget allocation for capacity development by MOE.

15. Although the issues of air pollution control in Phom Penh was not the mainstream activity of the project, the joint study with ITC on PM in Phnom Penh, supported to generate Output 3 of the project, eventually led to a follow-up assessment with an additional fund by UNDP. It was undertaken under a title of “the Research of PM2.5 and PM 10 in Phenom Penh in the Windy Season 2019 -2020” as part of the Sustainable Urban Mobility for All Initiative (SUMAI) Project. The management of pollution in Cambodia has only just begun and the challenges ahead are enormous. Resource mobilisation and funding arrangements should be further accelerated to ensure sustainable development in the post-COVID-19 era.

（Project Duration: from July 2017 until December 2021）

References

1) The Southern Economic Corridor: Boosting Trade and Investment in Cambodia, https://www.aseanbriefing.com/news/southern-economic-corridor-boosting-trade-investment-cambodia/ (Accessed on 10th April 2020)
2) United Nations, Department of Economic and Social Affairs, Population Division (2018). World Urbanization Prospects: The 2018 Revision, Online Edition. (Accessed on 10th April 2020)
3) Hatsukano, N., JETRO, Institute of Developing Economies, treatise, Cambodia: Civil war and the process of nation building, SRID Journal, 15, (http://www.sridonline.org/j/j201807idx.html) In Japanese, Accessed on 1st March 2020
4) Lim, L., Sasaki, Y., Transformation of Land Use Pattern in Phnom Penh City at a Watershed Scale, https://www.eventscribe.com/2016/CECAR7/assets/pdf/268071.pdf (Accessed on 14th April 2020)

THE KINGDOM OF CAMBODIA
MINISTRY OF ENVIRONMENT
JAPAN INTERNATIONAL COOPERATION AGENCY

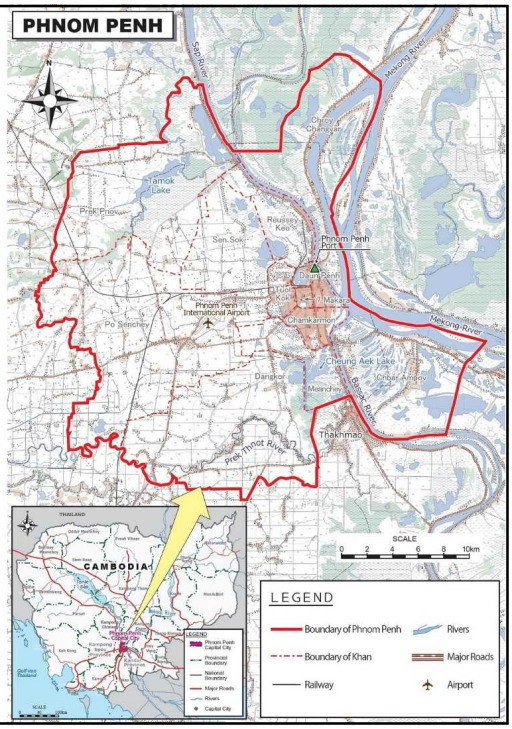
THE PROJECT FOR EFFECTIVE IMPLEMENTATION OF EIA AND POLLUTION CONTROL THROUGH THE CAPACITY DEVELOPMENT OF MOE

Project Brief Note

Project Area

Phnom Penh

The Capital of the Kingdom of Cambodia



1. Strategic Context and Sector issues

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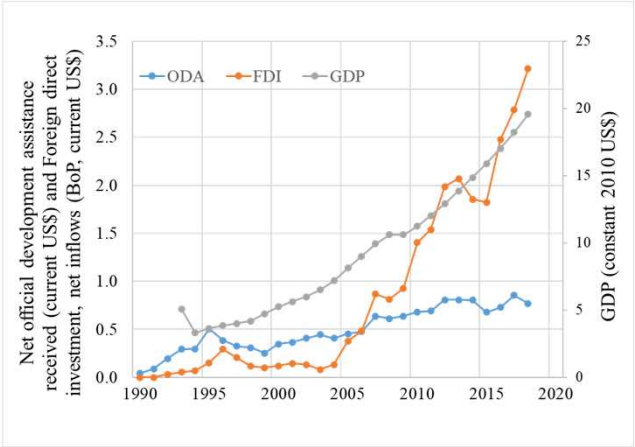
Rapid Economic Growth



Changes in GDP, FDI and ODA
Source: WB

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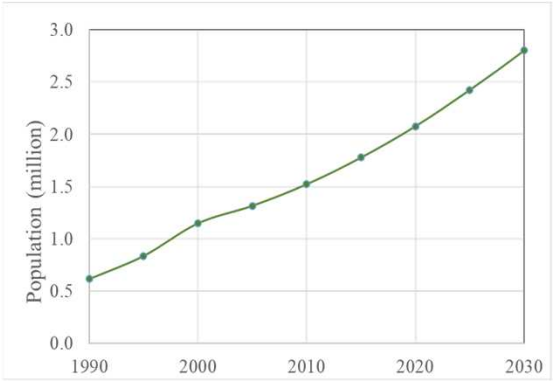
Rapid Population Growth



Changes in Phnom Penh Population
Source: United Nations

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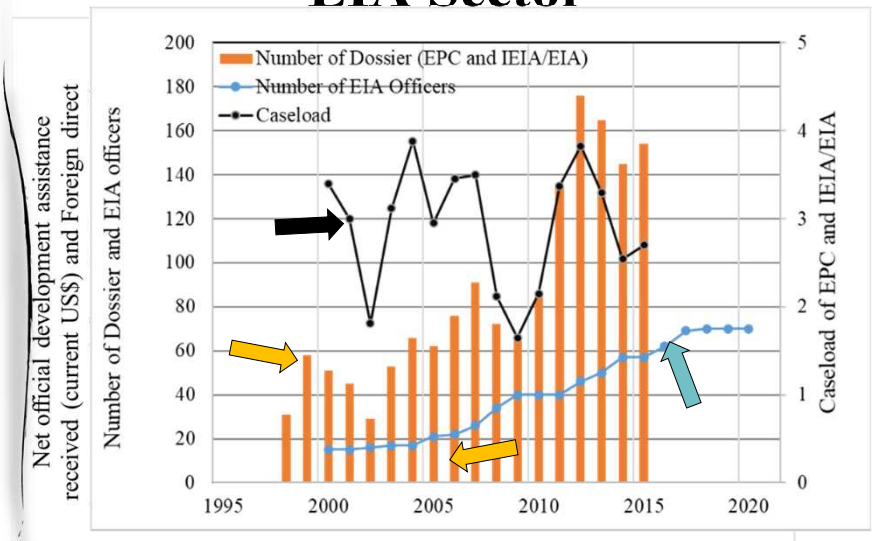
EIA Sector



Changes in EIA department Performance and Capacity
Source: EIA Department

6

6

Sector issues to be addressed

a. Need for Faster and Consistent Environmental Decisions to facilitate Investment in Emerging and Growing Sectors.

The EIA department had to compromise on its performance due to limited readiness for flexible internal mobilization of staff and broader expertise required to respond to the expanding and fast-changing economy. Such personnel arrangement for environmental assessment in a short-term and temporal manner has often resulted in inconsistency in the assessment process and its outcome as well.

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Sector issues to be addressed

b. Need for Overhauling the Water Quality Control Legislation

- The country has achieved GDP growth at 10 % or more each year. It has triggered increasing demand for housing and infrastructure, which was also accompanied by increased impervious cover. Stream self-purification enhanced by natural wetlands functions had previously absorbed the pollutants; though, the incremental pollution loads have gone beyond the capacity of such natural ecosystem.
- The Sub-decree on Water Quality Control was found to contain ambiguities and conflicts among articles in the main text and its annexes, which has prevented effective intervention into water quality control.

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Sector issues to be addressed

c. Limited Availability of Fundamental Tools and Mechanisms for Effective and Efficient Protection of Environment, and Needs for Refreshing Knowledge on Key Environmental Issues

- GDEP needed

1. Reliable information base on environmental degradation and
2. knowledgeable officers who are capable of translating the information into actions and implementing them.

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2. Key Approaches of the Project

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Key Approach 1

Setting up Task Forces to Deliberate Issues on EIA and Water Pollution

Task Forces were established to deliberate major environmental issues.

1. EIA Task Force
2. Water Quality Task Force

The members are competent officers of GDEP.

The JICA Team acted as facilitators. GDEP officers made decisions.

Active discussion in a Task Force Meeting on EIA

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Key Approach 2

Progressive Elaboration of Key Deliverables

the project was designed to address two distinctive but broad sectors: namely EIA and water quality.

⇩

It required management of complex issues at different timing on different sectors.

⇩

The approach and issues were progressively elaborated to reach a consensus.

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Key Approach 3

Enhancing Inter-Departmental and Inter-Agency Coordination/Cooperation

In recognition of the facts that environment protection cannot be accomplished by the GDEP alone in isolation from other stakeholders, the project enhanced coordination and cooperation among the relevant departments and other government agencies.

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Key Approach 4

Partnering with Private Sectors and Academes

Throughout the implementation period, the project supported GDEP in establishing partnership with private sectors and academes for various purposes.

Private sectors

- ✓ Japanese Business Association of Cambodia (JBAC)
- ✓Phnom Penh Special Economic Zone (PPSEZ).

Academe

- ✓Institute of Technology of Cambodia(ITC)

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Key Approach 5

Needs-based Programming of Comprehensive Training Courses

The training programme was so designed to respond to the diverse and growing needs on environmental protection.

Training on Inspection and Wastewater Treatment at Factories

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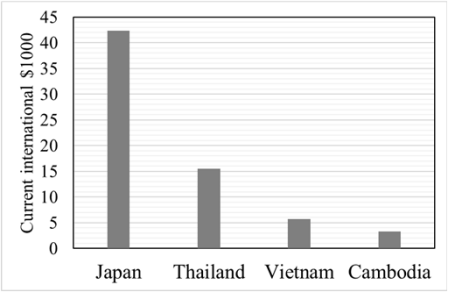
Key Approach 6

Design Practical and Applicable Overseas Training:

The Project was designed to send the nominated officers of GDEP to Thailand and Viet Nam because the two countries are in comparable level with Cambodia in terms of its development stage.



Comparison of GNI Per capita (2015)
Source: World Development Indicators
(World Development Indicators)

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3. Key Outputs of the Project

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Key Outputs of the Project

The Task Forces continued its doggedly tenacious efforts to deliberate the key issues in water and EIA, which led to the signing by Prime Minister Hun Sen for the formal amendment of the Sub-decree on Water Pollution Control and development of a wide range of EIA guidelines.

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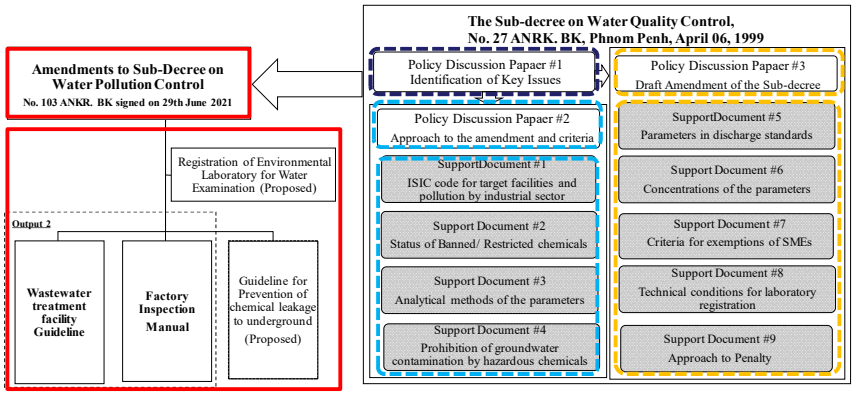
Water Pollution Control



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Key Deliverables in EIA

Documents	Sector	Level
EIA Sector Guidelines	Road	EIA
		IEIA
	Railway	EIA
		IEIA
	Industry	EIA
	SEZ	EIA
EIA Review Manual	-	-

20

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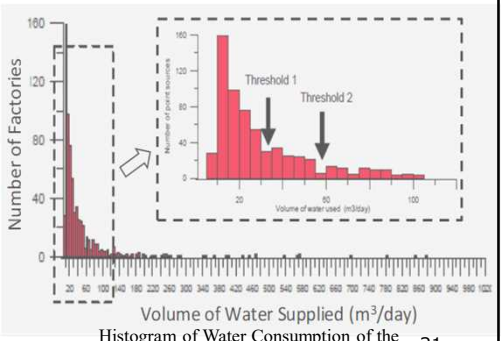
Key Outputs of the Project

Inter-Departmental and Inter-Agency Coordination/Cooperation served as basis for development of crucial information in environmental management.

1. Phnom Penh Water Supply Authority (PPWSA) provided water Supply data to industries,
2. Ministry of Industry, Science, Technology and Innovation (MISTI) provided the information on factory operation in Phnom Penh.



Histogram of Water Consumption of the Factories in Phnom Penh
Source: PPWSA, it was modified by the JICA Team

21

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Key Outputs of the Project

Partnering with Private Sectors and Academes led to increased sustainability and acceleration of international donor support.

The study on particulate matter in Phnom Penh has led to a follow-up assessment with an additional fund by UNDP. It was undertaken under a title of "the Research of PM2.5 and PM 10 in Phnom Penh in the Windy Season 2019 -2020" as part of the Sustainable Urban Mobility for All Initiative (SUMAI) Project.

PM monitoring in Phnom Penh

22

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Key Outputs of the Project

A Comprehensive Training Course responding to the needs offered to the counterpart officer throughput the project

A broad range of training was provided to the GDEP officers for key areas of environmental issues. They are broadly categorized into nine issues ranging from General training and Environmental Information Management to Environmental Impact Assessment (EIA).

	Course title
1.	General training
2.	Environmental information management
3.	Air pollution, noise, vibration
4.	Solid waste management
5.	Hazardous substances management
6.	Water quality management
7.	Inspection and Law Enforcement
8.	Environmental Impact Assessment (EIA)
9.	Training abroad

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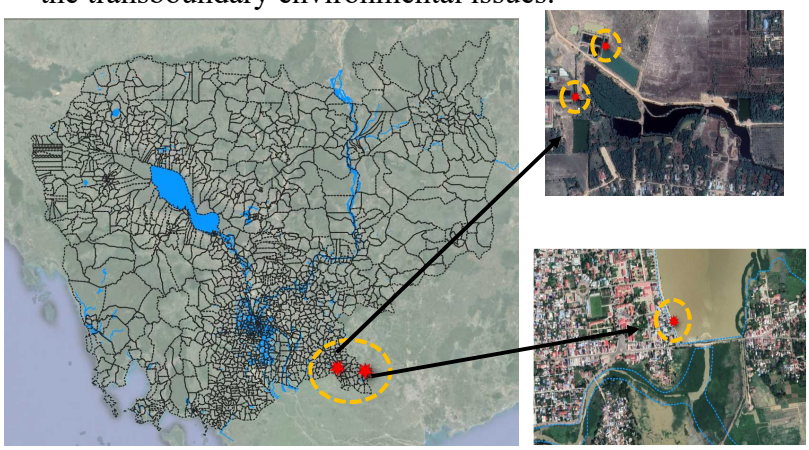
Key Outputs of the Project

Hands on training on Water quality Monitoring focused the transboundary environmental issues.



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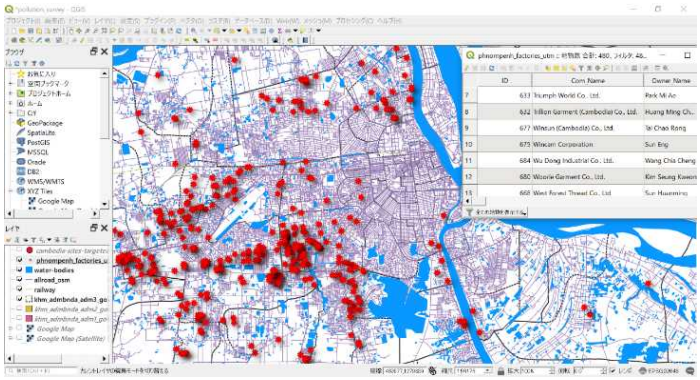
Key Outputs of the Project

The information from PPWSA and MISTI was integrated to develop a GIS based Pollution Source Inventory.



GIS based Pollution Inventory

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4. Lessons Learned

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Key Issues and Lessons Learned

- ✓ It was observed that barriers hindering information accessibility could be removed when the leaders were involved and played a role.
- ✓ An open, inclusive and constructive dialogue should be sought in a continuous manner to develop a common ground on how governments, industry, and civil society can work together in pollution control.
- ✓ It is noted that GDEP made a great effort to deliver technical information to the public in a plain manner by using indexes such as Water Quality Index and Air Quality Index. It is crucial to broaden a channel of information, in addition to such efforts, to the public and the private sectors for delivering information on the policy formulation and status of environment.

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Key Issues and Lessons Learned

- ✓ The Pollution Source Inventory integrated with a GIS database is a strong tool in controlling water pollution to identify and prioritize geographical areas and industrial sectors.
  a. Develop a mechanism for data entry and updates, which would be realized through inter-agency coordination with MIH/PPWSA;
  b. Improve the information system to allow faster data entry and effective analysis for intervention;
  c. Develop a set of rules for information update by identifying responsible officers; developing and agreeing on information security procedures; and determining the timing and the protocol for data entry and authorization;
  d. Setting up a structure to allow analysis of the information and thus to enable GDEP to revise the regulations, penalties, and other policy instruments.

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Annex 37 Newsletters

The following materials are those provided through the website of the GDEP developed under the Project. In the following sections, major materials are presented to avoid duplication with the main text of the report.

The 1st JCC Meeting

On 29 August 2017, General Directorate of Environmental Protection (GDEP) cooperated with JICA Project Team had organized the 1st Joint Coordination Committee (JCC) Meeting on the implementation of "The Project for Effective Implementation of EIA and Pollution Control through the Capacity Development of MOE" which held at Hotel Cambodiana in Phnom Penh. The meeting was presided by H.E. EANG Sophalleth, Under Secretary of State of Ministry of Environment, Mr. Kotaro TANAKA, Deputy Chief Representative of JICA Cambodia Office and H.E SAO Sopheap, Advisor and Director of Cabinet of Ministry of Environment.

The Joint Coordination Committee (JCC) members were representative of Ministry of Environment, Ministry of Economy and Finance, Ministry of Land Management, Urban Planning and Construction, Ministry of Industry and Handicraft, Ministry of Tourism, Ministry of Rural Development, Ministry of Water Resources and Meteorology, Ministry of Agriculture Forestry and Fisheries, Ministry of Mines and Energy, Ministry of Public Works and Transport and The Council of Development for Cambodia.

The meeting program was followed by the schedule:

Time	Activities	Responsible Person
08:00-08:30	Registration	Mr. MENG Kro Ms. SOPHAN Phaty
08:30-09:15	Welcome and Opening Remark by Repetitive of JICA Welcome and Opening Remark by Representative of Ministry of Environment	Mr. Kotaro TANAKA, Deputy Chief Representative of JICA Cambodia Office H.E EANG Sophalleth, Under Secretary of State
09:15-09:30	Introduction of Participants	
09:30-09:45	ToR for the Joint Coordination Committee and its discussion for collaboration	H.E HENG Nareth, Director General of General Directorate of Environmental Protection
09:45-10:05	Coffee Break	
10:05-10:35	Presentation on the Inception Report	Mr. Muramatsu YASUHIKO, JICA Project Team Leader
10:35-11:05	Open Forum on the Inception Report	
11:05-11:15	Preparation of Minutes of Meeting	
11:15-11:30	Signing of Minute of Meeting	
11:30-11:45	Closing Remark	H.E HENG Nareth
11:45-12:45	Lunch	

Mr. Muramatsu YASUHIKO, JICA Project Team Leader overviewed the project for effective implementation of EIA and Pollution Control through Capacity Development of MoE and H.E HENG Nareth emphasized on the Term of Reference (ToR) of the Joint Coordination Committee for the project. The final session of the meeting was active discussion initiated by H.E SAO Sopheap, Advisor and Director of Cabinet of Ministry of Environment. The meeting ended harmoniously and with mutual understanding.

H.E EANG Sophalleth, Under Secretary of State of MoE
Mr. Kotaro TANAKA, Deputy Chief Representative, JICA
H.E. SAO Sopheap, Advisor and Director of Cabinate, MoE

Group Photo at Cambodiana Hotel on 29 August 2017

JCC participants from Inter-ministries and Ministry of Environment
Venue: Cambodiana Hotel
Date: 29 August 2017

The 1st task force on EIA

The 1st task force meeting for Environmental Impact Assessment (EIA) held on September 29th,2017 at Kreal Meeting Room, 1st floor of the Ministry of Environment. The meeting was chaired by Mr. Chea Leng, Deputy Director of EIA Department and 12 participants from Department of EIA and JICA project team. Mr. Hatano has moderated about the priority sectors guideline, how to develop EIA sector guideline and review manual.

The EIA team agreed to create guideline related to infrastructure such as sky train, sub-way, road, railway, building, bridge…etc, industrial sector and Special Economic Zone (SEZ). To achieve the effective work implementation, JICA has provided the training to GDEP staff related to 1) EIA system outside Cambodia (Japan or others), 2) Sector specific guideline and its necessity 3) EIA review manual, 4) Major challenges in creating IEIA/EIA report, 5) Major challenges in reviewing IEIA/EIA report, 6) Practical training for IEIA/EIA screening/scoping/reviewing.

The 1st Task Force Meeting at Kreal Meeting Room,
the Ministry of Environment
Date: 29 September 2017

The 1st Taskforce Meeting on Water Pollution Control

The 1st task force meeting on water pollution control was held at Keal Meeting Room, 1st floor, the Ministry of Environment on October 02nd, 2017. The meeting was chaired by Mr. Chea Sina, Deputy Director General of General Directorate of Environmental Protection (GDEP), Mr. Phin Rady, Director of Water Quality Management as secretary of the task force and facilitated by Mr. Fukuda, JICA expert team/Pollution Control and Regulation.

The meeting was shown about the ToR of TF-WPC, review of legal document on water pollution control, selection of target area in water field for JICA project work which will be focusing on industrial wastewater, review of the preliminary work before official set up of task force including 1) Initial lecture/training program, and 2) Preparation of Policy Discussion Paper #1. The training lecture was conducted 5 topics are pollution control policy (basic), water pollution control in Japan, concentration level of pollutants in water at acceptable health risk, groundwater pollution by industrial chemicals, and how to control quality of measurement of private laboratories. The meeting also discussed about the work schedule of 2017-2018.

Mr. Chea Sina, Deputy Director General of General Directorate of Environmental Protection

Mr. Munehiro Fukuda and all participants at Trayorng Meeting Room, The Ministry of Environment
Date: 24 October 2017

The 2nd Task Force on EIA

The 2nd task force meeting on Environmental Impact Assessment (EIA) was held on October 24th,2017 at Kreal Meeting Room, 1st floor of the Ministry of Environment. The meeting was chaired by Mr. Chea Leng, Deputy Director of Department of EIA and moderated by Mr. Hatano, EIA expert, JICA.

The meeting discussed about the identification of current issues and problems without sector specific guideline, the advantages of developing sector specific guidelines and ideal form for the EIA system in Cambodia such as initial check list, sector guideline and review manual. Mr. Hatano showed the draft of chapter for selected sectors. After discussion, Mr. Chea Leng mentioned that EIA staff was busy with their routine work on ToR and EIA review. He suggested JICA team to recruit EIA consultant for assisting to develop sectoral guidelines and EIA review. JICA team agreed to hire local consultant for helping this work.

The 2nd Task Force Meeting at Kreal Meeting Room,
at the Ministry of Environment
Date: October 24, 2017

The 2nd Taskforce Meeting on Water Pollution Control

The 2nd task force meeting on Water Pollution Control was held at Department of Water Quality Management, the 1st floor, the Ministry of Environment on October 24th, 2017. The meeting was chaired by Mr. Chea Sina, Deputy Director General of General Directorate of Environmental Protection, Mr. Phin Rady, Director of Water Quality Management as secretary of the task force and moderated by Mr. Fukuda, JICA expert team/Pollution Control and Regulation Mr. Manuel I Gloria, JR, JICA expert team/Water Environment (Inspection).

The main purpose of the meeting was to show about the 1) identification and confirmation of current decrees, sub-decrees, and procedure for inspection and sampling including enforcement, 2) clarification and confirmation of extent of authority and powers of MoE inspection group, 3) observation one actual operation, 4) initial outline of factory inspection manual for discussion, revision and approval, 5) initial outline of wastewater treatment facility guideline for discussion, revision and approval, and 6) procurement of equipment for GDEP.

Mr. Manuel I Gloria, JR, JICA expert

Date: October 24, 2017

Participants in the Training Session

Date: October 24, 2017

The 2nd JCC Meeting Newsletter

The General Directorate of Environmental Protection (GDEP), the Ministry of Environment with JICA Project Team were organized the 2nd Joint Coordination Committee (JCC) Meeting on The Project for Effective Implementation of EIA and Pollution Control through the Capacity Development of MoE. The meeting was held on January 10, 2018 at Himawari Hotel in Phnom Penh and was presided by H.E Eang Sophalleth, Under Secretary of State, the Ministry of Environment and Mr. Kotaro TANAKA, Deputy Chief Representative of JICA Cambodia Office.

The counterpart institutions participated in the meeting were representative from various agencies such as Ministry of Economy and Finance, Ministry of Land Management, Urban Planning and Construction, Ministry of Industry and Handicraft, Ministry of Tourism, Ministry of Rural Development, Ministry of Water Resources and Meteorology, Ministry of Mines and Energy, Ministry of Public Works and Transport, Ministry of Agriculture Forestry and Fisheries, The Council for the Development of Cambodia, Embassy of Japan in Cambodia, JICA Cambodia Office, and All General Directorates of Ministry of Environment.

The purposes of the 2nd JCC Meeting are to report the progress of the project and to inform all members about the revision of Project Matrix Design (PDM). The PDM is a logical framework matrix which is describing about objectives, outputs, progress activities, and assumption of the project. It is an essential tool in project management and planning.

Mr. Muramatsu Yasuhiko presented about the progress of the project by establishing two task force team are Environmental Impact Assessment (TF-EIA) and Water Pollution Control (TF-WPC). TF-EIA team has discussed every month about EIA sector guidelines establishment related to infrastructure (road and railway), metal industry, and special economic zone (SEZ). TF-WPC team has discussed about the revision of sub-decree on Water Pollution Control. Moreover, the TF-WPC team has conducted the second time of consultation meeting with Cambodian Chamber of Commerce (CCC), Garment Manufacturing Association in Cambodia (GMAC) and Institute of Technology of Cambodia (ITC) to discuss about the progress of sub-decree on water pollution control revision. In addition, Mr. Muramatsu Yasuhiko showed about the revision of PDM version 2.0. All members approved the revision of PDM as proposed in the presentation after panel discussion.

The final session was facilitated by Mr. Pak Sokharavuth, Deputy Director General of General Directorate of Environmental Protection related to questions, comments and suggestion from all participants. All feedbacks, comments and suggestions were useful to improve the current project implementation. Finally, Mr. Muramatsu summarized the Minute of the 2nd JCC Meeting and shared it with all members to confirm all discussion.

The agenda of the meeting:

Time	Activities	Responsible Persons
08:00-08:30	Registration	Mr. Meng Kro Ms. Sophan Phaty
08:30-08:50	Opening Remarks by JICA	Mr. Kotaro TANAKA, JICA Representative
08:50-09:10	Opening Remarks by the Ministry of Environment	H.E Eang Sophallet, Under Secretary of State, MoE
09:10-09:40	Coffee Break	
09:40-10:15	Presentation on the Progress Report	Yasuhiko Muramatsu
10:15-10:30	Open Forum on the Inception Report	Discussion
1□:30-11:00	Presentation on the Project Design Matrix	Yasuhiko Muramatsu
11:00-11:30	Open Forum on the PDM	Discussion
11:30-11:45	Closing Remark	H.E Heng Nareth, Director General of GDEP
12:00	Lunch	

H.E Eang Sophalleth, Under Secretary of State, MoE and Mr. Kotaro TANAKA, Deputy Representative of JICA Cambodia Office, held on 10 January 2018 at Himawari Hotel






Participants in the 2nd JCC Meeting on 10 January 2018
at Himawari Hotel, Phnom Penh.

Annex 38 Monitoring Sheets

TO CR of JICA Cambodia OFFICE

Project Monitoring Sheet

Project Title : THE PROJECT FOR EFFECTIVE IMPLEMENTATION OF EIA AND POLLUTION CONTROL THROUGH THE CAPACITY DEVELOPMENT OF MOE

Version of the Sheet: Ver.1（Term: 29th August 2017 until 31st December 2017）

Name: Heng Nareth
Title: Project Director
Name: Yasuhiko Muramatsu
Title: Team Leader

Submission Date: 1st January 2018

I. Summary

1 Progress

1-1 Progress of Inputs

This project monitoring sheet covers the progress achieved in the period from the first Joint Coordination Committee meeting on 29th August 2017 until the end of the year 2017. The cumulative achievement and figures up to the end of the Year 2017 is also provided wherever appropriate and necessary.

Inputs by the Japanese Side

A total of fourteen (14) person-months (P-M) of experts have been mobilized during the evaluation period, which is equivalent to twenty-five (25) % of the planned total input for the activities in Cambodia by JICA on the experts amounting to 57.64 P-M during the entire project period. The experts include 1) the Team Leader/Environmental Management 1 with 1.23 P-M (25%), 2) Deputy Team Leader/Environmental Management 2 with 1.23 P-M (18%), 3) EIA with 2.3 P-M (39%), 4) Pollution Control and Regulations 1 with 3.5 P-M (50%), 5) Pollution Control and Regulations 2 with 1.1 P-M (28%), 6) Training Planner 1 with 1.77 P-M (25%), 7) Water Environment/ Training Planner 2/Coordinator with 2.07 P-M (17%) and 8) Water Environment (Inspection) with 1.0 P-M (18%). In the parenthesis, the percentages of P-M of respective expert are indicated as compared with the each of the total planned P-M during the entire project period. Two specialists for support of project implementation were contracted by the early August 2017. Thus the ten (10) person-months have been mobilized by the end of the year for organizing, filing and retrieving records of meetings, communicating with various departments and other agencies, scheduling appointments, and coordinating travel and accommodations.

A multifunction copy machine was procured and installed in the JICA project office for

preparing relevant project documents.

Inputs by the Cambodian Side

The counterpart staff of the Ministry has participated especially through the occasions of task force meetings formally established under the project.

The members of the Task Force on EIA Subsector include: 1) the Deputy Director as the chair of the Task Force, 2) the Chief of the Office of Research and Training in EIA department as the Deputy Chair and the Secretariat, 3) the Chief of Office of Legislation, 4) the Chief of Industrial and Health Project Review, 5) the Chief of Office of Mines and Energy Project Review, 6) the Chief of Office of Agricultural and Water Resources Project Review, 7) the Chief of Office of Infrastructure and Tourism Projects Review and 8) the Chief of Office of Project Monitoring. All the members are the representatives of the EIA department of the MoE.

On the other hand, the members of the tasks force on Water Subsector are: 1) Deputy Director General of GDEP as the chairperson of the task force, 2) the Director of water quality management as the Deputy Chair (Secretariat),3) Director of inspection and law enforcement as the Deputy Chair, 4) the Deputy Director of water quality management, 5) the Deputy director of EIA and staff of the water quality management and inspection and law enforcement departments.

The office space has been provided for the team of the JICA experts at the headquarter of MoE.

The office of the air quality mobilizes the staff for administration, coordination and management of the project.

1-2 Progress of Activities

Activity 1.1 Develop Task Force to Review Law and Regulation

Two Task forces were formally established separately for EIA and Water in September. The members of the task forces are presented in the part of the Inputs by the Cambodian Side of this report. Note that the task forces will concurrently act as the task forces to discuss the issues and activities under Output 2.

The task force meetings on EIA were convened in 2017 three times on: 1) 29th September 2) 24th October and 3) 7th November. On the other hand, the meetings on Water Pollution were convened three times on 1) 2nd October 2) 24th October and 29th November.

Activity 1.2 Finalize Items for Output 1

EIA Sector

The project will support the EIA department to improve performance capability of environmental review process.

The objective will be materialized by producing manuals/guidelines and hands-on training on review of EIA. The JICA Team will initially assist the Task Force members in reviewing past (I) EIA reports to identify key issues to prepare a Review Manual; and develop three sector guidelines for 1) Infrastructure, 2) industry and 3) Special Economic Zone/Land Development as agreed in a Task Force meeting. The sub-sectors that may be covered in this project may include road, sky train, subway, building for infrastructure and 2) factory, heavy industry, food industry, rubber processing for industry. They will be, however, further subject to review and consultation. Note that IEE reports will also be reviewed as necessary especially when an EIA report is not available or accessible.

Water sector

It was determined to give a focus on the Sub-Decree on Water Pollution Control. The specific output of the activities will include: 1) an amendment of current sub-decree on Water Pollution Control focusing on industrial wastewater control, 2) a Prakas on Registration of Environmental Laboratory for Water Examination; 3) a Wastewater treatment facility Guideline; 4) a Factory Inspection Manual; and 5) a Guideline for prevention of underground leakage of chemicals.

“

Activity 1.3 Review and Draft Revised Law and Regulation

The review and draft revised law and regulation is under process. The major issues identified so far include the followings:

- ✓ For the Sub-decree on Water Pollution Control, in article 4 under Chapter 2 on Provisions on Waste and Hazardous Discharge, the methods of analysis of the regulated substances are not identified in the sub-decree. On the other hand, Article 8 on groundwater protection shall be reviewed and elaborated to avoid ambiguity for its effective implementation. As for the effluent discharge permit system in Chapter 3, the categories of pollution sources should be desirably assigned with an international classification code for clarification purpose. Article 14 set forth that a permit shall be provided if the applying industry meet a technical guideline. However, details of such guideline are not provided. Annex 1 of the sub-decree provides a list of hazardous substances, in which the lists of substances contains inconsistency among the tables in the same annex. It is also recognized that the effluent standards have more parameters (52) than the environmental quality standards (25).

Activity 1.4 Consultation with Stakeholders

Two consultation meetings on water sector were convened for 1) academe and 2) the industry.

The consultation meeting with academe took place on 7th September 2017 with Institute of Technology of Cambodia to acquire views and feedback on the activities for modification of the relevant legislation on water quality control.

With industry, the meeting took place on 28th September 2017 with the Cambodian Chamber of Commerce (CCC).

Other informal consultation meetings with private sectors were also convened. The information is provided in a chronological order.

1) Nidec Corporation on 26th July
2) JBAC[1], Consultation meeting on 26th July and 25th August
3) Phnom Penh Specialized Economic Zone on 29th September
4) Cambodia Suzuki Motor Co., Ltd. on 23rd November2017.

The following meetings are not specific neither for water pollution nor EIA, but they are convened for overall project management and implementation to exert synergy effects.

1) The team of Environment & Social performance review of the World Bank on10th November
2) National Institute of Technology, Nagano College on 16th November 2017
3) Institute for Global Environmental Strategies on 14th November and 28th November.

Activity 1.5 Finalize Draft Law and Regulation

The activity will be performed most likely in the latter half of the year 2018.

Activity 1.6 Prepare Summary Report for Output 1

The activity will be performed most likely in the year 2019.

Activity 2.1 Develop Task Force to develop guidelines and procedure

The two tasks forces established on EIA and Water Pollution as reported in the part of Activity 1.1. will concurrently act as the task forces to discuss the issues and activities under Output 2.

Activity 2.2 Finalize Items for Output 2

For the EIA sub-sector, it was agreed to prepare a Review Manual; and three sector guidelines for 1) Infrastructure, 2) industry and 3) Special Economic Zone/Land Development.

Regarding the specific guidelines identified in Activity 1.2 on Inspection Manual and Wastewater treatment facility guidelines, the following table provide a general description.

1. Inspection Manual will set forth procedures, technical key issues in inspection with

[1] Japanese Business Association of Cambodia

due consideration on the Cambodian context. This will be developed through undertaking joint inspection exercise organized by the inspection department. The first draft manual would be prepared before the end of June 2018.

2. Wastewater treatment facility guideline will be designed to assist the officers in making decisions for wastewater discharge permit. This would provide information on the volume of wastewater generation, design of facility etc. the first draft guidelines will be prepared before the end of June 2018.

Activity 2.3 Develop draft Guideline and Procedures

The activity will be performed mostly in the year 2018. The fundamental components and the structure of the guidelines will be drafted before the end of June 2018, which will be further modified and refined in the subsequent phase of the project.

Activity 2.4 Consultation with Stakeholders

The consultation meetings on EIA and water will take place before the end of June 2018.

Activity 2.5 Finalize draft Guidelines and Procedure

The activity will be performed most likely in the latter half of the year 2018.

Activity 2.6 Prepare Summary Report

The activity will be performed most likely in 2019.

Activity 3.1 Finalize content/subject of training program

The discussions with the technical departments under GDEP were conducted to understand the organizational capacity and the needs for training related to human resource development. The draft Training plan was shared with the departments and reviewed with due consideration on the training needs of each department. Based on the reviewed draft training plan, the training syllabus is under development to identify 1) Field, 2) Course title, 3) Training planner/ trainer, 4) Course type, 5) Estimated required time, 6) Period/ frequency, 7) Venue, 8) Objective/ Expected results, 9) Course overview, 10) Target group, 11) Number of participants, 12) Course requirements, 13) References, 14) Required materials and 15) Budget.

Activity 3.2 Organize seminar

Eleven (11) tutorial classes and workshops/filed exercises were organized with a total number of participants of two hundred two (202). The themes included, but not limited to: Health risk of pollutants and determination of environmental standards, Groundwater

Pollution by Industrial Chemicals and Factory Inspection Workshop.

Activity 3.3 Study tour

A tentative schedule of the training in Japan is proposed as follows.

Period: Two weeks most likely from 4th November 2018 to 17th November 2018

Number of Participants: 10 officers

Receiving department: Tokyo International Centre

The schedule will be subject to further review considering availability of trainers and accommodation and other conditions.

Activity 3.4 Develop training program and implement

The training programme previously proposed in the Inception Report were reviewed and modified by integrating the findings and needs identified during the period.

Activity 3.5 Prepare summary report of output 3

The activity will be performed most likely in 2019.

1-3 Achievement of Output

The project is designed to achieve the following three outputs: 1) Legal documents related to EIA and pollution control focusing on water revised and processed for approval; 2) Technical issues and procedures related to EIA and pollution control focusing on water clarified and shared with GDEP staff as well as other stakeholders and 3) Capacity of GDEP as a whole and related departments under GDEP enhanced. At the time of this monitoring at the end of the year 2017, the project is on the track of producing the intended outputs.

1-4 Achievement of the Project Purpose

The purpose of the project is to strengthen GDEP capacity in preventing, reducing and mitigating environmental pollution focusing on EIA and water. At the time of this monitoring, the project is on the track of achieving the purpose.

1-5 Changes of Risks and Actions for Mitigation

A Cambodian general election is scheduled to take place on 29th July 2018 to elect members of the sixth National Assembly. The impacts of the election on the project is not predictable. The project, however, designed its implementation schedule to accommodate any changes and to minimize the potential impacts if any by: 1) completing the preparation process of draft legal documents, guidelines and manuals before the end of June 2018; and 2) proceeding to finalization process after the election.

1-6 Progress of Actions undertaken by JICA

To minimize the potential risks, the JICA team has discussed and designed the implementation schedule in close consultation with MoE.

1-7 Progress of Actions undertaken by Gov. of Cambodia

To minimize the potential risks, the MoE has discussed and designed the implementation schedule in close consultation with the JICA Team.

1-8 Progress of Environmental and Social Considerations (if applicable)

The project was fundamentally designed to conserve and protect environment. Adverse environmental impacts are not identified/anticipated. When such impacts are identified, appropriate consideration for environment will be exercised.

1-8 Progress of Considerations on Gender/Peace Building/Poverty Reduction (if applicable)

No specific gender issues have been identified.

1-9 Other remarkable/considerable issues related/affect to the project (such as other JICA's projects, activities of counterparts, other donors, private sectors, NGOs etc.)

2 Delay of Work Schedule and/or Problems (if any)

2-1 Detail

The procurement process of local experts on EIA is behind the schedule. Although some delay is observed, it is still manageable level to complete the project activities as designed.

2-2 Cause

It occurred mainly due to the unexpected cost and time schedule of the service offered by the bidders.

2-3 Action to be taken

the JICA Team is to procure freelance consultants to stay in the project budget by refining the TOR. The procurement process is almost complete at the end of December 2017.

2-4 Roles of Responsible Persons/Organization (JICA, Gov. of●●,etc.)

Not applicable.

3 Modification of the Project Implementation Plan

3-1 PO

PO have been modified as the Project Design Matrix was revised. The details of the modification is provided in the Progress Report 1.

3-2 Other modifications on detailed implementation plan

(Remarks: The amendment of R/D and PDM (title of the project, duration, project site(s), target group(s), implementation structure, overall goal, project purpose, outputs, activities, and input) should be authorized by JICA HDQs. If the project team deems it necessary to modify any part of R/D and PDM, the team may propose the draft.)

The Project Design Matrix is revised. Details of the modification is provided in the main text of the Progress Report 1.

4 Current Activities of Gov. of xx to Secure Project Sustainability after its Completion

The exit strategy of the project is under discussion.

II. Project Monitoring Sheet I & II *as Attached*

TO CR of JICA　Cambodia　OFFICE

Project Monitoring Sheet

Project Title : THE PROJECT FOR　EFFECTIVE IMPLEMENTATION OF EIA AND POLLUTION CONTROL THROUGH THE CAPACITY DEVELOPMENT OF MOE

Version of the Sheet: Ver.1（Term: 1st January 2018 until 31st May 2018）

Name: Heng Nareth
Title: Project Director
Name: Yasuhiko Muramatsu
Title:　Team Leader

Submission Date: 13th June 2018

I. Summary

1　Progress

1-1 Progress of Inputs

This project monitoring sheet covers the progress achieved in the period from the second Joint Coordination Committee meeting on 10th January 2018 until the end of May 2018. The cumulative achievement and figures up to the end of May 2018 is also provided wherever appropriate and necessary.

Inputs by the Japanese Side

A total of 7.94 person-months (P-M) of experts has been mobilized in Cambodia during the evaluation period. In addition to the assignment in Cambodia, a total of 0.4 P-M of the experts was mobilized in Japan for preparation of the trainings on air quality and waste management. A total cumulative P-M thus amounts to 22.67 P-M, which is equivalent to 38% of the total P-M at 59.04 P-M.

The cumulative P-M of each of the core experts is as follows: 1)the Team Leader/Environmental Management 1 with 1.4 P-M (28%), 2) Deputy Team Leader/Environmental Management 2 with 1.23 P-M (18%), 3) EIA with 3.6 P-M (61%), 4) Pollution Control and Regulations 1 with 4.57 P-M (65%), 5) Pollution Control and Regulations 2 with 2.0 P-M (50%), 6) Training Planner 1 with 2.87 P-M (41%), 7) Water Environment/ Training Planner 2/Coordinator with 4.43 P-M (38%) and 8) Water Environment (Inspection) with 1.0 P-M (18%). The figures in the parenthesis indicate the percentage progress of respective expert in terms of P-M. Refer to the assignment schedule attached to the Progress Report II for more details and other experts.

Two specialists for the support of project implementation were contracted before the early August 2017. Thus a total of 20 person-months has been mobilized by the end of the year for organizing, filing and retrieving records of meetings, communicating with various

departments and other agencies, scheduling appointments, and coordinating travel and accommodations.

For the equipment, in addition to the multifunction copy machine procured before the end of 2017, followings were procured and installed in MoE.

1 Three (3) sets of Multi Parameter-Water Quality Meters

2 A Portable Environmental Dust Monitor

Inputs by the Cambodian Side

As reported in the previous monitoring sheet, two task forces were formally established for implementation of the project separately on EIA and Water Pollution. During the evaluation period, the pertinent officers of MoE participated in the following formal meetings. The total inputs for such formal meetings stands at 15 Person-Days. In addition, between such meetings, the officers of MoE and other concerned people engaged in the project activities for guiding the JICA Experts on technical and administrative matters related to the project, coordinating for project activities among the departments in MOE and with other government agencies, reviewing and providing inputs in the documents prepared under the project. Quantitative data of such inputs by the Cambodian side, however, is unavailable. Such “hidden human contribution” of the officers are accordingly not reported in this sheet.

1 The Fourth TF meeting on 9th January 2018

✓ A Deputy Director and two Chief Officers of the EIA Department participated in the meeting for the two hours meeting.

2 The Fifth TF meeting on 29th January 2018

✓ Eight officers of the EIA departments participated in the meeting for the two and a half hours meeting. The attendants included the Director, Deputy Directors and Chief Officers of the EIA Department.

3 The Sixth TF meeting on 27th March 2018

✓ Five officers including Deputy Directors and Chief officers of the EIA Department participated in the two hours meeting.

4 The Fourth Task Force Meeting on 13th February 2018

✓ Fifteen officers including the Director General of GDEP, a Deputy Director General of GDEP and a Deputy Director General of GDEKI participated in the two and a half hours meeting to deliberate the proposed revision of the sub-decree.

5 Third consultation meeting

✓ At the occasion of the third consultation meeting on 20th February 2018, five officers participated in the two hours meeting. Other participants included representatives of the Phnom Penh Autonomous Port, Lecturers of Institute of Technology of Cambodia, Cambodian Chamber of Commerce (CCC) and representatives of private firms with a

total of 17 Cambodians.

Further, MoE convened a briefing session on Environmental Management Plan to the members of the Japanese Business Association of Cambodia with a participation of 25 people. This have contributed to the improved transparency in environmental management policies of MoE.

2-1 Progress of Activities

Activity 1.1　Develop Task Force to Review Law and Regulation

Two Task forces were formally established separately for EIA and Water in 2017. Note that the task forces concurrently act as the task forces to discuss the issues and activities under Output 2. The task force meetings convened during the evaluation period are presented above.

Activity 1.2　Finalize Items for Output 1

The items to be covered for generating Output 1 is generally agreed as follows.

For the EIA Sub-sector, the project supports the EIA department to improve performance capability of environmental review process. The objective would be materialized by producing manuals/guidelines and hands-on training on review of EIA. The JICA Team would initially assist the Task Force members in reviewing past (I) EIA reports to identify key issues to prepare a Review Manual; and develop three sector guidelines for 1) Infrastructure, 2) industry and 3) Special Economic Zone/Land Development. For the Infrastructure sector guideline, the members of the Task Force agreed to focus on Road and Railway.

For the Water Pollution Sub-sector, it was determined to give a focus on the Sub-Decree on Water Pollution Control. The specific output of the activities will include: 1) an amendment of current sub-decree on Water Pollution Control focusing on industrial wastewater control, 2) a Prakas on Registration of Environmental Laboratory for Water Examination; 3) a Wastewater treatment facility Guideline; 4) a Factory Inspection Manual; and 5) a Guideline for prevention of underground leakage of chemicals.

Activity 1.3　Review and Draft Revised Law and Regulation

The review of the Sub-decree on Water Pollution has been undertaken throughout the two consecutive periods since the commencement of the project. Majority of the issues identified and raised through the Task Force Meetings and the Consultation Meetings have been integrated in the draft revised Sub-decree. At the time of writing this evaluation, the threshold value to distinguish Small Medium Enterprises(SMEs) from large factories is a pending issue to be discussed in the subsequent period.

Activity 1.4 Consultation with Stakeholders

During the evaluation period, the third consultation meeting was convened on 20th February 2018 with the participation of representatives of the Cambodian Chamber of Commerce, the Garment Manufacturers Association in Cambodia and the Institute of Technology of Cambodia. In this meeting, the participants discussed the issues for exempting SMEs from uniform regulation.

In addition to the formal consultation meetings reported above, the members of the project engaged in supporting the Japanese Business Association of Cambodia (JBAC) in response to the request by the JICA Cambodia. The consultation meeting with JBAC also serves as basis for designing the project approach and outputs.

Activity 1.5 Finalize Draft Laws and Regulations

For the Sub-decree on Water Pollution, the draft document will be finalized from the latter half of the year 2018.

Activity 1.6 Prepare Summary Report for Output 1

The activity will be performed most likely in the year 2019.

Activity 2.1 Develop Task Force to develop guidelines and procedure

The two tasks forces established on EIA and Water Pollution as reported in the part of Activity 1.1. would concurrently act as the task forces to discuss the issues and activities under Output 2.

Activity 2.2 Finalize Items for Output 2

As reported in the previous evaluation, the items covered for generating Output 2 were agreed. The deliverables are presented in the section on Activity 1.2. However, appropriate policy instruments for formalization of the guidelines, manuals and other types of documents will be discussed and identified throughout the further consultation process. For clarification purpose, the followings provide the project deliverables which may be formalized as guidelines and manuals.

For the EIA sub-sector, they are: 1) a Review Manual; and three sector guidelines for 2) Infrastructure, 3) industry and 4) Special Economic Zone.

For the water sub-sector, the relevant guidelines to be prepared include 1) a Wastewater treatment facility Guideline; 2) a Factory Inspection Manual; and 3) a Guideline for prevention of underground leakage of chemicals.

Activity 2.3 Develop draft Guideline and Procedures

During the evaluation period, the relevant task force members drafted 1) a Review Manual; and 1) a sector guideline for Infrastructure(Road). Further, the members of the Task Force on Water Pollution discussed fundamental elements in the Guideline for prevention of underground leakage of chemicals.

Activity 2.4 Consultation with Stakeholders

For the EIA subsector, the first consultation meeting would take place most likely in September 2018. As for the Water Pollution Subsector, as reported in the section on Activity1.4, three consultation meetings were convened on 7th September 2017, 28th September 2017 and 20th February 2018.

Activity 2.5 Finalize draft Guidelines and Procedure

The activity will be performed most likely in the latter half of the year 2018.

Activity 2.6 Disseminate the finalized and/or draft guideline and procedure to stakeholders

The activity will be performed when guidelines are completed.

Activity 2.7 Prepare Summary Report for output 2

The activity will be performed most likely in 2019.

Activity 3.1 Review the institutional arrangements of GDEP to clarify the scope of the training

The discussions with the technical departments under GDEP were conducted to understand the organisational capacity and the needs for training related to human resource development.

Activity 3.1 Finalize content/subject of training program

As reported in the previous evaluation, the followings were identified through a series of discussions with the technical departments under GDEP: 1) organizational capacity and 2) the needs for training related to human resource development. The draft Training Plan prepared during the previous evaluation period was reviewed and revised before the end of May 2018. Based on the revised training plan, the training syllabus was also modified and updated.

Activity 3.2 Prepare the syllabus including contents/subjects of training program

With due consideration on the findings in the Review of the institutional arrangements in Activity 3.1, a training program was designed and prepared. It contains 32 training courses in 9 sector issues. A seminar was convened on 25th January 2018 with the participation of the officers of GDEP to discuss the draft training plan. Based on the training plan, the training syllabus was developed.

Activity 3.3 Organize seminars

A set of tutorial classes and workshops/filed exercises were designed and organized in an implementable manner. The feedbacks on the seminar under Activity 3.5 are used to further modify and organize the seminars.

Activity 3.4 Conduct Study tours

Although Japan was previously the first destination of the international study tours, the implementation schedule was re-designed in response to a request by JICA Headquarter made in the early part of the year 2018.

Between the GDEP and the JICA Team, it was generally agreed that the first study tour should be conducted in September 2018 to equip the participants with the knowledge on key issues and challenges in environmental management in Thailand.

Activity 3.5 Develop training programs reflecting the obtained results from seminars and study tours

A pre-and post-evaluation of seminars are carried out by using a questionnaire to inquire their level of understanding on the issues in the training course delivered. The findings will be used for designing the training.

Activity 3.6 Implement the developed training program

The following seminars were implemented during the period after the previous JCC meeting in January 2018. The figures in the parenthesis are the number of participants.

(A) General Training, 12th February (11)
(H) Environmental Impact Assessment, 6th March (17)
(H) Environmental Impact Assessment, 27th March (12)
(F) Water quality management, 24th April, (23)
(A) General Training, 25th April, (24)
(C) Air pollution, noise, vibration, 26th April, (26)
(A) General Training, 4th May, (9)

(D) Solid waste management, 22nd May, (13)
(D) Solid waste management, 24th May, (9)
(D) Solid waste management, 25th May, (10)
A total of one hundred fifty-four (154) officers participated in the ten tutorial classes.

Activity 3.7 Evaluate the implemented training program and prepare the next training

A pre-and post-evaluation of seminars are carried out.

Activity 3.8 Prepare summary report of output 3

The activity will be performed most likely in 2019.

2-2 Achievement of Output

The project is designed to achieve the following three outputs: 1) Legal documents related to EIA and pollution control focusing on water are organized; 2) Technical issues and procedures related to EIA and pollution control focusing on water are clarified and shared with GDEP staff as well as other stakeholders and 3) Capacity of GDEP and related departments under GDEP in the field of Environmental Management is enhanced. At the time of this monitoring at the end of May 2018, the project is on the track of producing the intended outputs.

2-3 Achievement of the Project Purpose

The purpose of the project is defined as “GDEP capacity to prevent, reduce and mitigate environmental pollution focusing on EIA and water is strengthened”. At the time of this monitoring, the project is on the track of achieving the purpose.

2-4 Changes of Risks and Actions for Mitigation

A Cambodian general election is scheduled to take place on 29th July 2018 to elect members of the sixth National Assembly. The impacts of the election on the project is not predictable. The project, however, designed its implementation schedule to accommodate any changes and to minimize the potential impacts if any by: 1) completing the preparation process of draft legal documents, guidelines and manuals before the end of June 2018; and 2) proceeding to finalization process after the election. For the some of the guidelines on the Water Pollution Sub-sector, the activities will be implemented after the election to avoid any interference with the political event.

2-5 Progress of Actions undertaken by JICA

To minimize the potential risks, the JICA team has discussed and designed the implementation schedule in close consultation with MoE.

2-6 Progress of Actions undertaken by Gov. of Cambodia

To minimize the potential risks, the MoE has discussed and designed the implementation schedule in close consultation with the JICA Team.

1-8 Progress of Environmental and Social Considerations (if applicable)

The project was fundamentally designed to conserve and protect environment. Any adverse environmental impacts are not identified/anticipated. When such impacts are identified, appropriate consideration for environment will be exercised.

2-7 Progress of Considerations on Gender/Peace Building/Poverty Reduction (if applicable)

No specific gender issues have been identified.

2-8 Other remarkable/considerable issues related/affect to the project (such as other JICA's projects, activities of counterparts, other donors, private sectors, NGOs etc.)

2 Delay of Work Schedule and/or Problems (if any)

2-1 Detail

The procurement of local experts on EIA has completed. No critical issues have been identified so far on the project implementation schedule.

2-2 Cause

N.A.

2-3 Action to be taken

N.A.

2-4 Roles of Responsible Persons/Organization (JICA, Gov. of●●,etc.)

Not applicable.

3 Modification of the Project Implementation Plan

3-1 PO

PO have been modified as the Project Design Matrix was revised. The details of the modification is provided in the Progress Report 1.

3-2 Other modifications on detailed implementation plan

(Remarks: The amendment of R/D and PDM (title of the project, duration, project site(s), target group(s), implementation structure, overall goal, project purpose, outputs, activities, and input) should be authorized by JICA HDQs. If the project team deems it necessary to modify any part of R/D and PDM, the team may propose the draft.)

The Project Design Matrix is revised. Details of the modification is provided in the main text of the Progress Report 1.

4 Current Activities of Gov. of Cambodia to Secure Project Sustainability after its Completion

The exit strategy of the project is under discussion.

II. Project Monitoring Sheet I & II *as Attached*

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Project Monitoring Sheet

Project Title : THE PROJECT FOR　EFFECTIVE IMPLEMENTATION OF EIA AND POLLUTION CONTROL THROUGH THE CAPACITY DEVELOPMENT OF MOE

Version of the Sheet: Ver.1（Term: 1st June 2018 until 31st December 2018）

Name: Heng Nareth
Title: Project Director
Name: Yasuhiko Muramatsu
Title:　Team Leader

Submission Date: 1st January 2019

I. Summary

1　Progress

1-1 Progress of Inputs

This project monitoring sheet covers the progress achieved in the period from 1st June 2018 until 31st December 2018. The cumulative achievement and its figures up to the end of December 2018 are also provided wherever appropriate and necessary.　Note that all the project activity was temporarily ceased in the period from July until the middle of August to avoid potential interference resulted from the general election on 29th July 2018.

Inputs by the Japanese Side

A total of 11.36 person-months (P-M) of experts has been mobilized in Cambodia during the evaluation period. A total cumulative P-M thus amounts to 33.8 P-M, which is equivalent to 57% of the total P-M at 59.04 P-M.

The cumulative P-M of each of the core experts is as follows: 1)the Team Leader/Environmental Management 1 with 3.2 P-M (64%), 2) Deputy Team Leader/Environmental Management 2 with 2.53 P-M (36%), 3) EIA with 4.1 P-M (69%), 4) Pollution Control and Regulations 1 with 5.73 P-M (81%), 5) Pollution Control and Regulations 2 with 3.47 P-M (86%), 6) Training Planner 1 with 3.4 P-M (49%), 7) Water Environment/ Training Planner 2/Coordinator with 6.2 P-M (53%) and 8) Water Environment (Inspection) with 2.77 P-M (49%). The figures in the parenthesis indicate the percentage progress of respective expert in terms of P-M. Refer to the assignment schedule attached to the Progress Report III for more details and other experts.

During the evaluation period, a study tour to Thailand was organized under the project for a period of nine (9) days in total.

Two Cambodian specialists for the support of project implementation were contracted before the early August 2017. Thus a total of 26 person-months has been mobilized by the

end of the year for organizing, filing and retrieving records of meetings, communicating with various departments and other agencies, scheduling appointments, and coordinating travel and accommodations.

The procurement of all the equipment has been complete. The followings are the list of equipment procured under the project.

1. Three sets of Potable Spectrophotometers,
2. Two sets of Hot-plates for Laboratory analysis,
3. Two sets of Water Baths for Laboratory Analysis, and
4. Two sets of pH meters were procured
5. One multifunction copy machine,
6. Three sets of Multi Parameter-Water Quality Meters,
7. A Portable Environmental Dust Monitor.

Inputs by the Cambodian Side

In June 2018, the Ministry of Environment hosted the third Joint Coordination Committee (JCC) of the Project with the participation of twenty-six (26) officers. They were twenty-two (22) officers of the Ministry of Environment, two (2) officers of the Ministry of Public Works and Transport, two (2) officers of the Ministry of Industry and Handicraft and one officer of the National Council for Sustainable Development.

Another major events during the evaluation period include the Study Tour to Thailand as briefly reported above. The participants of the tour included 1) eight (8) managerial level officers who participated in the tour for a period of six (6) days from 10th September until 15th September and 2) eight (8) technical officers for a period of nine (9) days from 10th September until 18th September 2018.

As for the Task Force meetings, the Ministry convened four meetings as follows:

For the Water Pollution Sub-sector,

1 The Fifth Task Force Meeting on 19th October 2018

- ✓ Seven officers including the Deputy Director General of GDEP, the Director of the Water Quality Management Department, Director of Inspection and Law Enforcement, Deputy Director of Water Quality Management Department, Deputy Director of Laboratory Department of GDEP participated in the three hours meeting to discus the training arrangement on Inspection and Wastewater Treatment.

On the EIA Sub-sector,

1 The Seventh Task Force meeting on 11th June 2018

- ✓ Major officers of the Department of EIA participated in the meeting to discuss the content of full EIA and Initial EIA of the Road Sector Guideline. The names of participants are not recorded in the minutes.

2 The Eighth Task Force Meeting on 30th August 2018

- ✓ The participants discussed the details of the content of the sectoral guidelines. The names of the participants are not recorded in the minutes.

3 The Ninth Task Force Meeting on 28th November 2018.

- ✓ Nine officers of the department of EIA participated in the meeting to discuss the EIA guidelines and arrangement for the Public Hearings on the guidelines. The participants included: the Deputy Directors, the Chief Officers and the Vice-Chief Officers of EIA Department.

4 The Tenth Task Force Meeting on 17th December 2018

- ✓ Comments and feedbacks on the guidelines were reviewed.

As for the training, followings were designed and organized.

1 Training for Wastewater on 4th December,

2 Wastewater treatment plant in factory at Svay Rieng on 5th to 6th December 2018

1-1 Progress of Activities

Activity 1.1 Develop Task Force to Review Law and Regulation

Two Task forces were formally established separately for EIA and Water in 2017. Note that the task forces concurrently act as the task forces to discuss the issues and activities under the Output. The task force meetings convened during the evaluation period are presented above.

Activity 1.2 Finalize Items for Output 1

With progressive elaboration process, the deliverables of the industrial water pollution control components have been further broken down. All the project deliverables are itemized below. The documents underlined below are those falling under Output1.

1) EIA Review Manual

2) EIA/IEE Sector Guidelines on the following sectors:

- ✓ Road
- ✓ Railway
- ✓ Industry
- ✓ Special Economic Zone/Land Development.

3) The Water Pollution Control sub-decree

4) Prakas on Registration of Laboratory for Water Quality Measurement

5) Prakas on Official Methods of Water Quality Measurement for Regulatory Purpose

6) Pollution Source Category by Industrial Classification

7) Guideline for prevention of chemical leakage to underground

8) Guidelines on Factory Inspection

8) Guidelines on Wastewater Treatment Processes and Facilities

9) Industrial Water Pollution Control Guidelines on the following sectors:

i. Textile Processing Industry
ii. Slaughterhouse and Meat Packing Industry
iii. Beverage Industry
iv. Piggery Industry

Activity 1.3 Review and Draft Revised Law and Regulation

The review of the Sub-decree on Water Pollution has been undertaken since the commencement of the project. Majority of the issues identified and raised through the Task Force Meetings and the Consultation Meetings have been integrated in the draft revised Sub-decree on Water Pollution Control.

Activity 1.4 Consultation with Stakeholders

No consultation meeting was convened during the evaluation period. Other consultation meetings will be convened in the coming period to disclose the information on the status and acquire any comments and feedbacks from the stakeholders.

Activity 1.5 Finalize Draft Laws and Regulations

The followings will be discussed and finalized in the next Task Force meeting scheduled in March 2019.

1) The Water Pollution Control sub-decree
2) Prakas on Registration of Laboratory for Water Quality Measurement
3) Prakas on Official Methods of Water Quality Measurement for Regulatory Purpose
4) Pollution Source Category by Industrial Classification
5) Guideline for prevention of chemical leakage to underground

Activity 1.6 Prepare Summary Report for Output 1

The activity will be performed most likely in the year 2019.

Activity 2.1 Develop Task Force to develop guidelines and procedure

The two tasks forces established on EIA and Water Pollution as reported in the part of Activity 1.1. would concurrently act as the task forces to discuss the issues and activities under Output 2.

Activity 2.2 Finalize Items for Output 2

As reported in the previous evaluation, the items covered for generating Output 2 were agreed. The deliverables are presented in the section on Activity 1.2. However, appropriate policy instruments for formalization of the guidelines, manuals and other types

of documents will be discussed and identified throughout the further consultation process. For clarification purpose, the followings provide the project deliverables which may be formalized as guidelines and manuals.

1) EIA Review Manual
2) EIA/IEE Sector Guidelines on the following sectors:
- ✓ Road
- ✓ Railway
- ✓ Industry
- ✓ Special Economic Zone/Land Development.

3) Guidelines on Factory Inspection
4) Guidelines on Wastewater Treatment Processes and Facilities
5) Industrial Water Pollution Control Guidelines on the following sectors:

i. Textile Processing Industry
ii. Slaughterhouse and Meat Packing Industry
iii. Beverage Industry
iv. Piggery Industry

Activity 2.3 Develop draft Guideline and Procedures

1) EIA Review Manual

The Department of EIA (DEIA) as the members of the Task Force undertook the first review of the draft manual in October 2018. The English version of the manual was revised by integrating the comments and feedbacks. It is ready to be translated the Khmer version.

2) EIA/IEE Sector Guidelines on Road

The draft guideline is complete.

3) EIA/IEE Sector Guidelines on Railway

The draft guideline is complete.

4) EIA/IEE Sector Guidelines on Industry

The Department of EIA (DEIA) as the members of the Task Force undertook the first review of the draft manual in October 2018. The English version of the manual was revised by integrating the comments and feedbacks. It is ready to be translated the Khmer version.

5) EIA/IEE Sector Guidelines on Special Economic Zone/Land Development.

The Department of EIA (DEIA) as the members of the Task Force undertook the first review of the draft manual in October 2018. The English version of the manual was revised by integrating the comments and feedbacks. It is ready to be translated the Khmer version.

6) Guidelines on Factory Inspection

The draft guidelines will be completed in December 2018 for translation before issuance to counterparts for review and comments.

7) Guidelines on Wastewater Treatment Processes and Facilities

The final version of the document will be issued in December 2018.

8) Industrial Water Pollution Control Guidelines on Textile Processing Industry

The final version of the document will be issued in December 2018.

9) Industrial Water Pollution Control Guidelines on Slaughterhouse and Meat Packing Industry

The final version of the document will be issued within December 2018.

10) Industrial Water Pollution Control Guidelines on Beverage Industry

The final version of the document will be issued within December 2018.

11) Industrial Water Pollution Control Guidelines on Piggery Industry

The final version of the document will be issued within December 2018.

Activity 2.4 Consultation with Stakeholders

It was previously scheduled to convene the first consultation meeting on EIA in September 2018. However, it is modified to accommodate the delay of translation arrangement. Now it is scheduled to take place before the end of the first quarter of the year 2019.

Activity 2.5 Finalize draft Guidelines and Procedure

The activity will be performed most likely in the latter half of the year 2019.

Activity 2.6 Disseminate the finalized and/or draft guideline and procedure to stakeholders

The activity will be performed in the years 2019 and 2020.

Activity 2.7 Prepare Summary Report for output 2

The activity will be performed most likely in 2019.

Activity 3.1 Review the institutional arrangements of GDEP to clarify the scope of the training

The discussions with the technical departments under GDEP were conducted to understand the organisational capacity and the needs for training related to human resource development.

Activity 3.1 Finalize content/subject of training program

As reported in the previous evaluation, the training program was finalized. It is now under

implementation stage.

Activity 3.2 Prepare the syllabus including contents/subjects of training program

As reported in the previous evaluation, the syllabus was developed. The training syllabus will be modified and updated when necessary.

Activity 3.3 Organize seminars

As reported in the previous monitoring, a set of tutorial classes and workshops/filed exercises were designed and organized in an implementable manner.

Activity 3.4 Conduct Study tours

During the evaluation period, a study tour to Thailand was conducted for a period of nine (9) days in total. The main issues learned in Thailand include: 1) EIA Project Implementation, 2) Industrial Waste Management, 3) Odour management and 4) PRTR among others. The sites visited include: 1) Map Ta Phut Industrial Estate, Rayong Province, 2) Sa Kaeo Industrial Estate in Special Economic Zones. GDEP prepared a separate report of the tour.

Activity 3.5 Develop training programs reflecting the obtained results from seminars and study tours

A pre-and post-evaluation of seminars are carried out by using a questionnaire to evaluate their level of understanding on the issues in the training course delivered. The findings will be used for designing the training.

Activity 3.6 Implement the developed training program

In December 2018, following courses were convened.

1) Training for Wastewater treatment facility Guideline

2) Wastewater treatment plant visit at Svay Rieng on 05-06 December 2018

Activity 3.7 Evaluate the implemented training program and prepare the next training

A pre-and post-evaluation of seminars are carried out.

Activity 3.8 Prepare summary report of output 3

The activity will be performed most likely in 2019.

1-2 Achievement of Output

The project is designed to achieve the following three outputs: 1) Legal documents related to EIA and pollution control focusing on water are organized; 2) Technical issues and procedures related to EIA and pollution control focusing on water are clarified and shared with GDEP staff as well as other stakeholders and 3) Capacity of GDEP and related departments under GDEP in the field of Environmental Management is enhanced. At the time of this monitoring at the end of May 2018, the project is on the track of producing the intended outputs.

1-3 Achievement of the Project Purpose

The purpose of the project is defined as “GDEP capacity to prevent, reduce and mitigate environmental pollution focusing on EIA and water is strengthened”. At the time of this monitoring, the project is on the track of achieving the purpose.

1-4 Changes of Risks and Actions for Mitigation

The general election in 2018 is over without any negative impacts on the project.

Although the approval of the Environment and Natural Resource Code was significantly delayed, it is expected to be complete most likely in the second quarter of the year 2019 according to the latest correspondence with the UNDP officer in charge of the Environmental Governance Reform Project.

Thus, there is no apparent risk involving in the project in the foreseeable future, however, the project will proceed to the new stage for consultation and approval of the Sub-decree and relevant guidelines, which would require cautious monitoring.

1-5 Progress of Actions undertaken by JICA

To minimize the potential risks, the JICA team will liaise closely with GDEP to see the development of the consultation and approval process.

1-6 Progress of Actions undertaken by Gov. of Cambodia

To minimize the potential risks, GDEP will liaise closely with the JICA Team to report and discuss the measure to address potential issues.

1-8 Progress of Environmental and Social Considerations (if applicable)

The project was fundamentally designed to conserve and protect environment. Any adverse environmental impacts are not identified/anticipated. When such impacts are identified, appropriate consideration for environment will be exercised.

1-7 Progress of Considerations on Gender/Peace Building/Poverty Reduction (if applicable)

The primary environmental media of the project is water. The project is designed to provide fundamental conditions for improving water quality and thus to contribute to increasing safe water accessibility.

- Cambodia has some of the worst health indicators in the region. Lack and poor access to clean water remains one of the major causes. Poor and vulnerable segment of the society including women and children are more disadvantaged especially in rural part as they are often responsible for promoting hygiene and sanitation in their families. According to time-use surveys conducted for preparation of a project funded by ADB, it was found that the burden of collecting and managing rural household water supply falls primarily on women and children.
- Meanwhile, Cambodia has limited infrastructure to respond to the ongoing and anticipated stress imposed by climate change. Rising temperatures and more extreme weather events cost lives, undermine environmental determinants of health, including clean air and water.

1-8 Other remarkable/considerable issues related/affect to the project (such as other JICA's projects, activities of counterparts, other donors, private sectors, NGOs etc.)

2 Delay of Work Schedule and/or Problems (if any)

2-1 Detail

The project was implemented with minor modifications of the implementation schedule. The changes in its schedule was resulted from an unexpected longer time for: 1) the coordination of the travel arrangement for the counterpart training in Thailand after the temporal discontinuation of the project activities during the general election in July and 2) the contract arrangement and translation of the deliverables in the EIA sub-sectors. However, the time for such arrangement would not have been avoided to ensure earlier internalization of the new aspects in the pollution control in Cambodia. The delay would not have significant impacts on the overall implementation schedule because it is absorbable due to the ample time before the closure of the project in the year 2020.

2-2 Cause

As stated above.

2-3 Action to be taken

As stated above.

2-4 Roles of Responsible Persons/Organization (JICA, Gov. of●●,etc.)

Not applicable.

3 Modification of the Project Implementation Plan

3-1 PO

PO have been modified as the Project Design Matrix was revised. The details of the modification is provided in the Progress Report 1.

3-2 Other modifications on detailed implementation plan

(Remarks: The amendment of R/D and PDM (title of the project, duration, project site(s), target group(s), implementation structure, overall goal, project purpose, outputs, activities, and input) should be authorized by JICA HDQs. If the project team deems it necessary to modify any part of R/D and PDM, the team may propose the draft.)

The Project Design Matrix was revised. Details of the modification is provided in the main text of the Progress Report 1.

4 Current Activities of Gov. of Cambodia to Secure Project Sustainability after its Completion

During the evaluation period, GDEP discussed the exit strategy/sustainability options framed around the following considerations:

- The need to sustain funding for operation of the Sub-Decree on Water Quality and implementation of the Environment and Natural Resources Code:
- The need to devise strategies for bridging the financial and technical gaps after the completion of the project.

The critical issues are summarised in the following three items

1) Limited Accuracy and reliability of Environmental Laboratory Testing Results,
2) Limited Capacity for Operation of the Sub-Decree on Water Quality and
3) Need for development of Legislative framework and Intuitional instruments for implementation of the Environment and Natural Resources Code.

GDEP also considered the need to meet SDG 3.9 and SDG 6.3, by the 2030 deadlines and, at the same time, to achieve the aim to become a an upper-middle income country by the Year 2030. It also recognized that a mere continuation of current intervention will not suffice to meet the said goals.

II. Project Monitoring Sheet I & II *as Attached*

TO CR of JICA Cambodia OFFICE

Project Monitoring Sheet

Project Title : THE PROJECT FOR EFFECTIVE IMPLEMENTATION OF EIA AND POLLUTION CONTROL THROUGH THE CAPACITY DEVELOPMENT OF MOE

Version of the Sheet: Ver.1 (Term: 1st January 2019 until 31st May 2019)

Name: Heng Nareth
Title: Project Director
Name: Yasuhiko Muramatsu
Title: Team Leader

Submission Date: 1st June 2019

I. Summary

1 Progress

1-1 Progress of Inputs

This project monitoring sheet covers the progress achieved in the period from 1st January 2019 until 31st May 2019. The cumulative achievement and its figures up to the end of May 2019 are also provided wherever appropriate and necessary.

Inputs by the Japanese Side

A total of 4.96 person-months (P-M) of experts has been mobilized in Cambodia during the evaluation period. A total cumulative P-M thus amounts to 38.5 P-M, which is equivalent to 66% of the total P-M at 59.03 P-M.

The cumulative P-M of each of the core experts is as follows: 1)the Team Leader/Environmental Management 1 with 3.4 P-M (68%), 2) Deputy Team Leader/Environmental Management 2 with 3.07 P-M (44%), 3) EIA with 4.53 P-M (76%), 4) Pollution Control and Regulations 1 with 6.43 P-M (91%), 5) Pollution Control and Regulations 2 with 3.47 P-M (86%), 6) Training Planner 1 with 3.63 P-M (51%), 7) Water Environment/ Training Planner 2/Coordinator with 7.57 P-M (65%) and 8) Water Environment (Inspection) with 3.77 P-M (66%). The figures in the parenthesis indicate the percentage progress of respective expert in terms of P-M. Refer to the assignment schedule attached to the Progress Report III for more details and other experts.

Two Cambodian specialists for the support of project implementation were contracted by the early August 2017 for organizing, filing and retrieving records of meetings, communicating with various departments and other agencies, scheduling appointments, and coordinating travel and accommodations.

Inputs by the Cambodian Side

As for the Task Force meetings, GDEP convened the Sixth (6th) Task Force meeting on the Water Pollution Sub-sector on 4th March 2019 to finalize the Draft Sub-decree on Water Pollution Control. On the EIA Sub-sector, GDEP convened a public Consultation meeting on 19th March 2019 to discuss the EIA/IEE Sector Guidelines on the Road and Railway Subsectors.

GDEP developed and launched its first website in the first quarter of the year 2019, through which GDEP would be able to disseminate the project information to the general public.

GDEP has acquired the information on factory registration from MIH. The information gathered by GDEP through filing application document and records of inspection were integrated with the MIH's factory registration record to develop a prototype of the computerized pollution source inventory. GDEP has initiated a field verification of the data is an on-going process to gather vital information for analysis on geographical location and relative intensity of pollution sources such as parameters, their concentration and volume of discharge.

GDEP undertook an assessment of PM2.5 in collaboration with ITC under a Memorandum of Understanding.

1-1 Progress of Activities

Activity 1.1 Develop Task Force to Review Law and Regulation

Two Task forces were formally established separately for EIA and Water in 2017. Note that the task forces concurrently act as the task forces to discuss the issues and activities under the Output. The task force meetings convened during the evaluation period are presented above.

Activity 1.2 Finalize Items for Output 1

With progressive elaboration process, the deliverables of the industrial water pollution control components have been further broken down. All the project deliverables are itemized below. Among the nine (9) documents below, Items numbered 3), 4), 5) and 6) may fall under the deliverables of Output 1.

1) EIA Review Manual

2) EIA/IEE Sector Guidelines on the following sectors: Road, Railway, Industry and Special Economic Zone/Land Development.

3) The Water Pollution Control sub-decree

4) Prakas on Registration of Laboratory for Water Quality Measurement

5) Prakas on Official Methods of Water Quality Measurement for Regulatory Purpose

6) Pollution Source Category by Industrial Classification
7) Guideline for prevention of chemical leakage to underground
8) Guidelines on Factory Inspection
8) Guidelines on Wastewater Treatment Processes and Facilities
9) Industrial Water Pollution Control Guidelines on the following sectors:
i. Textile Processing Industry
ii. Slaughterhouse and Meat Packing Industry
iii. Beverage Industry
iv. Piggery Industry

It was decided to integrate the Industrial Water Pollution Control Guidelines on the four sectors into the Guidelines on Wastewater Treatment Processes and Facilities as its appendixes in March 2019.

Activity 1.3 Review and Draft Revised Law and Regulation

The review of the Sub-decree on Water Pollution has been undertaken since the commencement of the project. Majority of the issues identified and raised through the Task Force Meetings and the Consultation Meetings have been integrated in the draft revised Sub-decree on Water Pollution Control. The members of the relevant Task Force discussed and finalized the draft Sub-decree and pertinent guidelines on 4th March 2019.

Activity 1.4 Consultation with Stakeholders

No consultation meeting relevant to Output 1 was convened during the evaluation period. Consultation meetings will be convened before the finalization of the Sub-decree and relevant guidelines.

Activity 1.5 Finalize Draft Laws and Regulations

The followings were discussed and finalized in the Task Force meeting on 4th March 2019. GDEP/MOE will finalize and authorize them before the end of 2020.

1) The Water Pollution Control sub-decree, 2) Prakas on Registration of Laboratory for Water Quality Measurement, 3) Prakas on Official Methods of Water Quality Measurement for Regulatory Purpose, 4) Pollution Source Category by Industrial Classification and 5) Guideline for prevention of chemical leakage to underground.

Activity 1.6 Prepare Summary Report for Output 1

The activity will be performed most likely in the year 2020.

Activity 2.1 Develop Task Force to develop guidelines and procedure

The two tasks forces established on EIA and Water Pollution as reported in the part of Activity 1.1. would concurrently act as the task forces to discuss the issues and activities under Output 2.

Activity 2.2 Finalize Items for Output 2

As reported in the previous evaluation, the items covered for generating Output 2 were agreed. The deliverables are presented in the section on Activity 1.2. However, appropriate policy instruments for formalization of the guidelines, manuals and other types of documents will be discussed and identified throughout the further consultation process.

Activity 2.3 Develop draft Guideline and Procedures

1) EIA Review Manual

The Department of EIA (DEIA) as the members of the Task Force undertook the first review of the draft manual in October 2018. The English version of the manual was revised by integrating the comments and feedbacks.

The following guidelines was subject to the Public Consultation meeting in March 2019.

1) EIA/IEE Sector Guidelines on Road
2) EIA/IEE Sector Guidelines on Railway

The comments and feedbacks on the Guidelines raised in the Public Consultation meeting will be integrated before the end of June 2019. The Guideline in English will be translated into Khmer. A follow-up consultation meeting with the participation of private consulting firm will be convened most likely in August 2019 to review and discuss the Khmer Version of the guidelines. The guidelines will be finalized for approval by the minister after integration of the comments and feedbacks.

The comments and feedbacks in the Public Consultation meeting on 19th March will also be reviewed and analysed for applicability to the following guidelines.

2) EIA/IEE Sector Guidelines on Industry
3) EIA/IEE Sector Guidelines on Special Economic Zone/Land Development.

After integration of them, the guidelines will be translated into Khmer. A stakeholder meeting to discuss the guidelines will be convened most likely in September 2019.

4) Guidelines on Factory Inspection

The draft of the Guidelines on Factory Inspection, renamed Factory Inspection Manual, was completed on 27 February 2019. The Khmer version was distributed to the participants of the seminar lecture on 11th March 2019.

5) Guidelines on Wastewater Treatment Processes and Facilities

The Guidelines on Wastewater Treatment Processes and Facilities were translated into

Khmer and the Khmer version was distributed to the participants of the seminar. The following guidelines are being integrated into the Guidelines on Wastewater Treatment Processes and Facilities as its appendixes: 1) Industrial Water Pollution Control Guidelines on Textile Processing Industry; 2) Industrial Water Pollution Control Guidelines on Slaughterhouse and Meat Packing Industry; 3) Industrial Water Pollution Control Guidelines on Beverage Industry and 4) Industrial Water Pollution Control Guidelines on Piggery Industry.

Activity 2.4 Consultation with Stakeholders

It was previously scheduled to convene the first consultation meeting on EIA in September 2018. However, it is modified to accommodate the delay of translation arrangement.
A Public Consultation meeting on the EIA/IEE Sector Guidelines on Road and Railway was convened on 19th March 2019.

Activity 2.5 Finalize draft Guidelines and Procedure

The activity will be performed most likely in the latter half of the year 2019.

Activity 2.6 Disseminate the finalized and/or draft guideline and procedure to stakeholders

The activity will be performed in the years 2019 and 2020.

Activity 2.7 Prepare Summary Report for output 2

The activity will be performed most likely in 2019.

Activity 3.1 Review the institutional arrangements of GDEP to clarify the scope of the training

The discussions with the technical departments under GDEP were conducted to understand the organisational capacity and the needs for training related to human resource development.

Activity 3.1 Finalize content/subject of training program

As reported in the previous evaluation, the training program was finalized. It is now under implementation stage.

Activity 3.2 Prepare the syllabus including contents/subjects of training program

As reported in the previous evaluation, the syllabus was developed. The training syllabus

are being modified and updated in the course of the project when necessary.

Activity 3.3 Organize seminars

As reported in the previous monitoring, a set of tutorial classes and workshops/filed exercises were designed and organized in an implementable manner.

Activity 3.4 Conduct Study tours

A study tour to Vietnam will take place in the third Quarter of the Year 2019. It is now under planning stage.

Activity 3.5 Develop training programs reflecting the obtained results from seminars and study tours

A pre-and post-evaluation of seminars are carried out by using a questionnaire to evaluate their level of understanding on the issues in the training course delivered. The findings will be used for designing the training.

Activity 3.6 Implement the developed training program

In the evaluation period, the following courses were convened.

1. A seminar lecture on Wastewater Treatment Processes and Facilities Guidelines as continuation of 4th December 2018.
2. A seminar lecture on the Factory Inspection Manual and Viewpoints on Factory Inspection guidelines was Conducted on 11th March
3. A seminar lecture on Wastewater Treatment Processes and Facilities Guidelines was conducted on 18th March for other government agencies; representative staff from Ministry of Industry and Handicraft, Ministry of Public Works and Transport, Phnom Penh Water Supply Authority, Cambodian Chamber of Commerce, Institute of Technology of Cambodia, and Garment Manufacturing Association of Cambodia (GMAC).

Activity 3.7 Evaluate the implemented training program and prepare the next training

A pre-and post-evaluation of seminars are carried out.

Activity 3.8 Prepare summary report of output 3

The activity will be performed most likely in 2020.

1-2 Achievement of Output

The project is designed to achieve the following three outputs: 1) Legal documents related to EIA and pollution control focusing on water are organized; 2) Technical issues and procedures related to EIA and pollution control focusing on water are clarified and shared with GDEP staff as well as other stakeholders and 3) Capacity of GDEP and related departments under GDEP in the field of Environmental Management is enhanced. At the time of this monitoring, the project is on the track of producing the intended outputs.

1-3 Achievement of the Project Purpose

The purpose of the project is defined as “GDEP capacity to prevent, reduce and mitigate environmental pollution focusing on EIA and water is strengthened”. At the time of this monitoring, the project is on the track of achieving the purpose.

1-4 Changes of Risks and Actions for Mitigation

No particular risks are identified.

1-5 Progress of Actions undertaken by JICA

No Specific Actions are taken.

1-6 Progress of Actions undertaken by Gov. of Cambodia

To minimize the potential risks, GDEP liaises closely with the JICA Team to report and discuss the measure to address potential issues.

1-8 Progress of Environmental and Social Considerations (if applicable)

The project was fundamentally designed to conserve and protect environment. Any adverse environmental impacts are not identified/anticipated. When such impacts are identified, appropriate consideration for environment will be exercised.

1-7 Progress of Considerations on Gender/Peace Building/Poverty Reduction (if applicable)

The primary environmental media of the project is water. The project is designed to provide fundamental conditions for improving water quality and thus to contribute to increasing safe water accessibility of all the people of Cambodia.

1-8 Other remarkable/considerable issues related/affect to the project (such as other JICA's projects, activities of counterparts, other donors, private sectors, NGOs etc.)

1 *Environmental Governance Reform (EGR) for Sustainable Development* is a UNDP funded project for MoE. The key outputs of the EGR include 1) the modernisation of the Ministry of Environment; 2) the institutional strengthening of the National Council

of Sustainable Development (NCSD) to facilitate inter-ministerial political dialogues; 3) the development of legal framework including Environment and Natural Resource Code (ENR Codes) that clarify roles and mandates of different agencies in governing natural resources and environment; and 4) the development of Integrated Ecosystem Mapping. All the deliverables of the JICA's project on water and EIA are designed in consonance with the ENR Codes. Approval/authorization of the ENR codes is one of the key elements in achieving the project goals.

2 *The Preparatory Survey on the project for Sewerage System Development in the Phnom Penh Capital City* is an on-going project to develop sewerage system. This parallel project is indispensable for achieving the SDG 6 for ensuring availability and sustainable management of water and sanitation for all in Cambodia. Close liaison between the members are taking place to expedite the approval process of the sewerage sector investment and thus to ensure jointly achieving the goal.

3 *The Project for Capacity Enhancement on Environmental Social Considerations in Implementing Agency in Road Sector in Cambodia* is designed to enhance the capacity of the Ministry of Public Works and Transport in managing the environment and social dimensions of the road sector investment projects. The members of the teams have kept abreast of the major activities and developments each other by having regular meetings to exchange information.

4 *The project for Capacity Development for Sewerage Management of Phnom Penh Capital Administration and Ministry of Public Works and Transport* is a JICA funded four(4) year project for development of capacity in managing sewerage with the major objective to strengthen fundamental structure on sewerage management of the Ministry of Public Works and Transport (MPWT) and the Department of Public Works and Transport (DPWT) under Phnom Penh Capital City Government. The project is designed to achieve the objective by generating two outputs: 1) the legal and institutional settings of MPWT on sewerage strengthened and 2) the legal and institutional settings of DPWT on sewerage strengthened.

2 Delay of Work Schedule and/or Problems (if any)

2-1 Detail

No significant issues in managing project timeline has been identified. However, the approval and authorization of the followings have to be closely monitored.

1 EIA/IEE Sector Guidelines on the Road, Railway, Industry and Special Economic Zone/Land Development.

3) The Water Pollution Control sub-decree and accompanying guidelines.

2-2 Cause
Not applicable.

2-3 Action to be taken
Not applicable.

2-4 Roles of Responsible Persons/Organization (JICA, Gov. of●●,etc.)
Not applicable.

3 Modification of the Project Implementation Plan

3-1 PO
PO have been modified as the Project Design Matrix was revised. The details of the modification is provided in the Progress Report 1.
3-2 Other modifications on detailed implementation plan
(Remarks: The amendment of R/D and PDM (title of the project, duration, project site(s), target group(s), implementation structure, overall goal, project purpose, outputs, activities, and input) should be authorized by JICA HDQs. If the project team deems it necessary to modify any part of R/D and PDM, the team may propose the draft.)
Not applicable.

4 Current Activities of Gov. of Cambodia to Secure Project Sustainability after its Completion

During the evaluation period, GDEP discussed the exit strategy/sustainability options. In the previous stage of the project, GDEP formulated a project to enhance its capacity beyond the timeframe of the project with a proposed project titled: Environmental Management Project in Cambodia.
The design of the project was reviewed and modified in this evaluation period to accommodate development needs by integrating an additional component for increasing transparency and accountability in environmental regulation for support of Private Sector Investment.
The following is a brief description of the revised project design.
The purpose of the Project is to increase Capacity of GDEP for controlling Point Source Pollution in a manner to sustain long-term business confidence for growth-enhancing private sector investment. The said purpose is achieved by generating following four outputs: 1) Governance in environmental management improved in partnership with private sectors; 2) Legislative framework and Intuitional instruments for implementation of the

Environment and Natural Resources Code strengthened; 3) The Sub-Decree on Water Pollution Control Instituted in an effective and efficient manner; and 4) Accuracy and reliability of Environmental Laboratory Testing Results Improved. The project will contribute to developing and strengthening a foundation to support the achievement of SDG 9.3, SDG 3.9 and SDG 6.3.

II. Project Monitoring Sheet I & II *as Attached*

TO CR of JICA　Cambodia　OFFICE

Project Monitoring Sheet

Project Title : THE PROJECT FOR　EFFECTIVE IMPLEMENTATION OF EIA AND POLLUTION CONTROL THROUGH THE CAPACITY DEVELOPMENT OF MOE

Version of the Sheet: Ver.1（Term: 1st June 2019 until 31st December 2019）

Name: Heng Nareth
Title: Project Director
Name: Yasuhiko Muramatsu
Title:　Team Leader

Submission Date: 1st January 2020

I. Summary

1　Progress

1-1 Progress of Inputs

This project monitoring sheet covers the progress achieved in the period from 1st June 2019 until 31st December 2019. The cumulative achievement and its figures are also provided wherever appropriate and necessary.

Inputs by the Japanese Side

A total of 3.93 person-months (P-M) of experts has been mobilized in Cambodia during the evaluation period. A total cumulative P-M thus amounts to 43.77 P-M, which is equivalent to 74% of the total P-M at 59.03 P-M.

The cumulative P-M of each of the core experts is as follows: 1)the Team Leader/Environmental Management 1 with 4.0 P-M (80%), 2) the Deputy Team Leader/Environmental Management 2 with 3.70 P-M (53%), 3) the EIA with 4.53 P-M (76%), 4) the Pollution Control and Regulations 1 with 7.0 P-M (100%), 5) the Pollution Control and Regulations 2 with 3.47 P-M (86%), 6) the Training Planner 1 with 5.7 P-M (95%), 7) the Water Environment/ Training Planner 2/Coordinator with 7.57 P-M (65%) and 8) the Water Environment (Inspection) with 4.7 P-M (82%). The figures in the parenthesis indicate the percentage progress of respective expert in terms of P-M. Refer to the assignment schedule attached to the Progress Report V for more details and other experts.

Two Cambodian specialists for the support of project implementation were contracted by the early August 2017 for organizing, filing and retrieving records of meetings, communicating with various departments and other agencies, scheduling appointments, and coordinating travel and accommodations.

Inputs by the Cambodian Side

MOE convened the fourth Joint Coordination Committee meeting on 17th June 2019 to discuss the Progress Report (IV) with the participation of the major officials including H.E.Mr.Eang Sophalleth, the Secretary of State of the Ministry of Environment, who gave an opening remark. The participants included nine (9) officers of GDEP and ten (10) officers of relevant ministries such as the Ministry of Industry and Handicraft, Mines and Energy and Economy and Finance, among others.

The officers of the Air Quality and Noise Management under GDEP participated in and completed the monitoring campaign of Particulate Matters (PM) in Phnom Penh; convened a seminar on 18th October 2019. A total of thirty (30) officers participated in the seminar to discuss the activity of PM monitoring.

MOE convened an inter-departmental review meeting on the Water Pollution Control sub-decree on 3rd December 2019.

1-1 Progress of Activities

Activity 1.1 Develop Task Force to Review Law and Regulation

Two Task forces were formally established separately for EIA and Water in 2017. Note that the task forces concurrently act as the task forces to discuss the issues and activities under the Output. The task force meetings convened during the evaluation period are presented above.

Activity 1.2 Finalize Items for Output 1

All the project deliverables agreed between the GDEP and the JICA Team are itemized below. They are categorized according to the nature and project outputs. Through the finalization process of the documents, some of them may be realigned and re-categorized for convenience and practical purpose.

The deliverables to generate Output 1

1) The Water Pollution Control sub-decree
2) Prakas on Registration of Laboratory for Water Quality Measurement
3) Prakas on Official Methods of Water Quality Measurement for Regulatory Purpose
4) Pollution Source Category by Industrial Classification

The deliverables to generate Output 2

1) EIA Review Manual
2) EIA/IEE Sector Guidelines on the following sectors: Road, Railway, Industry and Special Economic Zone/Land Development.
3) Guideline for prevention of chemical leakage to underground

4) Guidelines on Factory Inspection
5) Guidelines on Wastewater Treatment Processes and Facilities
As reported in the previous monitoring, the Industrial Water Pollution Control Guidelines will be integrated into these guidelines in the Appendix.

Activity 1.3 Review and Draft Revised Law and Regulation

The review of the Sub-decree on Water Pollution has been undertaken since the commencement of the project. Majority of the issues identified and raised through the Task Force Meetings and the Consultation Meetings have been integrated in the draft revised Sub-decree on Water Pollution Control. The members of the relevant Task Force discussed and finalized the draft Sub-decree and pertinent guidelines on 4th March 2019. The Sub-decree was translated into Khmer before October 2019, which was further subject to a Task Force meeting in the middle of October 2019.

Activity 1.4 Consultation with Stakeholders

An Inter-department Review Meeting on the Sub-decree on Water Quality Control was convened on 3rd December 2019. Among the articles in the sub-decree, Chapter 6 and 7 on Penalty was focused to be discussed on its validity and enforceability. The GDEP will bring the issue to the Ministry of Justice, most likely in the early January 2020. A technical issue discussed in the meeting included the harmonization of the standards with other standards set forth by the Ministry of Industry and Handicraft, the Ministry of Water Resources and Meteorology, the Ministry of Public Work and Transport. GDEP is planning to convene a consultation meeting in January 2020.

Activity 1.5 Finalize Draft Laws and Regulations

The MOE has entered the finalization process of the draft laws and regulations upon completion of the translation from the English version into Khmer.

Activity 1.6 Prepare Summary Report for Output 1

The activity will be performed most likely in the year 2020.

Activity 2.1 Develop Task Force to develop guidelines and procedure

The two tasks forces established on EIA and Water Pollution as reported in the part of Activity 1.1. would concurrently act as the task forces to discuss the issues and activities under Output 2.

Activity 2.2 Finalize Items for Output 2

As reported in the previous evaluation, the items covered for generating Output 2 were

agreed. The deliverables are presented in the section on Activity 1.2. However, appropriate policy instruments for formalization of the guidelines, manuals and other types of documents will be discussed and identified throughout the further consultation process.

Activity 2.3 Develop draft Guideline and Procedures

1) EIA Review Manual

The manual was translated into Khmer, which will be finalized when the sector guidelines are complete, most likely in the middle of 2020.

2) EIA Sector Guidelines

For the following sector guidelines, they are available in English and Khmer. MOE continued the review and modification of the guidelines to make them finalized before April 2020. They will be subject to the finalization and authorization process after the completion.

1) EIA/IEE Sector Guidelines on Road
2) EIA/IEE Sector Guidelines on Railway

For the following guidelines, they are available in English and Khmer. MOE continued the review and modification of the guidelines to make them finalized before September 2020. They will be subject to the finalization and authorization process after the completion.

3) EIA/IEE Sector Guidelines on Industry
4) EIA/IEE Sector Guidelines on Special Economic Zone/Land Development.

The following guidelines are developed and will be finalized before the end of the second quarter of the year 2020.

5) Guidelines on Factory Inspection
6) Guidelines on Wastewater Treatment Processes and Facilities

Activity 2.4 Consultation with Stakeholders

No consultation meeting was convened during the evaluation period.

Activity 2.5 Finalize draft Guidelines and Procedure

As reported above, MOE will proceed to the finalization process for the following guidelines in the year 2020.

1) EIA Review Manual
2) EIA/IEE Sector Guidelines on Road
3) EIA/IEE Sector Guidelines on Railway
4) EIA/IEE Sector Guidelines on Industry
5) EIA/IEE Sector Guidelines on Special Economic Zone/Land Development.
6) Guidelines on Factory Inspection

7) Guidelines on Wastewater Treatment Processes and Facilities

Activity 2.6 Disseminate the finalized and/or draft guideline and procedure to stakeholders

The activity will be performed in the years 2020.

Activity 2.7 Prepare Summary Report for output 2

The activity will be performed most likely in 2020.

Activity 3.1 Review the institutional arrangements of GDEP to clarify the scope of the training

The discussions with the technical departments under GDEP were conducted to understand the organisational capacity and the needs for training related to human resource development.

Activity 3.1 Finalize content/subject of training program

As reported in the previous evaluation, the training program was finalized. It is now under implementation stage.

Activity 3.2 Prepare the syllabus including contents/subjects of training program

As reported in the previous evaluation, the syllabus was developed. The training syllabus are being modified and updated in the course of the project when necessary.

Activity 3.3 Organize seminars

As reported in the previous monitoring, a set of tutorial classes and workshops/filed exercises were designed and organized in an implementable manner.

Activity 3.4 Conduct Study tours

The study tour to Vietnam will take place in the first Quarter of the Year 2020.

Activity 3.5 Develop training programs reflecting the obtained results from seminars and study tours

A pre-and post-evaluation of seminars are carried out by using a questionnaire to evaluate their level of understanding on the issues in the training course delivered. The findings will be used for designing the training.

Activity 3.6 Implement the developed training program

In the evaluation period, the following courses were convened.

MOE convened a seminar lecture on 13 December 2019 to discuss the factory inspection guidelines with the focuses on Textile Processing Industry, Slaughterhouse and Meat Packing Industry, Beverage (may now include milk or dairy) Industry and Piggery Industry.

Activity 3.7 Evaluate the implemented training program and prepare the next training

A pre-and post-evaluation of seminars are carried out.

Activity 3.8 Prepare summary report of output 3

The activity will be performed in 2020.

1-2 Achievement of Output

For the Output 1, the proposed amendment of the Sub-decree on Water Quality Control has been under the process for authorization. GDEP is coordinating with relevant departments to address the issues requiring clarification and modification to make them approved before June 2020. However, it is also noted that authorization *per se* is not the goal of the project. Instead, the smooth and steady transition to the water quality management as mandated under the amended sub-decree should be ensured and pursued.

The technical guidelines and procedures relevant to the water quality management has been under the finalization process as well. Especially those on wastewater management and facilities along with inspection manual will be finalized and the pertinent training for the officers will be provided before the end of the first quarter of the year. Other Guidelines on EIA are still under the process and expected to be complete before the end of the third quarter of the year.

For an indicator on Output 3, Result of water quality monitoring is opened to the public by GDEP, it requires two major conditions to be met: 1) the information on water quality monitoring is collected and compiled; and 2) a tool for providing the information to the public is established. For the water quality information, the officers of water quality control department of GDEP has collected and assembled the information. It will further require review and assessment of the data. As for the tool, GDEP has developed a website of the project, on which the information on water quality may be disclosed to the public. For the purpose of smooth delivery of the information, GIS tools also will be used to allow visual interpretation of the water quality information. A set of training program is now under preparation to equip the officers in operating the GIS.

Pollution source mapping in PP area has been complete. It may be uploaded on the website when GDEP authorize the publication.

Through the development process of the manual and the sector specific guidelines on EIA, the officers of EIA department has increasingly recognized major challenges in effective and efficient processing of EIA approval in a limited time and manpower. The guidelines *per se* will pave the way toward effective delivery of the service by allowing quick response of the officers in familiarizing with the emerging sectors and associated environmental concerns in road, railway, metal industry and SEZ. A training program will be fine-tuned and implemented by the end of the year.

1-3 Achievement of the Project Purpose

Indicator1: GDEP's work on EIA and water pollution control received 20 percent increased confidence from government offices related to the above mentioned fields compared to the level that of the starting point of the project

- ☐ A questionnaire survey will be designed and conducted by the end of the project to assess the changes resulted from the project. The term "confidence" may require elaboration of definitions to this end by reviewing the nature of the derivable; participation of the officers in decision making process.

Indicator2: Transparency of GDEP is increased through regular information disclosure

- ☐ GDEP has launched the website to disclose information. It has been regularly used to notify the people in Phnom Penh on the air quality.
- ☐ The website is also used to deliver information on the major activities and events of the department such as training workshop to enhance awareness on waste emission from various sources such as transport, construction, industry etc.

Indicator3: EIA review and water pollution control related works are carried out in accordance with the development of technical guidelines and procedures

- ☐ The performance indicator will be reviewed and assessed before the end of the project when the sub-decree and guidelines are finalized.

1-1 Changes of Risks and Actions for Mitigation

No particular risks are identified.

1-2 Progress of Actions undertaken by JICA

No Specific Actions are taken.

1-3 Progress of Actions undertaken by Gov. of Cambodia

To minimize the potential risks, GDEP liaises closely with the JICA Team to report and

discuss the measure to address potential issues.

1-8 Progress of Environmental and Social Considerations (if applicable)

The project was fundamentally designed to conserve and protect environment. Any adverse environmental impacts are not identified/anticipated. When such impacts are identified, appropriate consideration for environment will be exercised.

1-4 Progress of Considerations on Gender/Peace Building/Poverty Reduction (if applicable)

The primary environmental media of the project is water. The project is designed to provide fundamental conditions for improving water quality and thus to contribute to increasing safe water accessibility of all the people of Cambodia.

1-5 Other remarkable/considerable issues related/affect to the project (such as other JICA's projects, activities of counterparts, other donors, private sectors, NGOs etc.)

1 *Environmental Governance Reform (EGR) for Sustainable Development* is a UNDP funded project for MoE. The key outputs of the EGR include 1) the modernisation of the Ministry of Environment; 2) the institutional strengthening of the National Council of Sustainable Development (NCSD) to facilitate inter-ministerial political dialogues; 3) the development of legal framework including Environment and Natural Resource Code (ENR Codes) that clarify roles and mandates of different agencies in governing natural resources and environment; and 4) the development of Integrated Ecosystem Mapping. All the deliverables of the JICA's project on water and EIA are designed in consonance with the ENR Codes. Approval/authorization of the ENR codes is one of the key elements in achieving the project goals.

2 *The Preparatory Survey on the project for Sewerage System Development in the Phnom Penh Capital City* is an on-going project to develop sewerage system. This parallel project is indispensable for achieving the SDG 6 for ensuring availability and sustainable management of water and sanitation for all in Cambodia. Close liaison between the members are taking place to expedite the approval process of the sewerage sector investment and thus to ensure jointly achieving the goal.

3 *The Project for Capacity Enhancement on Environmental Social Considerations in Implementing Agency in Road Sector in Cambodia* is designed to enhance the capacity of the Ministry of Public Works and Transport in managing the environment and social dimensions of the road sector investment projects. The members of the teams have kept abreast of the major activities and developments each other by

having regular meetings to exchange information.

4 *The project for Capacity Development for Sewerage Management of Phnom Penh Capital Administration and Ministry of Public Works and Transport (CDSMPP)* is a JICA funded four(4) year project for development of capacity in managing sewerage with the major objective to strengthen fundamental structure on sewerage management of the Ministry of Public Works and Transport (MPWT) and the Department of Public Works and Transport (DPWT) under Phnom Penh Capital City Government. The project is designed to achieve the objective by generating two outputs: 1) the legal and institutional settings of MPWT on sewerage strengthened and 2) the legal and institutional settings of DPWT on sewerage strengthened. During the evaluation period, two meetings were convened at JICA Cambodia and the project office in MOE consecutively to discuss the challenges and measures of CDSMPP.

5 *Establishment of Environmental Conservation Platform of Tonle Sap Lake* is a 5-year project starting from April 2016 to March 2021 implemented under a scheme referred to as SATREPS which stands for Science and Technology Research Partnership for Sustainable Development (SATREPS Tonle Sap Lake). It is a Japanese government program to promote international joint research targeting global issues supported by the Japan Science and Technology Agency (JST) and JICA. Tokyo Institute of Technology and the Institute of Technology of Cambodia are the leading agency of the project. The project is designed to establish state-of-the-art research-oriented structures and facilities in ITC; to promote science-based management to the government of Cambodia; and to develop the Tonle Sap Water Environmental Platform (TSWEP) and make it one of the benchmarks in freshwater ecology and management studies in Southeast Asia. During the evaluation period, a meeting was convened at the office of the Project in MOE to exchange project information. Salient points of the discussion are as follows: 1) the SATREPS Tonle Sap Lake 1) has developed a water quality model covering the area of Tonle Sap Lake, 2) will validate the model by using the water quality monitoring data. The SATREPS Tonle Sap Lake was provided with the following information: parameters and frequencies of water quality monitoring undertaken by MOE. It was proposed to undertake an assessment on nitrogen and phosphate loading by using the model, which will provide key policy lessons.

2 Delay of Work Schedule and/or Problems (if any)

2-1 Detail

No significant issues in managing project timeline has been identified. However, the approval and authorization of the relevant laws and guidelines have to be closely monitored. For the Sub-decree on Water Quality Control, MOE developed an

implementation schedule for finalization and authorization. It is periodically monitored and updated. In the latest schedule, the signing by the Prime Minister is scheduled in April 2020.

2-2 Cause
Not applicable.

2-3 Action to be taken
Not applicable.

2-4 Roles of Responsible Persons/Organization (JICA, Gov. of●●,etc.)
Not applicable.

3 Modification of the Project Implementation Plan

3-1 PO
PO have been modified as the Project Design Matrix was revised. The details of the modification is provided in the Progress Report 1.
3-2 Other modifications on detailed implementation plan
(Remarks: The amendment of R/D and PDM (title of the project, duration, project site(s), target group(s), implementation structure, overall goal, project purpose, outputs, activities, and input) should be authorized by JICA HDQs. If the project team deems it necessary to modify any part of R/D and PDM, the team may propose the draft.)
Not applicable.

4 Current Activities of Gov. of Cambodia to Secure Project Sustainability after its Completion

The proposed project as summarised below is now under consideration for further assistance by the Government of Japan.
The purpose of the Project is to increase Capacity of GDEP for controlling Point Source Pollution in a manner to sustain long-term business confidence for growth-enhancing private sector investment. The said purpose is achieved by generating following four outputs: 1) Governance in environmental management improved in partnership with private sectors; 2) Legislative framework and Intuitional instruments for implementation of the Environment and Natural Resources Code strengthened; 3) The Sub-Decree on Water Pollution Control Instituted in an effective and efficient manner; and 4) Accuracy and reliability of Environmental Laboratory Testing Results

Improved. The project will contribute to developing and strengthening a foundation to support the achievement of SDG 9.3, SDG 3.9 and SDG 6.3.

II. Project Monitoring Sheet I & II *as Attached*

TO CR of JICA　Cambodia　OFFICE

Project Monitoring Sheet

Project Title : THE PROJECT FOR　EFFECTIVE IMPLEMENTATION OF EIA AND POLLUTION CONTROL THROUGH THE CAPACITY DEVELOPMENT OF MOE

Version of the Sheet: Ver.1（Term: 1st January 2020 until 31st May 2020）

Name: Heng Nareth
Title: Project Director
Name: Yasuhiko Muramatsu
Title:　Team Leader

Submission Date: 1st June 2020

I. Summary

1　Progress

1-1 Progress of Inputs

This project monitoring sheet covers the progress achieved in the period from 1st January 2020 until 31st May 2020. The cumulative achievement and its figures are also provided wherever appropriate and necessary.

Inputs by the Japanese Side

A total of 2.6 person-months (P-M) of experts has been mobilized in Cambodia during the evaluation period. To continue to make progress in achieving the project goals in the midst of the COVID-19 pandemic, a total of 6.4 P-M of the services in Cambodia has been reallocated to those in Japan to operate project activities remotely. For the details of the arrangement, please refer to the section on “Changes of Risks and Actions for Mitigation” of this monitoring sheet along with the pertinent section of the Progress Report VI. Accordingly, an additional 1.05 P-M has been mobilized in Japan to support project operation remotely. A total cumulative P-M thus amounts to 46.68 P-M, which is equivalent to 81% of the total P-M at 59.04 P-M. Note that some errors in the enumeration of P-M found in the previous monitoring were corrected by using the latest information.

The cumulative P-M of each of the core experts is as follows: 1)the Team Leader/Environmental Management 1 with 4.37 P-M (87%), 2) the Deputy Team Leader/Environmental Management 2 with 4.50 P-M (64%), 3) the EIA with 4.53 P-M (77%), 4) the Pollution Control and Regulations 1 with 7.1 P-M (100%), 5) the Pollution Control and Regulations 2 with 3.47 P-M (87%), 6) the Training Planner 1 with 5.37 P-M (77%), 7) the Water Environment/ Training Planner 2/Coordinator with 8.48 P-M (69%) and 8) the Water Environment (Inspection) with 5.67 P-M (100%). The figures in the

parenthesis indicate the percentage progress of respective expert in terms of P-M. Note that all the figures of the assignment are the summation of those both in Cambodia and Japan. Refer to the assignment schedule attached to the Progress Report VI for more details and other experts.
Two Cambodian specialists for the support of project implementation had been contracted by the early August 2017 for organizing, filing and retrieving records of meetings, communicating with various departments and other agencies, scheduling appointments, and coordinating travel and accommodations.

Inputs by the Cambodian Side
MOE convened the fifth Joint Coordination Committee meeting on 8th January 2020 to discuss the Progress Report V with the participation of the major officials including H.E. Mr. Sao Sopheap, the Secretary of State, the Ministry of Environment, who gave an opening remark along with Mr. Yuichi Sugano, the Chief Representative of JICA Cambodia. The participants included twenty (20) officers of GDEP and eight (8) officers of relevant ministries such as the Ministry of Economy and Finance, the Council for the Development of Cambodia among others.
MOE convened an internal meeting on the Water Pollution Control sub-decree on 28th January 2020 to discuss the issues identified in the JCC meeting. Since then, the counterpart officers have engaged in the revision of the sub-decree on water quality control. The EIA department has coordinated and worked on the finalization process of the relevant guidelines.

1-1 Progress of Activities

Activity 1.1 Develop Task Force to Review Law and Regulation

Two Task forces were formally established separately for EIA and Water in 2017. Note that the task forces concurrently act as the task forces to discuss the issues and activities under the Output. The task force meetings convened during the evaluation period are presented above.

Activity 1.2 Finalize Items for Output 1

All the project deliverables agreed between the GDEP and the JICA Team are itemized below. They are categorized according to the nature and project outputs. Through the finalization process of the documents, some of them may be realigned and re-categorized for convenience and practical purpose.
The deliverables to generate Output 1
1) The Water Pollution Control sub-decree

2) Prakas on Registration of Laboratory for Water Quality Measurement
3) Prakas on Official Methods of Water Quality Measurement for Regulatory Purpose
4) Pollution Source Category by Industrial Classification
The deliverables to generate Output 2
1) EIA Review Manual
2) EIA/IEE Sector Guidelines on the following sectors: Road, Railway, Industry and Special Economic Zone/Land Development.
3) Guideline for prevention of chemical leakage to underground
4) Guidelines on Factory Inspection
5) Guidelines on Wastewater Treatment Processes and Facilities

Activity 1.3 Review and Draft Revised Law and Regulation

The review of the Sub-decree on Water Pollution has been undertaken since the commencement of the project. Majority of the issues identified and raised through the Task Force Meetings and the Consultation Meetings have been integrated in the draft revised Sub-decree on Water Pollution Control. The members of the relevant Task Force discussed and finalized the draft Sub-decree and pertinent guidelines on 4th March 2019. The Sub-decree was translated into Khmer before October 2019, which was further subject to a Task Force meeting in the middle of October 2019.
In response to the meeting on 28th January 2020 as reported below, the JICA team interacted closely with GDEP. The details of the discussion in this occasion is provided in the Progress Report VI.

Activity 1.4 Consultation with Stakeholders

An Inter-department Review Meeting on the Sub-decree on Water Quality Control was convened on 3rd December 2019. Among the articles in the sub-decree, Chapter 6 and 7 on Penalty was focused to be discussed on its validity and enforceability. The GDEP will bring the issue to the Ministry of Justice, most likely in the early January 2020. A technical issue discussed in the meeting included the harmonization of the standards with other standards set forth by the Ministry of Industry and Handicraft, the Ministry of Water Resources and Meteorology, the Ministry of Public Work and Transport.
In the JCC meeting on 8th January 2020, the Director of the Water Quality and Management Department of GDEP gave a presentation on the issues in the approval of the Sub-decree on Water Quality Control. To further discuss the issues additionally identified in the meeting, GDEP convened an internal meeting on 28th January 2020 with a focus on the effluent standards. The participants of the meeting reviewed the effluent standards of the Sub-decree in comparison with those of Singapore and Vietnam.

Activity 1.5 Finalize Draft Laws and Regulations

The MOE has entered the finalization process of the draft laws and regulations upon completion of the translation from the English version into Khmer.

At the time of writing this monitoring report in May 2020, the Department of Water Quality Management is reviewing 1) the effluent standard parameter especially Total Nitrogen, Total Phosphorus, Cyanide…etc.; 2) the definition of technical term in revision of sub-decree on water pollution control to be consistent with sub-decree on management of drainage and wastewater treatment system and the Environmental Code as well; 3) the spelling of the Khmer terminologies. It is planning to submit the revised/finalized sub-decree to MoE management team for further review. After the review by the management team, the Sub-decree will be submitted to the Office of Minister for approval.

Activity 1.6 Prepare Summary Report for Output 1

The activity will be performed most likely in the latter part of the year 2020.

Activity 2.1 Develop Task Force to develop guidelines and procedure

The two tasks forces established on EIA and Water Pollution as reported in the part of Activity 1.1. would concurrently act as the task forces to discuss the issues and activities under Output 2.

Activity 2.2 Finalize Items for Output 2

As reported in the previous evaluation, the items covered for generating Output 2 were agreed. The deliverables are presented in the section on Activity 1.2. However, appropriate policy instruments for formalization of the guidelines, manuals and other types of documents will be discussed and identified throughout the further consultation process.

Activity 2.3 Develop draft Guideline and Procedures

1) EIA Review Manual

The manual was translated into Khmer, which will be finalized when the sector guidelines are complete. The schedule of finalizing the guidelines are now under review because of the impacts resulted from the COVID-19 pandemic has affected the operation process.

2) EIA Sector Guidelines

For the following sector guidelines, they are available in both English and Khmer. MOE continued the review and modification of the guidelines to make them finalized. They will be subject to the finalization and authorization process after the completion.

1) EIA/IEE Sector Guidelines on Road
2) EIA/IEE Sector Guidelines on Railway

For the following guidelines, they are available in English and Khmer. MOE continued the review and modification of the guidelines to make them finalized before September 2020. They will be subject to the finalization and authorization process after the completion.

3) EIA/IEE Sector Guidelines on Industry
4) EIA/IEE Sector Guidelines on Special Economic Zone/Land Development.

The following guidelines are finalized in March 2020.

5) Guidelines on Factory Inspection
6) Guidelines on Wastewater Treatment Processes and Facilities

Activity 2.4 Consultation with Stakeholders

No consultation meeting was convened during the evaluation period.

Activity 2.5 Finalize draft Guidelines and Procedure

As reported above, MOE will proceed to the finalization process for the following guidelines in the year 2020.

1) EIA Review Manual
2) EIA/IEE Sector Guidelines on Road
3) EIA/IEE Sector Guidelines on Railway
4) EIA/IEE Sector Guidelines on Industry
5) EIA/IEE Sector Guidelines on Special Economic Zone/Land Development.
6) Guidelines on Factory Inspection
7) Guidelines on Wastewater Treatment Processes and Facilities

Activity 2.6 Disseminate the finalized and/or draft guideline and procedure to stakeholders

The activity will be performed in the years 2020.

Activity 2.7 Prepare Summary Report for output 2

The activity will be performed most likely in 2020.

Activity 3.1 Review the institutional arrangements of GDEP to clarify the scope of the training

The discussions with the technical departments under GDEP were conducted to understand the organisational capacity and the needs for training related to human resource development.

Activity 3.1 Finalize content/subject of training program

As reported in the previous evaluation, the training program was finalized. It is now under implementation stage.

Activity 3.2 Prepare the syllabus including contents/subjects of training program

As reported in the previous evaluation, the syllabus was developed. The training syllabus are being modified and updated in the course of the project when necessary.

Activity 3.3 Organize seminars

As reported in the previous monitoring, a set of tutorial classes and workshops/filed exercises were designed and organized in an implementable manner.

Activity 3.4 Conduct Study tours

The study tour to Vietnam took place in the period from 12th January until 18th January 2020 with the participation of ten (10) GDEP officers.

The last training tours is scheduled to take place in the year 2020 to send the trainees to Japan. But the schedule of the training is now being modified due to the COVID-19 pandemic.

Activity 3.5 Develop training programs reflecting the obtained results from seminars and study tours

A pre-and post-evaluation of seminars are carried out by using a questionnaire to evaluate their level of understanding on the issues in the training course delivered. The findings will be used for designing the training.

Activity 3.6 Implement the developed training program

In the evaluation period, the following courses were convened.

MOE convened the following seminar and lectures:

1) The training on Inspection of Industry on 30th January 2020
2) The training on Water Quality Modelling on 30th January 2020
3) The seminar titled “Sampling and Flow Measurement on 5th February 2020
4) The training workshop on Environmental information management on 26th May 2020

Activity 3.7 Evaluate the implemented training program and prepare the next training

A pre-and post-evaluation of seminars are carried out.

Activity 3.8 Prepare summary report of output 3

The activity will be performed in the third and fourth quarter of the year 2020.

1-2 Achievement of Output

For the Output 1, the proposed amendment of the Sub-decree on Water Quality Control has been under the process for authorization. GDEP is coordinating with relevant departments to address the issues requiring clarification and modification to make them approved at an earliest period of time before the completion of the project. It was previously scheduled to be approved before June 2020. However, the COVID-19 pandemic has induced temporal suspension of the project activities from the middle of March 2020. As described in the subsequent section, a decision was made to facilitate and operate the activities remotely between Cambodia and Japan. This special arrangement just took effect in the middle of May 2020. The progress and the contribution to the improved efficiency in implementing the project have to be monitored to take further actions as necessary.

It should be kept in mind, as emphasized in the previous monitoring, that authorization *per se* is not the goal of the project. Instead, the smooth and steady transition to the water quality management as mandated under the amended sub-decree should be ensured and pursued.

The technical guidelines and procedures relevant to the water quality management has been finalized. They are: the Guidelines on Wastewater Management and Facilities along with the Inspection Manual. All the relevant trainings have been complete before the middle of March 2020.

Other Guidelines on EIA are still under the process. The timing of the finalization and authorization was scheduled to be complete before the end of the third quarter of the year. However, the delays caused by the COVID-19 pandemic may have impacts on the process and require monitoring to see the effects of the remote operation process on the project implementation.

For an indicator on Output 3, the following is one indicator: Result of water quality monitoring is opened to the public by GDEP. GDEP has completed the development of the Pollution Source Inventory which contains a set of information on the location of water pollution sources. GDEP designed and developed a website to disclose the information. The project has commenced the training course on GIS for the officer of GDEP. Thus all the pre-conditions for achieving the target would be met before the end of the third quarter of the year 2020.

1-3 Achievement of the Project Purpose

Indicator1: GDEP’s work on EIA and water pollution control received 20 percent increased

confidence from government offices related to the above-mentioned fields compared to the level that of the starting point of the project

- ☐ A questionnaire survey will be designed and conducted by the end of the project to assess the changes resulted from the project. The term “confidence” may require elaboration of definitions to this end by reviewing the nature of the derivable; participation of the officers in decision making process.

Indicator2: Transparency of GDEP is increased through regular information disclosure

- ☐ GDEP has launched the website to disclose information. It has been regularly used to notify the people in Phnom Penh on the air quality.
- ☐ The effort of the air quality management department of GDEP to monitor PM2.5 in Phnom Penh has led to a follow-up assessment of air quality under “the research of PM2.5 and PM 10 in Phenom Penh in the Windy Season 2019 -2020”. It is funded by UNDP as part of the Sustainable Urban Mobility for All Initiative (SUMAI) Project. Two (2) officers of the air quality management department participated in the monitoring activity which was coordinated and supported by the Institute of Technology of Cambodia. The series of activities of GDEP initiated and facilitated by the project has strengthened the network of GDEP with academe and the international donor which would provide a fundamental avenue for developing a transparent process for implementing and enforcing environmental legislation.
- ☐ The website is also used to deliver information on the major activities and events of the department such as training workshop to enhance awareness on waste emission from various sources such as transport, construction, industry etc.
- ☐ GDEP has uploaded the information on the project status in March 2020 at the following link of the website to increase transparency and increase the accessibility to the information.

  http://epa.moe.gov.kh/pages/categories/view/jica-activities

Indicator3: EIA review and water pollution control related works are carried out in accordance with the development of technical guidelines and procedures

- ☐ The performance indicator will be reviewed and assessed before the end of the project when the sub-decree and guidelines are finalized.

1-1 Changes of Risks and Actions for Mitigation

The COVID-19 pandemic has brought and will bring about significant impacts on the project especially in the following two respects: namely 1) delay and/or temporal discontinuation of project activities and 2) potential changes in the national policies and priorities of Cambodia. The first impact may be in a temporal manner, while, the latter may be caused in a longer time span.

1) Delay and/or discontinuation of project activities

The first confirmed case of infection is reported on 27th January 2020 in Cambodia and the number of the cases has increased especially since the early March. The Cambodian government issued an order, on 9th April, banning most travel throughout the country for more than a week until17th April. Meanwhile, Japan has experienced a worse situation in terms of number of victims. The JICA Headquarter therefore announced the first advisory on the postponement of international travel, virtually a travel ban, on 28th February 2020; then it extended the period of the travel ban for an undefined term. At the time of writing this Monitoring report, the numbers of infected both in Cambodia and Japan have dropped as compared with the status in the middle of March 2020. Especially in Cambodia, it seems that it has almost returned to business as usual except requirement of physical distancing. But it is unable to project when Japan will lift the international travel restriction. In such context, the project activities have been almost suspended since the middle of March. Smooth communication among the members have been also obstructed.

2) Potential changes in national policies and priorities of Cambodia

The COVID-19 pandemic could change national policies and priorities of Cambodia to reallocate the financial resources to public health sectors considering its urgency and scale. Likely impacts on the project is anticipated for the achievement of the project's overall goal by altering the decisions in resource allocation for manpower and budget at the national level.

- ☐ MoE's institutional and technical capacity is developed to implement the mission of ensuring environmental protection effectively and efficiently

In terms of controlling the virus, the government reaction may be seen as a success. Therefore, the direct impacts of the pandemic will be in a limited range as compared with most of the other counties.

However, it may also cause cascade impacts on the private sector investments on the industry, because the project was designed and implemented under the assumption that industrial investment would continue for the coming decades, which could eventually interrupt momentum for reform in environmental sector.

1-2 Progress of Actions undertaken by JICA

To continue to make progress in achieving the project goals in the midst of the COVID-19 pandemic, a total of 6.4 P-M of the services in Cambodia has been reallocated to those in Japan to operate project activities remotely. Thus, some of the activities most likely until the end of the third quarter 2020 will be implemented remotely but in a close coordination

between the Cambodian and Japan's sides. In the course of such endeavour to overcome this difficulty, novel approaches will be explored and tested to maximize efficiency of the project. Use of a web conference software will also be considered for hosting large scale meetings wherever possible.

1-3 Progress of Actions undertaken by Gov. of Cambodia

A coordination has just begun between GDEP and the JICA team to jointly work in a remote manner.

1-8 Progress of Environmental and Social Considerations (if applicable)

The project was fundamentally designed to conserve and protect environment. Any adverse environmental impacts are not identified/anticipated. When such impacts are identified, appropriate consideration for environment will be exercised.

1-4 Progress of Considerations on Gender/Peace Building/Poverty Reduction (if applicable)

The primary environmental media of the project is water. The project is designed to provide fundamental conditions for improving water quality and thus to contribute to increasing safe water accessibility of all the people of Cambodia.

1-5 Other remarkable/considerable issues related/affect to the project (such as other JICA's projects, activities of counterparts, other donors, private sectors, NGOs etc.)

1 *Environmental Governance Reform (EGR) for Sustainable Development* is a UNDP funded project for MoE. The key outputs of the EGR include 1) the modernisation of the Ministry of Environment; 2) the institutional strengthening of the National Council of Sustainable Development (NCSD) to facilitate inter-ministerial political dialogues; 3) the development of legal framework including Environment and Natural Resource Code (ENR Codes) that clarify roles and mandates of different agencies in governing natural resources and environment; and 4) the development of Integrated Ecosystem Mapping. All the deliverables of the JICA's project on water and EIA are designed in consonance with the ENR Codes. Approval/authorization of the ENR codes is one of the key elements in achieving the project goals.

2 *The Preparatory Survey on the project for Sewerage System Development in the Phnom Penh Capital City* is an on-going project to develop sewerage system. This parallel project is indispensable for achieving the SDG 6 for ensuring availability and sustainable management of water and sanitation for all in Cambodia. Close liaison

between the members are taking place to expedite the approval process of the sewerage sector investment and thus to ensure jointly achieving the goal.

3 *The Project for Capacity Enhancement on Environmental Social Considerations in Implementing Agency in Road Sector in Cambodia* is designed to enhance the capacity of the Ministry of Public Works and Transport in managing the environment and social dimensions of the road sector investment projects. The members of the teams have kept abreast of the major activities and developments each other by having regular meetings to exchange information.

4 *The project for Capacity Development for Sewerage Management of Phnom Penh Capital Administration and Ministry of Public Works and Transport (CDSMPP)* is a JICA funded four(4) year project for development of capacity in managing sewerage with the major objective to strengthen fundamental structure on sewerage management of the Ministry of Public Works and Transport (MPWT) and the Department of Public Works and Transport (DPWT) under Phnom Penh Capital City Government. The project is designed to achieve the objective by generating two outputs: 1) the legal and institutional settings of MPWT on sewerage strengthened and 2) the legal and institutional settings of DPWT on sewerage strengthened. During the evaluation period, two meetings were convened at JICA Cambodia and the project office in MOE consecutively to discuss the challenges and measures of CDSMPP.

5 *Establishment of Environmental Conservation Platform of Tonle Sap Lake* is a 5-year project starting from April 2016 to March 2021 implemented under a scheme referred to as SATREPS which stands for Science and Technology Research Partnership for Sustainable Development (SATREPS Tonle Sap Lake). It is a Japanese government program to promote international joint research targeting global issues supported by the Japan Science and Technology Agency (JST) and JICA. Tokyo Institute of Technology and the Institute of Technology of Cambodia are the leading agency of the project. The project is designed to establish state-of-the-art research-oriented structures and facilities in ITC; to promote science-based management to the government of Cambodia; and to develop the Tonle Sap Water Environmental Platform (TSWEP) and make it one of the benchmarks in freshwater ecology and management studies in Southeast Asia. During the evaluation period, a meeting was convened at the office of the Project in MOE to exchange project information. Salient points of the discussion are as follows: 1) the SATREPS Tonle Sap Lake 1) has developed a water quality model covering the area of Tonle Sap Lake, 2) will validate the model by using the water quality monitoring data. The SATREPS Tonle Sap Lake was provided with the following information: parameters and frequencies of water quality monitoring undertaken by MOE. It was proposed to undertake an assessment on nitrogen and

phosphate loading by using the model, which will provide key policy lessons.

2 Delay of Work Schedule and/or Problems (if any)

2-1 Detail

Due to the spread of COVID-19, some of the project activities have been delayed especially in the period from the middle of March until the end of May 2020. The major activities affected by the incidence include the followings:1) a preparatory arrangement and consultation to produce the Progress Report VI and a Project Brief Note, 2) Collection of comments/feedbacks on the EIA sector guidelines, 3) a preparatory arrangement for conducting training courses on EIA for provincial officers (H9) and EIA review practice for provincial officers (H10), 4) a preparatory arrangement for conducting training courses on major challenges/ issues in reviewing IEIA/EIA reports (H5) and Practical training for IEIA/EIA reviewing (H7), 5) update of the EIA Review Manual, 6) preparation of a explanatory note on the EIA sector guidelines, 7) an update and a review of the training programme, 8) Compilation and reporting of the completed training, 9) management and supervision of the training on GIS (B1, B2 and B3), 10) preparation and compilation of documents/materials for the training on Japan's experience in pollution control(A2) and 11) a preparatory work for the training on waste management. The codes in the parenthesis indicate those in the training programme.

2-2 Cause

The cause of the delay is incidence of the COVID-19 pandemic.

2-3 Action to be taken

As described in the section on "1-2 Progress of Actions undertaken by JICA", a total of 6.4 P-M of the services in Cambodia has been reallocated to those in Japan to operate project activities remotely. Further actions, when necessary, will be considered and taken to continue to make progress in achieving the project goals.

2-4 Roles of Responsible Persons/Organization (JICA, Gov. of Cambodia etc.)

The JICA Team closely work with GDEP/MOE in consultation with JICA Headquarter to enable smooth and flexible allocation of resources to minimize the potential delay of the project implementation.

3 Modification of the Project Implementation Plan

3-1 PO

PO have been modified as the Project Design Matrix was revised. The details of the

modification is provided in the Progress Report 1.

3-2 Other modifications on detailed implementation plan

(Remarks: The amendment of R/D and PDM (title of the project, duration, project site(s), target group(s), implementation structure, overall goal, project purpose, outputs, activities, and input) should be authorized by JICA HDQs. If the project team deems it necessary to modify any part of R/D and PDM, the team may propose the draft.)

Not applicable.

4 Current Activities of Gov. of Cambodia to Secure Project Sustainability after its Completion

The proposed project as summarised below is now under consideration for further assistance by the Government of Japan.

The purpose of the Project is to increase Capacity of GDEP for controlling Point Source Pollution in a manner to sustain long-term business confidence for growth-enhancing private sector investment. The said purpose is achieved by generating following four outputs: 1) Governance in environmental management improved in partnership with private sectors; 2) Legislative framework and Intuitional instruments for implementation of the Environment and Natural Resources Code strengthened; 3) The Sub-Decree on Water Pollution Control Instituted in an effective and efficient manner; and 4) Accuracy and reliability of Environmental Laboratory Testing Results Improved. The project will contribute to developing and strengthening a foundation to support the achievement of SDG 9.3, SDG 3.9 and SDG 6.3.

II. Project Monitoring Sheet I & II *as Attached*

TO CR of JICA　Cambodia　OFFICE

Project Monitoring Sheet

Project Title : THE PROJECT FOR　EFFECTIVE IMPLEMENTATION OF EIA AND POLLUTION CONTROL THROUGH THE CAPACITY DEVELOPMENT OF MOE

Version of the Sheet: Ver.1（Term: from 1st June 2020 to 31st December 2020）

Name: Chea Sina
Title: Project Director
Name: Yasuhiko Muramatsu
Title:　Team Leader

Submission Date: 3rd March 2021

I. Summary

1　Progress

1-1 Progress of Inputs

This project monitoring sheet covers the progress achieved in the period from 1st June 2020 until 31st December 2020. The cumulative achievement and its figures are also provided wherever appropriate and necessary.

Inputs by the Japanese Side

Due to the COVID-19 pandemic, a total of 6.4 P-M of the services in Cambodia previously was planned to be reallocated to those in Japan to operate the project remotely. However a total of 4.15 person-months was eventually mobilized to support the implementation of the project in a remote manner. Thus a total of 51.9 person-months has been mobilized since the beginning of the project in 2017. Meanwhile, the project period was extended over a half year to cope with the inefficiency resulted from discontinuation of the field work and face-to-face meetings. Now the JICA team holds 7.07 person-months resources to complete all the planned activities by the end of August 2021.

Two Cambodian specialists for the support of project implementation were contracted for organizing, filing and retrieving records of meetings, communicating with various departments and other agencies, scheduling appointments, and coordinating travel and accommodations. One of them has terminated the contract at the beginning of the year 2021.

Inputs by the Cambodian Side

MOE hosted on-line training sessions designed and convened under the project. All the activities during the period was performed remotely. The counterpart officers have thus engaged in review and feedbacks for the finalization of the relevant guidelines especially on EIA.

1-1 Progress of Activities

Activity 1.1 Develop Task Force to Review Law and Regulation

Two Task forces were formally established separately for EIA and Water in 2017. Note that the task forces concurrently act as the task forces to discuss the issues and activities under the Output. The task force meetings convened during the evaluation period are presented above.

Activity 1.2 Finalize Items for Output 1

All the project deliverables agreed between the GDEP and the JICA Team are itemized below. They are categorized according to the nature and project outputs. Through the finalization process of the documents, some of them may be realigned and re-categorized for convenience and practical purpose.

The deliverables to generate Output 1

1) The Water Pollution Control sub-decree
2) Prakas on Registration of Laboratory for Water Quality Measurement
3) Prakas on Official Methods of Water Quality Measurement for Regulatory Purpose
4) Pollution Source Category by Industrial Classification

The deliverables to generate Output 2

1) EIA Review Manual
2) EIA/IEE Sector Guidelines on the following sectors: Road, Railway, Industry and Special Economic Zone/Land Development.
3) Guideline for prevention of chemical leakage to underground
4) Guidelines on Factory Inspection
5) Guidelines on Wastewater Treatment Processes and Facilities

Activity 1.3 Review and Draft Revised Law and Regulation

The review of the Sub-decree on Water Pollution has been undertaken since the commencement of the project. Majority of the issues identified and raised through the Task Force Meetings and the Consultation Meetings have been integrated in the draft revised Sub-decree on Water Pollution Control. The members of the relevant Task Force discussed and finalized the draft Sub-decree and pertinent guidelines on 4th March 2019. The Sub-decree was translated into Khmer before October 2019, which was further subject to a Task Force meeting in the middle of October 2019.

In response to the meeting on 28th January 2020 as reported below, the JICA team interacted closely with GDEP. The details of the discussion in this occasion is provided in the Progress Report VI.

Activity 1.4 Consultation with Stakeholders

An Inter-department Review Meeting on the Sub-decree on Water Quality Control was convened on 3rd December 2019. Among the articles in the sub-decree, Chapter 6 and 7 on Penalty was focused to be discussed on its validity and enforceability. The GDEP will bring the issue to the Ministry of Justice, most likely in the early January 2020. A technical issue discussed in the meeting included the harmonization of the standards with other standards set forth by the Ministry of Industry and Handicraft, the Ministry of Water Resources and Meteorology, the Ministry of Public Work and Transport.
In the JCC meeting on 8th January 2020, the Director of the Water Quality and Management Department of GDEP gave a presentation on the issues in the approval of the Sub-decree on Water Quality Control. To further discuss the issues additionally identified in the meeting, GDEP convened an internal meeting on 28th January 2020 with a focus on the effluent standards. The participants of the meeting reviewed the effluent standards of the Sub-decree in comparison with those of Singapore and Vietnam.

Activity 1.5 Finalize Draft Laws and Regulations

The MOE has entered the finalization process of the draft laws and regulations upon completion of the translation from the English version into Khmer.
In May 2020, the Department of Water Quality Management reviewed 1) the effluent standard parameter especially Total Nitrogen, Total Phosphorus, Cyanide…etc.; 2) the definition of technical term in revision of sub-decree on water pollution control to be consistent with sub-decree on management of drainage and wastewater treatment system and the Environmental Code as well; 3) the spelling of the Khmer terminologies. It is planning to submit the revised/finalized sub-decree to MoE management team for further review.
GDEP submitted the Sub-decree on Water Quality to the Council of Ministers for approval in February 2021.

Activity 1.6 Prepare Summary Report for Output 1

The activity will be performed in the second quarter of the year 2021.

Activity 2.1 Develop Task Force to develop guidelines and procedure

The two tasks forces established on EIA and Water Pollution as reported in the part of Activity 1.1. would concurrently act as the task forces to discuss the issues and activities under Output 2.

Activity 2.2 Finalize Items for Output 2

As reported in the previous evaluation, the items covered for generating Output 2 were

agreed. The deliverables are presented in the section on Activity 1.2. However, appropriate policy instruments for formalization of the guidelines, manuals and other types of documents will be discussed and identified throughout the further consultation process.

Activity 2.3 Develop draft Guideline and Procedures

1) EIA Review Manual

The manual was translated into Khmer, which will be finalized when the sector guidelines are complete. The schedule of finalizing the guidelines are now under review because of the impacts resulted from the COVID-19 pandemic has affected the operation process.

2) EIA Sector Guidelines

For the following sector guidelines, they are available in both English and Khmer. MOE continued the review and modification of the guidelines to make them finalized. They will be subject to the finalization and authorization process after the completion.

1) EIA/IEE Sector Guidelines on Road
2) EIA/IEE Sector Guidelines on Railway

For the following guidelines, they are available in English and Khmer. MOE continued the review and modification of the guidelines to make them finalized before September 2020. They will be subject to the finalization and authorization process after the completion.

3) EIA/IEE Sector Guidelines on Industry
4) EIA/IEE Sector Guidelines on Special Economic Zone/Land Development.

The following guidelines are finalized in March 2020.

5) Guidelines on Factory Inspection
6) Guidelines on Wastewater Treatment Processes and Facilities

Activity 2.4 Consultation with Stakeholders

It was previously scheduled to convene a stakeholder meeting on the draft EIA/ISS Sector Guidelines on Industry (SEZ and Metal industry). Due to the Covid-19 pandemic, the project team collected feedbacks on the guidelines electronically via mails in the period from August to September 2020.

Activity 2.5 Finalize draft Guidelines and Procedure

During the period, no activities have been carried out on the following guidelines and manuals: 1)the EIA Review Manual, 2) the EIA/IEE Sector Guidelines on Road, and 3) the EIA/IEE Sector Guidelines on Railway.

For the EIA/IEE Sector Guidelines on Industry, a draft version was developed during the period. It is noted that a new sub-decree requires Environmental Social Impact Assessment(ESIA) for all the scale of investment in the Metal Industry. Thus it was

determined that the project would not further proceed to development of Initial Environmental Social Impact Assessment. The ESIA was revised and modified through a series of consultation process with the relevant government agencies and local consultants. It will be subject to the finalization and authorization along with other guidelines.

As for the EIA/IEE Sector Guidelines on Special Economic Zone/Land Development, a draft guidelines were prepared. For the IESIA, the preparation process was canceled due to the new sub-decree requiring ESIA for any scale of investment. The draft guidelines for ESIA was revised through the consultation process. They will be also subject to the finalization and authorization.

The following guidelines have been complete.

1) Guidelines on Factory Inspection
2) Guidelines on Wastewater Treatment Processes and Facilities

GDEP has embarked on further customization of the guidelines to make it more suited to the Cambodian context. The JICA team will support the endeavour of the GDEP for customization process whatever feasible.

Activity 2.6 Disseminate the finalized and/or draft guideline and procedure to stakeholders

The activity pertaining to EIA will be performed in the second quarter of the years 2021.

For the following guidelines, it was accomplished as part of the training programme.

1) Guidelines on Factory Inspection
2) Guidelines on Wastewater Treatment Processes and Facilities

Activity 2.7 Prepare Summary Report for output 2

The activity will be performed in the second quarter of the years 2021.

Activity 3.1 Review the institutional arrangements of GDEP to clarify the scope of the training

The discussions with the technical departments under GDEP were conducted to understand the organisational capacity and the needs for training related to human resource development.

Activity 3.1 Finalize content/subject of training program

As reported in the previous evaluation, the training program was finalized. It is now under implementation stage.

Activity 3.2 Prepare the syllabus including contents/subjects of training program

As reported in the previous evaluation, the syllabus was developed. The training syllabus are being modified and updated in the course of the project when necessary.

Activity 3.3 Organize seminars

As reported in the previous monitoring, a set of tutorial classes and workshops/filed exercises were designed and organized in an implementable manner.

During the evaluation period, an online training seminar was convened on waste disposal.

Activity 3.4 Conduct Study tours

The study tour to Vietnam took place in the period from 12th January until 18th January 2020 with the participation of ten (10) GDEP officers.

The last training tours was scheduled to send the trainees to Japan. However, it was judged impractical to make it happen at the time of writing this Evaluation because the travel requires 28 days of quarantine for a round trip. An alternative arrangement will be considered and discussed in the second quarter of the year 2021.

Activity 3.5 Develop training programs reflecting the obtained results from seminars and study tours

A pre-and post-evaluation of seminars are carried out by using a questionnaire to evaluate their level of understanding on the issues in the training course delivered. The findings will be used for designing the training.

Activity 3.6 Implement the developed training program

In the evaluation period, the following courses were convened.

MOE convened the following seminar and lectures:

1) The training on Inspection of Industry on 30th January 2020
2) The training on Water Quality Modelling on 30th January 2020
3) The seminar titled “Sampling and Flow Measurement on 5th February 2020
4) The training workshop on Environmental information management on 26th May 2020

Activity 3.7 Evaluate the implemented training program and prepare the next training

A pre-and post-evaluation of seminars are carried out.

Activity 3.8 Prepare summary report of output 3

The activity will be performed in the second quarter of the year 2021.

1-2 Achievement of Output

For the Output 1, the proposed amendment of the Sub-decree on Water Quality Control has been under the process for authorization. GDEP is coordinating with relevant departments to address the issues requiring clarification and modification to make them approved at an earliest period of time before the completion of the project. It was previously scheduled to be approved before June 2020. However, the COVID-19 pandemic has induced temporal suspension of the project activities from the middle of March 2020. As described in the subsequent section, a decision was made to facilitate and operate the activities remotely between Cambodia and Japan. This special arrangement just took effect in the middle of May 2020. The progress and the contribution to the improved efficiency in implementing the project have to be monitored to take further actions as necessary.

It should be kept in mind, as emphasized in the previous monitoring, that authorization *per se* is not the goal of the project. Instead, the smooth and steady transition to the water quality management as mandated under the amended sub-decree should be ensured and pursued.

The technical guidelines and procedures relevant to the water quality management has been finalized. They are: the Guidelines on Wastewater Management and Facilities along with the Inspection Manual. All the relevant trainings have been complete before the middle of March 2020.

Other Guidelines on EIA are still under the process. The timing of the finalization and authorization was scheduled to be complete before the end of the third quarter of the year. However, the delays caused by the COVID-19 pandemic may have impacts on the process and require monitoring to see the effects of the remote operation process on the project implementation.

For an indicator on Output 3, the following is one indicator: Result of water quality monitoring is opened to the public by GDEP. GDEP has completed the development of the Pollution Source Inventory which contains a set of information on the location of water pollution sources. GDEP designed and developed a website to disclose the information. The project has commenced the training course on GIS for the officer of GDEP. Thus all the pre-conditions for achieving the target would be met before the end of the third quarter of the year 2020.

GDEP submitted the Sub-decrees on Water Quality Control to the Council of Ministers for approval in February 2021. Thus the target for the Output 1 have been achieved.

The status of the achievement of other indicators will be assessed during the second quarter of the year 2021.

1-3 Achievement of the Project Purpose

Indicator1: GDEP’s work on EIA and water pollution control received 20 percent increased

confidence from government offices related to the above-mentioned fields compared to the level that of the starting point of the project

- ☐ A questionnaire survey will be designed and conducted by the end of the project to assess the changes resulted from the project. The term “confidence” may require elaboration of definitions to this end by reviewing the nature of the derivable; participation of the officers in decision making process.

Indicator2: Transparency of GDEP is increased through regular information disclosure

- ☐ GDEP has launched the website to disclose information. It has been regularly used to notify the people in Phnom Penh on the air quality.
- ☐ The effort of the air quality management department of GDEP to monitor PM2.5 in Phnom Penh has led to a follow-up assessment of air quality under “the research of PM2.5 and PM 10 in Phenom Penh in the Windy Season 2019 -2020”. It is funded by UNDP as part of the Sustainable Urban Mobility for All Initiative (SUMAI) Project. Two (2) officers of the air quality management department participated in the monitoring activity which was coordinated and supported by the Institute of Technology of Cambodia. The series of activities of GDEP initiated and facilitated by the project has strengthened the network of GDEP with academe and the international donor which would provide a fundamental avenue for developing a transparent process for implementing and enforcing environmental legislation.
- ☐ The website is also used to deliver information on the major activities and events of the department such as training workshop to enhance awareness on waste emission from various sources such as transport, construction, industry etc.
- ☐ GDEP has uploaded the information on the project status in March 2020 at the following link of the website to increase transparency and increase the accessibility to the information.

  http://epa.moe.gov.kh/pages/categories/view/jica-activities

Indicator3: EIA review and water pollution control related works are carried out in accordance with the development of technical guidelines and procedures

- ☐ The performance indicator will be reviewed and assessed before the end of the project when the sub-decree and guidelines are finalized.

1-1 Changes of Risks and Actions for Mitigation

The COVID-19 pandemic has brought about significant impacts on the project. As described elsewhere above, the project has inevitably reallocated project resources to allow remote operation from Japan. The Pandemic still continue to disturb the implementation of the project until the end of the project scheduled in August 2021. Thanks to better management and control of the pandemic in the country, the members of the team

will make effort to push through the activities.

1-2 Progress of Actions undertaken by JICA

In the first quarter of the year 2021, the Deputy Team Leader and the Team Leader of the JICA team travelled to Cambodia to push through the activities. However, there were cases of Covid-19 cluster linked to the February 20 community transmission in Phnom Penh, which may have subsequent impacts.

1-3 Progress of Actions undertaken by Gov. of Cambodia

The EIA department reacted to host a training session while the Deputy team leader was assigned in Cambodia. But it was also affected by the Covid-19 clusters.

1-8 Progress of Environmental and Social Considerations (if applicable)

The project was fundamentally designed to conserve and protect environment. Any adverse environmental impacts are not identified/anticipated. When such impacts are identified, appropriate consideration for environment will be exercised.

1-4 Progress of Considerations on Gender/Peace Building/Poverty Reduction (if applicable)

The primary environmental media of the project is water. The project is designed to provide fundamental conditions for improving water quality and thus to contribute to increasing safe water accessibility of all the people of Cambodia.

1-5 Other remarkable/considerable issues related/affect to the project (such as other JICA's projects, activities of counterparts, other donors, private sectors, NGOs etc.)

1 *Environmental Governance Reform (EGR) for Sustainable Development* is a UNDP funded project for MoE. The key outputs of the EGR include 1) the modernisation of the Ministry of Environment; 2) the institutional strengthening of the National Council of Sustainable Development (NCSD) to facilitate inter-ministerial political dialogues; 3) the development of legal framework including Environment and Natural Resource Code (ENR Codes) that clarify roles and mandates of different agencies in governing natural resources and environment; and 4) the development of Integrated Ecosystem Mapping. All the deliverables of the JICA's project on water and EIA are designed in consonance with the ENR Codes. Approval/authorization of the ENR codes is one of the key elements in achieving the project goals.

2 *The Preparatory Survey on the project for Sewerage System Development in the*

Phnom Penh Capital City is an on-going project to develop sewerage system. This parallel project is indispensable for achieving the SDG 6 for ensuring availability and sustainable management of water and sanitation for all in Cambodia. Close liaison between the members are taking place to expedite the approval process of the sewerage sector investment and thus to ensure jointly achieving the goal.

3 *The Project for Capacity Enhancement on Environmental Social Considerations in Implementing Agency in Road Sector in Cambodia* is designed to enhance the capacity of the Ministry of Public Works and Transport in managing the environment and social dimensions of the road sector investment projects. The members of the teams have kept abreast of the major activities and developments each other by having regular meetings to exchange information.

4 *The project for Capacity Development for Sewerage Management of Phnom Penh Capital Administration and Ministry of Public Works and Transport (CDSMPP)* is a JICA funded four(4) year project for development of capacity in managing sewerage with the major objective to strengthen fundamental structure on sewerage management of the Ministry of Public Works and Transport (MPWT) and the Department of Public Works and Transport (DPWT) under Phnom Penh Capital City Government. The project is designed to achieve the objective by generating two outputs: 1) the legal and institutional settings of MPWT on sewerage strengthened and 2) the legal and institutional settings of DPWT on sewerage strengthened. During the evaluation period, two meetings were convened at JICA Cambodia and the project office in MOE consecutively to discuss the challenges and measures of CDSMPP.

5 *Establishment of Environmental Conservation Platform of Tonle Sap Lake* is a 5-year project starting from April 2016 to March 2021 implemented under a scheme referred to as SATREPS which stands for Science and Technology Research Partnership for Sustainable Development (SATREPS Tonle Sap Lake). It is a Japanese government program to promote international joint research targeting global issues supported by the Japan Science and Technology Agency (JST) and JICA. Tokyo Institute of Technology and the Institute of Technology of Cambodia are the leading agency of the project. The project is designed to establish state-of-the-art research-oriented structures and facilities in ITC; to promote science-based management to the government of Cambodia; and to develop the Tonle Sap Water Environmental Platform (TSWEP) and make it one of the benchmarks in freshwater ecology and management studies in Southeast Asia. During the evaluation period, a meeting was convened at the office of the Project in MOE to exchange project information. Salient points of the discussion are as follows: 1) the SATREPS Tonle Sap Lake 1) has developed a water quality model covering the area of Tonle Sap Lake, 2) will validate the model by using

the water quality monitoring data. The SATREPS Tonle Sap Lake was provided with the following information: parameters and frequencies of water quality monitoring undertaken by MOE. It was proposed to undertake an assessment on nitrogen and phosphate loading by using the model, which will provide key policy lessons.

2 Delay of Work Schedule and/or Problems (if any)

2-1 Detail

Due to the spread of COVID-19, some of the project activities have been delayed especially in the period from the middle of March until the end of May 2020. The major activities affected by the incidence include the followings:1) a preparatory arrangement and consultation to produce the Progress Report VI and a Project Brief Note, 2) Collection of comments/feedbacks on the EIA sector guidelines, 3) a preparatory arrangement for conducting training courses on EIA for provincial officers (H9) and EIA review practice for provincial officers (H10), 4) a preparatory arrangement for conducting training courses on major challenges/ issues in reviewing IEIA/EIA reports (H5) and Practical training for IEIA/EIA reviewing (H7), 5) update of the EIA Review Manual, 6) preparation of a explanatory note on the EIA sector guidelines, 7) an update and a review of the training programme, 8) Compilation and reporting of the completed training, 9) management and supervision of the training on GIS (B1, B2 and B3), 10) preparation and compilation of documents/materials for the training on Japan's experience in pollution control(A2) and 11) a preparatory work for the training on waste management. The codes in the parenthesis indicate those in the training programme.

An effort was made to catch up with the original schedule. But the continuing impacts of the pandemic has prevented smooth implementation. The status will be further observed to promptly recover the delay.

2-2 Cause

The cause of the delay is incidence of the COVID-19 pandemic.

2-3 Action to be taken

As described in the section on "1-2 Progress of Actions undertaken by JICA", a total of 6.4 P-M of the services in Cambodia has been reallocated to those in Japan to operate project activities remotely. Further actions, when necessary, will be considered and taken to continue to make progress in achieving the project goals.

2-4 Roles of Responsible Persons/Organization (JICA, Gov. of Cambodia etc.)

The JICA Team closely work with GDEP/MOE in consultation with JICA Headquarter to enable smooth and flexible allocation of resources to minimize the potential delay of the

project implementation.

3 Modification of the Project Implementation Plan

3-1 PO

PO have been modified as the Project Design Matrix was revised. The details of the modification is provided in the Progress Report 1.

3-2 Other modifications on detailed implementation plan

(Remarks: The amendment of R/D and PDM (title of the project, duration, project site(s), target group(s), implementation structure, overall goal, project purpose, outputs, activities, and input) should be authorized by JICA HDQs. If the project team deems it necessary to modify any part of R/D and PDM, the team may propose the draft.)

Not applicable.

4 Current Activities of Gov. of Cambodia to Secure Project Sustainability after its Completion

The proposed project as summarised below is now under consideration for further assistance by the Government of Japan.

The purpose of the Project is to increase Capacity of GDEP for controlling Point Source Pollution in a manner to sustain long-term business confidence for growth-enhancing private sector investment. The said purpose is achieved by generating following four outputs: 1) Governance in environmental management improved in partnership with private sectors; 2) Legislative framework and Intuitional instruments for implementation of the Environment and Natural Resources Code strengthened; 3) The Sub-Decree on Water Pollution Control Instituted in an effective and efficient manner; and 4) Accuracy and reliability of Environmental Laboratory Testing Results Improved. The project will contribute to developing and strengthening a foundation to support the achievement of SDG 9.3, SDG 3.9 and SDG 6.3.

II. Project Monitoring Sheet I & II *as Attached*