PT PLN (PERSERO)

ENERGY TRANSITION AND SUSTAINABILITY DIVISION

Air Quality

MANAGEMENT GUIDELINE

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Key Abbreviation

AOI	:	Area of Influence
CEMS	:	Continuous Emission Monitoring System
CHSS	:	Community Health Safety and Security
CO	:	Carbon Monoxide
E&S	:	Environmental and Social
EHS	:	Environmental Health and Safety
ESMS	:	Environmental and Social Management System
ESMP	:	Environmental and Sosial Management Plan
ESS	:	Environmental and Social Standard
GHG	:	Greenhouse Gas
IA	:	Impact Assessment
IFC	:	International Finance Corporation
NOx	:	Nitrogen Oxide
ODS	:	Ozone Depleting Substance
PM	:	Particulate Matter
PS	:	Performance Standard
PV	:	Photovoltaic
SOx	:	Sulphur Oxide
VOC	:	Volatile Organic Compound
WBG	:	World Bank Group

1 Introduction

PLN is committed to avoid or minimize adverse impact on human health and the environment by avoiding or minimizing pollution from the project activities, including pollution from emission of short and long-lived climate pollutants. This guideline is developed in order to manage the impact on air quality resulted by PLN's Projects and facilities, whether for a new project development, expansion of an ongoing project, or there are changes in the operation of PLN's facilities. This guideline is developed to be consistent with the E&S principles as described in the ESMS Manual and based on international good practices, including the World Bank's Environmental and Social Standard (ESS) 3, WBG Environmental Health and Safety (EHS) Guidelines, IFC Performance Standard (PS) 3, and other documents as listed in **Section 13** of this management guideline.

This guideline will be required for projects with activities that could generate emissions from production process, use of vehicles and other equipment, and/or from dust and fumes. This guideline is developed to provide guidance in managing air quality aspects on a project, whereby implementing the management of air quality aspects, these following objectives could be achieved:

- To avoid or minimize adverse impacts on human health and the environment by avoiding or minimizing pollution from project activities;
- To avoid or minimize project-related emissions of short and long-lived climate pollutants[1];
- When avoidance is not feasible, to minimize emissions from both mobile and stationary sources of dust and particulate matter and of gaseous emission
- To ensure that air pollutants released to the environment can be controlled;
- To ensure that air pollutants release is in compliance with the national law and regulation or the international standard, whichever is more stringent and technically feasible to be applied.
- Minimal or no grievances arise from the community regarding air pollution from the Project.

In managing the risk and impact on air quality, it shall be managed following the mitigation hierarchy: avoid – minimize – compensate/restore.

2 Disclaimer

This management guideline should not be taken as a standard, regulation, or manual and is not described to the detail level of a work instruction. If a more relevant or updated standard, regulation, or manual is available and requires revision of this management guideline, then such revision is permitted. If any revision is made; references, rationales and amended sections should be clearly defined.

To be able to serve its purpose, this management guideline should be reviewed, implemented, and enforced by PLN staff with relevant authorities and competencies specified in the ESMS Manual Section 3. Any changes to this management guideline may potentially trigger the need

[1] This includes all GHGs and black carbon (BC).

to revise the associated procedures and other guidelines that connected with this guideline (e.g., Health and Safety management guideline, CHSS management guideline, etc.). Any update, deviation, or suggestion of this guideline will be followed up in alignment with the provision of Chapter 9 of the ESMS Manual (Management of Change).

3 Management Approach

The management of air quality impact is a risk-based approach, which means that the management activities will be proportional to risk or impact. The base activities of a risk-based approach are identifying potential impact on air quality and assessing the significance level of those impact, and based this impacts identification – assessment process, the management effort and activities will be determined proportional with the significance level of the impacts.

For example, based on impacts identification and assessment process it is determined that during operation stage of a small-scale solar PV power plant, no potential significant impact on air quality identified, thus an air quality modelling will not be taken as methodology for impact assessment process.

For effective air quality management, the following sequential approach shall be implemented:

- Identifying potential project impacts to air quality and the associated risks as early as possible in the project cycle, including the incorporation of EHS considerations into site selection process, engineering planning process for capital requests, facility modification, and layout and process change plans.
- Involving EHS professionals, who have the experience, competence, and training necessary to assess and manage EHS impacts and risks and carry out specialized air quality management functions.
- Understanding the likelihood and magnitude of project risks/impacts on air quality, based on the nature of project activities, the potential consequences to workers, communities, and the environment.
- Prioritizing risk and impact management strategies with the objective of achieving an overall reduction of risk to human health and the environment, by focusing on irreversible and/or significant impacts and by implementing the mitigation hierarchy (avoid – minimize – compensate/restore).
- When avoidance is not feasible, incorporating engineering and management controls to reduce or minimize the possibility and magnitude of undesired consequences.
- Improving the management performance through ongoing monitoring and regular management review.

4 Process Overview

In order to achieve the objectives of each step of the E&S safeguard process, the management of air quality will implement the following process:

- Identification of risks and impacts on air quality;
- Assessment of the identified risks and impacts;
- Planning of mitigation measures; and

- Monitoring and review of the implementation of mitigation measures.

All the above process is conducted within the Impact Assessment (IA) process as required by the ESMS manual, which includes the screening process and categorization, scoping, a baseline study analysing and assessing impact, defining mitigation measures and management and monitoring strategies. In every step of the IA process, the mitigation hierarchy will be taken into consideration.

5 Screening and Categorization

5.1 Screening of potential air quality impact

The screening stage is a key step for an initial identification of impacts related to air quality and emissions from a project, which conducted at an early stage of a project's lifecycle. The objective of screening in the context of air quality management is to identify potential major air quality impacts of a proposed project/activity. Screening of potential air quality impact serves as the basis for scoping (see **Section 6**) and will contribute in calculating the likely E&S effect of a project when determining project category (see ESMS Manual Chapter 5.3).

Screening is based on professional judgement and the information available at the time. Project screening and categorization process is conducted at the earliest possible stage in every project lifecycle; therefore, it is probable that the data used for identification is not widely available and not very detailed. Whenever possible the data collection and the initial identification of impact is conducted concurrently with or part of the pre-feasibility and feasibility studies, and in collaboration with preparers of the feasibility assessments.

The identification of impact on air quality will include of the following information:

- The source of impact.
  Emissions of air pollutants can occur from a wide variety of activities during the construction, operation, and decommissioning phases of a project. These activities can be categorized based on the spatial characteristic of the source including point sources, fugitive sources, and mobile sources and, further, by process, e.g., combustion, materials storage, or other industry sector-specific processes.
- Types of pollutant emitted (SOx, particulate matter, etc).
- The receptor of the impact (workers, communities, plants and animals, water bodies, etc).

Initial identification of potential impact on air quality will be based on information of the project type and its nature, the activities planned in general, and the proposed location in general. Information that needs to be obtained are the following but not limited to:

- Type of project (e.g., transmission line, types of power plant, distribution line, etc.)
- Technology used in general (e.g., types of combustion system and fuel will be used for power plant, etc.)
- Project phases (e.g., pre-construction, construction, operation, decommissioning)
- Location characteristic in general (e.g., administrative boundaries, other activities that may affect the airshed, biome, climate & weather, etc.)

Types of projects and technology that will be applied in each of the project phases could give information on typical sources of air quality pollutant and types of pollutant produced. The location characteristics can provide rough estimation of the potential for pollutant dispersion (e.g., climate & weather condition, topography, etc.), the receptors of the impact (e.g., biome, villages, proximity of the project location with receptor, etc.), and the possibility of trans boundary impacts (administrative boundaries), etc. Numerous sources can be used to obtain the above information, for examples spatial map, land use map, online database (e.g., climate components), remote sensing data, public reports, including interviews and site visits.

5.2 Source of air quality impact

The following is description of types of sources of air quality impact that can be used as reference in the process of identifying potential impact of air quality.

Point Sources

Point sources are discrete, stationary, identifiable sources of emission that release pollutants to the atmosphere. Within a given point source, there may be several individual ‘emission points’ that comprise the point source[2]. Point sources are characterized by the release of air pollutants typically associated with the combustion of fossil fuels, e.g., nitrogen oxides (NO_x), sulphur dioxide (SO_2), carbon monoxide (CO), particulate matter (PM), as well as other air pollutants, including certain volatile organic compounds (VOCs).

Fugitive Sources

Fugitive source air emissions refer to emissions that are distributed spatially over a wide area and not confined to a specific discharge point. They originate in operations where exhausts are not captured and passed through a stack. Fugitive emissions have the potential for much greater ground-level impacts per unit than stationary source emissions, since they are discharged and dispersed close to the ground. The two main types of fugitive emissions are Volatile Organic Compound (VOC) and particulate matter (PM). Other contaminants (NOx, SO_2, and CO) are mainly associated with combustion processes, as described above. Projects with potentially significant fugitive sources of emissions should establish the need for ambient quality assessment and monitoring practices.

Open burning of solid waste, whether hazardous or non-hazardous, is not considered good practice and should be avoided, as the generation of polluting emissions from this type of source cannot be controlled effectively. Open burning also prohibited in Indonesia as regulated in Act No. 18 Year 2008 regarding Waste Management.

The most common sources of fugitive VOC emissions are associated with industrial activities that produce, store, and use VOC-containing liquids or gases where the material is under pressure, exposed to a lower vapor pressure, or displaced from an enclosed space. Typical sources include equipment leaks, open vats and mixing tanks, storage tanks, unit operations in wastewater treatment systems, and accidental releases. Equipment leaks include valves, fittings, and elbows which are subject to leaks under pressure.

[2] Emission points refer to a specific stack, vent, or other discrete point of pollution release. This term should not be confused with point source, which is a regulatory distinction from area and mobile sources. The characterization of point sources into multiple emissions points is useful for allowing more detailed reporting of emissions information.

The most common pollutant involved in fugitive emissions is dust or particulate matter (PM). This is released during certain operations, for example, transport and open storage of solid materials (e.g., cut and fill material), and from exposed soil surfaces (e.g., land clearing), including unpaved roads (e.g., project access road).

Several chemicals are classified as ozone depleting substances (ODSs) and are scheduled for phase-out under the Montreal Protocol on Substances that Deplete the Ozone Layer[3]. The Montreal Protocol includes provision of control measures where no new systems or processes should be installed using CFCs, halons, 1,1,1-trichloroethane, carbon tetrachloride, methyl bromide or HBFCs. HCFCs should only be considered as interim/bridging alternatives as determined by the host country commitments and regulations[4].

Mobile Sources - Land-based

The mobile sources refer to emissions from vehicles which may include CO, NOx, SO2, PM and VOCs. Emissions from on-road and off-road vehicles should comply with national and regional law and regulation.

Greenhouse Gases (GHGs)

The energy sector is one of the sectors that has significant emissions of greenhouse gases (GHGs[5]). GHGs are generated from direct emissions from facilities within the physical project boundary and indirect emissions are associated with the off-site production of power used by the project.

5.3 Preliminary assessment of air quality impact

Once relevant information and potential air quality impacts has been assembled, a preliminary assessment will be conducted to assess the significance of the identified potential impacts. The significance of the potential air quality impacts is measured by assessing the probability and the consequence level, using reference criteria for probability and consequence as provided in Appendix 4 of the ESMS Manual, criteria for Resource Efficiency, Pollution and Emissions of Greenhouse Gases (GHG).

The significance of air quality impact will contribute to calculating the Likely E&S effect of a project when determining the project's category. The potential air quality impacts assessed will likely consist of several impacts, for examples impact of dust, NOx, etc., where each of these impacts will have its own impact significance. However, in context of determining project E&S category, the risk category will follow the highest risk significance.

The results of the screening and categorization process are preliminary in nature and will be expanded and revisited as part of the Impact Assessment, when more information about the

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[3] Examples include: chlorofluorocarbons (CFCs); halons; 1,1,1-trichloroethane (methyl chloroform); carbon tetrachloride; hydrochlorofluorocarbons (HCFCs); hydrobromofluorocarbons (HBFCs); and methyl bromide. They are currently used in a variety of applications including: domestic, commercial, and process refrigeration (CFCs and HCFCs); domestic, commercial, and motor vehicle air conditioning (CFCs and HCFCs); for manufacturing foam products (CFCs); for solvent cleaning applications (CFCs, HCFCs, methyl chloroform, and carbon tetrachloride); as aerosol propellants (CFCs); in fire protection systems (halons and HBFCs); and as crop fumigants (methyl bromide).

[4] Additional information is available through the Montreal Protocol Secretariat web site available at: http://ozone.unep.org/

[5] The six greenhouse gases that form part of the Kyoto Protocol to the United Nations Framework Convention on Climate Change include carbon dioxide ($C0_2$); methane (CH_4); nitrous oxide (N_2O); hydrofluorocarbons (HFCs); perfluorocarbons (PFCs); and sulfur hexafluoride (SF_6).

nature and the scope of a project becomes available or when project definition and circumstances change (e.g., screening of subprojects identified during project implementation, change of project design or components, etc.). This is in line with an adaptive risk management approach.

6 Scoping of Air Quality Impact

Scoping aims to deepen the understanding of the potential air quality impacts (in condition that they have been identified during Project Screening and Categorization), to clearly define what is within the scope of the assessment (activities, risks/impacts, affected area), and develop a suitable methodology and sampling strategy for the air quality Impact Assessment that ensues.

At the scoping stage, the identification of impacts on air quality will be further broadened and deepened. Identification of the potential impacts on air quality are still derived based on the project's description. However, more information about the project is usually available, detailed and more defined, compared to the information available during the project screening and categorization stage. All impacts identified from the project screening and categorization stage will still be included in the list of a project's potential impacts.

The scoping will include, but is not limited to:

a. Understanding project activities, project description and project alternatives.

   At this stage of the project, information regarding the project is available in a more comprehensive manner, such as the project's phases, the technology to be applied, the site design, etc., including some alternatives of project components design. Understanding of the project activities and description will be needed to identify potential interaction between the project and resources/receptors in the Area of Influence (see point c).

b. Identify potential air quality impact

   Identification of potential air quality impact in the scoping stage is basically an iteration of identifying potential impact in the screening stage. However, usually more information about the project is available, detailed and more defined (although some alternatives of design and/or project locations may still exist, but not in a broad range of selection), compared to the information available during the project screening and categorization process. Therefore, the identification of impacts on air quality is further broadened and deepened in this scoping process, which also include identification of GHG emission (see Section 6.1)

   Identification of air quality impacts is derived based on the project's description, activities that pose impact to air quality, and how it interacts with the receptors.

   During the identification of potential impacts, permit or license required related with emission shall be also identified. Identification of permit and license requirements will provide information on management action that may need to be conducted when developing mitigation measures plan.

c. Identify area of influence (AOI) for air quality impact.

The project activities will impact spatial (area) and temporal (time) dimension. Based on the potential air quality impact that has been identified (both in the screening process and deepened in this scoping process), the area of influence for air quality impacts will be determined. The extent of AOI for air quality impact will consider the extent of the direct and indirect impact of air quality impact and location characteristics. The extent of the direct impact may be determined based on reference to similar project or activities, standards related with air quality (e.g., distance for emission monitoring, etc.) or other justified studies. Location characteristics may limit the dispersion area of a pollutant, for example dust dispersion in a dense forest will be more limited than in a low-crop plantation area.

It should be noted that the AOI determined in the scoping process may be revised and adjusted when new information gathered throughout impact assessment process (e.g., new information on existing baseline condition from the baseline survey result) or circumstances change (e.g., changes in project design).

d. Identify sensitive receptors

Air quality impacts that related to or may affect sensitive receptors need to be identified in order to determine which air quality impacts that need to be focused and analysed in more depth. Sensitive receptors include community residential receptors, animals, plants, ecological sensitive area (e.g., national parks), children, the sick, infirm and the elderly can be more prone to respiratory conditions that make them particularly sensitive.

e. Identify existing environment conditions and social issues related to air quality and emissions

The existing environmental condition and social issues related to air quality and emission that can be exacerbated by the project will be identified. For example, if the AOI has a poor air quality in an airshed, or if there is public rejection of the existence of emission stacks. The presence of environmental conditions and/or social issues related to air quality and emissions needs to be considered when analysing the impacts, also as a basis for planning appropriate air quality impact management.

f. Define methodology for impact analysis

In analysing the potential air quality impacts, there are methods that can be used, including quantitative, semi-quantitative, and qualitative methods. As much as feasible, the air quality impact assessment is carried out quantitatively. In general, the methodology for air quality impact assessment consists of, but not limited to:

- Primary and secondary data collection

  The primary and secondary data collection will be conducted as part of the baseline study (see **Section 7**).

- Modelling

  In order to have a reliable quantitative data, some pollutant dispersion may need to be modelled, such as long-term emissions that has potentially significant impact to air quality. The output of air quality modelling will become an input for calculating the consequence of air quality emissions impacts during impact significance assessment (see **Section 8.2**). The modelling will be conducted using appropriate software program in accordance with the EHS guidelines[6], taking into consideration the characteristics of the pollutant, the source, and the geography of the AOI.

g. Identify baseline data requirements

Baseline data that need to be collected will be identified, based on the previous activities in the scoping, i.e., the potential impact identified, the AOI defined, and methodology for impact analysis that has been defined (including the requirements to conduct modelling), etc. Input from stakeholder engagement that has been conducted as part of the impact assessment process as a whole, especially related to air quality and emission will be taken into consideration in determining baseline data that may require to be collected.

6.1 GHG Scoping

When GHG emission is identified, then an estimation of gross GHG emissions resulting from the project should be conducted, providing that such estimation is technically and financially feasible. For projects that have diverse and small sources of emissions (for example, community-driven development projects) or where emissions are not likely to be significant (for example, projects in education and social protection), GHG estimations will not be required.

When determining whether a project produces significant emissions, sector-specific methodologies may be utilized to estimate GHG emissions, where energy sector is included in sector that produce significant emission. However, to be noted that certain projects are designed to produce GHG savings, where their emissions are not considered significant or calculating their gross GHG emissions is not considered technically feasible. These include reduction and control options such as: (a) enhancement of demand-side energy efficiency and reduction of system losses in transmission and distribution; (b) protection and enhancement of sinks and reservoirs of GHGs; (c) promotion of sustainable forms of agriculture and forestry; (d) promotion, development, and increased use of solar and wind energy; and (e) reduction of fugitive methane emissions or recovery of methane emissions for use in waste management. Other methodologies to determine whether a project has significant GHG emission thus required to calculate the GHG gross emission is for projects that are expected to or currently produce more than 25,000 tonnes of CO_2-equivalent annually[7].

PLN will quantify direct emissions from the facilities owned or controlled within the physical project boundary[8] (Scope 1), as well as indirect emissions associated with the off-site production of energy (Scope 2).

National methodologies for estimating GHG emissions accepted in the context of international agreements on climate change or other methodologies may be used to make the estimate[9].

[6] Examples of acceptable emission estimation and dispersion modelling approaches for point and fugitive sources is available in IFC General EHS Guideline – Annex 1.1.1 (www.ifc.org/ehsguidelines)

[7] The quantification of emissions should consider all significant sources of greenhouse gas emissions, including non-energy related sources such as methane and nitrous oxide, among others.

[8] Project-induced changes in soil carbon content or above ground biomass, and project-induced decay of organic matter may contribute to direct emissions sources and shall be included in this emissions quantification where such emissions are expected to be significant.

[9] In cases where the project is financed by IFI, provided such methodology is acceptable to both the PLN and the IFI.

7 Baseline Study

A baseline study will include collection of primary and secondary data collection and analysis of data collected. The primary and secondary data that shall be collected is utilized to understand the air quality conditions in the Project's AOI before the implementation of the Project and as input for modelling process.

The data to be collected will consider the characteristics of potential air quality impacts that have been identified, the location characteristics (including the potential receptors), and data required to conduct modelling that has been defined (if modelling is deemed necessary based on scoping practice).

Primary data collection may consist of field observations, ambient air quality sampling, laboratory analysis, and interviews. Secondary data collection may include available air quality studies that have been conducted earlier in the AOI and associated airshed and supporting data to analyse the air quality condition and potential air quality and emission impacts.

7.1 Primary data collection

In designing an air quality sampling program for primary data collection, the methodology used considers the following:

- Type of sources of potential air quality and emission impacts that have been identified through the scoping process;
- Data collection, methods, equipment are valid, reliable and consistent, i.e., will be conducted in accordance with applicable national laws and regulations or international standards, whichever is more stringent and technically feasible to be applied.
- Sampling of ambient air quality needs to represent the seasonal conditions (wet and dry seasons), by considering the timing of the activities and proportionate with the potential significance of the impacts.

Baseline calculations will also be required for modelling and monitoring purposes, where ambient air quality sampling at and in the vicinity of the site should be undertaken to assess background levels of key pollutants, in order to differentiate between existing ambient conditions and project-related impacts.

For the effectiveness of the project development process, determination of the sampling locations and parameters tested in each sampling location should be developed where it can serve the purposes of baseline study. The sampling locations should consider these factors, but not limited to:

- Location of the source of pollutant;
- The anticipated wind speed and direction;
- Location of the receptor (community, flora and fauna, water bodies, etc.), including sensitive receptors, and the distance from the source;
- The physical characteristics of the location;
- The project's boundaries and AOI.

Ambient air quality sampling parameters shall as a minimum follow the requirement of the applicable laws and regulations regarding ambient air quality[10] with appropriate limits of detection and sampling times or the international standard[11], whichever is more stringent and technically feasible to be applied. Additionally, the standards to be referred to, including the parameters planned to be sampled and the associated threshold will be identified based on scoping result, by taking into account the potential significance of the impacts. Reference of parameters and threshold for ambient air quality presented in **Table 7-1**. Other parameters may be added by considering the specific air pollutant that will be emitted by the pollutant sources, either at each sampling point or at certain sampling points where there is a possibility of an increase in the concentration of the specific pollutant.

Table 7-1 Ambient Air Quality Standard

[10] Government Regulation No. 22 Year 2021, Annex VII, Ambient Air Quality Standard.

[11] Several reference on the international standards: WHO Air Quality Guidelines (http://www.who.int/en), United States National Ambient Air Quality Standards (NAAQS) (http://www.epa.gov/air/criteria.html) and the relevant European Council Directives (Council Directive 1999/30/EC of 22 April 1999 / Council Directive 2002/3/EC of February 12 2002)

Parameters	Averaging Period	National Standard[a] (µg/m³)	WHO Guidelines[b] (µg/m³)
Sulphur Dioxide (SO_2)	10 minutes	N/A	500 (guideline)
	1 hour	150	N/A
	24 hours	75	125 (Interim target -1)
			50 (Interim target -2)
			20 (guideline)
	1 year	45	N/A
Carbon Monoxide (CO)	1 hour	10000	N/A
	8 hours	4000	
Nitrogen Dioxide (NO_2)	1 hour	200	200 (guideline)
	24 hours	65	N/A
	1 year	50	40 (guideline)
Ozone (O_3)	1 hour	150	N/A
	8 hours	100	160 (interim target -1)
			100 (guideline)
	1 year	35	N/A
Hydrocarbon Non-Methane (NMHC)	3 hours	160	N/A
TSP	24 hours	230	N/A
Particulate Matter (<10 µm)	24 hours	75	150 (Interim target -1)
			100 (Interim target -2)
			75 (Interim target -3)
			50 (guideline)
	1 year	40	70 (Interim target -1)
			50 (Interim target -2)
			30 (Interim target -3)
			20 (guideline)
Particulate Matter (<2.5 µm)	24 hours	55	75 (Interim target -1)
			50 (Interim target -2)
			37,5 (Interim target -3)
			25 (guideline)
	1 year	15	35 (Interim target -1)
			25 (Interim target -2)
			15 (Interim target -3)
			10 (guideline)
Lead (Pb)	24 hours	2	N/A

Note:
(a) Government Regulation No. 22 Year 2021, Annex VII, Ambient Air Quality Standard
(b) WBG's Environmental Health and Safety (EHS) Guidelines, 2007

7.2 Secondary data collection

As previously described, secondary data collection includes air quality studies that have been previously conducted in the AOI and supporting data to analyse the air quality condition and potential air quality and emission impacts. Supporting data may include but not limited to climate and meteorology components, e.g., rainfall, temperature, humidity, wind speed and direction, etc. These data can be obtained from BMKG (*Badan Meteorologi, Klimatologi dan Geofisika* – Meteorology, Climatology and Geophysics Agency) and/or the nearest weather station, and/or other accountable and credible sources. It should be noted that for modelling purpose, some specific data is required (for example, hourly meteorological data, etc.,) and other data components will need to be collected (for example, cloud cover, bowen ratio, etc.), depending on the modelling type and software used.

8 Analyse and Assess Air Quality Impact

8.1 Prediction of impact and impact mapping

All available information and data collected during the scoping process and from result of baseline study will be analysed to determine what could potentially happen to receptors as a consequence of the project and its associated activities. From the potentially significant interactions identified in scoping process, the impacts to the various receptors are described and evaluated. It is to be noted that impact assessment is not an isolated process, there may be additional information obtained which indicate that an impact will occur, where this impact has not previously identified during the scoping process, including an impact on one receptor that can cause downstream impacts to other receptors. This will require an assessment of the interaction of impacts that may intensify their scale and significance. For example, based on the scoping process, a potential impact is identified from the use of diesel generator, meanwhile from the baseline study, it is known that there is residential area next to the project boundary with quite large number of toddlers. Therefore, there is potential impact of air quality degradation upon children (sensitive receptor) due to the use of a diesel generator.

For long term, steady state emissions, it may be necessary to develop an appropriate air quality model. The model shall account for the physiology and climate of the AOI and established baseline and should include a receptor field that aligns with sensitive receptors in the area. The extent of the impact can be defined by the outcomes for sensitive receptors and if the air quality parameters meet or exceed the regulatory requirements. If the model determines that any receptor will experience pollutant levels in excess of the regulatory requirement, then the impact will be defined as severe.

Once all the impacts that have been collated, they will be grouped based on stages of the project where they will potentially occur, and the correlation between impacts (including impact other than air quality impact) will be mapped. This will give a clear picture of what impact that may influence other impact and any interaction amongst the identified impacts that will enable identification of possible indirect and cumulative impacts.

8.2 Significance of impact

After the identified potential impacts are defined and mapped, they will be assessed for their significance, using the same method as in the preliminary assessment stage using a risk matrix method. However, at this stage more reliable data is available, including impact modelling that will give a more quantitative reliable information, specifically related to the significance of the impact and other impact consequence factors (if available). The significance of impact will be assessed based on the probability of the impact to occur and the extent of its consequences if it occurs. The consequence of the impact will take into account the following factors:

- Type of impact (direct, indirect, and cumulative)
- Duration of impact (short, medium, or long term)
- Extent or size of the affected area, which may take into account the airshed factor.
- Reversibility of impact (reversible or permanent)
- Sensitivity of receptors (vulnerability)

It is important to note that in determining the impact significance, embedded controls (i.e., physical or procedural controls that are included in Project Description) are taken into account. An example of an embedded control is a standard emission filter that is designed to be installed prior to emission through a stack.

Once the significance of an impact has been defined, the next step is to evaluate what mitigation and enhancement measures are warranted (see **Section 9**). The main objective of developing mitigation measures is to reduce the significance of an impact by reducing the consequence and/or lowering the likelihood that it will occur. Re-evaluation of impact significance value needs to be conducted, once mitigation measures are developed. The significance of the residual impact will be assessed with the same risk matrix, taking into account the application of mitigation measures. For example, piles of excavated soil located adjacent to residential areas during the construction period (approximately 1 year) can cause dust dispersion which can reach the residential areas. This impact has been assessed as an impact with 'medium' consequence and 'very high' likelihood; thus, the impact significance is 'high'. The mitigation measure planned is to build barriers placed upwind of piles in order to block prevailing winds and blocking the spread of dust towards residential areas, thus the consequence will be reduced to 'minor' and the likelihood will be lowered to 'high', and the significance becomes ' moderate'.

All the impacts that have been assessed will be managed, through mitigation measures (See **Section 9**) that have been defined and will be monitored (see **Section 10**). The management and monitoring strategies will need to be developed to reduce the impact significance, prevent an impact to escalate, and to improve the E&S performance of a project. The management and monitoring strategies will be conducted through developing an Air Quality Management Plan (See **Section 11**).

9 Mitigation Measures

Where possible, facilities and projects should avoid, minimize, and control adverse impacts to human health, safety, and the environment from emissions to air. Where this is not possible, the generation and release of emissions of any type should be managed through a combination of the following aspects, whichever applicable and proportionate with the impact significance:

- Energy use efficiency;

- Process modification;
- Selection of fuels or other materials, the processing of which may result in less polluting emissions;
- Application of emissions control techniques, including management of other aspect, for example traffic/transportation management.

The selected prevention and control techniques may include one or more methods of treatment depending on:

- Regulatory requirements;
- Significance of the source of emission;
- Location of the source of emission relative to other sources;
- Location of sensitive receptors;
- Existing ambient air quality, and potential for degradation of the airshed from a proposed project;
- Technical feasibility and cost effectiveness of the available options for prevention, control, and release of emissions.

Projects with significant sources of air emissions, and have potential significant impacts to ambient air quality, should prevent or minimize impacts by ensuring that:

- Emissions do not result in pollutant concentrations that reach or exceed relevant ambient quality guidelines and standards by applying national legislated standards, or in their absence, the current WHO Air Quality Guidelines or other internationally recognized sources[12];
- Emissions do not contribute a significant portion to the attainment of relevant ambient air quality guidelines or standards. As a general rule, 25 percent[13] of the applicable air quality standards to allow additional, future sustainable development in the same airshed.

Projects located within poor air quality airsheds and within or next to areas established as ecologically sensitive (e.g., national parks), should ensure that any increase in pollution levels is as small as feasibility possible and amounts to a fraction of the applicable short-term and annual average air quality guidelines or standards as established by the government (if any) and/or determined in the project-specific environmental assessment.

Suitable mitigation measures may also include the relocation of significant sources of emissions outside the airshed in question, use of cleaner fuels or technologies, application of comprehensive pollution control measures, offset activities at installations controlled by the project sponsor or other facilities within the same airshed, and buy-down of emissions within the same airshed. Specific provisions for minimizing emissions and their impacts in poor air quality or ecologically sensitive airsheds should be established on a project-by-project or industry-specific basis.

Emissions from point sources should be avoided and controlled according to good international industry practice (GIIP) applicable to the relevant industry sector, depending on

[12] Refer to Footnote 8

[13] WBG General EHS Guidelines: Environmental. Air Emission and Ambient Air Quality. 2007

ambient conditions, through the combined application of process modifications and emissions controls. The stack height for all point sources of emissions, whether 'significant' or not, should be designed according to GIIP[14] to avoid excessive ground level concentrations due to downwash, wakes, and eddy effects, and to ensure reasonable diffusion to minimize impacts. For projects with multiple sources of emissions, stack heights should be established with consideration to emissions from all other project emission sources, both point and fugitive. Non-significant sources of emission, including small combustion sources[15], should also use GIIP in stack design.

Emissions should be controlled by any number of means, selected based on the degree of reduction required and the cost and feasibility control. Below are several examples of emission control measure:

- Particulate matters in stack emissions can be controlled with electrostatic precipitators, fabric filters (baghouses), mechanical collectors, and venturi scrubbers;
- Sulphur dioxide emissions can be controlled blending fuels, switching to lower-sulphur fuels, and removing sulphur dioxide from flue gases with spray or circulating dry absorbers, dry sorbent injection, or wet limestone flue-gas desulfurization process;
- Emission of nitrogen oxides can be reduced/controlled using low-NOx burners and overfire air (also known as air staging). Secondary controls include reburning, selective noncatalytic reduction, and selective catalytic reduction;
- Carbon monoxide emissions can be reduced with good combustion control.

Several example of dust and particulate matter control from stationary and mobile sources:

- Frequent water sprays at concrete plants and crushing plants and other dust-generating stationary plant (typically, multiple times per day in summer and other dry periods);
- Intermittent and scheduled application of water (or other dust suppressants) to roads and
  other bare ground;
- Covers (plastic, canvas, or material too heavy to blow) or vegetative growth on bare ground and piles of spoil and soil. Vegetation can be permanent or temporary depending on future plans for the area being covered;
- Barriers placed upwind of piles or bare ground in order to block prevailing winds;
- Forced-air ventilation in tunnels and shafts to clear airborne dust and provide fresh air;
- Wetting materials being dumped and/or reducing the height of material dumps;
- Clearing the minimum area needed for immediate construction and stabilizing/vegetating areas as soon as possible after construction at that location ends;
- Paving or frequently compacting areas subject to high traffic;
- Using wet drilling techniques;
- Wetting surface to be disturbed by blasting;
- Prohibiting open burning of wood and other materials.

[14] Reference: WBG EHS Guidelines, Annex 1.1.3. 2007

[15] Small combustion sources are those with a total rated heat input capacity of 50MWth or less.

The recommended prevention and control techniques for VOC emissions:

- Associated with equipment leaks include:
  - Equipment modifications;
  - Implementing a leak detection and repair (LDAR) program that controls fugitive emissions by regularly monitoring to detect leaks, and implementing repairs within a predefined time period.
- Associated with handling of chemicals in open vats and mixing processes, the recommended prevention and control techniques include:
  - Substitution of less volatile substances, e.g., aqueous solvents;
  - Collection of vapors through air extractors and subsequent treatment of gas stream by removing VOCs with control devices, e.g., condensers or activated carbon absorption;
  - Collection of vapors through air extractors and subsequent treatment with destructive control devices such as:
    - Catalytic Incinerators: Used to reduce VOCs from process exhaust gases exiting paint spray booths, ovens, and other process operations;
    - Thermal Incinerators: Used to control VOC levels in a gas stream by passing the stream through a combustion chamber where the VOCs are burned in air at temperatures between 700º C to 1,300º C;
    - Enclosed Oxidizing Flares: Used to convert VOCs into CO_2 and H_2O by way of direct combustion.
  - Use of floating roofs on storage tanks to reduce the opportunity for volatilization by eliminating the headspace present in conventional storage tanks.

The traffic and transportation management approach can be applied to reduce the potential of air pollution increment. Several examples of traffic management activities that can be implemented:

- Covers on truckloads of earthen and other materials that can generate dust;
- Transportation schedule arrangement to reduce traffic increase at one time;
- Vehicle speed limits on unsealed roads and tracks to reduce the generation of particulates in the air;
- Maintenance of vehicle engines by trained personnel in accordance with manufacturer's recommendation.

Recommendations for reduction and control of greenhouse gases include:

- Carbon financing;
- Enhancement of energy efficiency (see section on 'Energy Conservation');
- Protection and enhancement of sinks and reservoirs of greenhouse gases;
- Promotion of sustainable forms of agriculture and forestry;
- Promotion, development and increased use of renewable forms of energy;
- Carbon capture and storage technologies;
- Limitation and/or reduction of methane emissions through recovery and use in waste management, as well as in the production, transport and distribution of energy (coal, oil, and gas).

One mitigation measure can be applied to manage the impact on several air quality parameters, for example setting a material transport schedule that can control the NOx, SOx and particulate pollution levels at a specific time period.

Any equipment or technology uses that serve as mitigation measures will be maintained accordingly, e.g., maintenance of electrostatic precipitators, low-NOx burners, vegetative for barriers, access road re-compacting, etc. The maintenance activity shall be part of the emission control measures and Air Quality Management Plan.

10 Monitoring

Monitoring will serve as a tool to improve the E&S performance. As part of the air quality management, monitoring consists of periodical monitoring as part of management activities (i.e. mitigation measures planned) and review of the overall management plan.

10.1 Management activity monitoring

Each of the mitigation measures that are planned should be monitored to ensure that management activities are carried out according to plan, ensure that project activities do not violate the provisions that have been regulated and determined, as well as early detection of an increase in abnormal air pollution. The monitoring plan will be developed based on the mitigation measures that has been set, and will be commensurate with the significance level of impact based on the impact analysis and assessment result.

In developing a monitoring plan for activities planned in the management plan, the following items should be taken into account, but not limited to:

- Parameters to be monitored.
  Parameters to be monitored are the performance indicators that have been determined when developing management plan and the parameters selected should reflect the pollutants of concern associated with project processes. In most cases the parameters to be monitored are air quality parameters, both ambient air quality parameters and emission levels[16] (e.g., concentration of particulate in ambient air, concentration of NOx in stack's emission). For combustion processes, indicator parameters typically include the quality of inputs, for example the sulphur content of fuel. The parameters to be monitored should also include parameters that stated in the permits, if any.

- Baseline
  Before a project is developed, baseline of air quality at and in the vicinity of the site should be undertaken to assess background levels of key pollutants, in order to differentiate between existing ambient conditions and project-related impacts. Once compared to the applicable standards (compliance to regulatory and/or international standards), the result of monitoring should also be compared to the baseline condition prior the project commencement in order to analyse the project impact to the ambient air quality. Air quality targets should be based on the baseline condition plus the expected project contribution at the monitoring location.

- Monitoring location

[16] To be noted that there are different regulations that specifically regulate emissions from certain activities.

Air quality monitoring can be carried out on ambient air quality and emissions. Ambient air quality monitoring may consist of off-site or fence line monitoring. The location of ambient air quality monitoring stations should be established based on the results of scientific methods and mathematical models to estimate potential impact to the receiving airshed from an emissions source, taking into consideration such aspects as the location of potentially affected communities and prevailing wind directions. It is advisable to use the same locations that baseline measurements were taken during the baseline determination. Emission monitoring will include the level of emissions at the source of the impact (stack) in accordance with relevant standards. If any and/or applicable, Continuous Emission Monitoring System (CEMS) data can also be used if suitable calibration has been maintained.

- Frequency of inspection and monitoring.
  Data on emissions and ambient air quality generated through the monitoring program should be representative of the emissions discharged by the project over time. Emissions monitoring frequency and duration may also range from continuous (CEMS) for some combustion process operating parameters or inputs (e.g., the quality of fuel) to less frequent, monthly, quarterly or yearly stack tests. The frequency of monitoring will also depend on other various factors, for example the duration of impact, magnitude of impact, the sensitivity or limit of the receptor, the airshed condition, etc. Longer periods of impact, larger magnitudes of impact, more sensitive receptors and poor airshed condition naturally will require more frequent monitoring, likewise. The frequency of several parameters that are required to be monitored in the permit, if any, must comply with the provisions in the permit, at minimum.

- Sampling and analysis method
  Monitoring programs should apply national or international methods for sample collection and analysis, for examples those published by the International Organization for Standardization[17], the European Committee for Standardization[18], or the U.S. Environmental Protection Agency[19]. Sampling should be conducted by, or under, the supervision of suitably qualified individuals. Analysis should be conducted by entities permitted or certified for this purpose. Sampling and analysis Quality Assurance/Quality Control (QA/QC) plans should be applied and documented to ensure that data quality is adequate for the intended data use (e.g., method detection limits are below levels of concern). Monitoring reports should include QA/QC documentation.

- Instruments that will be used for monitoring, including calibration requirements.
  The method and instrument to be used will comply with applicable regulation (if any) and will follow the best practice as technically feasible.

- The resources

[17] An on-line catalogue of ISO standards relating to the environment, health protection, and safety is available at: http://www.iso.org/iso/en/CatalogueListPage.CatalogueList?ICS1=13&ICS2=&ICS3=&scopelist=

[18] An on-line catalogue of European Standards is available at: http://www.cen.eu/catweb/cwen.htm.

[19] The National Environmental Methods Index provides a searchable clearinghouse of U.S. methods and procedures for both regulatory and non-regulatory monitoring purposes for water, sediment, air and tissues, and is available at http://www.nemi.gov/.

The monitoring will determine the minimum required qualifications of persons who will conduct the monitoring and inspection. At some cases, public participation in monitoring can be a requirement or a strategy in a management. If public monitoring determined to be applied, then it should be regulated and the requirement of the public that will participate should be determined.

10.2 Management plan review

The Air Quality Management Plan (see Section **11**) is a living document and have to be referred to every stage along the project cycle. The target and approach established in the plan should be reviewed, modified, or renewed from time to time as deemed necessary to find the best possible result.

The following are items that need to be determined related to management plan review:

- Schedule for regular review. The management plan should be reviewed regularly. If the phase will be more than one year, then the regular review shall be conducted annually in minimum.
- The parties that responsible for conducting the review, making an amendment, and the party approving the result of the review.

11 Air Quality Management Plan

Mitigation measures and monitoring plan are arranged in a management plan for air quality and emission. The management plan can be part of the Project's ESMP, or to be a stand-alone document.

In general, Air Quality and Emission Management Plan should identify receptors that could be affected by emissions of air pollutants, including dust. The plan should also describe in detail the specific control measures that are used at the Project as well as maintenance requirements. It should also describe monitoring equipment and instrumentation. The components of Air Quality Management Plan are described below.

11.1 Component 1: *Objective(s)*

The main objective of the management of air quality and emission is that the pollutants released to the environment due to the activities of the Project are in compliance with the applicable national law and regulation or the international standard, whichever is more stringent and technically feasible to be applied. By avoiding, if possible, the release of air pollutants to the environment, or minimize and control the air pollution, it is aiming that issues or grievance related to air pollution generated from a Project will be none or minimum.

The specific objectives of the management plan are related to the impacts that has been assessed in the impact assessment process.

11.2 Component 2*: Source of impact, types of pollutant and impact receptor*

The source of impact, types of pollutant and impact receptor must be described in the management plan. This information can be drawn from the impact assessment process that was carried out previously.

11.3 Component 3: *Impact management activities*

This is the core of the management plan where all mitigation measures for each impact will be described. For specific project activity that requires permit for its implementation, any requirements of the permit related with management effort for the impact source should be described in the management plan.

The activities planned should also consider other plans that are related (if any), such as Noise & Vibration Management Plan, Occupational Health Safety Management Plan, Community Health Safety and Security Management Plan, Stakeholder Management Plan, etc.

The Air Quality Management Plan should also require that stakeholders that may be impacted to be consulted. The Plan must provide for timely handling of complaints/concerns received through the formal grievance mechanism or otherwise, including identifying the person or persons responsible for dealing with such issues.

11.4 Component 4: *Performance Indicator*

Every mitigation measure or management activity planned should have a measurable indicator of success as a tool to determine achievement targets and control the implementation of the management activity. Management indicators are determined shall be measurable, wherever possible to be quantitative in nature and can be measured with applicable tools. In most cases the indicators of success are based on specific air quality parameters that are regulated in applicable national laws and/or the international standard, whichever is more stringent and technically feasible to be implemented.

11.5 Component 5: *Institutional Responsibility*

The management plan must identify and describe the responsibilities of all parties (PLN, contractor or other relevant third parties) and competent authorities. The management plan must also identify the roles and responsibilities of individual positions within these organization, including the person or persons that are responsible to follow up and take action upon grievance related air quality that are submitted through the formal grievance mechanism.

11.6 Component 6: *Implementation Schedule*

The management plan should detail an implementation schedule of management activities, taking into account the planned timing of construction and other project activities, including any permit or license that should be obtain prior activity's commencing.

11.7 Component 7: *Cost Estimates*

The management plan should include cost estimates for each of activity or set of activities implementation, including up-front investment costs and long-term recurrent costs.

11.8 Component 8: *Monitoring, Recordkeeping and Reporting*

The management plan must call for inspection/monitoring of air quality & management activities, in order to ensure compliance with the applicable national laws and regulations or the international standard, as set in the management plan objectives. The monitoring plan in the management plan should specify:

- Parameters to be monitored;
- Monitoring location/position;
- The frequency of inspection and monitoring;
- Regulatory criteria and any specific requirement imposed on the project by government (as applicable);
- Sampling and analysis method;
- Instruments that will be used for monitoring, including calibration requirements;
- The required qualifications of persons who will conduct the monitoring and inspection, and of any members of the public who may participate in monitoring;
- Records that must be kept and the person responsible for keeping the records;
- Reports that will be prepared, to whom the reports are to be submitted for review, and the length of time records will be kept. This will include summary reports at intervals and to which institutional should be submitted.

For project activities or management activities that require a permit for their implementation, the monitoring plan must also include the requirements in the permit, for examples parameters to be monitored, the frequency, etc. The monitoring component is elaborated in **Section 10** of this guideline.

11.9 Component 9: *Management Plan Review*

The management plan should determine and state the schedule of management plan review (see **Section 10.2**). Regular review of the management plan and the party responsible for conducting a review, making an amendment and the party approving the results of the review and the changes made (if any) must be stated in the management plan.

12 Procedures

In carrying out air quality management activities, procedures can be developed as necessary (e.g., air quality sampling procedure, air quality monitoring procedure, maintenance procedure, etc.). The procedures required are highly dependent on the nature of the project and the impact and mitigation measures determined, although some procedures may be more general thus can be used for various projects (e.g., air quality sampling procedure).

In general, there are several key items that need to be included in the procedures to be developed are, but not limited to:

- Procedure Information, which includes procedure title, identification number, number of pages.
- Purpose. The procedure should provide information on the objective of the procedure.
- Scope. The procedure should inform the boundary of the procedure, aspects or parties that are covered under the procedure, and limitation to the procedure.
- Definition. The procedure should define the terms used in the procedure.
- Responsibilities. The procedure should identify and state the parties that will be responsible to follow the procedure, supervise the implementation of the procedure, provide training of the procedure, and parties that will regularly review and update the procedure.
- Work instructions. The procedure should list, in a simple and clear manners, the specific steps that will be taken to implement the procedure.

- Reference documents. The procedure should list the relevant documents that support, utilized as the basis or provide additional information for the procedure, including rules and regulation that to be complied.
- Records. The procedure should provide information of the required documented outcomes of the procedures. Format for required records will be provided under the procedure, as necessary.
- Approving authority. The procedure should provide information on party that is responsible for approving the procedures.
- Issue date. The procedure should provide information on time of procedure issuance.
- Revision date. The procedure should provide information on time of procedure reviewed and revised (Procedures should be continually updated and improved).
- Other Environmental & Social components, if applicable. The procedure should include other environmental and social component, if applicable, related with the activities in the procedure. Example: PPE required for the activities must be clearly stated in the procedure.

13 References

- Act No. 11 Year 2020 on Job Creation
- Act No.32 Year 2009 on Environmental Protection and Management
- Government Regulation (GR) No.22 Year 2021 on Implementation of Environmental Protection and Management
- Minister of Environment Decree No. Kep-13/MENLH/3/1995 on Emission Quality Standard for Non-mobile Sources.
- Minister of Environment and Forestry Regulation No. 14 Year 2020 on Air Pollutant Standard Index
- Minister of Environment Regulation No. 12 Year 2010 on Implementation of Air Pollution Control at The Regional Level
- Minister of Environment and Forestry Regulation No. 11 Year 2021 on Engine Emission Quality Standards with Internal Combustion
- World Bank Environmental and Social Framework (ESF), Environmental and Social Standard (ESS) 3: Resource Efficiency and Pollution Prevention and Management
- World Bank Environmental and Social Framework (ESF) Guidance Note, Environmental and Social Standard (ESS) 3: Resource Efficiency and Pollution Prevention and Management
- WBG’s Environmental Health and Safety (EHS) Guidelines, 2007
- IFC PS 3: Resource Efficiency and Pollution Prevention, 2012
- IFC Guidance Note 3: Resource Efficiency and Pollution Prevention, 2012