SFG2269 REV

Environmental and Social Management Framework

PT SARANA MULTI INFRASTRUKTUR (PERSERO)

2 November 2016

Abbreviations

Acronyms and abbreviations	Description
AMDAL	*Analisis Mengenai Dampak Lingkungan* (Complete EIA)
ANDAL	*Analisis Dampak Lingkungan* (Sector/issue-specific EIA)
BOQ	Bill of Quantities
CAP	Corrective Action Plan
DFI	Development Financial Institution
DER	Detail Engineering Report
DPPIPL	(Division of Investment for Local Goverment and Other Institutions - *Divisi Pembiayaan Pemda and Instansi Pemerintah Lainnya*
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
ESDD	Environmental and Social Due Diligence
ESEL	Environmental and Social Project Exclusion List
ESS&BCM	Environmental Social Safeguards and Business Continuity Management
ESSC	Environmental and Social Safeguards Checklist
E&S	Environmental and Social
ESMF	Environmental and Social Management Framework
FPIC	Free Prior Informed Consultation
GRM	Grievance Redress Mechanism
IEE	Initial Environmental Examination
IFC	International Finance Corporation
ILAR	Involuntary Land Acquisition and Resettlement
ILO	International Labour Organization
IPP	Indigenous Peoples Plan
IPPF	Indigenous Peoples Planning Framework
KA-ANDAL	*Kerangka Acuan - Analisis Dampak Lingkungan* (Terms of reference for preparing EIA)
LA	Loan Agreement
LAP	Loan Application Package
LARPF	Land Acquisition and Resettlement Policy Framework
LARAP	Land Acquisition and Resettlement Action Plan
MSW	Municipal Solid Waste
PAPs	Subproject Affected Persons
PDF	Project Development Facility
PF	Process Framework
PT SMI	PT Sarana Multi Infrastruktur (Persero)
RIDF	Regional Infrastructure Development Fund

Acronyms and abbreviations	Description
RKL-RPL	*Rencana Pengelolaan Lingkungan-Rencana Pemantauan Lingkungan* (Sector/issue-specific environmental management and monitoring plan)
SA	Social Assessment
SGs	Subnational Government
SIA	Social Impact Assessment
SPPL	*Surat Pernyataan Kesanggupan Pengelolaan dan Pemantauan Lingkungan Hidup* (Statement of environmental management and monitoring; required when subprojects have less impacts than the ones which required UKL-UPL documents)
SRAP	Supplemental Resettlement Action Plan
UKL-UPL	*Upaya Pengelolaan Lingkungan dan Upaya Pemantauan Lingkungan* (Environmental management and monitoring plan)
VLD	Voluntary Land Donation
WB	World Bank

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1. Introduction

Infrastructure investment in Indonesia has not caught up with pre-Asian financial crisis levels, and lags well behind regional competitors today. Infrastructure played a key role in driving growth and poverty reduction in the 30 years prior to the 1997 Asian financial crisis. After falling off sharply due to the crisis, Indonesia's infrastructure investment has struggled to recover. Total infrastructure investment declined from an average of 7 percent of GDP in 1995-97 to around 3-4 percent from 2011-2013. By comparison, neighbouring countries such as Thailand, Vietnam and China registered rates of approximately 7, 8, and 10 percent, respectively. Not surprisingly, Indonesia suffers from some of the poorest infrastructure indicators in the region. In 1996, Indonesia ranked ahead of countries like China and Thailand in the Global Competiveness Report's index of 'overall infrastructure quality', but by 2002 these countries had surpassed Indonesia.

Decreased spending on the part of government, state-owned enterprises (SOEs) and the private sector caused the decline in infrastructure investment as a proportion of GDP. Private sector investment experienced the biggest fall, declining from 2.3 percent of GDP during 1995-1997 to 0.4 percent from 2008-2011. This is a particular concern given the Government of Indonesia's (GoI) increasing focus on public-private partnerships (PPPs) to finance infrastructure development. Over the same period, infrastructure investment by SOEs and the central government fell by 1.8 and 1.9 percentage points, respectively, while subnational government spending increased by 0.9 percentage points. Subnational governments are now leading in infrastructure spending in Indonesia, accounting for 39 percent of total infrastructure spending in 2010-2011.

Currently available financing instruments in Indonesia are limited and ill-fitting for the nature and scale of the required urban and local-level infrastructure investment. In recent years, Indonesia has developed PPP vehicles for commercially viable infrastructure (e.g. energy generation, distribution and transmission; toll roads; airports and ports), but the market for PPPs is oriented towards large-scale revenue-generating projects. Regulations have been amended recently to enable subnational governments to issue bonds for urban infrastructure, but municipal bonds remain untapped, and only the larger cities or provinces with high fiscal capacity would be in a position to issue such bonds in the absence of a mature municipal bond market. Subnational government budgets (APBD) can only be used to pay for small-scale projects or marginal improvements in basic services that take less than one year to complete, due to government budgetary rules.

Addressing the 'missing middle' for medium- to long-term infrastructure finance is a critical priority for GoI to meet the local infrastructure gap. There are limited sources of project financing for subnational governments seeking to undertake multi-year investments that are economically viable even if not financially viable, such as water supply, sanitation, solid waste, drainage, affordable housing and urban transport projects. These subprojects generally have significant positive economic benefits, but may not always generate a clear or robust revenue stream.

Building on the lessons from past experiences of SLA/RDI/RDA and PIP implementation, and commensurate with the new government's continued emphasis on subnational infrastructure investment, the Minister of Finance took the decision in February 2015 to dissolve the PIP and transfer its assets into *PT Sarana Multi Infrastruktur (Persero)* ("PT SMI"). In doing so**,** the Minister transferred to PT SMI the mandate for subnational lending through the Regional Infrastructure Development Fund (RIDF). RIDF operates as a new and separate business line within the overall PT SMI structure (refer to **Figure 2**).

The proposed operation aims to support the structuring and operationalization of the RIDF as a retail domestic financial intermediary located within PT SMI to increase access to finance for basic environmental, productive and social infrastructure. The RIDF will mostly focus on financing economically-viable infrastructure that requires short, medium-to long-term tenor debt. RIDF will be accessible to creditworthy municipality, district and provincial governments across Indonesia (henceforth, these three local entities will be called Subnational Governments/SGs). However, it is expected that the RIDF business strategy will disproportionately target fast growing medium and large urban SGs across all island groups where infrastructure development is unable to keep pace with growing demand. The RIDF will be structured around principles of financial sustainability with the view in the medium-term of being able to increasingly leverage market-based sources of finance.

The RIDF would incorporate the products offered in the PIP model but enlarges the opportunity for the SGs to invest capital investments by providing longer tenor loan pricing. While the PIP product is useful, it is recognized that an expanded business line is needed for larger multi-year investments in environmental and logistic infrastructure. In addition to smaller projects, RIDF product enables PT SMI to expand the portfolio to a broader range of medium and large projects such as bus rapid transit system, solid waste treatment facilities, sanitary land fill sites, water treatment plants, water distribution networks, sewerage networks and treatment plants, etc. which are economically feasible but not always financially viable. The RIDF will be accessible to creditworthy local and provincial governments across Indonesia.

It is expected that the RIDF business strategy will effectively target fast growing medium and large urban SGs across all island groups where infrastructure development is unable to keep pace with growing demand. The RIDF will be structured around principles of financial sustainability with the view in the medium-term of being able to increasingly leverage market-based sources of finance. The Project will also include the establishment of a Project Development Facility (PDF) to support the development of a subproject pipeline as well as to channel technical assistance to the SGs in areas of subproject identification, preparation, design and construction supervision, and related advisory services.

As mentioned, the objectives of the establishment of RIDF are to increase access to infrastructure finance at the subnational level through a sustainable financial intermediary. The RIDF is expected to achieve its objectives by focusing exclusively on subnational infrastructure financing, with specific policy directives suitable to subnational lending, and an optimum blend of development-oriented approach and commercial focus. This project is being designed and appraised under a 'framework approach', where the assessment of project readiness requires that corporate systems, regulations and detailed operating procedures have been developed and installed.

The establishment plan for the RIDF lending unit and the RIDF-PDF within the PT SMI organizational structure is presented in Figure 2 (chapter 1.7)

1.1 RIDF project components

RIDF has two components: (i) Capital Support for RIDF and (ii) Project Development Facility (PDF).

Capital Support for RIDF

This component will provide capital injection for PT SMI to operate RIDF as a financial intermediary lending business line, providing senior debt to subnational governments in Indonesia for economically viable infrastructure projects. RIDF will extend loans directly, at its own credit risk, to creditworthy SGs (subnational governments) as final borrowers. It is anticipated that RIDF's initial focus will be on district-level (*kota* and *kabupaten*) governments, before eventually scaling up to more complex regional and inter-regional projects at the provincial level as its appraisal and financial capacity deepens. As its business grows, RIDF could also lend directly to local-level state-owned enterprises (e.g. PDAMs and *Perusahaan Daerah* or PD).

To be eligible to borrow from RIDF, a subnational government must satisfy eight criteria under existing GoI regulation, i.e.: i) Infrastructure to be financed is public infrastructure that is most needed (priority) and is contained in the RPJMD; ii) Approval of the relevant legislature (DPRD) at the subnational-level; iii) Subnational government is not in arrears, whether with SLA or other loan sources; iv) DSCR of at least 2.5 times (as stipulated in PP No. 30/2011); v) Loan amount should not exceed 75% of the accumulated general revenue amount in the APBD of the previous fiscal year; vi) Current fiscal year APBD deficit, if any, is within the limits prescribed by applicable regulations; vii) Audit results from BPK (supreme audit institution) from each of the last three years should be at least WDP (qualified opinion) or better; and viii) Recommendation from the Ministry of Home Affairs.

RIDF's core policies will include the following: i) appraisal of subprojects on the basis of economic rather than financial viability; ii) use of 'cost plus' pricing (i.e. to cover the cost of capital, operating expenses and anticipated risk; and iii) short to long-term tenor loans (e.g.

minimum tenor of 5 years to a maximum of 20 years). In addition, RIDF will be equipped with post-default guarantee with intercept mechanism. This would provide protection to PT. SMI in the case of SGs default. The exact value and structure of the guarantee mechanism will be finalized with a concern for moral hazard risk and assurances that PT. SMI retains a strong incentive to maintain rigorous appraisal and credit risk management practices. RIDF will also rely on a combination of prudential lending norms and rigorous appraisal adopted to considerably reduce the probability of defaults and consequently the need to fall back on security mechanisms to ensure debt servicing. In addition, the appraisal process would identify key repayment risks at every stage of the project; for example, regulatory risks, prior to commencement, construction risks, operations and maintenance risks etc. These risks would be mitigated by appropriate loan covenants and pre-disbursement conditions. These loan covenants would be stipulated in the loan agreement and would be expected to reduce the probability of default.

Further, RIDF will fund subprojects under an open menu of environmental, social and productive infrastructure that fall within the clear jurisdictional responsibility of subnational governments under Indonesia's decentralized system. Subprojects must also be economically viable and have clear development and poverty reduction impacts (see **Table 1** below for Eligible Sectors and Subprojects).

Table 1: Eligible sectors and subprojects

Eligible Sectors		Eligible Subprojects
1	Water Supply and Sanitation	<u>Water Supply</u> • Construction/rehabilitation/capacity augmentation of dams, lakes and reservoirs for purpose of supply of water to urban areas. The eligible costs shall include the expenses towards embankments, earthen works, diversion channels, source diversion and other similar works. • Construction of infrastructure incidental to source augmentation such as construction of jack-wells/bore wells, pumping equipment, etc. • Development of new water treatment plants and capacity augmentation of existing treatment plants including treatment technologies, civil works, etc. • Construction and laying of raw water transmission and treated water distribution systems (pipes, pumping stations, tanks, etc.). Including replacement and/or rehabilitation of the existing water supply systems • Installation of water meters at consumer and bulk connections and associated monitoring systems. • Implementation of SCADA and other systems for monitoring and pressure control. • Construction and installation of desalination plants for urban water

	Eligible Sectors	Eligible Subprojects
		supply in coastal areas. Sewerage • Collection network and waste-water treatment facility • Pumping stations and machinery • Regional facilities and system automation
2	Environmental Infrastructure	Solid Waste Management • Construction of a municipal waste-processing facility (sanitary, land-fill, processing plant, incineration unit, etc.). • Construction of construction and demolition waste processing facility. • Waste recycling project. • Purchase of vehicles and bins for solid waste collection. • Development of vehicle-tracking and waste disposal monitoring system. Drainage • Development of storm water drainage network • Rehabilitation of existing drainage networks • De-silting and/or strengthening of natural drains Energy Efficiency • Improvement of electricity installation and equipment in building and public facilities • Retrofitting building and infrastructure with efficient energy consumption instruments • Improving system that can control energy consumption
3	Low-Income Housing & Slum Upgrading	• Public housing units in slum areas (in-situ and or relocation) • Integrated urban upgrading including water, sewerage, drainage, roads and street lighting, etc.
4	Transportation, Productive, Logistics Infrastructure	• New carriageway development (at grade, flyovers, bridges) • Road rehabilitation, upgrading and/or widening • Junction-improvements projects • Development of mass transit (non - rail based) infrastructure. • Development of pedestrian infrastructure (foot-over bridges, footpath, street furniture, street-lighting, etc.). • Purchase of public buses • Development of street-furniture for bus-stops • Development of bus depot and shelters • Development of dedicated BRT lane and related infrastructure, tracking and monitoring system for operating BRT etc.

Eligible Sectors		Eligible Subprojects
		• Development of multi-level car parking structure • Development of traffic monitoring and management system • Development of building and/or facilities to house traffic management unit. • Irrigation infrastructure development
5	Social Infrastructure	• Development of new hospitals, schools and public markets. • Rehabilitation and/or expansion of hospitals, schools and public markets Public market facilities. • Development of facilities incidental to the social infrastructure such as parking facilities and equipment (medical equipment & beds for hospitals, teaching aid and furniture for schools, storage and warehousing for markets, etc.)

RIDF Project Development Facility

Most of the SGs are constrained both by availability of experienced, skilled personnel; and modern techniques to develop projects; and are also constrained in terms of developing reasonable, balanced procurement packages of an acceptable quality, in a timely manner. Capacities apart, the cost of project development is also rather high (typically, about 1-2 percent of total project cost) and is unaffordable to many of the SGs. The current need is to provide grant assistance for subproject preparation through professional experts with specific skills on subproject preparation, feasibility assessment, sectorial expertise, etc. to ensure a scientific, quality and timely development of the SGs' urban infrastructure projects.

An RIDF Project Development Fund (RIDF-PDF) is a financing facility which helps and facilitates robust subproject development, and supports the SGs in the preliminary feasibility process, detailed engineering design and subproject preparation. RIDF-PDF is designed to be a financing facility to support the SGs in developing subprojects which are initially assessed to be realistic, feasible and within the domain of RIDF funding. RIDF-PDF would lower the costs of subproject preparation for the SGs, provide expert assistance in standardizing designs and produce a pipeline of financeable subprojects for RIDF. It will facilitate subproject conceptualization and development by supporting the SGs in the following:

a) Identifying the overall process for subproject development and supporting the SGs through all stages of this subproject development;
b) Identification/appointment of necessary technical experts and overseeing their activities; and
c) Consultation with relevant stakeholders and decision makers enabling a buy in for the subprojects, among all stakeholders.

RIDF-PDF will operate in parallel with the operationalization of RIDF. The focus of the RIDF-PDF team in the initial phase is to be pro-actively approaching SGs and building the pipeline for support on subproject development. To start with, the PDF will identify potential subprojects/SGs applying for RIDF or those directly applying for PDF supports. The PDF is designed to be a development facility to support SGs in developing subprojects which are primarily realistic, feasible and within the ambit of RIDF lending facility. The PDF would also result in creating a pipeline of bank-able infrastructure subprojects sponsored by SGs, for the RIDF to evaluate lending to.

The primary interactions with various SGs indicate that the existing demand for medium and long term infrastructure funding and need for institutional support in subproject development activities would make RIDF-PDF a timely intervention for RIDF to succeed. RIDF-PDF will be managed by a team of specialists in the area of urban infrastructure and SG finances and operations. This team will be housed within PT SMI's existing Project Development Advisory team under Directorate of Project Preparation, which currently supports the PPP subprojects.

Eligible entities/sectors: PDF assists subprojects which are eligible for funding under the RIDF eligible sectors and under the jurisdiction of SGs. The grant support to the SGs under PDF would be limited to the below listed aspects of subproject development. All remaining activities would have to be undertaken by the SGs through its own internal resources/other sources of funding. The activities for PDF support include:

- Project identification and preliminary structuring – SGs often appreciate the solution involving larger infrastructure intervention, however, they are to some extent unable to identify the infrastructure interventions in a subproject format. The PDF will assist the SG towards subproject identification, prioritization and preliminary structuring.
- Project preparation studies – feasibility studies, environmental and social safeguards studies and detailed engineering designs - The PDF supports SGs by appointment of consultants / advisors to assist them in undertaking technical including detailed engineering designs (DEDs), financial including FS, environmental and social assessment/instruments. EIA document will be appraised by EIA Appraising Committee for the SG, and will issue the environmental permit. The appointment of such advisors / consultants shall follow a transparent procurement procedure, recommended by PDF team and be driven by the SG.
- Design-supervision assistance - Certain technically critical subprojects, might require all round support and would require accountability from the consultants in terms of design (for instance, a regional landfill or a treatment plant). In that case, the PDF can engage a consultant to both design and to supervise / vet the outputs for the subprojects.
- Preparation of Procurement and Contract Documents - The PDF would support LGs in preparation of contract / procurement documents, for subprojects being supported by the RIDF. Over time, PDF could help develop model / standard procurement and contract documents that can be used across various subproject types / sectors. This value addition of the PDF to the current system, can subsequently lead to standard procurement policies / acts, to be followed by SGs.
- Capacity building for subnational governments – The PDF would support SGs in the form of workshop, training, or advisory support in the area of technical, financial,

project management, and environmental and social aspects required to strengthen their capacity for subproject preparation and implementation.

SGs that require financial assistance from RIDF but still need to improve their subproject preparation studies could go to the PDF division for receiving additional assistance[1]. Before receiving assistance from PDF, in this specific case, SGs initially submit loan application to RIDF that must fulfil eight pre-conditions as explained in Section I.1 above. In addition, RIDF unit will also identify readiness level of each proposed subprojects (see Section I.2 below).

Based on the loan application submitted by the SGs, RIDF will identify the need of subproject preparation documents that are still needed to be prepared by the SG. At this stage RIDF will also screen the potential subproject impacts and identify the required environmental and social safeguards instruments to be prepared (or improved) by the SGs. RIDF will inform SGs that PDF can assist with subproject preparation if their subprojects fall under type 1, 2 and 3. PDF will, then, provide interested SGs with detailed information on requirements for PDF grant application.

1.2 Types of subprojects according to the level of preparedness

RIDF lending business will offer single financial products category, i.e. fund based products (i.e. senior debt); and consider for subprojects with different levels of preparedness or readiness for implementation. There will be three types of subprojects that would apply for RIDF funding and PDF support, which will require different types of review procedures:

(i) Type 1 – Subprojects in the early stages of preparation (with sites that have not been selected and design options that are still open). In addition to other subproject preparation documents (such as FS), the SGs will have to prepare and disclose Environmental and Social Safeguards documents (i.e. EIA, EMP, SIA, LARAP, IPP, etc.), as relevant, prior to subproject appraisal for RIDF funding support. At this stage, PT SMI will suggest the SGs to collaborate with the PDF team to prepare the necessary documents.

(ii) Type 2 – Subprojects that have been fully prepared (where construction bids have been invited). PT SMI will review the E&S documents that are available and will ask the SGs to supplement them or develop new ones, as applicable. SGs may seek assistance from the PDF team to prepare or improve the necessary documents. All required documents must be disclosed prior to subproject appraisal.

[1] LGs might also go directly to the PDF team for getting the assistance without necessarily seeking financial support from RIDF.

(iii) Type 3 – Subprojects with facilities that have already been constructed or the projects which is under construction. PT SMI will carry out a due diligence to confirm that: (a) the subproject is in compliance with this ESMF; (b) there are no reputational risks for PT SMI and the World Bank Group (WBG); and (c) there are no legacy issues or no pending legal disputes or liabilities. Based on the findings of such an assessment, PT SMI will ask the SGs to implement remedial measures, as needed, or to mitigate potential reputational risks or to address legacy issues or liabilities. All safeguards instruments will have to be disclosed prior to the subproject appraisal for RIDF funding.

1.3 Potential subproject pipelines

PT SMI has recorded potential subproject pipeline which is continuously growing as increasing number of SGs applied for funding support. As of now, application of SGs requesting support from PT SMI comprises of 38 subprojects that include roads, local hospitals, public markets, and flood mitigation infrastructure. The SGs that have interest in borrowing from PT SMI are geographically dispersed across the country: Sulawesi, Bali and West Nusa Tenggara, Sumatera, Papua and Maluku, Kalimantan, Java. It is expected that number of subprojects, types and geographical coverage of SGs interested to borrow from PT SMI under RIDF and/or to seek technical assistance support from RIDF-PDF will increase in the coming years, as the need for infrastructure development increases. The current applications indicate that the proposed amounts for borrowing for a subproject varies among SGs; most of the proposed investment values range from USD 10 to 30 million, with a few larger investments of up to USD 90 million. Most of the proposed subprojects are in the very early preparation stage (Type 1 subprojects), whereby its consistency with the regional/local spatial development plan needs to be confirmed.

1.4 Objective of Environmental and Social Management Framework (ESMF)

Subprojects to be financed by PT SMI under the RIDF business line, may have potential environmental and social impacts. PT SMI is committed to minimize, if not avoiding, any adverse environmental or social impacts. Similarly, the downstream investments as the results of the subproject preparation studies supported by RIDF-PDF may generate environmental and social impacts. This ESMF guides PT SMI in providing advice to the RIDF and the PDF clients, i.e. the SGs, in avoiding, and/or minimizing any potential adverse environmental and social impacts, and develop and implement measures to address such impacts in accordance with the PT SMI's Environmental and Social Safeguards Principles, Indonesian Laws and Regulations, and International Standards including the World Bank Safeguards Policies upon which this ESMF is developed.

This ESMF details the environmental and social safeguard policies, principles, procedures and requirements, institutional arrangements, and workflows for PT SMI to avoid, minimize, or mitigate any adverse environmental and social impacts of infrastructure subprojects supported by the RIDF and PDF.

1.5 Application of ESMF

Eligible Subprojects

This ESMF applies to all subprojects seeking for RIDF lending and RIDF-PDF support, irrespective of financing sources for the infrastructure investment. The application of the ESMF begins right at the time of loan application submission, and is relevant through the subproject preparation (via PDF), appraisal, disbursement (implementation), and subproject monitoring stages. For the purpose of ESMF application, types of eligible sectors and subprojects are presented in **Table 1** and the subprojects can be classified based on the level of preparedness (see **Table 2**) at the loan application stage.

Table 2: Subproject types according to level of preparedness

No.	Project Stage	Action under ESMF
1	**Type 1** Subproject is at a conceptual stage: sites and design alternatives are still being considered	The SGs will have to prepare and disclose all Environmental and Social Assessment documents as applicable (i.e. EIA, EMP, SIA, LARAP, IPDP, etc.) prior to appraisal of the subproject for RIDF funding support. At this stage, the SGs may collaborate with the PDF team to prepare the necessary documents.
2	**Type 2** Subproject preparation completed: construction bids may have begun	PT SMI will review the E&S documents that are available and will ask the SGs to supplement them or develop new ones. SGs may seek assistance from the PDF team to prepare or improve the necessary documents. All required documents must be disclosed prior to subproject appraisal.
3	**Type 3** Subproject implementation has begun or even completed.	PT SMI will carry out a due diligence to confirm that: (a) the subproject is in compliance with this ESMF including all applicable national environmental and social laws and regulations; (b) there are no reputational risks for PT SMI and the World Bank Group (WBG); and (c) there are no legacy issues or no pending legal disputes or liabilities. Based on the findings of such an assessment, PT SMI will

No.	Project Stage	Action under ESMF
		ask the SGs to implement remedial measures, as needed, or to mitigate potential reputational risks or to address legacy issues or liabilities. All safeguards instruments will have to be disclosed prior to the subproject appraisal for RIDF funding.

Area of influence and linked activities (refer to ESS 1 and ESS 5 on Section 2)

The ESMF extends not just to subproject footprint but also to the influence area that may be impacted by the subproject along with all of its ancillary aspects, such as power transmission corridors, pipelines, canals, tunnels, access roads, borrow or disposal areas, and construction camps, as well as unplanned developments arising from the subproject (e.g., spontaneous settlement, logging, or shifting agriculture along access roads). The area of influence may include, for example:

- Watershed within which the subproject is located
- Any affected estuary and coastal zone
- Off-site areas for resettlement or compensatory tracts
- Airshed (where airborne pollutants such as smoke or dust may enter or leave the area of influence)
- Migratory routes of humans, wildlife or fish, particularly where they relate to public health, economic activities or environmental conservation
- Areas used for livelihood activities (hunting, fishing, grazing, gathering, agriculture, etc.) or religious or ceremonial purposes of a customary nature.

In addition, the subproject shall take into account the linked activities regardless of financing sources which are: directly and significantly related to the RIDF-supported subproject, necessary to achieve the subproject objectives as set forth in the subproject documents, and, carried out or planned to be carried out, contemporaneously with the subproject.

1.6 Applicable Regulatory and Policy Review

The ESMF has been designed based on a set of applicable Indonesian laws and regulations related to social and environmental management, PT SMI's ESS (Environmental and Social Safeguards—Refer to Chapter 2 for details, also see **Table 9**) and International Standards including World Bank's environmental and social safeguards policies. Detail explanation of the policy is in **Annex 12**.

Indonesian laws and regulations:

Indonesia has a comprehensive set of laws governing environment protection, involuntary land acquisition and recognition of Indigenous Peoples (see **Table 30**).

1. Law No. 3/ 2009: Environmental Protection and Environmental Management
2. Law No. 5/1960: Basic Agrarian Law
3. Law No. 2/2012: Land Acquisition for Project Activity for Public Interest
4. Government Resolution No. 27/2012: Environmental Permits
5. Government Regulation No. 82/2001: Water Quality Management and Pollution Control.
6. Government Regulation No. 41/1999: Air Pollution Control
7. Government Regulation No. 101/2014: Hazardous Waste Management
8. Minister of the Environment Regulation No. 05/2012: Types of Business and/or Activities Mandated to Undertake Environmental Impact Assessment (AMDAL)
9. Presidential Regulation No. 71/2012, 40/2014, 99/2014, 30/2015: Land acquisition for Project Activity for Public Interest
10. Law No. 41/1999 on Forestry (plus Constitutional Court Decision No. 35/PUU-X/2012): Procedures to Settle Land Ownership Conflict in Forest Areas
11. Regulation of Head of BPN RI No. 5/2012 : Technical Guidelines on the Implementation of Land Acquisition
12. MOHA Regulation No. 52/2014: Guidelines on the Recognition and Protection of MHA
13. Ministerial Regulation of MOH No. P.62/2013: Establishment of Forest Area
14. Regulation of the Minister of Land Agency and Spatial Development No. 9/2015: Procedures to Establish the Land Communal Rights on MHA Land and Community Living in Special Areas
15. Law No. 18/2013: Prevention and Control of Deforestation (UUP3H).
16. Regulation of Ministry of Forestry No. P.39/Menhut-II/2013: Empowerment of Local Communities through Forest Partnerships
17. Law No. 24/2007: Disaster Management

PT SMI's Environmental and Social Safeguards

1. ESS-1: Assessment and Management of Environmental & Social Risks and Impact
2. ESS-2: Labour and Working Conditions
3. ESS-3: Pollution Prevention and Abatement
4. ESS-4: Safety, Health and Security
5. ESS-5: Land Acquisition and Resettlement
6. ESS-6: Biodiversity Conservation and Natural Resources Management
7. ESS-7: Indigenous Peoples and Local Communities
8. ESS-8: Cultural Heritage
9. ESS-9: Energy Conservation and Environment-Friendly Energy
10. ESS-10: Consultation and Grievance Mechanisms

Triggered World Bank's Safeguards Operational Policies

The World Bank has adopted a series of operational procedures that serve as environmental and social safeguards and also adopted an umbrella policy (OP 4.01) on environmental and social protection as a whole (see **Table 29**). There are also The World Bank Group General EHS Guidelines and Industry Sector Guidelines that are referred to in this ESMF (www.ifc.org/ehsguidelines).

1. OP 4.01 Environmental Assessment
2. OP 4.04 Natural Habitats
3. OP 4.09 Pest Management
4. OP 4.11 Physical Cultural Resources
5. OP 4.12 Involuntary Resettlement
6. OP 4.10 Indigenous Peoples
7. OP 4.36 Forests
8. OP 4.37 Safety of Dam
9. World Bank Group General EHS Guidelines and Industry Sector Guidelines

Annex 1D presents the relationship between the Type of Impact, National Laws/Regulations, PT SMI, and World Bank policies. This ESMF covers all those policies that will be implemented in the subprojects. Summary of gaps between the triggered World Bank Safeguards Policies and GoI's relevant regulations and measures to address such gaps in this ESMF is presented in **Table 3**.

1.6.1 Scope of ESMF in Business Process

This ESMF is mainstreamed in the loan processing cycles for subproject seeking funding support from RIDF through the inclusion of the Environmental and Social Safeguards instruments as well as in organizational arrangements of PT SMI under the RIDF business lines. The application of this ESMF begins right from the time of subproject preparation through PDF and the loan application through the loan tenure of RIDF: (1) loan application, (2) initial screening, (3) subproject appraisal, (4) contract signing, (5) loan disbursal, and (6) monitoring and evaluation. The ESMF also includes external audit, document update and disclosure norms. Overall, this ESMF covers:

- Environmental and social risk mitigation tools such as environmental impact assessment (EIA) and environmental management plan (EMP), based on the subproject risk categorization. The generic ToR of EIA and EMP are also provided so that can be used for subproject preparation studies (pre FS, FS) for PDF activities.
- Land acquisition and resettlement policy framework, which includes principles, procedures, requirements and organizational arrangements for involuntary land acquisition and resettlement; comprehensive land acquisition and resettlement plan or abbreviated resettlement action plan based on the subproject risk categorization
- Indigenous Peoples Planning Framework, which includes principles, procedures, requirements and organizational arrangements to address Indigenous Peoples affected by subproject; Social Assessment and Indigenous Peoples Plan when Indigenous Peoples are affected
- Grievance redress and stakeholders consultation mechanisms to ensure a participatory and fair approach in evaluating and mitigating project risks
- Details on stakeholders and their responsibilities.
- Details on human resource strengthening required in PT SMI for implementing the framework.
- Guidance on capacity building.
- Instructions on the monitoring and update of this document.

Details are elaborated in **Chapter 3**

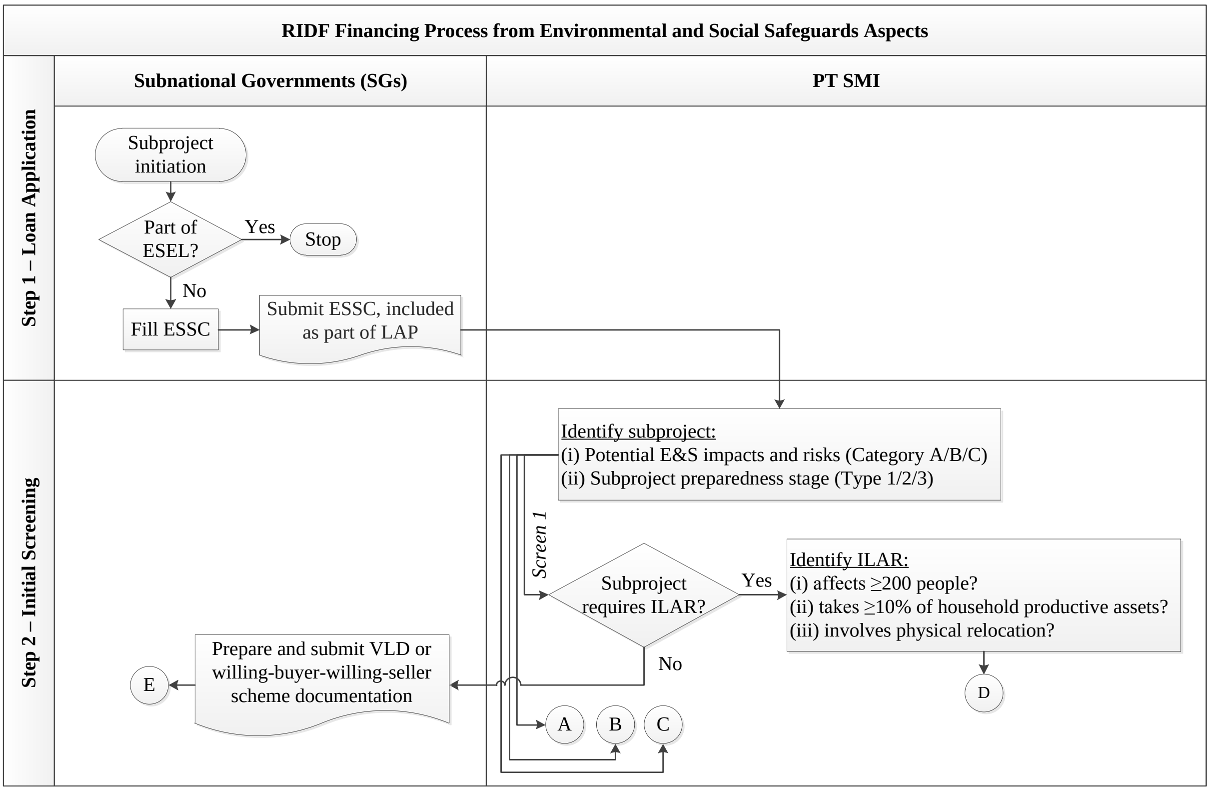
- This ESMF outlines the requirements and procedures for application of the frameworks in the business cycles of RIDF.
- The ESMF includes a set of tools such as templates for checklists and appraisal forms, sample terms of reference (ToRs) for preparing documents for safeguards mitigation measures, outlines for various environmental and social safeguards instruments, and a list of mandatory covenants to be included in loan agreements.
- It also provides details on how to follow the operating procedures, apply the frameworks, and use the templates, ToRs and outlines of EIA, UKL-UPL, LARAP, SA, and IPP are provided.

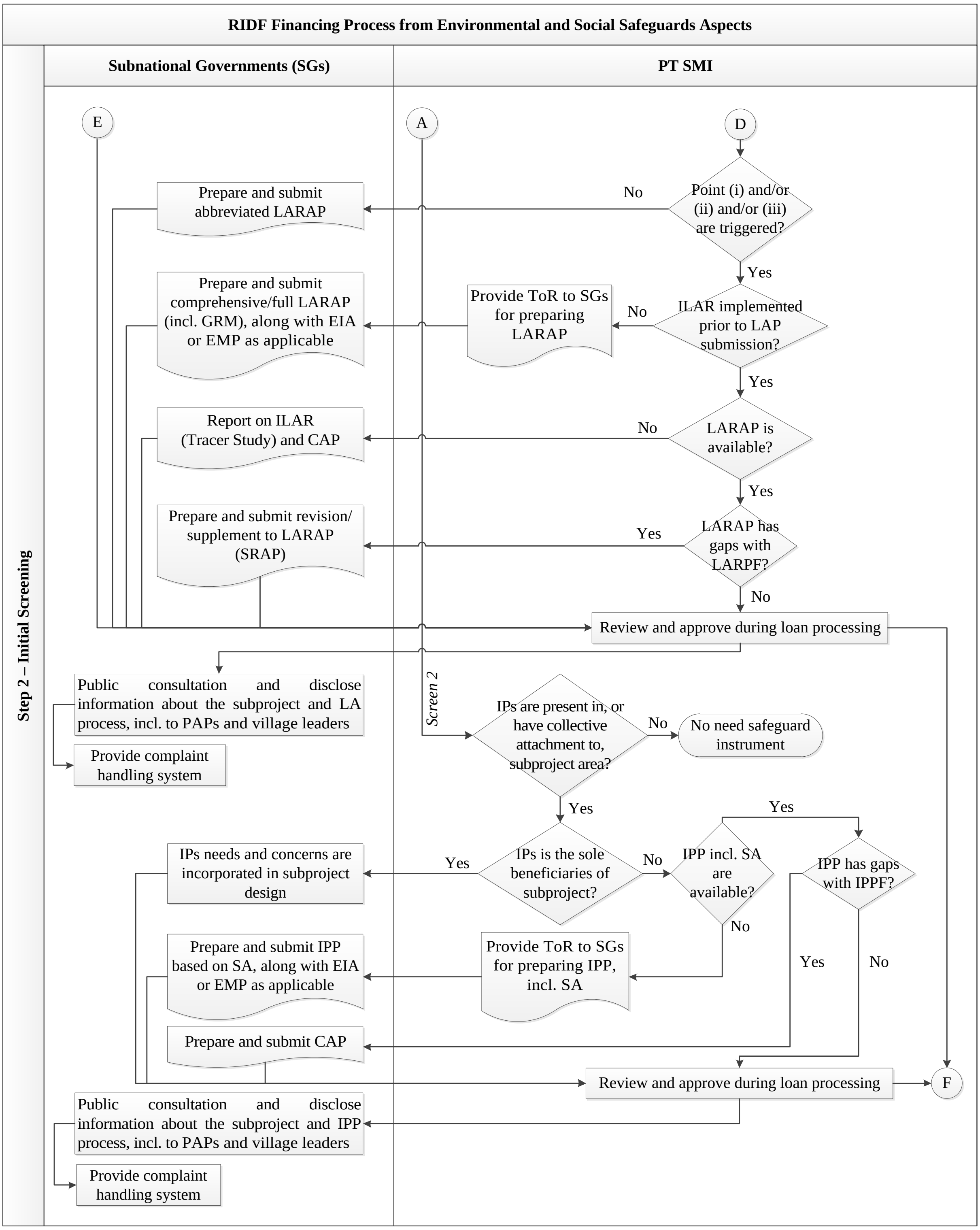
Details are elaborated in **Chapter 4**.

1.7 Implementation arrangements of ESMF: screening, impact assessment, review, approval, supervision and monitoring and reporting

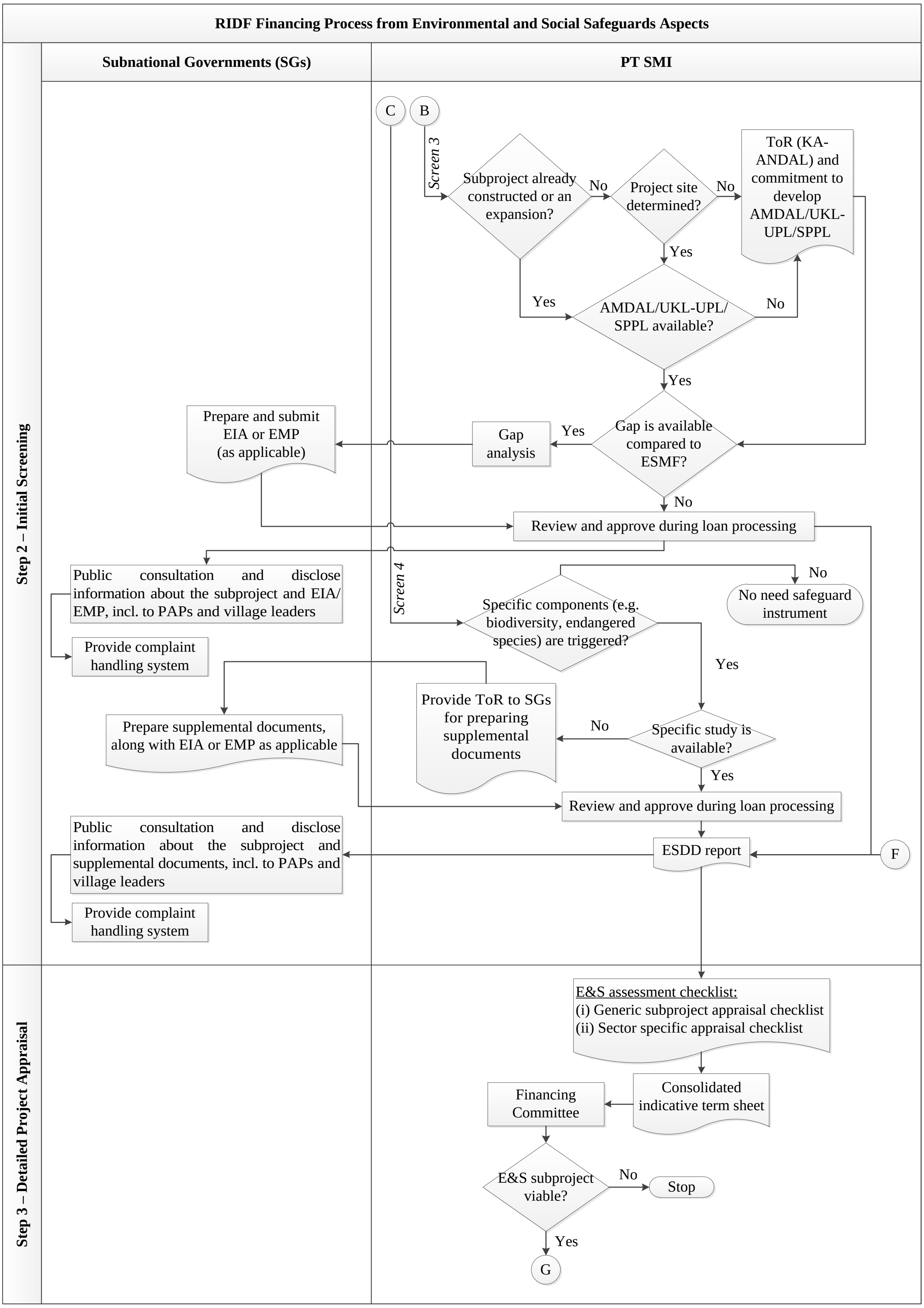
This ESMF has four major parts – (1) subproject screening and identification of impact assessment, (2) mitigation measures and instruments, (3) implementation of requirements specified in the ESMF, and (4) monitoring, supervision and reporting – which, together, aim at minimizing and managing the environmental and social impacts of the subprojects supported by RIDF and PDF. ESMF applies right from the time of the subproject preparation through PDF (in the case SGs are assisted by RIDF-PDF for subproject preparation) and the submission of loan application to PT SMI, through the loan tenure period (see **Figure 1**). Please note that PDF support can take place before the process described in Figure 1 or to become part of Step 2- Initial Screening when the SGs need to prepare safeguards instruments as part of loan requirements.

Figure 1: RIDF loan process and ESMF





RIDF Financing Process from Environmental and Social Safeguards Aspects
Subnational Governments (SGs)
PT SMI
Step 2 – Initial Screening
E
A
D
Point (i) and/or (ii) and/or (iii) are triggered?
No
Prepare and submit abbreviated LARAP
Yes
ILAR implemented prior to LAP submission?
No
Provide ToR to SGs for preparing LARAP
Prepare and submit comprehensive/full LARAP (incl. GRM), along with EIA or EMP as applicable
Yes
LARAP is available?
No
Report on ILAR (Tracer Study) and CAP
Yes
LARAP has gaps with LARPF?
Yes
Prepare and submit revision/ supplement to LARAP (SRAP)
No
Review and approve during loan processing
Public consultation and disclose information about the subproject and LA process, incl. to PAPs and village leaders
Provide complaint handling system
Screen 2
IPs are present in, or have collective attachment to, subproject area?
No
No need safeguard instrument
Yes
IPs is the sole beneficiaries of subproject?
Yes
IPs needs and concerns are incorporated in subproject design
No
IPP incl. SA are available?
Yes
IPP has gaps with IPPF?
No
Provide ToR to SGs for preparing IPP, incl. SA
Prepare and submit IPP based on SA, along with EIA or EMP as applicable
Yes
No
Prepare and submit CAP
Review and approve during loan processing
F
Public consultation and disclose information about the subproject and IPP process, incl. to PAPs and village leaders
Provide complaint handling system



The flowchart on **Figure 1** above will be updated along with PT SMI internal process.

1.7.1 Subproject screening and impacts assessment

1. **Environmental and social exclusion list**

   This list comprises types of subprojects excluded from RIDF funding as practiced by the government and international agencies due to their potential adverse impact on the environment (see exclusion list in Annex 1A).

2. **Impact assessment and project risk categorization**

   Based on the perceived environmental and social risks, subprojects are classified as Category A, B or C. Subprojects with high social and environmental risks are categorized as A and are scrutinized in detail to ensure that the objectives of ESMF are satisfied. **Tabel 1** above shows the eligible sectors and subprojects that can be funded by RIDF. Depending on the nature and intensity of potential environmental and social impacts, some subprojects could fall under Category B, for examples water supply, sewerage, drainage, public housing. However, some subprojects may fall into Category A, such as solid waste management and hospital, due to type of waste produced that are likely hazardous wastes.

3. **Minimizing subproject impact on society and environment**

   PT SMI will assess the subproject proposal and mitigation measures as specified in the agreed safeguards instruments to ensure that all impacts have been accurately and reliably managed, and the subproject design minimizes adverse impacts while maximizing any positive impacts, and a cumulative impact analysis is conducted while project alternatives are considered. The subproject alternatives include a 'no subproject' option. Only subprojects that are found to be environmentally and socially viable meeting the requirements specified in this ESMF are to be considered for financing under RIDF.

1.7.2 Preparation of impact mitigation plans

1. **Project impact mitigation**

   Based on the potential environmental and social impacts, and potential risks assessed by PT SMI during the review of subproject proposal and information available at the time of the screening, the SGs have to prepare mitigation measures or remedial actions to address and manage such impacts and risks. PT SMI will recommend the appropriate safeguards instruments to be prepared by the SGs for such mitigation measures or remedial actions in accordance with this ESMF. Depending on the nature of the environmental and social impacts, and hence the risks, and the availability and quality of the safeguards instruments available, PT SMI may require the SGs to prepare an EIA, EMP or AMDAL/UKL UPL acceptable to the Bank or supplemental documents to AMDAL, or UKL-UPL, and/or a Land Acquisition and Resettlement Action Plan (LARAP), a Plan of Action, and/or an Indigenous Peoples Plan (IPP) and/or a Corrective Action Plan for these three instruments in the case that they do not meet the requirements of this ESMF. Subnational Governments can get support from PDF in producing such documentations.

2. **Ensuring adherence to ESMF**

The SGs who seek for RIDF funding are required to fill an environmental and social checklist, which contains a series of questions to determine the triggering safeguards policies and standards specified in this ESMF (refer to section 1.6.1).

The subproject proposals are initially assessed based on their level of preparedness:

(i) Type 1 – Subprojects during project identification stage (with sites that have not been selected and design options that are still open). The SGs will prepare and disclose all Environmental and Social Assessment documents (i.e. EIA, EMP, SIA, LARAP, IPP, etc.), as applicable, prior to the subproject appraisal. At this stage, the SGs will be recommended to collaborate with the PDF team to prepare the necessary documents. In case any Environmental and Social safeguards instruments have been prepared, PT SMI will assess such instruments in reference to the requirements specified in this ESMF. In the case there is a gap, PT SMI will require the SG to prepare a Supplemental Safeguards Instruments or a Remedial Action Plan to meet the requirements of this ESMF. In the case that the SGs have not prepared any safeguards instruments and there is a need to prepare specific instruments to meet with the requirements of this ESMF. PT SMI will provide the ToRs for the SGs to prepare the required safeguards instruments.

(ii) Type 2 – Subprojects that have been fully prepared (where construction bids have been invited) where the required E&S safeguards instruments have been prepared. PT SMI will review the available E&S documents and will require the SGs to prepare a supplemental document based on a gap analysis in reference to the requirements specified in the ESMF or develop new ones based on the ToRs provided by PT SMI to meet the requirements specified in the ESMF.

(iii) Type 3 – Subprojects within the proximity of facilities that have already been constructed or an expansion of the existing infrastructure/facilities. PT SMI will carry out a due diligence, which will include site inspections and all necessary investigations, to confirm that: (a) the subproject is in compliance with the requirements specified in this ESMF; (b) there are no reputational risks for PT SMI and the World Bank Group (WBG); and (c) there are no legacy issues or no pending legal disputes or liabilities. Based on the findings of such an assessment, PT SMI will require its SGs to implement remedial measures, if needed, or to mitigate potential reputational risks or to address legacy issues or liabilities in the form of an Action Plan agreed by PT SMI.

All of the E&S safeguards documents shall be disclosed by the SGs prior to subproject appraisal.

1.7.3 Monitoring, supervision and reporting of the ESMF implementation

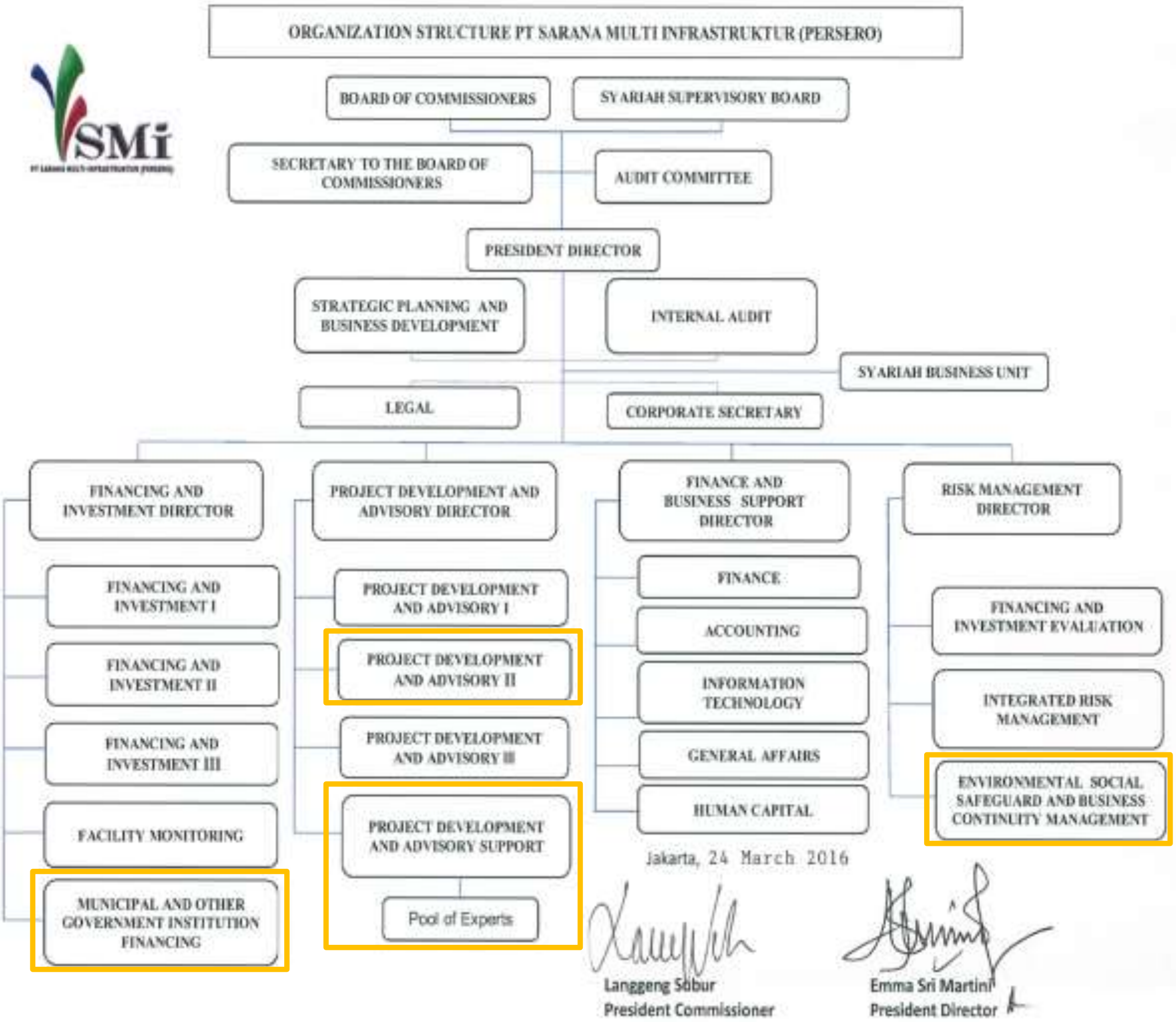
The subproject shall be monitored across its life-cycle to ensure that all the safeguards instruments agreed-upon at the loan approval are successfully implemented and complied with. Environmental Social Safeguards and Business Continuity Management (ESSBCM) Division under the Directorate of Risk Management of PT SMI (refer to **Figure 2**) will carry out the monitoring, supervision and reporting of the ESMF implementation.

Further fund disbursements shall be linked to continuous compliance by the SGs. PT SMI, namely the ESSBCM, will monitor all subprojects (during planning, construction and operation and maintenance stages) that it finances to ensure conformity to the requirements specified in this ESMF. The results of the monitoring of environmental and social safeguards implementation will be presented in the implementation/compliance reports as part of quarterly progress reports. The SGs are expected to make adequate internal arrangements to monitor the implementation of the environmental and social mitigation plan and submit regular progress reports including environmental and social implementation compliance reports to PT SMI. This arrangement is elaborated in section 4.6.

1.7.4 Institutional arrangements for environmental and social safeguards management in PT SMI

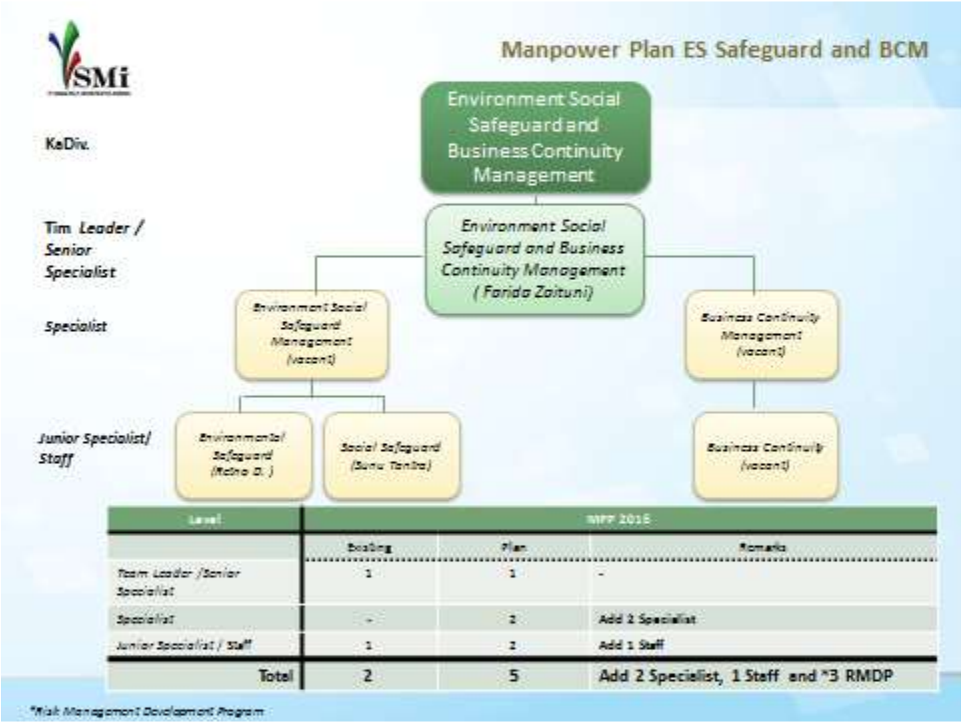
The RIDF Unit is located under the Directorate of Financing and Investment, at the Division of Investment for Local Goverments and Other Institutions (DPPIPL), The Environmental Social Safeguards and Business Continuity Management (ESSBCM) Division is located at the Directorate Risk Management. PDF is under Directorate of Project Development and Advisory, i.e. Project Development and Advisory Support 1 (see **Figure 2**).

Figure 2: Organization Structure of PT SMI



ESSBCM is a new structure, since for the previous one it was not a Division but a Team. It shows the commitment of PT SMI Management to really aware on the environmental social safeguards matters. The current staff of ESSBCM is three people including: 1 ESSBCM Team Leader; 1 Junior Environmental Safeguard Specialist; and 1 Social Safeguard Specialist (See **Figure 3**).

Figure 3: Manpower plan of ESSBCM Division



Currently the safeguards management practices in terms of its implementation into the project cycle has not been done properly. It is due to the lack of staff in the ESSBCM. However, In the very near future ESSBCM will have a Division Head, and will recruit two more environmental and social safeguards specialists as shown in **Figure 3**.

To strengthen the environmental and social management efforts, PT SMI will undertake the responsibility and leadership of the various issues related with the environmental and social management in infrastructure projects. In this sense, a number of activities have been identified to be undertaken by PT SMI to strengthen the in-house environmental and social management and ensure the environmental and social sustainability of the projects.

Considering that the environmental and social management issues will have to be started from base level at PT SMI, following three components have been identified to strengthen it:

a) Activities to promote and disseminate the environmental and social management tools;

b) Training workshops on special subjects to improve the environmental and social management within the institution; and

c) Requirements of work teams and means for the environmental and social management.To anticipate the growing pipeline, ESSBCM will also be assisted by consultants or consulting firms. The capacity building for the internal staff of PT SMI has already started by sending them to attend some trainings, among other to send them to the safeguards training organized by the World Bank recently. In anticipation of the growing portfolio and pipeline for local borrowing, PT SMI is planning to send the staff to get higher education, especially related to the environmental management.

In terms of the ESMF implementation, the ESSBCM will be responsible for subproject screening, impact assessment and subproject risk categorization, approval of the safeguards instruments, supervision and monitoring, as well as reporting. The ESSBCM will cooperate and coordinate with DPPIPL (Division of Investment for Local Goverment and Other Institutions - *Divisi Pembiayaan Pemda and Instansi Pemerintah Lainnya*) as they are the one who is the point of contact with the SGs.

The Business Division of PT SMI will use ESMF for screening subprojects. The Risk Management Division will use ESMF for subproject appraisal to evaluate the level of environmental and social risks and the adequacy of the proposed mitigation measures, and arrive at the loan covenants. It is expected that the Risk Management division would have to recruit a manager/consultant to manage the environmental and social risks. Finally, the Financing Facility Control division will use ESMF to monitor compliance with the loan covenants and disclosure norms.

The SGs will use this ESMF to fill ESSC (Environmental and Social Safeguards Checklist) as parts of LAP (Loan Application Package) for RIDF financing, and for guidance in preparing the applicable impact mitigation instruments, such as EIA, EMP or AMDAL/UKL UPL acceptable to the Bank or supplemental documents to AMDAL, or UKL-UPL.

Enforcing mitigation plans

The results of the subproject appraisal are to be translated into agreements on the implementation of the safeguards instruments between PT SMI and the SGs, which are to be incorporated in the loan agreement between PT SMI and the SGs. The loan covenant shall also specify measures in the case the SGs fail to consistently implement the safeguards instruments. A standard list of such covenants is provided in this document (refer to Annex 9).

Ensuring implementation of the mitigation plans

The SGs are required to regularly submit progress reports to PT SMI on the implementation of the mitigation plans as agreed in the safeguards instruments. Furthermore, PT SMI will undertake regular site visits to verify the progress and performance of the implementation of the agreed safeguards instruments.

1.7.5 World Bank support

In terms of safeguards, the Bank will review subprojects proposals as hands-on capacity building support for PT SMI, until PT SMI has sufficient capacity acceptable to the Bank in managing safeguards. PT SMI and the Bank will regularly discuss the capacity strengthening needs of PT SMI based on the Quarterly Progress Report in which implementation progress and performance of environmental and social safeguards are recorded.

Possible Bank roles and responsibility in supporting PT SMI in implementing the ESMF are:

(1) For the first five high-risk subprojects, the Bank will conduct joint appraisal and review together with PT. SMI prior to subproject approval. If found to be necessary during project implementation, this joint prior review approach could be extended to additional high-risk subprojects beyond the first five.
(2) As part of regular Bank supervision of project safeguards implementation, for medium and low-risk projects the Bank will monitor RIDF's operations through post-review to ensure that the ESMF is consistently adhered to, and promptly initiate any corrective action as required;
(3) Monitoring and providing implementation support to PT SMI in ensuring that the SGs fulfill the requirements specified in the ESMF;
(4) Strengthening capacity of PT SMI through joint-review, joint-supervision, training, etc.;
(5) Together with PT SMI, strengthening capacity of the SGs as needed.

1.8 Consultation and Disclosure Plan for ESMF

A stakeholder consultation for the Draft ESMF was held by PT SMI in June 20-21, 2016 in Jakarta. The main purposes of the consultation were to seek inputs for the ESMF from the SGs, key central agencies, relevant NGOs and other institutions; and to socialize the PT SMI's ESMF commitment that follow international best practices in ensuring that subprojects to be financed by the RIDF will be environmentally and socially sustainable. The consultation were attended by representatives of the SGs, NGOs, Ministry of Finance, Ministry of Public Works and Public Housing, Association of City Governments, Association of District (*Kabupaten*) Governments and Association of Provincial Governments, some representatives from local parliaments, and universities, etc. The invitation for this consultation was accompanied by a summary of the draft ESMF. PT SMI obtained positive feedbacks from the stakeholders, main concerns and suggestions, which as relevant, have been incorporated in this ESMF.

The draft ESMF has been disclosed in the PT SMI's website on June 15, 2016.

Subproject specific safeguards instruments (such as EIA, EMP, or AMDAL/UKL UPL acceptable to the Bank, LARAP, IPP, etc.) will be subject to consultations and disclosure by the SGs. The timing for consultations shall be carried out prior to subproject appraisal. The SGs will disclose the EIA, EMP, LARAP, IPP, etc. at the planning stage of subproject preparation, in their websites, a public space accessible to the affected groups, local NGOs and other stakeholders. In addition, PT SMI will also disclose such instruments in its website, upon endorsement of the SGs getting the loan from RIDF and support from PDF.

1.9 Updating the ESMF and operationalization of ESMF

This ESMF is a document that may be updated by PT SMI from time to time in accordance to the needs, lessons learned during the RIDF and PDF operations and recent situation. The updated ESMF shall be approved by the World Bank and will be made available to the stakeholders through PT SMI's website.

Detail operational procedures to be followed by PT SMI for each type of subprojects for screening, impact assessment, determining safeguards instruments and remedial actions, monitoring, supervision and reporting as well as public consultation and disclosure for subprojects will be put in the Project Operations Manual (POM), approved by the World Bank.

2. Environmental and Social Safeguards (ESS)

The objective of this ESMF is to ensure that the social and environmental commitments of the Indonesian government, PT SMI and the World Bank are adhered to. This ESMF is developed based on the Indonesian laws and regulations, PT SMI's Environmental and Social Safeguards principles, and the international standards including the triggered World Bank Safeguards Policies. A list of the triggered World Bank Safeguards Policies and Indonesian laws and regulations pertaining environmental and social safeguards is presented in **Annex 11.**

2.1 PT SMI's Environmental and social safeguards (PT SMI's ESS)

PT SMI follows a set of ten environmental and social safeguards principles including resource efficiency, pollution, biodiversity and energy conservation, and social concerns such as working conditions, involuntary resettlement, health and safety, inclusion of Indigenous Peoples and conservation of cultural heritage. The complete documentation of PT SMI ESS is compiled in a separate document. The summary and the list of environmental and social safeguards principles and their objectives of the ESS are as follow:

1. **ESS-1: Assessment and Management of Environmental & Social Risks and Impacts**
   - Prevent, or if prevention is impossible, to minimize, mitigate, or compensate the negative impacts on the environment and local communities.
   - Ensure that permits, mandated by the government to identify and assess positive or adverse environmental and social impacts, are obtained by project proponents prior to the project execution.
2. **ESS-2: Labour and Working Conditions**
   - Create, improve, and maintain relationships between the management and the workers.
   - Encourage fair treatment without discrimination, equal opportunities for workers and efforts to comply with the law. Preventing children labour and forced labour. Encourage safe and healthy working conditions as well as protect and promote worker health.
3. **ESS-3: Resource and Efficiency Pollution Prevention**
   - Prevent or minimize negative impacts on human health and environment by avoiding or minimizing pollution from project activities. Encourage reduction of emissions that contribute to climate change.

4. **ESS-4: Community Health and Safety**
   - Prevent or minimize the risks and impacts on health, safety and security of workers and surrounding community both in routine and non-routine activities.
   - Ensure protection of personnel and property is done properly so as to prevent or minimize risks to the community's safety and security.
5. **ESS-5: Land Acquisition, Restrictions on Land-Use and Involuntary Resettlement**
   - Avoid the negative impact or at least minimize the risk of involuntary resettlement.
   - Mitigate the social and economic impacts of land acquisition on the affected people by providing compensation for loss of assets at replacement cost; and ensuring that resettlement activities are undertaken properly, through information disclosure, consultation and informed participation of those affected.
   - Improve or at least restore the livelihoods and standards of living of the relocated people.
6. **ESS-6: Biodiversity Conservation and Sustainable Management of Natural resources**
   - Protect and conserve biodiversity and encourage sustainable development and natural resource utilization by applying integrated conservation techniques.
7. **ESS-7: Indigenous Peoples**
   - Protect Indigenous Peoples and local communities from development which is not in accordance with their educational, social and cultural levels, and thus impacts them adversely.
   - Encourage Indigenous Peoples and local communities to partner with the developers and share social and economic benefits of projects.
8. **ESS-8: Cultural Heritage**
   - Protect the cultural heritage from negative impacts of project activities and support its preservation.
   - Encourage the project developers to take responsibility towards protecting the cultural heritage around the project area.
9. **ESS-9: Energy Conservation and Environment-friendly Energy**

- Support energy conservation as a saving effort in the resources use in order to safeguard natural resources and encourage the planned and directed resources use in a sustainable manner.
- Encourage the sustainable development and energy use through an integrated application of conservation having the development priorities.
- Promote the development of environment-friendly green energy facilities which are as an effort to increase new and renewable energy

10. ESS-10: Information Disclosure and Stakeholder Engagement

- Encourage the information transparency and encourage the participation of community and other stakeholders as fair and profitable consulting efforts.
- Encourage community participation in sustainable development in the affected area as an effort to facilitate the culture of consensus and democracy in the project and affected communities through a grievance mechanism

2.2 Gap analysis

The ESMF has included measures to address the gaps between the requirements of the World Bank Safeguards Policies and those of the Indonesian laws and regulations pertaining environmental and social safeguards (see **Table 3**).

Table 3: ESMF and addressing the gaps

No.	Safeguards	Gaps	ESMF : Compliance Requirements and Safeguards Instruments (This ESMF covers PT SMI's ESS)
1	OP 4.01 Environmental Assessment	▪ Some components are not being assessed in a comprehensive manner under AMDAL/UKL-UPL, e.g. social impact, public consultation, project area of influence, ancillary facilities, bio diversity, labour and working conditions, community health and safety, IPs (Indigenous Peoples) and cultural	▪ Compliance Requirements: ESMF provides a guideline, check list on conducting "screening" and "detail appraisal" to evaluate gap analysis of AMDAL and UKL-UPL against the World Bank's Safeguard Policies (see Table 14, section 3.1.1 - 3.1.5. Section 4.2-4.5, Annex 1, 2 and 10) ▪ Safeguards instruments:

No.	Safeguards	Gaps	ESMF : Compliance Requirements and Safeguards Instruments (This ESMF covers PT SMI's ESS)
		heritage related to the project.	ESMF requires the preparation of a supplement to the AMDAL/UKL UPL document, following the World Bank's safeguard requirements. PT SMI can help prepare the TOR based on Annex 2. ▪ ESMF mandates the EIA/EMP to ensure setting up a grievance mechanisms, especially related to social issues and impacts due to subproject activities beyond land acquisition.
2	OP 4.04 Natural Habitats	▪ The AMDAL and UKL-UPL documents list the flora and fauna found at the project area of influence, but limited or no information on natural and/or critical habitats.	▪ Compliance Requirements: ESMF request the project to screen protected areas as per section 4.1.2. ▪ Safeguards instruments: TOR for a supplement to the AMDAL/UKL UPL document based on Annex 2. ▪ WB Group EHS Guidelines.
3	OP 4.36 Forests	▪ There are clear directives from the government on protected areas and status. Projects located in protected areas automatically require AMDAL.	
4	OP 4.09 Pest Management	In general, the institutional capacity for supervision and enforcement of pesticide use in Indonesia is weak. The regulation	Safeguards instruments: TOR for EIA document in Annex 2 has covered this aspect of potential increase in pesticide use from a

No.	Safeguards	Gaps	ESMF : Compliance Requirements and Safeguards Instruments (This ESMF covers PT SMI's ESS)
		does not specify the requirements for developing and implementing a pest management plan at the project level.	new irrigation construction project. Also see Crop Production Guidelines at www.ifc/ehsguidelines
5	OP 4.11 Physical Cultural Resources	▪ AMDAL and UKL-UPL rarely assess impacts on physical cultural heritage and lacks focus on conservation. ▪ Projects rarely develop 'Chance Find Protocols' that addresses the possibility and management of finding a cultural site or object inside a project area. ▪ Physical cultural heritage aspects of a project are rarely discussed in public consultations and there is no disclosure mechanism in place.	▪ <u>Safeguards instruments</u>: TOR for EIA document in Annex 2 has covered the potential impact to Physical Cultural Resources. A PCR management plan may be required in the EIA study if needed.
6	OP 4.12 Involuntary Resettlement	▪ Legislations on land acquisition are focused on land obtained for public developments. ▪ Indirect impacts are not covered in the land acquisition law ▪ 'Linked activities' are not covered ▪ Host communities are not explicitly covered in the GOI regulation	▪ <u>Compliance Requirements:</u> ESMF mandates screening process for land acquisition during the preparation phase ▪ ESMF also includes the land acquisition and resettlement action plan to be conducted by the SGs. ▪ The LARAP requires information on the vulnerable groups (women very poor, disable, etc.)

No.	Safeguards	Gaps	ESMF : Compliance Requirements and Safeguards Instruments (This ESMF covers PT SMI's ESS)
		▪ No specific measures to protect interests of vulnerable PAPs or women ▪ The required impact mitigation measures for the vulnerable PAPs are not elaborated ▪ Livelihoods ▪ Restriction on access	▪ Safeguards Instruments: ESMF mandates preparation of LARAP when subprojects involves involuntary land acquisition and resettlement ▪ LARPF provides requirements for compensation options, and licensed appraisers assess physical assets, cost and loss of non- physical assets and premium ▪ The LARPF specified that licensed appraisers compensation criteria include among others, assistance and livelihood restoration ▪ LARPF presents options for compensation ▪ IPP (Indigenous Peoples' Plan) specified that if a subproject needs to acquire land and affects indigenous population, LARPF applies. ▪ A process framework (similar to the Forest Partnership in Indonesian Legislation) is covered in the ESMF and is prepared when Bank-supported projects may cause restrictions in access to natural resources in legally designated parks and

No.	Safeguards	Gaps	ESMF : Compliance Requirements and Safeguards Instruments (This ESMF covers PT SMI's ESS)
			protected areas when the project causes restricted area.
7	OP 4.10 Indigenous Peoples	▪ There are no specific Indonesian laws that regulate to IPs, but recognition of the existence of IPs varies from one sector to the other sectors as well as other forms of recognition of IPs by governments. In addition there are also international agreements that have been ratified by Indonesia, and implemented in the legislation and also discourses at national level regarding the recognition of IPs. ▪ There seems to be ambiguity in the national legislation in recognizing ownership of indigenous people's forests, which states these are state forests located on IPs' land.	▪ Compliance Requirements: ESMF has included IPs in the IPPF, including requirements to screen and identify the IPs presence, Social Assessment and preparation of IPP in the case that a subproject is located in an area where IPs are presence and affected, through a free, prior and informed consultation. ▪ Safeguards Instruments: IPPF (Indigenous Peoples Planning Framework), IPP (Indigenous Peoples Plan). ESMF has included the IPs desktop study in the TOR for the environmental assessment plans.
8	OP 4.37 Safety of Dam	▪ There is no requirement for the provision of panel of experts for DAM construction higher than 15 meters.	▪ The TOR for EIA has included dam safety aspect in Annex 2 including its specific requirements and also Annex 10 for project review.

3. Environmental and Social Management Framework – Operational Procedures

The scope of this chapter is limited to establishing the relationship between the business process of RIDF and the implementation of ESMF. There are also subprojects that would get PDF support prior to loan application of RIDF that will also using the same ESMF. This kind of support is not illustrated here below and as explained before the ESSBCM division is required to clear the ToRs for such preparation studies to ensure that safeguards aspects have been incorporated. But there are also subprojects that would require PDF support during Step 2- Initial Screening that will be elaborated below.

3.1 Operational design of ESMF in the loan processing and implementation cycle

The process involves 5 stages (see **Figure 1**):

- Step 1: Loan application by the SGs
- Step 2: Initial screening
- Step 3: Detailed project appraisal
- Step 4: Loan sanction and disbursement
- Step 5: Project implementation and monitoring

3.1.1 Step 1 - Loan application by the SGs

Business procedure: The SGs apply to PT SMI for a loan by submitting the LAP.

ESMF application: The SGs are required to fill an ESSC. This checklist is included as part of the LAP. In filling the checklist, the SGs need to report whether or not the proposed subproject falls in the ESEL (Environmental and Social Project Exclusion List), assess the proximity of environmentally sensitive areas, make initial assessment of potential environmental and social impacts, and to what extent the proposed subproject will have to acquire land and make initial screening whether IPs are presence in the subproject area and would be affected (positively or negatively) by the proposed subproject, categorize the subproject based on magnitude of the risk and report the stage at which the subproject currently is. The latter is to define the type of subproject in terms of level of preparedness. Methods for the SGs to categorize subprojects in terms of environmental and social impacts and risks are presented in **Annex 1** and **Table 6**.

3.1.2 Step 2 – Business procedure/Screening:

1. The LAP is screened against eligibility criteria, as part of preliminary assessment by the business division of PT SMI.
2. The business division will examine the following aspects of the sub-project:
   a. Conformance to policy and regulation with regards to related infrastructure sector and loan provision;
   b. Readiness of the subproject including availability of feasibility study of the subproject and, subproject implementation plan
3. The business division prepares an initial screening report.
4. If the applicant satisfies all key criteria, the subproject proposal is forwarded to the risk management division for appraisal process. When the decision is made to proceed to appraisal stage, a 'confirmation to proceed' letter is issued by the business division to the SGs.

ESMF application:

PT SMI (ESSBCM Division under Risk Management Directorate) will carry out the following activities:

1. The following environmental and social eligibility criteria must be observed,
   a. An ESEL is to be made part of the eligibility criteria. Only loan applications pertaining to subproject not falling in the ESEL are to be considered eligible.
   b. Prepare impact mitigation plans commensurate with the identified environmental and social risk addressing all triggered policies/laws/regulations as specified in this ESMF
2. As part of the initial screening report, the following must be reported:
   a. Result of the screening against the ESEL
   b. Verification of subproject categorization
   c. List of applicable policies/laws/regulations
   d. List of safeguards readiness: subproject type
   e. Compliance with national laws and permit requirements
   f. Risk mitigation instrument applicable and required terms of reference
   g. Compliance with ESMF when planning for impact mitigation
3. The 'confirmation to proceed' letter shall be issued to the applicant only after the environmental and social eligibility criteria indicated above are fulfilled. The letter will specify the list of requirements (for instance what type of safeguards instruments need to be prepared, or remedial action, or else) that the SGs need to do and submit prior to subproject appraisal. PDF support can be obtained at this stage.

3.1.3 Step 3 – Detailed subproject appraisal:

PT SMI (ESSBCM Division under Risk Management Directorate) will carry out the following activities:

Business procedure:

1. The feasibility study is verified for comprehensiveness, accuracy and reliability
2. The project's feasibility is evaluated.
3. On finding the project viable, a recommendation is submitted to the credit committee

ESMF application:

1. E&S risk mitigation instruments are to be verified for comprehensiveness, accuracy and reliability
2. The environmental and social sustainability of the subproject, considering the mitigation measures proposed, should be evaluated
3. Only if the subproject is found to be socially and environmentally sustainable and has met the requirements specified in this ESMF, can be recommended to the credit committee to proceed with further step
4. The recommendation letter consists of (1) a summary activities that the SGs should do based on the approved safeguards instruments with clear timeline and estimated costs and source of funding (prior to loan signing, during subproject construction, during subproject operation); (2) proposed clause of agreements that need to be put in the loan agreement; this proposed clauses should have been discussed between ESSBCM Division and Law Division of PT SMI.

3.1.4 Step 4 – Loan sanction and disbursement

PT SMI (Division of Investment for Local Goverment and Other Institutions / "DPPIPL" - *Divisi Pembiayaan Pemda and Instansi Pemerintah Lainnya*) will carry out the following activities:

Business procedure

1. Loan sanction letter is sent to the SGs if the credit committee, and subsequently the RIDF board, approves the SGs to borrow for the subproject. The loan sanction letter contains the necessary loan covenants to ensure compliance with applicable policies and the linkages of the loan disbursement to implementation schedules
2. After the SGs agree with the stipulations in the loan sanction letter, a loan agreement is to be drafted, which includes all applicable covenants.

ESMF application

1. Every loan sanction letter is required to be accompanied by a list of mandatory environmental and social covenants (refer Annex 9) in addition to any other covenants emerging from the E&S appraisal of the subproject.
2. In addition to conveying its agreement to stipulated loan covenants the SG must also submit a certificate of readiness and proof of adherence to disclosure requirements.
3. Furthermore, the loan disbursement is to be linked to the disclosure and land acquisition/resettlement checklist.

3.1.5 Step 5 - Project implementation and monitoring

Business procedure

1. The RIDF procurement team (lead by Manager- Procurement) will guide the SGs in undertaking subproject procurement, ensuring that it follows GoI's regulations on procurements. The procurement of subproject will be done by a ULP of the SG getting the RIDF funding through e-procurement.
2. The SGs would be required to submit quarterly progress reports, indicating physical and financial milestones targeted and achieved.
3. Monthly reports on quality of work should be submitted during the progress review of every subproject. A format indicating technical parameters for ensuring quality would be prepared and given to the PMC (Project Management Consultant) / local body (whoever is responsible to supervise the quality of work).
4. After the subproject is completed, a post-evaluation report is to be prepared and submitted to the RIDF board.
5. In terms of the ESMF, PT SMI will monitor and provide guidance to the SGs during the implementation of the mitigation measures as specified in the approved safeguards instruments (EIA, EMP, LARAP, IPP etc.) during prior construction, construction and subproject operation.

ESMF application

1. The bidding document should contain the mitigation measures activities recommended by the safeguards instruments (such as EIA, EMP, LARAP, IPP, etc.) that need to be implemented by the winning contractors during construction.
2. Guidance for the SGs to include the mitigation measures that need to be done by the winning contractor during construction as specified in the safeguards instruments (EIA, EMP, LARAP, IPP, etc.) is presented in Annex 4, 5 and 6.
3. As part of the quarterly progress reports (QPR), SGs are to submit progress in implementing provisions of the risk mitigation instruments (outline of QPR is presented in POM).
4. The template provided for quality monitoring should also include environmental and social considerations (template is provided in the POM).

5. Upon completion of the subproject construction and during subproject operation (as applicable), the extent of environmental and social impacts mitigated should be recorded according to prescribed performance parameters (format is presented in the POM).

4. Procedural Guidance for Following the ESMF

4.1 Step 1- Loan application

The SGs are required to fill the template provided in Annex 1. The information that needs to be provided covers:

1. Name of the subproject and the subnational government
2. Subproject location, sector/subsector and description
3. Proximity of the subproject to environmentally sensitive areas (use Annex 1B)
4. Environmental and social impact information summarized from AMDAL/UKL-UPL/SPPL (if these documents are already available)
5. The need for land acquisition and/or resettlement (please add to the format Annex 1)
6. Indication of potential IPs presence in the subproject area (please add to the format Annex 1)
7. Information on the availability of the environmental and social safeguards documents

Summary of potential environmental and social impacts, potential land acquisition and /or resettlement, potential IPs presence and determination of risk category and safeguard policies triggered by a subproject will be carried out by PT SMI (see **Figure 1**).

4.1.1 Exclusion list

A subproject or any of its sub-components which falls within the ESEL is not applicable for assistance under RIDF (see **Table 4**).

Table 4: Environmental and social project exclusion list

Environmental and social project exclusion list for RIDF
▪ Production or trade in any product or activity deemed illegal under host country laws or regulations or international conventions and agreements, or subject to international bans, such as pharmaceuticals, pesticides/herbicides, ozone depleting substances, wildlife or products regulated under the Convention on International Trade in Endangered Species of Wild Fauna and Flora ▪ Manufacturing or trade in weapons and munitions ▪ Production or trade in alcoholic beverages (excluding beer and wine) ▪ Production or trade in tobacco ▪ Gambling, casinos and equivalent enterprises ▪ Production or trade in radioactive materials. This does not apply to the purchase of

Environmental and social project exclusion list for RIDF
medical equipment, quality control (measurement) equipment and any equipment where International Finance Corporation considers the radioactive source to be insignificant and/or adequately shielded ▪ Production or trade in un-bonded asbestos fibres. This does not apply to purchase and use of bonded asbestos cement sheeting where the asbestos content is less than 20%; ▪ Drift net fishing in the marine environment using nets in excess of 2.5 km. in length ▪ Production or activities involving harmful or exploitative forms of forced labour/harmful child labour. ▪ Commercial logging operations for use in primary tropical moist forest. ▪ Production or trade in wood or other forestry products other than from sustainably managed forests ▪ Production, trade, storage, or transport of significant volumes of hazardous chemicals, or commercial scale usage of hazardous chemicals such as gasoline, kerosene, and other petroleum products. ▪ Production or activities that impinge on the lands owned, used, or claimed under adjudication, by Indigenous Peoples, without full documented free, prior, informed consultation and consent from such people.

4.1.2 Proximity to environmentally sensitive areas

The list of environmentally sensitive areas, as specified in the Presidential Decree No. 32 of 1990, and their definitions are provided in **Table 5** below. If a subproject location falls in any of these areas, it should be mentioned in the screening template. Further, details information of subproject site and the subproject sub-components affecting the sensitive areas are to be provided.

Table 5: Environmentally sensitive areas

No.	Environmentally sensitive areas based on subproject location	Definition
1.	Protected forest area	Forest on the slopes $\geq$ 40 %, $\geq$ 2,000 m above sea level.
2.	Peaty area (*kawasan bergambut*)	Peaty soil with a thickness of $\geq$ 3 meters
3.	Water catchment boundary	▪ high rainfall, soil structure

No.	Environmentally sensitive areas based on subproject location	Definition
		▪ easy to absorb water ▪ geomorphological forms that can absorb rain water on a large scale
4.	Beach boundary	At least 100 meters from the highest tide
5.	River boundary	▪ River outside of settlement area, a both side At least 100 meters on big river and 50 meters on small river ▪ River around settlement area, estimated to be enough to build the road with cross-section between 10-15 meters
6.	Around lake or reservoir area	At least 50 – 100 m from the high tide
7.	Spring water boundary area	Radius 200 m from spring water
8.	Sea wildlife	Marine, inland waters, coastal areas, estuaries, and a cluster of coral atolls which have characteristics such as diversity and /or unique ecosystems
9.	Mangrove forested coastal area (*kawasan pantai berhutan bakau*)	Minimum 130 times the average value of the difference between the highest and lowest tide.
10.	National park and national park marine	Having good diversity plant and animal, good landscape, and good access for tourism purposes
11.	Forest park	Forest Park is a conservation zone that is mainly utilized for the purpose of collection of plants or animals, the development of science, education and training, culture, tourism and recreation
12.	Heritage and science regional area	▪ Spot and space around high cultural value buildings, archaeological sites and regions. ▪ Area with specific geological formations that have high benefits for science development.
13.	Natural park	a. Designated region has a high diversity of plants and wildlife and ecosystem types; b. Representing the formation of certain species c. Has natural conditions, do not or have not been disturbed by human;

No.	Environmentally sensitive areas based on subproject location	Definition
		d. Unique and may be the only one in a region, and requires conservation efforts.
14.	Forest park tourism area	a. an interesting and aesthetic either natural or man-made; b. Good for recreation and sports as well as located near the centres of settlement; c. Have sufficient and safe area
15.	Germplasm protection area	Have unique types of germplasm
16.	Fauna transit area	a. Area of wildlife origin inhabited b. Has a specific area that allows the life cycle of these species
17.	Natural disaster area	Area potential for eruption, and land slide

4.1.3 Potential environmental impacts

Potential environmental impacts can be identified through the guidance table (see **Table 6**).

Table 6: Sector-wise key environmental issues

No.	Investment focus sector	Eligible Subprojects	Key environmental issues
1.	Water supply and wastewater treatment	**Water Supply** • Construction/rehabilitation/capacity augmentation of dams, lakes and reservoirs for purpose of supply of water to urban areas. The eligible costs shall include the expenses towards embankments, earthen works, diversion channels, source diversion and other similar works. • Construction of infrastructure incidental	Water treatment i. Solid waste residuals generated during water treatment such as process residuals, used filtration membranes ii. Wastewater from water treatment projects such as filter backwash, reject streams from membrane filtration processes, and brine streams from ion exchange or demineralization processes iii. Storage of hazardous chemicals for treatment

No.	Investment focus sector	Eligible Subprojects	Key environmental issues
		to source augmentation such as construction of jack-wells/bore wells, pumping equipment, etc. • Development of new water treatment plants and capacity augmentation of existing treatment plants including treatment technologies, civil works, etc. • Construction and laying of raw water transmission and treated water distribution systems (pipes, pumping stations, tanks, etc.). Including replacement and/or rehabilitation of the existing water supply systems • Installation of water meters at consumer and bulk connections and associated monitoring systems. • Implementation of SCADA and other systems for monitoring and pressure control. • Construction and installation of desalination plants for urban water supply in coastal areas.	processes iv. Air emission from water treatment operations including ozone (in the case of ozone disinfection) and gaseous or volatile chemicals used for disinfection (e.g., chlorine and ammonia) Water distribution i. Water system leaks ii. Water pipe flushing in which the discharge is high in suspended solids, residual chlorine, and other contaminants that can harm surface water bodies
		Sewerage • Collection network and	Domestic wastewater discharges i. Uncontrolled discharge of

No.	Investment focus sector	Eligible Subprojects	Key environmental issues
		waste-water treatment facility • Pumping stations and machinery • Regional facilities and system automation	domestic wastewater, including sewage and grey water, into aquatic systems can lead to microbial and chemical contamination, depleting oxygen levels, increasing turbidity, and lower levels of eutrophication. ii. Wastewater discharge onto streets or open ground can contribute to the spread of disease, odours, contaminate wells, lead to deterioration of streets, etc. <u>Industrial wastewater discharges</u> i. Leaks and overflows from the sewerage system can contaminate soil, groundwater, and surface water <u>Wastewater and sludge treatment and discharge</u> i. Quantity of liquid effluents ii. Solids removed from wastewater collection and treatment iii. Air emissions from wastewater treatment operations include hydrogen sulphide, methane, ozone (in the case of ozone disinfection), volatile organic compounds (such as from industrial discharges), gaseous or volatile chemicals used for disinfection (e.g., chlorine and ammonia) and

No.	Investment focus sector	Eligible Subprojects	Key environmental issues
			bio aerosols iv. Wastewater treatment often includes use of hazardous chemicals, such as strong acids and bases for pH control, chlorine or other compounds for disinfection v. Accidents and injuries, chemical exposure, hazardous atmosphere, exposure to pathogens and vectors and noise related to occupational health & safety
2.	Environmental Infrastructure	**Solid Waste Management** • Construction of a municipal waste-processing facility (sanitary, land-fill, processing plant, incineration unit, etc.). • Construction of construction and demolition waste processing facility. • Waste recycling project. • Purchase of vehicles and bins for solid waste collection. • Development of vehicle-tracking and waste disposal monitoring system.	<u>Municipal solid waste (MSW)</u> i. Air emissions from MSW collection and transport such as dust and bio-aerosols, odours, and vehicle emissions ii. Leachate from waste piles caused by exposure to precipitation and from residual liquids in the waste itself containing organic matter, nutrients, metals, salts, pathogens, and hazardous chemicals iii. Litter during waste collection, unloading, processing, and storage iv. Noise and vibration by truck traffic; loading equipment (e.g., cranes, wheeled loaders), stationary compactors, balers, grinders, and other treatment and conveyance systems v. Air emissions from

No.	Investment focus sector	Eligible Subprojects	Key environmental issues
			incineration vi. Landfill leachate collection and disposal vii. Landfill gas emissions and methane capture and management <u>Industrial hazardous waste</u> i. Spills and releases during waste transport ii. Air emissions such as releases of particulate matter and volatile organic compounds from storage vessels and waste processing equipment iii. Air emissions associated with storage and transfer operations iv. Generation of wash water and runoff from waste management areas v. Wastewater from biological and chemical processes like runoff and leachate vi. Solid waste residuals from biological and chemical treatments vii. Incinerator bottom ash viii. Migration of hazardous constituents in land filled industrial hazardous wastes as leachate or in the gas phase
		Drainage • Development of storm water drainage network	i. Potentially of dumping garbage area ii. Waste from construction

No.	Investment focus sector	Eligible Subprojects	Key environmental issues
		• Rehabilitation of existing drainage networks • De-silting and/or strengthening of natural drains	material
		Energy Efficiency • Improvement of electricity installation and equipment in building and public facilities • Retrofitting building and infrastructure with efficient energy consumption instruments • Improving system that can control energy consumption	i. Safety issues ii. Waste from construction material
3.	Low-Income Housing & Slum Upgrading	**Housing** • Public housing units in slum areas (in-situ and or relocation) • Integrated urban upgrading including water, sewerage, drainage, roads and street lighting, etc.	Planning i. Alteration in natural drainage systems ii. Alteration of land use iii. Impacts of the proposed activity on the facilities adjacent to the proposed site Construction phase i. Construction activities like site clearance, excavation, foundation preparation, material movement on site, haul roads ii. Dust emissions from construction camps, stockpile areas, storage of materials iii. Quantities of earthwork

No.	Investment focus sector	Eligible Subprojects	Key environmental issues
			involved in the construction activity-cutting, filling, reclamation iv. Exhaust from construction machinery and equipment including generators, earth moving equipment and transport vehicles v. Felling of trees during site clearance vi. Demand of water for construction activities and labour camps vii. Conversion of industrial land use to residential – soil contamination viii. Runoff from construction activities, dumping of debris and excavation spoils on neighbouring water bodies, lands ix. Water demand for construction x. Water drawl impacts on ground water <u>Operation phase</u> i. Solid waste management ii. Sewerage iii. Water consumption iv. Storm water management v. Parking spaces vi. Micro-climate alteration due to building/s vii. Fire hazard
4.	Transportation, Productive,	**Mass transportation** • Development of mass	Key issues related to widening of roads for metro rail and bus rapid

No.	Investment focus sector	Eligible Subprojects	Key environmental issues
	Logistics Infrastructure	transit (non - rail based) infrastructure. • Purchase of public buses • Development of street-furniture for bus-stops • Development of bus depot and shelters • Development of dedicated BRT lane and related infrastructure, tracking and monitoring system for operating BRT etc.	transport system (BRTS) is listed under roads **Metro rail projects** <u>Construction phase</u> i. Cutting of trees ii. Storage and disposal of construction debris iii. Runoff from excavated material or stored construction material to neighbouring water bodies iv. Emissions owing to transportation of construction material v. Emissions from haul roads vi. Use of diesel generator sets and storage of diesel vii. Use of heavy plant and machinery like cranes viii. Landfilling and reclamation in coastal areas for train maintenance depots, casting yards ix. Traffic diversion and congestion during construction increasing air pollution x. Noise from mechanical piling and rafting xi. Noise from using of impact and pneumatic machinery and occupational safety xii. Dewatering of excavated areas xiii. Batching plant – air emissions

No.	Investment focus sector	Eligible Subprojects	Key environmental issues
			xiv. Labour camp – sanitation, waste disposal <u>Operation phase</u> i. Generation of solid waste ii. Illumination at stations and along the line causing public intrusion iii. Traffic congestion near stations – air quality, noise iv. Washing of rakes-generation of effluents v. Chemical storage (transformer/ diesel/ mobile oil, grease, turpentine etc. vi. Generation of hazardous waste (waste oil) vii. Visual impacts – overhead rail viii. Use of overhead equipment for electrification - safety **Bus rapid transit system projects** <u>Construction phase</u> i. Felling of trees within right of way (ROW) ii. Traffic congestion due to road constriction / diversions iii. Exhaust from construction machinery, equipment including generators, earth moving equipment and transport vehicles iv. Disposal of excavation spoil material and transportation of materials v. Labour camps demand for fuel wood, solid waste

No.	Investment focus sector	Eligible Subprojects	Key environmental issues
			management, sanitation vi. Construction activities like site clearance, excavation, foundation preparation, material movement on site, haul roads vii. Dust from construction camps, stockpile areas, storage of materials viii. Demand of water for construction and from labour camps ix. Construction and honking by vehicles especially in and around demarcated silent zones x. Air pollution, increase in noise levels and obstruction to access of some areas xi. Use of diesel powered construction equipment xii. Reduction in ROW during construction xiii. Disposal of material xiv. Traffic congestion, diesel powered equipment, material transportation xv. Extraction of soil from borrow pits and extraction of rocks and sand from river beds xvi. Runoff from construction activities, dumping of debris and excavation spoils Operation phase i. Location of bus stops ii. Design and configuration of

No.	Investment focus sector	Eligible Subprojects	Key environmental issues
			buses iii. Traffic congestions due to reduced roadway capacity by operation of bus rapid transit (BRT) Others i. Increase in impermeable surface area thus increasing the rate of surface water runoff ii. Solid waste/residues generated during construction and maintenance of roads iii. Air emissions due to dust during construction and exhaust from vehicles iv. Wastewater discharges from maintenance facilities v. Traffic noise that is generated by vehicles, exhaust emissions, aerodynamic sources, and tire / pavement interaction vi. Physical, chemical and biological hazards related to occupational health and safety vii. Chance find of artefacts with archaeological or historical value
		Road and bridges • New carriageway development (at grade, flyovers, bridges) • Road rehabilitation, upgradation and/or	i. Safety, health, and traffic management issues ii. Waste from construction material

No.	Investment focus sector	Eligible Subprojects	Key environmental issues
		widening • Junction-improvements projects • Development of pedestrian infrastructure (foot-over bridges, footpath, street furniture, street-lighting, etc.). • Development of multi-level car parking structure • Development of traffic monitoring and management system • Development of building and/or facilities to house traffic management unit.	
		Irrigation • Irrigation infrastructure development	i. Pesticide use (if more than 3000 Ha, an EIA is required) or IPM approach (Integrated Pest Management). ii. Waste from construction material, Occupational Health and Safety.
5.	Social Infrastructure	**Health care facilities** • Development of new hospitals • Rehabilitation and/or expansion of hospitals • Development of facilities incidental to the main infrastructure, such as parking facilities and equipment (medical	i. Hazardous health care waste ii. Emissions due to exhaust air from heating, ventilation, and air conditioning (HVAC) systems, ventilation of medical gases and emissions from medical waste storage areas, medical technology areas, and isolation wards, exhaust

No.	Investment focus sector	Eligible Subprojects	Key environmental issues
		equipment & beds for hospitals, etc.)	from medical waste incineration iii. Contaminated wastewater from discharges from medical wards and operating theatres (e.g. body fluids and excreta, anatomical waste), laboratories (e.g. microbiological cultures, stocks of infectious agents),pharmaceutical and chemical stores; cleaning activities (e.g. waste storage rooms), and x-ray development facilities, treatment disposal technologies and techniques like autoclaving, microwave irradiation, chemical disinfection, and incineration iv. Exposure to infections and diseases, exposure to hazardous materials / waste, exposure to radiation and fire safety related to occupational health and safety
		Education • Development of new schools • Rehabilitation and/or expansion of schools • Development of facilities incidental to the main infrastructure such as parking facilities and equipment (teaching aid and furniture for schools, etc.)	i. Educational facilities would require construction of infrastructure – land, building. ii. Key issues faced here would be same as those listed under housing

No.	Investment focus sector	Eligible Subprojects	Key environmental issues
		Traditional market • Development of new public markets. • Rehabilitation and/or expansion of public markets. • Development of facilities incidental to the main infrastructure such as parking facilities and equipment (storage and warehousing for markets, etc.)	Similarly to education, traditional market would require construction of infrastructure – land and building. Key issues faced here would be the same as those listed under low-income housing and education sector

4.1.4 Potential social impacts

The screening template consists of a questionnaire on various potential social impacts. The types of impacts covered by this questionnaire are given below:

1. Possibility of involuntary land acquisition and/or resettlement
2. Magnitude and nature of people displaced
3. Impacts on livelihoods
4. Impacts on access restriction
5. Magnitude and nature of assets affected
6. Vulnerable and gender focus of the subproject
7. Possibility subprojects affect IPs
8. Health & safety of the community
9. Impacts on cultural heritage
10. Labour and working conditions
11. Impacts (positive and negative) of subproject on Indigenous Peoples

Additional screening for potential issues of violence against women and children resulting from influx of workers in communities in the subproject area shall be incorporated into the questionnaire. The SGs shall prepare the LARAP and IPP documents in the case that a subproject involve involuntary land acquisition and/or resettlement and/or affect IPs, respectively. Social impacts beyond land acquisition and involuntary resettlement should be identified and addressed as part of the environmental impact assessment (EIA or EMP or AMDAL/UKL-UPL accepted to the Bank).

4.1.5 Project categorization

PT SMI (ESSBCM Division) will decide the risk category of a subproject. Categorization is determined based on the level or intensity of the potential environmental and social impacts of the subproject (see **Table 7**). The principles to be followed in allocating the risk category:

1. If a subproject fulfils even one criteria, the corresponding risk category shall be applicable to the subproject
2. A subproject can be assigned only one risk category. If more than one risk category is applicable to a subproject, the more severe shall apply.

Table 7: Potential risk category of subprojects

Risk Category	Criteria	Indicative Type of Subprojects
A	There are potentially significant negative impacts on the environment which are both sensitive and diverse, which may be long-term in nature, OR There are potentially significant negative social impacts which are both sensitive and diverse, OR There are potentially significant impacts on health and security	i. Large-scale dams and reservoirs ii. Development of new industrial estates iii. Extractive industries, including oil and gas development iv. Development of ports, airports, railways and major train station v. Development projects involving the brownfield development on important public lands vi. Development of large power plants vii. Development of toll roads and toll bridges
B	There are potential negative environmental impacts but they are not significant in magnitude and occurrence, not diverse and complex, not unprecedented and not sensitive, only localized to the project-site, , and short-term in nature OR there are potential negative impacts related to social issues that only localized at the project site OR	i. Transmission of electricity ii. Telecommunication iii. Renewable energy (except hydroelectricity projects with large scale) iv. Drinking water and sanitation v. New project in an industrial area vi. Development of waste water treatment facilities vii. Road construction on a small scale such as village roads / residential

Risk Category	Criteria	Indicative Type of Subprojects
	There are health and security issues but they are not significant	
C	Projects that have zero or minimal potential negative impact on the environment, and there are no potential social issues, and there are no potential health and safety issues	i. Workshop, training or capacity building events under PDF supports ii. Development of biogas in a household scale

Projects that fall under categories A or B are required to prepare environmental and social mitigation plans such as ESIA, EMP, (AMDAL, UKL UPL acceptable to the Bank) or LARAP, IPP, Pest Management Plan, PCR Management Plan etc.

Social impacts sensitivity will also contribute to the determination of the subproject risk category. The higher the sensitivity of a subproject, the higher the risk could be and PT SMI (ESSBCM Division of the Risk Management Directorate) has to pay more attention on the mitigation measures specified in the social safeguards instruments proposed by the SGs. **Table 8** below provides guidance to measure the sensitivity of a subproject in terms of social impacts.

Table 8: Social impacts sensitivity

Issues	Site Sensitivity		
	Low	Medium	High
Involuntary resettlement	Low population density; dispersed population; land tenure is well-defined; homogenous population in terms of culture and economic activities	Medium population density; mixed ownership and land tenure; heterogeneous population in terms of culture and economic activities	High population density; major towns and villages; low income families and/or illegal land ownerships; communal properties; high heterogeneous population in terms

			of culture and economic activities
IPs	No IPs	Dispersed or mixed IPs; highly acculturated IPs	IPs territories; reserves and/or land for cultural, social and economic activities; vulnerable IPs; unclear rights of IPs

Identifying applicable policies/laws/regulations

One of the fundamental uses of the ESMF is to identify the triggered applicable national laws and regulations, PT SMI and World Bank's safeguards policies for a proposed subproject. **Table 9** provides the applicability of safeguards. Based on this applicability matrix, the relevant safeguards policies triggered are to be marked in the Screening Checklist.

Table 9: Policy trigger matrix

Trigger	National laws and regulations	PT SMI standards	International standard operating policies
Sub-project may cause environmental impact	a. Law No. 3 of 2009 b. Government Resolution No. 27 of 2012 c. Minister of Environment Regulation No. 5 of 2012 d. Government Regulation No. 82 of 2011 e. Government Regulation No. 41 of 1999 f. Government Regulation No. 101 of 2014	ESS-1	WB OP 4.01; WBG General EHS Guidelines and Industry Sector Guidelines (refer to Annex 1D and Annex 10).
Subproject may adversely impact natural habitat or threatened species	a. Law No. 41 on Forestry and Constitutional Court decision No. 35/PUU-X/2012 b. Ministerial Regulation of MOH No. P.62/2013 c. MOHA Regulation No. 52/2014 d. Regulation of Minister of Land Agency and Spatial Development No. 9 of 2015 e. Law No. 18 of 2013	ESS-6	WB OP 4.04, OP 4.36
Subproject may adversely impact places/objects of	-	ESS-8	WB OP 4.11 IFC PS 8

Trigger	National laws and regulations	PT SMI standards	International standard operating policies
cultural/historical values			
Peoples belonging to the traditional community live/IPs occupy or use the subproject sites or the neighbouring areas of the subproject site or affected by a subproject	a. Law No. 5 of 1960 b. Presidential Decree No. 111/1999 c. Law No. 41/1999 on Forestry (plus Constitutional Court Decision No. 35/PUU-X/2012): Procedures to Settle Land Ownership Conflict in Forest Areas d. MOHA Regulation No. 52/2014: Guidelines on the Recognition and Protection of MHA e. Ministerial Regulation of MOH No. P.62/2013: Establishment of Forest Area f. Regulation of the Minister of Land Agency and Spatial Development No. 9/2015: Procedures to Establish the Land Communal Rights on MHA Land and Community Living in Special Areas g. Law No. 18/2013: Prevention and Control of Deforestation (UUP3H). h. Regulation of Ministry of Forestry No. P.39/Menhut-II/2013: Empowerment of Local Communities through Forest Partnerships	ESS-7	WB OP 4.10 IFC PS 7
Subproject may cause	i. Law No. 2 of 2012, Presidential Regulations No. 71 of 2012, No.	ESS-5	WB OP 4.12

Trigger	National laws and regulations	PT SMI standards	International standard operating policies
land acquisition and/or involuntary resettlement	40 of 2014, No. 99 of 2014 and No. 30 of 2015 and Ministry of Agrarian and Spatial Development Regulation No. 5 of 2012, No. 6 of 2015.		IFC PS 5
Subproject is located on land with lack of clarity on ownership	-	-	WB OP 7.60
Subproject may cause agricultural diseases or directly involve use of pesticides	-	-	WB OP 4.09, WBG General EHS Guidelines and Industry Sector Guidelines (refer to Annex 1D and Annex 10)
All subprojects		ESS-2, ESS-3, ESS-10	IFC PS 1, PS 2, PS 3, PS 4 WBG General EHS Guidelines and Industry Sector Guidelines (refer to Annex 1D and Annex 10)
Sub-projects may cause significant impact on health, safety and security	-	ESS-4	IFC PS 4; WBG General EHS Guidelines and Industry Sector Guidelines (refer to Annex 1D and

Trigger	National laws and regulations	PT SMI standards	International standard operating policies
			Annex 10)

4.1.6 Project documentation

In the case that the SGs have already prepared an AMDAL, or UKL-UPL to obtain environmental permit under Indonesian law, and LARAP and/or IPP, it must be duly recorded in the checklist. A copy of the AMDAL or UKL-UPL should also be submitted along with the loan application package. PT SMI (ESSBCM Division) will review these documents (similar case if the SGs have already had LARAP and IPP) and identify gaps with the requirements specified in this ESMF. If there are gaps, PT SMI will require the SGs to either improve the submitted documents or to prepare a new impact mitigation instruments with ToRs provided by PT SMI.

4.2 Step 2- Screening

4.2.1 Verifying the ESSC

The application submitted by the SGs is to be verified by PT SMI based on the detailed subproject report or subproject concept note and the information provided by the SGs in the ESSC. It should be noted that if the subproject falls in the ESEL, the loan application should be rejected (see **Figure 1**).

For eligible subprojects, PT SMI (ESSBCM Division) may request additional information from the SGs, to confirm the contents of the ESSC submitted. In the screening stage, PT SMI (ESSBCM Division) will review the filled-in ESSC and confirm the proposed subproject on the:

1. Inclusion/exclusion of the subproject from the environmental and social exclusion list (use Annex 1A)
2. Proximity of the project to environmentally sensitive areas (use Annex 1B), and potential social impact due to the subproject
3. Potential involuntary land acquisition and/or resettlement (use Annex 1)
4. Subproject categorization based on ESMF (use Annex 1C)
5. Applicable WB safeguards, environmental permits and PT SMI standards (use Annex 1D)

As mentioned in Chapter 1, there may be three types of subprojects seeking loan assistance from PT SMI under the RIDF business line (see **Table 10**).

Table 10: ESMF action based on project stage

No.	Project Stage	Action under ESMF
1	Subproject is at a conceptual stage: land	The SGs will prepare and disclose all Environmental and Social Assessment documents/instruments (i.e.

No.	Project Stage	Action under ESMF
	sites/footprint and design alternatives are still being considered	EIA, EMP, SIA, LARAP, IPP, etc.) prior to subproject appraisal. At this stage, it may be suggested that the SGs collaborate with the PDF team to prepare the necessary documents. The SGs cannot proceed to subproject appraisal stage if the required Environmental and Social Assessment documents/instruments are not available
2	Subproject preparation completed: construction bids may have begun	PT SMI (ESSBCM Division) will review the E&S documents that are available, identify gaps within the requirements specified in the ESMF, and will ask the SGs to supplement them to improve the documents or develop new ones with ToRs provided by PT SMI. All required documents must be disclosed prior to subproject appraisal.
3	Subproject implementation has begun or even completed	PT SMI (ESSBCM Division) will carry out a due diligence to confirm that: (a) the subproject is in compliance with all applicable national environmental and social laws and regulations; (b) there are no reputational risks for PT SMI and the World Bank Group (WBG); and (c) there are no legacy issues or no pending legal disputes or liabilities. Based on the findings of such an assessment, PT SMI will require the SGs to implement remedial measures, as needed, or to mitigate potential reputational risks or to address legacy issues or liabilities.

4.2.1.1 Preliminary potential impact assessment and determination safeguards instruments

Identifying the impact mitigation instruments

Based on the results of the PT SMI's (ESSBCM Division) review on the ESSC, PT SMI (ESSBCM Division) will also identify the potential environmental and social impacts and risks of the proposed subproject (also refer to Section 4.1.3 and 4.1.4 and the potential generic environmental and social impacts of sectors/subsectors in Chapter 1) based on the available documents and information available and provided by the SGs. Depending on the type of the proposed subproject and the potential environmental and social impacts and risks, PT SMI (ESSBCM Division) will require the SGs to prepare 1) an over-arching EIA/EMP, along with separate instruments for 2) LARAP and 3) IPP, and/or 4) supplemental documents, remedial action plan or else, as applicable. PT SMI will also provide the applicant the ToRs for preparing these instruments, which are developed in compliance with the requirements specified in this ESMF.

Step 1: Identify the environment and social impact instruments using ***Table 11****.*

Table 11: Matrix for identifying E&S instrument

Trigger	Safeguard instrument
Project is Category A	Environmental impact assessment
Project is Category B	Environmental management plan
Project is Category C	Statement of readiness

Step 2: Assess whether a LARAP is required and identify the instrument applicable using ***Table 12***

Table 12: Matrix for identifying applicable instrument for land acquisition and involuntary resettlement

Trigger	Safeguard instruments
When land acquisition for a subproject affects more than 200 people, takes more than 10% of household productive assets and/or involves physical relocation	A comprehensive LARAP
When land acquisition for a subproject affects less than 200 people, less than 10% of household productive assets are affected and/or does not involve physical relocation	An abbreviated LARAP
When a subproject lead to involuntary restriction of access to the legally designated parks and protected areas resulting in adverse impacts on the livelihoods of the displaced	A Plan for Action as a result of Process Framework

Trigger	Safeguard instruments
persons	
The project requires neither land acquisition nor resettlement	N/A

Note: Refer to the LARPF in Chapter 5.

Step 3: *Assess whether a plan is required for IPs using* ***Table 13****.*

Table 13: Matrix for identifying applicable safeguards instrument for IPs

Trigger	Safeguard instrument
IPs may form a portion of the beneficiaries/persons affected	An IPP based on a Social Assessment
The subproject does not impact the IPs or the IPs is the sole beneficiaries of a subproject	IPP is not required or IPs needs and concerns are incorporated in the subproject design

Note: refer to IPP Framework in Chapter 6.

Requiring the SGs to prepare safeguards instruments

The way to proceed with this step depends of whether or not the applicant has already prepared an E&S impact mitigation instruments, and the nature of mitigation required under the ESMF requirements as well as the quality of the mitigation instruments in reference to the requirements specified in the ESMF (see **Table 14**).

Table 14: Matrix for preliminary assessment of impact mitigation instrument

Application Type	Action to be taken
Accompanied with AMDAL/UKL-UPL/SPPL as per Indonesian Law or any other Environmental and Social Assessment document	A gap analysis is to be conducted considering: a. The contents of the applicable instrument and requirements as prescribed under the ESMF b. Policies and regulations referred to in the instrument as compared to those triggered by the subproject
No mitigation instrument have been	A terms of reference should be provided by

Application Type	Action to be taken
prepared	PT SMI to the applicant considering: a. The plan templates corresponding to the subproject b. The policies/laws/regulations triggered by the subproject The SGs may be advised to obtain assistance from the Project Development Facility (PDF) in preparing the instruments, capacity building and improving the subproject design
Accompanied by a LARAP or similar instrument	A gap analysis is to be conducted considering: a. The contents of the applicable instrument and requirements as prescribed under the ESMF b. Policies and regulations referred to in the instrument as compared to those triggered by the subproject
Not accompanied by a LARAP or similar instrument	A terms of reference should be provided by PT SMI to the applicant considering: a. The plan templates corresponding to the subproject b. The policies/laws/regulations triggered by the subproject The SGs may be advised to obtain assistance from the Project Development Facility (PDF) in preparing the instruments, capacity building and improving the subproject design
Accompanied by an IPP (including Social Assessment)	A gap analysis is to be conducted considering: a. The contents of the applicable instrument and requirements as prescribed under the ESMF b. Policies and regulations referred to in the instrument as compared to those

Application Type	Action to be taken
	triggered by the subproject
Not accompanied by an IPP (including Social Assessment)	A terms of reference should be provided by PT SMI to the applicant considering: a. The plan templates corresponding to the subproject b. The policies/laws/regulations triggered by the subproject The SGs may be advised to obtain assistance from the Project Development Facility (PDF) in preparing the instruments, capacity building and improving the subproject design

Upon receipt of the appropriate mitigation instruments, PT SMI (ESSBCM Division) should appraise these documents ensuring that the contents of the plan and the policies/laws/regulations triggered have been covered by the instruments in accordance with the requirements specified in this ESMF. An initial screening report is to be prepared by PT SMI (ESSBCM Division) to record the above activities. It should be noted that for all Category A subprojects, the ToR that has been prepared by PT SMI (ESSBCM Division) should be reviewed and approved by the World Bank prior to providing it to the SG.

4.3 Step 3 - Detailed subproject appraisal

The subproject appraisal, under the ESMF, is to be carried out with two objectives:

1. Assess the accuracy and reliability of the E&S impact mitigation instrument
2. Assess the E&S sustainability of the project considering the mitigation measures proposed through the mitigation instrument

The appraisal is to be conducted in two parts – a generic subproject appraisal, following by a detailed appraisal using sector-specific toolkits (see **Figure 1**).

4.3.1 Generic subproject appraisal

The extent, to which the subproject design, environmental and social plans and other documents help mitigate potential adverse impacts, arising from the subproject, if any, needs to be investigated by PT SMI (ESSBCM Division).

The appraisal of the subproject documentation to be carried out by PT SMI (ESSBCM Division) should consider the potential environmental and social issues (refer Annex 1) while answering the following questions,

- What is the nature and magnitude of the potential impacts?
- Are the environmental and social assessment and management measures provided adequate as per the requirements specified in the ESMF?
- Is there scope for enhancing the subproject, in relation to the environment and the society?
- Is the subproject proposal compliant with regulatory requirements and have the necessary clearances been obtained? (a guide on environmental and social regulations and responsible institutions is given in Annex 10)
- Is there integration of environmental and social impact mitigation measures in to the design wherever relevant? If not, provide details.
- Are there adequate arrangements for implementation of the environmental management plan, LARAP, IPP, remedial action plans, including institutional capacity and contractual provisions? If not, provide details.
- Have the management measures been factored in the project cost? If not, make such inclusions.
- Have the provisions of the mitigation measures recommended by environmental management plan and the LARAP, IPP, remedial action plans to be implemented during construction been included in the bid document? If so, please detail.
- Is there a need for a legal covenant to address any specific environmental and social risks including regulatory risks (this could be an input to the sanction letter)? If so, mention the relevant legal covenants.
- Review of environmental and social impact assessments and mitigation plans and their adequacy to the ESMF provisions and magnitude and nature of impacts.
- Has all environmental and social impact mitigation measures been consulted with the subproject affected persons? Has the IPP development consulted the affected IPs through a free, prior, informed consultation (leading to broad support)? Provide details
- Has public disclosure of subproject information and environmental and social mitigation documents been conducted and is there public consensus on the subproject and locations/ sites involved?
- What is the state of readiness of the subproject sites?

4.3.2 Sector specific appraisal

Questionnaires have been provided in Annex 8 for the following sectors:

1. Water supply and Sanitation
2. Environmental Infrastructure
3. Low-Income Housing and Slum Upgrading
4. Transportation, Productive, Logistic Infrastructure
5. Social Infrastructure

The question set corresponding to the sector should be identified and filled.

4.3.3 Consolidated subproject appraisal report

The 'overall subproject appraisal' and the 'sector-specific appraisal' should be consolidated and a detailed note should be prepared for the subproject appraisal. An outline of the appraisal report is provided in Annex 7. A financing committee comprising divisions of investment, legal, risk management of PT SMI should review the detailed environment and social appraisal notes and decide on the subproject's environmental and social viability. If the financing committee finds the subproject to be environmentally and/or socially unviable, the loan application should be rejected. On the other hand, if the subproject is found to be environmentally and socially viable, then the proposal should be forwarded along with recommendations on the appropriate environmental and social covenants which should be included in the loan agreement.

The roles of the Bank were explicitly explained in Chapter 1. It should be consistent in all steps outlined in Chapter 4. In principle, as an FI, the Bank will not involve in deciding whether the subproject proposals are eligible for getting RIDF funding or not, however, in terms of safeguards, the Bank will review subprojects proposals as hands-on capacity building support for PT SMI, until PT SMI has sufficient capacity acceptable to the Bank in managing safeguards (refer to Section 1.7.5).

4.4 Step 4 - Loan sanction and disbursement

This stage is initiated after the financing committee gives its approval for the subproject. Subsequently, the negotiations are made with the SGs to put in place necessary safeguard measures in the form of loan covenants, conditions precedent and changes in the subproject configuration (see **Figure 1**).

4.4.1 Communication of loan covenants to the subnational government

The mitigation measures finalized through the subproject appraisal phase should be translated into contractual obligations in the form of loan covenants. Through these covenants, the environmental and social responsibilities of the SGs shall be linked to the loan disbursement. At the later stage, these covenants will be used as a basis for the SGs to put the mitigation measures, as recommended by the safeguards instruments which need to be implemented prior to construction, and during construction, in the bidding document for the contractors and/or during the operation of subproject.

A list of mandatory environmental and social covenants, as a minimum requirement, has been provided in **Table 15**.

Table 15: Mandatory environmental and social clauses in covenants

The following clauses should be inserted into the construction contractor's agreement additionally among others: a) The contractor shall implement all measures recommended in the environmental and social management plan b) The contractor shall implement the special and general conditions stated in the environmental permits, forest clearance, and wildlife clearance applicable to construction phase of the project. c) The contractor shall comply with all applicable regulations with regards to control of pollution d) The contractor shall conduct six monthly environmental monitoring of ambient air quality, water quality and noise levels through approved agencies in consultation with PT SMI. These reports shall be submitted to PT SMI. e) The contractor shall obtain consents for hot mix plant, wet mix plant, crushers, diesel generator sets and batching plant and submit to PT SMI. f) Where the contractor obtains construction material from third party sources, a copy of the agreement/invoice from these third party agencies should be obtained by the Contractor and submitted to PT SMI. g) The contractor shall obtain permits from respective regulatory/ local authority for use of water, borrow pits during construction and submit to PT SMI. h) The contractor shall furnish to PT SMI and respective regulatory authorities immediate notice of any incident or accident relating to the project and likely to have a highly adverse effect on the environment. i) The contractor will bear the cost of damage to any private or government property during construction caused due to negligence or inaction of good construction

practices

The following clauses should be inserted into the engineering procurement and construction contract additionally among others, as applicable –

1. The EPC contractor shall implement all mitigation measures applicable during pre-construction and construction phase specified in the environmental management plan prepared for the project.
2. The EPC contractor shall implement all conditions specified in the environmental clearance certificate applicable during pre-construction and construction.
3. The EPC contractor shall provide amenities and follow health and safety standards for construction labour and staff at all times as per labour laws.
4. The EPC contractor shall obtain required environment, health & safety clearances/ permits/ approvals as required by regulatory authorities.
5. The EPC contractor shall implement all conditions stated in clearances/ permits/ approvals granted for the project by regulatory authorities.
6. The contractor shall not indulge in harmful or exploitative forms of forced labour or child labour.
7. The EPC contractor shall provide its labour and staff periodic training on environmental protection (housekeeping, preventing spills, wastage etc.) and occupational health & safety practices (use of PPE, harness, safe working practices etc.).
8. The EPC contractor shall designate person/s to attend to public grievances due to construction.
9. The EPC contractor shall prepare and implement an emergency preparedness and response plan for the project site under their control during construction. Line of authority should be established for decision making during emergencies and all staff and workers/supervisors should be trained as per their job description.

4.4.2 Pre-requisite to signing the agreement

If the SGs disagree to such covenants, the LAP shall stand cancelled and shall be returned to the SGs. On the other hand, if the SGs agree to the proposed loan covenants, a request should be made to the SGs to submit the readiness certificate and to comply with PT SMI norms specified in this ESMF for public disclosure. Details of both these requirements are provided below:

Readiness certificate

The readiness certificate must be issued by the mayor of the concerned SGs as the effective stipulation (loan disbursement stipulation). It should confirm the availability of sites, 'right of way' required for the subproject, payment of compensation for the land to the titleholders, rehabilitation and resettlement assistance to project-affected-persons, including those occur during construction; in the event of non- acceptance of the compensation or any other legal issue, the amount should be credited in the escrow account.

Public disclosure

The following documents should be disclosed in the offices of the SGs, besides in the websites of the SGs/relevant departments: (i) ESMF requirements (a procedural flowchart format to be included for easy understanding), (ii) the EIA/EMP, LARAP and IPP reports in English and in Bahasa Indonesia (iii) a non-technical summary in Bahasa Indonesia, (iv) environmental and social mitigation plan documents, (v) annual E & S Audits, and (vi) LARAP and IPP implementation reports. LARAP and IPP shall also be disclosed in the public space closest to the subproject affected peoples.

Step 4.1: Verification of Compliance

Upon reception of the readiness certificate and a letter stating compliance with the public disclosure norms, the same should be verified. The readiness certificate should be scrutinized against proofs, whereas the public disclosure may be verified by visiting the SGs' website as well as the physical office.

Step 4.2 Issuance of invitation for loan agreement signing

Upon successful verification of the SGs' compliance, the SGs will be formally invited to sign the loan agreement with PT SMI.

4.5 Step 5 – Project implementation and monitoring

After the loan agreement has been signed, but prior to disbursement of the funds, compliance with the approved subproject configuration and other contractual agreements need to be verified.

4.5.1 First loan tranche

Request LG for necessary compliance

The SGs should be requested to submit proofs of meeting the following compliance requirements before the loan is disbursed for the first time to the SGs (such as advance payment). Loan will be channelled to APBD and the SGs will transfer the loan to the contractor/vendors.

Clearance for initial fund disbursement

Once the SGs submit proofs to show fulfilment of the compliance requirements and the same are satisfactorily verified, clearance may be issued for the initial fund disbursement to the SGs.

4.5.2 Subsequent loan tranches

Subsequent instalments should be disbursed by PT SMI based on verification of progress reports and field visits, the compliance reports and compliance with other loan-disbursement conditions.

Monitoring prior to hand-over of site to contractor

It should be communicated to the SGs that prior to hand-over of site to contractors, the following compliance must be met:

(i) Certification from the SGs along with necessary details from the relevant authorities such as the district administration indicating that the payment of land acquisition compensation and R&R assistance, along with replacement of affected community assets, has been completed

(ii) Certification from the SGs indicating that the sites are free of all encumbrance, and all approvals and clearances have been secured

(iii) Written commitment from the SGs in the case that measures activities that will have to be continued during construction and beyond as specified in the LARAP (such as livelihood restoration) and/or IPP will be implemented consistent as specified in the approved LARAP and/or IPP.

Clearance for subsequent disbursement of funds

Once the SGs submit the requisite certifications related prior hand-over of the site, and the same are satisfactorily verified, clearance may be issued for the fund disbursement to the SGs.

4.6 Monitoring subproject for compliance with ESMF

The subproject shall be monitored across its life-cycle to ensure that all the safeguards agreed-upon are successfully implemented and complied with. Further fund disbursements shall be linked to continuous compliance by the SGs (see **Figure 1**).

Tier 1 Monitoring - environmental and social reports

PT SMI will monitor all subprojects (during planning, construction and operation and maintenance stages) that it finances to ensure conformity to standards. Monitoring of environmental and social components will be carried out through environmental and social implementation/compliance reports that form part of quarterly progress reports. The SGs are expected to make adequate internal arrangements to monitor the implementation of the environmental and social mitigation plan and submit regular progress reports including environmental and social implementation compliance reports to PT SMI (see **Table 16**).

Table 16: Subproject stage-wise documentation requirement

No.	Project stage	Project documents
1	Pre-construction	– AMDAL, UKL-UPL, Environmental Permit, LARAP, IPP – Implementation of activities specified in LARAP and IPP that need to be implemented prior to construction
2	Construction	– EIA, Environmental Monitoring Efforts, Environmental Management Efforts – Environmental permit – EIA monitoring report – Ground water extraction – Temporary storage of hazardous waste permit – Surat pengesahan Panitia Pembina Keselamatan dan Kesehatan Kerja (P2K3) – Corporate policy regarding environmental and occupational health and safety – Work accident report – Emergency response preparedness document – Community complaint handling report – Worker health monitoring report – Worker policy

No.	Project stage	Project documents
3	Operation and maintenance	– EIA, environmental control efforts, environmental management efforts. – Environmental permit – EIA monitoring report – Implementation of LARAP that need to be implemented during construction – Implementation of IPP that need to be implemented during construction – Ground water extraction – Temporary storage of hazardous waste permit – Surat pengesahan panitia pembina kesehatan keselamatan kerja (P2K3) – Corporate policy regarding environmental, health, safety work – Work accident report – Emergency response document – Community complaint handling report – Worker health monitoring report – Worker policy Laporan Pengaduan Masyarakat – Program corporate social responsibility policy

Tier 2 Monitoring – Field visits

PT SMI will undertake periodic field visits to those projects that are under implementation and its findings should be shared with respective implementing agencies for their follow-up. Any non-compliance and corrective measures therein should be highlighted in these reports, and they should be followed up on a periodic basis.

Tier 3 Monitoring – Audit of ESMF compliance

PT SMI should carry out annual audits of its portfolio to review the status of ESMF compliance of the RIDF portfolio. The audit should focus on the process followed for categorization and approval of E&S reports, disclosures and related aspects. It should also be based on field visits to all environment and social aspects for A and B category projects to verify their implementation on the ground, and solicit feedback from affected peoples and other stakeholders. The audit should be done annually for activities completed until the previous financial year, with bi-annual reviews for environmentally and socially sensitive projects. The draft report should be shared with the World Bank and other institutions providing support to RIDF and the final audit report should be released in PT SMI website. The interventions recommended in the audit findings should form the basis of appropriate revision of the ESMF document or suitable analytical studies to improve the environmental and social safeguards management in infrastructure development in Indonesia.

5. Land Acquisition and Resettlement Policy Framework (LARPF)

This framework applies for a subproject that involve involuntary resettlement (includes land acquisition and resettlement) implemented under the eminent domain principle. This framework covers direct economic and social impacts due to the subproject financed by PT SMI (through RIDF) and are caused by (a) the involuntary taking of land resulting in relocation of loss of shelter, loss of assets or access to assets, or loss of income sources or means of livelihood, whether or not the affected persons must move to another location; or, (b) the involuntary restriction of access to legally designated parks and protected areas resulting in adverse impacts on the livelihoods of the displaced persons. In case a subproject proposed by an applicant involves land acquisition and resettlement, it should be duly recorded in the ESSC submitted by the SGs to the SMI in the application package.

This framework relies on Government of Indonesia laws and regulations to the extent that they are in compliance with the World Bank OP 4.12 on Involuntary Resettlement and PT SMI's ESS 5 (see Chapter 2.1). Specific provisions are included in this framework to address any aspect of the OP 4.12 and PT SMI's ESS 5 that are not fully addressed in the Government of Indonesia laws and regulations.

5.1 Purpose of Land Acquisition and Resettlement Policy Framework (LARPF)

The purpose of this LARPF is to clarify the principles, procedures, organizational arrangements to be applied to the preparation of LARAP for the RIDF subprojects, either supported by PDF or financed by SG itself. LARPF provides guidance to PT SMI in the screening, categorization of subprojects, and define the appropriate type of LARAP to be prepared by the SGs for subprojects seeking RIDF financing, as well as to monitor and supervising the SGs in implementing the approved LARAP. The LARPF also provides guidance to the SGs on the requirements and procedures of preparing the LARAP and its content.

Applicable Indonesian laws and regulations, and main gaps with World Bank OP 4.12 on Involuntary Resettlement refer to **Table 3** in Chapter 2.2.

5.2 Application of LARPF

This LARPF applies for the following situation:

a. Impacts caused by a subproject resulting in involuntary land acquisition, relocation, loss of assets or loss of access to assets, loss of income sources or means of livelihood whether or not the PAPs (Subproject Affected Persons) must move to another location; resulting in the involuntary restriction of access to legally designated parks and protected areas that would result in adverse impacts on the livelihoods of the PAPs. Displacement can be full or partial, permanent or temporary. Physical displacement is relocation arising from the loss of residential land or shelter, while economic displacement is loss of land, assets, access to assets, income sources, or means of livelihoods. Restrictions on land and resource use refer to involuntary restrictions on the use of resources on people who live around or within such areas.

b. Activities as listed in Table 1 and activities resulting in involuntary land acquisition and resettlement in linked activities, regardless of financing sources, that are (1) directly and significantly related to the RIDF subproject; (2) necessary to achieve the RIDF subproject objectives as set forth in the subproject documents and (3) carried out, or planned to be carried out, contemporaneously with the RIDF subproject. Linked subproject should be identified during the screening of the proposed subproject in the application package, so that the required instruments to be prepared by the LG, i.e. LARAP, will include the linked subprojects.

5.2.1 Principles and policies

The following principles and policies will be applied to land acquisition and resettlement to subprojects financed by PT SMI (also refers to PT SMI ESS 5 in Chapter 2.1):

Principle 1

Minimizing land acquisition and resettlement. Involuntary land acquisition and resettlement should be avoided, where feasible, or minimized, exploring all viable alternative subproject sites and designs.

Principle 2

Where it is not possible to avoid land acquisition and resettlement, activities of land acquisition and resettlement should be conceived and executed as sustainable development programs, providing sufficient investment resources to enable the PAPs to share the subproject benefits.

Principle 3

Assistance to the PAPs. If land acquisition and resettlement is unavoidable, persons displaced by a subproject should be supported in their efforts to gain access to adequate habitation. If the relocation affects their income sources and/or their livelihoods, displaced persons should be offered support for a transition period, based on a reasonable estimate of the time likely to be needed to restore their livelihood and standards of living.

Principle 4

The PAPs should be assisted in their efforts to improve their livelihoods and standards of living or at least to restore them, in real terms, to pre-land acquisition and resettlement levels or to levels prevailing prior to beginning of subproject implementation, whichever is higher.

Principle 5

The PAPs should be meaningfully consulted and should have opportunities to participate in planning and implementing the land acquisition and resettlement programs. Involuntary land acquisition and resettlement options and support shall be designed in consultation with the displaced persons. The consultations should involve a two-way transfer of information between the subproject owner and the displaced persons.

Principle 6

Legal resettlement sites. Occupants of state or government land who are displaced by a subproject should be provided with opportunities to resettle at locations that can be legally occupied

Principle 7

Public facilities and community infrastructure. In the case of group relocation, public facilities and community infrastructure affected by a subproject will be rebuilt at the resettlement sites if at new resettlement sites have not been provided similar public facilities and community infrastructure

Principle 8

The PAPs should be provided prompt compensation at replacement cost for loss of assets attributable to the subproject including land, housing, structure, crops, trees, etc. once the negotiation has been completed.

5.2.2 Requirements of involuntary land acquisition and resettlement

a. Screen subproject components during the early stages to identify involuntary resettlement impacts and risks through inventory of losses/detailed measurement surveys and socioeconomic surveys. The survey results will be utilized as inputs for resettlement planning and gender analysis.

b. Hold meaningful consultations with all entitled parties including those living in the subproject areas, communities that will host the displaced persons, concerned non-governmental organizations and civil society organizations. Inform all PAPs about their entitlements. Consultations process and decision making on the options and schemes of compensation and resettlement should be tailored to the special needs of these groups.

c. Involve all PAPs in resettlement planning. Pay particular attention to the needs of vulnerable groups such as those below the poverty line, the landless, the elderly, women and children, and Indigenous Peoples, and those without legal title to land, and ensure their participation in consultations.

d. The LARAP shall contain strategies to restore the livelihoods of PAPs to at least pre-project level to include (i) land-based resettlement strategies where possible; (ii) timely replacement of affected assets with assets of equal or higher value; (iii) compensation at full replacement cost for assets that cannot be restored; and (iv) provision of additional entitlement as legally possible such as through benefit sharing schemes where possible.

e. Compensate for the lost assets and provide assistance to the PAPs irrespective of their legal rights – the PAPs who have legal rights to land or are entitled for land and non-land assets legally as well as PAPs who lost the land that they occupy and have neither legal rights nor recognizable claims to such land.

f. Disclose the LARAP, including documentations of consultations, in a timely manner, at places accessible to all levels of the affected community and in languages that can be understood by all community groups, including Indigenous Peoples whose language may be different from the majority in the subproject areas.

g. Do not commence physical or economic displacement unless entitled parties are fully compensated and all other entitlements are provided.

h. Provide physically and economically displaced persons with the needed assistance, including: (i) in case of relocation, secured tenure to relocation land, better housing at resettlement sites with comparable access to employment and production opportunities, integration of resettled persons economically and socially with the host communities, and extension of subproject benefits to host communities; (ii) transitional support and development assistance such as land development, credit facilities, training or employment opportunities; and (iii) civic infrastructure and community services, as required.

i. PT SMI will not issue the notice to proceed for civil works unless the subproject implementing agency, through the land acquisition team, has satisfactorily completed the payment of compensation for affected assets/non-assets and additional cash assistance as per the entitlement matrix, and relocation of the PAPs, if any physical displacement is involved, in accordance with the approved LARAP. Income restoration measures must also be implemented, but not necessarily completed, as these may be ongoing activities.

j. Monitor and evaluate the resettlement process and its outcomes, its impact on the standards of living of the PAPs, and resettlement compliance. The reports should be disclosed in a timely manner and accessible to the PAPs.

k. For any unanticipated involuntary resettlement impact identified during subproject implementation or with other subprojects that may be identified later, compensation and other entitlements shall follow the policies set forth in this LARPF.

l. The SG should establish a grievance redress mechanisms (GRM) for PAPs affected by the subproject. LG can use the existing well-functioning GRM, in the case it is available.

Scope and application of LARPF according to subproject types

Table 17 below presents the scope and application in the three subproject types according to level of preparedness, during the loan cycle process.

Table 17: Scope and application of subproject type according to preparedness level

Application Type	Action to be taken
No mitigation instrument have been prepared	A terms of reference should be provided by PT SMI to the applicant considering: c. The plan templates corresponding to the subproject d. The policies/laws/regulations triggered by the subproject The SGs may be advised to obtain assistance from the Project Development Facility (PDF) in preparing the instruments, capacity building and improving the subproject design. As needed, LG will prepare a LARAP or Report on Land Acquisition/Tracer Study and disclose it prior to subproject appraisal.
Accompanied by a LARAP or similar instrument	At project stage type 2, PT SMI (ESSBCM Division) will review LARAP that has been available, identify gaps within the requirements specified in the LARPF, and will ask the SGs to supplement them to improve the documents or develop new ones with ToRs provided by PT SMI. The LARAP must be disclosed prior to subproject appraisal. At project stage type 3, PT SMI (ESSBCM Division) will carry out a due diligence to confirm that: (a) the subproject is in compliance with LARPF; (b) there are no reputational risks for PT SMI and the World Bank Group (WBG); and (c) there are no legacy issues or no pending legal

Application Type	Action to be taken
	disputes or liabilities. Based on the findings of such an assessment, PT SMI will require the SGs to implement remedial measures (CAP), as needed, or to mitigate potential reputational risks or to address legacy issues or liabilities.
Not accompanied by a LARAP or similar instrument	The SGs will prepare and disclose LARAP prior to subproject appraisal. At this stage, it may be suggested that the SGs collaborate with the PDF team to prepare the necessary documents. The SGs cannot proceed to subproject appraisal stage if the required documents/instruments are not available.
Accompanied by an IPP (including Social Assessment)	At project stage type 2, PT SMI (ESSBCM Division) will review IPP (including SA) that has been available, identify gaps within the requirements specified in the IPPF, and will ask the SGs to supplement them to improve the documents or develop new ones with ToRs provided by PT SMI. The IPP (including SA) document must be disclosed prior to subproject appraisal. At project stage type 3, PT SMI (ESSBCM Division) will carry out a due diligence to confirm that: (a) the subproject is in compliance with IPPF; (b) there are no reputational risks for PT SMI and the World Bank Group (WBG); and (c) there are no legacy issues or no pending legal disputes or liabilities. Based on the findings of such an assessment, PT SMI will require the SGs to implement remedial measures (CAP), as needed, or to mitigate potential reputational risks or to address

Application Type	Action to be taken
	legacy issues or liabilities.
Not accompanied by an IPP (including SA)	The SGs will prepare and disclose IPP (including SA) prior to subproject appraisal. At this stage, it may be suggested that the SGs collaborate with the PDF team to prepare the necessary documents. The SGs cannot proceed to subproject appraisal stage if the required documents/instruments are not available.

Instruments

Based on the identified possible subprojects it is likely that many projects in the PT SMI pipeline will require land acquisition, and thus, may require LARAP (see **Table 18**). Impact areas will only be known after the subproject is identified and submitted to the PT SMI by the SGs.

PT SMI will screen individual subprojects based on the site visits and project sitting, definition of subproject area for involuntary land acquisition/use and any unavoidable structure demolition, crop/asset destruction, livelihood displacement, restriction of access to natural resources that may be caused by the subproject construction following appropriate alternative analysis in the EA phase.

The SGs will prepare a full/abbreviated LARAP (refer to Annex 4 and 5 for contents of LARAP), if there is involuntary land acquisition and resettlement, but the subproject is not yet implemented. If the full/abbreviated LARAP has gap with the requirements specified in LARPF, the SGs need to provide a revision of LARAP or supplement to LARAP.

In the case that the SGs have implemented activities involving land acquisition prior to subproject appraisal (due diligence), or are incompliance on the implementation of the LARAP, they will have to prepare a Report on the Land Acquisition and/or Resettlement (or the so-called a Tracer Study) and a Corrective Action Plan for the incompliance. The Tracer Study and the Correction Action Plan will have to be reviewed by PT SMI prior to subproject appraisal and disclosed by the LG and PT SMI prior to subproject appraisal.

Table 18: Resettlement instruments

No.	Conditions	Resettlement Instruments
1	If there is involuntary land acquisition and resettlement, but not yet implemented	Full/abbreviated LARAP
2	If the full/abbreviated LARAP has gap with the requirements specified in LARPF	Revision of LARAP or supplement to LARAP
3	If the subproject leads to Access Restriction	A plan of action

No.	Conditions	Resettlement Instruments
4	If involuntary land acquisition and resettlement has been completed or partially completed	A Report on the Land Acquisition and/or Resettlement or a Tracer Study
5	If there is gap with the requirements in LARPF	Corrective Action Plan

5.2.3 Likely PAPs category, entitlement, eligibility and cut-off dates

Entitled parties/PAPs are those who stand to lose, as a consequence of the subproject, all or part of their physical and non-physical assets, including houses, productive and non-productive lands, resource such as forests, range lands, fishing areas, or important cultural sites, commercial properties, tenure, income-earning opportunities, social and cultural networks and activities. Such impacts may be permanent or temporary. The entitled parties / PAPs will be confirmed during the social-economic survey (including baseline study) and stakeholder consultations

Entitled parties/PAPs identified within the subproject areas that are eligible for compensation, in the form of cash, replacement land, replacement house, or resettlement, and other assistance can be described as (i) persons with formal legal rights to land they may lose in its entirety or in part, such as land rights holders, managing rights holders, and land tenure holders; (ii) persons who may lose the land they occupy or utilize in its entirety or in part, who have no formal legal rights to such land or resources, but have claims to such lands or resources such as customary claims, that are recognized or recognizable under national laws, i.e., *nadzi* for *waqaf* land, customary rights secured by landowners, IPs including MHA and parties occupying state land in good faith; and (iii) persons who may lose the land they occupy or utilize in its entirety or in part, who have neither formal legal rights nor recognized or recognizable claims to such land or resources, such as owners of buildings, plants or other objects related to land. For IPs including MHA, process of public consultations should follow FPIC principle to obtain consent on the right of property and avoid dispute in the future. The result of the public consultation is credible document as reference for land valuation.

The cut-off date for project entitlements refers to the date when the land acquisition team led by the land agency, posts the results of the detailed measurement survey, which include the list of entitled parties/PAPs and the affected assets in public places (e.g., village office, district office, and location of the land). Persons who occupy the area after this date will not be entitled to any compensation.

5.2.4 Land valuation and entitlement matrix

As required by Law 2/2012 and its implementing regulations, values of affected assets will be assessed by licensed appraisers which will be assigned by the provincial BPN in accordance with the national procurement regulations. The values defined by the licensed appraiser will be used as a basis for negotiation with the PAPs. Types and compensation level will be defined based on the results of the negotiation between the SG (or agency that need the land) and the land or property owners. Value assessment will be carried out on per affected land plot basis which include land, space above and beneath the land, buildings or structures, plants, and other things that relate to the affected land and/or other loss that can be valued (e.g. non-physical loss that can be equivalent with monetary value; loss of jobs or income earning sources, costs for moving, cost for change of profession, and value for remaining property). The remaining property that is no longer physically or, economically viable, can be also compensated if the owners prefer to do so.

Land valuation/appraisal by the licensed appraisers will be carried out based on the MAPPI[2] Standards as specified in the MAPPI Guidelines. Compensation comprises of market price plus transaction costs and other costs plus premium, in more details as follows:

a. Real property (Physical assets): land, buildings and facilities, plants, and other things related to the land acquired to replace them with a property of at least the same quality as that owned prior to the land acquisition;

b. Cost and loss (non-physical losses): Transaction costs, moving costs, loss of ongoing business (business interruption), other losses of special nature which are subjective and difficult to calculate;

c. Premium.

[2] Indonesian Society of Appraisers or ISA

An overview of the entitlement for the PAPs is presented in a matrix in **Table 19** below.

Table 19: Entitlement Matrix for the PAPs

No	Impact/ Loss Category	Entitled Person	Entitlement	Remarks
A.	**LAND LOSS**			
1	Loss of land, including agricultural and residential land	Those who have formal legal rights (certificate) or those whose claim over the land is recognized as a full title including persons occupying the state land in good faith.	▪ Cash compensation at replacement cost and reflective of fair market value at the time of payment of compensation; or land replacement with at least similar attributes to the acquired land in term of value, productivity, location, and titling. ▪ Financial assistance for the renewal of land ownership documents (certificate and land documents recognized as full title) for the residual area of the entitled persons' land ▪ If the remaining affected land is no longer viable for specific use and utilization, the entitled party can ask for compensation for their entire land at replacement cost (Law No. 2/2012 clause 35)	Applicable for Land Acquisition[3] Valuation of compensation conducted by a licensed independent property appraiser, and negotiation will be carried out by the Land Acquisition Implementing Team
2	Loss of Ulayat	Customary communities	▪ Land replacement will be provided with similar	The presence of Indigenous

[3] *Land acquisition refers to land acquisition activities by way of giving equitable and fair compensation for losses to the entitled parties who controls or possess the land acquisition objects. Included within this scope is the land acquisition on the river banks / riparian area legally owned by another party. See Law No. 2/2012, Article 1.*

No	Impact/ Loss Category	Entitled Person	Entitlement	Remarks
	land/customary land	(*Masyarakat Hukum adat*[4])	value or higher (in terms of value, productivity, location, and titling)	Peoples will be based on the results of the study, the SGs regulations, or the map on Indigenous Peoples.
3	Government/state enterprise land	National, Provincial or the SGs	▪ Cash Compensation at replacement cost; or ▪ Land replacement with similar value or higher (in terms of value, productivity, location, and titling)	Compensation will be provided for: i) Land owned/controlled by government with building used actively for governance; ii) land is owned/controlled by national and local state owned enterprises; iii) village land BPN transfers the acquired land owned by government / provincial government / regional government / village owned enterprise, to the agency requiring land within 60 working days

[4] *Customary or indigenous community is a community that is characterized by; i) the existence of group of people who are still bound by customary legal order as a whole community of an alliance with a particular customary law, who recognizes and implements the tradition in their daily life; ii) the existence of certain customary lands, which are the environment of the customary community and the area where they take their daily needs; and iii) the existence of common law regarding the maintenance of order, dominance, and applicable customary land use adhered by the members of the community. PP No. 71/2012, Article 22.*

No	Impact/ Loss Category	Entitled Person	Entitlement	Remarks
				after the district/ mayor issued location confirmation
4	Loss of Agricultural Land For Food Security	Ministry of Agriculture	Replacement of agricultural land For irrigated lands, the area of replacement land should be at least three times the area of affected irrigated land where the replacement land is non-irrigated; For developed tidal and non-tidal land or reclaimed swamp land the area of the replacement land should be at least twice the area of affected land where the replacement land is a raw land. For non-irrigated land, the area of replacement land should be equal to the land area of non- irrigated converted land.	Land acquisition procedure will follow Law No. 12/2012 and the provisions of agricultural land replacement will follow Law No. 41/2009[5]
5	Loss of Forest Land	Ministry of Forestry / Forestry Agency	Forestry land: compensation[6] will be guided under the law and regulations related to land use permit issued by Ministry of Forestry.	Land acquisition procedure will follow the Law No. 12/2012 and consider relevant regulations on

[5] Provisions of the land acquisition in agricultural land for sustainable food security: i) at least three times the land area for converted irrigated land one time for not irrigated converted land. ii) at least twice the land area in case of a converted tidal and non-tidal reclaimed swampland iii) at least one times the land area in a not irrigated converted land. See Law No. 41/ 2009.

[6] *Compensation for forestland include: i) Payment for forestry boundaries; ii) payment for affected timbers; iii) Commitment for reclamation and forestation; iv) Investment cost; v) land replacement or PNBP. Provisions on land acquisition in the agricultural land for sustainable food protection: i) at least three times the land area in terms of converted irrigated land (productive land); ii) at least two times the land area in terms of reclamation of land converted to tidal marsh and also which is not depending on tide; iii) at least once in terms of land area if converted land is not irrigated.*

No	Impact/ Loss Category	Entitled Person	Entitlement	Remarks
				forestry.
B. LOSS OF CROPS AND TREES				
1.	Loss of Crops and Trees:	Owners, regardless of land tenure status (with certificate or recognizable rights, informal dwellers, occupants).	▪ Annual crops: cash compensation will be paid based on prevailing market rates. ▪ Perennial crops: compensation at replacement cost taking into account their productivity and age ▪ Timbers/trees: compensation at current market rate based on age, type of trees and diameter of trunk at breast height	Valuation of non-commercial crops will adopt market approach with standard reference prices issued by the SGs. Valuation of non-productive plants will use cost approach; 30 to 60 days advance notice will be issued to owners before land clearing.
C. LOSS OF STRUCTURE				
1	Loss of main structures (houses, offices, independen t shops) and secondary structures (fences, driveways, extended eaves, sheds, etc.)	Owners of the affected structure, regardless of tenure	▪ Compensation at full replacement cost that reflects prevailing market prices of materials and cost of labour for dismantling, transferring and rebuilding at the time of compensation payment. No depreciation should be applied **or**; ▪ Option of Relocation with comparable access to employment and production. ▪ For partially affected structures, the cost of repairing the residual unaffected portion of the structure in addition to the compensation at replacement cost for the	Applicable for Land Acquisition and Clearing Valuation is determined by an independent appraiser Depreciation applies only for the physical condition of structures/ buildings. There is no depreciation for age of the building. A "premium" value will be provided by the certified independent appraisers as compensation for intangible value

No	Impact/ Loss Category	Entitled Person	Entitlement	Remarks
			affected portion of the same	of the loss assets due to for instance, emotional and cultural attachment to the loss of assets (solatium). Six months advance notice is given to the entitled party prior to the date on which they must demolish their entirely affected houses or shops. If more than 50% of the main structure is affected, the entire structure will be replaced at full replacement cost. If less than 50% of the main structure is affected, but would endanger the stability of the residual area of the main structure, that is, structurally unstable, then the project will compensate at full replacement cost of equivalent structures.

No	Impact/ Loss Category	Entitled Person	Entitlement	Remarks
				In case of delay in the construction of relocation sites, cash assistance equivalent to temporary house rental rates prevailing in the locality should be provided to affected households (AHs) until the completion of resettlement in a new place. The AH may opt to find a place to rent or may seek the assistance of the IA. 3 months - 1 year advance notice, before the date on which the owner of affected structure must move
		Relocated persons regardless of land tenure	Cash allowance for moving/transport to carry AHs belongings to a new place.	3 months - 1 year advance notice, before the date on which the affected AHs must move The determination of the required amount for the provision of transportation assistance will be incorporated into the TOR of Independent Agency that will

No	Impact/ Loss Category	Entitled Person	Entitlement	Remarks
				conduct valuation of affected assets
		Tenant house / shop regardless of tenure	▪ Cash assistance equivalent of 6 months rental cost based on the prevailing rental fee in the locality	3 months prior notice before the date on which the affected tenants must move.
2	Infrastructure and public facilities / objects attached to land	Government or State Enterprises / communal property and assets (e.g. schools, mosques, village office power poles, etc.)	▪ Rebuilding the facility or provide cash compensation based on the agreement with the affected parties	Valuation of affected assets will be performed by an independent appraiser
3	Temporary or permanent impacts due to construction activities	For those who have formal legal rights (certificate) or those whose claim on land is recognized as a full right	▪ For lease payments of the affected land by the contractor based on the applicable rental fees and agreements with landowners. ▪ For temporary impact on productive land, the AH may choose: ▪ (1) costs of the rental valued to be not less than the net income that will be generated from affected land; or (2) provision of free water connection to the household. ▪ Compensation for non-land assets acquired (trees / plants, structure) permanently affected will be compensated at replacement cost	30-60 days prior notice given to the owner of the land before it is used temporarily by contractors. This provision should be stipulated in the contract / agreement with civil works contractors

No	Impact/ Loss Category	Entitled Person	Entitlement	Remarks
			▪ Land will be restored to pre-project conditions or even better after the construction is completed	
		Those who do not have legal rights and entitlements that can be recognized as full ownership	There is no land rental costs during the period of impact Land will be restored as it was before the project, or even better.	
D. Other Appraisable Loss				
1.	Loss of income, venture and job	Business owner and employees regardless of tenure	**The loss of a permanent business (restaurant, barber) or a termination due to closure of business premises:** Replace the loss in cash based on the loss of business investment (capital, other production mode) including loss of revenue of at least 6 months	**Applicable for Land Acquisition and Land Clearing:**
			Temporary Loss of business: Compensations in cash based on the loss of expected revenue that can be generated through continued use of affected assets	Cost for the relocation of Informal Settlers as a result of land acquisition will be derive from Government Social Programs.
			Permanent job loss: Damages in cash equivalent to the amount of lost job income multiplied at least by 6 months, or **Change of profession**: Cash compensation based on the costs required to change the profession at par with	The compensation for loss jobs will be based on the Payment slip to be provided by PAP. In case where PAPs cannot present payment slip, then

No	Impact/ Loss Category	Entitled Person	Entitlement	Remarks
			previous professions based on an assessment by a licensed appraiser	compensation for lost job will be based on the prevailing minimum wage. For land clearance, compensation can be derive from social programs
			Temporary loss jobs: Compensation equivalent to the income lost during the disruption.	The compensation for temporary lost jobs will be based on the Payment slip to be provided by PAP. In case where PAPs cannot present payment slip, then compensation for lost job will be based on the prevailing minimum wage. For land clearance, compensation can be covered from social programs
2	Loss of the resource base (high risk of impoverish ment)	Entitled parties who've lost 10% or more of total assets or earning revenue sources; Entitled Party,	Participate in Income Restoration Program (IRP), where priority shall be for subproject related employment, wherever the beneficiary qualifies.	**Applicable for land acquisition and clearing** IRP includes agricultural support, provision

No	Impact/ Loss Category	Entitled Person	Entitlement	Remarks
		poor and vulnerable[7], regardless of the severity of the impact		of training, job placement, additional financial grants and micro loans for equipment and buildings, as well as organizational support / logistics to establish alternative income generating activities for affected populations IRP could be integrated with the SGs' social programs where the project is located

Vulnerable people (women, elderly, difable, and the very poor) should be given a special attention, depending on the situation, through a focus group discussion to provide them opportunities to voice their needs and aspirations during the inventory of the PAPs, social assessment and preparation and implementation of LARAP. LARAP should accommodate the special needs and aspirations of the vulnerable people.

5.2.5 Screening and defining instruments

PT SMI will screen the applicability of LARAP based on potential intensity of land acquisition and/or resettlement due to the subproject, and it is established during the Social and Environmental Assessment process (see **Table 12 above and 20**).

[7] *These are distinct groups of people who might suffer more or face the risk of being further marginalized due to the project and specifically include: i) households that are headed by women, ii) household heads with disabilities, and iii) elderly household heads*

Table 20: Matrix for identifying resettlement instrument

Trigger	Safeguard Instrument
When land acquisition for the project affects more than 200 people, takes more than 10% of household productive assets and/or involves physical relocation	Comprehensive/Full LARAP
When land acquisition for the project affects less than 200 people, takes less than 10% of household productive assets and/or does not involve physical relocation	An abbreviated LARAP
The subproject neither requires land acquisition nor resettlement	N/A

Note: Also refer to Table 12

5.3 Preparation, review, approval and disclosure of LARAP

Based on the screening carried out by PT SMI (refer to section) on the potential involuntary land acquisition and/or resettlement, the SGs are notified of the need to prepare a Full LARAP or an abbreviated LARAP, or a Report on the Land Acquisition (Tracer Study) or to prepare remedial action plan.

- For type 1 subproject, PT SMI will provide the ToR to the SGs for preparing the LARAP in reference to the requirements specified in this LARPF. The SGs will have to submit the LARAP to PT SMI, along with an EIA or EMP as applicable, for review prior to subproject appraisal.
- In the case for Type 2 and 3 subproject (according to level of preparedness, refer to Chapter 1) where a LARAP has been available, prior to the appraisal stage, PT SMI will assess the plan for its adequacy. The social safeguards team of ESSBCM of PT SMI will carry out a due diligence to see whether the potential adverse impacts of the subprojects have been addressed in a manner consistent with the LARPF in this ESMF. Should there be inconsistency between the principles and requirements in the LARAP and those of this LARPF, PT SMI will request the SGs to prepare a remedial/corrective action plan to address such

inconsistencies, and submit it to PT SMI for review prior to subproject appraisal.

- In the case that LG has acquired land prior to the submission of loan application package, PT SMI will require such SG to prepare a Report on the Land Acquisition (or a Tracer Study) and if based on the review of the ESSBCM that there gaps in principles and requirements specified in this LARPF, PT SMI will require the SG to prepare a Remedial Action Plan. The Remedial Action Plan should be reviewed by PT SMI and disclosed prior to subproject appraisal.
- The requirements to implement mitigation measures specified in the approved LARAP or in the remedial/corrective action plan are then translated into covenants in the loan agreement. The loan covenant shall also include among others, requirements for the SG to include actions that need to be implemented during construction by the contractors. The loan signing as well as loan disbursements are linked to compliance with public disclosure and implementation of the approved LARAP. Suggested contents of a full LARAP, abbreviated LARAP and a Tracer Study are presented in Annex 4, 5, and 6A, respectively.
- A Remedial Action Plan should at least cover the issues that need to be addressed, detail actions to address such issues, clear indicators to be achieved by the actions, time frame to achieve such output and outcome indicators linked with subproject disbursement or physical progress, budget required, responsible parties for each action, monitoring and reporting requirements, and supervision arrangements by PT SMI.

Following disclosure of all relevant information on the subproject plan, the SGs will consult with and facilitate the informed participation of affected persons and communities, including host communities, this process should be conducted as part of the stakeholder engagement as described in ESS 1. In relation to the resettlement and livelihood restoration processes, the SGs will apply a decision-making process that includes options and alternatives, where applicable. The SGs will disclose information about the subproject and land acquisition process to the PAPs and the village leader and explain the proposal, potential impacts and legal rights of the PAPs under this framework.

The PAPs should be provided with opportunities to participate in planning and implementation of any activity that will affect them - adversely or positively. All PAPs should be informed of the potential impacts and proposed mitigation measures, including compensation/assistance schemes.

Subproject disclosure will continue during the implementation, monitoring, and evaluation of compensation payment, livelihood restoration activities and resettlement to achieve outcomes that are consistent with the objectives of this ESMF.

The SGs, particularly local agencies proposing subproject for getting financing from PT SMI through RIDF is responsible to prepare and implement the LARAP. The RIDF-PDF could provide support and assistance for the SGs in preparing the LARAP. LARAP preparation should take into account the land acquisition requirements and documentation as specified in Law No. 2/2012 and its implementing regulations. PT SMI particularly the ESSBCM will review and approve the LARAP prior to appraisal. The draft LARAP can be updated once the DED is being prepared, as subproject exact footprint on the ground may be adjusted for technical reasons and/or to avoid as much as possible social impacts. The Draft LARAP should be disclosed in the SG's website, public places nearby the PAPs, and also in the PT SMI's website prior to subproject appraisal.

(Refer to Section 5.6 about Disclosure).

5.4 Organizational Arrangements

Institutions involved in the land acquisition process

As specified in Law No.2/2012 and its implementation rules, there are some important institutions which have authority in the process of land acquisition and resettlement, which are:

- **District/ City Government**

  The District/Citygovernment as the agency requiring land prepare the land acquisition planning documents, conduct the land acquisition process which includes; i) notice of the development plan; ii) initial location identification of the development plan; and iii) public consultation on development plan; iv) announcement of the location determination for project development by the Regent/Mayor. If there are objections, the governor/ regent / mayor also will establish a special team to assess team. The LARAP will take into account the information available in the land acquisition planning documents, and covers organizational arrangements for preparing and implementing it, to ensure that implementation procedures are clear; that responsibility is clearly designated for provision of all forms of assistance and that adequate coordination among all agencies in the LARAP implementation is assured.

  The LARAP must include a detailed implementation schedule, linking the subproject construction time table to land acquisition-related activities. In-cash or in-kind compensation should be given to the PAPs prior to subproject construction. The LARAP should also include the estimated budget and provision for ensuring timely budget availability should be included.

The District/City Governments or SGs will be responsible for allocating budget needed as specified in the approved LARAP for land acquisition, assistance and livelihood restorations.

- **Land Agency / BPN**

  Land Agency BPN establishes a land acquisition team and implements land acquisition with primary activities including: i) inventory and identification of control, ownership, use, and land use; ii) compensation assessment to be performed by an independent appraiser; iii) deliberations of compensation determination; iv) delivery of compensation; and v) delivery of the acquired land to the agency requiring land. Upon delivery of the acquired land to institutions requiring land, the civil works/ construction can commence. Land acquisition located in a district/ city, the land acquisition implementation can be assigned to the land office at district/ city level.

- **Independent Appraisers of MAPPI**

  Assigned by the provincial BPN, the Licensed Independent Appraisers will be responsible to appraise the value of the affected assets as regulated by Law 2/2012. The roles of the Independent Appraisers are explained in Section 5.2.5.

- **PT SMI**

  PT SMI will ensure that the LARAP is prepared in consistent with this ESMF in general and with this LARPF in particular, and monitor the implementation of the approved LARAP ensuring that it is consistently implemented. As mentioned earlier, PT SMI will review and approve the Draft LARAP prepared and submitted by the SGs seeking RIDF financing prior to the subproject appraisal during the loan processing.

5.5 Grievance Redress Mechanisms

Process, procedures, requirements as well as time for complaints to be solved during the land acquisition process will follow the Law 2/2012 and its implementing regulations (including amendments). In addition, the SGs have to use the existing complaint handling system, if any, or establish a new one to receive and respond to complaints. In principle, objection to any aspect of the subproject and land acquisition will be addressed through consultations to reach an agreement and settlement, and sought to be resolved as much as possible at sub-project level. Relevant institutions, such as the district/city, sub districts and villages governments will be involved in addressing the complaints. When the grievance cannot be addressed, it will be resolved through litigation procedures as set forth in Law No. 2/2012 and Presidential regulation No.71/2012. There is no fee charged to the complainant. Grievance acceptance and the follow-up mechanism will ensure cultural and gender sensitivities of the entitled parties. Complaints and their follow-up should be recorded and documented and included in the quarterly implementation progress report prepared by the SGs and submitted to PT SMI.

The LARAP should include a clear grievance redress mechanisms for the PAPs. It should specify the contact or venue to file complaints that are widely disseminated, service standards to respond to complaints, and documentation.

5.6 Public Consultations and Disclosures

Stakeholder consultation for the draft RPF has been done together with the draft ESMF's consultation as explained in Chapter 8 and Annex 8 of this ESMF.

The SGs will disclose information about the subproject and land acquisition process to the PAPs and the village leader and explain the proposal, potential impacts and legal rights of the PAPs under this framework.

The PAPs should be provided with opportunities to participate in planning and implementation of any activity that will affect them - adversely or positively. All PAPs should be informed of the potential impacts and proposed mitigation measures, including compensation/assistance schemes.

The SGs will ensure that women will be involved in the consultation process. In case of under-representation or where needed, separate meetings with marginalized households, including women, will be organized to discuss their specific concerns. Consultations will be undertaken at venues and times that are suitable for women and will not disadvantage them. Where it is inconvenient for women to attend meetings, these women will be consulted by visiting their homes.

If a LARAP is required, a brochure or project information booklet containing relevant information such as the entitlement matrix, grievance procedures, and time frame of payments will be prepared and distributed to the entitled parties at each subproject site involving physical and other losses related to livelihood, etc. The LARAP will be made available in English and Bahasa Indonesia. Notices about meetings and other subproject activities/updates will be made accessible at public locations, such as the village or sub-districts office. Village leaders and entitled households will be provided with a summary LARAP or brochure prepared in Bahasa Indonesia. The document will also be published on the LG and PT SMI's websites.

Refer to previous sections on disclosures.

5.7 Financing LARAP preparation and implementation

The SG will have to finance the preparation and implementation of LARAP as part of the subproject costs. If any activities identified in the LARAP have to be implemented by the contractor during construction, as relevant, the cost for such activities will have to be included in the construction package. List of such activities should be specified in the bidding document.

If the SG is eligible for PDF assistance, the costs for preparing a LARAP may be provided by the PDF facility. Otherwise, SG has to cover the costs for LARAP preparation by its APBD. Cost to implement LARAP will at least cover: compensation, assistance, livelihood restoration, development of relocation site, administration and management, etc. as relevant. SG can borrow from PT SMI for LARAP implementation as part of the borrowing package for infrastructure, except for purchasing land and other assets affected by the subproject.

5.8 Monitoring and Reporting

The SGs will prepare a Quarterly Progress Report which includes the implementation progress of the approved LARAP or Corrective Action Plan (as relevant). This report will include all records and documentation of land acquisition and resettlement activities as specified in the LARAP. In addition, the report will highlight the outstanding issues of the LARAP implementation, the reasons and the corrective measures that will be taken to address the outstanding issues. PT SMI will monitor the SGs in implementing all activities specified in the approved LARAP, based on the Quarterly Progress Report submitted by the SGs. Monitoring indicators address the specific contents of the LARAP activities and entitlements with key parameters as follows:

a. Payment of compensation

b. Completion of land acquisition activities for any component should be completed prior to issue notice to proceed for civil works

c. Entitlements of subproject benefit

d. Public consultation and awareness of compensation policy

e. Entitled parties should be monitored regarding restoration of productive activities

f. Level of satisfaction of entitled parties with the implementation of activities specified in the LARAP. The operation for grievance redress mechanism, and the speed of grievance redress, type and intensity of complaints and follow-up will be monitored

g. Throughout the implementation process, the trends of living standards will be observed and checked. Any potential problems should be reported and resolved.

PT SMI will review the monitoring results based on the above in reference to the loan covenants, and discuss with the SG if a sanction for incompliance will be activated. PT SMI and the SGs should agree on how to proceed with the subproject financing after compliance to the loan covenant is in place.

5.9 Other potential schemes of land acquisition

This chapter provides guidance for cases where the eminent domain is not applicable and land is to be acquired either through donation from the land-owner or mutual negotiation (willing-buyer willing-seller) between the land owners and the SG. This guidance specifies the requirements which aim to ensure that the land-owners are not exploited under the premise of voluntary land donation and land owners have the rights to refuse donate their land or to sell their land in the case of a willing-buyer willing-seller and the government will not use its eminent domain power to acquire the land. Voluntary land donation and willing-buyer willing-seller activities have to be recorded and well documented by theSLG and these will be part of the application package for subproject appraisal.

5.9.1 Voluntary land donation

Voluntary land donation will be accepted if the following indicators are met:

a. The infrastructure, to be set up on the donated land, must not be site specific

b. The impact of voluntary donations are marginal (land donated not more than 10% of the total land assets owned by household owner);

c. Impacts do not result in displacement of households or cause loss of household’s incomes and livelihood;

d. Households making voluntary donations are direct beneficiaries of the project;

e. Donated land is free from any dispute on ownership or any other encumbrances;

f. Consultations with entitled parties is conducted in transparent manner with no coercion;

g. Land transactions are supported by transfer of titles;

h. Proper documentation of consultation meetings, grievances and actions taken to address such grievances is well documented

i. Voluntary land donation will be accepted if the following indicators are met:

j. The infrastructure, to be set up on the donated land, must not be site specific

k. The impact of voluntary donations are marginal (land donated not more than 10% of the total land assets owned by household owner);

l. Impacts do not result in displacement of households or cause loss of household’s incomes and livelihood;

m. Households making voluntary donations are direct beneficiaries of the project;

n. Donated land is free from any dispute on ownership or any other encumbrances;

o. Consultations with entitled parties is conducted in transparent manner with no coercion;

p. Land transactions are supported by transfer of titles;

q. Proper documentation of consultation meetings, grievances and actions taken to address such grievances is well documented

The process and results of Voluntary Land Donation will have to be documented and submitted by the SGs to PT SMI as part of the sub-loan package.

5.9.2 Willing-buyer willing-seller scheme

As per the provision under the Presidential Regulation No. 40/ 2014, acquisition of land less than 5 hectares will be undertaken through transaction, exchange, or other means acceptable by land owners and parties that need the land (in this case the SGs). The SGs will apply the following principles in undertaking land acquisition through willing-buyer willing-seller scheme:

a. Compensation is paid at replacement value which takes into account the prevalent market prices as determined by a Licenced Independent Appraiser(s). No administrative cost will be deducted and tax obligations will be covered by the negotiated transaction;

b. All negotiations with the landowners and users, if any, will be carried out in an accessible location, in an open and consultative manner without any coercion and with sufficient time for consideration of offers;

c. The documents pertaining to the land acquisition such as map, land registries, sales written records, consultation records, decision records, law and policies for the negotiations and development plans are to be disclosed to the entitled parties involved in the negotiated land acquisition or settlement;

d. Adequate and fair price for land and/or other assets will be offered. If negotiations fail, an alternative way will be sought and the process begins again, which will follow the Law 2/2012 requirements;

e. The negotiated amount will be paid immediately to landowners after all necessary documents required for the land acquisition processes have been completed by land owners;

f. Negotiation and other consultation proceedings will be documented and the land sale and purchase agreement will be signed by the negotiating parties in the presence of a land deed official (notary);

g. Grievance mechanism will be established by the SG (or using the existing one) to receive and facilitate resolution of the entitled parties concerns; and

h. PT SMI will not award a civil works contract until (a) payment has been fully provided to the entitled parties and rehabilitation measures are implemented if any; (b) already-compensated entitled parties have cleared the area in a timely manner; and (c) the area is free from any encumbrances.

The willing-buyer-willing seller process and results will have to be documented and shared by the SGs with PT SMI as part of the sub-loan application package.

6. Indigenous Peoples Planning Framework (IPPF)

6.1 Objective and Indigenous Peoples

The main objective of this IPPF is to help ensure that subprojects are designed and implemented in a way that fosters full respect for IPs' identity, dignity, human rights, livelihood systems, and cultural uniqueness as defined by the IPs themselves to enable them to (i) receive culturally appropriate social and economic benefits; (ii) do not suffer adverse impacts as a result of the project; and (iii) can participate actively in the project. This IPPF safeguards the rights of IPs to participate and equitably receive culturally appropriate benefits from the subproject. An IPP will be prepared if a project affect (positive or adversely) IPs communities.

There is no universally accepted definition of IPs. IPs may refer to in different countries by such terms as "Indigenous ethnic minorities", "aboriginals", "hill tribes", "minority nationalities", "scheduled tribes", or "tribal groups". In this Principle, the term "Indigenous Peoples" is used in a generic sense to refer to a distinct social and cultural group possessing the following characteristics in varying degrees:

a. self-identification as members of a distinct indigenous cultural group and recognition of this identity by others;
b. collective attachment to geographically distinct habitats or ancestral territories in the project area and to the natural resources in these habitats and territories;
c. customary cultural, economic, social, or political institutions that are separate from those of the dominant society and culture;
d. an indigenous language, often different from the official language of the country or region.

The term "Indigenous Peoples" is often associated with "*Masyarakat Hukum Adat"* (or *MHA*--Customary Law Communities) which is a common terminology used in Indonesian Laws and Regulations to describe groups of people with similar characteristics as those of IPs specified above. Ascertaining whether a particular group is considered as Indigenous Peoples for the purpose of this Principle may require technical judgement.

6.2 General requirements

6.2.1 Avoidance of adverse impacts

The SGs will identify through a process of social and environmental assessment all communities of Indigenous Peoples who may be affected by the project within the subproject's area of influence, as well as the nature and degree of the expected social, cultural (including cultural heritage), and environmental impacts on them, and avoid adverse impacts wherever feasible.

When avoidance is not feasible, the SGs will minimize, mitigate or compensate for these impacts in a culturally appropriate manner. The SGs' proposed action will be developed with the informed participation of affected IPs and contained in a time-bound plan, such as an IPP, or a broader community development plan.

6.2.2 Information disclosure, consultation and informed participation

The SGs will establish an ongoing relationship with the affected communities of IPs from as early as possible in the subproject planning and throughout the life of the subproject. In subprojects where IPs are presence and affected, the consultation process will ensure their free, prior, and informed consultation (FPIC) to obtain broad community support for the proposed subproject and facilitate their informed participation on matters that affect them directly, such as proposed mitigation measures, the sharing of development benefits and opportunities, and implementation issues. The process of community engagement will be culturally appropriate and commensurate with the risks and potential impacts to the IPs. In particular, the process will include the following steps:

- Involve IPs' representative bodies (for example, councils of elders or village councils, among others)
- Be inclusive of both women and men and of various age groups in a culturally appropriate manner
- Provide sufficient time for Indigenous Peoples' collective decision-making processes
- Facilitate the Indigenous Peoples' expression of their views, concerns, and proposals in the language of their choice, without external manipulation, interference, or coercion, and without intimidation
- Ensure that the grievance mechanism established for the project, is culturally appropriate and accessible for IPs.

PT SMI (ESSBCM Division of the Risk Management Directorate) will ensure that the SGs makes the IPP available to the affected IP communities in an appropriate form, manner, and language prior to subproject appraisal as specified in the POM.

6.3 Screening and identification of IPs presence

Once the application package (including the ESSC) from the SGs is received, PT SMI carries out a screening to determine whether IPs or *MHA* are present in, or have collective attachment to, the subproject area. Initial screening will be done by using the EGiMap tools (World Bank IP Screening Study 2010, details in the POM), and by seeking technical judgement of qualified social scientists with expertise on the social and cultural groups in the subproject area. PT SMI also consults with the IPs communities concerned and the LG. Further confirmation and verification of the IPs or MHA presence will be done once the subproject footprint and area of influence are defined, by visiting the area, gather information from the village, sub-district, and SG, NGOs and universities who have worked with or have the interest in protecting IPs communities.

6.4 Social assessment (SA)

The presence of IPs communities in the subproject sites requires the LG to conduct a social assessment to evaluate the subproject's potential positive and adverse effects on the IPs, and to examine subproject alternatives where adverse effects may be significant. A social assessment is required and this commences with a review of the legal and institutional framework that defines IPs involvement within the subproject context. The assessment shall generate the necessary baseline information on the demographic, social, cultural, and political characteristics of the affected IP communities as well as the land and territories that they have traditionally owned or customarily used or occupied and the natural resources on which they depend. The social assessment shall utilize Participatory Rural Appraisal tools such as Participatory mapping, historical trends, oral testimonies, etc. with a free, prior, informed consultations for stakeholder identification and analysis to craft culturally appropriate and gender-sensitive processes for meaningful consultation with IP communities at each stage of subproject preparation and implementation. Methods for data collection shall observe culturally appropriate norms.

Potential adverse and positive effects of the subproject shall be identified through free, prior, informed consultation with the affected IP communities. In assessing these impacts, the IPs will be engaged in a Participatory Mapping activity through a free, prior, informed consultation to identify subproject location and potential impacts. The results of the activity will be presented in a plenary where participants can openly express his/her opinions on the pros and cons of the subject matter and generate consensus on possible mitigating measures that must be adopted by the subproject. Gender-sensitive analysis of IPs vulnerability and risks brought about by the subproject in comparison to other groups (IPs and non-IPs) will be made a key focus of the assessment. This entails the involvement of wives, unmarried women and children in identifying potential risks and benefits associated with the project. In some IP communities, this sector is often marginalized and their roles are limited to household chores. In effect, the assessment shall in the end identify and recommend the necessary measures to avoid adverse effects and enhancement or maximization of positive impacts. If avoidance is not possible, mitigation activities or alternatives will have to be mutually developed with IP communities through meaningful free, prior, informed consultation, to ensure that the IPs receive culturally appropriate benefits under the project. Suggested outline of Social Assessment is presented in Annex 5B.

When avoidance is not feasible, the SGs will minimize, mitigate or compensate for these impacts in a culturally appropriate manner and based on the Social Assessment prepare an IPP. The SGs' proposed action will be developed with the free, prior, informed consultations with the affected IPs and contained in a time-bound plan IPP, or a broader community development plan (see **Table 21**).

Table 21: Matrix for identifying applicable safeguards instrument for IPs

Trigger	Safeguard instrument
Indigenous Peoples (IPs) may form a portion of the beneficiaries/persons affected	An Indigenous Peoples Plan based on a Social Assessment
The subproject does not impact the Indigenous Peoples or the IPs is the sole beneficiaries of a subproject	NA or IPs needs and concerns are incorporated in the subproject design; subproject design include elements of IPP and a separate IPP is not required

6.5 Development benefits

The SGs will seek to identify, through the process of free, prior, and informed consultation with and the informed participation of the affected communities of IPs, opportunities for culturally appropriate development benefits. Such opportunities should be commensurate with the degree of subproject impacts, with the aim of improving their standard of living and livelihoods in a culturally appropriate manner, and to fostering the long-term sustainability of the natural resource on which they depend.

6.6 Special requirements

Because IP communities may be particularly vulnerable to the subproject circumstances described below, the following requirements will also apply, in the circumstances indicated, in addition to the general requirements above. When any of these Special Requirements apply, the SGs will retain qualified and experienced external experts to assist it in conducting the Assessment.

6.6.1 Impacts on traditional or customary lands under use

The IPs are often closely tied to their traditional or customary lands and natural resources on these lands. While these lands may not be under legal ownership pursuant to national law, use of these lands, including seasonal or cyclical use, by communities of Indigenous Peoples for their livelihoods, or cultural, ceremonial, or spiritual purposes that define their identity and community, can often be substantiated and documented. The SGs will follow when traditional or customary lands are under use in a manner described in this paragraph.

If the SGs propose to locate the subproject on, or commercially develop natural resources located within, traditional or customary lands under use, and adverse impacts can be expected on the livelihoods, or cultural, ceremonial, or spiritual use that define the identity and community of the IPs, the SGs will respect their use by taking the following steps:

- The SGs will document its efforts to avoid or at least minimize the size of land proposed for the project
- The IPs land use will be documented by experts in collaboration with the affected communities of IPs without prejudicing any IPs land claim
- The affected communities of IPs will be informed of their rights with respect to these lands under national laws, including any national law recognizing customary rights or use
- The SGs will offer affected communities of IPs compensation and undertake due process available to those with full legal title to land in the case of commercial development of their land under national laws, together with culturally appropriate development opportunities; land-based compensation or compensation-in-kind will be offered in lieu of cash compensation where feasible
- The SGs will enter into good faith negotiation with the affected communities of IPs, and document their informed participation and the successful outcome of the negotiation

6.6.2 Relocation of Indigenous Peoples from traditional or customary lands

The SGs will consider feasible alternative subproject designs to avoid the relocation of IPs from their communally held traditional or customary lands under use. If such relocation is unavoidable, the SGs will not proceed with the subproject unless it enters into a good faith negotiation with the affected communities of IPs, and documents their informed participation and the successful outcome of the negotiation. The relocation will not be carried out without obtaining broad support from the affected indigenous community as part of the FPIC process. A LARAP will be prepared in accordance with the requirements specified in the LARPF, and will be compatible with the IPs' cultural preferences. Where feasible, the SG should provide land-based resettlement strategies for the relocated IPs. Relocated IPs should be able to return to their traditional or customary lands, should the reason for their relocation cease to exist.

6.6.3 Cultural Resources

Where a subproject proposes to use the cultural resources, knowledge, innovations, or practices of IPs for commercial purposes, the SGs will inform the IPs of: (i) their rights under national law; (ii) the scope and nature of the proposed commercial development; and (iii) the potential consequences of such development. The SGs will not proceed with such commercialization unless it: (i) enters into a good faith negotiation with the affected communities of IPs; (ii) documents their informed participation and the successful outcome of the negotiation; and (iii) provides for fair and equitable sharing of benefits from commercialization of such knowledge, innovation, or practice, consistent with their customs and traditions.

6.7 Review, Approval and Implementation of the IPP

Based on the screening carried out by PT SMI (refer to section 6.3) on the potential presence of the IP communities in, or have collective attachment to, the subproject site and area of influence, the SGs are notified of the need to prepare an IPP or to improve the IPP or to prepare remedial action plan.

- For type 1 subproject, PT SMI will provide the ToR to the SGs for preparing the IPP in reference to the requirements specified in this IPPF. The SGs will have to submit the IPP to PT SMI, along with an EIA or EMP as applicable, for approval prior to subproject appraisal.
- In the case for Type 2 and 3 subproject (according to level of preparedness, refer to Chapter 1) where IPP (in the case that IP communities are affected by a subproject) has been available, at the appraisal stage, PT SMI will assess the plan for its adequacy. The social safeguards team of ESSBCM of PT SMI will carry out a due

diligence to see whether the potential adverse impacts of the subprojects have been addressed in a manner consistent with the IPPF in this ESMF. Should there be inconsistency between the handling of IP communities specified in the IPP and the IPPF principle, PT SMI will request the SGs to prepare a remedial/corrective action plan to address such inconsistencies, and submit it to PT SMI for review prior to subproject appraisal.

The requirements to implement mitigation measures specified in the IPP or in the remedial/corrective action plan are then translated into covenants in the loan agreement. The loan covenant shall also include among others, requirements for the SG to include measures that need to be implemented during construction by the contractors. The loan signing as well as loan disbursements are linked to compliance with public disclosure and implementation of the IPP. Suggested outline of Social Assessment and content of IPP is presented in Annex 6.

6.8 Monitoring and Reporting

The SGs will monitor the implementation progress of the approved IPP (or Corrective Action Plan, as applicable) and prepare a quarterly report which explain the progress of the implementation of the approved IPP, and evaluate whether the intended activities have reached the objectives with clear performance indicators and timeframe as specified in the IPP. This Quarterly Report will also report the implementation of the activities that need to be done by the contractors during the construction period. The Quarterly Report will be submitted to PT SMI.

6.9 Grievance Redress Mechanisms and Disclosure of IPP

The SGs will have to develop or use the existing complaint handling system that allow the public and the IP communities to file complaints, raise issues and/or convey their aspirations on the subprojects. The quarterly report shall include the records on the complaints received and followed-up, and remaining unsolved issues.

The SA and IPP require wide dissemination among the affected IPs' community using culturally appropriate methods and locations. The SGs will make the SA Report and draft IPP available to the affected IP communities in appropriate form, manner, and language. PT SMI will also disclose the SA and the IPP in its website prior to subproject appraisal.

7. Grievance Redress Mechanisms

PT SMI promotes transparency and accountability for sustainable infrastructure development in the country, not only from the environmental and social safeguards perspectives but also from the technical, financial, economic and political viewpoints. In this light, PT SMI opens to constructive inputs and aspirations from the public, the SGs, and users that it finances through RIDF financing. As one of the efforts to achieve these objectives, PT SMI is establishing a Grievance Redress Mechanisms to serve as an effective tool for early identification, assessment, and resolution of complaints on subprojects.

The Internal Audit (IA) Division of PT SMI is the one that responsible for the GRM. It is under and reporting directly to the President Director of PT SMI. The IA Division will receive all the inputs, complaints, aspirations, ideas that is addressed to PT SMI. The IA Division will pass them on to the responsible Divsiion with adjust to the subjects/matters. There is already a guidance for a Whistle Blowing System (WBS) of PT SMI, namely "Pedoman Sistem Pelaporan Pelanggaran". There is a link in SMI's website related to the people http://192.168.29.251:81/wbssmi/

The IA Division will pass the issues related to the safeguards on to the Environmental Social Safeguard and Business Continuity Management (ESSBCM) Division. The ESSBCM Division of PT SMI will establish a GRM that will allow public, affected IP communities or individuals, and PAPs to file complaints and to receive satisfying responses in timely manner. The system will also record and consolidate complaints and their follow-ups. This system will be designed not only for complaints regarding the preparation and implementation of LARAP, IPP and TS, but also for handling complaints of issues (including environmental and other social safeguards issues) related to the subprojects financed by the PT SMI and the Word Bank under this project.

More specifically, the purposes of the GRM are to:

- Be responsive to the needs of beneficiaries and to address and resolve their grievances;
- Serve as a conduit for soliciting inquiries, inviting suggestions, and increasing community participation;
- Collect information that can be used to improve operational performance;
- Enhance the project's legitimacy among stakeholders;
- Promote transparency and accountability; and
- Deter fraud and corruption and mitigate project risks.

At the subproject level, the relevant SGs will have to establish a grievance redress mechanisms (GRM) for complaints related to the financed project. The SGs have to assign a staff to be responsible in managing the GRM system. The system will receive, and properly follow up complaints from the public, IP communities or individuals, and PAPs in a timely manner, as well as records complaints and their follow-ups. The SGs could use its existing GRM system, if it is already available and well-functioned with procedures and mechanisms that are in line with the requirements of the GRM as specified in the OM. Otherwise, the SGs will have to improve its current GRM system and capacity to be able to implement the GRM as specified in the POM.

7.1 Approach to grievance redress

The approach to redress grievance should involve the following:

1. **Assessment of risks and potential grievances and disputes:**

   The Risk Management Directorate (RMD) must understand the issues that are – or are likely to be – at the heart of disputes related to the subproject, such as clarity over land rights, benefit distribution, existing ethnic tension, or labour issues. For this, the RMD along with the SGs must conduct a rapid review of contentious issues, stakeholders, and institutional capacity, strongly relying on existing information from the SGs, civil society and other non-state institutions. The review must map who the key stakeholders to these issues are and what the nature of the debate is (informed, polarised, etc.). Attention must be paid to the local dispute resolution culture and, particularly, to the capacity and track-record of stakeholders to settle disputes through mediation or constructive negotiation.

2. **Capacity assessment**

   The review must also cover the availability, credibility and capabilities of local and national institutions to address the issues related to the subproject or program. For each of the institutions that are expected to deal with these issues, a credibility assessment must be undertaken, based on the following criteria:

   a. *Legitimacy:* is its governance structure widely perceived as sufficiently independent from the parties to a particular grievance?

   b. *Accessibility:* does it provide sufficient assistance to those who face barriers such as language, literacy, awareness, cost, or fear of reprisal?

   c. *Predictability:* does it offer a clear procedure with time frames for each stage and clarity on the types of results it can (and cannot) deliver?

   d. *Fairness:* are its procedures widely perceived as fair, especially in terms of access to information and opportunities for meaningful participation in the final decision?

   e. *Rights compatibility:* are its outcomes consistent with applicable national and international standards? Does it restrict access to other redress mechanisms?

f. *Transparency:* are its procedures and outcomes transparent enough to meet the public interest concerns at stake?

g. *Capability:* does it have the necessary technical, human and financial resources to deal with the issues at stake?

3. **Action plan (should be done in the preparation of this ESMF)**
   Action plans must necessarily be subproject specific, but should focus on tangible steps that can be taken during preparation and implementation to strengthen grievance capacity more widely.

7.2 Grievance redress mechanisms structure

The GRM general structure must involve the following:

Step 1: Access point / complaint uptake

a) An easily accessible and well publicised focal point or user-facing ‘help desk’ must be set-up. The help desk can be within the relevant agency or government department, but must be in a location that is seen as credible and accessible.

b) Uptake channels should include phone hotline, email, mail, SMS, webpage, and/or face-to-face. The uptake channels should be publicized and advertised via local media and the implementing agency. It is a common practice today that an SMS complaint system is effective to receive complaints accessible to all with almost at no costs without any deviation of the information in the complaints. The SMS system can be linked to a web-based system.

c) Staff members who receive complaints verbally should put them in writing for them to be considered. Recognising that many complaints may be resolved ‘on the spot’ and informally by project staff, there are opportunities to encourage these informal resolutions to be logged here to (i) encourage responsiveness; and (ii) ensure that repeated or low-level grievances are being noted in the system. The GRM should have the ability to handle anonymous complaints.

d) The user should be provided with a receipt and ‘roadmap’ telling him/her how the complaint process works and when to expect further information.

Step 2: Grievance log

a) It is important that all complaints are logged in writing and maintained in a database, either a simple Excel file or a publicly accessible web site (with appropriate steps taken to preserve anonymity).

b) Complaints received should be assigned a number that will help the complainant track progress via the online system or database.
c) Complainants should be handed a receipt and a flyer that describes the GRM procedures and timeline (staff should be trained to read this orally for illiterate complainants).
d) Where possible, the grievance log should capture complaints being made via informal or traditional systems, such as village councils or elders.
e) This will often require training local people and putting in place a formal link between the traditional systems and a more structured GRM system (this could take the form of a verbal agreement or a written MoU).
f) At a minimum, the database should track and report publicly the complaints received, complaints resolved and the complaints that have gone to mediation. The database should also show the issues raised and location of complaints circle around.

Step 3: Assessment, acknowledgment, and response

a) Eligibility should be a procedural step to ensure that the issue being raised is relevant to the project.
b) Complaints that cannot be resolved on the spot should be directed to the grievance focal point who will have a set number of days to assess the issue and provide a written response to the complainant, acknowledging receipt and detailing the next steps it will take (one week or less is recommended).
c) Grievances should be categorised according to the type of issue raised and the effect on the environment/claimant if the impacts raised in the complaint were to occur. Based on this categorisation, the complaint can be prioritised based on risk and assigned for appropriate follow up. For example, claims relating to land may be referred to an existing land claims court if this has been identified as a credible institution for resolving these disputes.
d) Assessment of the issue must consider the following:
   i. It is anticipated that the majority of issues raised will be informational in nature or feedback that requires small course corrections; these should generally be handled by the SGs. Issues having to do with governance issues, at the SGs or by PT SMI staff, should be addressed at a higher level, either an appeals or supervisory body within the SGs or senior management (Board of Commissioners) within PT SMI. The 'tip of the iceberg' complaints will likely be those reflecting outright opposition to a project or open conflict between stakeholders. These issues are unlikely to be

resolved via a GRM and should be handled at the highest appropriate level within either the country or the World Bank. Higher risk issues will require greater independence to handle, whereas lower-level feedback can and should be handled "in-house," i.e. by the SGs.

ii. To understand the level of risks, whether it is low risk, medium risk, or high risk, training will be required to ensure staff managing the GRM. It is to build awareness of what would constitute a higher-risk issue for the project, so the entity can handle such a complaint properly.

iii. If an issue is already being handled, for example by a local court or mediation body, or within the World Bank, then the issue should most likely be excluded from the grievance redress process in order to avoid duplication and confusion on the part of the complainant.

e) *Resolution:* Once the above issues have been considered, the complainant should be offered option(s) for resolution of their issue. The option offered is likely to fall into one of the following three categories:

i. The complaint falls under the mandate of the SGs and resolution can be offered immediately according to the request made by the complainant. The response will describe how and when resolution will be provided by the SGs and the name and contact information of the staff member responsible for it.

ii. The complaint falls under the mandate of the SGs but various options for resolution can be considered and/or extraordinary resources are required. The response will invite the complainant to a meeting to discuss these options.

iii. The complaint does not fall or partially falls under the mandate of the SGs. The response will indicate that the complaint has been referred to the appropriate body (e.g. Complaints related to resettlement will be forwarded to the Resettlement Committee), which will continue communications with the complainant.

Step 4: Appeals

Where an agreement has not been reached, the complainant should be offered an appeals process.

a) One approach is to refer appeals to the national courts or other suitable process.

b) In some instances, it is helpful to convene a senior and independent panel of individuals to seek appropriate resolution of the case, with representation from both government and civil society. This panel may also play the role of providing strategic oversight and assurance of the mechanism through reviewing monitoring and tracking data.

c) At this stage it may be helpful to offer third party fact-finding, facilitation or mediation. PT SMI to maintain a roster of independent professionals located in the regions and can provide independent support on a contract basis. Costs will be paid by the project.
   i. If the complainant accepts the options, and an agreement is reached, implementation will be monitored by the mediation service and a minute will be signed signalling the complaint has been resolved.
   ii. If the complainant does not accept these options or if he/she does but an agreement is not reached, the case will be closed. The complainant may seek redress through courts or other mechanisms available at the country level.

Step 5: Resolve and follow-up

a) Where there is an agreement between the complainant and the SGs or contractor on how the complaint will be resolved, a minute will be drafted and signed by both parties. After due implementation of it, a new minute will be signed stating that the complaint has been resolved.
b) All supporting documents of meetings needed to achieve resolution should be part of the file related to the complaint. This should include meetings that have been escalated to an appeals level or are handled by a third party.
c) The SGs should provide regular (monthly or quarterly) reports to the public that track the complaints received, resolved, not resolved, and referred to a third party. The World Bank project team should receive either the raw grievance data or the monthly reports, in order to support the PT SMI in early identification of developing risks.
d) The GRM data should feed into management system of PT SMI to demonstrate responsiveness and early resolution of issues (and help teams identify outstanding complaints in need of attention).

8. Public Consultations and Disclosures

A stakeholder consultation for the Draft of ESMF, including RPF, IPPF and PF, was held by PT SMI in June 20-21, 2016 in Jakarta. The main purposes of the consultation were to seek inputs on the ESMF from SGs, key central agencies, relevant NGOs and other institutions; and to socialize the PT SMI's ESMF commitment developed based on the national laws and regulations, PT SMI's ESS and international standards in ensuring that subprojects to be financed by the RIDF meet the requirements for environmental and social sustainability. The consultation were attended by representatives of the SGs, NGOs, Ministry of Finance, Ministry of Public Works and Public Housing, Association of City Governments, Association of Kabupaten Governments and Association of Provincial Governments, some representatives from local parliaments, and universities, etc. (Minutes of consultation is available, however it is still in Bahasa Indonesia). The invitation for this consultation was accompanied by a summary of the draft ESMF. PT SMI obtained positive feedbacks from the stakeholders, main concerns and suggestions.

The Draft ESMF has been disclosed in the PT SMI's website on June 15, 2016.

Subproject specific safeguards instruments (such as EIA, EMP or AMDAL/ UKL-UPL acceptable to the Bank, LARAP, IPP, etc.) will be subject to consultations and disclosure by the SGs. The timing for consultations shall be carried out at the planning stage of subproject preparation. SGs will disclose the EIA, EMP, LARAP, IPP, etc. at the planning stage of subproject preparation, i.e. prior to subproject appraisal, in their websites, a public space accessible to the affected groups, local NGOs and other stakeholders. These documents will also be disclosed in the PT SMI's website.

8.1 Conveying information to the public

The following table summarizes some of the most commonly used techniques for conveying information to the public and lists some of the advantages and disadvantages of each.

Table 22: Techniques for conveying information

Technique	Key points	Advantages	Disadvantages
Printed materials	• Information bulletins, brochures, reports: brochures, reports: Text	• Direct • Can impart detailed information • Cost-effective • Yields a	• Demands specialized skills and resources.

Technique	Key points	Advantages	Disadvantages
	should be simple and non-technical and relevant to the reader. • Provide clear instructions on how to obtain more information	permanent record of communication.	
Displays and exhibits	• Can serve both to inform and to collect comments. • Should be located where the target audience gathers or passes regularly.	• May reach previously unknown parties • Minimal demands the public	• Costs of preparation and staffing • Insufficient without supporting techniques
Print media	• Newspapers, press releases, and press conferences can all disseminate a large amount and wide variety of information • Identify newspapers	• Offers both national and local coverage • Can reach most literate adults • Can provide detailed information	• Loss of control of presentation • Media relationships are demanding • Excludes illiterates and the poor

Technique	Key points	Advantages	Disadvantages
	likely to be interested in the project and to reach the target audience		
Electronic media	• Television, radio, and video: Determine the coverage (national or local), the types of viewer; the perceived objectivity, and the type of , broadcast offered	• May be considered authoritative • Many people have access to radio	• Time allocated may be limited • Costs can be high
Advertising	• Useful for announcing public meetings or other activities • Effectiveness depends on good preparation and targeting	• Retain control of presentation	• May engender suspicion
Formal information sessions	• *Targeted briefing:* Can be arranged by project sponsor or	• Useful for groups with specific concerns • Allow detailed	• May raise unrealistic expectation

Technique	Key points	Advantages	Disadvantages
	by request, for a particular community group, firm, or industry association	discussion of specific issues	
Informal information sessions	• *Open House, Site Visits, Field Offices*: A selected audience can obtain first-hand information or interact with project staff. Visits should be supported with more detailed written material or additional briefings or consultations.	• Provide detailed information • Useful for comparing alternatives • Immediate and direct • Useful when the project is complex • Local concerns are communicated to staff • May help reach non- resident stakeholders	• Attendance is difficult to predict, resulting in limited consensus-building value • May demand considerable planning • Field offices can be costly to operate • Only reach a small group of people

Source: World Bank Environmental Assessment Sourcebook, Number 26

8.2 Listening to the public

Table 23 some of the most commonly used techniques for determining public opinion on a particular issue and lists some advantages and disadvantages of each (see **Table 23**).

Table 23: Listening to the public

Technique	Key points	Advantages	Disadvantages

Technique	Key points	Advantages	Disadvantages
Survey techniques	• Interviews, formal surveys, polls and questionnaires can rapidly show who is interested and why • May be structured (using a fixed questionnaire) or non-structured • Experienced interviewers or surveyors familiar with the project should be used • Pre-test the questions • Open-ended questions are best	• Shows how groups want to be involved • Allows direct communication with the public • Helps access the views of the majority • Less vulnerable to the influence of vocal groups • Identifies concerns linked to social grouping • Statistically representative results • Can reach people who are not in organized groups	• Poor interviewing is counter-productive • High cost • Requires specialists to deliver and analyse • Trade-off between openness and statistical validity
Small meetings	• Public seminars, or focus groups create formal information exchanges between the sponsor and the public; may consist of randomly selected individuals or target group members; experts	• Allows detailed and focused discussion • Can exchange information and debate • Rapid, low-cost monitor of public mood	• Complex to organize and run • Can be diverted by special interest groups • Not objective

Technique	Key points	Advantages	Disadvantages
	may be invited to serve as a resource.	• A way to reach marginal groups	or statistically valid • May be unduly influenced by moderators
Large meetings	• Public meetings allow the public to respond directly to formal presentations by project sponsors. Effective meetings need a strong chairman, a clear agenda, and good presenters or resource people.	• Useful for medium-sized audiences • Allow immediate response and feedback • Acquaint different interest groups	• Not suitable for detailed discussions • Not good for building consensus • Can be diverted by special interest groups • Attendance is difficult to predict
Conferences	• Technical experts and representatives of interest groups may be brought together.	• Impart specialized technical information • Promote data sharing and compromise • Resolve technical issues	• Time and effort needed to prepare • Cost if experts are hired
Community organizers/ advocates	• These work closely with a selected group to facilitate informal contacts,	• Mobilize difficult-to-reach groups.	• Potential conflicts between employers

Technique	Key points	Advantages	Disadvantages
	visit homes or work places, or simply be available to the public.		and SGs • Time needed to get feedback

Source: World Bank Environmental Assessment Sourcebook, Number 26

8.3 Involving the public in decision making

Table 24 summarizes some of the most commonly used techniques for involving the public in making environmental decisions and lists some advantages and disadvantages of each.

Table 24: Involving the public in decision making

Technique	Key points	Advantages	Disadvantages
Advisory groups	• *Task forces*: Set up task groups to focus on a single technical issue. Define the limits of the group's authority and lifetime; ensure that all interests are represented and that contact with the public is maintained.	• Can address highly technical problems • Helps prioritize and reach consensus	• Rarely represents all interested parties • May replace wider consultatio ns • Often focuses too much on procedures
Problem-solving techniques	• *Brainstorming:* Designed to enhance creativity and generate ideas quickly. Selection of the facilitator and participants is critical.	• Helps groups break out of the obvious • Provides insights for decision making	• Difficult to include a full range of views • May yield too many ideas to evaluate

Technique	Key points	Advantages	Disadvantages
Consensus-building technique	• *Unassisted negotiations, mediation*: Voluntary processes by which representatives of affected organizations make decisions by consensus, to be ratified by parent organizations. Parties either agree on decision-making procedures at the outset or use an experienced mediator	• A forum for jointly identifying solutions • Puts responsibility on the disputants to identify common ground. • Robust agreements with broad support • Quick resolution of contentious issues	• Not all parties will participate • Parties may drop out before the end • Requires good faith • May take too long • Highly skilled mediators are scarce
Arbitration	• A process by which conflicting parties seek a solution through an impartial mediator. It can be binding, by prior agreement, or all sides may reserve judgment until the outcome.	• Impartiality from an uninvolved party • Difficult to oppose the arbitrator's recommendati on	• All parties must stand to gain • Difficult to identify an acceptable neutral party

Source: World Bank Environmental Assessment Sourcebook, Number 26

9. Organizational Arrangements and Funding for Implementing the ESMF

PT SMI has recruited one Senior Environmental Specialist, one Junior Environmental Specialist, and one Social Development Specialist will join on August 15, 2016.The ESSBCM Division main tasks is to oversee the environmental and social aspects of the infrastructure projects during their preparation, construction, operation, and handover phases. They are responsible both for ensuring that PDF subprojects preparation and also RIDF subprojects loan processing and implementation meets the requirements specified in this ESMF. These specialists will ensure that PT SMI implement the detailed procedures, requirements and formats that will comply with the Government of Indonesia's laws and regulations, the PT SMI's ESS, World Bank's safeguards policies, and international labor and occupational health and safety standards. PT SMI's environmental and social specialists will hire expert consultants to support detailed project reviews depending on specific project characteristics. In addition, a professional firm will be recruited to assist PT SMI in screening/appraisal/monitoring and further provide capacity building, including safeguards review and management.

This ESMF is being detailed in the Project Operations Manual (POM). As PT SMI is responsible to implement consistently the POM, it is necessary that PT SMI's environmental and social development specialists as well as PT SMI's consultants be fully conversant with PT SMI's POM.

To strengthen the environmental and social management efforts, PT SMI will undertake the responsibility and leadership of the various issues related with the environmental and social management in Infrastructure Projects. In this sense, a number of activities have been identified to be undertaken by the PT SMI to strengthen the environmental management within the institution and ensure the environmental and social sustainability of the projects supported by it.

Considering that the environmental and social management issues shall have to be started from base level at PT SMI, following three components have been identified to strengthen it:

a) Activities to promote and disseminate the environmental and social management tools;
b) Training workshops on special subjects to improve the environmental and social management within the institution;
c) Hand-holding assistance of PT SMI to the SGs; and
c) Requirements of work teams and means for the environmental and social management.

In addition to those of PT SMI, the successful implementation of the ESMF depends on staff, institutional commitments and professionals operating outside of PT SMI. This chapter provides for the responsibilities of each of these stakeholders for operationalizing the ESMF.

9.1 Organizational framework stakeholders external to RIDF

The key external stakeholders involved in implementing this ESMF are (see **Table 25**):

- The SGs and their various related departments
- External environment and social consultants and agencies carrying out technical studies / environment and social assessments, monitoring activities, training programs etc.

Table 25 & 26: Roles and responsibilities of key stakeholders on the implementation of ESMF

Stakeholder	Role and responsibility
Subnational governments in Indonesia	The SGs will have to play a pivotal role in getting the requirements implemented on the ground and providing feedback / communication on performance. Some of the key activities of the SGs would involve: ▪ Identifying various subprojects within their jurisdiction as outlined in the subproject pipeline (sectors), and the eligibility criteria of funding through RIDF and develop them with help from PDF ▪ Engaging with consultants / agencies for preparing the scope of work related to statutory legal compliance and conformance with environment and social safeguards
External agencies carrying out environment and social studies and assessments	The primary role of the external consultants and agencies will be to conduct the studies, assessments, training programs etc. as specified in their scope of work issued to them and provide quality outputs within the stipulated time periods in consonance with the requirements as specified in the ESMF

9.2 Organizational arrangements of PT SMI

The key stakeholders within RIDF involved in operationalizing the ESMF:

- Board of Commissioners (PT SMI)
- The Board of Directors (PT SMI)
- Risk Management Directorate (PT SMI)
- Business Directorate (PT SMI)
- Financing Facility Control Division (PT SMI)

The roles and responsibilities of each of these members of the RIDF forms the organizational framework for implementing the ESMF. The same is provided below (see Table 27).

Table 27: Organizational framework for implementing ESMF

Stakeholder	Role and Responsibility
Board of Commissioner, PT SMI	▪ Nominate members of the Board of Directors; ▪ Approve RIDF's annual business plan and annual budget and also approve its annual accounts; ▪ Monitor RIDF's performance on a quarterly basis; ▪ Approve subprojects recommended by the Board of Directors for subprojects where RIDF's investment is beyond a specified subproject cost[1]; ▪ Decide the threshold limit of subproject costs; and ▪ Provide approval and suggestions for improvement on performance reviews of RIDF loans ▪ Finalize the grievance redress mechanisms plan/concept and approve its initial establishment
Board of Directors, PT SMI	▪ Establish policies and risk management of

Stakeholder	Role and Responsibility
	ESMF implementation for RIDF's activities funded by multilateral agencies ▪ Establish the organizational structure including clear authority and responsibility related to ESMF implementation for the SGs' subprojects financed by multilateral agencies ▪ To monitor compliance with ESMF implementation for multilateral projects fund and provide guidance on ESMF management improvement of multilateral projects fund in RIDF's activities.
Business Directorate	▪ To ensure that the project is not included in the Exclusion List. ▪ To coordinate with the counterparty/debtor for completing the necessary documents in the ESMF management. ▪ To monitor the financing and investment facilities or project development or consulting services. ▪ To keep and maintain hardcopies or softcopies of RIDF documents.
Environmental and social safeguard officers (specialists), PT SMI, i.e. ESSBCM (*As applicable based on thematic relevance*)	▪ Coordinate with World Bank safeguards team, the SGs and consultants for implementation of the ESMF ▪ Identify, screen and recommend consultants / agencies for conducting assessments, studies and training activities related to environment and social safeguards ▪ Review ToRs for subproject preparation studies (for PDF) ▪ Review ToRs for EIA of subprojects, as prepared by consultants ▪ Review Detailed Project Reports for subprojects

Stakeholder	Role and Responsibility
	▪ Review EIA reports for subprojects ▪ Review LARAP and IPP ▪ Participate in site visits with SG teams for project appraisal ▪ Review project appraisal formats for projects being reviewed ▪ Conduct project-related environment and social internal audits ▪ Review project environment and social monitoring reports and develop internal communication reporting for RIDF and the World Bank safeguards team on legal compliance and safeguard conformance ▪ To plan, ensure and oversee capacity building training programs for stakeholders ▪ To maintain and update ESMF on a regular basis and record changes in the revision sheet ▪ To keep and maintain hardcopies or softcopies of ESMF documents.
Director, Risk Management Directorate	▪ To ensure 1/ financing and investment activities, 2/ project development, and 3/ consulting service provision are in compliance with the provisions as set forth in the regulations, in accordance with the scope of ESMF ▪ To establish risk categories of ESMF ▪ To approve the Project Appraisal Report prepared under ESMF prepared by E&S Safeguard Specialist. ▪ To submit Project Appraisal Report to the Business Divisions and the Financing Committee for the consideration of financing and investment decisions.

Stakeholder	Role and Responsibility
	▪ To ensure adequacy of resources related to the implementation of the ESMF in the Risk Management Directorate.
Financing Facility Control Division (DPFP)	▪ To monitor the fulfilment of compliance obligations of the parties, including the fulfilment of the impact mitigation plan (EIA/EMP), LARAP, IPP, in accordance with the financing and investment agreement. ▪ To keep and manage the original ESMF documents as a part of financing and investment documentations.
World Bank Supports	▪ For the first five high-risk subprojects, the Bank will conduct joint appraisal and review together with PT. SMI prior to subproject approval. If found to be necessary during project implementation, this joint prior review approach could be extended to additional high-risk subprojects beyond the first five. As part of regular Bank supervision of project safeguards implementation, for medium and low-risk projects the Bank will monitor RIDF's operations through post-review to ensure that the ESMF is consistently adhered to, and promptly initiate any corrective action as required. ▪ Monitoring and providing implementation support to PT SMI in ensuring that the SGs fulfill the requirements specified in the ESMF. Strengthening capacity of PT SMI through joint-review, joint-supervision, training, etc. Together with PT SMI, strengthening capacity of the SGs as needed.

9.2.1 Capacity strengthening

The Environmental and Social Safeguard and Business Continuity Management (ESSBCM) Division of PT SMI is situated in the Risk Management Directorate of PT SMI. This ESSBCM Division is chaired by a Division Head. The present capacity of E & S Unit at PT SMI will be continuously strengthened to appropriately manage the environmental and social safeguards as per requirements specified in the ESMF. The responsibilities of the E&S staff have already been listed in the Table provided earlier. Also, in addition to staff recruitment, training for E&S staff will be required to ensure update on knowledge and skills in commensurate with the ESMF requirements. Capacity strengthening is detailed in the following section.

9.3 Institutional capacity strengthening

As the subproject portfolio and pipeline for SG borrowing will be continuously growing, there is a need for PT SMI to strengthen its current capacity in managing environmental and social safeguards, particularly the ESSBCM Division under the Risk Management Directorate. The capacity of PT SMI should be strengthened to ensure that all key players are competent to discharge their respective duties as far as environmental and social safeguards management is concerned. In addition to the Risk Management Directorate, PT SMI should also assist and ensure that SGs have adequate capacity to meet the requirements specified in the ESMF. The following are the strategy for improving the current capacity of PT SMI in managing environmental and social safeguards:

Operational Documents

As explained earlier, PT SMI will elaborate the ESMF into an operational document, i.e., Project Operation Manual (POM), whereby this ESMF is part of, along with the details of the operational arrangements to guide the - ESSBCM Division and SGs; and Guidance Notes for sectors/subsectors/environmental management/social safeguards management for the SGs. The POM will be made available in September 2016 and Guidance Notes will be ready in January 2017.

Staffing

Depending on the needs from the growing portfolio and pipeline, PT SMI will increase its staffing for the ESSBCM Division gradually. Today PT SMI has two environmental specialists. This year, PT SMI is planning to hire another full-timer social safeguards specialist and another full timer environmental specialist. In 2017, two full-timer social safeguards specialist and one full-timer environmental safeguards specialist will be recruited. In addition, PT SMI will also utilize the “pool of experts” that are available on call basis.

Outsourcing

PT SMI will hire consulting firms and/or individual environmental and social safeguards specialists, as needed, to assist it in carrying out the review, assessment and environmental and social due diligence (ESDD), and to carry out in-house training for PT SMI ESS staff and other units' staff for awareness training. In addition, PT SMI, as needed, will also outsource monitoring and evaluation of the ESMF implementation at the SG level and at the PT SMI level. It is expected that from the outsourcing, PT SMI ESS staff will increase their knowledge and experiences as the consulting firms will handhold them during the review, ESDD and monitoring the SGs.

Training

This capacity building should be accomplished by organizing awareness-raising / sensitization programs, hands-on workshops (on application of ESMF), training programs (technical and thematic areas related to environment and social issues in RIDF's subproject portfolio and pipeline), etc.

These programs should be coordinated and anchored through training institutions available in the country and other local, national or international experts experienced in various aspects of urban infrastructure projects. The expertise of DFIs also should be tapped whenever needed for capacity building. The capacity building tasks can be out-sourced to reputable international and domestic consulting firms.

Training programs should be conducted according to an annual training calendar to impart working skills for implementing ESMF, to update stakeholders on external changes (legal requirements, safeguards, etc.) and for operational experience-sharing, and to communicate revisions carried out in the ESMF. The training programmes should clearly designate the intended audience, responsible implementers and estimated costs along with the timing of the activities.

Training programs organized for such purposes should typically include topics necessary for carrying out ESMF assessment and those related to the structure of the ESMF. They should be designed to improve knowledge and ability to deliver environmental and social support across projects at all implementation levels. Such programs can address the following areas;

a. Environment and social issues linked to urban infrastructure development in Indonesia

b. Indonesian legal governance and requirements (applicable to RIDF projects)

c. Environment and social safeguards and management systems of DFIs

d. ESMF structure and objectives

e. Operationalization of ESMF comprising assessment processes integrated in business cycle through case studies (screening, identifying legal requirements, impact assessment, identifying mitigation measures, categorization)

f. Monitoring of projects – what to monitor / measure, why and how often

g. Impact assessment of projects (environmental as well as social)

h. Internal and external audit (objectives, protocol, reporting, corrective actions)

i. Document management (update to ESMF policy and procedures based on external and internal changes, revisions in formats for recording information)

All of the ESS staff of PT SMI will have to be provided training, which can be in-house training and external training. Each staff will have to take at least one regular and one thematic training, depending on the needs and the interests. Training can be in the form of programmed training, seminar, workshop or knowledge forum exchange. The E&S staff will provide regular awareness training and refresher training to all staff of PT SMI, as part of the importance of mainstreaming environmental and social safeguards aspect in the decision making process for lending to the SG.

World Bank will support the capacity building of ESSBCM division staff by conducing joint review, joint supervision and training as stipulated in Table 27.

Corporate responsibility

PT SMI will is planning to carry out outreach and training to SGs on its environmental and social safeguards management principles, as applicable, with the assistance of experts hired by PT SMI. In addition, as needed, PT SMI will also provide training for specific needs to SG, such as training for health and safety, training for dam safety, etc. This capacity building for SGs will be delivered together with the PDF Directorate.

Funding

PT SMI will allocate sufficient budget annually to implement the above activities. Institutional strengthening capacity plan will be part of the PT SMI Annual Work Plan, and accordingly budget to implement such plan will be part of the annual budget plan.

PT SMI will maintain records of the institutional capacity strengthening, detailing the training programs, agenda comprising topic, duration and trainer, qualifications of the trainer for conduct of training, and attendance sheet of participants. Training content should also be maintained and updated as required. Similar records will have to be maintained for workshop, seminar, outreach, etc. that have been attended by the ESS staff of PT SMI (see **Table 28**).

Table 28: PT SMI's Institutional Capacity Strengthening Plan 2016-2019

Activities	Target indicators (TI)/estimated costs (EC) in USD							
	2016		2017		2018		2019	
	TI	EC	TI	EC	TI	EC	TI	EC
POM	EoY	-						
Guidance Notes			5	200 K				
Full-timer Environmental specialist	3	75 K	3	75 K	3	75 K	3	75 K
Full-timer social safeguards specialist	1	75 K	3	75 K	3	75 K	3	75 K
Outsourcing	1 firm	100 K	1 firm	100 K	1 firm	100 K	1 firm	100 K
Regular training	2	10 K	2	10 K	2	10 K	2	10 K
Thematic training	2	10 K	2	10 K	2	10 K	2	10 K
Outreach and LG training	2	20 K	2	20 K	2	20 K	2	20 K
Total Estimated Costs		290 K		490 K		290 K		290 K

9.4 Monitoring and evaluation of the implementation of ESMF

To review the performance of ESMF, the Bank will regularly review the capacity and performance of PT SMI in implementing the ESMF as part of the implementation support mission, to be undertaken at least twice a year. In addition, a periodic (at least once in two years) review should be carried out by the World Bank through an external competent review agency that should be appointed on the basis of accepted procurement norms. It should be mandated to conduct the following activities:

i. Review ESMF by examining key documents (see below an indicative list) provided by RIDF:

   - Review ESMF structure, procedures and formats
   - Review screening process (exclusion and screening of projects), EIA/LARAP/IPP guidelines.
   - Check documents / records of subprojects to establish (with objective evidence) that effective mitigation measures and operational controls have been applied in the subprojects where the ESMF has been adopted. This will be based on interviews with staff from RIDF, SGs, implementing agencies, contractors, O&M agencies etc.
   - Conduct the audit process at the PT SMI; all necessary documents should be made available to the auditors.
   - Conduct sample subproject site visits (one day visit for one project site in different regions). The objective of these visits is to review on-ground ESMF implementation on the site limited to the actions / controls identified in the ESMF documents / records and applicable to the particular project.

ii. Based on the above review, the external reviewer should prepare a short report that reflects its opinion on:

   - How and to what extent does the ESMF address environment and social concerns relevant to the subprojects undertaken?
   - How relevant and comprehensive are the key elements of ESMF and how are they aligned to environment and social safeguards of DFIs and national / state level regulation?
   - Are the institutional arrangements effective and adequate in implementing ESMF at various levels?

9.5 Document Control and Update

The ESMF should be updated periodically to ensure that it is in tune with DFIs' environment and social safeguards, regulatory requirements, nature / scale of projects and status of the environment.

External review findings / observations, and lessons learnt should also be incorporated to ensure its continued suitability, adequacy and effectiveness. The updates should be recorded in the document control revision sheet of the ESMF to preserve the history and reasons for changes. The environment and social safeguard staff of RIDF is responsible for updates.

10. Templates and Document Outlines

Annex 1. Environmental and Social Screening Checklist

Project Summary		
Name of Project		
Name of Subnational Government		
Project Location		
Does the project in any of the below areas? (see Annex 1B for definition of areas)		
Area Description	**Yes/No**	**Details**
Protected forest area		
Water Catchment Area		
Beach		
River		
Lake		
Nature reserves		
Mangrove forested coastal area		
National park		
Natural habitats		
Private/community/indigenous forest		
Germplasm protection area		

Coral reefs		
SOCIAL ASSESSMENT CHECKLIST		
Question		**Answer**
Does the project involve acquisition of private land?		
Does the project involve acquisition of Government land?		
Number of people to be displaced?		
Describe existing land uses on and around the project area (e.g., community facilities, agriculture, tourism, private property)?		
Will the project result in loss of access to current livelihoods?		
Is the project likely to provide local employment opportunities, including employment opportunities for women?		
Is the project being planned with sufficient attention to local poverty alleviation objectives?		
Are there socio-cultural groups present in the project area (ethnic communities, minorities, or indigenous communities)?		
Do such groups self-identify as being part of a distinct social and cultural group?		
Do such groups maintain cultural, economic, social, and political institutions distinct from the dominant society and culture?		
Do such groups speak a distinct language or dialect?		
Have such groups been historically, socially and economically marginalized, disempowered, excluded, and/or discriminated against?		
Will the project directly or indirectly benefit or target Indigenous Peoples?		
Will the project directly or indirectly affect Indigenous Peoples'		

traditional socio-cultural and belief practices? (E.g. child-rearing, health, education, arts, and governance)?	
Will the project affect the livelihood systems of Indigenous Peoples? (e.g., food production system, natural resource management, crafts and trade, employment status)?	
Will the project be in an area (land or territory) occupied, owned, or used by Indigenous Peoples, and/or claimed as ancestral domain?	

Summary of Potential Impacts of the Project	
Environmental Impacts	
Social Impacts	

What ESMF Risk Category does the project fall in? (See Annex 1C)	
	Category A
	Category B
	Category C

Which are the safeguard policies/laws triggered by the Project (refer Annex 1D)	
Indonesian Laws and Regulations	
PT SMI Standards	
International-Standard Operating Policies	

Have environmental permits been obtained by the applicant?

No.	Permit	Yes	No	N/A	Details (Number, date of issue, validity date, permit issuing agency)

1	AMDAL/UKL-UPL/SPPL				
2	Location permit				
3	Hazardous and toxic waste disposal permit				
4	Hazardous and Toxic waste temporary storage permit				
5	Groundwater Use Permit				
6	Other permits				

Annex 1A

Environmental and Social Exclusion List for RIDF
▪ Production or trade in any product or activity deemed illegal under host country laws or regulations or international conventions and agreements, or subject to international bans, such as pharmaceuticals, pesticides/herbicides, ozone depleting substances, wildlife or products regulated under the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) ▪ Activities that will significantly converse or degrade critical natural habitats or critical forest or natural habitats or natural forests. ▪ Production or trade in weapons and munitions ▪ Production or trade in alcoholic beverages (excluding beer and wine) ▪ Production or trade in tobacco ▪ Gambling, casinos and equivalent enterprises ▪ Production or trade in radioactive materials. This does not apply to the purchase of medical equipment, quality control (measurement) equipment and any equipment where IFC considers the radioactive source to be trivial and/or adequately shielded ▪ Production or trade in un-bonded asbestos fibres. This does not apply to purchase and use of bonded asbestos cement sheeting where the asbestos content is less than 20%; ▪ Drift net fishing in the marine environment using nets in excess of 2.5 km. in length ▪ Production or activities involving harmful or exploitative forms of forced

labor/harmful child labor.

- Commercial logging operations for use in primary tropical moist forest.
- Production or trade in wood or other forestry products other than from sustainably managed forests
- Production, trade, storage, or transport of significant volumes of hazardous chemicals, or commercial scale usage of hazardous chemicals. Hazardous chemicals include gasoline, kerosene, and other petroleum products.
- Production or activities that impinge on the lands owned, or claimed under adjudication, by Indigenous Peoples, without full documented consent of such peoples

Annex 1B

No.	Environmental Sensitive Areas	Definition
1.	Protected forest area	Forest on the slopes ≥ 40 %, rainfall of 175 , high ≥ 2,000 m above sea level.
2.	Peaty area	peaty soil with a thickness of ≥ 3 meters,
3.	Water catchment boundary	▪ high rainfall, soil structure ▪ easy to absorb water ▪ geomorphological forms that can absorb rain water on a large scale
4.	Beach boundary	at least 100 meters from the highest tide
5.	River boundary	▪ River outside of settlement area, a both side At least 100 meters on big river and 50 meters on small river ▪ River around settlement area, estimated to be enough to build the road inspection between 10-15 meters
6.	Around Lake or reservoir area	At least 50 – 100 m from the high

		tide
7.	Spring water boundary area	Radius 200 m from spring water
8.	Sea wildlife	marine, inland waters, coastal areas, estuaries, and a cluster of coral atolls which have characteristics such as diversity and / or unique ecosystems
9.	Mangrove forested coastal area	Minimum 130 times the average value of the difference between the highest and lowest tide.
10	National park and national park marine	Having good diversity plant and animal, good landscape, and good access for tourism purposes
11	Forest park	Forest Park is a conservation zone that is mainly utilized for the purpose of collection of plants or animals, the development of science, education and training, culture, tourism and recreation
12	Heritage and science regional area	▪ Spot and space around high cultural value buildings, archaeological sites and regions. ▪ Area with specific geological formations that have high benefits for science development.
13	Natural park	a. Designated region has a high diversity of plants and wildlife and ecosystem types; b. Representing the formation of certain species c. Has natural conditions, do not or have not been disturbed by human; d. Unique and may be the only one in a region, and requires conservation efforts.

14	Forest Park tourism area	c. an interesting and aesthetic either natural or man-made; d. Good for recreation and sports as well as located near the centers of settlement; d. Have sufficient and safe area
15	Germplasm protection area	Have unique types of germplasm
16	Fauna transit area	a. Area of wildlife origin inhabited b. Has a specific area that allows the life cycle of these species
17	Natural disaster area	Area potential for eruption, and land slide

Annex 1C

Risk Category	Criteria
A	Project requires AMDAL, OR There are potentially significant negative impacts on the environment which are both sensitive and diverse, which may be long-term in nature. OR There are potentially significant negative social impacts which are both sensitive and diverse, OR There are potentially significant impacts on health and security
B	Project requires UKL-UPL, OR There are potential negative environmental impacts but they local to the project-site, and short-term in nature OR There are potential negative impacts related to social issues that only localized at the project site OR There are health and security issues but they are not significant
C	Project requires SPPL, and the project has zero or minimal potential negative impact on the environment, and there are no potential social issues, and there are no potential health and safety issues

Annex 1D

Type of Impact	National Law/Regulation	PT SMI Standard	International Standard
Project may cause environmental impact	a. Law No. 3 of 2009 b. Government Resolution No. 27 of 2012 c. Minister of Environment Regulation No. 5 of 2012 d. Government Regulation No. 82 of 2011 e. Government Regulation No. 41 of 1999 f. Government Regulation No. 101 of 2014	ESS-1	WB OP 4.01 IFC PS WBG General EHS Guidelines and Industry Sector Guidelines
Project may adversely impact natural habitat or threatened species	a. Law No. 41 on Forestry and Constitutional Court decision No. 35/PUU-X/2012 b. Ministerial Regulation of MOH No. P.62/2013 c. MOHA Regulation No. 52/2014 d. Regulation of Minister of Land Agency and Spatial Development No. 9 of 2015 e. Law No. 18 of 2013	ESS-6	OP 4.04, OP 4.36
Project may adversely impact places/objects of cultural/historical value	-	ESS-8	OP 4.11
People belonging to the traditional community live/occupy the project site or the neighbouring	a. Law No. 5 of 1960 b. Presidential Decree No. 111/1999	ESS-7	OP 4.10

areas			
Project may cause involuntary resettlement	a. Law No. 2 of 2012, Presidential Regulations No. 71 of 2012, No. 40 of 2014, No. 99 of 2014 and No. 30 of 2015	ESS-5	OP 4.12
Project is located on land with lack of clarity on ownership	-	-	OP 7.60
Project may cause agricultural diseases or directly involve use of pesticides	-	-	OP 4.09 WBG General EHS Guidelines and Industry Sector Guidelines
All projects		ESS-2, ESS-3, ESS-10	
Project may cause significant impact on health, safety and security	-	ESS-4	WBG General EHS Guidelines and Industry Sector Guidelines

Annex 2. **Outline terms of reference for environmental and social impact assessment study**

Terms of Reference (ToR) to Conduct Environmental Impact Assessment Studies for Category A Projects

1.0 Brief Introduction

A brief introduction to the project should be provided in this section

A brief description of the project area / city and salient features of the city such as geographic location, climate, rainfall, soil profile, wind direction, existing drainage system, need for the proposed project, etc. should be given.

2.0 Project objectives and need

A brief profile of the status of existing infrastructure in the city where the project is proposed, service levels, problems and issues, and salient features and environmental implications of the proposed project should be discussed in this section by covering the following objectives:

- Establish the environmental baseline in the study area
- identify and assess the adverse environmental impact and provide requisite measures to address the impact
- identify the opportunities for environmental enhancements in the project area and provide requisite guidance/plans in this regard
- Identify and assess the climate change-related aspects of the project
- Wherever relevant, integrate the measures (mitigation- and enhancement-related) in project planning and design
- Develop appropriate management plans and codes of practices for implementing, monitoring and reporting the environmental mitigation and enhancement measures suggested

The EA should be carried out in line with GoI regulations, and to suit ESMF.

The EA should comprise filling the screening format, environmental screening, project EA, and environmental management plans (EMPs) and mitigation measures. The EA should be carried out in a consultative manner through stakeholder consultations, at various stages, with the affected communities, NGOs, selected government agencies and other stakeholders.

3.0 Scope of work

Consultants should carry out the following tasks while conducting EA for the project including nature, scale and magnitude of impact on the environment.

Task 1 Description of project

A succinct description of the proposed project should be provided covering: (a) status analysis of existing infrastructure (b) description of each of the proposed components, activities and sub-activities. It should also bring out the rationale for the proposed project and list out its various benefits. The consultant should also provide necessary maps to scale.

Task 2 Review of previous studies

The consultants should review various earlier studies such as feasibility and detailed project reports, etc., of the project and understand all related aspects. This will provide a base to formulate the environmental surveys necessary for the project and assessing its impact.

Task 3 Legislative and regulatory considerations

A review of the legal and regulatory provisions applicable to the project should be carried out to bring out the legal and policy issues to be addressed in the project at various stages such as planning, design, execution and operation. In addition to the environmental laws such as EP Act, Water Act, Air Act, EIA notifications etc., the consultants should review applicable operational policies / directives of the EFA.

The review should, thus, provide a complete list of regulatory formalities required for the project and various clearances required from different regulatory agencies including the State Pollution Control Board.

Task 4 Preparation of environmental profile

An environmental profile of the project influence area should be prepared, based on appropriate primary & secondary surveys and field investigations. Its objective is to establish existing environmental conditions of the project area, in terms of air, water, noise, soil and other environmental parameters, which should form the basis for predicting the impact of the proposed project. As part of this, environmentally sensitive land uses (protected natural areas, areas of ecological value, sensitive receptors like schools, hospitals etc.) would also be identified and plotted on a map to scale.

The extent and duration (at least one season for rapid assessment and the three seasons for full detailed assessment) of surveys should be judiciously decided by the consultant in accordance with the environmental regulations applicable in Indonesia and guidelines of international funding agencies. The profile prepared should be adequate enough to predict the impact of the project and should cater to the requirements of obtaining necessary environmental clearances from the authorities.

The profile should essentially include all physical, ecological and socio-economic components of the project environment and bring out its salient and sensitive features. Important aspects such as reserve forests, national parks, major water bodies, structures of archaeological / historic importance, and other environmental resources (if any) should be identified and their salient features should be presented.

In addition to the basic environmental profile, the quality of water supplied by the present water supply system, potential points of cross-contamination and health profile of the project area population should also be brought out in detail through appropriate sampling surveys and field investigations.

Task 5 Determination of potential impact

Based on the environmental profile of the project area and the proposed project activities discussed under Activity 1, the consultants should carry out environmental screening to determine the nature of impact and level of EA to be carried out (Section 5.0 provide details).

- If the impact is of a low / insignificant level, where an EMP will suffice, the consultant should review the recent versions of generic EMPs available with MPUDC and carry out necessary changes to suit the project requirements.
- As part of screening, if impact will be medium to high, requiring a detailed EA and stand-alone EMP, the consultant should carry out a detailed impact analysis. The consultant should predict the environmental impact of the project components, activities and sub-activities on various environmental attributes (bio, geo and physical) through appropriate analytical tools and techniques such as modelling techniques, overlays, etc. Each type of impact – significant or insignificant, permanent or temporary, reversible or irreversible, negative or positive –impact should be categorized separately and presented for each phase of project development.
- Based on the outcome of the screening, if any climate change impact is envisaged in project implementation or during operation then the consultants should collect relevant information and appraise that impact.

The consultants should identify the adaptation needs of the project, review the potential for greenhouse gas reduction and identify necessary measures for implementation.

All identified effects should be summarized in an easily understandable format and the magnitude and significance of each impact should be explained in detail.

An analysis of various project alternatives, including the 'Project' and 'No project' scenario should be brought out and impact analysed for each scenario. Based on this analysis the best alternative that causes minimum or no impact should be recommended for implementation.

Task 6 Stakeholder consultations

The consultants should carry out consultations with experts, NGOs, forest department (if applicable) select government agencies and other stakeholders to (a) collect baseline information, (b) obtain a better understanding of the potential impact (c) appreciate the perspectives/concerns of the stakeholders, and (d) secure their active involvement during subsequent stages of the project as appropriate. For A projects, at least two consultations should be conducted, one after screening and the second with the draft final EA / EMP.

Consultations should be preceded by a systematic stakeholder analysis that would (a) identify the individual or stakeholder groups relevant to the project and to environmental issues, (b) include expert opinion and inputs, (c) determine the nature and scope of consultation with each type of stakeholders, and (d) determine the tools to be used in contacting and consulting each type of stakeholder. A systematic consultation plan with attendant schedules should be prepared for subsequent stages of project preparation as well as implementation and operation, as required. Where community consensus is required in respect of proposed mitigation measures for impact on community assets including water bodies, places of worships etc., specific plan for modification/relocation etc. have to be disclosed and consensus obtained.

Task 7 Development of an EMP / determination of mitigation measures

Based on the outcomes in steps detailed above, the consultants should develop an implementable EMP for the project (detailed in Section 5.0).

4.0 Environmental screening and EA activities to be carried out in detail

4.1 Environment screening

1. Environmental screening should be undertaken to identify the environmental hot spots along the project corridors, project relevance to climate change and determine the level of environmental analysis required for the EA. The consultant should carry out a preliminary analysis to assess the nature, scale and magnitude of the impact that the project is likely to cause on the environment. If the likelihood of significant environmental impact is assessed (may be applicable to the entire project/specific project interventions/specific locations), the consultants should explore possible alternatives to the project and/or project components in a consultative manner. The deliverable at this stage is the **Environmental Screening Report.**

2. The screening exercise should be supported by secondary and primary information collection and stakeholder consultations on the existing environment scenario. As part of the screening exercise the consultants should:

   (a) Identify sensitive locations in the project area including regionally or nationally recognized environmental resources and sensitive manmade locations such as hospitals, schools, etc.

   (b) Establish baseline environmental quality with regard to air, water and noise.

   (c) List and map common property resources such as roadside trees; forests, large water bodies; and major physical cultural properties, etc.

   (d) Identify human settlement, physical infrastructure and project activities that would result in severance.

   (e) The consultants should also assess whether the project has substantial greenhouse gas reduction potential and whether there it would need to be substantially modified to adapt to possible climate change.

4.2 Project EA

1. Existing environment and baseline conditions: Baseline assessment of a project should be carried out based on the outcome of environmental screening. The baseline conditions should be established through detailed primary level field surveys. At this stage, the consultants should prepare detailed maps showing candidate sites for environmental improvements.

2. Data collection: Data should be collected on relevant physical, biological and socioeconomic conditions to establish the current environmental status of the project area and get meaningful information that can help in assessing impact and preparing the management plan.

   Broadly, the data categories to be covered (the consultant is also encouraged to use professional judgement and local knowledge in defining other data requirements) include current land uses at the proposed project site and the study area using maps plotted to appropriate scale, covering lakes/ponds and their uses, forests and its classification, ecologically sensitive areas (sanctuaries, national parks, wildlife corridors, identified areas of nesting, mangroves and / or of interest of migratory birds, etc.), prominent land marks, sensitive receptors, community severance, village settlements, agricultural lands, pasture and barren lands, various categories of CRZ areas, if any, etc.

   Among physical features, data should be collected related to geology, topography, soils, climate and meteorology (with emphasis on critical season considering water bodies and air quality), ambient air quality, surface and groundwater hydrology, existing sources of air emissions, existing water quality status of water bodies of importance, in addition to:

   1. Biological and ecological assessment covering water bodies, fauna & flora, ecologically sensitive areas (perceived as well as officially listed).
   2. Additional air and noise quality monitoring (based on the outcome of screening report) that may, in future, depict the baseline conditions for EMP monitoring.

   Critical areas of environmental importance should be identified while determining the current environmental status of the project site.

<u>Impact prediction</u>: The consultant should identify both the positive and negative impact of the proposed project, interpreting “environmental” throughout the EA to include socio-economic impact as well as impact on the natural environment. All project activities during pre-construction, construction and operation phases should be considered to assess the impact. In addition, the impact assessment analysis should necessarily cover the “no action” alternative. The consultants should

regularly interact with the project's technical and social team to share the findings of the impact assessment. The assessment of environmental impact should necessarily cover (but not limited to) the following:

(a) Impact on water bodies (including, but not limited to the impact on the water source proposed to be developed for the project in case of a water supply scheme) (OP 4.01, OP 4.04)

(b) Impact on topography and surface drainage

(c) Community and cultural severance, also physical cultural resources identified through consultations (OP 4.11)

(d) Expected impact on land use patterns at and around the proposed project facilities/components (OP 4.01)

(e) Impact on ecologically sensitive features including spawning areas in creeks/estuarine areas, etc (OP 4.04)

(f) Detailed assessment of impact on receiving water bodies (including source of water bodies and downstream impact on riparian rights)

(g) Assess the change of stream course due to diversion channels to construction intake structures and its impact on downstream users

(h) Socio-economic impact

(i) Noise- and air quality-related impact during construction period on sensitive receptors

(j) Impact on trees, forest area, public utilities and other community structures, cross-overs, impact from commercial plantation etc. (OP 4.36)

(k) Impact on Dam safety from the water withdrawal activity or a dam construction (OP/BP 4.37)

(l) Impact on possible potential increase of pesticide use from a new irrigation construction (OP 4.09).

(m) Any impact that is irreversible and/or cannot be avoided or mitigated

(n) **Climate change adaptation** (climate proofing) that should ensure that the desired developmental impact of the strategy or measure is not endangered despite the predicted effects of climate change. Moreover, the assessment should analyze whether the capacity for adaptation of the strategy or measure can be increased further. The assessment should cover the expected climate changes and their consequences for the strategy or measure, including both direct effects (e.g., more frequent flooding or drying out of water sources) and indirect effects. The analysis should also examine all possible effects on the project beyond its formal period; on this basis, options should be developed and implemented to increase the capacity of the project to adapt.

(o) Potential for **greenhouse gas reduction** (climate mitigation) to avoid substantial greenhouse gas emissions. First, the expected development of greenhouse gases in the project area/sector should be assessed; this should be followed by a review of the planned strategies or measures for their contribution to greenhouse gas emissions and an assessment of greenhouse gas reduction potential. On this basis, options for greenhouse gas reduction should be developed, (also taking into account the developmental impact, if applicable).

5.0 Environmental management plan

The EMP should suggest ways / options to mitigate the negative impact of the project, and the preventive measures necessary. Wherever required, the EMP should reflect community consensus on the mitigation measures proposed. It should identify the means / agency responsible for implementation and recommend a suitable monitoring mechanism for the plan. The EMP should be in the form of contract covenants and should provide detailed cost estimates (converted into BOQ items wherever necessary and applicable for implementation). The consultant should also recommend an appropriate institutional mechanism as per the requirements of EMP.

This should be applicable for both generic EMPs and specific EMPs developed from detailed EAs.

The consultant should prepare a detailed EMP covering the measures to mitigate and/or minimize the negative impact, including the implementation arrangement and a monitoring plan for the same with site specific requirements. The EMP should include:

- Management / mitigation / enhancement measures:

(i) The consultant should recommend measures to eliminate or mitigate every significant negative impact. If any impact cannot be avoided, the cost of damage arising from it should be estimated and adequate compensatory measures recommended.

(ii) Consultants should recommend all necessary measures that have to be incorporated in the design to attain energy efficiency, enable reuse of treated water, control water leakage, energy generation etc.

(iii) The cost (capital and recurring) of all mitigation measures and the parties responsible for their implementation should be clearly identified; the cost should be translated into BOQ items. Wherever possible, the measures should be drafted as contract clauses that can be incorporated into construction/operational phase agreements

(iv) The mitigation measures should contain conceptual designs wherever necessary. The consultants should also identify neighbourhood committees to supervise effective implementation of the proposed mitigation measures.

- Landscape plan: Wherever necessary, the landscaping plan should meet all project-specific requirements and should be prepared keeping in mind the project area as a whole; the EA should provide a conceptual landscape plan for all project components while taking into account special environmental and social needs.
- Budget estimates: EMP budget estimates should be prepared for each of the project components and integrated with overall project cost estimates; the relevant costs should be included in the BOQ provisions
- Monitoring plan: The consultant should specify the types of monitoring needed for potential environmental impact during construction and operation. As in the case of the mitigation plan, the requirements should be specific as to what is to be monitored, and how and by whom, along with reporting formats and recommendations. Where monitoring reports are to be prepared, the recipient responsible for review and any corrective action should be identified. The monitoring plan should be supplemented with a detailed schedule of implementation of EMP measures.

- Institutional arrangement to manage environment impact effectively: The consultants should identify institutional/organizational needs to implement the recommendations of the project EA and propose steps to strengthen or expand, if required. This may extend to new agency functions, inter-sectorial arrangements, management procedures and training, staffing, operation and maintenance, training and budgeting.

6.0 Public disclosure

The consultants should assist the SGs in meeting disclosure requirements, which, at the minimum, should meet the EFA's policy on public disclosure. The consultants have to prepare a plan for in-country disclosure, specifying the timing and locations; translate the key documents, such as the EA summary in Bahasa Indonesia; draft the newspaper announcements for disclosure; and help the SGs to place the EA reports on the SGs's website.

The consultants should prepare an executive summary of the draft EA report in both English and Hindi for public disclosure. In addition, for A projects, they should provide, for initial consultation, a summary of the proposed project's objectives, its description, and its potential impact and a summary of the EA's conclusions after the draft EA report is prepared.

7.0 Inputs to be provided by the SGs

The SGs should make available all relevant documents and reports in connection to the project area/study area and enable the consultants to procure data.

8.0 Outputs and estimated time schedule

The study should be completed within a period of ____ months from date of the contract and the schedule of deliverables should be as specified below.

- Inception report - within __ month of date of award of contract; includes initial site assessment
- Interim report - within __ months of date of award of contract. Includes baseline parameters, environmental profile and analysis of level of impact, stakeholders' consultation.
- Draft report - within __ months of date of award of contract

This includes detailed EA and/or site-specific EMP climate assessment and adaptation and mitigation measures, and social assessment.

- Final report - within xx months of date of award of contract.

Annex 3. **Contents of an Environmental Management Plan**

1. A project's environmental management plan (EMP) consists of the set of mitigation, monitoring, and institutional measures to be taken during implementation and operation to eliminate adverse environmental and social impact, offset them, or reduce them to acceptable levels. The plan also includes the actions needed to implement these measures.[8] Management plans are essential elements of EA reports for Category A projects; for many Category B projects, the EA may result in a management plan only. To prepare a management plan, the SGs and its EA design team (a) identify the set of responses to potentially adverse impact; (b) determine requirements for ensuring that those responses are made effectively and in a timely manner; and (c) describe the means for meeting those requirements.[9] More specifically, the EMP includes the following components.

Mitigation

2. The EMP identifies feasible cost-effective measures that may reduce potentially significant adverse environmental impact to acceptable levels. The plan includes compensatory measures if mitigation measures are not feasible, cost-effective, or sufficient. Specifically, the EMP

(a) identifies and summarizes all anticipated significant adverse environmental impacts (including those involving indigenous people or involuntary resettlement);

(b) describes--with technical details--each mitigation measure, including the type of impact to which it relates and the conditions under which it is required (e.g., continuously or in the event of contingencies), together with designs, equipment descriptions, and operating procedures, as appropriate;

(c) estimates any potential environmental impact of these measures; and

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[8]*The management plan is sometimes known as an "action plan." The EMP may be presented as two or three separate plans covering mitigation, monitoring, and institutional aspects, depending on borrowing country requirements.*

[9]*For projects involving rehabilitation, upgrading, expansion, or privatization of existing facilities, remediation of existing environmental problems may be more important than mitigation and monitoring of expected impacts. For such projects, the management plan focuses on cost-effective measures to remediate and manage these problems.*

(d) Provides linkage with any other mitigation plans (e.g., for involuntary resettlement, indigenous peoples, cultural property or other social impacts such as potential issues of violence against women and children resulting from influx of workers in communities in the subproject area etc.) required for the project.

Monitoring

3. Environmental monitoring during project implementation provides information about key environmental aspects of the project, particularly its environmental impact, and the effectiveness of mitigation measures. Such information enables the SGs and the Bank to evaluate the success of mitigation as part of project supervision, and allows corrective action to be taken when needed. Therefore, the EMP identifies monitoring objectives and specifies the type of monitoring, with linkages to the impact assessed in the EA report and the mitigation measures described in the EMP. Specifically, the monitoring section of the EMP provides (a) a specific description, and technical details, of monitoring measures, including the parameters to be measured, methods to be used, sampling locations, frequency of measurements, detection limits (where appropriate), and definition of thresholds that will signal the need for corrective actions; and (b) monitoring and reporting procedures to (i) ensure early detection of conditions that necessitate particular mitigation measures, and (ii) furnish information on the progress and results of mitigation.

Capacity Development and Training

4. To support timely and effective implementation of environmental project components and mitigation measures, the EMP draws on the EA's assessment of the existence, role, and capability of environmental units on site or at the agency and ministry level.3[10] If necessary, the EMP recommends the establishment or expansion of such units, and the training of staff, to allow implementation of EA recommendations. Specifically, the EMP provides a specific description of institutional arrangements - who is responsible for carrying out the mitigation and monitoring measures (e.g., for operation, supervision, enforcement, monitoring of implementation, remedial action, financing, reporting, and staff training). To

[10] *For projects having significant environmental implications, it is particularly important that there be in the implementing ministry or agency an in-house environmental unit with adequate budget and professional staffing strong in expertise relevant to the project (for projects involving dams and reservoirs, see BP 4.01, annexure B).*

strengthen environmental management capability in the agencies responsible for implementation, most EMPs cover one or more of the following additional topics: (a) technical assistance programs, (b) procurement of equipment and supplies, and (c) organizational changes.

Implementation Schedule and Cost Estimates

5. For all three aspects (mitigation, monitoring, and capacity development), the EMP provides (a) an implementation schedule for measures that must be carried out as part of the project, showing phasing and coordination with overall project implementation plans; and (b) the capital and recurrent cost estimates and sources of funds for implementing the EMP. These figures are also integrated into the total project cost tables.

Integration of EMP with Subproject

6. The SGs' decision to proceed with a subproject and the Bank's decision to support it are predicated in part on the expectation that the EMP will be executed effectively. Consequently, the Bank expects the plan to be specific in its description of the individual mitigation and monitoring measures and its assignment of institutional responsibilities, and it must be integrated into the project's overall planning, design, budget, and implementation. Such integration is achieved by establishing the EMP within the project so that the plan will receive funding and supervision along with the other components.

1. ENVIRONMENTAL MANAGEMENT PLAN – WATER SUPPLY PROJECTS

Sl.no	Potential Negative Impacts	Mitigation Measures	Time frame	Responsible agencies
	PRE-CONSTRUCTION STAGE			
1	Clearances	All clearance required for Environmental aspects during construction shall be ensured and made available before start of work.	Before construction	Subnational Government / Concerned Departments & agency / Contractor
2	Tree Cutting	i. Try to save the trees by changing	Pre-	Contractor

Sl.no	Potential Negative Impacts	Mitigation Measures	Time frame	Responsible agencies
		the alignment ii. Provide adequate protection to the trees to be retained with tree guards (e.g. Masonry tree guards, Low level RCC tree guards, Circular Iron Tree Guard with Bars) as required. iii. Identify the number of trees that will be affected with girth size & species type along the sewer mains, pumping / lifting station sites and sewerage treatment plant site. The details to be indicated in a strip map plan. iv. Trees shall be removed from the construction sites before commencement of construction with prior permission from the concerned department. v. Undertake afforestation in nearby areas. vi. Compensatory plantation by way of Re-plantation of at least twice the number of trees cut should be carried out in the project area.	construction & construction phase	
3	Utility Relocation	i. Identify the common utilities to be affected such as: telephone cables, electric cables, electric poles, water pipelines, public water taps, etc. ii) Affected utilities shall be relocated with prior approval of the concerned agencies before construction starts.	Pre-construction & construction phase	Concerned departments
4	Baseline parameters	Adequate measures shall be taken and checked to control the Baseline parameters of Air, Water and Noise pollution. Base line parameters shall be recorded and ensured conformance till	Pre-construction, construction and post-construction	Prospective contractor

Sl.no	Potential Negative Impacts	Mitigation Measures	Time frame	Responsible agencies
		the completion of the project.	phase	
5	Planning of temporary Traffic arrangements	i. Temporary diversion will be provided with the approval of the engineer. Detailed traffic control plans will be prepared and submitted to the engineers for approval, one week prior to commencement of works. ii. The traffic control plans shall contain details of temporary diversion, details of arrangements for construction under traffic, details of traffic arrangement after cessation of work each day, signages, safety measures for transport of hazardous materials and arrangement of flagmen.	Pre-construction & construction phase	Prospective contractor
6	Disposal of waste water.	i. The waste water quality shall comply with the regulatory standards to let out into the stream / water channels /open land /irrigation purposes, and necessary permission to be obtained from the concerned department. ii) Ensure efficient working condition of treatment plant.	Pre-construction & construction phase	Subnational Government
7	Storage of materials	The contractor shall identify the site for temporary use of land for construction sites /storage of construction materials, etc.	Pre-construction & construction phase	Prospective contractor
8	Construction of labour camps	Contractor shall follow all relevant provisions of the Best Practice Management of the Construction Workers. The location, layout and basic facility provision of each labour camp will be	During the construction	Prospective contractor

Sl.no	Potential Negative Impacts	Mitigation Measures	Time frame	Responsible agencies
		submitted to Engineer prior to their construction. The construction will commence only upon the written approval of the Engineer.		
		The contractor shall maintain necessary living accommodation and ancillary facilities in functional and hygienic manner and as approved by the Engineer. All temporary accommodation must be constructed and maintained in such a fashion that uncontaminated water is available for drinking, cooking and washing. The sewage system for the camp must be planned. Adequate health care is to be provided for the work force. The layout of the construction camp and details of the facilities provided should be prepared and shall be approved by the engineer.		

CONSTRUCTION & OPERATION PHASE MITIGATION MEASURES

No.	Systems / Impacts	Action to be taken	Responsible agencies	Time frame for implementation
1	**Water Head Works**			
1.1	Change of stream course due to diversion channels to construct intake structures	No appreciable change to the stream course shall occur due to diversion channel and intake structures shall be constructed accordingly.	Prospective contractor	Design, construction and operation
1.2	Disposal of construction debris and excavated materials.	A suitable site should be identified for safe disposal, in relatively low lying areas, away from the water bodies etc., and got approved by the Engineer.	Prospective contractor	Pre-construction and operation.
1.3	Disposal of oil and	A suitable site should be identified for safe disposal / without contaminating the	Prospective contractor/	Pre-construction and operation.

No.	Systems / Impacts	Action to be taken	Responsible agencies	Time frame for implementation
	grease	source, in relatively low lying areas, away from the water bodies etc., as approved by the Engineer & as per specific procedures.	proponent	
1.4	Downstream users (impacts arising due to coffer dams, etc.)	Ensure that the stream is not obstructed, affecting the downstream users due to coffer dams, etc.	Prospective contractor	Design, construction and operation
1.5	Water quality in the source / water bodies	Establish the baseline water quality prior to initiation of construction and to be periodically monitored and report sent to the Engineer.	Prospective contractor / Proponent	Pre-construction and Construction
1.6	Restoring river bed / water source	Ensure the restoring of river bed to its natural shape free from any debris or construction junk material that may obstruct the flow.	Prospective contractor / Proponent	construction and operation
1.7	Safety measures	i. Barricading of construction site / manholes at all times in a day with adequate signage. ii. Where loose soil is met with, shoring and strutting shall be provided to avoid collapse of soil. iii. The contractor shall supply all necessary safety appliances such as safety goggles, helmets, safety belts, ear plugs, mask etc. to workers and staff.	Prospective contractor / Proponent	construction and operation

2.	Construction of Transmission Mains		Responsible agencies	Time frame for implementation
2.1	Shifting of common utilities	Ensure community consensus and minimum impact to common utilities like telephone cable, electric cables, electric poles, water taps and etc., Proper clearance to be obtained from the concerned	Pre-construction &construction phase	Concerned departments / SGs

2.	**Construction of Transmission Mains**		**Responsible agencies**	**Time frame for implementation**
		authorities and sent to the SGs before commencement of works.		
2.2	Compensatory plantation of trees	Compensatory plantation of at least twice the number trees felled should be done in line with competent authority guidelines	Pre-construction and Construction	Prospective contractor / proponent
2.3	Disposal of construction debris and excavated materials.	The contractor shall identify the sites for debris disposal and should be finalized prior to start of the earthworks; taking into account the following (a) The dumping does not impact natural drainage courses (b) no endangered / rare flora is impacted by such dumping (c) Settlement area located at least 1.0 km away from the site. (d) Should be located in non-residential areas located in the downwind side (e) Located at least 100m from the designated forest land. (f) Avoid disposal on productive land. (g) should be located with the consensus of the local community , in consultation with the engineer and shall be approved by the highways department (h) Minimize the construction debris by balancing the cut and fill requirements	Pre-construction and operation	Prospective contractor / proponent
2.4	Protection of top soil	The top soil to be protected and compacted after completion of work, where the pipelines run, including open lands and agricultural lands.	SGs / Prospective contractor	Construction and operation
2.5	Laying of pipeline	Adequate precautions should be taken while laying the water supply	During construction	Prospective contractor

2.	Construction of Transmission Mains		Responsible agencies	Time frame for implementation
		mains to avoid the possibility of cross connection with sewer lines.		
2.6	Traffic diversion	Before taking up of construction activity, a Traffic Control Plan shall be devised and implemented to the satisfaction of the Engineer. Construction shall be taken phase – wise so that sections are available for traffic. Temporary diversion will be provided with the approval of the engineer. The Detailed traffic control plans prepared and submitted to the engineers for approval one week prior to commencement of works shall contain details of temporary diversion, details of arrangements for construction under traffic, details of traffic arrangement after cessation of work each day, signages, safety measures for transport of hazardous materials and arrangement of flagmen. The arrangement for the temporary diversion of the land shall ensure to minimize the environmental impacts, like loss of vegetation, productive lands etc., prior to the finalization of diversion and detours. Special consideration will be given to the preparation of the traffic control plan for safety of pedestrians and workers at night. The contractor will ensure that the diversion / detour is always maintained in running condition, particularly during the monsoon to	During pre-construction and construction	Prospective contractor / SGs

2.	Construction of Transmission Mains		Responsible agencies	Time frame for implementation
		avoid disruption to traffic flow. He shall inform local community of changes to traffic routes, conditions and pedestrians access arrangements. This plan will be periodically reviewed with respect to site conditions. The temporary traffic detour will be kept free of dust by frequent application of water.		
2.7	Temporary flooding due to excavation.	Proper drainage arrangements to be made, to avoid the overflowing of existing drains due to excavation during the laying of sewer mains.	During construction	Prospective contractor / SGs
2.8	Using of modern machineries	Using of modern machineries such as backhoes etc., shall be used to minimize the construction period, it will reduce the construction period impacts to the nearby residents.	During construction	Prospective contractor
2.9	Prevention of accidents	Prevention of accidents involving human beings, animals or vehicles falling or accidents due to open trenches/manholes during construction period. This needs to be ensured with proper signage and barricading.	Construction and operation	SGs / Prospective contractor
2.10	Barricading site	The construction site should be barricaded at all time in a day with adequate marking, flags, reflectors etc. for safety of general traffic movement and pedestrians.	During construction	Prospective contractor
2.11	Dust Pollution near settlements	(i) All earth work will be protected in manner acceptable to the engineer to minimize generation of dust. Area under construction shall be covered & equipped will dust collector. (ii) Construction material shall be covered or stored in such a manner so as to avoid being	During construction	Prospective contractor

2.	Construction of Transmission Mains		Responsible agencies	Time frame for implementation
		affected by wind direction. iii) Unpaved haul roads near / passing through residential and commercial areas to be watered thrice a day. (iii) Trucks carrying construction material to be adequately covered to avoid the dust pollution and to avoid the material spillage		
2.12	Protection of residential / sensitive receptors.	(i) Noisy construction operations in residential and sensitive areas should be done only between 7.30 am and 6.00 pm. (ii) Preventive maintenance of construction equipment and vehicles to meet emission standards and to keep them with low noise. (iii) Provision of enclosing generators and concrete mixers at site. (iv) Sound barriers in inhabited areas shall be installed during the construction phase. (v) Adequate barricading / other measures to protect dust pollution near sensitive receptors like schools and hospital etc. to be ensured.	During construction	Prospective contractor / SGs
2.13	Vehicular noise pollution at residential / sensitive receptors.	(i) Idling of temporary trucks or other equipment should not be permitted during periods of loading / unloading or when they are not in active use. The practice must be ensured especially near residential / commercial / sensitive areas. (ii) Stationary construction	During construction	Prospective contractor / SGs

2.	Construction of Transmission Mains		Responsible agencies	Time frame for implementation
		equipment will be kept at least 500m away from sensitive receptors. (iii) All possible and practical measures to control noise emissions during drilling shall be employed. The SGs may direct to take adequate controls measures depending on site conditions.		
2.14	Noise from vehicles, plants a equipment	(i) Servicing of all construction vehicles and machinery will be done regularly and during routine servicing operations, the effectiveness of exhaust silencers will be checked and if found defective will be replaced. (ii) Maintenance of vehicles, equipment and machinery shall be regular and up to the satisfaction of the Engineer to keep noise levels at the minimum.	During construction	Prospective contractor / SGs
2.15	Storage of construction materials	Site for storage of pipes and construction materials to be identified, without affecting the traffic and other common utilities.	Prospective contractor	During construction
2.16	Storage Of chemicals and other hazardous materials	(i) A suitable site should be identified for the safe storage and handling of chemicals and other hazardous materials with proper display of requirements and marking as protected area. (ii) Providing specific appliances for safe working of personnel in critical areas like chlorination plant shall be ensured.	During construction and operation	Prospective contractor /respective operating agency
2.17	Labour camp &facilities	Setting up of labour camps needs to be done as per the procedures.	Pre-construction	Perspective contractor /

2.	Construction of Transmission Mains		Responsible agencies	Time frame for implementation
		Adequate potable water facilities, sanitation and drainage etc., in conformity with the Indonesian labour laws shall be ensured. The contractor shall also guarantee the following: (i) The location, layout and basic facility provision of each labour camp will be submitted to Engineer prior to their construction. (ii) The construction will commence only upon the written approval of the Engineer. (iii) The Contractor shall construct and maintain all labour accommodation in such a fashion that uncontaminated water is available for drinking, cooking and washing. (iv) Supply of sufficient quantity of potable water as per Indonesian standards in every workplace/labour camp site at suitable and easily accessible places and regular maintenance of such facilities. (v) The sewage system for the camp shall be designed, built and operated in such a fashion that no health hazards occurs and no pollution to the air, ground water or adjacent water courses take place. Ensure adequate water supply is to be provided in all toilets and urinals.	and construction	SGs
2.18	Waste	(i) The contractor shall provide	During	Prospective

2.	Construction of Transmission Mains		Responsible agencies	Time frame for implementation
	Disposal	garbage bins in the camps and ensure that these are regularly emptied and disposed of in a hygienic manner as per the Comprehensive Solid Waste Management Plan approved by the Engineer. (ii) Unless otherwise arranged by local sanitary authority, arrangements for disposal of night soils (human excreta) suitably approved by the local medical health or municipal authorities or as directed by Engineer will have to be provided by the contractor.	Construction	contractor
2.19	Clearing of construction camps and restoration	(i) Contractor to prepare site restoration plans, the plan is to be implemented by the contractor prior to demobilization. (ii) On completion of the works, all temporary structures will be cleared away, all rubbish cleared, excreta or other disposal pits or trenches filled in and effectively sealed off and the site left clean and tidy, at the contractor's expenses, to the entire satisfaction of the engineer.	Post construction	Prospective contractor
2.20	Pollution from Construction Wastes	The Contractor shall take all precautionary measures to prevent the wastewater generated during construction (e.g. during the testing of pipeline) from entering into streams, water bodies or the irrigation system. All waste arising from the project is to be disposed of in the manner that	During Construction and post-construction	Prospective contractor / SGs

2.	Construction of Transmission Mains		Responsible agencies	Time frame for implementation
		is acceptable by the Engineer. The engineer shall certify that all liquid wastes disposed of from the sites meet the discharge standard.		
2.21	Pollution from Fuel and	(i) The contractor shall ensure that all construction vehicle parking location, fuel/lubricants storage sites, vehicle, machinery and equipment maintenance and refuelling sites will be located at least 500 m from rivers and irrigation canal/ponds. ii) All location and lay-out plans of such sites shall be submitted by the Contractor prior to their establishment and will be approved by the Engineer. (ii) Contractor shall ensure that all vehicle/machinery and equipment operation, maintenance and refuelling will be carried out in such a fashion that spillage of fuels and lubricants does not contaminate the ground. (iii) Contractor shall arrange for collection, storing and disposal of oily wastes to the pre-identified disposal sites (list to be submitted to Engineer) and approved by the Engineer. All spills and collected petroleum products will be disposed off in accordance with MoF and state pollution control agency guidelines. (iv) Engineer will certify that all arrangements comply with the guidelines of the pollution control agency/ MoF or any	Construction and operation	SGs / Prospective contractor

2.	Construction of Transmission Mains		Responsible agencies	Time frame for implementation
		other relevant laws.		
2.22	Safety Aspects	(i) Adequate precautions shall be taken to prevent the accidents and from the machineries. All machines used shall confirm to the relevant Indonesian standards Code and shall be regularly inspected by the SGs. (ii) Where loose soil is met with, shoring and strutting shall be provided to avoid collapse of soil. (iii) Protective footwear and protective goggles to all workers employed on mixing of materials like cement, concrete etc. (iv) iii) Welder's protective eye-shields shall be provided to workers who are engaged in welding works. (v) Earplugs shall be provided to workers exposed to loud noise, and workers working in crushing, compaction, or concrete mixing operation. (vi) The contractor shall supply all necessary safety appliances such as safety goggles, helmets, safety belts, ear plugs, mask etc. to workers and staffs. The contractor will comply with all the precautions as required for ensuring the safety of the workmen as per the International Labour Organization (ILO) Convention No. 62 as far as those are applicable to this contract. The contractor will make sure that during the construction work all	During construction	Prospective contractor

2.	**Construction of Transmission Mains**		**Responsible agencies**	**Time frame for implementation**
		relevant provisions of the Factories Act, 1948 and the Building and other Construction Workers (regulation of Employment and Conditions of Services) Act, 1996 are adhered to. The contractor shall not employ any person below the age of 14 years for any work and no woman will be employed for painting with products containing lead in any form.		
2.23	Risk from Electrical Equipment(s)	The Contractor shall take all required precautions to prevent danger from electrical equipment and ensure that - (i) No material will be so stacked or placed as to cause danger or inconvenience to any person or the public. (ii) All necessary fencing and lights will be provided to protect the public in construction zones. All machines to be used in the construction will conform to the relevant Indonesian Standards (IS) codes, will be free from patent defect, will be kept in good working order, will be regularly inspected and properly maintained as per IS provision and to the satisfaction of the Engineer	During construction	Prospective contractor
2.24	First Aid	The contractor shall arrange for: (i) A readily available first aid unit including an adequate supply of sterilized dressing materials and appliances as per the Factories Rules in every work zone (ii) Availability of suitable transport	During construction	Prospective contractor

2.	Construction of Transmission Mains		Responsible agencies	Time frame for implementation
		at all times to take injured or sick person(s) to the nearest hospital		

3.	Water Treatment Plant / Booster stations		Responsible agencies	Time frame for implementation
3.1	Tree cutting	Try to save the trees by changing the alignment and provide adequate protection to the trees with tree guards as required. Such as Masonry tree guards, Low level RCC tree guards, Circular Iron Tree Guard with Bars, etc.	Pre-construction and Construction	SGs / Prospective contractor
3.2	Compensatory plantation of trees	Compensatory plantation of at least twice the number of trees felled should be done in line with competent authority guidelines.	Pre-construction and Construction	Prospective contractor / SGs
3.3	Protection of top soil & Environmental enhancing	The top soil to be protected and compacted after completion of work. Top soil from the water treatment plant area should be stored in stock piles and that can be used for gardening purposes at water treatment plant site which will be an environmental enhancing measure.	SGs/ Prospective contractor	During construction
3.4	Disposal of construction debris and excavated materials.	A suitable site should be identified for safe disposal, in relatively low lying areas, away from the water bodies, residential and agricultural fields etc., and got approved by the Engineer. Care should be taken that dumped material does not affect natural drainage system.	SGs / Prospective contractor	During construction
3.5	Pollution from Fuel and Lubricants	i) The contractor shall ensure that all construction vehicle parking location, fuel/lubricants storage sites, vehicle, machinery and	Construction and operation.	Prospective contractor / SGs

3.	Water Treatment Plant / Booster stations		Responsible agencies	Time frame for implementation
		equipment maintenance and refuelling sites will be located at least 500 m from rivers and irrigation canal/ponds. ii) All location and lay-out plans of such sites shall be submitted by the Contractor prior to their establishment and will be approved by the Engineer. iii) Contractor shall ensure that all vehicle/machinery and equipment operation, maintenance and refuelling will be carried out in such a fashion that spillage of fuels and lubricants does not contaminate the ground. iv) Contractor will arrange for collection, storing and disposal of oily wastes to the pre-identified disposal sites (list to be submitted to Engineer) and approved by the Engineer. All spills and collected petroleum products will be disposed off in accordance with environment department and pollution control agency guidelines. Engineer will certify that all arrangements comply with the guidelines of environment department or pollution control agency or any other relevant laws.		
3.6	Pollution from Construction Wastes	The Contractor shall take all precautionary measures to prevent the wastewater generated during	During Construction	Prospective contractor / SGs

3.	Water Treatment Plant / Booster stations		Responsible agencies	Time frame for implementation
		construction from entering into streams, water bodies or the irrigation system. All waste arising from the project is to be disposed off in the manner that is acceptable by the Engineer.		
3.7	Storage of chemicals and other hazardous materials	i) A suitable site should be identified / construct for the safe storage and handling of chemicals and other hazardous materials with proper Display of requirements and marking as protected area. ii) Providing specific appliances for safe working of personnel in critical areas like chlorination plant shall be ensured.	During construction and operation	Prospective contractor / respective operating agency
3.8	Disposal of sludge	A suitable site should be identified for the safe disposal of sludge generated at the WTP site and got approved by the Engineer. Prepare a sludge disposal plan and adheres to the same.	Pre-construction / construction and operation stage	SGs Prospective contractor
3.9	Information Signs and Hoardings	The contractor shall provide, erect and maintain information/safety signs, hoardings written in English and Bahasa Indonesia, wherever required or as suggested by the Engineer.	During construction	Prospective contractor / SGs
3.10	Risk from Electrical Equipment	The Contractor shall take all required precautions to prevent danger from electrical equipment and ensure that - i) No material will be so stacked or placed as to cause danger or inconvenience to any person or the public. ii) All necessary fencing and lights will be provided to protect the	During construction	Prospective contractor

3.	Water Treatment Plant / Booster stations		Responsible agencies	Time frame for implementation
		public in construction zones. All machines to be used in the construction will conform to the relevant Indonesian Standards (IS) codes, will be free from patent defect, will be kept in good working order, will be regularly inspected and properly maintained as per IS provision and to the satisfaction of the Engineer.		
3.11	Labour camp & facilities	Setting up of labour camps needs to be done as per the procedures. Adequate potable water facilities, sanitation and drainage etc., in conformity with the Indonesian labour laws shall be ensured. The contractor shall also guarantee the following: i) The location, layout and basic facility provision of each labour camp will be submitted to Engineer prior to their construction. ii) The construction will commence only upon the written approval of the Engineer. iii) The Contractor shall construct and maintain all labour accommodation in such a fashion that uncontaminated water is available for drinking, cooking and washing. iv) Supply of sufficient quantity of potable water (as per IS) in every workplace/labour camp site at suitable and easily accessible places and regular maintenance of such facilities. v) The sewage system for the camp	During Pre - construction and construction	Perspective contractor / SGs

3.	Water Treatment Plant / Booster stations		Responsible agencies	Time frame for implementation
		are designed, built and operated in such a fashion that no health hazards occurs and no pollution to the air, ground water or adjacent water courses take place. Ensure adequate water supply is to be provided in all toilets and urinals.		
3.12	Safety Aspects	i) Adequate precautions shall be taken to prevent the accidents and from the machineries. All machines used shall confirm to the relevant Indonesian standards Code and shall be regularly inspected by the SGs. ii) Where loose soil is met with, shoring and strutting shall be provided to avoid collapse of soil. iii) Protective footwear and protective goggles to all workers employed on mixing of materials like cement, concrete etc. iv) Welder’s protective eye-shields shall be provided to workers who are engaged in welding works. v) Earplugs shall be provided to workers exposed to loud noise, and workers working in crushing, compaction, or concrete mixing operation. vi) The contractor shall supply all necessary safety appliances such as safety goggles, helmets, safety belts, ear plugs, mask etc. to workers and staffs. vii) The contractor will comply with all the precautions as required for ensuring the safety of the workmen as per the International	During construction	Prospective contractor

3.	Water Treatment Plant / Booster stations		Responsible agencies	Time frame for implementation
		Labour Organization (ILO) Convention No. 62 as far as those are applicable to this contract. viii) The contractor will make sure that during the construction work all relevant provisions of the Factories Act, 1948 and the Building and other Construction Workers (regulation of Employment and Conditions of Services) Act, 1996 are adhered to. ix) The contractor will not employ any person below the age of 14 years for any work and no woman will be employed on the work of painting with products containing lead in any form.		
3.13	First Aid	The contractor shall arrange for : i) A readily available first aid unit including an adequate supply of sterilized dressing materials and appliances as per the Factories Rules in every work zone ii) Availability of suitable transport at all times to take injured or sick person(s) to the nearest hospital	During construction	Prospective contractor

4	Distribution Network and OHTs		Time frame	Responsible agencies
4.1	Shifting of community utilities	Pre-construction and Construction	Prospective contractor	Pre-construction and Construction
4.2	Laying of distribution pipelines	i) During construction	Prospective contractor	During construction

4.3	Using of modern machineries	During construction	Prospective contractor	During construction
4.4	Disposal of construction debris and excavated materials.	i) A suitable site should be identified for safe disposal, in relatively low lying areas, away from the water bodies, residential and agricultural fields etc., and got approved by the Engineer. ii) Care should be taken that dumped material does not affect natural drainage system. iii) Minimize the construction debris by balancing the cut and fill requirements. iv) All vehicles delivering material to the site shall be covered to avoid material spillage.	During construction	Prospective contractor
4.5	Dust Pollution near settlements	i) Unpaved haul roads near / passing through residential and commercial areas to be watered thrice a day. ii) Trucks carrying construction material to be adequately covered to avoid the dust pollution and to avoid the material spillage	During construction	Prospective contractor
4.6	Vehicular noise pollution at residential / sensitive receptors.	i) Idling of temporary trucks or other equipment should not be permitted during periods of loading / unloading or when they are not in active use. The practice must be ensured especially near residential / commercial / sensitive areas. ii) Construction activity induced noise level shall be mitigated at the residential and sensitive receptors. The Contractor shall employ mitigation	During construction	Prospective contractor

		measures as directed by the SGs. iii) Stationary construction equipment will be kept at least 500m away from sensitive receptors. iv) All possible and practical measures to control noise emissions during drilling shall be employed. The SGs may direct to take adequate controls measures depending on site conditions.		
4.7	Protection of residential / sensitive receptors.	i) Noisy construction operations in residential and sensitive areas should be restricted between 7.30 am and 6.00 pm. ii) Preventive maintenance of construction equipment and vehicles to meet emission standards and to keep them with low noise. iii) Provision of enclosing generators and concrete mixers at site. iv) Sound barriers in inhabited areas shall be installed during the construction phase. v) Adequate barricading / other measures to protect dust pollution near sensitive receptors like schools and hospital etc. to be ensured.	During construction	Prospective contractor
4.8	Barricading site	The construction site should be barricaded at all time in a day with adequate marking, flags, reflectors etc. for safety of general traffic movement and pedestrians	During construction	Prospective contractor
4.9	Safety Aspects	i) Adequate precautions shall be taken to prevent the accidents and from the machineries. All	During construction	Prospective contractor

		machines used shall confirm to the relevant Indonesian standards Code and shall be regularly inspected by the SGs. ii) Provide temporary crossing / bridges wherever necessary to facilitate normal life and business iii) Where loose soil is met with, shoring and strutting shall be provided to avoid collapse of soil. iii) The contractor shall supply all necessary safety appliances such as safety goggles, helmets, safety belts, ear plugs, mask etc. to workers and staffs. iv) A readily available first aid unit including an adequate supply of sterilized dressing materials and appliances as per the Factories Rules in every work zone vi) Availability of suitable transport at all times to take injured or sick person(s) to the nearest hospital		

5.0	**Environmental enhancement and special issues:**		**Implementing Agency**	**Location**
5.1	Flora and Chance found Fauna	The contractor will take reasonable precaution to prevent his workmen or any other persons from removing and damaging any flora (plant/vegetation) and fauna (animal) including fishing in any water body and hunting of any animal. If any wild animal is found near the construction site at any point of time, the contractor will immediately upon discovery thereof acquaint the Engineer and	Prospective contractor	Project area

		carry out the Engineer's instructions for dealing with the same. The Engineer will report to the nearby forest office (range office or divisional office) and will take appropriate steps/ measures, if required in consultation with the forest officials.		
5.2	Chance Found Archaeological Property	All fossils, coins, articles of value of antiquity, structures and other remains or things of geological or archaeological interest discovered on the site shall be the property of the Government and shall be dealt with as per provisions of the relevant legislation. The contractor will take reasonable precautions to prevent his workmen or any other persons from removing and damaging any such article or thing. He will, immediately upon discovery thereof and before removal acquaint the Engineer of such discovery and carry out the SC's instructions for dealing with the same, waiting which all work shall be stopped. The Engineer will seek direction from the appropriate direction frombefore instructing the Contractor to recommence the work in the site.	Prospective contractor	Project area
5.3	Monitoring of environment parameters	The contractor shall undertake seasonal monitoring of air, water, and noise and soil quality through an approved monitoring agency. The parameter to be monitored, frequency and duration of monitoring plan shall be prepared	Prospective contractor	Corridor of Impact
5.4	Sensitive Areas	The sensitive areas like Schools,	Prospective	Corridor of

		hospitals to be provided with suitable noise barriers and safety measures, prior to the start of work in order to minimize the dust and noise impacts due to vehicle movement during construction and their effectiveness to be checked during operation phase.	contractor	Impact
5.5	Clearing of construction of camps and restoration	Contractor to prepare site restoration plans for approval by the engineer. The plan is to be implemented by the contractor prior to demobilization. On completion of the works, all temporary structures will be cleared away, all rubbish cleared, excreta or other disposal pits or trenches filled in and effectively sealed off and the site left clean and tidy, at the contractor's expenses, to the entire satisfaction of the engineer.	Prospective contractor	All construction workers camps
5.6	Tree Protection, Tree Planting,	▪ Giving due protection to the trees that fall in the shoulders /corridor of impact shall be the prime focus during Construction/post construction ▪ Masonry tree guards, Low level RCC tree guards, Circular Iron Tree Guard with Bars, use of plate compactors near trees may also be considered where necessary ▪ Re-plantation of at least twice the number of trees cut should be carried out along the project road. Since the major portion of the project road may pass through open lands, planting of trees along the entire stretch of the road is recommended as an enhancement measure.	Concerned agency/Contractor / SGs	All tree plantation / greenery areas of the project

		▪ Growth and survival of trees planted shall be ensured and monitoring done at least for a period of 3 years .Survival status shall be reported on monthly basis to Engineer in-charge.		
5.7	Other Potential Social Impacts (e.g. violence against women and children resulting from influx of workers in communities in the subproject area)	▪ The contractor shall engage security personnel to undertake seasonal monitoring and inspection of the workers camp and also the construction site ▪ Zero tolerance of violence against this aspect.	During Contractor	Contractor

S.no	Activity/ Issue	Management Measures	Responsible agencies	Monitoring agencies
	OPERATION PHASE			
1	Flooding of the downstream areas; soil erosion; water logging of low-lying areas etc.	Ensure proper technical design of the storage reservoir to minimize seepage and chances of possible failure of the structure.	Contractor	Public work agency
2	Increase moisture content in soil, which affects the structures/found at ion of buildings in nearby areas.	Ensure proper site selection. Ensure proper design, construction and operation of the structure and system to minimize seepage and appropriate implementation techniques. In case of failure of nearby building structures / foundations, monetary compensation shall be provided	Design Consultant, Contractor and SGs	Public work agency
3	Wastage of	▪ Ensure leak control system in	Design	Environmental

S.no	Activity/ Issue	Management Measures	Responsible agencies	Monitoring agencies
	water due to leakage or indiscriminate use	the design and monitoring. ▪ Increase awareness on water conservation and explore options like metering.	Consultant, Contractor and SGs	Agency
4	Generation of additional quantity of wastewater leading to contamination of surface/subsurface sources, if not adequ	▪ Provide sewerage system with sufficient treatment capacity to suffice to increased water supply levels ▪ Plan and cost for adequate centralized/decentralized sewage disposal and treatment, and sanitation facilities.	Contractor and SGs	Environmental Agency
5	Safety hazards from chlorination process, accidents in handling chlorine cylinders and operation of plants	Install chlorine leak detectors; require protection and emergency response equipment for operators. Provide safety equipment to operating staff and training in handling the plant and chlorine cylinder	Contractor and SGs	Environmental Agency
6	Soil and water contamination sludge disposal	Use only approved, appropriate disposal sites	Contractor and SGs	Manpower agency
7	High energy demand for pumping operation.	Use of energy efficient pumps Periodical maintenance	SGs	Public work agency

Annex 4. Contents of a Full Land Acquisition and Resettlement Action Plan (LARAP)

A full LARAP shall include, at minimum, the elements elow, as relevant. If any component is not relevant to the Project Activity's circumstances, it needs to be explained on the full LARAP:

1. Description of Project Activity. A general decription of the Subproject Activity and identification of the Sibproject Activity's site.
2. Potential Impacts. Identification of: (a) components of the Project Activity that would require land and/or relocation; (b) areas to be affected by the Project Activity (area of influence); (c) alternatives to avoid or minimize land acquisition and/or relocation/
3. Objectives. Objectives of the full LARAP.
4. Census of the Project Affected Persons (PAPs) and inventory of affected assets.Census results and asset inventory, including the following information:
   a. List of PAPs, with differentiation of those having land rights and occupants who do not have land rights; vulnerable and gender;
   b. Inventory of land parcels and structures affected by the Project Activity, covering the following information:
      - Size of total land parcels affected, size of land to be acquired by the Project Activity, and size of the remaining land;
      - Ownership status of the land and structure affected by the Project Activity and proof of ownerships;
      - Function of land affected by the Project Activity;
      - Size and function of the affected structure, and remaining size of the structure;
      - Condition of the affected structures (permanent, semi-permanent, temporary, etc.)
      - Other assets affected by the Project Activity (trees, crops, wells, fences, etc.)
   c. Total number of PAPs and households affected by the Project Activity (Project Affected Households - PAH)

d. Number of PAHs to be relocated, which differentiate (1) those who can rebuild their houses in the remaining land from the affected land, and (2) those who have to relocate to other locations; and

e. Number of PAHs who lose more than 10% of their productive assets.

The above information should be summarized in a Table as presented in Annex 23 "Format of Inventory List of Land & Assets on the Land".

5. Socio-economic Study. The Socio-economic Study must be conducted in the early stage of the Project Activity's preparation and with the involvement of the potentially PAPs. The Study must include the following components:

   a. The results of the Census of the PAPs in para No. 4 above

   b. The description about production systems, labour, and household organization; and baseline information on livelihoods and standards of living of the PAPs;

   c. Characteristics of social interaction within the affected communities, including social networks and social support systems, and how they will be affected by the Project Activity;

   d. Information about vulnerable groups or persons for whom special provisions may have to be made;

   e. Existing land ownership rights and systems of land transfer, including an inventory of shared natural resources, sources from which community members obtain their livelihood and food, right to use system based on non-ownership rights (including fishing, harvesting from vegetation/trees for own consumption, or use of forested areas) as governed by land allocation mechanisms, locally-applicable systems, and systems to settle any issues arising due to particular land occupation schemes;

   f. Magnitude of the expected loss –total or partial—of assets and the extent of displacement, physical or economic, as well as public infrastructure and social services to be affected;

   g. Social and cultural characteristics of the PAPs, including a description about local formal and informal institutions (for example, community organizations, ritual groups, non-government organizations (NGO), who are possibly related to the public consultation strategy, project design process and implementation of resettlement);

   h. Initial information concerning the livelihoods of PAPs (to include, if necessary, level of production and income obtained from any formal as well as informal economic activity) and level of their livelihood (including their health status); and

i. Provisions to update information on the PAPs' livelihoods and standard of living at regular intervals so that the latest information is available at the time of their displacement.

6. Legal Analysis. The findings of an analysis of the legal framework, covering,

   a. The scope of the power of eminent domain and the nature of compensation associated with it, in terms of both the valuation methodology and the timing of payment;

   b. The applicable legal and administrative procedures, including a description of remedies available to the PAPs in the judicial process, the normal time frame for such procedures, and any available alternative dispute resolution mechanisms that may be relevant to resettlement under the Project;

   c. Relevant laws (including customary and traditional laws) governing land tenure, valuation of assets and losses, compensation and natural usage of rights; customary personal law related to displacement; and environmental laws and social welfare legislation;

   d. Laws and regulations relating to the agencies responsible for implementing land acquisition and resettlement;

   e. Any legal steps necessary to ensure the effective implementation of land acquisition and resettlement under the Project, including, as appropriate, a process for recognizing claims to legal rights to land, including any claims obtained according to traditional law and traditional usage.

7. Institutional Framework. The findings of an analysis of the institutional framework includes:

   a. The identification of agencies responsible for resettlement activities and NGOs that may have a role in Project Activity implementation;

   b. An assessment of the institutional capacity of such agencies and NGOs; and

   c. Any measure proposed to enhance the institutional capacity of agencies and NGOs responsible for implementing land acquisition and resettlement.

8. Entitlement. Identification of PAPs entitled to receive compensation, assistance for resettlement and support for rehabilitation, in addition to explanations regarding the criteria to determine the entitlement among various categories of PAPs, including the time for announcing the PAPs as affected and eligible for compensation (the cut-off-date).

9. Asset valuation and calculation of compensation on affected assets. A description of procedures to determine the types and amount of compensation to be offered to the PAPs, which represent the value assessment carried out by the licensed appraisers.

10. Compensation, assistance for resettlement and support for rehabilitation. A description about the (1) various compensation packages to be offered to PAPs whose land and/or other assets are going to be acquired by the Project Activity; (2) assistance for resettlement to the community members who are physically relocated, and (3) support for rehabilitation for community members who will lose their source of income or livelihood due to land acquisition for the Project Activity. The compensation packages, combined with assistance and other support offered for every category of PAPs must be sufficient to ensure that their livelihood following resettlement is not getting worse. Options for resettlement and other assistance offered to PAPs must be prepared based on consultation and must be technically and economically appropriate, and in accordance to the most preferable options from the cultural viewpoint of the PAPs.

11. Location selection, preparation, and resettlement. Alternative resettlement sites and the description of each site including:

    a. Institutional and technical arrangements that are needed to identify and prepare the resettlement site, whether it is in rural or urban areas, of which, a combination of potentially productive and beneficial locations, as well as a combination of other factors, to the greatest extent possible, will give equal benefits to the PAPs compared to their situation in their previous location, within an estimated time period required to obtain and to convert the land and its additional resources;

    b. Measures to prevent land speculation or an increasing influx of newcomers who are ineligible for resettlement, to the site;

    c. Procedures for physical relocation, including a schedule for preparation of the new relocation site and land transfers; and,

d. Legal arrangements to occupy the land in the new relocation site and to transfer land rights to the PAPs.

12. Housing, infrastructure, and social services. Plans to provide (or to finance) the settlers to receive their entitlements pertaining to housing, infrastructure (for example, clean water, road access etc.), and basic social services (for example, schools, health services etc.); plans to ensure that those services are equal or greater than the existing standards of the host community; and exploration for expansion of location, technique, and architectural design for those facilities.

13. Environmental management. A description on the boundaries of relocation area, and assessment on the environmental impacts due to the proposed land acquisition, and the steps to reduce and mitigate the impacts (to be coordinated, as necessary, with the environmental assessment of the Project Activity, which requires land acquisition).

14. Participatory Process. Participation of affected community and host community is crucial. This requires:

a. A description of the strategy of public consultation and the participatory process, involving the PAPs, as well as the host community, in design, as well as in implementation of the land acquisition process;

b. A summary of the views expressed by the PAPs and how these views are being considered in the LARAP;

c. Review of alternatives to land acquisition are offered and a decision is made by PAPs concerning the various available options, including options on forms of compensation and assistance due to land acquisition, or relocation for families, individuals, or part of the communities or of kinship communities, and efforts to maintain patterns of existing social organization, as well as efforts to maintain access to cultural land (e.g. places of religious worship, or burial);

d. Institutional arrangements in which the relocated community members can report their concerns to the authorized parties of the Project, during the planning and implementation stages, and efforts are in place to ensure that the vulnerable groups are properly represented; and

e. Measures taken to reduce impacts of land acquisition on the community members/host community (if relocation takes place), including consultation with members of the host community and SGs. There are arrangements to accelerate payment to the community members/host community for the affected land or other assets which are bought for the relocated peoples, as well as arrangements to overcome any possible conflict between the relocated peoples and the host community; and to provide basic public services (for example, education, water, health, and production facilities etc.) for host communities, which should be of equal service level to those of the relocated group.

15. Grievance Procedures. The procedures must be accessible (inexpensive and easy) by any third party to obtain settlement for any dispute arising from the Project Activity, as listed in Full LARAP. Such grievance procedures should consider options for settlement through court and other mechanisms such as community-based settlement of dispute, as well as traditional dispute resolution mechanisms.

16. Institutional Responsibility. The organizational frameworks for land acquisition and resettlement, including identification of institutions responsible for the implementation of Full LARAP, of procedures on land acquisition and provision of services; plan to ensure that proper coordination between various institutions and jurisdictions involved in the implementation is already made; and every step (including technical assistance) required to strengthen the capacity of the implementing agency to design and carry out land acquisition; to transfer the work to the local authorized party or to the settlers to manage their own facility and service provided by the Project and to transfer other responsibility from the implementing agency for land acquisition, if any.

17. Schedule of Implementation. A schedule for implementation, which includes all land acquisition activities, starting from preparation to implementation, including target deadlines for realization of benefits expected for the settlers and host community and cut-off dates for the various forms of assistance. The schedule needs to describe how resettlement is linked with the overall Project Activity's implementation.

18. Cost and Budget. A table showing an estimation of costs for all land acquisition activities, including an inflation factor, population growth, and other contingency

expenses; schedule of disbursement; source of fund; timely cash flow plan, and funding for land acquisition, if any, for areas beyond the jurisdictions of the implementing agency.

19. Monitoring and Evaluation. Plan for monitoring toward land acquisition and resettlement activity by the implementing agency, supported by independent observers as considered necessary by the Bank, to ensure that complete and objective information can be collected; indicators for performance monitoring to measure input, output, and outcome of the land acquisition activity; PAPs' participation in the monitoring; submission of monitoring report to the Bank; evaluation of the impact of land acquisition within a set time frame to be determined after all land acquisition activities and related activities are completed. The results of monitoring should also be used to improve implementation.

Annex 5. **Contents of an Abbreviated LARAP**

An Abbreviated LARAP is required for a Project Activity that affects less than 200 people, or if it creates insignificant and minor impacts on the PAPs. Impacts are considered minor and insignificant if the PAPs physically do not have to be relocated and not more than 10% of their productive assets are acquired by the Project Activity. An Abbreviated LARAP shall include, at minimum, the following components:

1. Description of the Project Activity. General description concerning the Project Activity and identification of the Project Activity's site.
2. Potential various impacts that may occur. The identification includes: (i) components of Project Activities that would require land acquisition; and (ii) areas to be affected by the activity.
3. Census on the PAPs, and inventory of assets affected by the Project Activity. Results of the survey and asset inventory, which will include: (i) list of PAPs, which differentiate PAPs who have land rights and land users (tenants) who do not have land rights; and, (ii) inventory of land parcels and structures affected by the Project Activity. Information produced by the survey needs to be summarized into a table (see suggested table template in Annex 26 and 27).
4. Eligibility. Identification of which PAPs will be entitled to receive compensation and explanation of the criteria used to determine eligibility.
5. Compensation, assessment of land and assets valuation, and resettlement assistance to be provided. This includes a description of thecompensation options and resettlement assistance that will be offered to the PAPs. Assessment of land and asset values will be determined by the result of an assessment result by licensed appraisers.
6. Public consultation with local community members who will lose their land and other assets. This include activities to (a) inform the PAPs about various impacts of the Project Activity, available options for compensation and resettlement assistance, and procedures to obtain compensation, and (b) provide opportunity for the PAPs to express their opinion or concerns.
7. Institutional Responsibility. Brief description concerning the organizational frameworks to implement the activities of land acquisition.
8. Schedule of Implementation. An implementation schedule shall be made to include all land acquisition activities, including target deadlines for compensation payments. The schedule must describe how land acquisition activities are linked to the overall Project Activity's implementation.
9. Cost and Budget. Costs estimations for land acquisition are required by the Project Activity.

10. Complaints Handling Procedures. A workable procedure must be set up, which can be accessed by complainants for settlement of disputes arising from the land acquisition; such complaints' mechanisms should consider the options to go to the district court as well as community-based and traditional dispute resolution mechanisms.
11. Monitoring. Plan to monitor land acquisition activities and compensation payment to the PAPs.

Annex 6. **Sample Outline of LARAP**

Remarks: *The outline is mainly used for an Abbreviated LARAP. For a full LARAP, results of socio-economic studies of the Project Affected Persons should be added, as well as other information as required in accordance with the Full LARAP format (please refer to the above description – Annex 4).*

1. Description of Project Activity:
   a. Identify the location of the Project Activity, including District/City and Province.
   b. Components of the Project Activity that require Land Acquisition.

2. Census on the Project Affected Persons (PAPs), loss of asset, and asset valuation:
   a. Name of the owner(s) of affected assets;
   b. Area of land/existing buildings/structures;
   c. Area of land/buildings/structures acquired by the Project Activity;
   d. Area of residual land/buildings/structures after the activity exposure (if the remaining of buildings/land/structures are considered inhabitable or for use, all of the land/buildings/structures should be acquired by the Project Activity);
   e. Percentage of land/buildings/structures acquired by the Project Activity;
   f. Ownership status of the land/buildings/structures;
   g. Functions of land/buildings/structures to be acquired;
   h. The conditions of the buildings/structures (permanent, semi-permanent, temporary, IMB, non IMB);
   i. Plants/trees affected by the Project Activity (type, quantity, condition, age, productivity);
   j. Other assets affected, e.g. wells, electrical installation, fence, etc., as well as the costs of acquisition.
      - The identification and inventory list will be disseminated in a place that is easily accessed by PAPs.
      - See the example table for the presentation of the results of the identification/inventory, or use the nominative list as specified in the Regulation of BPN Head No.5/2012, as appropriate.

3. Asset valuation and compensation schemes:
   a. Alternative compensation offered (cash, land replacement, or other forms);
   b. The affected land and building tax (NJOP);
   c. The value/price of the land, plant, buildings and assets attached to the land based on an assessment of licensed appraisers;

d. The desired compensation level that result from consultation with PAPs;
e. Land certification process;
   - The result of negotiations shall be announced in a place accessible by the PAPs.

4. The consultation process on options of compensation:
   a. How the public consultation were being implemented;
   b. When they were held, and how frequently;
   c. Where the consultations took place;
   d. Persons participated in the consultations;
   - Minutes of meetings must be completed and signed by all participants, and the attendance lists of participants for all consultation should be made available.
5. Grievance mechanisms.
6. Financing.
7. Monitoring and evaluation.
8. Institutional arrangements for the land acquisition and grievance redress mechanism:
   a. The organization or committee responsible for the implementation of the land acquisition, including persons who can be contacted directly by the PAPs;
   b. Organization responsible for reporting and monitoring;
   c. Mechanisms for filing complaints and follow-up, including the person who can be contacted by the complainants in the case he/she will file a complaint.
9. Schedule for implementation and payment. The following is the schedule of the land acquisition phases. The types of activities in the schedule should be adjusted in accordance to the implementation in the field.

Sample of Schedule for Full and Abbreviated LARAP

Program	**Activity**	**Output**	**Location**	**Unit**	**Person**	**Time**	**Cost**	**Financia**	**Remarks**
1. Establishment of Land Acquisition Team									
2. Appointment of licensed appraisers									
3. Socialization to PAPs									
4. Land Measurement and boundary marking									
5. Community Meeting									

Program	Activity	Output	Location	Unit	Person	Time	Cost	Financia	Remark s
6. Land and Asset Valuation									
7. Negotiations									
8. Compensation Payment									
9 Transfer of Affected Land and Certification of Remaining Lands									
10. Relocation and Utility (and Site Securing)									
11. Monitoring									
12. Reporting									

Annex 6A: Contents of Report on Land Acquisition Implementation/ Tracer Study (in the case for relocation, this content should be adjusted)

- Project / activity description
- Explanation on the needs for land acquisition
- Status of land acquisition when the project was planned/identified
- Description of land to be acquired when the project was at planning stage
- Identification of project's impacts due to land acquisition
- Agencies and other parties involved in each stage of land acquisition process, its roles and responsibility
- List of PAPs and their social economic characteristics, and land and assets affected
- Eligibility of PAPs, category of PAPs
- Types of compensation offered and received by PAPs for land and assets as well as livelihoods, and time when the compensation was received
- Methodology for appraising the loss of land, assets and livelihoods/income
- Socialization, consultation, negotiation (attach all minutes of meetings and agreements, list of participants attended the meetings, photos etc.)
- Grievance Redress Mechanisms that has been applied for this project, number of complaints received and follow-ups; type of complaints; follow-up status for complaints; pending follow-up and reasons.
- Schedule for land acquisition, implementation of land acquisition that has been completed, costs that have been spent for land acquisition activities and process that have been carried out;
- Remaining activities that still need to be carried out with clear schedule and cost breakdown and financing sources, and agencies responsible
- Results of Monitoring and Evaluation of the land acquisition process, and plan for monitoring and evaluation for the remaining land acquisition activities.

ANNEX 6B: PROCESS FRAMEWORK (PF)

A. BACKGROUND

Implementation of project/sub-project activities may cause restrictions of traditional access to natural resources in legally designated parks and protected areas. For instance, road development unintentionally restrict forest-dependent communities to benefit from the services provided by natural resources. Although construction activities may not always acquire land through eminent domain, the purchase of private land, the establishment of infrastructure in or nearby protected areas may prohibit local communities' access to the area they depend on, and could adversely affect social and economic livelihoods of these communities. This Process Framework (PF) is instituted to promote community participation in the design of infrastructure project that can enforce conservation activities as well as identification of acceptable alternatives sustainable resource use due to the access restriction caused by the infrastructure development. In the event that infrastructure development requires forest-dependent communities to stop or reduce their activities, these communities must be able to find alternative sources of livelihoods. In order for conservation initiatives to be effective while maintaining sources of livelihoods for the affected communities, infrastructure development may call for the provision of incentives to affected communities. Such incentives are not necessarily directly linked to forest rent (payment for results) but can also be monetary or non-monetary benefits to enable or motivate a particular behaviour. When the affected communities are IPs depending on forest for livelihood and culture, this PF also provides guidelines for participation of IPs in the preparation, implementation, monitoring and evaluation of forest/natural resources management plans, which will also consider collaborative arrangements with communities.

This PF serves as a guideline for planning, managing, monitoring and evaluating the impacts of access restrictions on livelihoods due to project implementation. The main objective of this framework is to ensure that livelihoods can be restored to, at least, "before-the-project" levels. Once the sites and communities affected have been identified, this PF requires that the SGs proposing a project to be financed by RIDF prepare a Plan of Action (refer to paragraph K) or an equivalent instrument be developed in consultations with affected communities outlining among others specific measures to be undertaken, types of alternative livelihoods, facilitation support and in some instances monetary and/or non-monetary compensation, implementation arrangements, clear indicators of outputs and outcomes and timelines.

B. POLICY OBJECTIVES AND KEY DEFINITIONS

It is often not possible and practical to presume that all livelihood impacts of proposed restrictions can be predefined. The nature of the restrictions caused by infrastructure development and the specific interventions needed to restore people's livelihoods also cannot be necessarily known fully in advance. This PF is required with a view to ensure that project activities fulfil the objectives of conservation and infrastructure development as well, while at the same time promote sustainable livelihoods of forest dependent communities by 1) promoting sustainable use and management of natural resources; 2) avoiding unnecessary restrictions of access to these resources and fostering partnership with local communities[11]; 3) ensuring adequate participation and consultations of the affected population in the overall project areas; 4) ensuring that a restorative and mitigation plan of action, which describe specific measures to assist people adversely affected by the proposed infrastructure development causing restrictions, are put in place prior to the enforcement and implementation of project/sub-project activities.

Key definitions used in the framework are as follows:

a. **Project Affected Persons (PAPs)** refers to all of the people who, on account of the project related activities, would have their (i) standard of living adversely affected; or (ii) rights, titles, interest in any property rights (including premises, agricultural, grazing and hunting land) and/or any other fixed or movable assets acquired or possessed temporarily or permanently; (iii) access to productive assets adversely affected, temporarily or permanently; (iv) business, occupation, work or place of residence or habitat adversely affected;
b. **Access Restriction** refers to a process whereby local communities residing in and/or near project sites lose access partially or wholly, temporarily or permanently to land and natural resources in legally designated parks or protected areas. Such restrictions can be the consequence of voluntary and involuntary actions.
c. **Rehabilitation** is the process by which PAPs are provided sufficient opportunity to restore productivity, incomes and living standards. Compensation for assets is often not sufficient to achieve full rehabilitation.
d. **Compensation** can be monetary and non-monetary prior project implementation or after achievement of certain emission reduction indicators (payment for results). Funds from public or donor sources can be used to provide incentives and assistance for sustainable land use and livelihoods.
e. **Land acquisition** is the process whereby a person involuntarily loses ownership, use of or access to, land as a result of project/sub-project activities. Land acquisition can lead to a range of associated impacts including loss of residence, livelihoods, or other productive assets.

[11] *Specific guideline for Forest Partnership could be referred to Ministerial Regulation no.P.39/Menhut-II/2013 on Local Community Empowerment through Forestry Partnership*

C. KEY PRINCIPLES

In developing a Plan of Action to mitigate adverse impacts of access restrictions, the following principles need to be adhered to:

a. **Participation:** Broad public participation by affected communities are sought. Affected communities shall be engaged in a method that is culturally appropriate and based on free, prior, and informed consultation particularly where Indigenous Peoples (*Masyarakat Hukum Adat*) are present. All affected communities will be openly in an effort to collaborate and be made aware of the option to refuse to participate in the project.
b. **Access to information and disclosure:** Information is made available in a language(s) acceptable to affected communities, adopting various media to ensure broad outreach. Communication of project interventions will begin early during the preparation phase, occur regularly throughout the project cycle in a consistent and transparent manner and allow for the timely disclosure of relevant information.
c. **Social inclusion:** Engagement shall take into consideration critical issues of gender equity, illiteracy, disability, ethnicity, and other exclusion factors for socially excluded and other vulnerable groups to ensure that any dialogue is inclusive and mitigation measures are tailored to meet the needs of vulnerable persons.
d. **Transparency:** Information about project interventions, including their positive and negative impacts, are communicated to affected communities in a transparent manner. Information about implementation of mitigation measures, including budgeting, GRM, and monitoring and evaluation, shall be accessible to affected communities.
e. **Free, Prior, and Informed Consultation:** Consultations with affected communities shall be well-documented, adequately resourced, capture stakeholder views to inform decision about the project (i.e. two-way communication) and allow adequate time for community decision-making.
f. **Avoiding unnecessary restrictions:** Subproject design shall strive to seek alternatives to achieve carbon emission reduction objectives while maintaining local communities' access to conservation areas e.g. partnership schemes. These partnership schemes are established on the basis of agreements between affected communities and license/concession holders, investors, project owners, and/or the government entities, including forest management units (FMUs) outlining agreed schemes, periods, benefit sharing, technical support and arrangement (see benefit sharing note below, section L). Such schemes are aimed to facilitate these communities to restore and improve livelihoods and foster mutually beneficial collaboration to ensure sustainability and ownership of the infrastructure investments established in their territories. There are a range of schemes that can

be adopted, depending on the resources available (financial and manpower), existing social capital, access to market, community buy-in, etc. Activities vary and can be in the form of economic development (e.g. harvesting of non-forest timber products/NTFP, community forestry, eco-tourism, craft production, etc.), capacity building (e.g. training, exchange, technical assistance etc.), supporting tenue security (e.g. supporting affected communities to obtain licenses for customary forest (*hutan adat*), village forest (*hutan desa*), partnership forest (*hutan kemitraan*) or community forestry (*hutan kemasyarakatan*), and sustainable forest management (e.g. forest patrolling, forest rehabilitation, community incentives for conservation, etc.) among others.

D. COMMUNITY ENGAGEMENT

Forest dependent communities may have long-standing use of the forest resources. Households may depend on natural resources for the sustenance of their livelihoods such as income, employment and food, as well as social and cultural practices. Affected communities may be adversely affected by construction activities both temporarily and permanently, and such impacts could be particularly severe in the events of loss of productive assets and livelihoods. For IPs, their culture and history are connected to their ancestral territories, often in forest areas. It is therefore critically important to engage forest-dependent communities at all levels under the subproject since the success of carbon emission reduction partly hinges on behavioural change of these communities. Some of these aspects for community engagement need to be taken into consideration:

a. Forest dependent communities are recognized as a diverse group even if they may belong to the same communities or organizations. The pattern of forest dependence, natural resource use, and hierarchy including gender roles may differ from place to place and time to time. Efforts should not overlook vulnerable groups in the affected communities;
b. Forest dependent communities, including IPs and local communities are regarded as equal partners and stakeholders in the management of conservation areas and natural resources in general. Their views must be considered and respected.
c. Although community members may not be able to fully participate in the scientific design process (e.g. valuation of carbon, or zonation), their traditional knowledge will be incorporated in the overall design.
d. It is critical not to raise community expectations beyond what the project is able to deliver. Efforts shall be made to ensure that communities are properly informed about key biodiversity interests to ensure the achievement of carbon reduction emission.
e. When affected communities are IPs depending on forest for livelihood and culture, they should participate in the preparation, implementation, monitoring and evaluation of forest or natural resources management plans in collaboration

with the local communities. The process should follow the FPIC principles as specified in the IPPF.

f. Not all community stakeholders are aware of the intent, management, technical issues, planning processes or benefit sharing mechanisms and therefore will require some guidance to facilitate their participation. Awareness raising is therefore key to fostering engagement and participation of affected communities, and may take the form of community meetings, informational presentations, and dissemination of informational materials among others.

E. IDENTIFICATION AND ELIGIBILITY OF DISPLACED PERSONS

Two categories of eligibility are established in this framework, including:

a. Eligible communities

As per the World Bank's OP 4.12, the term "displaced persons" used in this framework is synonymous with "project affected persons" and is not limited to those subjected to physical displacement. Displaced communities may be classified in one of the following three groups:

i. Those who have formal legal rights to land;
ii. Those who do not have formal legal rights to land at the time the census begins but have a claim to such land, assets or properties that such claims are recognized under the national laws or become recognized through a process supported by the project;
iii. Those who do not have recognizable legal rights to the land under the national laws, but recognized by other claimants (e.g. customary and traditional rights not recognized under the national laws).

Depending on the level of property ownership and level of vulnerability or whether the impacts are direct or indirect, the forms and types of livelihood support may vary. This framework apply to all those persons who lose access to legally designated parks and protected areas resulting in adverse impacts on their livelihoods. It is important to highlight in this framework that a baseline assessment is required to establish eligibility criteria and identify eligible community members. The baseline is also important to demonstrate the types and extent of loss of access as a result of access restrictions.

b. Ineligible communities

Livelihood support and allowance is made for the flexibility to exclude from displacement assistance anyone who is involved in unsustainable and destructive activities after the establishment of protected and conservation areas and zoning schemes have been fully consulted and agreed. This is to be clearly communicated to community members during initial consultations.

F. ESTABLISHING IMPACTS ON LOCAL COMMUNITIES

While the project is expected to affect the livelihoods of local community members through restrictions to resources, specific impacts will not be necessarily fully known until the implementation of project activities begin. In order to adequately determine those impacts, it will be necessary to collaborate and consult with community members, and their representative organizations to identify those who are being directly affected and determine the ways in which the effects are being experienced.

G. LIVELIHOODS RESTORATION AND FACILITATION

The overall aim of the restorative and mitigation measures is to compensate for and diversify the livelihoods of the affected communities in and surrounding conservation areas. The Project will support the development of community-based enterprises or other small-scale livelihood activities such as agriculture, fishery, agroforestry etc. that can help offset the opportunity costs of access restrictions. Such efforts can be done in partnership with other entities such as CSOs, NGOs, and the private sector. The process of developing alternative livelihood strategies will be participatory and will be underlined by the spirits of equity and community-driven decision making. The process to achieve this will be started with mobilizing affected community members to ensure that they have the space and opportunity to consider the options available to them. Mitigation measures and assistance support being taken to address livelihood restoration must be long-term in order for them to achieve a restorative effect.

H. GRIEVANCE REDRESSAL MECHANISM (GRM)

A GRM is instituted to identify procedures to effectively address grievances arising from project implementation. Affected communities mush have an avenue where they can formally lodge their complaints and grievances in a confidential manner and have them properly considered and duly addressed in due course. A GRM can help project management significantly enhance operational efficiency in a variety of ways such as fostering public awareness about the project and its objectives, enhancing trust of the good intent of the project, deterring fraud and corruption, mitigating risks, providing project staff with practical suggestions that allow them to be more accountable, transparent and responsive to communities, assessing the effectiveness of internal organizational processes and improving stakeholder involvement in the project. The GRM arrangement for this project is described in Section 7 of this ESMF.

I. MONITORING AND EVALUATION OF PROCESS FRAMEWORK

The main purpose of the PF M&Es system is to monitor the extent and the significance of adverse impacts and the effectiveness of measures designed to assist affected communities to improve or restore livelihoods. The M&E is designed in a participatory manner involving affected communities and various methods and approaches can be developed in this regards (see Section on Monitoring and Evaluation in this ESMF). Those who benefit from livelihoods restoration and support will also be involved to monitor and evaluate the effectiveness of the alternative livelihood measures being undertaken by the project.

J. DISCLOSURE

Mitigation measures as well as their implementation arrangement and budgeting as outlined in the Plan of Action are prepared in consultation with affected communities. A draft must be disclosed, as soon as feasible but never less than two weeks prior any meetings or consultations. The disclosure also includes the findings of social assessments and analyses that inform the Plan of Action. Disclosure is delivered in a culturally appropriate manner and in a language that can be understood by the majority community members. Extra efforts shall be made to outreach communities who reside in remote areas to ensure broad information dissemination. In some instances, verbal communication may be more efficient than written forms. The Plan of Action, together with the agreements reached with affected communities and minutes of public consultations, must also be available in the SGs and PT SMI's websites and will be periodically updated.

K. OUTLINE OF PLAN OF ACTION FOR ACCESS RESTRICTION

Project background and how the plan is prepared, including consultations with local communities and other stakeholders. This section needs to highlight which project components/sub-components that may result in access restrictions;

a. The socio-economic profiles of local communities and their dependence on natural resources and social and cultural attachment to the legally designated parks and conservation areas;
b. The nature and scope of restrictions, their timing, as well as administrative and legal procedures to protect affected communities' interests;
c. Protected area boundaries and zones as well as the length of legal enforcement for conservation (i.e. permanent vs. temporary);
d. The anticipated social and economic impacts of the restrictions;
e. The communities or persons eligible for assistance;
f. Specific measures to assist these people, along with clear timetables of actions and financing sources;
g. Implementation arrangements, roles and responsibilities of various stakeholders, including government and non-government entities, service provides (NGOs, CSOs) and other entities providing services or assistance to affected communities;

h. Arrangement for monitoring and enforcement of restrictions and natural resources management agreements;
i. Clear output and outcome indicators developed in consultation with affected communities

L. BENEFIT SHARING

1 Definition:

Integral to the Process Framework is benefit sharing with affected PAPs whose land and income streams become disrupted or declining due to infrastructure development financed by the subproject. Benefit sharing involves the intentional transfer of monetary and non-monetary incentives and assistance to enable affected parties to implement activities that could offset the impacts induced/triggered by subproject activities. The benefits can range from participation in the labor-force, shares in the stock-market, social development initiatives, direct financial payments and technical assistance (for instance technology provision or skill-training in relevant areas). Arrangements for sharing these benefits can involve mechanisms for revenue sharing (i.e. shares) or alternatively mechanisms for transferring monetary and non-monetary assistance among parties in the agreement. Important conditions in benefit sharing require identifying the beneficiaries and necessary benefits. All parties in the agreement must agree on obligations or responsibilities that need to be met in order to access the benefits. There is also a need to develop systems for recording and monitoring the distribution of benefits and milestones of related obligations.

The key principle of benefit sharing goes beyond one-time compensation payment and short-term resettlement support for PAPs. Benefit sharing treats both displaced people and affected communities that host infrastructure subprojects in their locality as legitimate partners in the subproject and first among their beneficiaries. Benefit sharing is generally regulated under the Law No.2 Year 2012 on Land Acquisition for Public Interest, where compensation can be in the form of shares in the stock market or other forms agreed between PAPs and subproject owners.

Benefit sharing arrangements recognize the nature of the impacts induced by subproject activities, which are to some extent irreversible and long-term. Depending on the types of benefit sharing, such arrangements could also be used to mobilize financing and activities to improve the management of ecosystem services permanently transformed by infrastructure development which may result in impoverishment and livelihood displacement for PAPs. Although benefit sharing is mostly applicable to commercial infrastructure subprojects to be viable (i.e. toll road, hydropower, electricity, etc.), its application could also be expanded to the non-commercial sector with differing length and amount of benefits depending on the nature and scale of impacts. Benefit sharing should be flexible and depending on the agreement, may continue over the economic life of subproject assets.

2 Requirements:

It is important to ensure that all stakeholders understand about the mechanism, including the proportion/ratio of the benefits distributed, benefit-flows, as well as eligibility criteria. It is also important for beneficiaries to have sufficient understanding how benefits are calculated including the balance between the level of revenue sharing (as a percentage of revenue generated by subproject-specific activities) and the impacts of such sharing on profitability. Promoting such understanding across different levels of stakeholders is important to foster transparency and allay suspicion that may arise due to information gaps.

The general approach for benefit sharing calls for:

1. An agreed formula and standard procedures to remit a share of the revenue generated by infrastructure subprojects into revenue sharing funds and internalize such costs into calculation of ROI (return on investment);
2. Establishment of the eligibility criteria, grant selection, and award procedures and administrative arrangements for the fund;
3. Appointment of a benefit sharing council/board/organization with appropriate local representation and capacity to communicate benefit sharing arrangement with beneficiaries, manage the Fund transparently and make other recommendations on non-monetary forms of benefit sharing e.g. social development, in-kind assistance, etc.
4. Use of the fund to offer a menu of local development options preferred by beneficiaries; grants are often managed on a competitive basis based on an agreed criteria;
5. Mechanisms for transparency, accountability and monitoring to foster public confidence;

3 Steps:

There are multiple approaches for benefit sharing, depending on socio-economic circumstances, level of governance, as well as subproject types. The steps outlined in the following serve as an example and is not meant to be prescriptive and exhaustive:

1. Consultations with affected communities with regards to the subproject activities including locations, timeline, the need for labor-force and requirements, as well as the scale of (perceived and real) impacts and their nature (permanent and/or temporary) and who bear those impacts the most. Such consultations must take

place early during subproject preparation once the locations have been identified and be conducted more than once to ensure outreach. In some situations, this process may call for the presence of mediators to foster neutrality and impartiality.

2. Once the affected communities have obtained sufficient understanding and come to agreement to the subprojects, selection of community representatives to be in the benefit sharing council can begin. Participation in this council is voluntary and selection needs to be aware of elite capture and therefore preparation is key to ensure broad representation of community interests in the council. A rotation system also needs to be established for this council to ensure participation of other eligible members.
3. Together with the benefit sharing council, preparation of benefit sharing arrangement. This includes establishing eligibility criteria, priorities, period of benefit flows, fund management, types of eligible programs, technical assistance, etc. Every unclassified material must be furnished to the council in a user friendly manner and in a timeframe that allows them to digest the information. Such information may include the proportion of revenue sharing as well as monetary and/or non-monetary transfer in ratio with projected profits.
4. Another round of consultations with affected communities to consult the draft agreement including all the provisions in benefit-sharing. Critical points to be agreed upon include eligible beneficiaries, types of benefits, length of benefit-sharing, ratio of the benefits to the overall profits by specific subproject activities. This process could be led by the council assisted by mediators if considered necessary. This agreement should also look into the timeline of the arrangement (e.g. whether benefits will be incremental and gradually increase along with profitability, and frequency) and arrangement for grievance redressal.
5. Pilot the delivery and monitoring mechanisms, as well as grievance measures, potentially starting from the directly affected communities before scaling up to other communities as envisioned in the agreement.
6. Stock-taking exercise with affected communities with regards to what works and does not and at the same time, improve the system as well as build the capacity of implementing organizations and benefit sharing council.

Annex 7. Contents of an Indigenous Peoples Plan

The following template presents the outline of an IPP. The template can be further developed based on field conditions and as per characteristics of the Project Activity.

Title of Chapter/Sub-Chapter	Content/Remarks
1. DESCRIPTION OF THE PROJECT	
	Summary Description of Project Activity (concerning area boundary, location, type of occupation, area size, area of influence, etc.)
2. SUMMARY OF SOCIAL ASSESMENT	
2.1.Baseline Data on IPs	
	• Baseline information on the demographic, social, cultural, and political characteristic of the IPs community, the land and territories traditionally owned or customarily used or occupied and the natural resources that they depend • Identification of key project stakeholders and elaboration of culturally appropriate process for consulting with the IPs at each stage of project cycle
2.2. Summary of results of the free, prior, and informed consultations with the affected Indigenous Peoples' communities that was carried out during Project Activity's preparation and led to broad community support for the Project Activity	• Identification of potential adverse and positive effects of Project Activity of the affected IPs within the Project Activity's area of influence • Development of measures necessary to avoid adverse effects or identification of measures to minimize, mitigate, or compensate for such effects and ensure that IPs receive culturally appropriate benefits from the Project Activity • Mechanism to prepare and implement the public consultation with the Indigenous People (consultation concerning the draft Project Activity plan, etc. as relevant), to include: determination of location and schedule of consultation, information dissemination /invitation, etc. • Public consultation process • Result/resolution and mutual agreement obtained during consultation meeting. • Number and representative of organization/institution presented by participants in the said consultation meeting.
2.3. A framework for ensuring the free, prior, and informed consultations with the affected IPs communities during project implementation	
3. ACTION PLAN (INPUTS FROM THE RESULTS OF THE SOCIAL ASSESSMENT)	
3.1. Activities for IPs to receive social and economic benefits	
3.2. Activities to avoid, minimize, mitigate, or compensate for adverse effects	
3.3. Measures to Enhance the Capacity of the Project Management	
3.4. Consultation with the affected IPs on the Draft IPP	
4. COST ESTIMATE AND FINANCING PLAN	In form of table containing information about: type of activity, party in charge, timeline/milestones, cost, funding source, and remarks.
5. INSTITUTIONAL ARRANGEMENT TO IMPLEMENT IPP	

Title of Chapter/Sub-Chapter	Content/Remarks
• Agencies responsible for managing the implementation of the Indigenous Peoples Plan • Agencies responsible for reporting and monitoring on the implementation of the Indigenous Peoples Plan • Arrangements for monitoring of the implementation of the Indigenous Peoples Plan by the affected IPs	
6. GRIEVANCE REDRESS MECHANISM ACCESSIBLE TO THE AFFECTED IPs • Mechanism for managing grievances as suggested by the results of the Social Assessment results	
7. PROJECT MONITORING, EVALUATION, AND REPORTING OF IPP IMPLEMENTATION Includes arrangement for free, prior, and informed consultation with the affected IPs • Explaining the Work Plan for monitoring implementation of IPs and Reporting Mechanism. • Monitoring on progress implementation of IPP • Monitoring on process implementation of IPP • Reporting on implementation of (report to whom, which format to use, and deadline for submission of the report).	
ATTACHMENT	
Attach original or copy of documents as relevant to IPP, for example: • Information about the Project Activity (Map) • Table containing Baseline Data of IPs • Minutes of Dissemination and Consultation Meetings • Minutes of Agreement on Compensation Plan (if any) based on the consultations • Other relevant documentation	

Annex 7A: Outline Social Assessment for Indigenous Peoples

1. **Objectives**. The purpose of Social Assessment (SA) is to evaluate the subproject's potential positive and adverse effects on the Indigenous Peoples in the case that Indigenous Peoples are present in, or have collective attachment to the project area (based on the screening in accordance with the four criteria as specified in the World Bank OP 4.10 and criteria on *Masyarakat Hukum Adat* and/or local values), and to examine project alternatives where adverse effects may be significant. The breadth, depth, and type of analysis in the SA are proportional to the nature and scale of the proposed subproject's potential effects on the Indigenous Peoples, whether such effects are positive or adverse. In carrying out an SA, the city government will have to be assisted by a consultant team or individuals who are social scientist whose qualifications, experience, and terms of reference are acceptable to the PMU. Experts from local universities or local NGOs who have worked and have experienced in working with the IPs are encouraged to assist the city government.

2. **Outline of the SA**. The SA will at least cover the following:

   a. Description of Subproject Activity
   b. Information about the Subproject Activity's site and condition of the cultural community
   c. Social Economic Characteristics of the affected Indigenous Peoples' community
      i. General Characteristics of IPs
      ii. Specific characteristics of IPs
         - Cultural Social Institutions
         - Economic Condition and Source of livelihood for villagers
         - Cultural practices
         - Etc.
      iii. Stakeholders assessments

   d. Consultation process during the Social Assessment reflecting a free, prior and informed consultation that leads to broad support from the affected IPs community on the proposed Subproject Activity.

   e. Findings and potential Subproject Activity's impacts (positive and adverse).
      a. Any potential negative *(give examples)*
         - Economic domination by outsiders
         - Transfer of *ulayat* rights
         - …
      b. Proposed Mitigation (*give example)*
         - Mitigation related to domination by outsiders
         - …
      c. Potential positive impacts and efforts to maximize these impacts

f. Proposed Action Plans in form of a table containing (to be included in the Draft IPP):

i. Plan to maximize the positive impacts
ii. Negative issues as findings from the study which needs mitigation
iii. The mitigation program
iv. Subproject Activities within the mitigation framework
v. Location where the impact and mitigation is going to be done
vi. Consultation framework for preparing and implementing IPP
vii. Institution in charge for preparing and implementing IPP
viii. Schedule for implementation
ix. Budget
x. Source of budget
xi. Remarks (other matters needs to be put in the report)

Annex 8. **Documentation from Public Consultation of Draft ESMF (June 21 and 22, 2016**

1. Stakeholders Consultation Workshop was held on June 21-22, 2016 in Jakarta. Objective of the workshop were to disseminate draft Environmental and Social Management Framework (ESMF) of Regional Infrastructure Development Project (RIDF) and to get inputs from stakeholders to improve the draft Framework as well as to socialize the PT SMI's ESMF commitment developed based on the national laws and regulations, PT SMI's ESS and international standards in ensuring that subprojects to be financed by the RIDF meet the requirements for environmental and social sustainability. The invitation was sent to all participants a week before the consultation incorporated a summary of the draft ESMF for reference. In addition, PT.SMI team has also contacted all the proposed participants to make sure they received the invitation. The Draft ESMF has been disclosed in the PT SMI's website on June 15, 2016.

2. The workshop was attended by 70 participants, including representative of Central Government (e.g. Ministry of Finance, Ministry of Forestry and Environment, Ministry of Public Works and Public Housing), several SGss (SGs), Association of City Governments, Association of Kabupaten Governments, Association of Provincial Governments, some representatives from local parliaments, universities, NGOs and other development partners. The Bank staff was also invited and attended the meeting as observers. Agenda of the workshop has consisted of two main sessions, first is presentation of the project description for RIDF and the importance of safeguards requirements during the entire project cycles (preparation, implementation, monitoring and evaluation of the project). Second session was a discussion of substance of the ESMF (triggered safeguards policy) and wrap-up of the meeting results. Since the consultations were held during the month of Ramadhan, PT.SMI considered of having two separate events to accommodate schedule of participants. During the consultations, PT. SMI obtained positive and encouraging feedback from the stakeholders, main concerns and suggestion.

3. Below are some points that were discussed during the workshop that need to be considered as inputs for revision of the ESMF:

a. Safeguards Issues:
   i. **Overall design of RIDF**. PT SMI explained to all stakeholders the concept of RIDF that Ministry of Finance has prepared to improve access to infrastructure financing at the regional level. Detailed eligibility criteria and sectors are also shared and discussed. All stakeholders recognize that for RIDF, eligible sectors are those that qualify under jurisdictional responsibility of the SGss. RIDF excludes sub-projects that are more

prone to environmental and social issues such as toll road, coal power plant, airports, large ports, high-cost urban transportation project such as MRT and LRT, etc. RIDF will also focus on general obligation borrowing and economic viable project without eliminating the needs of stringent environmental and social issues. Especially under this project, PT.SMI will also introduce Project Development Facility which will be established under different directorate in PT.SMI to help SGss prepare their sub-projects complied with the current standards set by PT.SMI.

ii. **Purpose of the ESMF** is as an enabler rather than as a constraint to achieve project objectives need to be emphasized. Message that safeguards is a tool to reduce negative impact and improve more positive impact needs to be enhance through capacity building. This ESMF will provide guidance to PT.SMI and SGss in mitigating the current and future risk related not only to E&S issues but also on the sustainability of RIDF itself. The ESMF will not only look at the impact during construction but also during implementation. PT. SMI mentioned that they will review 10 safeguard related components during sub-project preparation, construction and also monitoring & evaluation.

iii. **Land issues**.

- Land is provided by the LG and should be integrated with the LG's Spatial Plans. .In order to receiving financing through this facility, SGs require to have a clear land before construction could begin. As mentioned in the ESMF, SGs also need to submit documentations related to land acquisition, resettlements process, *etc* to PT. SMI. As mentioned in the ESMF, PT. SMI will also scrutinize the impact of sub-project construction to people's income. The resettlement process shall apply willing to buy and willing to sell procedures.

b. Management Issues related to safeguards that have been discussed are as follows:

i. Gaps between National and International Policies; for example the issue of biodiversity, although in the EIA does not appear, however International policies suggests to exclude sub-projects that have a significant impact.

ii. Funding. There is a question raised regarding possible funding for the preparation of the safeguards documents outside of SGs budget where PT. SMI stressed out that the main obligation should be under SGss. However, PT. SMI, through the PDF team, could assist SGs in the preparation of those documents,

iii. Based on suggestion, PT SMI will conduct continuous capacity building to potential SGs and ensure all training materials are suitable and accessible for community and related stakeholders.
iv. The stakeholders reminded the importance of mitigating livelihoods issues if the sub-projects deal with land issues.
v. PT. SMI already has a complaint handling mechanism through corporate secretary unit. The mechanism is regularly being enhanced.

c. An NGO questioned and concered on the criteria in carrying out the ESMF principles, such as tools use as a control mechanism. PT SMI explained that there are clear guidelines and procedures to implement these principles. For example, the development of hospital, the requirement of permits, accreditations, *etc* should be provided from a technical ministry. Related to the waste management, hospital management regulations reference has been described in detail.

d. PT SMI described its commitment to apply this ESMF. PT SMI has a mission not only to build infrastructures but also to create sustainability of the implementation for those subprojects. PT SMI also recognizes the challenges during implementation, especially for the SGs who have limited competency. Therefore, SMI agrees to continuously educate stakeholders.

e. ESMF. One way to promote the ESMF, PT SMI supports the Renewable Energy and it is outlined in the ESS 9. So there will be models that can be replicated by other institutions.

f. Another NGO gave inputs related to Indigenous Peoples (IPs). The definition of IPs, to follow Decision of Mahkamah Konstitusi (MK) Number 35/2012 describes, for example about the origins, values, and their own institutions. Not all SGss already have regulations related to indigenous peoples. In Indonesia there are only a few that protect indigenous peoples. Based on this ESMF. PT SMI will conduct special consultations with indigenous peoples where NGO participation expected.

Nomor: S-363/SMI/DU/0616

14 Juni 2016

Kepada Yth.
Yayasan Pusaka
Kompleks Rawa Bambu I
Jl. H No. 4, Pasar Minggu
Jakarta Selatan

Perihal : Undangan Konsultasi Publik Penyusunan Kerangka Kerja Pengelolaan Lingkungan Hidup dan Sosial PT Sarana Multi Infrastruktur (Persero) ("PT SMI")

Dengan hormat,

Sehubungan dengan penyusunan Kerangka Kerja Pengelolaan Lingkungan Hidup dan Sosial (*Environmental and Social Management Framework* – ESMF) untuk Program Pembiayaan Pemerintah Daerah dan Instansi Pemerintah Lainnya (*Regional Infrastructure Development Fund* – RIDF) oleh PT SMI, maka dipandang perlu untuk melaksanakan konsultasi publik atas rencana tersebut kepada *stakeholders* PT SMI.

Sehubungan dengan hal tersebut, bersama ini mengundang 2 (dua) orang perwakilan dari instansi Bapak/Ibu dalam kegiatan "Konsultasi Publik Penyusunan Kerangka Kerja Pengelolaan Lingkungan Hidup dan Sosial PT SMI" yang akan diselenggarakan pada:

Hari/tanggal : Rabu, 22 Juni 2016
Waktu : 15.00 – 18.30 WIB
Tempat : Ceria Room, Hotel Shangri-La
Jl. Jend. Sudirman Kav 1, Jakarta
Agenda : Terlampir

Demikian undangan ini kami sampaikan. Atas perhatiannya, kami ucapkan terima kasih.

PT SARANA MULTI INFRASTRUKTUR (PERSERO)

Emma Sri Martini
Direktur Utama

PT SARANA MULTI INFRASTRUKTUR (PERSERO)
Wisma GKBI, 8th Floor
Jl. Jend. Sudirman No. 28, Jakarta 10210
Tel : 62-21 5785 1499, Fax : 62-21 5785 4298

SMi
PT SARANA MULTI INFRASTRUKTUR (PERSERO)

AGENDA
Konsultasi Publik Pembahasan Penyusunan Kerangka Kerja Pengelolaan Lingkungan Hidup dan Sosial PT Sarana Multi Infrastruktur (Persero) ("PT SMI")

Rabu, 22 Juni 2016

Waktu	Agenda	Pengisi Acara	Keterangan
15.00 – 15.30	Registrasi		
15.30 – 16.00	Pembukaan	Direksi PT SMI	MC
16.00 – 16.45	Paparan pengantar konsultasi publik	PT SMI	Moderator
16.45 – 17.30	Diskusi dan tanya jawab	Moderator	
17.30 – 17.45	Penutupan	Direksi PT SMI	Penyampaian rencana tindak lanjut
17.45 – 18.30	Makan malam		Buka puasa bersama dan sholat Maghrib

PT SARANA MULTI INFRASTRUKTUR (PERSERO)
Wisma GKBI, 8th Floor
Jl. Jend. Sudirman No. 28, Jakarta 10210
Tel : 62-21 5785 1499, Fax : 62-21 5785 4298

Ringkasan Kerangka Pengelolaan Lingkungan dan Sosial
(ESMF-Environmental and Social Management Framework)
Regional Infrastructure Development Fund (RIDF)
PT SARANA MULTI INFRASTRUKTUR

Latar Belakang

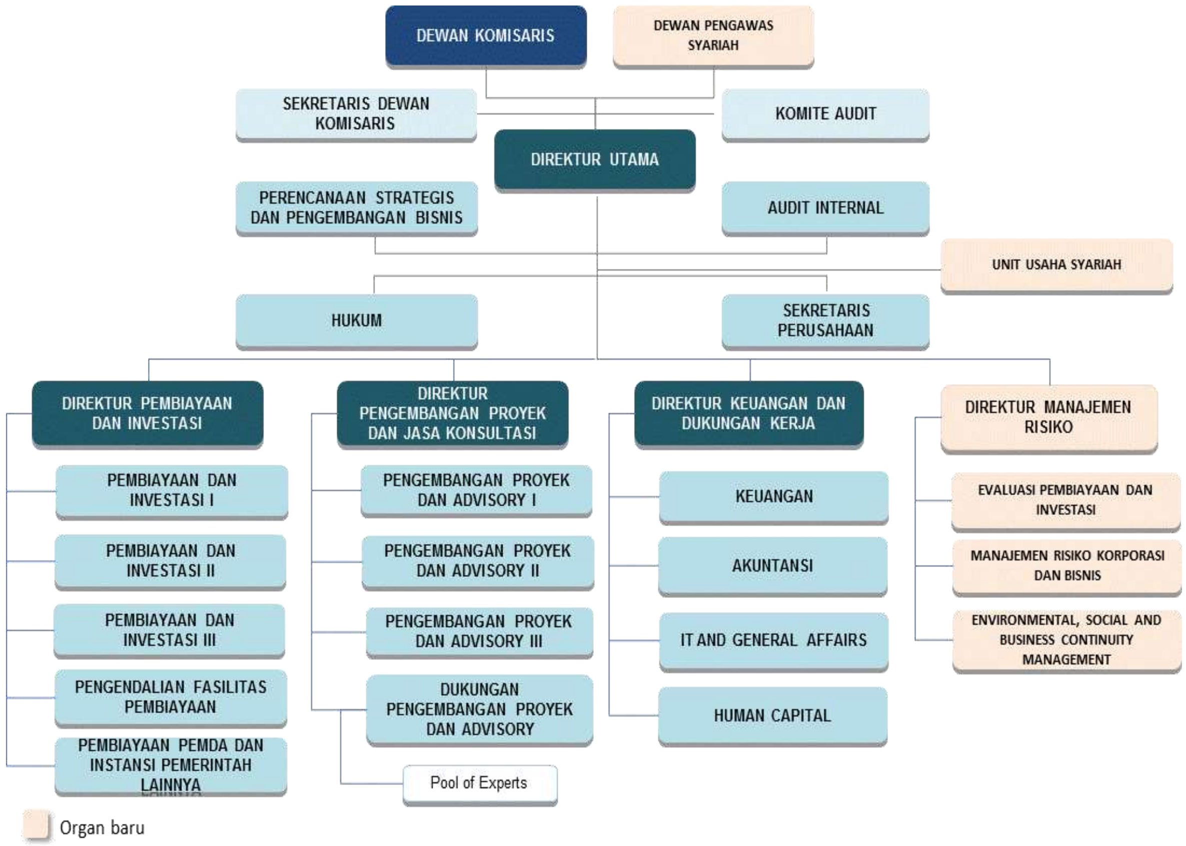
RIDF bertujuan untuk meningkatkan kapasitas dan akses pembiayaan pembangunan infrastruktur melalui pinjaman kepada pemerintah daerah baik di tingkat provinsi maupun kabupaten/kota. RIDF adalah perpanjangan tangan PT SMI (Sarana Multi Infrasturtur) yang dibentuk Kementerian Keuangan untuk menyalurkan pinjaman kepada Pemda yang awalnya berada di bawah skema pembiayaan *general obligation* – lihat Gambar 1, dan kemudian seiring dengan meningkatnya kemampuan teknis Pemda maka pemberian pinjaman dapat dialokasikan kepada proyek-proyek yang secara finansial layak. Oleh sebab itu untuk awal bisnisnya, RIDF akan berlandaskan kepada beberapa hal seperti: i) penilaian kelayakan sub-proyek lebih berdasarkan kepada kelayakan ekonomi dibandingkan keuangan (termasuk aspek sosial dan lingkungan hidup); ii) tenor pinjaman mencakup jangka pendek hingga panjang (misalnya tenor 5 hingga 20 tahun). Untuk mengurangi dampak negatif terhadap posisi keuangan PT.SMI, bisnis RIDF akan dilengkapi dengan jaminan dari Pemerintah Pusat melalui mekanisme pemotongan DAU/DBH. Hal ini akan memberikan perlindungan kepada PT.SMI dalam kasus gagal bayar.

Gambar 1. Kriteria Pinjaman Daerah

RIDF juga akan mengaplikasikan norma kehati-hatian dalam memberikan pinjaman (*prudential norms*) dan proses penilaian yang ketat. Proyek-proyek infrastruktur yang akan dibiayai oleh RIDF bersifat *open menu* di sektor yang terkait dengan infrasturktur lingkungan, sosial dan sektor produktif dan menjadi kewenangan dari pemerintah daerah sebagaimana diatur oleh peraturan yang berlaku. Adapun sektor tersebut adalah i) pasokan air dan sanitasi; ii) infrastruktur lingkungan (seperti manajemen limbah padat, drainase, dan energy effisiensi); iii) perumahan rakyat dan peningkatan pemukiman kumuh; iv) infrastruktur transportasi dan logistik (seperti pembangunan jalan, pembangunan infrastruktur untuk *Buss Rapid Transit*); v) infrastuktur sosial (seperti pembangunan rumah sakit, sekolah, dan pasar baru)–lihat table 1.

Komponen selanjutnya dalam proyek RIDF ini, juga akan dibentuk RIDF Project Development Facility yang bertujuan untuk memberikan pengembangan kapasitas dan pendampingan kepada Pemda dalam bidang penyiapan proyek, studi kelayakan, keahlian sektoral dan lain-lain. Untuk RIDF akan dilaksanakan oleh PT. SMI dibawah Divisi Pembiayaan Pemda dan Instansi Pemerintah Lainnya yang berada di bawah Direktorat Pembiayaan dan Investasi. Adapun komponen RIDF-PDF akan berada di bawah Divisi Pengembangan Proyek dan Jasa Konsultasi yang berada di bawah Direktorat Pengembangan Proyek dan Jasa Konsultasi.

Gambar 2. Struktur Organisasi PT. SMI



Aplikasi Kerangka Pengelolaan Lingkungan dan Sosial (ESMF) RIDF

Kerangka Pengelolaan Lingkungan dan Sosial RIDF akan menjelaskan secara detail kebijakan, prinsip, prosedur, kerangka kerja institusi, dan juga alur kerja PT. SMI untuk menghindari, meminimisasi dan mengelola dampak lingkungan dan sosial terkait proyek infrastruktur yang didukung oleh RIDF. ESMF ini disusun berdasarkan peraturan Pemerintah Indonesia, ESS (Environmental and Social Standards) PT.SMI dan Standar Internasional termasuk Kebijakan Safeguards Bank Dunia (OP 4.01, OP 4.04, OP 4.09, OP 4.36, OP. 4.11, OP 4.37 dan OP 4.10 and OP 4.12) (mohon lihat Annex 1 untuk penjelasan).

Seperti telah disebutkan di atas, kerangka pengelolaan lingkungan dan sosial ini berlaku untuk semua proyek yang akan mendapatkan pembiayaan melalui RIDF. Proyek yang menjadi cakupan ESMF ini dibagi menjadi 3 yaitu:

Tabel 1. Tipe Proyek dan Action melalui ESMF

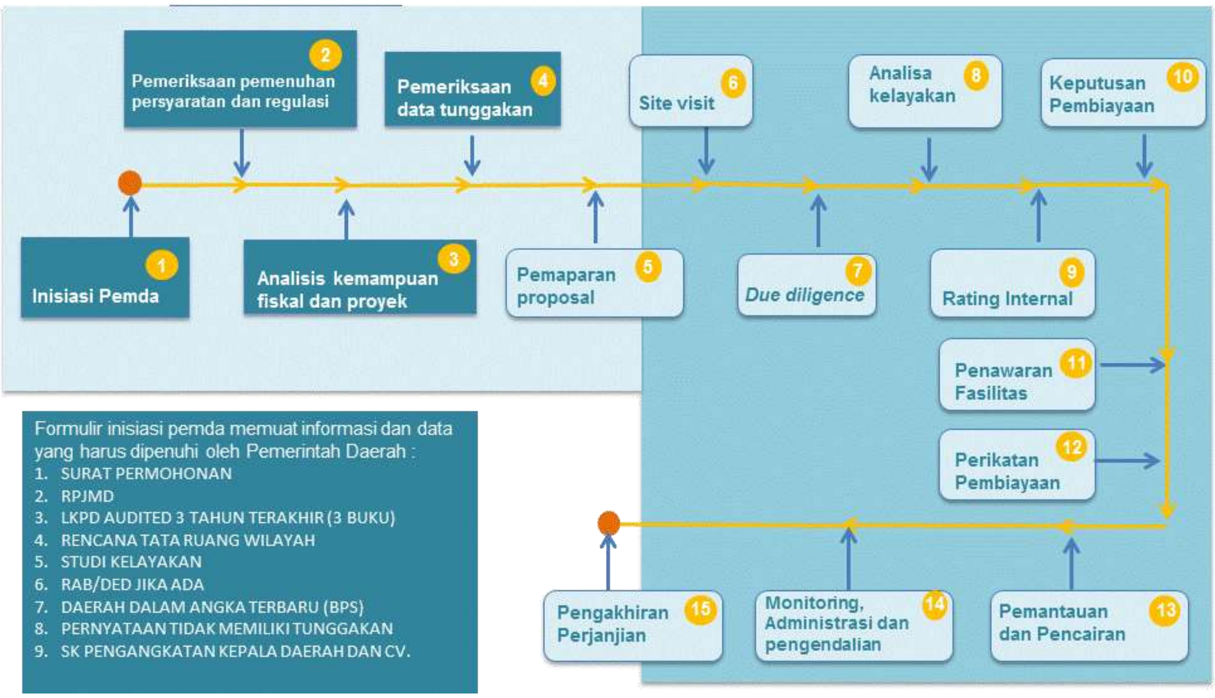
No	Jenjang Proyek	Action di ESMF
1	**Type 1** Proyek masih pada tahap konseptual. Lokasi dan alternatif desain masih dipertimbangankan	Pemda akan menyiapkan dan mengungkapkan semua dokumen lingkungan dan social (yaitu AMDAL, UKL/UPL, EIA, EMP, SIA, LARAP, IPP, dll) sebelum persetujuan proyek yang akan mendapatkan dukungan pendanaan dari RIDF. Pada tahap ini, pemohon dapat berkolaborasi dengan tim PDF untuk mempersiapkan dokumen yang diperlukan. Dokumen lingkungan dan sosial yang memiliki dampak signifikan dan penting harus dilakukan konsultasi publik yang bermakna sebelum finalisasi.
2	**Type 2** Tahap persiapan proyek telah selesai; bidding untuk konstruksi sudah dimulai. Dokumen lingkungan dan sosial telah selesai.	PT.SMI akan meninjau dokumen lingkungan dan social yang sudah tersedia dan akan meminta Pemda untuk melengkapi atau melakukan pengembangan atau penambahan studi lanjutan apabila diperlukan. Semua dokumen harus disetujui oleh PT SMI dan dilakukan konsultasi public yang bermakna sebelum persetujuan pinjaman
3	**Type 3** Proyek yang sudah dimulai atau bahkan sudah selesai konstruksinya	PT. SMI akan melakukan *due diligence* untuk mengkonfirmasi bahwa: (a) proyek tersebut memenuhi ESMF ini termasuk juga semua peraturan nasional dan internasional lain yang berlaku terkait dengan aspek lingkungan dan social; (b) tidak ada resiko reputasi bagi PT.SMI dan juga Bank Dunia; (c) tidak

No	Jenjang Proyek	Action di ESMF
		ada masalah terdahulu (legacy issue) atau kewajiban hukum. Berdasar atas penilaian tersebut, PT. SMI akan meminta Pemda untuk menerapkan langkah-langkah perbaikan, yang diperlukan, untuk mengurangi resiko potensial terkait reputasi atau masalah yang terkait kewajiban di masa lalu.

Cakupan ESMF ini juga melihat dampak terhadap daerah sekitar yang kemungkinan akan terkena dampak dari proyek tersebut seperti halnya dampak dari proyek terhadap *quarry* (area penggalian material), koridor, transmisi listrik, jaringan pipa, kanal, terowongan, jalan akses, daerah pembuangan (disposal area), serta daerah yang berkembang secara tidak direncanakan yang timbul dari adanya proyek (influx management), seperti misalnya pemukiman mendadak, logging, atau pergeseran lahan pertanian di sepanjang jalan akses. ESMF ini juga akan mencakup analisa dampak proyek terhadap area yang digunakan untuk kegiatan mata pencaharian seperti berburu, memancing, pengembalaan, pengumpulan, pertanian, dll atau terkait dengan upacara keagamaan atau upacara yang bersifat adat. Pada intinya, ESMF ini juga melihat dampak baik langsung maupun tidak langsung dari proyek yang dibiayai oleh RIDF terhadap kegiatan lainnya yang masih berhubungan dengan proyek tersebut.

ESMF ini menjelaskan secara komprehensif instrumen *safeguards* yang digunakan serta peran dari pihak terkait (PT. SMI dan Pemda) pada tiap siklus proses pinjaman dari inisiasi/aplikasi pinjaman, *screening* awal, penilaian proyek, penandatangan kontrak, pencairan, hingga evaluasi dan pemantauan.

Gambar 2. Alur Proses Pinjaman Daerah



Dokumen ESMF ini juga mencakup audit eksternal, pembaruan dokumen dan norma-norma pengungkapan. Adapun dokumen ESMF ini meliputi:

- Alat mitigasi resiko lingkungan dan sosial seperti penilaian dampak lingkungan (AMDAL, UKL UPL) dan rencana pengelolaan lingkungan (EMP atau RKL RPL) berdasarkan kategorisasi resiko proyek.
- Pembebasan lahan dan kerangka kebijakan pemukiman kembali atau disingkat rencana aksi pemukiman kembali berdasarkan kategorisasi resiko proyek (LARAP – Land Acquisition and Resettlement Action Plan).
- Kerangka perencanaan masyarakat adat termasuk penanganan keluhan dan mekanisme, konsultasi public untuk memastikan pendekatan partisipatif dan adil dalam mengevaluasi dan mengurangi resiko proyek.
- ESMF ini juga menjelaskan secara detail stakeholder yang terkait termasuk peran dan kewajibannya. Direktorat Manajemen Resiko di PT.SMI akan menggunakan dokumen ini dalam melakukan penilaian terhadap dampai resiko lingkungan dan sosial dan bagaimana mitigasi resiko dapat diukur dan dilakukan sebelum tercapainya perjanjian akan pinjaman. Divisi Pengendalian Fasilitias Pembiayaan juga akan memonitor compliance dari perjanjian pinjaman dan norma pengungkapan (disclosure). Di lain sisi, Pemda sebagai pihak peminjam akan menggunakan dokumen ESMF ini untuk mengisi checklist terkait lingkungan dan sosial sebagai bagian dari paket aplikasi pinjaman untuk RIDF dan juga sebagai panduan dalam menyiapkan dokumen dan instrument mitigasi dampak seperti AMDAL, UKL-UPL, LARAP, IPP, dan remedial action plan, dll.

- Pedoman terkait capacity building (peningkatan kapasitas).
- Seperti telah disebutkan diatas, ESMF ini menguraikan secara detail prosedur penerapan kerangka kerja dalam siklus bisnis RIDF.
- ESMF mencakup juga seperangkat alat pembantu seperti *template* untuk check list dan bentuk penilaian, kerangka acuan (terms of reference) untuk mempersiapkan dokumen untuk pengamanan langkah-langkah mitigasi, detail perencanaan, dan detail terkait safeguards yang harus dimasukkan ke dalam perjanjian pinjaman.
- ESMF ini juga menjelaskan secara detail prosedur operasional, aplikasi dari kerangka tersebut dan juga penggunaan template, kerangka acuan dan petunjuk lainyang telah disediakan.

ESMF ini terdiri atas 4 bagian – (i) Penapisan proyek dan penilaian dampak ; (ii) Langkah mitigasi beserta implementasinya; (iii) Implementasi terkait kebutuhan yang telah disebutkan; dan (iv) pemantauan, pengawasan dan pelaporan.

Dalam menegakkan rencana mitigasi, hasil dari penilaian isu terkait lingkungan dan social harus diterjemahkan kedalam perjanjian tentang pelaksanaan instrumen pengamanan antara PT.SMI dan Pemda. Dalam perjanjian pinjaman tersebut juga harus menentukan langkah-langkah yang harus diambil apabila terjanji masalah yang tidak diinginkan. Pemda juga diwajibkan secara berkala menyampaikan laporan kemajuan kepada PT. SMI terkait pelaksanaan rencana mitigasi yang disepakati dalam instrumen safeguards. Selanjutnya, PT. SMI akan melakukan kunjungan rutin untuk memverifikasi kemajuan dan kinerja pelaksanaan instrument safeguards yang disepakati. Secara khusus, ESMF ini juga mengharuskan pembebasan lahan dan persyaratan pengungkapan (disclosure requirement) terkait harus terpenuhi sebelum pencairan pinjaman.

Updating dan Operasionalisasi ESMF

ESMF ini adalah dokumen yang dapat terus diperbaharui oleh PT. SMI dari waktu ke waktu sesuai dengan kebutuhan dan situasi terkini. ESMF yang diperbaharui harus juga mendapat persetujuan dari pihak Bank Dunia dan akan tersedia untuk para pemangku kepentingan melalui website PT. SMI.

Detail prosedur yang harus diikuti olehPT.SMI untuk setiap jenis proyek untuk screening, penilaian dampak, dan penentuan instrument pengamanan dan tindakan perbaikan, pemantauan, pengawasan dan pelaporan serta konsultasi publik dan pengungkapan untuk proyek akan dimasukkan ke dalam dokumen Operational Manual dari RIDF.

Annex 1. PT.SMI ESS dan World Bank Safeguards Operational Policies

PT SMI's Environmental and Social Safeguards

11. ES-1: Assessment and Management of Environmental & Social Risks and Impact
12. ES-2: Labour and Working Conditions
13. ES-3: Pollution Prevention and Abatement
14. ES-4: Safety, Health and Security
15. ES-5: Land Acquisition and Resettlement
16. ES-6: Biodiversity Conservation and Natural Resources Management
17. ES-7: Indigenous Peoples and Local Communities
18. ES-8: Cultural Heritage
19. ES-9: Energy Conservation and Environment-Friendly Energy
20. ES-10: Consultation and Grievance Mechanisms

World Bank's Safeguards Operational Policies

10. OP 4.01 Environmental Assessment
11. OP 4.04 Natural Habitats
12. OP 4.09 Pest Management
13. OP 4.11 Physical Cultural Resources
14. OP 4.12 Involuntary Resettlement
15. OP 4.10 Indigenous Peoples
16. OP 4.36 Forests
17. OP 4.37 Safety of Dam
18. World Bank Group General EHS Guidelines and Industry Sector Guidelines

DAFTAR HADIR
Konsultasi Publik Environmental & Social Management Framework (ESMF) RIDF
PT Sarana Multi Infrastruktur (Persero)

Hari/ Tanggal : Rabu, 22 Juni 2016
Waktu : 15.00 – selesai
Tempat : Hotel Shangri-La Jakarta

No	Nama	Institusi	Phone	Email	TTD
1	Ardian Alhadath	ERM Indonesia	0811686698	ardian.alhadath@erm.com	
2	Randy Umail	Insidity Consulting	0811 892583	randy.umail@insidity-asia.com	
3	Agung Budiono	Publish What You Pay	081291697629	agungbudiono@pwyp-indonesia.org	
4	Fauzi Nasution	World Bank	08128897085	anasution@worldbank.org	
5	Krisna	WB	081321889864	Kisomartana@	
6	Adri	WB	08788762035		
7	IYO	INFID	081214273182	iyo@infid.org	

No	Nama	Institusi	Phone	Email	TTD
8	KEVIN JEAMES	ASIAN DEVELOPMENT BANK		jeamskevin@gmail.com	
9	Safrurius	KIA Lindata Rein			
10	N. Tri Aprianti	—//—	08124175368	mazaaziz@yahoo.com	
11	Indrawati	—//—	08526605894	indrawatidg@gmail.com	
12	DWI PURNAMA	—//—	081354962552	sguava23@gmail.com	
13	Efendi Patulak	Dinas PU Prov. Sultra.	082281459111	efendy.martin@gmail.com	
14	Fauzi Nasution	World Bank	08128897085	anasution@worldbank.org	
15	Dr. Ir. Agus S. Lasuida, MM	BLUD RS Kawanua Jakarta	082326059862	agus.lasuida@yahoo.com	
16	H. M. Aris	Mutis	081287200401		
17	FERDINAND	Opus	085288836271		

SMi

PT SARANA MULTI INFRASTRUKTUR (PERSERO)

No	Nama	Institusi	Phone	Email	TTD
18	I Gede Githa A.P	KND - DJKN		githa.ryuzabi@gmail.com	
19	Amurib.	Pemda. Polewali Mandar	082347207900	amurib_72@yahoo.com	
20	IDA AYU INDIRA	WB	0811896662	dindira@worldbank.org	
21	Adri Poesoro	WB			
22	Marcus Lee	WB	082153716162	mlee1@worldbank.org	
23	MAUL HARWONO	DINAS PU PROV. SULTRA	0813 1138 4938	[illegible] @ yahoo.com	
24	[illegible]	SMI			
25	DYAH ADNITA	DJPK	0811 [illegible]	[illegible]	
26	Lenny M	DJPK			
27	dr Syamsiah	RSUD	081 343 913 [illegible]	polewalirsud@yahoo.co.id	

SMi

PT SARANA MULTI INFRASTRUKTUR (PERSERO)

No	Nama	Institusi	Phone	Email	TTD
28	Ary Sudijanto	KLHK	0816 1181801	asujanto@gmail.com	
29					
30					
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32					
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35					
36					
37					

DOCUMENTATIONS

KONSULTASI PENYUSUNAN KERANGKA KERJA PENGELOLAAN LINGKUNGAN DAN SOSIAL (*ENVIRONMENTAL AND SOCIAL MANAGEMENT FRAMEWORK – ESMF*)

DIREKTORAT MANAJEMEN RISIKO

Juni 2016

PT Sarana Multi Infrastruktur (Persero)

Ruang Lingkup

1. Tujuan Konsultasi Publik

- Mendapatkan masukan dan saran dari stakeholders terkait Kerangka Kerja Pengelolaan Lingkungan dan Sosial (*Environmental and Social Management Framework – ESMF*).
- Mengembangkan ESMF guna mengurangi, mitigasi dan mengelola risiko dan potensi dampak, serta pengelolaan Environmental and Social Safeguards (ESS) PT. SMI.
- Pelaksanaan Program Pembiayaan Pemerintah Daerah dan Instansi Pemerintah Lainnya (Regional Infrastructure Development Fund – RIDF)
- Sebagai Kepatuhan Hukum terkait Keterbukaan Informasi Publik; UU No. 14 Tahun 2008.
- Sebagai Kepatuhan Hukum terkait Keterlibatan Masyarakat Dalam Proses AMDAL dan Izin Lingkungan; Permen LH No.17 Tahun 2012
- Sebagai bagian dari konsep Lingkungan , Sosial dan Pemerintahan sesuai dengan *guideline* OJK terkait *Roadmap* Keberlanjutan Keuangan yang dikeluarkan pada 5 Desember 2014

2. Latar Belakang

- RIDF bertujuan untuk meningkatkan akses pembiayaan infrastruktur di tingkat subnasional, dengan arahan kebijakan khusus yang cocok untuk pinjaman subnasional.
- Diharapkan strategi RIDF yang efektif akan mempercepat pertumbuhan infrastruktur di perkotaan di seluruh daerah di mana pembangunan infrastruktur tidak dapat mengimbangi permintaan.
- Komponen RIDF: (i) Dukungan modal untuk RIDF; (ii) Pembangunan fasilitas proyek (PDF).
- Sektor dan subproyek yang memenuhi syarat; (i) Air Minum & Sanitasi; (ii) Saluran Air; (iii) Efisiensi Energi; (iv) Perbaikan Perkampungan Kumuh; (v) Infrastruktur Sosial (Rumah Sakit)

3. Landasan Hukum (a)

- ❖ Undang – Undang No. 14 Tahun 2008 tentang Keterbukaan Informasi Publik
- ❖ Undang - Undang No. 32 Tahun 2009 tentang Perlindungan dan Pengelolaan Lingkungan Hidup.
- ❖ Undang - Undang Republik Indonesia No. 13 Tahun 2003 tentang Ketenagakerjaan.
- ❖ Undang-Undang Republik Indonesia No. 2 Tahun 2012 tentang Pengadaan Tanah Bagi Pembangunan Untuk Kepentingan Umum.
- ❖ Undang-undang Republik Indonesia No. 7 Tahun 1984 tentang Pengesahan Konvensi Penghapusan Segala Bentuk Diskriminasi Terhadap Wanita
- ❖ Undang - Undang Republik Indonesia No 1 Tahun 1970 tentang Keselamatan Kerja.
- ❖ Undang-Undang Republik Indonesia No. 7 Tahun 2012 tentang Penanganan Konflik Sosial.
- ❖ Undang-Undang Republik Indonesia No. 11 Tahun 2009 tentang Kesejaheraan Sosial.

3, Landasan Hukum (b)

- ❖ Undang-Undang Republik Indonesia No. 9 Tahun 1998 tentang Kemerdekaan menyampaikan Pendapat di Muka Umum.
- ❖ Undang-undang Republik Indonesia No. 11 Tahun 2010 tentang Cagar Budaya.
- ❖ Peraturan Pemerintah No. 70 Tahun 2009 tentang Konservasi Energi.
- ❖ Permen LH No. 17 Tahun 2012 tentang Keterlibatan Masyarakat Dalam Proses AMDAL dan Izin Lingkungan
- ❖ Anggaran Dasar PT Sarana Multi Infrastruktur.
- ❖ Pedoman *Environmental and Social Management System* (ESMS) Proyek.
- ❖ Pedoman Tata Kelola Perusahaan (*Good Corporate Governance*).
- ❖ Pedoman Etika Usaha dan Tata Perilaku *(Code of Conduct).*
- ❖ Pedoman Manajemen Risiko.
- ❖ Pedoman Penyusunan Kebijakan Perseroan.
- ❖ Peraturan Direksi mengenai Tugas Pokok dan Fungsi Divisi Perseroan.
- ❖ Peraturan dan/atau standar Internasional, seperti; IFC Performance Standards, The World Bank Safeguard Policy, ADB Safeguard Policy Statements (SPS), serta lembaga internasional lainnya.
- ❖ Undang-Undang Republik Indonesia No. 11 Tahun 2009 tentang Kesejaheraan

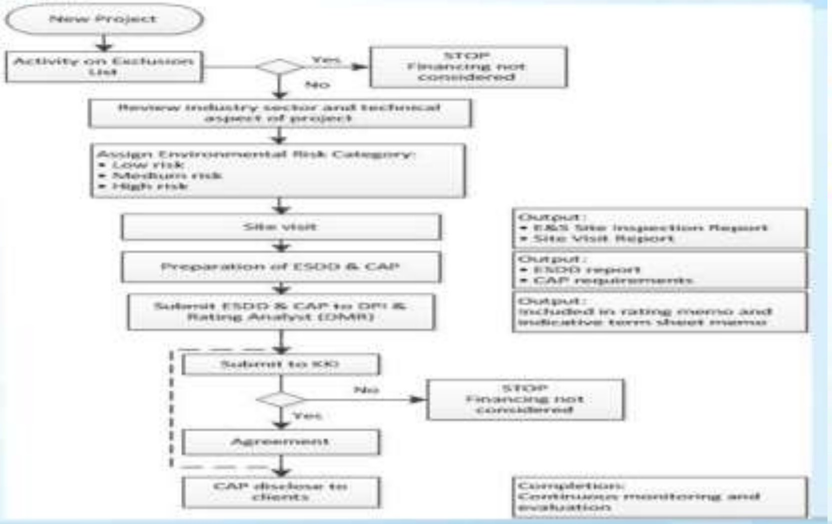
4. RIDF – Prosedur Operasional

1. Tahap Pengajuan Loan (dilakukan oleh PEMDA):
   - Nama Pemda dan Proyek yang diajukan
   - Lokasi, sektor dan deskripsi sub-proyek
   - Perkiraan lokasi sub-proyek dengan area sensitif (Kriteria sensitif area sudah disiapkan)
   - Informasi dampak lingkungan dan sosial yang ditimbulkan
   - Informasi terkait dokumen lingkungan dan sosial (jika sudah ada)

5. Tahapan/Proses Pelaksanaan RIDF

- ❖ Proses ini melibatkan 5 tahap :
  - Langkah I : Aplikasi pinjaman oleh pemohon RIDF
  - Langkah II : Skrining awal
  - Langkah III : Detil penilaian proyek
  - Langkah IV : Keputusan Pinjaman dan pencairan
  - Langkah V : Implementasi dan monitoring proyek

Diagram Penerapan E&S Dalam Proyek



Peraturan Lingkungan & Sosial PT. SMI (Environmental & Social Safeguard = ESS)

- ESS 1 : **Sistem Manajemen Sosial dan Lingkungan (SMSL)**
  (Social & Environmental Assessment & Management System – SEMS)
- ESS 2 : **Tenaga Kerja dan Kondisi Kerja**
  (Labor & Working Conditions)
- ESS 3 : **Pencegahan Polusi, Pengurangan, dan Perubahan Iklim**
  (Pollution Prevention, Abatement & Climate Change)
- ESS 4 : **Kesehatan Masyarakat, Keselamatan dan eamanan/Keselamatan Bendungan**
  (Community Health, Safety & Security/Dam Safety)
- ESS 5 : **Pembebasan Lahan dan Pemukiman Kembali Secara Tidak Sukarela**
  (Land Acquisition & Involuntary Resettlement)
- ESS 6 : **Konservasi Keanekaragaman Hayati dan Pengelolaan Sumber Daya Alam Berkelanjutan**
  (Biodiversity Conservation & Sustainable Natural Resource Management)
- ESS 7 : **Masyarakat Adat (MA)**
  (Indigenous Peoples (IP))
- ESS 8 : **Properti dan Warisan Budaya**
  (Cultural Property & Heritage)
- ESS 9 : **Konservasi Energi dan Energi Ramah Lingkungan**
  (Energy Conservation & Environmentaly Friendly Energy)
- ESS 10: **Konsultasi & Penanganan Keluhan**
  (Consultation & Grievance Mechanism)

ESS 1: Sistem Manajemen Lingkungan dan Sosial (SMLS)

Risiko L&S harus dikelola sejak tahap awal dan selama proyek itu beroperasi. Prinsip ini terdiri dari:

- Seleksi dan kategorisasi proyek;
- Penilaian Lingkungan & Sosial;
- Manajemen Lingkungan & Sosial;
- Kapasitas organisasi;
- Pelatihan;
- Keterlibatan pemangku kepentingan dan konsultasi; dan
- Monitoring, pelaporan, dan perbaikan yang terus-menerus.

Berlaku untuk semua proyek SMI

* *ESS 1 mengadopsi WB OP 4.01 & IFC Performance Standard 1 - Environmental Assessment*

ESS 2: Tenaga Kerja dan Kondisi Kerja

- Membangun, menjaga, dan meningkatkan hubungan baik buruh-manajemen;
- Menghindari tenaga kerja anak/pekerja dibawah umur dan melarang adanya pekerja paksa; dan
- Meningkatkan kondisi kerja yang aman dan sehat.

Berlaku untuk semua proyek SMI

* *ESS 2 mengadopsi IFC Perfomance Standard 2 – Labour and Working Conditions*

ESS 3: Pencegahan Polusi, Pengurangan, dan Perubahan Iklim

- Mencegah polusi dan mengelola dampak yang timbul dari kegiatan proyek;
- Memastikan kegiatan proyek sesuai dengan praktik yang terbaik dan standar global; dan
- Memastikan bahwa masalah perubahan iklim yang terkait dengan kegiatan proyek diperhitungkan, dikurangi, dan dipantau selama umur investasi SMI, dan diharapkan untuk tetap menerapkan prinsip keberlanjutan sosial dan lingkungan selama umur proyek.

Berlaku untuk semua proyek SMI

** ESS 3 mengadopsi WB OP 4.09 Pest Management & IFC Performance Standard 3 Resource Efficiency and Pollution Prevention*

ESS 4: Kesehatan Masyarakat, Keselamatan dan Keamanan/Keselamatan Bendungan

- Berusaha untuk menghindarkan atau meminimalkan risiko dan dampak terhadap kesehatan masyarakat, keselamatan, dan keamanan yang mungkin timbul dari kegiatan proyek; dan
- Termasuk persyaratan khusus yang berkaitan dengan keamanan bendungan yang berhubungan dengan proyek.

Berlaku untuk semua proyek SMI

** ESS 4 mengadopsi World Bank Group General EHS Guidelines and Industry Sector Guidelines & IFC Performance Standard 4 – Community Health, Safety & Security*

ESS 5: Pembebasan Lahan dan Pemukiman Kembali Secara Tidak Sukarela

- Mengacu kepada pemindahan fisik (karena relokasi atau kehilangan tempat tinggal) dan pemindahan ekonomi (karena kehilangan aset atau akses kepada aset yang menyebabkan hilangnya sumber penghasilan atau mata pencaharian) akibat kegiatan proyek yang membutuhkan pembebasan lahan;
- Pemukiman kembali tidak berlaku bila dihasilkan dari transaksi tanah sukarela (jual-beli); dan
- Dampak harus dihindari, diminimalisir, dikurangi atau dikompensasi, melalui proses Penilaian Sosial dan Lingkungan dalam Prinsip 1.

Penerapan Prinsip ini akan ditentukan selama penyaringan dan penilaian proyek

**ESS 5 mengadopsi WB OP 4.12 Involuntary Resettlement & IFC Performance Standard 5 – Land Acquisition and Involuntary Resettlement*

ESS 6: Konservasi Keanekaragaman Hayati dan Pengelolaan Sumber Daya Alam yang Berkelanjutan

- Termasuk perlindungan, konservasi dan pengelolaan keanekaragaman hayati, dan mempromosikan penggunaan sumber daya alam yang terbarukan.

Penerapan Prinsip ini akan ditentukan selama penyaringan dan penilaian proyek

** ESS 6 mengadopsi WB OP 4.04 Natural Habitats & IFC Performance Standard 6 – Biodiversity Conservation and Sustainable Management of Living Natural resources*

ESS 7: Masyarakat Adat (MA)

- Termasuk identifikasi semua dampak (positif dan negatif) terhadap Masyarakat Adat, penilaian sosial, konsultasi dan pengungkapan Rencana Pembangunan Masyarakat Adat; dan
- Berlaku untuk proyek-proyek yang berdampak terhadap individu-individu atau masyarakat yang memenuhi definisi Masyarakat Adat, penentuan definisi mungkin memerlukan konsultasi dengan para pemangku kepentingan, termasuk investor strategis.

Masyarakat Adat mengacu pada suatu kelompok terpisah dan khas, relatif rentan secara sosial dan budaya yang memiliki karakteristik dalam berbagai derajat berikut:

- Punya identitas diri yang berbeda dan diakui keberbedaannya oleh kelompok dominan
- Memiliki keterikatan kolektif dengan tanah dan sumber daya alam
- Adat budaya, ekonomi, sosial atau lembaga-lembaga politik yang terpisah dari orang-orang dari masyarakat dan budaya yang lebih dominan
- Berbahasa adat

Penerapan Prinsip ini akan ditentukan selama penyaringan dan penilaian proyek

** ESS 7 mengadopsi WB OP 4.10 & IFC Performance Strandard 7 - Indigenous Peoples*

ESS 8: Properti Budaya dan Warisan

- Mengakui pentingnya benda budaya dan warisan bagi generasi sekarang dan masa depan, sesuai dengan Konvensi Mengenai Perlindungan Budaya Dunia dan Warisan Alam; dan
- Berusaha untuk membimbing para sponsor proyek dalam mengidentifikasi dan melindungi warisan budaya dalam desain proyek dan eksekusi proyek.

Penerapan Prinsip ini akan ditentukan selama penyaringan dan penilaian proyek

** ESS 8 mengadopsi WB OP 4.11 - Physical Cultural Resources & IFC Performance Standard 8 – Cultural Heritage*

ESS 9: Konservasi Energi dan Energi Ramah Lingkungan

- Mendorong konservasi energi sebagai upaya penghematan dalam pemakaian sumber daya dalam upaya perlindungan sumber daya alam dan mendorong penggunaan sumber daya secara terencana dan terarah secara berkelanjutan.
- Mendorong pembangunan berkelanjutan dan penggunaan energi melalui penerapan-penerapan konservasi yang terintegrasi dengan prioritas pembangunan.
- Mendorong pembangunan fasilitas energi hijau yang ramah lingkungan dalam upaya peningkatan energi baru dan terbarukan.

Berlaku untuk semua proyek SMI

** ESS 9 merupakan penjabaran lebih detil dari IFC Performance Standard 3 dan 4*

ESS 10: Konsultasi & Penanganan Keluhan

- Mendorong keterbukaan informasi dan mendorong peran serta masyarakat serta *stakeholders* lainnya sebagai upaya konsultasi dalam kesetaran yang saling menguntungkan.
- Mendorong partisipasi masyarakat dalam pembangunan berkelanjutan di wilayah yang terkena dampak.
- Sebagai upaya yang memfasilitasi budaya musyawarah untuk mufakat pada proyek dan masyarakat yang terkena dampak sebagai mekanisme penanganan keluhan.

Berlaku untuk semua proyek SMI

** ESS 10 merupakan penjabaran lebih detil dari IFC Performance Standard 2 dan 7*

Contoh Kasus

Potensi bahaya longsor

Lemahnya pengawasan terhadap tenaga kerja dari subcontractor

Limbah cair yang dibuang kedalam badan air

Debu akibat penanganan yang kurang baik

Contoh Kasus

Konflik lahan

Manusia Vs hewan liar

Konflik dengan Masyarakat Adat

"Chance Find Protocol"

DISKUSI

Annex 9. Outline of Environmental and Social Appraisal Report

A. Introduction

1. Project description: title, type of project, location and setting, amount, size (scale, capacity, number of staff, etc.).
2. Environmental and social categorization and rationale.
3. Applicable Environmental and Social Requirements.

B. Scope of Review and Methodology

1. Documents reviewed (e.g., environmental assessment reports, involuntary resettlement plan, Indigenous Peoples plan, or environmental and social compliance audit reports, copies of permits/licenses, etc.).
2. Methodology adopted (e.g. site visit, inspection report, etc.).

C. Compliance and Liability (by relevant safeguard requirements applicable for the specific project, examine environmental and social issues and compliance)

1. Examine issues in terms of environmental, involuntary resettlement and indigenous peoples impacts, mitigation measures to address these issues (or corrective action plan for existing facilities) and compliance status with applicable World Bank environmental and social safeguard requirements and national laws, regulations, and standards:

   (i) Environmental Safeguards

   a. appropriate identification of major anticipated environmental impacts and risks;
   b. adequacy of environmental assessment (for category A projects, including the adequacy of alternative analysis);
   c. compliance status with applicable requirements on (i) information disclosure, (ii) consultation with affected people and other stakeholders,(iii) occupational and community health and safety, biodiversity conservation and sustainable natural resource management, and physical cultural resources; and
   d. adequacy of mitigation measures and EMP (mitigation measures, monitoring and reporting, institutional arrangement, budget), or corrective action plan for existing facilities, if any.

   (ii) Involuntary Land Acquisition and Resettlement

   a. appropriate identification of major anticipated involuntary resettlement impacts and risks (including both physical displacement and economic displacement);
   b. adequacy of assessment of social impacts, information disclosure and consultation with affected people and other stakeholders;

c. adequacy of compensation and benefits for displaced persons

d. adequacy of resettlement plan (measures to enhance or restore the livelihoods of displaced persons, monitoring and reporting, institutional arrangement, budget), or corrective action plan for existing facilities, if any; and

e. Private sector responsibilities under government-manages resettlement.

(iii) Indigenous Peoples

(a) appropriate identification of major anticipated impacts on Indigenous Peoples (including potential impacts on traditional or customary lands under use; relocation of Indigenous Peoples from traditional and customary lands, and impacts on cultural resources);

(b) adequacy of information disclosure and meaningful consultation;

(c) broad community support, where applicable;

(d) adequacy of measures to avoid adverse impacts; and

(e) adequacy of Indigenous Peoples Plan (benefit sharing, measures to mitigate and minimize adverse impacts, monitoring and reporting, institutional arrangement, budget), or corrective action plan for existing facilities, if any.

(iv) Adequacy of grievance redress mechanism arrangements

1 Recommend mitigation measures, or corrective action plans, if gaps are identified

2 For existing facilities including projects under construction, examine whether the project company paid pollution charges or fines/penalties for non-compliance in the last two years in accordance with national laws, whether the project company is exposed to potentially significant liabilities, such as those arising from known or suspected land/groundwater contamination, major accidents and incidents related to the company's past or ongoing operations, and state further actions required/planned by the project, in particular actions to address any non-compliance problems and liabilities. Also examine whether there are complaints from the public or local communities regarding the project company's environmental and social performance.

3 State any risk control or mitigation measures to be taken by the project, such as conditions, loan covenants or monitoring and reporting requirements

D. Other Project Specific Issues, if any

E. Conclusion and Recommendations

F. Format for Corrective Action Plan

Name of Sub-Project					Date of Audit:		
Documents reviewed:							
Sr. No.	**Identified Non-Compliances**	**Recommended Corrective Actions**	**Timeframe**	**Action completion indicator**	**Means of Evaluation**	**Name of Responsible person**	**Remarks**
(Signature of Environmental / Social Safeguards Specialist) Name:							

Annex 10. **Sector wise environmental review / appraisal checklist and Generic (Cross cutting) Aspects**

I. Water Supply

Note: See table 1 at Chapter 1 about the potential sub-projects for each sector.

There is a specific World Bank Group EHS Industry Sector Guidelines for Water and Sanitation at www.ifc/ehsguidelines that that is applicable and strongly relevant to be used to complement this appraisal checklist.

No.	Process	Description	Yes	No	N/A	Sufficiency of Mitigation Measures Proposed
1.	Water Withdrawal (For Dams, water treatment plants, deep wells, transmission and distribution lines etc.)	Have the potential adverse effects of withdrawal of surface water on downstream ecosystems been evaluated?				
		Has appropriate environmental flow assessment been conducted to determine acceptable withdrawal rates?				
		Does the raw water supply have a source of pollution at the upstream like industries, agriculture, and sewage and soil erosion? Are adequate measures taken to treat these?				
		Does the project pose a hazard of land subsidence due to excessive ground water pumping? On Dam Safety aspect?				For water withdrawal from a dam, the ESMF shall requires reviews by a dam expert for the potential impact of the withdrawal to the operation and maintenance aspects, its emergency preparedness and the requirement of periodic safety

No.	Process	Description	Yes	No	N/A	Sufficiency of Mitigation Measures Proposed
						inspections of the dam.
2.	Water Treatment	Does the treated water meet national standards?				
		Have adequate measures been taken to reduce the solid waste residual generated through the treatment process?				
		Does the effluent from the treatment process like filter backwash, reject streams from membrane filtration processes, and brine streams from ion exchange or demineralization processes treated and meet country standards?				
		Are adequate measures taken to prevent and control hazards during storage and use of hazardous chemicals?				
		Is there emission generated from the treatment process? Have measures been taken to mitigate these impacts?				
		Is the water treatment facility located in designated protected areas? Will the project activities cause any damage to these?				
		Is the water treatment facility located in a densely				

No.	Process	Description	Yes	No	N/A	Sufficiency of Mitigation Measures Proposed
		populated area or an area with heavy developmental activities?				
3.	Water Distribution	Does the design of the distribution system include checks and measures to minimize leaks and loss of pressure?				
		Is the water used for flushing the water pipes disposed in accordance to country requirements?				
4.	Supporting facilities for Water Supply Facilities;	Are water supply facilities completed with adequate transmission lines?				
		Are the impairments associated with transmission lines and access roads adequately addressed?				
		Is the increase in water supply supported by adequate sewerage network and sewage treatment facility?				
5.	Health and safety	Are adequate measures taken to prevent, minimize and mitigate occupational health and safety hazards to workers in projects?				
6.	The project might	For small dams (<15 m in height), policy requirement is				

No.	Process	Description	Yes	No	N/A	Sufficiency of Mitigation Measures Proposed
	finance the construction of a dam as part of water supply system and water resource management infrastructure in the region	for the dam to be designed by a qualified engineer. For large dams (15 m and higher), the ESMF shall requires reviews by an independent panel of experts, preparation and implementation of detail plans (construction, instrumentation, operation and maintenance, and emergency preparedness), prequalification of bidders and periodic safety inspections of the dam after completion.				

II. Sewerage and Sanitation

There is a specific World Bank Group EHS Industry Sector Guidelines for Water and Sanitation at www.ifc/ehsguidelines that that is applicable and strongly relevant to be used to complement this appraisal checklists.

No.	Process	Description	Yes	No	N/A	Sufficiency of Mitigation Measures Proposed
1.	On-site systems	Are suitable facilities for storage, handling and treatment of faecal sludge from septic systems provided?				
2.	Sewerage system	Does the design of the sewerage system meet country standards?				
		Are adequate measures				

No.	Process	Description	Yes	No	N/A	Sufficiency of Mitigation Measures Proposed
		taken to prevent and minimize leaks from the sewerage system into the ground?				
3.	Sewage Treatment	Is the sewage adequately treated before release into aquatic systems? Do they meet country standards?				
		Is the sludge generated from the treatment plant disposed as per country specifications?				
		Are adequate measures taken to minimize odour from the treatment facility?				
		Does the effluent from the treatment facility meet country and sponsors standards for disposal into aquatic systems?				
		Are adequate measures taken to prevent and control hazards during storage and use of hazardous chemicals?				
		Are adequate measures taken to prevent overflows and flooding of neighbouring properties with raw				

No.	Process	Description	Yes	No	N/A	Sufficiency of Mitigation Measures Proposed
		sewage?				
		Is the water treatment facility located in designated protected areas? Will the project activities cause any damage to these?				
		Is the water treatment facility located in a densely populated area or an area with heavy developmental activities?				
4.	Industrial Waste Water	Is the wastewater adequately treated before release into sewerage system or aquatic systems? Do the effluents meet country standards?				
5.	Occupational Health and Safety	Are adequate measures taken to prevent accidents and injuries to workers while working?				
		Are adequate measures taken to prevent chemical hazards during handling and storage of hazardous chemicals?				
		Are protective equipment and training provided to workers against exposure to				

No.	Process	Description	Yes	No	N/A	Sufficiency of Mitigation Measures Proposed
		hazard?				

III. Solid Waste Management

There is a specific World Bank Group EHS Industry Sector Guidelines for Waste Management Facilities at www.ifc/ehsguidelines that is applicable and strongly relevant to be used to complement this appraisal checklists.

No.	Process	Description	Yes	No	N/A	Information
1.	Collection and Transport	Are adequate Litter bins and refuse collection services available to prevent littering and clandestine dumping?				
		Are adequate measures taken to mitigate air emission?				
2.	Waste Receipt, Unloading, Processing and Storage	Are adequate measures taken to prevent migration of leachate into soil, surface water and groundwater?				
		Are adequate measures taken to prevent, minimize, and control waste from project?				
3.	Biological Treatment	Are adequate measures taken to control leachate and runoff from waste storage and processing areas?				If not, then….
		Are adequate measures taken to prevent combustion of waste?				
4.	Landfilling	Is the landfill site located in accordance to country				

No.	Process	Description	Yes	No	N/A	Information
		specifications?				
		Are adequate measures taken for collection, treatment and disposal of leachate from landfill?				
		Is the quantity of leachate generated regularly monitored?				
		Is a landfill gas collection system designed and operated in accordance with applicable national requirements standards?				
		Are adequate measures taken to prevent, minimize, and control dispersal of litter?				
		Is adequate buffer zone maintained around the landfill to alleviate nuisances?				
5.	MSW Incineration Facilities	Does project own/operate incinerator for MSW? If yes, does it have valid permit?				Number of permit: Date of issue: Date of validity: Agency of Permit Issuance:
		Do emissions from incinerators meet country and standards?				
		Are ash and other residuals disposed in accordance to country specifications?				
6.	Health and Safety	Are adequate measures taken to minimize and mitigate health and safety hazards to workers from toxic gases and hazardous				

No.	Process	Description	Yes	No	N/A	Information
		materials on site?				
		Are adequate measures taken to protect the public and neighbourhood from odour, smoke from fire, diseases transmitted by flies, rodents, insects and birds etc.?				

IV. Hazardous and Toxic Waste Management Facilities

There is a specific World Bank Group EHS Industry Sector Guidelines for Waste Management Facilities at www.ifc/ehsguidelines that is applicable and strongly relevant to be used to complement this appraisal checklists

No.	Process	Description	Yes	No	N/A	Information
1.	Collection and Transport	Are adequate measures taken to prevent spills and releases to environment?				
		Are national and sponsors standards followed for packaging, labelling, and transport of hazardous materials and wastes? Permit obtained for storage, transport and treatment?				
2.	Waste Receipt, Unloading, Processing, and Storage	Is the incoming waste adequately identified and classified for storage, treatment and disposal?				
		Are adequate measures taken to prevent spills and releases during waste storage and handling?				
		Are adequate measures taken to prevent and control releases of particulate matter and VOCs				

No.	Process	Description	Yes	No	N/A	Information
		from waste processing equipment?				
3.	Biological-Physical-Chemical Treatment	Is the facility designed and operated in accordance with applicable national requirements?				
		Are adequate measures taken to control leachate and runoff from waste storage and processing areas?				
4.	Incineration Facilities	Does project have/operate incinerator for hazardous and toxic waste? If yes, does it have valid permit?				Number of permit: Date of issue: Validity date: Agency of Permit Issuance:
		Do emissions from incinerators meet country standards?				
		Are ash and other residuals disposed in accordance to country specifications?				

V. Road Access, Land Transportation, Irrigation, Logistics, Terminals

There are specific World Bank Group EHS Industry Sector Guidelines for "Toll Road", "Shipping", "Ports, Harbours, Terminals", "Airports", "and Railways", "Irrigation", at www.ifc/ehsguidelines that are applicable and strongly relevant to be used to complement this appraisal checklists.

No.	Environmental Component	Description	Yes	No	N/A	Information
1.	Ecology	Does the project lie in proximity to or cut across any designated Protected Area?				

No.	Environmental Component	Description	Yes	No	N/A	Information
		Does the project or its activities cause disruption of terrestrial and aquatic habitats? If yes which of the following impacts does it cause ▪ fragmentation of forested habitat; ▪ loss of nesting sites of listed rare, threatened, or endangered species and / or high biodiversity / sensitive habitat; disruption of watercourses; ▪ creation of barriers to wildlife movement; ▪ visual and auditory disturbance due to the presence of machinery, construction workers, and associated equipment				
		Does the project involve regular maintenance of vegetation within road right-of-way causing likelihood of the establishment of invasive species?				
2.	Hydrology	Would the alteration of topography and installation of project components like tunnels adversely affect surface and ground water flows?				
3.	Topography and Geology	Does the project involve activities that have a likelihood of causing slope failures and landslides?				
4.	Storm water	Does the project or its activities cause increase in rate of surface water runoff?				
5.	Waste	Does the project or its activities lead to generation of the				

No.	Environmental Component	Description	Yes	No	N/A	Information
		following types of waste ▪ Solid waste may be generated during construction and maintenance ▪ Vegetation waste ▪ Sediment and sludge from storm water drainage system maintenance ▪ Waste generated from road and bridge maintenance				
6.	Air Quality	Will the project cause increased local air pollution due to rock crushing, cutting and filling works and chemical vapor from asphalt processing?				
7.	Water Quality	Would the surface runoff from cut and fill areas cause degradation of water quality in the downstream water bodies?				
		Would the surface runoff from roads contaminate surrounding water sources and/or ground water? Mitigation measure for pesticide use increase from irrigation projects?				
8.	Public Health	Will the project lead to creation of temporary breeding habitats for mosquito vectors of disease?				
		Are there accident risks associated with increased vehicular traffic, leading to loss of life (communities around project area)?				
9.	Occupational Health and Safety	Are adequate measures taken to prevent physical hazards while operating machinery, from moving vehicles and working at elevation on bridges and				

No.	Environmental Component	Description	Yes	No	N/A	Information
		overpasses?				
		Are adequate measures taken to prevent chemical hazards from construction and paving activities, exhaust emissions from heavy equipment and motor vehicles during all construction and maintenance activities? Mitigation measure for pesticide use increase from irrigation projects?				

VI. Urban Slum Improvements, Housing,Social Infrastructure Buildings (such as hospitals, public markets, schools)

There is a specific World Bank Group EHS Industry Sector Guidelines for "Health Care Facilities" at www.ifc/ehsguidelines that is applicable and strongly relevant to be used to complement this appraisal checklists. For Urban Slum improvement works and Building construction (schools, markets) the WBG General EHS Guidelines has been referred to complement this checklist.

No.	Environmental Component	Checklist	Yes	No	Comments/Information
1.	Ecology	Will the project alter the micro-climate of the area due to building design?			
		Does the project require large scale felling of trees? Have measures been planned to transplant these trees?			
2.	Energy	Are passive solar architecture features being used in the building to optimize energy consumption?			

No.	Environmental Component	Checklist	Yes	No	Comments/Information
3.	Land	Have adequate measures been planned to prevent land degradation due to dumping of construction waste and excavation spoil? Have designated locations been identified by the local body for dumping of such waste?			
		Is material for construction like sand and aggregate sourced from authorized quarries?			
		Does the project require conversion of land use from industrial to residential? Has the soil been tested for contamination before commencement of excavation?			
		Will the housing facility impact the existing facilities adjacent to the site? (Such as open spaces, community facilities, details of the existing land use, disturbance to the local ecology).			
		Have measures been planned for solid waste management from the housing facility after occupation?			
		Have adequate parking spaces been provided also considering the rise in social status?			
4.	Natural drainage	Has the main natural drainage of the site been			

No.	Environmental Component	Checklist	Yes	No	Comments/Information
		retained and incorporated in the master planning to prevent future flooding?			
		Have adequate measures been planned to prevent obstruction to natural drainage due to dumping of construction waste and excavation spoil?			
5.	Air Quality	Is the ambient air quality within the host country's standards for most of the times?			
		Are air polluting industries located in the vicinity of the project area. Will the project add to the air pollution load in the area?			
		Will the project cause increased local air pollution especially SPM and RSPM levels due to rock crushing, cutting and filling works and fugitive dust emissions form stockpile, construction camps, haul roads?			
		Is the exhaust from equipment used during construction like diesel generator sets, crushers etc. within limits prescribed by State Pollution Control Boards?			
6.	Water Quality	Would the surface runoff from cut and fill areas cause degradation of water quality in the downstream water			

No.	Environmental Component	Checklist	Yes	No	Comments/Information
		bodies and ground water?			
		Does the project or its activities cause increase in rate of surface water runoff?			
		Will the runoff from construction activities, stockpile areas for debris and excavation spoil affect water quality of surrounding water bodies?			
		Have measures been planned for conveyance of sewerage? Has a sewage treatment facility been installed for the housing facility?			
7.	Water Demand	How is the water demand been met for construction? Will the drawl of ground water for construction affect the water availability to existing habitations?			
8.		Have adequate provisions been made for water supply to the housing facility after occupancy?			
		Is ground water development of the area in critical zone?			
9.	Public Health	Will the project lead to creation of temporary breeding habitats for mosquito vectors of disease?			
10.		Has the housing facility and amenities provided been planned in accordance to fire hazard regulations? Has a fire fighting system been installed?			

No.	Environmental Component	Checklist	Yes	No	Comments/Information
11.	Occupational Health and Safety	Are adequate measures taken to prevent physical hazards while operating machinery, from working at elevation on scaffolding, from collapse of slabs and such structural members?			
		Are the labour provided clean water for consumption and cooking?			
		Have adequate sanitation facilities been provided at labour camps?			
12.	For HOSPITAL construction	Have requirements in the WBG EHS Industry Sector Guideliens for Health Care Facilities been met?			If Not…..

Source: CRIS recommendation

VII. Health Care Facilities

	Environmental Component	Checklist	Yes	No	Comments/Information
1.	Waste Management	Is a health care waste management system (HWMS) established, operated and maintained?			
		Are practices and procedures adopted to minimize waste generation through avoiding products containing hazardous materials?			
		Is waste identified and segregated at the point of generation?			
		Are the waste bags identified			

	Environmental Component	Checklist	Yes	No	Comments/Information
		and labelled appropriately before removal?			
		Does the waste handling, collection, transport, storage, treatment and disposal meet national and sponsors standards?			
		Are appropriate waste disposals strategies employed for different streams of waste such as infectious waste, sharps, pharmaceutical waste, chemical waste, radioactive waste etc.?			
2.	Air quality	Are adequate measures taken at treatment and disposal facilities to maintain ambient air quality within standards prescribed by national regulatory authority or sponsors?			
3.	Wastewater	Is the contaminated wastewater from medical wards and operating theatres adequately treated before discharge?			
4.	Occupational Health and safety	Are adequate safety measures adopted to prevent and control exposure to infections and diseases?			
		Are adequate measures taken to prevent, minimize and control fire hazards during storage, handling, and presence of chemicals, pressurized, gases, boards, plastics, and other flammable substrates?			
		Are adequate measures taken to prevent, minimize and control occupational radiation exposure from equipment emitting X-rays			

	Environmental Component	Checklist	Yes	No	Comments/Information
		and gamma rays (e.g. CT scanners), radiotherapy machines, and equipment for nuclear medicine activities?			

VIII. Generic Aspects: Ambient Air, Water and Noise Conditions of the Sub-Projects

No.	Process	Description	Yes	No	N/A	Information
1.	Ambient Air Quality	Do emissions from project and supporting activities (e.g. heavy equipment, loading-unloading) have adverse impacts to ambient air quality? Have measures been taken to mitigate these impacts?				
		Are there any industries contribute air pollution to around project area? Will the project increase air pollution to the area?				
		Does ambient air quality around project area meet national standards?				
2.	Noise and Vibration	Is sufficient buffer maintained around project area (pump, water and waste water treatment plant, power generation and other system and equipment) to reduce noise and vibration?				
		Are adequate measures taken to mitigate noise and vibration impacts generated from vehicles and heavy equipment?				
		Are there any industries contribute noise and vibration to around project area?				
		Do noise and vibration levels meet national standards?				
3.	Ambient Water Quality	Do waste water from project and supporting activities have adverse impacts to ambient water quality? Have measures been taken to mitigate these impacts?				

No.	Process	Description	Yes	No	N/A	Information
		Are there any industries contribute water pollution to around project area? Will the project increase water pollution to the area?				
		Does ambient water quality around project area meet national standards?				

IX. **Generic Aspects: Occupational Health and Safety Management System (OHSMS) , Community Health and Safety and Construction Aspects of the Sub-Project**

No.	Process	Description	Yes	No	N/A	Information
1.	Management System	Have the project implemented OHSMS?				
		Have OHSMS of the project been audited /evaluated periodically?				
2.	Personnel	Does project hire personnel competent at OHSMS and safety related to project field?				
3	Man-hours	Does project record man-hours? If yes, what is the amount? If no, what is the reason?				
4.	Emergency Response and Preparedness	Does project have emergency response and preparedness plan to manage and control any emergency conditions?				
5.	Construction Aspects	Has the project considers decommissioning and other environment and social aspects of construction as guided by the WBG General EHS guidelines (such as influx management)				
6	Community	Has the project considers this				If not,

No.	Process	Description	Yes	No	N/A	Information
	Health and Safety	aspect as guided by the WBG General EHS guidelines.				procedure 4.4 applies
7	Traffic Management	Has the project considers traffic management aspect as guided by the WBG General EHS guidelines.				

X. Generic Aspects: Monitoring and Reporting

No.	Process	Description	Yes	No	N/A	Information
1.	EIA and EMP Monitoring and Reporting	Does project manage and monitor environment and social aspects on a periodic basis in accordance with EIA/EMP (AMDAL/UKL-UPL/SPPL acceptable to the Bank) requirements which has been approved by the Government? Has project reported EMP to the Government?				

………………,…………2016

Reported by: Approved by:

Annex 11. Covenants pertaining to environmental and social safeguards for inclusion on contractual agreements

The following clauses should be inserted into the Construction Contractor's Agreement additionally among others:

a) The contractor shall implement all measures recommended in the Environmental Management Plan

b) The Contractor shall implement the special and general conditions stated in the environmental permits, forest clearance, and wildlife clearance applicable to construction phase of the project.

c) The Contractor shall comply with all applicable regulations with regards to control of pollution

d) The Contractor shall conduct six monthly environmental monitoring of ambient air quality, water quality and noise levels through approved agencies in consultation with RIDF. These reports shall be submitted to RIDF.

e) The Contractor shall obtain consents for hot mix plant, wet mix plant, crushers, diesel generator sets and batching plant and submit to RIDF.

f) Where the Contractor obtains construction material from third party sources, a copy of the consents of these third party agencies should be obtained by the Contractor and submitted to RIDF.

g) The Contractor shall obtain permits from respective regulatory/ local authority for use of water, borrow pits during construction and submit to RIDF.

h) The Contractor shall furnish to RIDF and respective regulatory authorities immediate notice of any incident or accident relating to the Project and likely to have a highly adverse effect on the environment.

i) The Contractor will bear the cost of damage to any private or government property during construction caused due to negligence or inaction of good construction practices

The following clauses should be inserted into the EPC Contract additionally among others, as applicable –

1. The EPC Contractor shall implement all mitigation measures applicable during pre-construction and construction phase specified in the Environmental Management Plan prepared for the project.
2. The EPC Contractor shall implement all conditions specified in the Environmental Clearance Certificate applicable during pre-construction and construction.
3. The EPC Contractor shall provide amenities and follow health and safety standards for construction labour and staff at all times as per Labour Laws.

4. The EPC Contractor shall obtain required environment, health & safety clearances/ permits/ approvals as required by regulatory authorities.
5. The EPC Contractor shall implement all conditions stated in clearances/ permits/ approvals granted for the project by regulatory authorities.
6. The Contractor shall not indulge in harmful or exploitative forms of forced[12]labour or child[13]labour.
7. The EPC Contractor shall provide its labour and staff periodic training on environmental protection (housekeeping, preventing spills, wastage etc.) and occupational health & safety practices (use of PPE, harness, safe working practices etc.).
8. The EPC Contractor shall designate person/s to attend to public grievances due to construction.
9. The EPC Contractor shall prepare and implement an emergency preparedness and response plan for the project site under their control during construction. Line of authority should be established for decision making during emergencies and all staff and workers/supervisors should be trained as per their job description.
10. The EPC contractor shall engage security personnel to undertake seasonal monitoring and inspection of the workers camp and also the construction site for possible violence against women and children resulting from influx of workers in communities in the subproject area. Alto to implement “Zero Tolerance” Human Resource policy of such violence against this aspect.

[12] *Forced labour means all work or services not voluntarily performed, that is, extracted from individuals under threat of force or penalty. http://www.ilo.org/ilolex/english/convdisp1.htm (scroll down for Convention No. 29)*

[13] *Child labour means the employment of children whose age is below the host country’s statutory minimum age of employment or employment of children in contravention of International Labour Organization Convention No. 138 “Minimum Age Convention” http://www.ilo.org/ilolex/english/convdisp1.htm (scroll down for Convention No. 138)*

Annex 12. Applicable World Bank Policies and Indonesian Laws

World Bank policies

The World Bank has adopted a series of operational procedures that serve as environmental and social safeguards and also adopted an umbrella policy (OP 4.01) on environmental and social protection as a whole (see **Table 29**). There are also The World Bank Group General EHS Guidelines and Industry Sector Guidelines that are referred to in this ESMF (www.ifc.org/ehsguidelines).

Table 29: World Bank's Environmental and Social Safeguard Policies

No.	Safeguard	Objective
1	OP 4.01 Environmental Assessment	Help ensure environmental and social soundness and sustainability of projects. Support integration of environmental and social aspects of projects into the decision-making process.
2	OP 4.04 Natural Habitats	Promote environmentally sustainable development by supporting the protection, conservation, maintenance, and rehabilitation of natural habitats and their functions.
3	OP 4.09 Pest Management	Minimize and manage the environmental and health risks associated with pesticide use and promote and support safe, effective, and environmentally sound pest management.
4	OP 4.11 Physical Cultural Resources	Assist in preserving physical cultural resources and in preventing their destruction or damage. Physical cultural resources includes resources of archaeological, paleontological, historical, architectural and religious (including graveyards and burial sites), aesthetic, or other cultural significance.
5	OP 4.12 Involuntary Resettlement	Avoid or minimize involuntary resettlement and, where this is not feasible, assist displaced persons in improving or restoring their livelihoods and standards of living in real terms relative to the pre-displacement levels or to levels prevailing prior to the beginning of project, whichever is higher.
6	OP 4.10 Indigenous People	Design and implement projects giving due importance to indigenous people's dignity, human rights, and cultural uniqueness and ensure that they (1) receive culturally compatible social and economic benefits, and (2) do not suffer during the development process.

No.	Safeguard	Objective
7	OP 36 Forests	Realize the potential of forests to reduce poverty in a sustainable manner, integrate forests effectively into sustainable economic development, and protect the forest's vital local and global environmental services.
8	OP 4.37 Safety of Dam	Ensure quality and safety in the design, construction and rehabilitation of dams, and mitigate any adverse impacts arising from the dams.
9	OP 7.50 Projects on International Waterways	Ensure that the international aspects of projects on international waterway are dealt with at the earliest and that the riparian's are notified of the proposed project and its details.
10	OP 7.60 Projects in Disputed Areas	Ensure that other claimants to the disputed area have no objection to the project, or ensure that the special circumstances of the case warrant the World Bank's support of the project notwithstanding any objection or lack of approval by other claimants.

Indonesian laws

Indonesia has a comprehensive set of laws governing environment protection, involuntary land acquisition and recognition of the indigenous population (see **Table 30**).

Table 30: Indonesian Laws and Regulations related to Environmental and Social Protection

No.	Regulation	Objective
1	Law No. 32/2009	**Environmental protection and environmental management.** The purpose of this law is to ensure environmentally sustainable development through environmental planning, and rational exploitation, development, maintenance, restoration, supervision and control of the environment. Environmental protection and management will be undertaken in phases: collection of data on natural resources; identification of eco-regions; and formulation of environmental protection and management plans.
2	Law No. 5/1960	**Agrarian basic principles.** This law defines the fundamental rights of private individuals and

No.	Regulation	Objective
		entities. It describes the role of the state with regard to the direct use of land as well as its regulation of private rights and uses of land. This law also recognises the "adat" law, or Indonesia customary law, as long as it does not conflict with national interest or other regulations set out in this law.
3	Law No. 2/2012	**Land acquisition for the development of facilities for public use**. This law substantially clearly outlines the mechanism for the acquisition of civilian land to facilitate the development of new infrastructure projects, and thus substantially accelerates the land acquisition process for development in the public interest.
4	Government Regulation No. 27/2012	**Environmental permit.** This regulation requires that the application for environmental permit should be accompanied by environmental assessment documents (AMDAL and UKL/UPL), business legal documents and business profile document. Further, the project owners need to apply for environmental permit to the appropriate government authority before project implementation.
5	Government Regulation No. 82/2001	**Water quality management and pollution control.** This regulation is designed to control water quality and pollution in an integrated manner using the ecosystem approach in planning, implementation, supervision, and evaluation phases.
6	Government Regulation No. 41/1999	**Control of air pollution.** This regulation is designed for**:** (a) guaranteeing the safety, conservation of environmental and public services function; (b) raising public awareness regarding the environment so as to achieve harmony, suitability and equilibrium between human and environment; (c) controlling the exploitation of resources wisely; and (d) controlling sources of pollution so that the air quality meets the necessary standards.

No.	Regulation	Objective
7	Government Regulation No. 101/2014	**Hazardous waste management.** This regulation governs the management and disposal of toxic and hazardous wastes and covers: (a) method for identifying, reducing, storing, collecting, transporting, utilizing and processing hazardous wastes; (b) procedures for dumping hazardous wastes into the open sea or land; and (c) risk mitigation and emergency preparedness.
8	Minister of the Environment Regulation No. 05/2012	**Types of business and/or activities mandated to undertake environmental impact assessment (AMDAL).** This regulation lists activities in different sectors and businesses that require AMDAL (complete environmental impact assessment, EIA) study. Activities not listed in this regulation require UKL-UPL study (a scaled down EIA) or at least a statement of readiness (SPPL).
9	Presidential Regulation No. 71/2012 Presidential Regulation No. 40/2014 Presidential Regulation No. 99/2014 Presidential Regulation No. 30/2015	**Land acquisition for the development of facilities for public use.** This regulation has been changed thrice, the latest being No. 30/2015. The new regulation has facilitated timely funding for land acquisition. Under the new law, private investors can provide funds at an early stage, confident that these funds will either be refunded directly or through revenue arrangements as the project proceeds. This is in contrast with previous version whereby land acquisition was contingent on disbursement of the state budget, which is often limited and subject to a long budgeting cycle. As per the regulation No. 30/2015, in case of land measuring less than 5 hectares, the project proponent can purchase the land directly from the owner.
10	Law No. 41 on Forestry (plus Constitutional Court Decision No. 35/PUU-X/2012)	Procedures to settle land ownership conflict in forest areas
11	MOHA Regulation No. 52/2014	Guidelines on the recognition and protection of MHA

No.	Regulation	Objective
12	Ministerial Regulation of MOH No. P.62/2013	(Adjustment of Ministerial Regulation No. P.44/2012) on the establishment of forest area
13	Regulation of the Minister of Land Agency and Spatial Development No. 9/2015	Procedures to establish the land communal rights on MHA land and community living in special areas
14	Law No. 18/2013	Prevention and control of deforestation (UUP3H).
15	Regulation of Ministry of Forestry No. P.39/Menhut-II/2013	Empowerment of local communities through a forest partnership. This regulations aims at enhancing local communities' capability and autonomy in order to gain benefits from forest resources in an optimal and equitable way through forest partnerships.

Annex 13. **EHS (Environmental, Health and Safety) Guidelines for RIDF subprojects**

The applicability of the EHS Guidelines should be tailored to the hazards and risks established for each project on the basis of the results of an environmental assessment in which site specific variables, such as host country context, assimilative capacity of the environment, and other project factors, are taken into account. The applicability of specific technical recommendations should be based on the professional opinion of qualified and experienced persons. When host country regulations differ from the levels and measures presented in this EHS Guidelines, projects are expected to achieve whichever is more stringent. If less stringent levels or measures than those provided in these EHS Guidelines are appropriate, in view of specific project circumstances, a full and detailed justification for any proposed alternatives is needed as part of the site-specific environmental assessment. This justification should demonstrate that the choice for any alternate performance levels is protective of human health and the environment.

A. General EHS Guidelines

The Environmental, Health, and Safety (EHS) Guidelines are technical reference documents with general and industry-specific examples of Good International Industry Practice (GIIP). When one or more members of the World Bank Group are involved in a project, these EHS Guidelines are applied as required by their respective policies and standards. These General EHS Guidelines are designed to be used together with the relevant Industry Sector EHS Guidelines which provide guidance to users on EHS issues in specific industry sectors. For complex projects, use of multiple industry-sector guidelines may be necessary.

General Approach to the Management of EHS Issues at the Facility or Project Level

Effective management of environmental, health, and safety (EHS) issues entails the inclusion of EHS considerations into corporate and facility-level business processes in an organized, hierarchical approach that includes the following steps:

- Identifying EHS project hazards and associated risks as early as possible in the facility development or project cycle, including the incorporation of EHS considerations into the site selection process, product design process, engineering planning process for capital requests, engineering work orders, facility modification authorizations, or 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 environmental management functions including the preparation of project or activity-specific plans and procedures that incorporate the technical recommendations presented in this document that are relevant to the project.
- Understanding the likelihood and magnitude of EHS risks, based on:

a. The nature of the project activities, such as whether the project will generate significant quantities of emissions or effluents, or involve hazardous materials or processes;
b. The potential consequences to workers, communities, or the environment if hazards are not adequately managed, which may depend on the proximity of project activities to people or to the environmental resources on which they depend.

- Prioritizing risk management strategies with the objective of achieving an overall reduction of risk to human health and the environment, focusing on the prevention of irreversible and / or significant impacts.
- Favoring strategies that eliminate the cause of the hazard at its source, for example, by selecting less hazardous materials or processes that avoid the need for EHS controls.
- When impact avoidance is not feasible, incorporating engineering and management controls to reduce or minimize the possibility and magnitude of undesired consequences, for example, with the application of pollution controls to reduce the levels of emitted contaminants to workers or environments.
- Preparing workers and nearby communities to respond to accidents, including providing technical and financial resources to effectively and safely control such events, and restoring workplace and community environments to a safe and healthy condition.
- Improving EHS performance through a combination of ongoing monitoring of facility performance and effective accountability.

1.0 Environmental

1.1 Air Emissions and Ambient Air Quality

Applicability and Approach

This guideline applies to facilities or projects that generate emissions to air at any stage of the project life-cycle. It complements the industry-specific emissions guidance presented in the Industry Sector Environmental, Health, and Safety (EHS) Guidelines by providing information about common techniques for emissions management that may be applied to a range of industry sectors. This guideline provides an approach to the management of significant sources of emissions, including specific guidance for assessment and monitoring of impacts. It is also intended to provide additional information on approaches to emissions management in projects located in areas of poor air quality, where it may be necessary to establish project-specific emissions standards. 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, such as combustion, materials storage, or other industry sector specific processes.

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:

- 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

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

- Regulatory requirements
- Significance of the source
- Location of the emitting facility 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

Ambient Air Quality

General Approach

Projects with significant sources of air emissions, and potential for 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;
- Emissions do not contribute a significant portion to the attainment of relevant ambient air quality guidelines or standards. As a general rule, this Guideline suggests 25 percent of the applicable air quality standards to allow additional, future sustainable development in the same airshed.

At facility level, impacts should be estimated through qualitative or quantitative assessments by the use of baseline air quality assessments and atmospheric dispersion models to assess potential ground level concentrations. Local atmospheric, climatic, and air quality data should be applied when modeling dispersion, protection against atmospheric downwash, wakes, or eddy effects of the source, nearby structures, and terrain features. The dispersion model applied should be internationally recognized, or comparable. Model selection is dependent on the complexity and geomorphology of the project site (e.g. mountainous terrain, urban or rural area).

Projects Located in Degraded Airsheds or Ecologically Sensitive Areas

Facilities or projects located within poor 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 feasible, and amounts to a fraction of the applicable short-term and annual average air quality guidelines or standards as established 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. Offset provisions outside the immediate control of the project sponsor or buy-downs should be monitored and enforced by the local agency responsible for granting and monitoring emission permits. Such provisions should be in place prior to final commissioning of the facility / project.

Point Sources

Point sources are discrete, stationary, identifiable sources of emissions that release pollutants to the atmosphere. They are typically located in manufacturing or production plants. Within a given point source, there may be several individual 'emission points' that comprise the point source.

Point sources are characterized by the release of air pollutants typically associated with the combustion of fossil fuels, such as nitrogen oxides (NOx), sulfur dioxide (SO_2), carbon monoxide (CO), and particulate matter (PM), as well as other air pollutants including certain volatile organic compounds (VOCs) and metals that may also be associated with a wide range of industrial activities. Emissions from point sources should be avoided and controlled according to good international industry practice (GIIP) applicable to the relevant industry sector, depending on ambient conditions, through the combined application of process modifications and emissions controls, examples of which are provided in Annex 1.1.2. Additional recommendations regarding stack height and emissions from small combustion facilities are provided below.

Stack Height

The stack height for all point sources of emissions, whether 'significant' or not, should be designed according to GIIP (see Annex 1.1.3) to avoid excessive ground level concentrations due to downwash, wakes, and eddy effects, and to ensure reasonable diffusion to minimize impacts. For projects where there are multiple sources of emissions, stack heights should be established with due consideration to emissions from all other project sources, both point and fugitive. Non-significant sources of emissions, including small combustion sources, should also use GIIP in stack design.

Small Combustion Facilities Emissions Guidelines

Small combustion processes are systems designed to deliver electrical or mechanical power, steam, heat, or any combination of these, regardless of the fuel type, with a total, rated heat input capacity of between three Megawatt thermal (MWth) and 50 MWth. The emissions guidelines in Table 1.1.2 are applicable to small combustion process installations operating more than 500 hours per year, and those with an annual capacity utilization of more than 30 percent. Plants firing a mixture of fuels should compare emissions performance with these guidelines based on the sum of the relative contribution of each applied fuel. Lower emission values may apply if the proposed facility is located in an ecologically sensitive airshed, or airshed with poor air quality, in order to address potential cumulative impacts from the installation of more than one small combustion plant as part of a distributed generation project.

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 Compounds (VOCs) and particulate matter (PM). Other contaminants (NO_X, 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 wastes, whether hazardous or nonhazardous, is not considered good practice and should be avoided, as the generation of polluting emissions from this type of source cannot be controlled effectively.

Volatile Organic Compounds (VOCs)

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. The recommended prevention and control techniques for VOC emissions associated with equipment leaks include:

- Equipment modifications, examples of which are presented in Annex 1.1.4;
- 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. For VOC emissions associated with handling of chemicals in open vats and mixing processes, the recommended prevention and control techniques include:
- Substitution of less volatile substances, such as aqueous solvents;

- Collection of vapors through air extractors and subsequent treatment of gas stream by removing VOCs with control devices such as condensers or activated carbon absorption;
- Collection of vapors through air extractors and subsequent treatment with destructive control devices such as:
    a. Catalytic Incinerators: Used to reduce VOCs from process exhaust gases exiting paint spray booths, ovens, and other process operations
    b. 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
    c. Enclosed Oxidizing Flares: Used to convert VOCs into CO2 and H2O 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.

Particulate Matter (PM)

The most common pollutant involved in fugitive emissions is dust or particulate matter (PM). This is released during certain operations, such as transport and open storage of solid materials, and from exposed soil surfaces, including unpaved roads.

Recommended prevention and control of these emissions sources include:

- Use of dust control methods, such as covers, water suppression, or increased moisture content for open materials storage piles, or controls, including air extraction and treatment through a baghouse or cyclone for material handling sources, such as conveyors and bins;
- Use of water suppression for control of loose materials on paved or unpaved road surfaces. Oil and oil by-products is not a recommended method to control road dust. Examples of additional control options for unpaved roads include those summarized in Annex 1.1.5.

Ozone Depleting Substances (ODS)

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. 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.

Mobile Sources – Land-based

Similar to other combustion processes, emissions from vehicles include CO, NO_X, SO_2, PM and VOCs. Emissions from on-road and off-road vehicles should comply with national or regional programs. In the absence of these, the following approach should be considered:

- Regardless of the size or type of vehicle, fleet owners/operators should implement the manufacturer recommended engine maintenance programs;
- Drivers should be instructed on the benefits of driving practices that reduce both the risk of accidents and fuel consumption, including measured acceleration and driving within safe speed limits;
- Operators with fleets of 120 or more units of heavy duty vehicles (buses and trucks), or 540 or more light duty vehicles (cars and light trucks) within an airshed should consider additional ways to reduce potential impacts including:
    a. Replacing older vehicles with newer, more fuel efficient alternatives
    b. Converting high-use vehicles to cleaner fuels, where feasible
    c. Installing and maintaining emissions control devices, such as catalytic converters
    d. Implementing a regular vehicle maintenance and repair program

Greenhouse Gases (GHGs)

Sectors that may have potentially significant emissions of greenhouse gases (GHGs) include energy, transport, heavy industry (e.g. cement production, iron / steel manufacturing, aluminum smelting, petrochemical industries, petroleum refining, fertilizer manufacturing), agriculture, forestry and waste management. GHGs may be generated from direct emissions from facilities within the physical project boundary and indirect emissions associated with the off-site production of power used by the project.

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).

Monitoring

Emissions and air quality monitoring programs provide information that can be used to assess the effectiveness of emissions management strategies. A systematic planning process is recommended to ensure that the data collected are adequate for their intended purposes (and to avoid collecting unnecessary data). This process, sometimes referred to as a data quality objectives process, defines the purpose of collecting the data, the decisions to be made based on the data and the consequences of making an incorrect decision, the time and geographic boundaries, and the quality of data needed to make a correct decision. The air quality monitoring program should consider the following elements:

- Monitoring parameters: The monitoring parameters selected should reflect the pollutants of concern associated with project processes. For combustion processes, indicator parameters typically include the quality of inputs, such as the sulfur content of fuel.
- Baseline calculations: Before a project is developed, baseline air quality monitoring 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.
- Monitoring type and frequency: Data on emissions and ambient air quality generated through the monitoring program should be representative of the emissions discharged by the project over time. Examples of time-dependent variations in the manufacturing process include batch process manufacturing and seasonal process variations. Emissions from highly variable processes may need to be sampled more frequently or through composite methods. Emissions monitoring frequency and duration may also range from continuous for some combustion process operating parameters or inputs (e.g. the quality of fuel) to less frequent, monthly, quarterly or yearly stack tests.
- Monitoring locations: Ambient air quality monitoring may consists of off-site or fence line monitoring either by the project sponsor, the competent government agency, or by collaboration between both. 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.
- Sampling and analysis methods: Monitoring programs should apply national or, when not available, international methods (e.g., International Organization for Standardization, the European Committee for Standardization, or the U.S. Environmental Protection Agency). Sampling should be conducted by, or under, the supervision of trained 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.

Monitoring of Small Combustion Plants Emissions

- Additional recommended monitoring approaches for boilers:

  Boilers with capacities between =3 MWth and < 20 MWth:

  a. Annual Stack Emission Testing: SO_2, NO_X and PM. For gaseous fuel-fired boilers, only NO_X. SO_2 can be calculated based on fuel quality certification if no SO_2 control equipment is used.
  b. If Annual Stack Emission Testing demonstrates results consistently and significantly better than the required levels, frequency of Annual Stack Emission Testing can be reduced from annual to every two or three years.
  c. Emission Monitoring: None

Boilers with capacities between =20 MWth and < 50 MWth

a. Annual Stack Emission Testing: SO_2, NO_X and PM. For gaseous fuel-fired boilers, only NO_X. SO_2 can be calculated based on fuel quality certification (if no SO_2 control equipment is used)
b. Emission Monitoring: SO_2. Plants with SO_2 control equipment: Continuous. NO_X: Continuous monitoring of either NO_X emissions or indicative NOx emissions using combustion parameters. PM: Continuous monitoring of either PM emissions, opacity, or indicative PM emissions using combustion parameters / visual monitoring.

- Additional recommended monitoring approaches for turbines:
  a. Annual Stack Emission Testing: NO_X and SO_2 (NO_X only for gaseous fuel-fired turbines).
  b. If Annual Stack Emission Testing results show constantly (3 consecutive years) and significantly (e.g. less than 75 percent) better than the required levels, frequency of Annual Stack Emission Testing can be reduced from annual to every two or three years.
  c. Emission Monitoring: NO_X: Continuous monitoring of either NO_X emissions or indicative NO_X emissions using combustion parameters. SO_2: Continuous monitoring if SO_2 control equipment is used.
- Additional recommended monitoring approaches for engines:
  a. Annual Stack Emission Testing: NO_X, SO_2 and PM (NOx only for gaseous fuel-fired diesel engines).
  b. If Annual Stack Emission Testing results show constantly (3 consecutive years) and significantly (e.g. less than 75 percent) better than the required levels, frequency of Annual Stack Emission Testing can be reduced from annual to every two or three years.
  c. Emission Monitoring: NO_X: Continuous monitoring of either NO_X emissions or indicative NO_X emissions using combustion parameters. SO_2: Continuous monitoring if SO2 control equipment is used. PM: Continuous monitoring of either PM emissions or indicative PM emissions using operating parameters.

1.2 Energy Conservation

Applicability and Approach

This guideline applies to facilities or projects that consume energy in process heating and cooling; process and auxiliary systems, such as motors, pumps, and fans; compressed air systems and heating, ventilation and air conditioning systems (HVAC); and lighting systems. It complements the industry specific emissions guidance presented in the Industry Sector Environmental, Health, and Safety (EHS) Guidelines by providing information about common techniques for energy conservation that may be applied to a range of industry sectors. Energy management at the facility level should be viewed in the context of overall consumption patterns, including those associated with production processes and supporting utilities, as well as overall impacts associated with emissions from power sources. The following section provides guidance on energy management with a focus on common utility systems often representing technical and financially feasible opportunities for improvement in energy conservation. However, operations should also evaluate energy conservation opportunities arising from manufacturing process modifications.

Energy Management Programs

Energy management programs should include the following elements:

- Identification, and regular measurement and reporting of principal energy flows within a facility at unit process level
- Preparation of mass and energy balance;
- Definition and regular review of energy performance targets, which are adjusted to account for changes in major influencing factors on energy use
- Regular comparison and monitoring of energy flows with performance targets to identify where action should be taken to reduce energy use
- Regular review of targets, which may include comparison with benchmark data, to confirm that targets are set at appropriate levels

Energy Efficiency

For any energy-using system, a systematic analysis of energy efficiency improvements and cost reduction opportunities should include a hierarchical examination of opportunities to:

- Demand/Load Side Management by reducing loads on the energy system
- Supply Side Management by:
  a. Reduce losses in energy distribution
  b. Improve energy conversion efficiency
  c. Exploit energy purchasing opportunities
  d. Use lower-carbon fuels

Process Heating

Process heating is vital to many manufacturing processes, including heating for fluids, calcining, drying, heat treating, metal heating, melting, melting agglomeration, curing, and forming.

In process heating systems, a system heat and mass balance will show how much of the system's energy input provides true process heating, and quantify fuel used to satisfy energy losses caused by excessive parasitic loads, distribution, or conversion losses. Examination of savings opportunities should be directed by the results of the heat and mass balance, though the following techniques are often valuable and cost-effective.

Heating Load Reduction

- Ensure adequate insulation to reduce heat losses through furnace/oven etc. structure
- Recover heat from hot process or exhaust streams to reduce system loads
- In intermittently-heated systems, consider use of low thermal mass insulation to reduce energy required to heat the system structure to operating temperature

- Control process temperature and other parameters accurately to avoid, for example, overheating or overdrying
- Examine opportunities to use low weight and/or low thermal mass product carriers, such as heated shapers, kiln cars etc.
- Review opportunities to schedule work flow to limit the need for process reheating between stages
- Operate furnaces/ovens at slight positive pressure, and maintain air seals to reduce air in-leakage into the heated system, thereby reducing the energy required to heat unnecessary air to system operating temperature
- Reduce radiant heat losses by sealing structural openings and keep viewing ports closed when not in use
- Where possible, use the system for long runs close to or at operating capacity
- Consider use of high emissivity coatings of high temperature insulation, and consequent reduction in process temperature
- Near net weight and shape heat designs
- Robust Quality assurance on input material
- Robust Scheduled maintenance programs

Heat Distribution Systems

Heat distribution in process heating applications typically takes place through steam, hot water, or thermal fluid systems. Losses can be reduced through the following actions:

- Promptly repair distribution system leaks
- Avoid steam leaks despite a perceived need to get steam through the turbine. Electricity purchase is usually cheaper overall, especially when the cost to treat turbine-quality boiler feed water is included. If the heat-power ratio of the distribution process is less than that of power systems, opportunities should be considered to increase the ratio; for example, by using low-pressure steam to drive absorption cooling systems rather than using electrically-driven vapor compression systems.
- Regularly verify correct operation of steam traps in steam systems, and ensure that traps are not bypassed. Since steam traps typically last approximately 5 years, 20% should be replaced or repaired annually
- Insulate distribution system vessels, such as hot wells and de-aerators, in steam systems and thermal fluid or hot water storage tanks
- Insulate all steam, condensate, hot water and thermal fluid distribution pipework, down to and including 1” (25 mm) diameter pipe, in addition to insulating all hot valves and flanges
- In steam systems, return condensate to the boiler house for re-use, since condensate is expensive boiler-quality water and valuable beyond its heat content alone
- Use flash steam recovery systems to reduce losses due to evaporation of high-pressure condensate
- Consider steam expansion through a back-pressure turbine rather than reducing valve stations

- Eliminate distribution system losses by adopting point-of use heating systems

Energy Conversion System Efficiency Improvements

The following efficiency opportunities should be examined for process furnaces or ovens, and utility systems, such as boilers and fluid heaters:

- Regularly monitor CO, oxygen or CO_2 content of flue gases to verify that combustion systems are using the minimum practical excess air volumes
- Consider combustion automation using oxygen-trim controls
- Minimize the number of boilers or heaters used to meet loads. It is typically more efficient to run one boiler at 90% of capacity than two at 45%. Minimize the number of boilers kept at hot–standby
- Use flue dampers to eliminate ventilation losses from hot boilers held at standby
- Maintain clean heat transfer surfaces; in steam boilers, flue gases should be no more than 20 K above steam temperature)
- In steam boiler systems, use economizers to recover heat from flue gases to pre-heat boiler feed water or combustion air
- Consider reverse osmosis or electrodialysis feed water treatment to minimize the requirement for boiler blowdown
- Adopt automatic (continuous) boiler blowdown
- Recover heat from blowdown systems through flash steam recovery or feed-water preheat
- Do not supply excessive quantities of steam to the deaerator
- With fired heaters, consider opportunities to recover heat to combustion air through the use of recuperative or regenerative burner systems
- For systems operating for extended periods (> 6000 hours/year), cogeneration of electrical power, heat and /or cooling can be cost effective
- Oxy Fuel burners
- Oxygen enrichment/injection
- Use of turbolators in boilers
- Sizing design and use of multiple boilers for different load configurations
- Fuel quality control/fuel blending

Process Cooling

The general methodology outlined above should be applied to process cooling systems. Commonly used and cost-effective measures to improve process cooling efficiency are described below.

Load Reduction

- Ensure adequate insulation to reduce heat gains through cooling system structure and to below-ambient temperature refrigerant pipes and vessels
- Control process temperature accurately to avoid overcooling

- Operate cooling tunnels at slight positive pressure and maintain air seals to reduce air in-leakage into the cooled system, thus reducing the energy required to cool this unnecessary air to system operating temperature
- Examine opportunities to pre-cool using heat recovery to a process stream requiring heating, or by using a higher temperature cooling utility
- In cold and chill stores, minimize heat gains to the cooled space by use of air curtains, entrance vestibules, or rapidly opening/closing doors. Where conveyors carry products into chilled areas, minimize the area of transfer openings, for example, by using strip curtains
- Quantify and minimize "incidental" cooling loads, for example, those due to evaporator fans, other machinery, defrost systems and lighting in cooled spaces, circulation fans in cooling tunnels, or secondary refrigerant pumps (e.g. chilled water, brines, glycols)
- Do not use refrigeration for auxiliary cooling duties, such as compressor cylinder head or oil cooling
- While not a thermal load, ensure there is no gas bypass of the expansion valve since this imposes compressor load while providing little effective cooling
- In the case of air conditioning applications, energy efficiency techniques include:
  a. Placing air intakes and air-conditioning units in cool, shaded locations
  b. Improving building insulation including seals, vents, windows, and doors
  c. Planting trees as thermal shields around buildings
  d. Installing timers and/or thermostats and/or enthalpy-based control systems
  e. Installing ventilation heat recovery systems

Energy Conversion

The efficiency of refrigeration service provision is normally discussed in terms of Coefficient of Performance ("COP"), which is the ratio of cooling duty divided by input power. COP is maximized by effective refrigeration system design and increased refrigerant compression efficiency, as well as minimization of the temperature difference through which the system works and of auxiliary loads (i.e. those in addition to compressor power demand) used to operate the refrigeration system.

System Design

- If process temperatures are above ambient for all, or part, of the year, use of ambient cooling systems, such as provided by cooling towers or dry air coolers, may be appropriate, perhaps supplemented by refrigeration in summer conditions.
- Most refrigeration systems are electric-motor driven vapor compression systems using positive displacement or centrifugal compressors. The remainder of this guideline relates primarily to vapor-compression systems. However, when a cheap or free heat source is available (e.g. waste heat from an engine-driven generator—low-pressure steam that has passed through a back-pressure turbine), absorption refrigeration may be appropriate.

- Exploit high cooling temperature range: precooling by ambient and/or 'high temperature' refrigeration before final cooling can reduce refrigeration capital and running costs. High cooling temperature range also provides an opportunity for countercurrent (cascade) cooling, which reduces refrigerant flow needs.
- Keep 'hot' and 'cold' fluids separate, for example, do not mix water leaving the chiller with water returning from cooling circuits.
- In low-temperature systems where high temperature differences are inevitable, consider two-stage or compound compression, or economized screw compressors, rather than single-stage compression.

Minimizing Temperature Differences

A vapor-compression refrigeration system raises the temperature of the refrigerant from somewhat below the lowest process temperature (the evaporating temperature) to provide process cooling, to a higher temperature (the condensing temperature), somewhat above ambient, to facilitate heat rejection to the air or cooling water systems. Increasing evaporating temperature typically increases compressor cooling capacity without greatly affecting power consumption. Reducing condensing temperature increases evaporator cooling capacity and substantially reduces compressor power consumption.

Elevating Evaporating Temperature

- Select a large evaporator to permit relatively low temperature differences between process and evaporating temperatures. Ensure that energy use of auxiliaries (e.g. evaporator fans) does not outweigh compression savings. In air-cooling applications, a design temperature difference of 6-10 K between leaving air temperature and evaporating temperature is indicative of an appropriately sized evaporator. When cooling liquids, 2K between leaving liquid and evaporating temperatures can be achieved, though a 4K difference is generally indicative of a generously-sized evaporator.
- Keep the evaporator clean. When cooling air, ensure correct defrost operation. In liquid cooling, monitor refrigerant/process temperature differences and compare with design expectations to be alert to heat exchanger contamination by scale or oil.
- Ensure oil is regularly removed from the evaporator, and that oil additions and removals balance.
- Avoid the use of back-pressure valves.
- Adjust expansion valves to minimize suction superheat consistent with avoidance of liquid carry-over to compressors.
- Ensure that an appropriate refrigerant charge volume is present.

Reducing Condensing Temperature

- Consider whether to use air-cooled or evaporation-based cooling (e.g. evaporative or water cooled condensers and cooling towers). Air-cooled evaporators usually have higher condensing temperatures, hence higher compressor energy use, and auxiliary power consumption, especially in low humidity climates. If a wet system is used, ensure adequate treatment to prevent growth of legionella bacteria.

- Whichever basic system is chosen, select a relatively large condenser to minimize differences between condensing and the heat sink temperatures. Condensing temperatures with air cooled or evaporative condensers should not be more than 10K above design ambient condition, and a 4K approach in a liquid-cooled condenser is possible.
- Avoid accumulation of non-condensable gases in the condenser system. Consider the installation of refrigerated non-condensable purgers, particularly for systems operating below atmospheric pressure.
- Keep condensers clean and free from scale. Monitor refrigerant/ambient temperature differences and compare with design expectations to be alert to heat exchanger contamination.
- Avoid liquid backup, which restricts heat transfer area in condensers. This can be caused by installation errors such as concentric reducers in horizontal liquid refrigerant pipes, or “up and over” liquid lines leading from condensers.
- In multiple condenser applications, refrigerant liquid lines should be connected via drop-leg traps to the main liquid refrigerant line to ensure that hot gases flow to all condensers.
- Avoid head pressure control to the extent possible. Head pressure control maintains condensing temperature at, or near, design levels. It therefore prevents reduction in compressor power consumption, which accompanies reduced condensing temperature, by restricting condenser capacity (usually by switching off the condenser, or cooling tower fans, or restricting cooling water flow) under conditions of less severe than design load or ambient temperature conditions. Head pressure is often kept higher than necessary to facilitate hot gas defrost or adequate liquid refrigerant circulation. Use of electronic rather than thermostatic expansion valves, and liquid refrigerant pumps can permit effective refrigerant circulation at much reduced condensing temperatures.
- Site condensers and cooling towers with adequate spacing so as to prevent recirculation of hot air into the tower.

Refrigerant Compression Efficiency

- Some refrigerant compressors and chillers are more efficient than others offered for the same duty. Before purchase, identify the operating conditions under which the compressor or chiller is likely to operate for substantial parts of its annual cycle. Check operating efficiency under these conditions, and ask for estimates of annual running cost. Note that refrigeration and HVAC systems rarely run for extended periods at design conditions, which are deliberately extreme. Operational efficiency under the most commonly occurring off-design conditions is likely to be most important.
- Compressors lose efficiency when unloaded. Avoid operation of multiple compressors at part-load conditions. Note that package chillers can gain coefficient

of performance (COP) when slightly unloaded, as loss of compressor efficiency can be outweighed by the benefits of reduced condensing and elevated evaporating temperature. However, it is unlikely to be energy efficient to operate a single compressor-chiller at less than 50% of capacity.

- Consider turndown efficiency when specifying chillers. Variable speed control or multiple compressor chillers can be highly efficient at part loads.
- Use of thermal storage systems (e.g., ice storage) can avoid the need for close load-tracking and, hence, can avoid part-loaded compressor operation.

Refrigeration System Auxiliaries

Many refrigeration system auxiliaries (e.g. evaporator fans and chilled water pumps) contribute to refrigeration system load, so reductions in their energy use have a double benefit. General energy saving techniques for pumps and fans, listed in the next section of these guidelines, should be applied to refrigeration auxiliaries.

Additionally, auxiliary use can be reduced by avoidance of part load operation and in plant selection (e.g. axial fan evaporative condensers generally use less energy than equivalent centrifugal fan towers).

Under extreme off-design conditions, reduction in duty of cooling system fans and pumps can be worthwhile, usually when the lowest possible condensing pressure has been achieved.

Compressed Air Systems

Compressed air is the most commonly found utility service in industry, yet in many compressed air systems, the energy contained in compressed air delivered to the user is often 10% or less of energy used in air compression. Savings are often possible through the following techniques:

Load reduction

- Examine each true user of compressed air to identify the air volume needed and the pressure at which this should be delivered.
- Do not mix high volume low pressure and low volume high pressure loads. Decentralize low volume high-pressure applications or provide dedicated low-pressure utilities, for example, by using fans rather than compressed air.
- Review air use reduction opportunities, for example:
    a. Use air amplifier nozzles rather than simple open-pipe compressed air jets
    b. Consider whether compressed air is needed at all
    c. Where air jets are required intermittently (e.g. to propel product), consider operating the jet via a process-related solenoid valve, which opens only when air is required
    d. Use manual or automatically operated valves to isolate air supply to individual machines or zones that are not in continuous use
    e. Implement systems for systematic identification and repair of leaks

f. All condensate drain points should be trapped. Do not leave drain valves continuously ‘cracked open’
g. Train workers never to direct compressed air against their bodies or clothing to dust or cool themselves down.

Distribution

- Monitor pressure losses in filters and replace as appropriate
- Use adequately sized distribution pipework designed to minimize pressure losses

1.3 Wastewater and Ambient Water Quality

Applicability and Approach

This guideline applies to projects that have either direct or indirect discharge of process wastewater, wastewater from utility operations or stormwater to the environment. These guidelinesare also applicable to industrial discharges to sanitary sewers that discharge to the environment without any treatment. Process wastewater may include contaminated wastewater from utility operations, stormwater, and sanitary sewage. It provides information on common techniques for wastewater management, water conservation, and reuse that can be applied to a wide range of industry sectors. This guideline is meant to be complemented by the industry-specific effluent guidelines presented in the Industry Sector Environmental, Health, and Safety (EHS) Guidelines. Projects with the potential to generate process wastewater, sanitary (domestic) sewage, or stormwater should incorporate the necessary precautions to avoid, minimize, and control adverse impacts to human health, safety, or the environment. In the context of their overall ESHS management system, facilities should:

- Understand the quality, quantity, frequency and sources of liquid effluents in its installations. This includes knowledge about the locations, routes and integrity of internal drainage systems and discharge points
- Plan and implement the segregation of liquid effluents principally along industrial, utility, sanitary, and stormwater categories, in order to limit the volume of water requiring specialized treatment. Characteristics of individual streams may also be used for source segregation.
- Identify opportunities to prevent or reduce wastewater pollution through such measures as recycle/reuse within their facility, input substitution, or process modification (e.g. change of technology or operating conditions/modes).
- Assess compliance of their wastewater discharges with the applicable: (i) discharge standard (if the wastewater is discharged to a surface water or sewer), and (ii) water quality standard for a specific reuse (e.g. if the wastewater is reused for irrigation). Additionally, the generation and discharge of wastewater of any type should be managed through a combination of:
    a. Water use efficiency to reduce the amount of wastewater generation
    b. Process modification, including waste minimization, and reducing the use of hazardous materials to reduce the load of pollutants requiring treatment

c. If needed, application of wastewater treatment techniques to further reduce the load of contaminants prior to discharge, taking into consideration potential impacts of cross-media transfer of contaminants during treatment (e.g., from water to air or land)

When wastewater treatment is required prior to discharge, the level of treatment should be based on:

- Whether wastewater is being discharged to a sanitary sewer system, or to surface waters
- National and local standards as reflected in permit requirements and sewer system capacity to convey and treat wastewater if discharge is to sanitary sewer
- Assimilative capacity of the receiving water for the load of contaminant being discharged wastewater if discharge is to surface water
- Intended use of the receiving water body (e.g. as a source of drinking water, recreation, irrigation, navigation, or other)
- Presence of sensitive receptors (e.g., endangered species) or habitats
- Good International Industry Practice (GIIP) for the relevant industry sector

General Liquid Effluent Quality

Discharge to Surface Water

Discharges of process wastewater, sanitary wastewater, wastewater from utility operations or stormwater to surface water should not result in contaminant concentrations in excess of local ambient water quality criteria or, in the absence of local criteria, other sources of ambient water quality. Receiving water use and assimilative capacity37, taking other sources of discharges to the receiving water into consideration, should also influence the acceptable pollution loadings and effluent discharge quality. Additional considerations that should be included in the setting of project-specific performance levels for wastewater effluents include:

- Process wastewater treatment standards consistent with applicable Industry Sector EHS Guidelines. Projects for which there are no industry-specific guidelines should reference the effluent quality guidelines of an industry sector with suitably analogous processes and effluents;
- Compliance with national or local standards for sanitary wastewater discharges or, in their absence, the indicative guideline values applicable to sanitary wastewater discharges shown in Table 1.3.1 below;
- Temperature of wastewater prior to discharge does not result in an increase greater than 3°C of ambient temperature at the edge of a scientifically established mixing zone which takes into account ambient water quality, receiving water use and assimilative capacity among other considerations.

Discharge to Sanitary Sewer Systems

Discharges of industrial wastewater, sanitary wastewater, wastewater from utility operations or stormwater into public or private wastewater treatment systems should:

- Meet the pretreatment and monitoring requirements of the sewer treatment system into which it discharges.
- Not interfere, directly or indirectly, with the operation and maintenance of the collection and treatment systems, or pose a risk to worker health and safety, or adversely impact characteristics of residuals from wastewater treatment operations.
- Be discharged into municipal or centralized wastewater treatment systems that have adequate capacity to meet local regulatory requirements for treatment of wastewater generated from the project. Pretreatment of wastewater to meet regulatory requirements before discharge from the project site is required if the municipal or centralized wastewater treatment system receiving wastewater from the project does not have adequate capacity to maintain regulatory compliance.

Land Application of Treated Effluent

The quality of treated process wastewater, wastewater from utility operations or stormwater discharged on land, including wetlands, should be established based on local regulatory requirements. Where land is used as part of the treatment system and the ultimate receptor is surface water, water quality guidelines for surface water discharges specific to the industry sector process should apply.38 Potential impact on soil, groundwater, and surface water, in the context of protection, conservation and long term sustainability of water and land resources should be assessed when land is used as part of any wastewater treatment system.

Septic Systems

Septic systems are commonly used for treatment and disposal of domestic sanitary sewage in areas with no sewerage collection networks, Septic systems should only be used for treatment of sanitary sewage, and unsuitable for industrial wastewater treatment. When septic systems are the selected form of wastewater disposal and treatment, they should be:

- Properly designed and installed in accordance with local regulations and guidance to prevent any hazard to public health or contamination of land, surface or groundwater.
- Well maintained to allow effective operation.
- Installed in areas with sufficient soil percolation for the design wastewater loading rate.
- Installed in areas of stable soils that are nearly level, well drained, and permeable, with enough separation between the drain field and the groundwater table or other receiving waters.

Wastewater Management

Wastewater management includes water conservation, wastewater treatment, stormwater management, and wastewater and water quality monitoring.

Industrial Wastewater

Industrial wastewater generated from industrial operations includes process wastewater, wastewater from utility operations, runoff from process and materials staging areas, and miscellaneous activities including wastewater from laboratories, equipment maintenance shops, etc.. The pollutants in an industrial wastewater may include acids or bases (exhibited as low or high pH), soluble organic chemicals causing depletion of dissolved oxygen, suspended solids, nutrients (phosphorus, nitrogen), heavy metals (e.g. cadmium, chromium, copper, lead, mercury, nickel, zinc), cyanide, toxic organic chemicals, oily materials, and volatile materials. , as well as from thermal characteristics of the discharge (e.g., elevated temperature). Transfer of pollutants to another phase, such as air, soil, or the sub-surface, should be minimized through process and engineering controls.

Process Wastewater – – Examples of treatment approaches typically used in the treatment of industrial wastewater are summarized in Annex 1.3.1. While the choice of treatment technology is driven by wastewater characteristics, the actual performance of this technology depends largely on the adequacy of its design, equipment selection, as well as operation and maintenance of its installed facilities. Adequate resources are required for proper operation and maintenance of a treatment facility, and performance is strongly dependent on the technical ability and training of its operational staff. One or more treatment technologies may be used to achieve the desired discharge quality and to maintain consistent compliance with regulatory requirements. The design and operation of the selected wastewater treatment technologies should avoid uncontrolled air emissions of volatile chemicals from wastewaters. Residuals from industrial wastewater treatment operations should be disposed in compliance with local regulatory requirements, in the absence of which disposal has to be consistent with protection of public health and safety, and conservation and long term sustainability of water and land resources.

Wastewater from Utilities Operations - Utility operations such as cooling towers and demineralization systems may result in high rates of water consumption, as well as the potential release of high temperature water containing high dissolved solids, residues of biocides, residues of other cooling system anti-fouling agents, etc. Recommended water management strategies for utility operations include:

- Adoption of water conservation opportunities for facility cooling systems as provided in the Water Conservation section below;
- Use of heat recovery methods (also energy efficiency improvements) or other cooling methods to reduce the temperature of heated water prior to discharge to ensure the discharge water temperature does not result in an increase greater than 3°C of ambient temperature at the edge of a scientifically established mixing zone which takes into account ambient water quality, receiving water use, potential receptors and assimilative capacity among other considerations;
- Minimizing use of antifouling and corrosion inhibiting chemicals by ensuring appropriate depth of water intake and use of screens. Least hazardous alternatives should be used with regards to toxicity, biodegradability, bioavailability, and bioaccumulation potential. Dose applied should accord with local regulatory requirements and manufacturer recommendations;

- Testing for residual biocides and other pollutants of concern should be conducted to determine the need for dose adjustments or treatment of cooling water prior to discharge.

Stormwater Management - Stormwater includes any surface runoff and flows resulting from precipitation, drainage or other sources. Typically stormwater runoff contains suspended sediments, metals, petroleum hydrocarbons, Polycyclic Aromatic Hydrocarbons (PAHs), coliform, etc. Rapid runoff, even of uncontaminated stormwater, also degrades the quality of the receiving water by eroding stream beds and banks. In order to reduce the need for stormwater treatment, the following principles should be applied:

- Stormwater should be separated from process and sanitary wastewater streams in order to reduce the volume of wastewater to be treated prior to discharge
- Surface runoff from process areas or potential sources of contamination should be prevented
- Where this approach is not practical, runoff from process and storage areas should be segregated from potentially less contaminated runoff
- Runoff from areas without potential sources of contamination should be minimized (e.g. by minimizing the area of impermeable surfaces) and the peak discharge rate should be reduced (e.g. by using vegetated swales and retention ponds);
- Where stormwater treatment is deemed necessary to protect the quality of receiving water bodies, priority should be given to managing and treating the first flush of stormwater runoff where the majority of potential contaminants tend to be present;
- When water quality criteria allow, stormwater should be managed as a resource, either for groundwater recharge or for meeting water needs at the facility;
- Oil water separators and grease traps should be installed and maintained as appropriate at refueling facilities, workshops, parking areas, fuel storage and containment areas.
- Sludge from stormwater catchments or collection and treatment systems may contain elevated levels of pollutants and should be disposed in compliance with local regulatory requirements, in the absence of which disposal has to be consistent with protection of public health and safety, and conservation and long term sustainability of water and land resources.

Sanitary Wastewater

Sanitary wastewater from industrial facilities may include effluents from domestic sewage, food service, and laundry facilities serving site employees. Miscellaneous wastewater from laboratories, medical infirmaries, water softening etc. may also be discharged to the sanitary wastewater treatment system. Recommended sanitary wastewater management strategies include:

- Segregation of wastewater streams to ensure compatibility with selected treatment option (e.g. septic system which can only accept domestic sewage);

- Segregation and pretreatment of oil and grease containing effluents (e.g. use of a grease trap) prior to discharge into sewer systems;
- If sewage from the industrial facility is to be discharged to surface water, treatment to meet national or local standards for sanitary wastewater discharges;
- If sewage from the industrial facility is to be discharged to either a septic system, or where land is used as part of the treatment system, treatment to meet applicable national or local standards for sanitary wastewater discharges is required.
- Sludge from sanitary wastewater treatment systems should be disposed in compliance with local regulatory requirements, in the absence of which disposal has to be consistent with protection of public health and safety, and conservation and long term sustainability of water and land resources.

Emissions from Wastewater Treatment Operations

Air emissions from wastewater treatment operations may include hydrogen sulfide, methane, ozone (in the case of ozone disinfection), volatile organic compounds (e.g., chloroform generated from chlorination activities and other volatile organic compounds (VOCs) from industrial wastewater), gaseous or volatile chemicals used for disinfection processes (e.g., chlorine and ammonia), and bioaerosols. Odors from treatment facilities can also be a nuisance to workers and the surrounding community. Recommendations for the management of emissions are presented in the Air Emissions and Ambient Air Quality section of this document and in the EHS Guidelines for Water and Sanitation.

Residuals from Wastewater Treatment Operations

Sludge from a waste treatment plant needs to be evaluated on a case-by-case basis to establish whether it constitutes a hazardous or a non-hazardous waste and managed accordingly as described in the Waste Management section of this document.

Occupational Health and Safety Issues in Wastewater Treatment Operations

Wastewater treatment facility operators may be exposed to physical, chemical, and biological hazards depending on the design of the facilities and the types of wastewater effluents managed. Examples of these hazards include the potential for trips and falls into tanks, confined space entries for maintenance operations, and inhalation of VOCs, bioaerosols, and methane, contact with pathogens and vectors, and use of potentially hazardous chemicals, including chlorine, sodium and calcium hypochlorite, and ammonia. Detailed recommendations for the management of occupational health and safety issues are presented in the relevant section of this document. Additional guidance specifically applicable to wastewater treatment systems is provided in the EHS Guidelines for Water and Sanitation.

Monitoring

A wastewater and water quality monitoring program with adequate resources and management oversight should be developed and implemented to meet the objective(s) of the monitoring program. The wastewater and water quality monitoring program should consider the following elements:

- Monitoring parameters: The parameters selected for monitoring should be indicative of the pollutants of concern from the process, and should include parameters that are regulated under compliance requirements;
- Monitoring type and frequency: Wastewater monitoring should take into consideration the discharge characteristics from the process over time. Monitoring of discharges from processes with batch manufacturing or seasonal process variations should take into consideration of time-dependent variations in discharges and, therefore, is more complex than monitoring of continuous discharges. Effluents from highly variable processes may need to be sampled more frequently or through composite methods. Grab samples or, if automated equipment permits, composite samples may offer more insight on average concentrations of pollutants over a 24-hour period. Composite samplers may not be appropriate where analytes of concern are short-lived (e.g., quickly degraded or volatile).
- Monitoring locations: The monitoring location should be selected with the objective of providing representative monitoring data. Effluent sampling stations may be located at the final discharge, as well as at strategic upstream points prior to merging of different discharges. Process discharges should not be diluted prior or after treatment with the objective of meeting the discharge or ambient water quality standards.
- Data quality: Monitoring programs should apply internationally approved methods for sample collection, preservation and analysis. Sampling should be conducted by or under the supervision of trained 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 prepared and, implemented. QA/QC documentation should be included in monitoring reports.

Table 31: Examples of Industrial Wastewater Treatment Approaches

Pollutant/Parameter	Control Options / Principle	Common End of Pipe Control Technology
pH	Chemical, Equalization	Acid/Base addition, Flow equalization
Oil and Grease / TPH	Phase separation	Dissolved Air Floatation, oil water separator, grease trap
TSS - Settleable	Settling, Size Exclusion	Sedimentation basin, clarifier, centrifuge, screens
TSS - Non-Settleable	Floatation, Filtration - traditional and tangential	Dissolved air floatation, Multimedia filter, sand filter, fabric filter, ultrafiltration, microfiltration
Hi - BOD (> 2 Kg/m3)	Biological - Anaerobic	Suspended growth, attached growth, hybrid
Lo - BOD (< 2 Kg/m3)	Biological - Aerobic, Facultative	Suspended growth, attached growth, hybrid
COD - Non-Biodegradable	Oxidation, Adsorption, Size Exclusion	Chemical oxidation, Thermal oxidation, Activated Carbon, Membranes
Metals - Particulate and Soluble	Coagulation, flocculation, precipitation, size exclusion	Flash mix with settling, filtration - traditional and tangential
Inorganics / Non-metals	Coagulation, flocculation, precipitation, size exclusion, Oxidation, Adsorption	Flash mix with settling, filtration - traditional and tangential, Chemical oxidation, Thermal oxidation, Activated Carbon, Reverse Osmosis, Evaporation
Organics - VOCs and SVOCs	Biological - Aerobic, Anaerobic, Facultative; Adsorption, Oxidation	Biological : Suspended growth, attached growth, hybrid; Chemical oxidation, Thermal oxidation, Activated Carbon
Emissions – Odors and VOCs	Capture – Active or Passive; Biological; Adsorption, Oxidation	Biological : Attached growth; Chemical oxidation, Thermal oxidation, Activated Carbon
Nutrients	Biological Nutrient Removal,	Aerobic/Anoxic biological treatment, chemical hydrolysis and air

	Chemical, Physical, Adsorption	stripping, chlorination, ion exchange
Color	Biological - Aerobic, Anaerobic, Facultative; Adsorption, Oxidation	Biological Aerobic, Chemical oxidation, Activated Carbon
Temperature	Evaporative Cooling	Surface Aerators, Flow Equalization
TDS	Concentration, Size Exclusion	Evaporation, crystallization, Reverse Osmosis
Active Ingredients/Emerging Contaminants	Adsorption, Oxidation, Size Exclusion, Concentration	Chemical oxidation, Thermal oxidation, Activated Carbon, Ion Exchange, Reverse Osmosis, Evaporation, Crystallization
Radionuclides	Adsorption, Size Exclusion, Concentration	Ion Exchange, Reverse Osmosis, Evaporation, Crystallization
Pathogens	Disinfection, Sterilization	Chlorine, Ozone, Peroxide, UV, Thermal
Toxicity	Adsorption, Oxidation, Size Exclusion, Concentration	Chemical oxidation, Thermal oxidation, Activated Carbon, Evaporation, crystallization, Reverse Osmosis

1.4 Water Conservation

Applicability and Approach

Water conservation programs should be implemented commensurate with the magnitude and cost of water use. These programs should promote the continuous reduction in water consumption and achieve savings in the water pumping, treatment and disposal costs. Water conservation measures may include water monitoring/management techniques; process and cooling/heating water recycling, reuse, and other techniques; and sanitary water conservation techniques.

General recommendations include:

- Storm/Rainwater harvesting and use
- Zero discharge design/Use of treated waste water to be included in project design processes
- Use of localized recirculation systems in plant/facility/shops (as opposed to centralized recirculation system), with provision only for makeup water
- Use of dry process technologies e.g. dry quenching
- Process water system pressure management
- Project design to have measures for adequate water collection, spill control and leakage control system

Water Monitoring and Management

The essential elements of a water management program involve:

- Identification, regular measurement, and recording of principal flows within a facility;
- Definition and regular review of performance targets, which are adjusted to account for changes in major factors affecting water use (e.g. industrial production rate);
- Regular comparison of water flows with performance targets to identify where action should be taken to reduce water use.

Water measurement (metering) should emphasize areas of greatest water use. Based on review of metering data, ‘unaccounted’ use–indicating major leaks at industrial facilities–could be identified.

Process Water Reuse and Recycling

Opportunities for water savings in industrial processes are highly industry-specific. However, the following techniques have all been used successfully, and should be considered in conjunction with the development of the metering system described above.

- Washing Machines: Many washing machines use large quantities of hot water. Use can increase as nozzles become enlarged due to repeated cleaning and /or wear. Monitor machine water use, compare with specification, and replace nozzles when water and heat use reaches levels warranting such work.
- Water reuse: Common water reuse applications include countercurrent rinsing, for example in multi-stage washing and rinsing processes, or reusing waste water from one process for another with less exacting water requirements. For example, using bleaching rinse water for textile washing, or bottle-washer rinse water for bottle crate washing, or even washing the floor. More sophisticated reuse projects requiring treatment of water before reuse are also sometimes practical.
- Water jets/sprays: If processes use water jets or sprays (e.g. to keep conveyors clean or to cool product) review the accuracy of the spray pattern to prevent unnecessary water loss.
- Flow control optimization: Industrial processes sometimes require the use of tanks, which are refilled to control losses. It is often possible to reduce the rate of water supply to such tanks, and sometimes to reduce tank levels to reduce spillage. If the process uses water cooling sprays, it may be possible to reduce flow while maintaining cooling performance. Testing can determine the optimum balance.
    a. If hoses are used in cleaning, use flow controls to restrict wasteful water flow
    b. Consider the use of high pressure, low volume cleaning systems rather than using large volumes of water sprayed from hosepipes
    c. Using flow timers and limit switches to control water use
    d. Using ‘clean-up’ practices rather than hosing down

Building Facility Operations

Consumption of building and sanitary water is typically less than that used in industrial processes. However, savings can readily be identified, as outlined below:

- Compare daily water use per employee to existing benchmarks taking into consideration the primary use at the facility, whether sanitary or including other activities such as showering or catering
- Regularly maintain plumbing, and identify and repair leaks
- Shut off water to unused areas
- Install self-closing taps, automatic shut-off valves, spray nozzles, pressure reducing valves, and water conserving fixtures (e.g. low flow shower heads, faucets, toilets, urinals; and spring loaded or sensored faucets)
- Operate dishwashers and laundries on full loads, and only when needed
- Install water-saving equipment in lavatories, such as lowflow toilets

Cooling Systems

Water conservation opportunities in cooling systems include:

- Use of closed circuit cooling systems with cooling towers rather than once-through cooling systems
- Limiting condenser or cooling tower blowdown to the minimum required to prevent unacceptable accumulation of dissolved solids
- Use of air cooling rather than evaporative cooling, although this may increase electricity use in the cooling system
- Use of treated waste water for cooling towers
- Reusing/recycling cooling tower blowdown

Heating Systems

Heating systems based on the circulation of low or medium pressure hot water (which do not consume water) should be closed. If they do consume water, regular maintenance should be conducted to check for leaks. However, large quantities of water may be used by steam systems, and this can be reduced by the following measures:

- Repair of steam and condensate leaks, and repair of all failed steam traps
- Return of condensate to the boilerhouse, and use of heat exchangers (with condensate return) rather than direct steam injection where process permits
- Flash steam recovery
- Minimizing boiler blowdown consistent with maintaining acceptably low dissolved solids in boiler water. Use of reverse osmosis boiler feed water treatment substantially reduces the need for boiler blowdown
- Minimizing deaerator heating

1.5 Hazardous Materials Management

Applicability and Approach

These guidelines apply to projects that use, store, or handle any quantity of hazardous materials (Hazmats), defined as materials that represent a risk to human health, property, or the environment due to their physical or chemical characteristics. Hazmats can be classified according to the hazard as explosives; compressed gases, including toxic or flammable gases; flammable liquids; flammable solids; oxidizing substances; toxic materials; radioactive material; and corrosive substances. Guidance on the transport of hazardous materials is covered in Section 3 of this document.

When a hazardous material is no longer usable for its original purpose and is intended for disposal, but still has hazardous properties, it is considered a hazardous waste (see Section 1.4). This guidance is intended to be applied in conjunction with traditional occupational health and safety and emergency preparedness programs which are included in Section 2.0 on Occupational Health and Safety Management, and Section 3.7 on Emergency Preparedness and Response. Guidance on the Transport of Hazardous Materials is provided in Section 3.5. This section is divided into two main subsections:

General Hazardous Materials Management: Guidance applicable to all projects or facilities that handle or store any quantity of hazardous materials.

Management of Major Hazards: Additional guidance for projects or facilities that store or handle hazardous materials at, or above, threshold quantities, and thus require special treatment to prevent accidents such as fire, explosions, leaks or spills, and to prepare and respond to emergencies.

The overall objective of hazardous materials management is to avoid or, when avoidance is not feasible, minimize uncontrolled releases of hazardous materials or accidents (including explosion and fire) during their production, handling, storage and use. This objective can be achieved by:

- Establishing hazardous materials management priorities based on hazard analysis of risky operations identified through Social and Environmental Assessment;
- Where practicable, avoiding or minimizing the use of hazardous materials. For example, non-hazardous materials have been found to substitute asbestos in building materials, PCBs in electrical equipment, persistent organic pollutants (POPs) in pesticides formulations, and ozone depleting substances in refrigeration systems;
- Preventing uncontrolled releases of hazardous materials to the environment or uncontrolled reactions that might result in fire or explosion;
- Using engineering controls (containment, automatic alarms, and shut-off systems) commensurate with the nature of hazard;
- Implementing management controls (procedures, inspections, communications, training, and drills) to address residual risks that have not been prevented or controlled through engineering measures.

General Hazardous Materials Management

Projects which manufacture, handle, use, or store hazardous materials should establish management programs that are commensurate with the potential risks present. The main objectives of projects involving hazardous materials should be the protection of the workforce and the prevention and control of releases and accidents. These objectives should be addressed by integrating prevention and control measures, management actions, and procedures into day-to-day business activities. Potentially applicable elements of a management program include the following:

Hazard Assessment

The level of risk should be established through an on-going assessment process based on:

- The types and amounts of hazardous materials present in the project. This information should be recorded and should include a summary table with the following information:
    a. Name and description (e.g. composition of a mixture) of the Hazmat
    b. Classification (e.g. code, class or division) of the Hazmat
    c. Internationally accepted regulatory reporting threshold quantity or national equivalent40 of the Hazmat
    d. Quantity of Hazmat used per month
    e. Characteristic(s) that make(s) the Hazmat hazardous (e.g. flammability, toxicity)

- Analysis of potential spill and release scenarios using available industry statistics on spills and accidents where available
- Analysis of the potential for uncontrolled reactions such as fire and explosions
- Analysis of potential consequences based on the physical geographical characteristics of the project site, including aspects such as its distance to settlements, water resources, and other environmentally sensitive areas

Hazard assessment should be performed by specialized professionals using internationally-accepted methodologies such as Hazardous Operations Analysis (HAZOP), Failure Mode and Effects Analysis (FMEA), and Hazard Identification (HAZID).

Management Actions

The management actions to be included in a Hazardous Materials Management Plan should be commensurate with the level of potential risks associated with the production, handling, storage, and use of hazardous materials.

Release Prevention and Control Planning

Where there is risk of a spill of uncontrolled hazardous materials, facilities should prepare a spill control, prevention, and countermeasure plan as a specific component of their Emergency Preparedness and Response Plan (described in more detail in Section 3.7). The plan should be tailored to the hazards associated with the project, and include:

- Training of operators on release prevention, including drills specific to hazardous materials as part of emergency preparedness response training
- Implementation of inspection programs to maintain the mechanical integrity and operability of pressure vessels, tanks, piping systems, relief and vent valve systems, containment infrastructure, emergency shutdown systems, controls and pumps, and associated process equipment
- Preparation of written Standard Operating Procedures (SOPs) for filling USTs, ASTs or other containers or equipment as well as for transfer operations by personnel trained in the safe transfer and filling of the hazardous material, and in spill prevention and response
- SOPs for the management of secondary containment structures, specifically the removal of any accumulated fluid, such as rainfall, to ensure that the intent of the system is not accidentally or willfully defeated
- Identification of locations of hazardous materials and associated activities on an emergency plan site map
- Documentation of availability of specific personal protective equipment and training needed to respond to an emergency
- Documentation of availability of spill response equipment sufficient to handle at least initial stages of a spill and a list of external resources for equipment and personnel, if necessary, to supplement internal resources
- Description of response activities in the event of a spill, release, or other chemical emergency including:
    a. Internal and external notification procedures

b. Specific responsibilities of individuals or groups
c. Decision process for assessing severity of the release, and determining appropriate actions
d. Facility evacuation routes
e. Post-event activities such as clean-up and disposal, incident investigation, employee re-entry, and restoration of spill response equipment.

Occupational Health and Safety

The Hazardous Materials Management Plan should address applicable, essential elements of occupational health and safety management as described in Section 2.0 on Occupational Health and Safety, including:

- Job safety analysis to identify specific potential occupational hazards and industrial hygiene surveys, as appropriate, to monitor and verify chemical exposure levels, and compare with applicable occupational exposure standards
- Hazard communication and training programs to prepare workers to recognize and respond to workplace chemical hazards. Programs should include aspects of hazard identification, safe operating and materials handling procedures, safe work practices, basic emergency procedures, and special hazards unique to their jobs. Training should incorporate information from Material Safety Data Sheets (MSDSs) for hazardous materials being handled. MSDSs should be readily accessible to employees in their local language.
- Definition and implementation of permitted maintenance activities, such as hot work or confined space entries
- Provision of suitable personal protection equipment (PPE) (footwear, masks, protective clothing and goggles in appropriate areas), emergency eyewash and shower stations, ventilation systems, and sanitary facilities
- Monitoring and record-keeping activities, including audit procedures designed to verify and record the effectiveness of prevention and control of exposure to occupational hazards, and maintaining accident and incident investigation reports on file for a period of at least five years

Process Knowledge and Documentation

The Hazardous Materials Management Plan should be incorporated into, and consistent with, the other elements of the facility ES/OHS MS and include:

- Written process safety parameters (i.e., hazards of the chemical substances, safety equipment specifications, safe operation ranges for temperature, pressure, and other applicable parameters, evaluation of the consequences of deviations, etc.)
- Written operating procedures
- Compliance audit procedures

Preventive Measures

Hazardous Materials Transfer

Uncontrolled releases of hazardous materials may result from small cumulative events, or from more significant equipment failure associated with events such as manual or mechanical transfer between storage systems or process equipment. Recommended practices to prevent hazardous material releases from processes include:

- Use of dedicated fittings, pipes, and hoses specific to materials in tanks (e.g., all acids use one type of connection, all caustics use another), and maintaining procedures to prevent addition of hazardous materials to incorrect tanks
- Use of transfer equipment that is compatible and suitable for the characteristics of the materials transferred and designed to ensure safe transfer
- Regular inspection, maintenance and repair of fittings, pipes and hoses
- Provision of secondary containment, drip trays or other overflow and drip containment measures, for hazardous materials containers at connection points or other possible overflow points.

Overfill Protection

Overfills of vessels and tanks should be prevented as they are among the most common causes of spills resulting in soil and water contamination, and among the easiest to prevent. Recommended overfill protection measures include:

- Prepare written procedures for transfer operations that includes a checklist of measures to follow during filling operations and the use of filling operators trained in these procedures
- Installation of gauges on tanks to measure volume inside
- Use of dripless hose connections for vehicle tank and fixed connections with storage tanks
- Provision of automatic fill shutoff valves on storage tanks to prevent overfilling
- Use of a catch basin around the fill pipe to collect spills
- Use of piping connections with automatic overfill protection (float valve)
- Pumping less volume than available capacity into the tank or vessel by ordering less material than its available capacity
- Provision of overfill or over pressure vents that allow controlled release to a capture point

Reaction, Fire, and Explosion Prevention

Reactive, flammable, and explosive materials should also be managed to avoid uncontrolled reactions or conditions resulting in fire or explosion. Recommended prevention practices include:

- Storage of incompatible materials (acids, bases, flammables, oxidizers, reactive chemicals) in separate areas, and with containment facilities separating material storage areas
- Provision of material-specific storage for extremely hazardous or reactive materials
- Use of flame arresting devices on vents from flammable storage containers
- Provision of grounding and lightning protection for tank farms, transfer stations, and other equipment that handles flammable materials

- Selection of materials of construction compatible with products stored for all parts of storage and delivery systems, and avoiding reuse of tanks for different products without checking material compatibility
- Storage of hazardous materials in an area of the facility separated from the main production works. Where proximity is unavoidable, physical separation should be provided using structures designed to prevent fire, explosion, spill, and other emergency situations from affecting facility operations
- Prohibition of all sources of ignition from areas near flammable storage tanks

Control Measures

Secondary Containment (Liquids)

A critical aspect for controlling accidental releases of liquid hazardous materials during storage and transfer is the provision of secondary containment. It is not necessary for secondary containment methods to meet long term material compatibility as with primary storage and piping, but their design and construction should hold released materials effectively until they can be detected and safely recovered. Appropriate secondary containment structures consist of berms, dikes, or walls capable of containing the larger of 110 percent of the largest tank or 25% percent of the combined tank volumes in areas with above-ground tanks with a total storage volume equal or greater than 1,000 liters and will be made of impervious, chemically resistant material. Secondary containment design should also consider means to prevent contact between incompatible materials in the event of a release.

Other secondary containment measures that should be applied depending on site-specific conditions include:

- Transfer of hazardous materials from vehicle tanks to storage in areas with surfaces sufficiently impervious to avoid loss to the environment and sloped to a collection or a containment structure not connected to municipal wastewater/stormwater collection system
- Where it is not practical to provide permanent, dedicated containment structures for transfer operations, one or more alternative forms of spill containment should be provided, such as portable drain covers (which can be deployed for the duration of the operations), automatic shut-off valves on storm water basins, or shut off valves in drainage or sewer facilities, combined with oil-water separators
- Storage of drummed hazardous materials with a total volume equal or greater than 1,000 liters in areas with impervious surfaces that are sloped or bermed to contain a minimum of 25 percent of the total storage volume
- Provision of secondary containment for components (tanks, pipes) of the hazardous material storage system, to the extent feasible
- Conducting periodic (e.g. daily or weekly) reconciliation of tank contents, and inspection of visible portions of tanks and piping for leaks;
- Use of double-walled, composite, or specially coated storage and piping systems particularly in the use of underground storage tanks (USTs) and underground

piping. If double-walled systems are used, they should provide a means of detecting leaks between the two walls.

Storage Tank and Piping Leak Detection

Leak detection may be used in conjunction with secondary containment, particularly in high-risk locations43. Leak detection is especially important in situations where secondary containment is not feasible or practicable, such as in long pipe runs. Acceptable leak detection methods include:

- Use of automatic pressure loss detectors on pressurized or long distance piping
- Use of approved or certified integrity testing methods on piping or tank systems, at regular intervals
- Considering the use of SCADA44 if financially feasible

Underground Storage Tanks (USTs)

Although there are many environmental and safety advantages of underground storage of hazardous materials, including reduced risk of fire or explosion, and lower vapor losses into the atmosphere, leaks of hazardous materials can go undetected for long periods of time with potential for soil and groundwater contamination. Examples of techniques to manage these risks include:

- Avoiding use of USTs for storage of highly soluble organic materials
- Assessing local soil corrosion potential, and installing and maintaining cathodic protection (or equivalent rust protection) for steel tanks
- For new installations, installing impermeable liners or structures (e.g., concrete vaults) under and around tanks and lines that direct any leaked product to monitoring ports at the lowest point of the liner or structure
- Monitoring the surface above any tank for indications of soil movement
- Reconciling tank contents by measuring the volume in store with the expected volume, given the stored quantity at last stocking, and deliveries to and withdrawals from the store
- Testing integrity by volumetric, vacuum, acoustic, tracers, or other means on all tanks at regular intervals
- Considering the monitoring groundwater of quality down gradient of locations where multiple USTs are in use
- Evaluating the risk of existing UST in newly acquired facilities to determine if upgrades are required for USTs that will be continued to be used, including replacement with new systems or permanent closure of abandoned USTs. Ensuring that new USTs are sited away from wells, reservoirs and other source water protection areas and floodplains, and maintained so as to prevent corrosion.

Management of Major Hazards

In addition to the application of the above-referenced guidance on prevention and control of releases of hazardous materials, projects involving production, handling, and storage of hazardous materials at or above threshold limits should prepare a Hazardous Materials

Risk Management Plan, in the context of its overall ES/OHS MS, containing all of the elements presented below. The objective of this guidance is the prevention and control of catastrophic releases of toxic, reactive, flammable, or explosive chemicals that may result in toxic, fire, or explosion hazards.

Management Actions

- Management of Change: These procedures should address:
  a. The technical basis for changes in processes and operations
  b. The impact of changes on health and safety
  c. Modification to operating procedures
  d. Authorization requirements
  e. Employees affected
  f. Training needs
- Compliance Audit: A compliance audit is a way to evaluate compliance with the prevention program requirements for each process. A compliance audit covering each element of the prevention measures (see below) should be conducted at least every three years and should include:
  a. Preparation of a report of the findings
  b. Determination and documentation of the appropriate response to each finding
  c. Documentation that any deficiency has been corrected
- Incident Investigation: Incidents can provide valuable information about site hazards and the steps needed to prevent accidental releases. An incident investigation mechanism should include procedures for:
  a. Initiation of the investigation promptly
  b. Summarizing the investigation in a report
  c. Addressing the report findings and recommendations
  d. A review of the report with staff and contractors
- Employee Participation: A written plan of action should describe an active employee participation program for the prevention of accidents.
- Contractors: There should be a mechanism for contractor control which should include a requirement for them to develop hazard materials management procedures that meet the requirements of the hazardous materials management plan. Their procedures should be consistent with those of the contracting company and the contractor workforce should undergo the same training. Additionally, procedures should require that contractors are:
  a. Provided with safety performance procedures and safety and hazard information
  b. Observe safety practices
  c. Act responsibly
  d. Have access to appropriate training for their employees
  e. Ensure that their employees know process hazards and applicable emergency actions

f. Prepare and submit training records for their employees to the contracting company
g. Inform their employees about the hazards presented by their work
h. Assess trends of repeated similar incidents
i. Develop and implement procedures to manage repeated similar incidents

- Training: Project employees should be provided training on Hazmat management. The training program should include:
  a. A list of employees to be trained
  b. Specific training objectives
  c. Mechanisms to achieve the objectives (i.e., hands-on workshops, videos, etc.)
  d. The means to determine whether the training program is effective
  e. Training procedures for new hires and refresher courses for existing employees

Preventive Measures

The purpose of preventive measures is to ensure that safety-related aspects of the process and equipment are considered, limits to be placed on the operations are well known, and accepted standards and codes are adopted, where they apply.

a. Process Safety Information: Procedures should be prepared for each hazardous materials and include:
b. Compilation of Material Safety Data Sheets (MSDS)
c. Identification of maximum intended inventories and safe upper/lower parameters
d. Documentation of equipment specifications and of codes and standards used to design, build and operate the process

Operating Procedures: SOPs should be prepared for each step of all processes or operations within the project (e.g. initial startup, normal operations, temporary operations, emergency shutdown, emergency operations, normal shutdown, and start-up following a normal or emergency shutdown or major change). These SOPs should include special considerations for Mazmats used in the process or operations (e.g. temperature control to prevent emissions of a volatile hazardous chemical; diversion of gaseous discharges of hazardous pollutants from the process to a temporary storage tank in case of emergency).
Other procedures to be developed include impacts of deviations, steps to avoid deviations, prevention of chemical exposure, exposure control measures, and equipment inspections.

Mechanical Integrity of process equipment, piping and instrumentation: Inspection and maintenance procedures should be developed and documented to ensure mechanical integrity of equipment, piping, and instrumentation and prevent uncontrolled releases of hazardous materials from the project. These procedures should be included as part of the project SOPs. The specific process components of major interest include pressure vessels and storage tanks, piping systems, relief and vent systems and devices, emergency shutdown systems, controls, and pumps. Recommended aspects of the inspection and maintenance program include:

a. Developing inspection and maintenance procedures
b. Establishing a quality assurance plan for equipment, maintenance materials, and spare parts
c. Conducting employee training on the inspection and maintenance procedures
d. Conducting equipment, piping, and instrumentation inspections and maintenance
e. Identifying and correcting identified deficiencies
f. Evaluating the inspection and maintenance results and, if necessary, updating the inspection and maintenance procedures
g. Reporting the results to management.

Hot Work Permit: Hot work operations – such as brazing, torch-cutting, grinding, soldering, and welding – are associated with potential health, safety, and property hazards resulting from the fumes, gases, sparks, and hot metal and radiant energy produced during hot work. Hot work permit is required for any operation involving open flames or producing heat and/or sparks. The section of SOPs on hot work should include the responsibility for hot work permitting, personal protection equipment (PPE), hot work procedures, personnel training, and recordkeeping.

Pre-Start Review: Procedures should be prepared to carry out pre-start reviews when a modification is significant enough to require a change in safety information under the management of change procedure. The procedures should:

a. Confirm that the new or modified construction and/or equipment meet design specifications
b. Ensure that procedures for safety, operation, maintenance, and emergency are adequate
c. Include a process hazard assessment, and resolve or implement recommendations for new process
d. Ensure that training for all affected employees is being conducted

Emergency Preparedness and Response

When handling hazardous materials, procedures and practices should be developed allowing for quick and efficient responses to accidents that could result in human injury or damage to the environment. An Emergency Preparedness and Response Plan, incorporated into and consistent with, the facility's overall ES/OHS MS, should be prepared to cover the following:

- Planning Coordination: Procedures should be prepared for:
  a. Informing the public and emergency response agencies
  b. Documenting first aid and emergency medical treatment
  c. Taking emergency response actions
  d. Reviewing and updating the emergency response plan to reflect changes, and ensuring that employees are informed of such changes
- Emergency Equipment: Procedures should be prepared for using, inspecting, testing, and maintaining the emergency response equipment.
- Training: Employees and contractors should be trained on emergency response procedures.

Community Involvement and Awareness

When hazardous materials are in use above threshold quantities, the management plan should include a system for community awareness, notification and involvement that should be commensurate with the potential risks identified for the project during the hazard assessment studies. This should include mechanisms for sharing the results of hazard and risk assessment studies in a timely, understandable and culturally sensitive manner with potentially affected communities that provides a means for public feedback. Community involvement activities should include:

- Availability of general information to the potentially affected community on the nature and extent of project operations, and the prevention and control measures in place to ensure no effects to human health
- The potential for off-site effects to human health or the environment following an accident at planned or existing hazardous installations
- Specific and timely information on appropriate behavior and safety measures to be adopted in the event of an accident including practice drills in locations with higher risks
- Access to information necessary to understand the nature of the possible effect of an accident and an opportunity to contribute effectively, as appropriate, to decisions concerning hazardous installations and the development of community emergency preparedness plans.

1.6 Waste Management

Applicability and Approach

These guidelines apply to projects that generate, store, or handle any quantity of waste across a range of industry sectors. It is not intended to apply to projects or facilities where the primary business is the collection, transportation, treatment, or disposal of wastes. Specific guidance for these types of facilities is presented in the Environmental Health and Safety (EHS) Guidelines for Waste Management Facilities.

A waste is any solid, liquid, or contained gaseous material that is being discarded by disposal, recycling, burning or incineration. It can be byproduct of a manufacturing process or an obsolete commercial product that can no longer be used for intended purpose and requires disposal.

Solid (non-hazardous) wastes generally include any garbage, refuse. Examples of such waste include domestic trash and garbage; inert construction / demolition materials; refuse, such as metal scrap and empty containers (except those previously used to contain hazardous materials which should, in principle, be managed as a hazardous waste); and residual waste from industrial operations, such as boiler slag,clinker, and fly ash.

Hazardous waste shares the properties of a hazardous material (e.g. ignitability, corrosivity, reactivity, or toxicity), or other physical, chemical, or biological characteristics that may pose a potential risk to human health or the environment if improperly managed. Wastes may also be defined as “hazardous” by local regulations or international conventions, based on the origin of the waste and its inclusion on hazardous waste lists, or based on its characteristics.

Sludge from a waste treatment plant, water supply treatment plant, or air pollution control facility, and other discarded material, including solid, liquid, semisolid, or contained gaseous material resulting from industrial operations needs to be evaluated on a case-by-case basis to establish whether it constitutes a hazardous or a non-hazardous waste.

Facilities that generate and store wastes should practice the following:

- Establishing waste management priorities at the outset of activities based on an understanding of potential Environmental, Health, and Safety (EHS) risks and impacts and considering waste generation and its consequences
- Establishing a waste management hierarchy that considers prevention, reduction, reuse, recovery, recycling, removal and finally disposal of wastes.
- Avoiding or minimizing the generation waste materials, as far as practicable
- Where waste generation cannot be avoided but has been minimized, recovering and reusing waste
- Where waste can not be recovered or reused, treating, destroying, and disposing of it in an environmentally sound manner

General Waste Management

The following guidance applies to the management of nonhazardous and hazardous waste. Additional guidance specifically applicable to hazardous wastes is presented below. Waste management should be addressed through a Waste management system that addresses issues linked to waste minimization, generation, transport, disposal, and monitoring.

Waste Management Planning

Facilities that generate waste should characterize their waste according to composition, source, types of wastes produced, generation rates, or according to local regulatory requirements. Effective planning and implementation of waste management strategies should include:

- Review of new waste sources during planning, siting, and design activities, including during equipment modifications and process alterations, to identify expected waste generation, pollution prevention opportunities, and necessary treatment, storage, and disposal infrastructure
- Collection of data and information about the process and waste streams in existing facilities, including characterization of waste streams by type, quantities, and potential use/disposition
- Establishment of priorities based on a risk analysis that takes into account the potential EHS risks during the waste cycle and the availability of infrastructure to manage the waste in an environmentally sound manner
- Definition of opportunities for source reduction, as well as reuse and recycling
- Definition of procedures and operational controls for onsite storage

- Definition of options / procedures / operational controls for treatment and final disposal

Waste Prevention

Processes should be designed and operated to prevent, or minimize, the quantities of wastes generated and hazards associated with the wastes generated in accordance with the following strategy:

- Substituting raw materials or inputs with less hazardous or toxic materials, or with those where processing generates lower waste volumes
- Applying manufacturing process that convert materials efficiently, providing higher product output yields, including modification of design of the production process, operating conditions, and process controls
- Instituting good housekeeping and operating practices, including inventory control to reduce the amount of waste resulting from materials that are out-of-date, offspecification, contaminated, damaged, or excess to plant needs
- Instituting procurement measures that recognize opportunities to return usable materials such as containers and which prevents the over ordering of materials
- Minimizing hazardous waste generation by implementing stringent waste segregation to prevent the commingling of non-hazardous and hazardous waste to be managed

Recycling and Reuse

In addition to the implementation of waste prevention strategies, the total amount of waste may be significantly reduced through the implementation of recycling plans, which should consider the following elements:

- Evaluation of waste production processes and identification of potentially recyclable materials
- Identification and recycling of products that can be reintroduced into the manufacturing process or industry activity at the site
- Investigation of external markets for recycling by other industrial processing operations located in the neighborhood or region of the facility (e.g., waste exchange)
- Establishing recycling objectives and formal tracking of waste generation and recycling rates
- Providing training and incentives to employees in order to meet objectives

Treatment and Disposal

If waste materials are still generated after the implementation of feasible waste prevention, reduction, reuse, recovery and recycling measures, waste materials should be treated and disposed of and all measures should be taken to avoid potential impacts to human health and the environment. Selected management approaches should be consistent with the characteristics of the waste and local regulations, and may include one or more of the following:

- On-site or off-site biological, chemical, or physical treatment of the waste material to render it nonhazardous prior to final disposal
- Treatment or disposal at permitted facilities specially designed to receive the waste. Examples include: composting operations for organic non-hazardous wastes; properly designed, permitted and operated landfills or incinerators designed for the respective type of waste; or other methods known to be effective in the safe, final disposal of waste materials such as bioremediation.

Hazardous Waste Management

Hazardous wastes should always be segregated from nonhazardous wastes. If generation of hazardous waste cannot be prevented through the implementation of the above general waste management practices, its management should focus on the prevention of harm to health, safety, and the environment, according to the following additional principles:

- Understanding potential impacts and risks associated with the management of any generated hazardous waste during its complete life cycle
- Ensuring that contractors handling, treating, and disposing of hazardous waste are reputable and legitimate enterprises, licensed by the relevant regulatory agencies and following good international industry practice for the waste being handled
- Ensuring compliance with applicable local and international regulations

Waste Storage

Hazardous waste should be stored so as to prevent or control accidental releases to air, soil, and water resources in area location where:

- Waste is stored in a manner that prevents the commingling or contact between incompatible wastes, and allows for inspection between containers to monitor leaks or spills. Examples include sufficient space between incompatibles or physical separation such as walls or containment curbs
- Store in closed containers away from direct sunlight, wind and rain
- Secondary containment systems should be constructed with materials appropriate for the wastes being contained and adequate to prevent loss to the environment
- Secondary containment is included wherever liquid wastes are stored in volumes greater than 220 liters. The available volume of secondary containment should be at least 110 percent of the largest storage container, or 25 percent of the total storage capacity (whichever is greater), in that specific location
- Provide adequate ventilation where volatile wastes are stored.

Hazardous waste storage activities should also be subject to special management actions, conducted by employees who have received specific training in handling and storage of hazardous wastes:

- Provision of readily available information on chemical compatibility to employees, including labeling each container to identify its contents
- Limiting access to hazardous waste storage areas to employees who have received proper training

- Clearly identifying (label) and demarcating the area, including documentation of its location on a facility map or site plan
- Conducting periodic inspections of waste storage areas and documenting the findings
- Preparing and implementing spill response and emergency plans to address their accidental release (additional information on Emergency Plans in provided in Section 3 of this document)
- Avoiding underground storage tanks and underground piping of hazardous waste

Transportation

On-site and Off-site transportation of waste should be conducted so as to prevent or minimize spills, releases, and exposures to employees and the public. All waste containers designated for off-site shipment should be secured and labeled with the contents and associated hazards, be properly loaded on the transport vehicles before leaving the site, and be accompanied by a shipping paper (i.e., manifest) that describes the load and its associated hazards, consistent with the guidance provided in Section 3.4 on the Transport of Hazardous Materials.

Treatment and Disposal

In addition to the recommendations for treatment and disposal applicable to general wastes, the following issues specific to hazardous wastes should be considered:

Commercial or Government Waste Contractors

In the absence of qualified commercial or government-owned waste vendors (taking into consideration proximity and transportation requirements), facilities generating waste should consider using:

- Have the technical capability to manage the waste in a manner that reduces immediate and future impact to the environment
- Have all required permits, certifications, and approvals, of applicable government authorities
- Have been secured through the use of formal procurement agreements

In the absence of qualified commercial or government-owned waste disposal operators (taking into consideration proximity and transportation requirements), project sponsors should consider using:

- Installing on-site waste treatment or recycling processes
- As a final option, constructing facilities that will provide for the environmental sound long-term storage of wastes on-site (as described elsewhere in the General EHS Guidelines) or at an alternative appropriate location up until external commercial options become available

Small Quantities of Hazardous Waste

Hazardous waste materials are frequently generated in small quantities by many projects through a variety of activities such as equipment and building maintenance activities.

Examples of these types of wastes include: spent solvents and oily rags, empty paint cans, chemical containers; used lubricating oil; used batteries (such as nickel-cadmium or lead acid); and lighting equipment, such as lamps or lamp ballasts. These wastes should be managed following the guidance provided in the above sections.

Monitoring

Monitoring activities associated with the management of hazardous and non-hazardous waste should include:

- Regular visual inspection of all waste storage collection and storage areas for evidence of accidental releases and to verify that wastes are properly labeled and stored. When significant quantities of hazardous wastes are generated and stored on site, monitoring activities should include:
    a. Inspection of vessels for leaks, drips or other indications of loss
    b. Identification of cracks, corrosion, or damage to tanks, protective equipment, or floors
    c. Verification of locks, emergency valves, and other safety devices for easy operation (lubricating if required and employing the practice of keeping locks and safety equipment in standby position when the area is not occupied)
    d. Checking the operability of emergency systems
    e. Documenting results of testing for integrity, emissions, or monitoring stations (air, soil vapor, or groundwater)
    f. Documenting any changes to the storage facility, and any significant changes in the quantity of materials in storage
- Regular audits of waste segregation and collection practices
- Tracking of waste generation trends by type and amount of waste generated, preferably by facility departments
- Characterizing waste at the beginning of generation of a new waste stream, and periodically documenting the characteristics and proper management of the waste, especially hazardous wastes
- Keeping manifests or other records that document the amount of waste generated and its destination
- Periodic auditing of third party treatment, and disposal services including re-use and recycling facilities when significant quantities of hazardous wastes are managed by third parties. Whenever possible, audits should include site visits to the treatment storage and disposal location
- Regular monitoring of groundwater quality in cases of Hazardous Waste on site storage and/or pretreatment and disposal
- Monitoring records for hazardous waste collected, stored, or shipped should include:
    a. Name and identification number of the material(s) composing the hazardous waste
    b. Physical state (i.e., solid, liquid, gaseous or a combination of one, or more, of these)

c. Quantity (e.g., kilograms or liters, number of containers)
d. Waste shipment tracking documentation to include, quantity and type, date dispatched, date transported and date received, record of the originator, the receiver and the transporter
e. Method and date of storing, repacking, treating, or disposing at the facility, cross-referenced to specific manifest document numbers applicable to the hazardous waste
f. Location of each hazardous waste within the facility, and the quantity at each location

1.7 Noise

Applicability

This section addresses impacts of noise beyond the property boundary of the facilities. Worker exposure to noise is covered in Section 2.0 on Occupational Health and Safety.

Prevention and Control

Noise prevention and mitigation measures should be applied where predicted or measured noise impacts from a project facility or operations exceed the applicable noise level guideline at the most sensitive point of reception. The preferred method for controlling noise from stationary sources is to implement noise control measures at source.

- Methods for prevention and control of sources of noise emissions depend on the source and proximity of receptors. Noise reduction options that should be considered include:
- Selecting equipment with lower sound power levels
- Installing silencers for fans
- Installing suitable mufflers on engine exhausts and compressor components
- Installing acoustic enclosures for equipment casing radiating noise
- Improving the acoustic performance of constructed buildings, apply sound insulation
- Installing acoustic barriers without gaps and with a continuous minimum surface density of 10 kg/m2 in order to minimize the transmission of sound through the barrier. Barriers should be located as close to the source or to the receptor location to be effective
- Installing vibration isolation for mechanical equipment
- Limiting the hours of operation for specific pieces of equipment or operations, especially mobile sources operating through community areas
- Re-locating noise sources to less sensitive areas to take advantage of distance and shielding
- Siting permanent facilities away from community areas if possible
- Taking advantage of the natural topography as a noise buffer during facility design
- Reducing project traffic routing through community areas wherever possible

- Planning flight routes, timing and altitude for aircraft (airplane and helicopter) flying over community areas
- Developing a mechanism to record and respond to complaints

Noise Level Guidelines

Noise impacts should not exceed the levels presented in Table 1.7.1, or result in a maximum increase in background levels of 3 dB at the nearest receptor location off-site. Highly intrusive noises, such as noise from aircraft flyovers and passing trains, should not be included when establishing background noise levels.

Monitoring

Noise monitoring may be carried out for the purposes of establishing the existing ambient noise levels in the area of the proposed or existing facility, or for verifying operational phase noise levels.

Noise monitoring programs should be designed and conducted by trained specialists. Typical monitoring periods should be sufficient for statistical analysis and may last 48 hours with the use of noise monitors that should be capable of logging data continuously over this time period, or hourly, or more frequently, as appropriate (or else cover differing time periods within several days, including weekday and weekend workdays). The type of acoustic indices recorded depends on the type of noise being monitored, as established by a noise expert. Monitors should be located approximately 1.5 m above the ground and no closer than 3 m to any reflecting surface (e.g., wall). In general, the noise level limit is represented by the background or ambient noise levels that would be present in the absence of the facility or noise source(s) under investigation.

1.8 Contaminated Land

Applicability and Approach

This section provides a summary of management approaches for land contamination due to anthropogenic releases of hazardous materials, wastes, or oil, including naturally occurring substances. Releases of these materials may be the result of historic or current site activities, including, but not limited to, accidents during their handling and storage, or due to their poor management or disposal.

Land is considered contaminated when it contains hazardous materials or oil concentrations above background or naturally occurring levels.

Contaminated lands may involve surficial soils or subsurface soils that, through leaching and transport, may affect groundwater, surface water, and adjacent sites. Where subsurface contaminant sources include volatile substances, soil vapor may also become a transport and exposure medium, and create potential for contaminant infiltration of indoor air spaces of buildings.

Contaminated land is a concern because of:

- The potential risks to human health and ecology (e.g. risk of cancer or other human health effects, loss of ecology);

- The liability that it may pose to the polluter/business owners (e.g., cost of remediation, damage of business reputation and/or business-community relations) or affected parties (e.g. workers at the site, nearby property owners).

Contamination of land should be avoided by preventing or controlling the release of hazardous materials, hazardous wastes, or oil to the environment. When contamination of land is suspected or confirmed during any project phase, the cause of the uncontrolled release should be identified and corrected to avoid further releases and associated adverse impacts.

Contaminated lands should be managed to avoid the risk to human health and ecological receptors. The preferred strategy for land decontamination is to reduce the level of contamination at the site while preventing the human exposure to contamination.

To determine whether risk management actions are warranted, the following assessment approach should be applied to establish whether the three risk factors of 'Contaminants', 'Receptors', and 'Exposure Pathways' co-exist, or are likely to co-exist, at the project site under current or possible future land use:

- Contaminant(s): Presence of hazardous materials, waste, or oil in any environmental media at potentially hazardous concentrations
- Receptor(s): Actual or likely contact of humans, wildlife, plants, and other living organisms with the contaminants of concern
- Exposure pathway(s): A combination of the route of migration of the contaminant from its point of release (e.g., leaching into potable groundwater) and exposure routes (e.g., ingestion, transdermal absorption), which would allow receptor(s) to come into actual contact with contaminants

When the three risk factors are considered to be present (in spite of limited data) under current or foreseeable future conditions, the following steps should be followed (as described in the remaining parts of this section):

1) Risk screening;
2) Interim risk management;
3) Detailed quantitative risk assessment; and
4) Permanent risk reduction measures.

Risk Screening

This step is also known as "problem formulation" for environmental risk assessment. Where there is potential evidence of contamination at a site, the following steps are recommended:

- Identification of the location of suspected highest level of contamination through a combination of visual and historical operational information;
- Sampling and testing of the contaminated media (soils or water) according to established technical methods applicable to suspected type of contaminant;
- Evaluation of the analytical results against the local and national contaminated sites regulations. In the absence of such regulations or environmental standards,

other sources of risk-based standards or guidelines should be consulted to obtain comprehensive criteria for screening soil concentrations of pollutants.

- Verification of the potential human and/or ecological receptors and exposure pathways relevant to the site in question

The outcome of risk-screening may reveal that there is no overlap between the three risk-factors as the contaminant levels identified are below those considered to pose a risk to human health or the environment. Alternatively, interim or permanent risk reduction measures may need to be taken with, or without, more detailed risk assessment activities, as described below.

Interim Risk Management

Interim risk management actions should be implemented at any phase of the project life cycle if the presence of land contamination poses an "imminent hazard", i.e., representing an immediate risk to human health and the environment if contamination were allowed to continue, even a short period of time. Examples of situations considered to involve imminent hazards include, but are not restricted to:

- Presence of an explosive atmosphere caused by contaminated land
- Accessible and excessive contamination for which shortterm exposure and potency of contaminants could result in acute toxicity, irreversible long term effects, sensitization, or accumulation of persistent biocumulative and toxic substances
- Concentrations of pollutants at concentrations above the Risk Based Concentrations (RBCs60) or drinking water standards in potable water at the point of abstraction

Appropriate risk reduction should be implemented as soon as practicable to remove the condition posing the imminent hazard.

Detailed Risk Assessment

As an alternative to complying with numerical standards or preliminary remediation goals, and depending on local regulatory requirements, a detailed site-specific, environmental risk assessment may be used to develop strategies that yield acceptable health risks, while achieving low level contamination on-site. An assessment of contaminant risks needs to be considered in the context of current and future land use, and development scenarios (e.g., residential, commercial, industrial, and urban parkland or wilderness use).

A detailed quantitative risk assessment builds on risk screening (problem formulation). It involves first, a detailed site investigation to identify the scope of contamination. Site investigation programs should apply quality assurance/quality control (QA/QC) measures to ensure that data quality is adequate for the intended data use (e.g., method detection limits are below levels of concern). The site investigation in turn should be used to develop a conceptual site model of how and where contaminants exist, how they are transported, and where routes of exposure occur to organisms and humans. The risk factors and conceptual site model provide a framework for assessing contaminant risks.

Human or ecological risk assessments facilitate risk management decisions at contaminated sites. Specific risk assessment objectives include:

- Identifying relevant human and ecological receptors (e.g., children, adults, fish, wildlife)
- Determining if contaminants are present at levels that pose potential human health and/or ecological concerns (e.g., levels above applicable regulatory criteria based on health or environmental risk considerations)
- Determining how human or ecological receptors are exposed to the contaminants (e.g., ingestions of soil, dermal contact, inhalation of dust)
- Identifying the types of adverse effects that might result from exposure to the contaminants (e.g., effect on target organ, cancer, impaired growth or reproduction) in the absence of regulatory standards
- Quantifying the magnitude of health risks to human and ecological receptors based on a quantitative analysis of contaminant exposure and toxicity (e.g. calculate lifetime cancer risk or ratios of estimated exposure rates compared to safe exposure rates)
- Determining how current and proposed future land use influence the predicted risks (e.g. change of land use from industrial to residential with more sensitive receptors such as children)
- Quantifying the potential environmental and/or human health risks from off-site contaminant migration (e.g., consider if leaching and groundwater transport, or surface water transport results in exposure at adjacent lands/receptors)
- Determining if the risk is likely to remain stable, increase, or decrease with time in the absence of any remediation (e.g., consider if the contaminant is reasonably degradable and likely to remain in place, or be transported to other media)

Addressing these objectives provides a basis to develop and implement risk reduction measures (e.g., clean-up, on-site controls) at the site. If such a need exists, the following additional objectives become relevant:

- Determining where, and in what conceptual manner, risk reduction measures should be implemented
- Identifying the preferred technologies (including engineering controls) needed to implement the conceptual risk reduction measures
- Developing a monitoring plan to ascertain whether risk reduction measures are effective
- Considering the need and appropriateness for institutional controls (e.g. deed restriction, land use restrictions) as part of a comprehensive approach

Permanent Risk Reduction Measures

The risk factors and conceptual site model within the contaminant risk approach described also provide a basis to manage and mitigate environmental contaminant health risks. The underlying principle is to reduce, eliminate, or control any or all of the three risk factors illustrated in Figure 1.8.1. A short list of examples of risk mitigation strategies is provided below, although actual strategies should be developed based on site-specific conditions, and the practicality of prevailing factors and site constraints. Regardless of the management options selected, the action plan should include, whenever possible, contaminant source reduction (i.e., net improvement of the site) as part of the overall strategy towards managing health risks at contaminated sites, as this alone provides for improved environmental quality.

Figure 1.8.2 presents a schematic of the inter-relationship of risk factors and example strategies to mitigate contaminant health risk by modifying the conditions of one or more risk factors to ultimately reduce contaminant exposure to the receptor. The selected approach should take into consideration the technical and financial feasibility (e.g. operability of a selected technology given the local availability of technical expertise and equipment and its associated costs).

Example risk mitigation strategies for contaminant source and exposure concentrations include:

- Soil, sediment, and sludge:
  a. In situ biological treatment (aerobic or anaerobic)
  b. In situ physical/chemical treatment (e.g., soil vapor extraction with off-gas treatment, chemical oxidation)
  c. In situ thermal treatment (e.g., steam injection, 6-phase heating)
  d. Ex situ biological treatment (e.g., excavation and composting)
  e. Ex situ physical/chemical treatment (e.g., excavation and stabilization)
  f. Ex situ thermal treatment (e.g., excavation and thermal desorption or incineration)
  g. Containment (e.g. landfill)
  h. Natural attenuation
  i. Other treatment processes
- Groundwater, surface water, and leachate:
  a. In situ biological treatment (aerobic and/or aerobic)
  b. In situ physical/chemical treatment (e.g., air sparging, zero-valent iron permeable reactive barrier)
  c. Ex situ biological, physical, and or chemical treatment (i.e., groundwater extraction and treatment)
  d. Containment (e.g., slurry wall or sheet pile barrier)
  e. Natural attenuation
  f. Other treatment processes
- Soil vapor intrusion:
  a. Soil vapor extraction to reduce VOC contaminant source in soil
  b. Installation of a sub-slab depressurization system to prevent migration of soil vapor into the building

c. Creating a positive pressure condition in buildings
d. Installation (during building construction) of an impermeable barrier below the building and/or an alternative flow pathway for soil vapor beneath building foundations (e.g., porous media and ventilation to shunt vapors away from building)

Example risk mitigation strategies for receptors include:

- Limiting or preventing access to contaminant by receptors (actions targeted at the receptor may include signage with instructions, fencing, or site security)
- Imposing health advisory or prohibiting certain practices leading to exposure such as fishing, crab trapping, shellfish collection
- Educating receptors (people) to modify behavior in order to reduce exposure (e.g., improved work practices, and use of protective clothing and equipment)

Example risk mitigation strategies for exposure pathways include:

- Providing an alternative water supply to replace, for example, a contaminated groundwater supply well
- Capping contaminated soil with at least 1m of clean soil to prevent human contact, as well as plant root or small mammal penetration into contaminated soils
- Paving over contaminated soil as an interim measure to negate the pathway of direct contact or dust generation and inhalation
- Using an interception trench and pump, and treat technologies to prevent contaminated groundwater from discharging into fish streams

The above-reference containment measures should also be considered for immediate implementation in situations where source reduction measures are expected to take time.

Occupational Health and Safety Considerations

Investigation and remediation of contaminated lands requires that workers be mindful of the occupational exposures that could arise from working in close contact with contaminated soil or other environmental media (e.g., groundwater, wastewater, sediments, and soil vapor). Occupational health and safety precautions should be exercised to minimize exposure, as described in Section 2 on Occupational Health and Safety. In addition, workers on contaminated sites should receive special health and safety training specific to contaminated site investigation and remediation activities.

2.0 Occupational Health and Safety

Applicability and Approach

Employers and supervisors are obliged to implement all reasonable precautions to protect the health and safety of workers. This section provides guidance and examples of reasonable precautions to implement in managing principal risks to occupational health and safety. Although the focus is placed on the operational phase of projects, much of the guidance also applies to construction and decommissioning activities. Companies should hire contractors that have the technical capability to manage the occupational health and safety issues of their employees, extending the application of the hazard management activities through formal procurement agreements.

Preventive and protective measures should be introduced according to the following order of priority:

- Eliminating the hazard by removing the activity from the work process. Examples include substitution with less hazardous chemicals, using different manufacturing processes, etc;
- Controlling the hazard at its source through use of engineering controls. Examples include local exhaust ventilation, isolation rooms, machine guarding, acoustic insulating, etc;
- Minimizing the hazard through design of safe work systems and administrative or institutional control measures. Examples include job rotation, training safe work procedures, lock-out and tag-out, workplace monitoring, limiting exposure or work duration, etc.
- Providing appropriate personal protective equipment (PPE) in conjunction with training, use, and maintenance of the PPE.

The application of prevention and control measures to occupational hazards should be based on comprehensive job safety or job hazard analyses. The results of these analyses should be prioritized as part of an action plan based on the likelihood and severity of the consequence of exposure to the identified hazards. An example of a qualitative risk ranking or analysis matrix to help identify priorities is described in Table 2.1.1.

2.1 General Facility Design and Operation

Integrity of Workplace Structures

Permanent and recurrent places of work should be designed and equipped to protect OHS:

- Surfaces, structures and installations should be easy to clean and maintain, and not allow for accumulation of hazardous compounds.
- Buildings should be structurally safe, provide appropriate protection against the climate, and have acceptable light and noise conditions.
- Fire resistant, noise-absorbing materials should, to the extent feasible, be used for cladding on ceilings and walls.
- Floors should be level, even, and non-skid.
- Heavy oscillating, rotating or alternating equipment should be located in dedicated buildings or structurally isolated sections.

Severe Weather and Facility Shutdown

- Work place structures should be designed and constructed to withstand the expected elements for the region and have an area designated for safe refuge, if appropriate.
- Standard Operating Procedures (SOPs) should be developed for project or process shut-down, including an evacuation plan. Drills to practice the procedure and plan should also beundertaken annually.

Workspace and Exit

- The space provided for each worker, and in total, should be adequate for safe execution of all activities, including transport and interim storage of materials and products.
- Passages to emergency exits should be unobstructed at all times. Exits should be clearly marked to be visible in total darkness. The number and capacity of emergency exits should be sufficient for safe and orderly evacuation of the greatest number of people present at any time, and there should be a minimum two exits from any work area.
- Facilities also should be designed and built taking into account the needs of disabled persons.

Fire Precautions

The workplace should be designed to prevent the start of fires through the implementation of fire codes applicable to industrial settings. Other essential measures include:

- Equipping facilities with fire detectors, alarm systems, and fire-fighting equipment. The equipment should be maintained in good working order and be readily accessible. It should be adequate for the dimensions and use of the premises, equipment installed, physical and chemical properties of substances present, and the maximum number of people present.
- Provision of manual firefighting equipment that is easily accessible and simple to use
- Fire and emergency alarm systems that are both audible and visible

The IFC Life and Fire Safety Guideline should apply to buildings accessible to the public (See Section 3.3).

Lavatories and Showers

- Adequate lavatory facilities (toilets and washing areas) should be provided for the number of people expected to work in the facility and allowances made for segregated facilities, or for indicating whether the toilet facility is "In Use" or "Vacant". Toilet facilities should also be provided with adequate supplies of hot and cold running water, soap, and hand drying devices.
- Where workers may be exposed to substances poisonous by ingestion and skin contamination may occur, facilities for showering and changing into and out of street and work clothes should be provided.

Potable Water Supply

- Adequate supplies of potable drinking water should be provided from a fountain with an upward jet or with a sanitary means of collecting the water for the purposes of drinking
- Water supplied to areas of food preparation or for the purpose of personal hygiene (washing or bathing) should meet drinking water quality standards

Clean Eating Area

- Where there is potential for exposure to substances poisonous by ingestion, suitable arrangements are to be made for provision of clean eating areas where workers are not exposed to the hazardous or noxious substances

Lighting

- Workplaces should, to the degree feasible, receive natural light and be supplemented with sufficient artificial illumination to promote workers' safety and health, and enable safe equipment operation. Supplemental 'task lighting' may be required where specific visual acuity requirements should be met.
- Emergency lighting of adequate intensity should be installed and automatically activated upon failure of the principal artificial light source to ensure safe shut-down, evacuation, etc.

Safe Access

- Passageways for pedestrians and vehicles within and outside buildings should be segregated and provide for easy, safe, and appropriate access
- Equipment and installations requiring servicing, inspection, and/or cleaning should have unobstructed, unrestricted, and ready access
- Hand, knee and foot railings should be installed on stairs, fixed ladders, platforms, permanent and interim floor openings, loading bays, ramps, etc.
- Openings should be sealed by gates or removable chains
- Covers should, if feasible, be installed to protect against falling items
- Measures to prevent unauthorized access to dangerous areas should be in place

First Aid

- The employer should ensure that qualified first-aid can be provided at all times. Appropriately equipped first-aid stations should be easily accessible throughout the place of work
- Eye-wash stations and/or emergency showers should be provided close to all workstations where immediate flushing with water is the recommended first-aid response
- Where the scale of work or the type of activity being carried out so requires, dedicated and appropriately equipped first aid room(s) should be provided. First aid stations and rooms should be equipped with gloves, gowns, and masks for protection against direct contact with blood and other body fluids
- Remote sites should have written emergency procedures in place for dealing with cases of trauma or serious illness up to the point at which patient care can be transferred to an appropriate medical facility.

Air Supply

- Sufficient fresh air should be supplied for indoor and confined work spaces. Factors to be considered in ventilation design include physical activity, substances in use, and process related emissions. Air distribution systems should be designed so as not to expose workers to draughts
- Mechanical ventilation systems should be maintained in good working order. Point-source exhaust systems required for maintaining a safe ambient environment should have local indicators of correct functioning.
- Re-circulation of contaminated air is not acceptable. Air inlet filters should be kept clean and free of dust and microorganisms. Heating, ventilation and air conditioning (HVAC) and industrial evaporative cooling systems should be equipped, maintained and operated so as to prevent growth and spreading of disease agents (e.g. Legionnella pneumophilia) or breeding of vectors (e.g. mosquitoes and flies) of public health concern.

Work Environment Temperature

- The temperature in work, rest room and other welfare facilities should, during service hours, be maintained at a level appropriate for the purpose of the facility.

2.2 Communication and Training

OHS Training

- Provisions should be made to provide OHS orientation training to all new employees to ensure they are apprised of the basic site rules of work at / on the site and of personal protection and preventing injury to fellow employees.
- Training should consist of basic hazard awareness, site-specific hazards, safe work practices, and emergency procedures for fire, evacuation, and natural disaster, as appropriate. Any site-specific hazard or color coding in use should be thoroughly reviewed as part of orientation training.

Visitor Orientation

- If visitors to the site can gain access to areas where hazardous conditions or substances may be present, a visitor orientation and control program should be established to ensure visitors do not enter hazard areas unescorted.

New Task Employee and Contractor Training

- The employer should ensure that workers and contractors, prior to commencement of new assignments, have received adequate training and information enabling them to understand work hazards and to protect their health from hazardous ambient factors that may be present.

  The training should adequately cover:

  a. Knowledge of materials, equipment, and tools
  b. Known hazards in the operations and how they are controlled
  c. Potential risks to health

d. Precautions to prevent exposure
e. Hygiene requirements
f. Wearing and use of protective equipment and clothing
g. Appropriate response to operation extremes, incidents and accidents

Basic OHS Training

- basic occupational training program and specialty courses should be provided, as needed, to ensure that workers are oriented to the specific hazards of individual work assignments. Training should generally be provided to management, supervisors, workers, and occasional visitors to areas of risks and hazards.
- Workers with rescue and first-aid duties should receive dedicated training so as not to inadvertently aggravate exposures and health hazards to themselves or their coworkers.
  Training would include the risks of becoming infected with blood–borne pathogens through contact with bodily fluids and tissue.
- Through appropriate contract specifications and monitoring, the employer should ensure that service providers, as well as contracted and subcontracted labor, are trained adequately before assignments begin.

Area Signage

- Hazardous areas (electrical rooms, compressor rooms, etc), installations, materials, safety measures, and emergency exits, etc. should be marked appropriately.
- Signage should be in accordance with international standards and be well known to, and easily understood by workers, visitors and the general public as appropriate.

Labeling of Equipment

- All vessels that may contain substances that are hazardous as a result of chemical or toxicological properties, or temperature or pressure, should be labeled as to the contents and hazard, or appropriately color coded.
- Similarly, piping systems that contain hazardous substances should be labeled with the direction of flow and contents of the pipe, or color coded whenever the pipe passing through a wall or floor is interrupted by a valve or junction device.

Communicate Hazard Codes

- Copies of the hazard coding system should be posted outside the facility at emergency entrance doors and fire emergency connection systems where they are likely to come to the attention of emergency services personnel.
- Information regarding the types of hazardous materials stored, handled or used at the facility, including typical maximum inventories and storage locations, should be shared proactively with emergency services and security personnel to expedite emergency response when needed.

- Representatives of local emergency and security services should be invited to participate in periodic (annual) orientation tours and site inspections to ensure familiarity with potential hazards present.

2.3 Physical Hazards

Physical hazards represent potential for accident or injury or illness due to repetitive exposure to mechanical action or work activity. Single exposure to physical hazards may result in a wide range of injuries, from minor and medical aid only, to disabling, catastrophic, and/or fatal. Multiple exposures over prolonged periods can result in disabling injuries of comparable significance and consequence.

Rotating and Moving Equipment

Injury or death can occur from being trapped, entangled, or struck by machinery parts due to unexpected starting of equipment or unobvious movement during operations. Recommended protective measures include:

- Designing machines to eliminate trap hazards and ensuring that extremities are kept out of harm’s way under normal operating conditions. Examples of proper design considerations include two-hand operated machines to prevent amputations or the availability of emergency stops dedicated to the machine and placed in strategic locations. Where a machine or equipment has an exposed moving part or exposed pinch point that may endanger the safety of any worker, the machine or equipment should be equipped with, and protected by, a guard or other device that prevents access to the moving part or pinch point. Guards should be designed and installed in conformance with appropriate machine safety standards.
- Turning off, disconnecting, isolating, and de-energizing (Locked Out and Tagged Out) machinery with exposed or guarded moving parts, or in which energy can be stored (e.g. compressed air, electrical components) during servicing ormaintenance, in conformance with a standard such as CSA Z460 Lockout or equivalent ISO or ANSI standard
- Designing and installing equipment, where feasible, to enable routine service, such as lubrication, without removal of the guarding devices or mechanisms

Noise

Noise limits for different working environments are provided in Table 2.3.1.

- No employee should be exposed to a noise level greater than 85 dB(A) for a duration of more than 8 hours per day without hearing protection. In addition, no unprotected ear should be exposed to a peak sound pressure level (instantaneous) of more than 140 dB(C).
- The use of hearing protection should be enforced actively when the equivalent sound level over 8 hours reaches 85 dB(A), the peak sound levels reach 140 dB(C), or the average maximum sound level reaches 110dB(A). Hearing protective devices provided should be capable of reducing sound levels at the ear to at least 85 dB(A).

- Although hearing protection is preferred for any period of noise exposure in excess of 85 dB(A), an equivalent level of protection can be obtained, but less easily managed, by limiting the duration of noise exposure. For every 3 dB(A) increase in sound levels, the 'allowed' exposure period or duration should be reduced by 50 percent.
- Prior to the issuance of hearing protective devices as the final control mechanism, use of acoustic insulating materials, isolation of the noise source, and other engineering controls should be investigated and implemented, where feasible
- Periodic medical hearing checks should be performed on workers exposed to high noise levels

Vibration

Exposure to hand-arm vibration from equipment such as hand and power tools, or whole-body vibrations from surfaces on which the worker stands or sits, should be controlled through choice of equipment, installation of vibration dampening pads or devices, and limiting the duration of exposure. Limits for vibration and action values, (i.e. the level of exposure at which remediation should be initiated) are provided by the ACGIH66. Exposure levels should be checked on the basis of daily exposure time and data provided by equipment manufacturers.

Electrical

Exposed or faulty electrical devices, such as circuit breakers, panels, cables, cords and hand tools, can pose a serious risk to workers. Overhead wires can be struck by metal devices, such as poles or ladders, and by vehicles with metal booms. Vehicles or grounded metal objects brought into close proximity with overhead wires can result in arcing between the wires and the object, without actual contact. Recommended actions include:

- Marking all energized electrical devices and lines with warning signs
- Locking out (de-charging and leaving open with a controlled locking device) and tagging-out (warning sign placed on the lock) devices during service or maintenance
- Checking all electrical cords, cables, and hand power tools for frayed or exposed cords and following manufacturer recommendations for maximum permitted operating voltage of the portable hand tools
- Double insulating / grounding all electrical equipment used in environments that are, or may become, wet; using equipment with ground fault interrupter (GFI) protected circuits
- Protecting power cords and extension cords against damage from traffic by shielding or suspending above traffic areas
- Appropriate labeling of service rooms housing high voltage equipment ('electrical hazard') and where entry is controlled or prohibited (see also Section 3 on Planning, Siting, and Design);

- Establishing “No Approach” zones around or under high voltage power lines in conformance with Table 2.3.2
- Rubber tired construction or other vehicles that come into direct contact with, or arcing between, high voltage wires may need to be taken out of service for periods of 48 hours and have the tires replaced to prevent catastrophic tire and wheel assembly failure, potentially causing serious injury or death;
- Conducting detailed identification and marking of all buried electrical wiring prior to any excavation work

Eye Hazards

Solid particles from a wide variety of industrial operations, and / or a liquid chemical spray may strike a worker in the eye causing an eye injury or permanent blindness. Recommended measures include:

- Use of machine guards or splash shields and/or face and eye protection devices, such as safety glasses with side shields, goggles, and/or a full face shield. Specific Safe Operating Procedures (SOPs) may be required for use of sanding and grinding tools and/or when working around liquid chemicals. Frequent checks of these types of equipment prior to use to ensure mechanical integrity is also good practice. Machine and equipment guarding should conform to standards published by organizations such as CSA, ANSI and ISO (see also Section 2.3 on Rotating and Moving Equipment and 2.7 on Personal Protective Equipment).
- Moving areas where the discharge of solid fragments, liquid, or gaseous emissions can reasonably be predicted (e.g. discharge of sparks from a metal cutting station, pressure relief valve discharge) away from places expected to be occupied or transited by workers or visitors. Where machine or work fragments could present a hazard to transient workers or passers-by, extra area guarding or proximity restricting systems should be implemented, or PPE required for transients and visitors.
- Provisions should be made for persons who have to wear prescription glasses either through the use overglasses or prescription hardened glasses.

Welding / Hot Work

Welding creates an extremely bright and intense light that may seriously injur a worker’s eyesight. In extreme cases, blindness may result. Additionally, welding may produce noxious fumes to which prolonged exposure can cause serious chronic diseases. Recommended measures include:

- Provision of proper eye protection such as welder goggles and/or a full-face eye shield for all personnel involved in, or assisting, welding operations. Additional methods may include the use of welding barrier screens around the specific work station (a solid piece of light metal, canvas, or plywood designed to block welding light from others). Devices to extract and remove noxious fumes at the source may also be required.

- Special hot work and fire prevention precautions and Standard Operating Procedures (SOPs) should be implemented if welding or hot cutting is undertaken outside established welding work stations, including 'Hot Work Permits, stand-by fire extinguishers, stand-by fire watch, and maintaining the fire watch for up to one hour after welding or hot cutting has terminated. Special procedures are required for hot work on tanks or vessels that have contained flammable materials.

Industrial Vehicle Driving and Site Traffic

Poorly trained or inexperienced industrial vehicle drivers have increased risk of accident with other vehicles, pedestrians, and equipment. Industrial vehicles and delivery vehicles, as well as private vehicles on-site, also represent potential collision scenarios. Industrial vehicle driving and site traffic safety practices include:

- Training and licensing industrial vehicle operators in the safe operation of specialized vehicles such as forklifts, including safe loading/unloading, load limits
- Ensuring drivers undergo medical surveillance
- Ensuring moving equipment with restricted rear visibility is outfitted with audible back-up alarms
- Establishing rights-of-way, site speed limits, vehicle inspection requirements, operating rules and procedures (e.g. prohibiting operation of forklifts with forks in down position), and control of traffic patterns or direction
- Restricting the circulation of delivery and private vehicles to defined routes and areas, giving preference to 'one-way' circulation, where appropriate

Working Environment Temperature

Exposure to hot or cold working conditions in indoor or outdoor environments can result temperature stress-related injury or death. Use of personal protective equipment (PPE) to protect against other occupational hazards can accentuate and aggravate heat-related illnesses. Extreme temperatures in permanent work environments should be avoided through implementation of engineering controls and ventilation. Where this is not possible, such as during short-term outdoor work, temperature-related stress management procedures should be implemented which include:

- Monitoring weather forecasts for outdoor work to provide advance warning of extreme weather and scheduling work accordingly
- Adjustment of work and rest periods according to temperature stress management procedures provided by ACGIH, depending on the temperature and workloads
- Providing temporary shelters to protect against the elements during working activities or for use as rest areas
- Use of protective clothing
- Providing easy access to adequate hydration such as drinking water or electrolyte drinks, and avoiding consumption of alcoholic beverages

Ergonomics, Repetitive Motion, Manual Handling

Injuries due to ergonomic factors, such as repetitive motion, overexertion, and manual handling, take prolonged and repeated exposures to develop, and typically require periods of weeks to months for recovery. These OHS problems should be minimized or eliminated to maintain a productive workplace. Controls may include:

- Facility and workstation design with 5th to 95th percentile operational and maintenance workers in mind
- Use of mechanical assists to eliminate or reduce exertions required to lift materials, hold tools and work objects, and requiring multi-person lifts if weights exceed thresholds
- Selecting and designing tools that reduce force requirements and holding times, and improve postures
- Providing user adjustable work stations
- Incorporating rest and stretch breaks into work processes, and conducting job rotation
- Implementing quality control and maintenance programs that reduce unnecessary forces and exertions
- Taking into consideration additional special conditions such as left handed persons

Working at Heights

Fall prevention and protection measures should be implemented whenever a worker is exposed to the hazard of falling more than two meters; into operating machinery; into water or other liquid; into hazardous substances; or through an opening in a work surface. Fall prevention / protection measures may also be warranted on a case-specific basis when there are risks of falling from lesser heights. Fall prevention may include:

- Installation of guardrails with mid-rails and toe boards at the edge of any fall hazard area
- Proper use of ladders and scaffolds by trained employees
- Use of fall prevention devices, including safety belt and lanyard travel limiting devices to prevent access to fall hazard area, or fall protection devices such as full body harnesses used in conjunction with shock absorbing lanyards or self-retracting inertial fall arrest devices attached to fixed anchor point or horizontal life-lines
- Appropriate training in use, serviceability, and integrity of the necessary PPE
- Inclusion of rescue and/or recovery plans, and equipment to respond to workers after an arrested fall

Illumination

Work area light intensity should be adequate for the general purpose of the location and type of activity, and should be supplemented with dedicated work station illumination, as needed. The minimum limits for illumination intensity for a range of locations/activities appear in Table 2.3.3.

Controls should include:

- Use of energy efficient light sources with minimum heat emission
- Undertaking measures to eliminate glare / reflections and flickering of lights
- Taking precautions to minimize and control optical radiation including direct sunlight. Exposure to high intensity UV and IR radiation and high intensity visible light should also be controlled
- Controlling laser hazards in accordance with equipment specifications, certifications, and recognized safety standards. The lowest feasible class Laser should be applied to minimize risks.

2.4 Chemical Hazards

Chemical hazards represent potential for illness or injury due to single acute exposure or chronic repetitive exposure to toxic, corrosive, sensitizing or oxidative substances. They also represent a risk of uncontrolled reaction, including the risk of fire and explosion, if incompatible chemicals are inadvertently mixed. Chemical hazards can most effectively be prevented through a hierarchical approach that includes:

- Replacement of the hazardous substance with a less hazardous substitute
- Implementation of engineering and administrative control measures to avoid or minimize the release of hazardous substances into the work environment keeping the level of exposure below internationally established or recognized limits
- Keeping the number of employees exposed, or likely to become exposed, to a minimum
- Communicating chemical hazards to workers through labeling and marking according to national and internationally recognized requirements and standards, including the International Chemical Safety Cards (ICSC), Materials Safety Data Sheets (MSDS), or equivalent. Any means of written communication should be in an easily understood language and be readily available to exposed workers and first-aid personnel
- Training workers in the use of the available information (such as MSDSs), safe work practices, and appropriate use of PPE

Air Quality

Poor air quality due to the release of contaminants into the work place can result in possible respiratory irritation, discomfort, or illness to workers. Employers should take appropriate measures to maintain air quality in the work area. These include:

- Maintaining levels of contaminant dusts, vapors and gases in the work environment at concentrations below those recommended by the ACGIH68 as TWA-TLV's (threshold limit value)—concentrations to which most workers can be exposed repeatedly (8 hours/day, 40 hrs/week, week-afterweek), without sustaining adverse health effects.
- Developing and implementing work practices to minimize release of contaminants into the work environment including:
  a. Direct piping of liquid and gaseous materials

b. Minimized handling of dry powdered materials;
c. Enclosed operations
d. Local exhaust ventilation at emission / release points
e. Vacuum transfer of dry material rather than mechanical or pneumatic conveyance
f. Indoor secure storage, and sealed containers rather than loose storage

- Where ambient air contains several materials that have similar effects on the same body organs (additive effects), taking into account combined exposures using calculations recommended by the ACGIH
- Where work shifts extend beyond eight (8) hours, calculating adjusted workplace exposure criteria recommended by the ACGIH

Fire and Explosions

Fires and or explosions resulting from ignition of flammable materials or gases can lead to loss of property as well as possible injury or fatalities to project workers. Prevention and control strategies include:

- Storing flammables away from ignition sources and oxidizing materials. Further, flammables storage area should be:
  a. Remote from entry and exit points into buildings
  b. Away from facility ventilation intakes or vents
  c. Have natural or passive floor and ceiling level ventilation and explosion venting
  d. Use spark-proof fixtures
- Be equipped with fire extinguishing devices and self-closing doors, and constructed of materials made to withstand flame impingement for a moderate period of time
- Providing bonding and grounding of, and between, containers and additional mechanical floor level ventilation if materials are being, or could be, dispensed in the storage area
- Where the flammable material is mainly comprised of dust, providing electrical grounding, spark detection, and, if needed, quenching systems
- Defining and labeling fire hazards areas to warn of special rules (e.g. prohibition in use of smoking materials, cellular phones, or other potential spark generating equipment)
- Providing specific worker training in handling of flammable materials, and in fire prevention or suppression

Corrosive, oxidizing, and reactive chemicals

Corrosive, oxidizing, and reactive chemicals present similar hazards and require similar control measures as flammable materials. However, the added hazard of these chemicals is that inadvertent mixing or intermixing may cause serious adverse reactions. This can lead to the release of flammable or toxic materials and gases, and may lead directly to fires and explosions. These types of substances have the additional hazard of causing significant personal injury upon direct contact, regardless of any intermixing issues. The following controls should be observed in the work environment when handling such chemicals:

- Corrosive, oxidizing and reactive chemicals should be segregated from flammable materials and from other chemicals of incompatible class (acids vs. bases, oxidizers vs. reducers, water sensitive vs. water based, etc.), stored in ventilated areas and in containers with appropriate secondary containment to minimize intermixing during spills
- Workers who are required to handle corrosive, oxidizing, or reactive chemicals should be provided with specialized training and provided with, and wear, appropriate PPE (gloves, apron, splash suits, face shield or goggles, etc).
- Where corrosive, oxidizing, or reactive chemicals are used, handled, or stored, qualified first-aid should be ensured at all times. Appropriately equipped first-aid stations should be easily accessible throughout the place of work, and eye-wash stations and/or emergency showers should be provided close to all workstations where the recommended first-aid response is immediate flushing with water

Asbestos Containing Materials (ACM)

The use of asbestos containing materials (ACM) should be avoided in new buildings or as a new material in remodeling or renovation activities. Existing facilities with ACM should develop an asbestos management plan which clearly identifies the locations where the ACM is present, its condition (e.g. whether it is in friable form with the potential to release fibers), procedures for monitoring its condition, procedures to access the locations where ACM is present to avoid damage, and training of staff who can potentially come into contact with the material to avoid damage and prevent exposure. The plan should be made available to all persons involved in operations and maintenance activities. Repair or removal and disposal of existing ACM in buildings should only be performed by specially trained personnel71 following host country requirements, or in their absence, internationally recognized procedures.

2.5 Biological Hazards

Biological agents represent potential for illness or injury due to single acute exposure or chronic repetitive exposure. Biological hazards can be prevented most effectively by implementing the following measures:

- If the nature of the activity permits, use of any harmful biological agents should be avoided and replaced with an agent that, under normal conditions of use, is not dangerous or less dangerous to workers. If use of harmful agents cannot be avoided, precautions should be taken to keep the risk of exposure as low as possible and maintained below internationally established and recognized exposure limits.
- Work processes, engineering, and administrative controls should be designed, maintained, and operated to avoid or minimize release of biological agents into

the working environment. The number of employees exposed or likely to become exposed should be kept at a minimum.

- The employer should review and assess known and suspected presence of biological agents at the place of work and implement appropriate safety measures, monitoring, training, and training verification programs.
- Measures to eliminate and control hazards from known and suspected biological agents at the place of work should be designed, implemented and maintained in close co-operation with the local health authorities and according to recognized international standards.

Biological agents should be classified into four groups:

- Group 1: Biological agents unlikely to cause human disease, and consequently only require controls similar to those required for hazardous or reactive chemical substances;
- Group 2: Biological agents that can cause human disease and are thereby likely to require additional controls, but are unlikely to spread to the community;
- Group 3: Biological agents that can cause severe human disease, present a serious hazard to workers, and may present a risk of spreading to the community, for which there usually is effective prophylaxis or treatment available and are thereby likely to require extensive additional controls;
- Group 4: Biological agents that can cause severe human disease, are a serious hazard to workers, and present a high risk of spreading to the community, for which there is usually no effective prophylaxis or treatment available and are thereby likely to require very extensive additional controls.

The employer should at all times encourage and enforce the highest level of hygiene and personal protection, especially for activities employing biological agents of Groups 3 and 4 above. Work involving agents in Groups 3 and 4 should be restricted only to those persons who have received specific verifiable training in working with and controlling such materials. Areas used for the handling of Groups 3 and 4 biological agents should be designed to enable their full segregation and isolation in emergency circumstances, include independent ventilation systems, and be subject to SOPs requiring routine disinfection and sterilization of the work surfaces.

HVAC systems serving areas handling Groups 3 and 4 biological agents should be equipped with High Efficiency Particulate Air (HEPA) filtration systems. Equipment should readily enable their disinfection and sterilization, and maintained and operated so as to prevent growth and spreading of disease agents, amplification of the biological agents, or breeding of vectors e.g. mosquitoes and flies of public health concern.

2.6 Radiological Hazards

Radiation exposure can lead to potential discomfort, injury or serious illness to workers. Prevention and control strategies include:

- Places of work involving occupational and/or natural exposure to ionizing radiation should be established and operated in accordance with recognized international safety standards and guidelines. The acceptable effective dose limits appear Table 2.6.1.
- Exposure to non-ionizing radiation (including static magnetic fields; sub-radio frequency magnetic fields; static electric fields; radio frequency and microwave radiation; light and near-infrared radiation; and ultraviolet radiation) should be controlled to internationally recommended limits75.
- In the case of both ionizing and non-ionizing radiation, the preferred method for controlling exposure is shielding and limiting the radiation source. Personal protective equipment is supplemental only or for emergency use. Personal protective equipment for near-infrared, visible and ultraviolet range radiation can include appropriate sun block creams, with or without appropriate screening clothing.

2.7 Personal Protective Equipment (PPE)

Personal Protective Equipment (PPE) provides additional protection to workers exposed to workplace hazards in conjunction with other facility controls and safety systems. PPE is considered to be a last resort that is above and beyond the other facility controls and provides the worker with an extra level of personal protection. Table 2.7.1 presents general examples of occupational hazards and types of PPE available for different purposes. Recommended measures for use of PPE in the workplace include:

- Active use of PPE if alternative technologies, work plans or procedures cannot eliminate, or sufficiently reduce, a hazard or exposure
- Identification and provision of appropriate PPE that offers adequate protection to the worker, co-workers, and occasional visitors, without incurring unnecessary inconvenience to the individual
- Proper maintenance of PPE, including cleaning when dirty and replacement when damaged or worn out. Proper use of PPE should be part of the recurrent training programs for Employees
- Selection of PPE should be based on the hazard and risk ranking described earlier in this section, and selected according to criteria on performance and testing established by recognized organizations76.

2.8 Special Hazard Environments

Special hazard environments are work situations where all of the previously described hazards may exist under unique or especially hazardous circumstances. Accordingly, extra precautions or rigor in application of precautions is required.

Confined Space

A confined space is defined as a wholly or partially enclosed space not designed or intended for human occupancy and in which a hazardous atmosphere could develop as a result of the contents, location or construction of the confined space or due to work done in or around the confined space. A "permit-required" confined space is one that also contains physical or atmospheric hazards that could trap or engulf the person.

Confined spaces can occur in enclosed or open structures or locations. Serious injury or fatality can result from inadequate preparation to enter a confined space or in attempting a rescue from a confined space. Recommended management approaches include:

- Engineering measures should be implemented to eliminate, to the degree feasible, the existence and adverse character of confined spaces.
- Permit-required confined spaces should be provided with permanent safety measures for venting, monitoring, and rescue operations, to the extent possible. The area adjoining an access to a confined space should provide ample room for emergency and rescue operations.
- Access hatches should accommodate 90% of the worker population with adjustments for tools and protective clothing.

The most current ISO and EN standards should be consulted for design specifications;

- Prior to entry into a permit-required confined space:
    a. Process or feed lines into the space should be disconnected or drained, and blanked and locked-out.
    b. Mechanical equipment in the space should be disconnected, de-energized, locked-out, and braced, as appropriate.
    c. The atmosphere within the confined space should be tested to assure the oxygen content is between 19.5 percent and 23 percent, and that the presence of any flammable gas or vapor does not exceed 25 percent of its respective Lower Explosive Limit (LEL).
- If the atmospheric conditions are not met, the confined space should be ventilated until the target safe atmosphere is achieved, or entry is only to be undertaken with appropriate and additional PPE.
- Safety precautions should include Self Contained Breathing Apparatus (SCBA), life lines, and safety watch workers stationed outside the confined space, with rescue and first aid equipment readily available.
- Before workers are required to enter a permit-required confined space, adequate and appropriate training in confined space hazard control, atmospheric testing, use of the necessary PPE, as well as the serviceability and integrity of the PPE should be verified. Further, adequate and appropriate rescue and / or recovery plans and equipment should be in place before the worker enters the confined space.

Lone and Isolated Workers

A lone and isolated worker is a worker out of verbal and line of sight communication with a supervisor, other workers, or other persons capable of providing aid and assistance, for continuous periods exceeding one hour. The worker is therefore at increased risk should an accident or injury occur.

- Where workers may be required to perform work under lone or isolated circumstances, Standard Operating Procedures (SOPs) should be developed and implemented to ensure all PPE and safety measures are in place before the worker starts work. SOPs should establish, at a minimum, verbal contact with the worker at least once every hour, and ensure the worker has a capability for summoning emergency aid.

- If the worker is potentially exposed to highly toxic or corrosive chemicals, emergency eye-wash and shower facilities should be equipped with audible and visible alarms to summon aid whenever the eye-wash or shower is activated by the worker and without intervention by the worker.

2.9 Monitoring

Occupational health and safety monitoring programs should verify the effectiveness of prevention and control strategies. The selected indicators should be representative of the most significant occupational, health, and safety hazards, and the implementation of prevention and control strategies. The occupational health and safety monitoring program should include:

- Safety inspection, testing and calibration: This should include regular inspection and testing of all safety features and hazard control measures focusing on engineering and personal protective features, work procedures, places of work, installations, equipment, and tools used. The inspection should verify that issued PPE continues to provide adequate protection and is being worn as required. All instruments installed or used for monitoring and recording of working environment parameters should be regularly tested and calibrated, and the respective records maintained.
- Surveillance of the working environment: Employers should document compliance using an appropriate combination of portable and stationary sampling and monitoring instruments. Monitoring and analyses should be conducted according to internationally recognized methods and standards. Monitoring methodology, locations, frequencies, and parameters should be established individually for each project following a review of the hazards. Generally, monitoring should be performed during commissioning of facilities or equipment and at the end of the defect and liability period, and otherwise repeated according to the monitoring plan.
- Surveillance of workers health: When extraordinary protective measures are required (for example, against biological agents Groups 3 and 4, and/or hazardous compounds), workers should be provided appropriate and relevant health surveillance prior to first exposure, and at regular intervals thereafter. The surveillance should, if deemed necessary, be continued after termination of the employment.
- Training: Training activities for employees and visitors should be adequately monitored and documented (curriculum, duration, and participants). Emergency exercises, including fire drills, should be documented adequately. Service providers and contractors should be contractually required to submit to the employer adequate training documentation before start of their assignment.

Accidents and Diseases monitoring

- The employer should establish procedures and systems for reporting and recording:
  a. Occupational accidents and diseases
  b. Dangerous occurrences and incidents

These systems should enable workers to report immediately to their immediate supervisor any situation they believe presents a serious danger to life or health.

- The systems and the employer should further enable and encourage workers to report to management all:
  a. Occupational injuries and near misses
  b. Suspected cases of occupational disease
  c. Dangerous occurrences and incidents
- All reported occupational accidents, occupational diseases, dangerous occurrences, and incidents together with near misses should be investigated with the assistance of a person knowledgeable/competent in occupational safety. The investigation should:
  a. Establish what happened
  b. Determine the cause of what happened
  c. Identify measures necessary to prevent a recurrence
- Occupational accidents and diseases should, at a minimum, be classified according to Table 2.10.1. Distinction is made between fatal and non-fatal injuries. The two main categories are divided into three sub-categories according to time of death or duration of the incapacity to work. The total work hours during the specified reporting period should be reported to the appropriate regulatory agency.

3.0 Community Health and Safety

This section complements the guidance provided in the preceding environmental and occupational health and safety sections, specifically addressing some aspects of project activities taking place outside of the traditional project boundaries, but nonetheless related to the project operations, as may be applicable on a project basis. These issues may arise at any stage of a project life cycle and can have an impact beyond the life of the project.

3.1 Water Quality and Availability

Groundwater and surface water represent essential sources of drinking and irrigation water in developing countries, particularly in rural areas where piped water supply may be limited or unavailable and where available resources are collected by the consumer with little or no treatment. Project activities involving wastewater discharges, water extraction, diversion or impoundment should prevent adverse impacts to the quality and availability of groundwater and surface water resources.

Water Quality

Drinking water sources, whether public or private, should at all times be protected so that they meet or exceed applicable national acceptability standards or in their absence the current edition of WHO Guidelines for Drinking-Water Quality. Air emissions, wastewater effluents, oil and hazardous materials, and wastes should be managed according to the guidance provided in the respective sections of the General EHS Guidelines with the objective of protecting soil and water resources. Where the project includes the delivery of water to the community or to users of facility infrastructure (such as hotel hosts and hospital patients), where water may be used for drinking, cooking, washing, and bathing, water quality should comply with national acceptability standards or in their absence the current edition of with WHO Drinking Water Guidelines. Water quality for more sensitive well-being-related demands such as water used in health care facilities or food production may require more stringent, industry-specific guidelines or standards, as applicable. Any dependency factors associated with the delivery of water to the local community should be planned for and managed to ensure the sustainability of the water supply by involving the community in its management to minimize the dependency in the long-term.

Water Availability

The potential effect of groundwater or surface water abstraction for project activities should be properly assessed through a combination of field testing and modeling techniques, accounting for seasonal variability and projected changes in demand in the project area.

Project activities should not compromise the availability of water for personal hygiene needs and should take account of potential future increases in demand. The overall target should be the availability of 100 liters per person per day although lower levels may be used to meet basic health requirements.Water volume requirements for well-being-related demands such as water use in health care facilities may need to be higher.

3.2 Structural Safety of Project Infrastructure

Hazards posed to the public while accessing project facilities may include:

- Physical trauma associated with failure of building structures
- Burns and smoke inhalation from fires
- Injuries suffered as a consequence of falls or contact with heavy equipment
- Respiratory distress from dust, fumes, or noxious odors
- Exposure to hazardous materials

Reduction of potential hazards is best accomplished during the design phase when the structural design, layout and site modifications can be adapted more easily. The following issues should be considered and incorporated as appropriate into the planning, siting, and design phases of a project:

- Inclusion of buffer strips or other methods of physical separation around project sites to protect the public from major hazards associated with hazardous materials incidents or process failure, as well as nuisance issues related to noise, odors, or other emissions

- Incorporation of siting and safety engineering criteria to prevent failures due to natural risks posed by earthquakes, tsunamis, wind, flooding, landslides and fire. To this end, all project structures should be designed in accordance with engineering and design criteria mandated by site-specific risks, including but not limited to seismic activity, slope stability, wind loading, and other dynamic loads
- Application of locally regulated or internationally recognized building codes80 to ensure structures are designed and constructed in accordance with sound architectural and engineering practice, including aspects of fire prevention and response
- Engineers and architects responsible for designing and constructing facilities, building, plants and other structures should certify the applicability and appropriateness of the structural criteria employed.

International codes, such as those compiled by the International Code Council (ICC)81, are intended to regulate the design, construction, and maintenance of a built environment and contain detailed guidance on all aspects of building safety, encompassing methodology, best practices, and documenting compliance. Depending on the nature of a project, guidance provided in the ICC or comparable codes should be followed, as appropriate, with respect to:

- Existing structures
- Soils and foundations
- Site grading
- Structural design
- Specific requirements based on intended use and occupancy
- Accessibility and means of egress
- Types of construction
- Roof design and construction
- Fire-resistant construction
- Flood-resistant construction
- Construction materials
- Interior environment
- Mechanical, plumbing and electrical systems
- Elevators and conveying systems
- Fire safety systems
- Safeguards during construction
- Encroachments into public right-of-way

Although major design changes may not be feasible during the operation phase of a project, hazard analysis can be undertaken to identify opportunities to reduce the consequences of a failure or accident. Illustrative management actions, applicable to hazardous materials storage and use, include:

- Reducing inventories of hazardous materials through inventory management and process changes to greatly reduce or eliminate the potential off-site consequences of a release
- Modifying process or storage conditions to reduce the potential consequences of an accidental off-site release
- Improving shut-down and secondary containment to reduce the amount of material escaping from containment and to reduce the release duration
- Reducing the probability that releases will occur through improved site operations and control, and through improvements in maintenance and inspection
- Reducing off-site impacts of releases through measures intended to contain explosions and fires, alert the public, provide for evacuation of surrounding areas, establish safety zones around a site, and ensure the provision of emergency medical services to the public

3.3 Life and Fire Safety (L&FS)

Applicability and Approach

All new buildings accessible to the public should be designed, constructed, and operated in full compliance with local building codes, local fire department regulations, local legal/insurance requirements, and in accordance with an internationally accepted life and fire safety (L&FS) standard. The Life Safety Code, which provides extensive documentation on life and fire safety provisions, is one example of an internationally accepted standard and may be used to document compliance with the Life and Fire Safety objectives outlined in these guidelines. With regard to these objectives:

- Project sponsors' architects and professional consulting engineers should demonstrate that affected buildings meet these life and fire safety objectives.
- Life and fire safety systems and equipment should be designed and installed using appropriate prescriptive standards and/or performance based design, and sound engineering practices.
- Life and fire safety design criteria for all existing buildings should incorporate all local building codes and fire department regulations.

These guidelines apply to buildings that are accessible to the public.

Examples of such buildings include:

- Health and education facilities
- Hotels, convention centers, and leisure facilities
- Retail and commercial facilities
- Airports, other public transport terminals, transfer facilities

Specific Requirements for New Buildings

The nature and extent of life and fire safety systems required will depend on the building type, structure, construction, occupancy, and exposures. Sponsors should prepare a Life and Fire Safety Master Plan identifying major fire risks, applicable codes, standards and regulations, and mitigation measures. The Master Plan should be prepared by a suitably qualified professional, and adequately cover, but not be limited to, the issues addressed briefly in the following points. The suitably qualified professional selected to prepare the Master Plan is responsible for a detailed treatment of the following illustrative, and all other required, issues.

Fire Prevention

Fire prevention addresses the identification of fire risks and ignition sources, and measures needed to limit fast fire and smoke development. These issues include:

- Fuel load and control of combustibles
- Ignition sources
- Interior finish flame spread characteristics
- Interior finish smoke production characteristics
- Human acts, and housekeeping and maintenance

Means of Egress

Means of Egress includes all design measures that facilitate a safe evacuation by residents and/or occupants in case of fire or other emergency, such as:

- Clear, unimpeded escape routes
- Accessibility to the impaired/handicapped
- Marking and signing
- Emergency lighting

Detection and Alarm Systems

These systems encompass all measures, including communication and public address systems needed to detect a fire and alert:

- Building staff
- Emergency response teams
- Occupants
- Civil defense

Compartmentation

Compartmentation involves all measures to prevent or slow the spread of fire and smoke, including:

- Separations
- Fire walls
- Floors
- Doors
- Dampers
- Smoke control systems

Fire Suppression and Control

Fire suppression and control includes all automatic and manual fire protection installations, such as:

- Automatic sprinkler systems
- Manual portable extinguishers
- Fire hose reels

Emergency Response Plan

An Emergency Response Plan is a set of scenario–based procedures to assist staff and emergency response teams during real life emergency and training exercises. This chapter of the Fire and Life Safety Master Plan should include an assessment of local fire prevention and suppression capabilities.

Operation and Maintenance

Operation and Maintenance involves preparing schedules for mandatory regular maintenance and testing of life and fire safety features to ensure that mechanical, electrical, and civil structures and systems are at all times in conformance with life and fire safety design criteria and required operational readiness.

L&FS Master Plan Review and Approval

- A suitably qualified professional prepares and submits a Life and Fire Safety (L&FS) Master Plan, including preliminary drawings and specifications, and certifies that the design meets the requirements of these L&FS guidelines. The findings and recommendations of the review are then used to establish the conditions of a Corrective Action Plan and a time frame for implementing the changes.
- The suitably qualified professional conducts a review as part of the project completion test at the time of life and fire safety systems testing and commissioning, and certifies that construction of these systems has been carried out in accordance with the accepted design. The findings and recommendations of the review are used as the basis for establishing project completion or to establish the conditions of a Pre-Completion Corrective Action Plan and a time frame for implementing the changes.

Specific Requirements for Existing Buildings

- All life and fire safety guideline requirements for new buildings apply to existing buildings programmed for renovation. A suitably qualified professional conducts a complete life and fire safety review of existing buildings slated for renovation. The findings and recommendations of the review are used as the basis to establish the scope of work of a Corrective Action Plan and a time frame for implementing the changes.
- If it becomes apparent that life and fire safety conditions are deficient in an existing building that is not part of the project or that has not been programmed for renovation, a life and fire safety review of the building may be conducted by a

suitably qualified professional. The findings and recommendations of the review are used as the basis to establish the scope of work of a Corrective Action Plan and a time frame for implementing the changes.

Other Hazards

- Facilities, buildings, plants, and structures should be situated to minimize potential risks from forces of nature (e.g. earthquakes, tsunamis, floods, windstorms, and fires from surrounding areas).
- All such structures should be designed in accordance with the criteria mandated by situation-, climatic-, and geology-specific location risks (e.g. seismic activity, wind loading, and other dynamic loads).
- Structural engineers and architects responsible for facilities, buildings, plants and structures should certify the applicability and appropriateness of the design criteria employed.
- National or regional building regulations typically contain fire safety codes and standards83 or these standards are found in separate Fire Codes. Generally, such codes and regulations incorporate further compliance requirements with respect to methodology, practice, testing, and other codes and standards86. Such nationally referenced material constitutes the acceptable fire life safety code.

3.4 Traffic Safety

Traffic accidents have become one of the most significant causes of injuries and fatalities among members of the public worldwide. Traffic safety should be promoted by all project personnel during displacement to and from the workplace, and during operation of project equipment on private or public roads. Prevention and control of traffic related injuries and fatalities should include the adoption of safety measures that are protective of project workers and of road users, including those who are most vulnerable to road traffic accidents. Road safety initiatives proportional to the scope and nature of project activities should include:

- Adoption of best transport safety practices across all aspects of project operations with the goal of preventing traffic accidents and minimizing injuries suffered by project personnel and the public. Measures should include:
  a. Emphasizing safety aspects among drivers
  b. Improving driving skills and requiring licensing of drivers
  c. Adopting limits for trip duration and arranging driver rosters to avoid overtiredness
  d. Avoiding dangerous routes and times of day to reduce the risk of accidents
  e. Use of speed control devices (governors) on trucks, and remote monitoring of driver actions
- Regular maintenance of vehicles and use of manufacturer approved parts to minimize potentially serious accidents caused by equipment malfunction or premature failure.

Where the project may contribute to a significant increase in traffic along existing roads, or where road transport is a significant component of a project, recommended measures include:

- Minimizing pedestrian interaction with construction vehicles
- Collaboration with local communities and responsible authorities to improve signage, visibility and overall safety of roads, particularly along stretches located near schools or other locations where children may be present. Collaborating with local communities on education about traffic and pedestrian safety (e.g. school education campaigns)
- Coordination with emergency responders to ensure that appropriate first aid is provided in the event of accidents
- Using locally sourced materials, whenever possible, to minimize transport distances. Locating associated facilities such as worker camps close to project sites and arranging worker bus transport to minimizing external traffic
- Employing safe traffic control measures, including road signs and flag persons to warn of dangerous conditions

3.5 Transport of Hazardous Materials

General Hazardous Materials Transport

- Projects should have procedures in place that ensure compliance with local laws and international requirements applicable to the transport of hazardous materials, including:
  a. IATA requirements 89 for air transport
  b. IMDG Code90 sea transport
  c. UN Model Regulations 91 of other international standards as well as local requirements for land transport
  d. Host-country commitments under the Basel Convention on the Control of Transboundary Movements of Hazardous Waste and their disposal and Rotterdam Convention on the prior Inform Consent Procedure forCertain Hazardous Chemicals and Pesticides in International Trade, if applicable to the project activities
- The procedures for transportation of hazardous materials (Hazmats) should include:
  a. Proper labeling of containers, including the identify and quantity of the contents, hazards, and shipper contact information
  b. Providing a shipping document (e.g. shipping manifest) that describes the contents of the load and its associated hazards in addition to the labeling of the containers. The shipping document should establish a chain-of-custody using multiple signed copies to show that the waste was properly shipped, transported and received by the recycling or treatment/disposal facility

c. Ensuring that the volume, nature, integrity and protection of packaging and containers used for transport are appropriate for the type and quantity of hazardous material and modes of transport involved
d. Ensuring adequate transport vehicle specifications
e. Training employees involved in the transportation of hazardous materials regarding proper shipping procedures and emergency procedures
f. Using labeling and placarding (external signs on transport vehicles), as required
g. Providing the necessary means for emergency response on call 24 hours/day

Major Transportation Hazards

Guidance related to major transportation hazards should be implemented in addition to measures presented in the preceding section for preventing or minimizing the consequences of catastrophic releases of hazardous materials, which may result in toxic, fire, explosion, or other hazards during transportation. In addition to these aforementioned procedures, projects which transport hazardous materials at or above the threshold quantities should prepare a Hazardous Materials Transportation Plan containing all of the elements presented below93.

Hazard Assessment

The hazard assessment should identify the potential hazard involved in the transportation of hazardous materials by reviewing:

- The hazard characteristics of the substances identified during the screening stage
- The history of accidents, both by the company and its contractors, involving hazardous materials transportation
- The existing criteria for the safe transportation of hazardous materials, including environmental management systems used by the company and its contractors This review should cover the management actions, preventive measures and emergency response procedures described below.

The hazard assessment helps to determine what additional measures may be required to complete the plan.

Management Actions

- Management of Change: These procedures should address:
  a. The technical basis for changes in hazardous materials offered for transportation, routes and/or procedures
  b. The potential impact of changes on health and safety
  c. Modification required to operating procedures
  d. Authorization requirements
  e. Employees affected
  f. Training needs
- Compliance Audit: A compliance audit evaluates compliance with prevention requirements for each transportation route or for each hazardous material, as

appropriate. A compliance audit covering each element of the prevention measures (see below) should be conducted at least every three years. The audit program should include:

a. Preparation of a report of the findings
b. Determination and documentation of the appropriate response to each finding
c. Documentation that any deficiency has been corrected.

- Incident Investigation: Incidents can provide valuable information about transportation hazards and the steps needed to prevent accidental releases. The implementation of incident investigation procedures should ensure that:
  a. Investigations are initiated promptly
  b. Summaries of investigations are included in a report
  c. Report findings and recommendations are addressed
  d. Reports are reviewed with staff and contractors
- Employee Participation: There should be a written plan of action regarding the implementation of active employee participation in the prevention of accidents.
- Contractors: The plan should include procedures to ensure that:
  a. The contractor is provided with safety performance procedures and safety and hazard information
  b. Contractors observe safety practices
  c. Verify that the contractor acts responsibly
  d. The plan should also include additional procedures to ensure the contractors will:
  e. Ensure appropriate training for their employees
  f. Ensure their employees know process hazards and applicable emergency actions
  g. Prepare and submit training records
  h. Inform employees about the hazards presented by their work
- Training: Good training programs on operating procedures will provide the employees with the necessary information to understand how to operate safely and why safe operations are needed. The training program should include:
  a. The list of employees to be trained
  b. Specific training objectives
  c. Mechanisms to achieve objectives (i.e. hands-on workshops, videos, etc.)
  d. Means to determine the effectiveness of the training program
  e. Training procedures for new hires and refresher programs

Preventive Measures

The plan should include procedures to implement preventive measures specific to each hazardous material offered for transportation, including:

- Classification and segregation of hazardous materials in warehouses and transport units
- Packaging and packaging testing
- Marking and labeling of packages containing hazardous materials

- Handling and securing packages containing hazardous materials in transport units
- Marking and placarding of transport units
- Documentation (e.g. bills of lading)
- Application of special provisions, as appropriate

Emergency Preparedness and Response

It is important to develop procedures and practices for the handling of hazardous materials that allow for quick and efficient responses to accidents that may result in injury or environmental damage. The sponsor should prepare an Emergency Preparedness and Response Plan that should cover:

- Planning Coordination: This should include procedures for:
  a. Informing the public and emergency response agencies
  b. Documenting first aid and emergency medical treatment
  c. Taking emergency response actions
  d. Reviewing and updating the emergency response plan to reflect changes and ensuring that the employees are informed of such changes
- Emergency Equipment: The plan should include procedures for using, inspecting, testing, and maintaining emergency response equipment.
- Training: Employees should be trained in any relevant Procedures

3.6 Disease Prevention

Communicable Diseases

Communicable diseases pose a significant public health threat worldwide. Health hazards typically associated with large development projects are those relating to poor sanitation and living conditions, sexual transmission and vector-borne infections. Communicable diseases of most concern during the construction phase due to labor mobility are sexually-transmitted diseases (STDs), such as HIV/AIDS. Recognizing that no single measure is likely to be effective in the long term, successful initiatives typically involve a combination of behavioral and environmental modifications.

Recommended interventions at the project level include:

- Providing surveillance and active screening and treatment of workers
- Preventing illness among workers in local communities by:
  a. Undertaking health awareness and education initiatives, for example, by implementing an information strategy to reinforce person-to-person counseling addressing systemic factors that can influence individual behavior as well as promoting individual protection, and protecting others from infection, by encouraging condom use
  b. Training health workers in disease treatment
  c. Conducting immunization programs for workers in local communities to improve health and guard against infection
  d. Providing health services

- Providing treatment through standard case management in on-site or community health care facilities. Ensuring ready access to medical treatment, confidentiality and appropriate care, particularly with respect to migrant workers
- Promoting collaboration with local authorities to enhance access of workers families and the community to public health services and promote immunization

Vector-Borne Diseases

Reducing the impact of vector-borne disease on the long-term health of workers is best accomplished through implementation of diverse interventions aimed at eliminating the factors that lead to disease. Project sponsors, in close collaboration with community health authorities, can implement an integrated control strategy for mosquito and other arthropod-borne diseases that might involve:

- Prevention of larval and adult propagation through sanitary improvements and elimination of breeding habitats close to human settlements
- Elimination of unusable impounded water
- Increase in water velocity in natural and artificial channels
- Considering the application of residual insecticide to dormitory walls
- Implementation of integrated vector control programs
- Promoting use of repellents, clothing, netting, and other barriers to prevent insect bites
- Use of chemoprophylaxis drugs by non-immune workers and collaborating with public health officials to help eradicate disease reservoirs
- Monitoring and treatment of circulating and migrating populations to prevent disease reservoir spread
- Collaboration and exchange of in-kind services with other control programs in the project area to maximize beneficial effects
- Educating project personnel and area residents on risks, prevention, and available treatment
- Monitoring communities during high-risk seasons to detect and treat cases
- Distributing appropriate education materials
- Following safety guidelines for the storage, transport, and distribution of pesticides to minimize the potential for misuse, spills, and accidental human exposure

3.7 Emergency Preparedness and Response

An emergency is an unplanned event when a project operation loses control, or could lose control, of a situation that may result in risks to human health, property, or the environment, either within the facility or in the local community. Emergencies do not normally include safe work practices for frequent upsets or events that are covered by occupational health and safety.

All projects should have an Emergency Preparedness and Response Plan that is commensurate with the risks of the facility and that includes the following basic elements:

- Administration (policy, purpose, distribution, definitions, etc)
- Organization of emergency areas (command centers, medical stations, etc)
- Roles and responsibilities
- Communication systems
- Emergency response procedures
- Emergency resources
- Training and updating
- Checklists (role and action list and equipment checklist)
- Business Continuity and Contingency

Additional information is provided for key components of the emergency plan, as follows below.

Communication Systems

Worker notification and communication

Alarm bells, visual alarms, or other forms of communication should be used to reliably alert workers to an emergency. Related measures include:

- Testing warning systems at least annually (fire alarms monthly), and more frequently if required by local regulations, equipment, or other considerations
- Installing a back-up system for communications on-site with off-site resources, such as fire departments, in the event that normal communication methods may be inoperable during an emergency

Community Notification

If a local community may be at risk from a potential emergency arising at the facility, the company should implement communication measures to alert the community, such as:

- Audible alarms, such as fire bells or sirens
- Fan out telephone call lists
- Vehicle mounted speakers
- Communicating details of the nature of the emergency
- Communicating protection options (evacuation, quarantine)
- Providing advise on selecting an appropriate protection option

Media and Agency Relations

Emergency information should be communicated to the media through:

- A trained, local spokesperson able to interact with relevant stakeholders, and offer guidance to the company for speaking to the media, government, and other agencies
- Written press releases with accurate information, appropriate level of detail for the emergency, and for which accuracy can be guaranteed

Emergency Resources

Finance and Emergency Funds

- A mechanism should be provided for funding emergency activities.

Fire Services

- The company should consider the level of local fire fighting capacity and whether equipment is available for use at the facility in the event of a major emergency or natural disaster. If insufficient capacity is available, fire fighting capacity should be acquired that may include pumps, water supplies, trucks, and training for personnel.

Medical Services

- The company should provide first aid attendants for the facility as well as medical equipment suitable for the personnel, type of operation, and the degree of treatment likely to be required prior to transportation to hospital.

Availability of Resources

Appropriate measures for managing the availability of resources in case of an emergency include:

- Maintaining a list of external equipment, personnel, facilities, funding, expert knowledge, and materials that may be required to respond to emergencies. The list should include personnel with specialized expertise for spill clean-up, flood control, engineering, water treatment, environmental science, etc., or any of the functions required to adequately respond to the identified emergency
- Providing personnel who can readily call up resources, as required
- Tracking and managing the costs associated with emergency resources
- Considering the quantity, response time, capability, limitations, and cost of these resources, for both site-specific emergencies, and community or regional emergencies
- Considering if external resources are unable to provide sufficient capacity during a regional emergency and whether additional resources may need to be maintained on-site

Mutual Aid

Mutual aid agreements decrease administrative confusion and provide a clear basis for response by mutual aid providers.

- Where appropriate, mutual aid agreements should be maintained with other organizations to allow for sharing of personnel and specialized equipment.

Contact List

- The company should develop a list of contact information for all internal and external resources and personnel. The list should include the name, description, location, and contact details (telephone, email) for each of the resources, and be maintained annually.

Training and Updating

The emergency preparedness facilities and emergency response plans require maintenance, review, and updating to account for changes in equipment, personnel, and facilities. Training programs and practice exercises provide for testing systems to ensure an adequate level of emergency preparedness. Programs should:

- Identify training needs based on the roles and responsibilities, capabilities and requirements of personnel in an emergency
- Develop a training plan to address needs, particularly for fire fighting, spill response, and evacuation
- Conduct annual training, at least, and perhaps more frequent training when the response includes specialized equipment, procedures, or hazards, or when otherwise mandated
- Provide training exercises to allow personnel the opportunity to test emergency preparedness, including:
  a. Desk top exercises with only a few personnel, where the contact lists are tested and the facilities and communication assessed
  b. Response exercises, typically involving drills that allow for testing of equipment and logistics
  c. Debrief upon completion of a training exercise to assess what worked well and what aspects require improvement
  d. Update the plan, as required, after each exercise. Elements of the plan subject to significant change (such as contact lists) should be replaced
  e. Record training activities and the outcomes of the training

Business Continuity and Contingency

Measures to address business continuity and contingency include:

- Identifying replacement supplies or facilities to allow business continuity following an emergency. For example, alternate sources of water, electricity, and fuel are commonly sought.
- Using redundant or duplicate supply systems as part of facility operations to increase the likelihood of business continuity.
- Maintaining back-ups of critical information in a secure location to expedite the return to normal operations following an emergency.

Construction and Decommissioning

Applicability and Approach

This section provides additional, specific guidance on prevention and control of community health and safety impacts that may occur during new project development, at the end of the project life-cycle, or due to expansion or modification of existing project facilities. Cross referencing is made to various other sections of the General EHS Guidelines.

4.1 Environment

a. Noise and Vibration

During construction and decommissioning activities, noise and vibration may be caused by the operation of pile drivers, earth moving and excavation equipment, concrete mixers, cranes and the transportation of equipment, materials and people. Some recommended noise reduction and control strategies to consider in areas close to community areas include:

- Planning activities in consultation with local communities so that activities with the greatest potential to generate noise are planned during periods of the day that will result in least disturbance
- Using noise control devices, such as temporary noise barriers and deflectors for impact and blasting activities, and exhaust muffling devices for combustion engines.
- Avoiding or minimizing project transportation through community areas

b. Soil Erosion

Soil erosion may be caused by exposure of soil surfaces to rain and wind during site clearing, earth moving, and excavation activities. The mobilization and transport of soil particles may, in turn, result in sedimentation of surface drainage networks, which may result in impacts to the quality of natural water systems and ultimately the biological systems that use these waters. Recommended soil erosion and water system management approaches include:

c. Sediment mobilization and transport

- Reducing or preventing erosion by:
    a. Scheduling to avoid heavy rainfall periods (i.e., during the dry season) to the extent practical
    b. Contouring and minimizing length and steepness of slopes
    c. Mulching to stabilize exposed areas
    d. Re-vegetating areas promptly
    e. Designing channels and ditches for post-construction flows
    f. Lining steep channel and slopes (e.g. use jute matting)
- Reducing or preventing off-site sediment transport through use of settlement ponds, silt fences, and water treatment, and modifying or suspending activities during extreme rainfall and high winds to the extent practical.

d. Clean runoff management

- Segregating or diverting clean water runoff to prevent it mixing with water containing a high solids content, to minimize the volume of water to be treated prior to release

e. Road design

- Limiting access road gradients to reduce runoff-induced erosion
- Providing adequate road drainage based on road width, surface material, compaction, and maintenance

f. Disturbance to water bodies

- Depending on the potential for adverse impacts, installing free-spanning structures (e.g., single span bridges) for road watercourse crossings
- Restricting the duration and timing of in-stream activities to lower low periods, and avoiding periods critical to biological cycles of valued flora and fauna (e.g., migration, spawning, etc.)
- For in-stream works, using isolation techniques such as berming or diversion during construction to limit the exposure of disturbed sediments to moving water
- Consider using trenchless technology for pipeline crossings (e.g., suspended crossings) or installation by directional drilling

g. Structural (slope) stability

- Providing effective short term measures for slope stabilization, sediment control and subsidence control until long term measures for the operational phase can be implemented
- Providing adequate drainage systems to minimize and control infiltration

h. Air Quality

Construction and decommissioning activities may generate emission of fugitive dust caused by a combination of on-site excavation and movement of earth materials, contact of construction machinery with bare soil, and exposure of bare soil and soil piles to wind. A secondary source of emissions may include exhaust from diesel engines of earth moving equipment, as well as from open burning of solid waste on-site. Techniques to consider for the reduction and control of air emissions from construction and decommissioning sites include:

- Minimizing dust from material handling sources, such as conveyors and bins, by using covers and/or control equipment (water suppression, bag house, or cyclone)
- Minimizing dust from open area sources, including storage piles, by using control measures such as installing enclosures and covers, and increasing the moisture content
- Dust suppression techniques should be implemented, such as applying water or non-toxic chemicals to minimize dust from vehicle movements
- Selectively removing potential hazardous air pollutants, such as asbestos, from existing infrastructure prior to demolition
- Managing emissions from mobile sources according to Section 1.1
- Avoiding open burning of solid (refer to solid waste management guidance in Section 1.6)

i. Solid Waste

Non-hazardous solid waste generated at construction and decommissioning sites includes excess fill materials from grading and excavation activities, scrap wood and metals, and small concrete spills. Other non-hazardous solid wastes include office, kitchen, and dormitory wastes when these types of operations are part of construction project activities. Hazardous solid waste includes contaminated soils, which could potentially be encountered on-site due to previous land use activities, or small amounts of machinery maintenance materials, such as oily rags, used oil filters, and used oil, as well as spill cleanup materials from oil and fuel spills. Techniques for preventing and controlling nonhazardous and hazardous construction site solid waste include those already discussed in Section 1.6.

j. Hazardous Materials

Construction and decommissioning activities may pose the potential for release of petroleum based products, such as lubricants, hydraulic fluids, or fuels during their storage, transfer, or use in equipment. These materials may also be encountered during decommissioning activities in building components or industrial process equipment. Techniques for prevention, minimization, and control of these impacts include:

- Providing adequate secondary containment for fuel storage tanks and for the temporary storage of other fluids such as lubricating oils and hydraulic fluids,
- Using impervious surfaces for refueling areas and other fluid transfer areas
- Training workers on the correct transfer and handling of fuels and chemicals and the response to spills
- Providing portable spill containment and cleanup equipment on site and training in the equipment deployment
- Assessing the contents of hazardous materials and petroleum-based products in building systems (e.g. PCB containing electrical equipment, asbestos-containing building materials) and process equipment and removing them prior to initiation of decommissioning activities, and managing their treatment and disposal according to Sections 1.5 and 1.6 on Hazardous Materials and Hazardous Waste Management, respectively
- Assessing the presence of hazardous substances in or on building materials (e.g., polychlorinated biphenyls, asbestos-containing flooring or insulation) and decontaminating or properly managing contaminated building materials

k. Wastewater Discharges

Construction and decommissioning activities may include the generation of sanitary wastewater discharges in varying quantities depending on the number of workers involved. Adequate portable or permanent sanitation facilities serving all workers should be provided at all construction sites. Sanitary wastewater in construction and other sites should be managed as described in Section 1.3.

l. Contaminated Land

Land contamination may be encountered in sites under construction or decommissioning due to known or unknown historical releases of hazardous materials or oil, or due to the presence of abandoned infrastructure formerly used to store or handle these materials, including underground storage tanks. Actions necessary to manage the risk from contaminated land will depend on factors such as the level and location of contamination, the type and risks of the contaminated media, and the intended land use. However, a basic management strategy should include:

- Managing contaminated media with the objective of protecting the safety and health of occupants of the site, the surrounding community, and the environment post construction or post decommissioning
- Understanding the historical use of the land with regard to the potential presence of hazardous materials or oil prior to initiation of construction or decommissioning activities
- Preparing plans and procedures to respond to the discovery of contaminated media to minimize or reduce the risk to health, safety, and the environment consistent with the approach for Contaminated Land in Section 1.6
- Preparation of a management plan to manage obsolete, abandoned, hazardous materials or oil consistent with the approach to hazardous waste management described in Section 1.6.

Successful implementation of any management strategy may require identification and cooperation with whoever is responsible and liable for the contamination.

4.2 Occupational Health and Safety

a. Over-exertion

Over-exertion, and ergonomic injuries and illnesses, such as repetitive motion, over-exertion, and manual handling, are among the most common causes of injuries in construction and decommissioning sites. Recommendations for their prevention and control include:

- Training of workers in lifting and materials handling techniques in construction and decommissioning projects, including the placement of weight limits above which mechanical assists or two-person lifts are necessary
- Planning work site layout to minimize the need for manual transfer of heavy loads
- Selecting tools and designing work stations that reduce force requirements and holding times, and which promote improved postures, including, where applicable, user adjustable work stations
- Implementing administrative controls into work processes, such as job rotations and rest or stretch breaks

b. Slips and Falls

Slips and falls on the same elevation associated with poor housekeeping, such as excessive waste debris, loose construction materials, liquid spills, and uncontrolled use of electrical cords and ropes on the ground, are also among the most frequent cause of lost time accidents at construction and decommissioning sites. Recommended methods for the prevention of slips and falls from, or on, the same elevation include:

- Implementing good house-keeping practices, such as the sorting and placing loose construction materials or demolition debris in established areas away from foot paths
- Cleaning up excessive waste debris and liquid spills regularly
- Locating electrical cords and ropes in common areas and marked corridors
- Use of slip retardant footwear

c. Work in Heights

Falls from elevation associated with working with ladders, scaffolding, and partially built or demolished structures are among the most common cause of fatal or permanent disabling injury at construction or decommissioning sites. If fall hazards exist, a fall protection plan should be in place which includes one or more of the following aspects, depending on the nature of the fall hazard95:

- Training and use of temporary fall prevention devices, such as rails or other barriers able to support a weight of 200 pounds, when working at heights equal or greater than two meters or at any height if the risk includes falling into operating machinery, into water or other liquid, into hazardous substances, or through an opening in a work surface
- Training and use of personal fall arrest systems, such as full body harnesses and energy absorbing lanyards able to support 5000 pounds (also described in this section in Working at Heights above), as well as fall rescue procedures to deal with workers whose fall has been successfully arrested. The tie in point of the fall arresting system should also be able to support 5000 pounds
- Use of control zones and safety monitoring systems to warn workers of their proximity to fall hazard zones, as well as securing, marking, and labeling covers for openings in floors, roofs, or walking surfaces

d. Struck By Objects

Construction and demolition activities may pose significant hazards related to the potential fall of materials or tools, as well as ejection of solid particles from abrasive or other types of power tools which can result in injury to the head, eyes, and extremities. Techniques for the prevention and control of these hazards include:

- Using a designated and restricted waste drop or discharge zones, and/or a chute for safe movement of wastes from upper to lower levels
- Conducting sawing, cutting, grinding, sanding, chipping or chiseling with proper guards and anchoring as applicable
- Maintaining clear traffic ways to avoid driving of heavy equipment over loose scrap
- Use of temporary fall protection measures in scaffolds and out edges of elevated work surfaces, such as hand rails and toe boards to prevent materials from being dislodged

- Evacuating work areas during blasting operations, and using blast mats or other means of deflection to minimize fly rock or ejection of demolition debris if work is conducted in proximity to people or structures
- Wearing appropriate PPE, such as safety glasses with side shields, face shields, hard hats, and safety shoes

e. Moving Machinery

Vehicle traffic and use of lifting equipment in the movement of machinery and materials on a construction site may pose temporary hazards, such as physical contact, spills, dust, emissions, and noise. Heavy equipment operators have limited fields of view close to their equipment and may not see pedestrians close to the vehicle. Center-articulated vehicles create a significant impact or crush hazard zone on the outboard side of a turn while moving. Techniques for the prevention and control of these impacts include:

- Planning and segregating the location of vehicle traffic, machine operation, and walking areas, and controlling vehicle traffic through the use of one-way traffic routes, establishment of speed limits, and on-site trained flag-people wearing high-visibility vests or outer clothing covering to direct traffic
- Ensuring the visibility of personnel through their use of high visibility vests when working in or walking through heavy equipment operating areas, and training of workers to verify eye contact with equipment operators before approaching the operating vehicle
- Ensuring moving equipment is outfitted with audible back-up alarms
- Using inspected and well-maintained lifting devices that are appropriate for the load, such as cranes, and securing loads when lifting them to higher job-site elevations.

f. Dust

- Dust suppression techniques should be implemented, such as applying water or non-toxic chemicals to minimize dust from vehicle movements
- PPE, such as dusk masks, should be used where dust levels are excessive

g. Confined Spaces and Excavations

Examples of confined spaces that may be present in construction or demolition sites include: silos, vats, hoppers, utility vaults, tanks, sewers, pipes, and access shafts. Ditches and trenches may also be considered a confined space when access or egress is limited. In addition to the guidance provided in Section 2.8 the occupational hazards associated with confined spaces and excavations in construction and decommissioning sites should be prevented according to the following recommendations:

- Controlling site-specific factors which may contribute to excavation slope instability including, for example, the use of excavation dewatering, side-walls support, and slope gradient adjustments that eliminate or minimize the risk of collapse, entrapment, or drowning
- Providing safe means of access and egress from excavations, such as graded slopes, graded access route, or stairs and ladders

- Avoiding the operation of combustion equipment for prolonged periods inside excavations areas where other workers are required to enter unless the area is actively ventilated

h. Other Site Hazards

Construction and decommissioning sites may pose a risk of exposure to dust, chemicals, hazardous or flammable materials, and wastes in a combination of liquid, solid, or gaseous forms, which should be prevented through the implementation of project-specific plans and other applicable management practices, including:

- Use of specially trained personnel to identify and remove waste materials from tanks, vessels, processing equipment or contaminated land as a first step in decommissioning activities to allow for safe excavation, construction, dismantling or demolition
- Use of specially trained personnel to identify and selectively remove potentially hazardous materials in building elements prior to dismantling or demolition including, for example, insulation or structural elements containing asbestos and Polychlorinated Biphenyls (PCBs), electrical components containing mercury
- Use of waste-specific PPE based on the results of an occupational health and safety assessment, including respirators, clothing/protective suits, gloves and eye protection

4.3 Community Health and Safety

a. General Site Hazards

Projects should implement risk management strategies to protect the community from physical, chemical, or other hazards associated with sites under construction and decommissioning. Risks may arise from inadvertent or intentional trespassing, including potential contact with hazardous materials, contaminated soils and other environmental media, buildings that are vacant or under construction, or excavations and structures which may pose falling and entrapment hazards. Risk management strategies may include:

- Restricting access to the site, through a combination of institutional and administrative controls, with a focus on high risk structures or areas depending on site-specific situations, including fencing, signage, and communication of risks to the local community
- Removing hazardous conditions on construction sites that cannot be controlled affectively with site access restrictions, such as covering openings to small confined spaces, ensuring means of escape for larger openings such as trenches or excavations, or locked storage of hazardous materials

b. Disease Prevention

Increased incidence of communicable and vector-borne diseases attributable to construction activities represents a potentially serious health threat to project personnel and residents of local communities. Recommendations for the prevention and control of communicable and vector-borne diseases also applicable to construction phase activities are provided in Section 3.6 (Disease Prevention).

c. Traffic Safety

Construction activities may result in a significant increase in movement of heavy vehicles for the transport of construction materials and equipment increasing the risk of traffic-related accidents and injuries to workers and local communities. The incidence of road accidents involving project vehicles during construction should be minimized through a combination of education and awareness-raising, and the adoption of procedures described in Section 3.4 (Traffic Safety).

B. EHS Guidelines for Water Supply and Sanitation

Applicability

The EHS Guidelines for Water and Sanitation include information relevant to the operation and maintenance of (i) potable water treatment and distribution systems, and (ii) collection of sewage in centralized systems (such as piped sewer collection networks) or decentralized systems (such as septic tanks subsequently serviced by pump trucks) and treatment of collected sewage at centralized facilities.

1.1 Industry-Specific Impacts and Management

Environment

Environmental issues associated with water and sanitation projects may principally occur during the construction and operational phases, depending on project-specific characteristics and components. Recommendations for the management of EHS issues associated with construction activities as would typically apply to the construction of civil works are provided in the General EHS Guidelines.

Drinking Water

Water Withdrawal

Traditional sources for potable water treatment include surface water from lakes, streams, rivers, etc. and groundwater resources. Where surface or groundwater of adequate quality is unavailable, other sources of water including seawater, brackish water, etc. may be used to produce potable water. Development of water resources often involves balancing competing qualitative and quantitative human needs with the rest of the environment. This is a particularly challenging issue in the absence of a clear allocation of water rights which should be resolved with the participation of appropriate parties in advance of project design and implementation. Recommended measures to prevent, minimize, and control environmental impacts associated with water withdrawal and to protect water quality include:

- Evaluate potential adverse effects of surface water withdrawal on the downstream ecosystems and use appropriate environmental flow assessment3 to determine acceptable withdrawal rates;
- Design structures related to surface water withdrawal, including dams and water intake structures, to minimize impacts on aquatic life. For example:

a. Limit maximum through-screen design intake velocity to limit entrainment of aquatic organisms
b. Avoid construction of water intake structures in sensitive ecosystems. If there are threatened, endangered, or other protected species within the hydraulic zone of influence of the surface water intake, ensure reduction of impingement and entrainment of fish and shellfish by the installation of technologies such as barrier nets (seasonal or year-round), screens, and aquatic filter barrier systems
c. Design water containment and diversion structures to allow unimpeded movement of fish and other aquatic organisms and to prevent adverse impacts on water quality
d. Design dam outlet valves with sufficient capacities for releasing the appropriate environmental flows

- Avoid construction of water supply wells and water intake structures in sensitive ecosystems;
- Evaluate potential adverse effects of groundwater withdrawal, including modeling of groundwater level changes and resulting impacts to surface water flows, potential land subsidence, contaminant mobilization and saltwater intrusion. Modify extraction rates and locations as necessary to prevent unacceptable adverse current and future impacts, considering realistic future increases in demand.

1. Water Treatment

Environmental issues associated with water treatment include:

- Solid waste
- Wastewater
- Hazardous chemicals
- Air emissions
- Ecological impacts

2. Solid Waste

Solid waste residuals generated by water treatment include process residuals, used filtration membranes, spent media and miscellaneous wastes. Process residuals primarily consist of settled suspended solids from source water and chemicals added in the treatment process, such as lime and coagulants. Pre-sedimentation, coagulation (e.g. with aluminum hydroxide [alum] or ferric hydroxide), lime softening, iron and manganese removal, and slow sand and diatomaceous earth filtration all produce sludge. Composition of the sludge depends on the treatment process and the characteristics of the source water, and may include arsenic and other metals, radionuclides, lime, polymers and other organic compounds, microorganisms, etc. Damaged or exhausted membranes are typically produced from water treatment systems used for desalination. Spent media may include filter media (including sand, coal, or diatomaceous earth from filtration plants), ion exchange resins, granular activated carbon [GAC], etc. Recommended measures to manage solid wastes from water treatment include:

- Minimize the quantity of solids generated by the water treatment process through optimizing coagulation processes;

- Dispose of lime sludges by land application if allowed, limiting application rates to about 20 dry metric tons per hectare (9 dry tons per acre) to minimize the potential for mobilization of metals into plant tissue and groundwater;
- Dispose of ferric and alum sludges by land application, if allowed and if such application can be shown through modeling and sampling to have no adverse impacts on groundwater or surface water (e.g. from nutrient runoff). Balance use of ferric and alum sludges to bind phosphorous (e.g. from manure application at livestock operations) without causing aluminum phytotoxicity (from alum), iron levels in excess of adulteration levels for metals in fertilizers, or excessively low available phosphorous levels;
- Potential impact on soil, groundwater, and surface water, in the context of protection, conservation and long term sustainability of water and land resources, should be assessed when land is used as part of any waste or wastewater treatment system;
- Sludges may require special disposal if the source water contains elevated levels of toxic metals, such as arsenic, radionuclides, etc.;
- Regenerate activated carbon (e.g. by returning spent carbon to the supplier).

3. Wastewater

Wastewater from water treatment projects include filter backwash, reject streams from membrane filtration processes, and brine streams from ion exchange or demineralization processes. These waste streams may contain suspended solids and organics from the raw water, high levels of dissolved solids, high or low pH, heavy metals, etc. Recommended measures to manage wastewater effluents include:

- Land application of wastes with high dissolved solids concentrations is generally preferred over discharge to surface water subject to an evaluation of potential impact on soil, groundwater, and surface water resulting from such application;
- Recycle filter backwash into the process if possible;
- Treat and dispose of reject streams, including brine, consistent with national and local requirements. Disposal options include return to original source (e.g. ocean, brackish water source, etc.) or discharge to a municipal sewerage system, evaporation, and underground injection.

4. Hazardous Chemicals

Water treatment may involve the use of chemicals for coagulation, disinfection and water conditioning. In general, potential impacts and mitigation measures associated with storage and use of hazardous chemicals are similar to those for other industrial projects. Recommended measures to prevent, minimize, and control potential environmental impacts associated with the storage, handling and use of disinfection chemicals in water treatment facilities include:

- For systems that use gas chlorination:
    a. Install alarm and safety systems, including automatic shutoff valves, that are automatically activated when a chlorine release is detected
    b. Install containment and scrubber systems to capture and neutralize chlorine should a leak occur

c. Use corrosion-resistant piping, valves, metering equipment, and any other equipment coming in contact with gaseous or liquid chlorine, and keep this equipment free from contaminants, including oil and grease
d. Store chlorine away from all sources of organic chemicals, and protect from sunlight, moisture, and high temperatures

- Store sodium hypochlorite in cool, dry, and dark conditions for no more than one month, and use equipment constructed of corrosion-resistant materials;
- Store calcium hypochlorite away from any organic materials and protect from moisture; fully empty or re-seal shipping containers to exclude moisture. Calcium hypochlorite can be stored for up to one year;
- Isolate ammonia storage and feed areas from chlorine and hypochlorite storage and feed areas;
- Minimize the amount of chlorination chemicals stored on site while maintaining a sufficient inventory to cover intermittent disruptions in supply;
- Develop and implement a prevention program that includes identification of potential hazards, written operating procedures, training, maintenance, and accident investigation procedures;
- Develop and implement a plan for responding to accidental releases.

5. Air Emissions

Air emissions from water treatment operations may include ozone (in the case of ozone disinfection) and gaseous or volatile chemicals used for disinfection processes (e.g., chlorine and ammonia). Measures related to hazardous chemicals discussed above will mitigate risks of chlorine and ammonia releases. In addition, specific recommended measures to manage air emissions include installation of an ozone-destroying device at the exhaust of the ozone-reactor (e.g., catalytic oxidation, thermal oxidation, or GAC).

6. Water Distribution

The most fundamental environmental health issues associated with distribution networks is the maintenance of adequate pressure to protect water quality in the system as well as sizing and adequate maintenance to assure reliable delivery of water of suitable quality. The most significant environmental issues associated with operation of water distribution systems include:

- Water system leaks and loss of pressure
- Water discharges

7. Water System Leaks and Loss of Pressure

Water system leaks can reduce the pressure of the water system compromising its integrity and ability to protect water quality (by allowing contaminated water to leak into the system) and increasing the demands on the source water supply, the quantity of chemicals, and the amount of power used for pumping and treatment. Leaks in the distribution system can result from improper installation or maintenance, inadequate corrosion protection, settlement, stress from traffic and vibrations, frost loads, overloading, and other factors. Recommended measures to prevent and minimize water losses from the water distribution system include:

- Ensure construction meets applicable standards and industry practices;

- Conduct regular inspection and maintenance;
- Implement a leak detection and repair program (including records of past leaks and unaccounted- for water to identify potential problem areas);
- Consider replacing mains with a history of leaks of with a greater potential for leaks because of their location, pressure stresses, and other risk factors.

8. Water Discharges

Water lines may be periodically flushed to remove accumulated sediments or other impurities that have accumulated in the pipe. Flushing is performed by isolating sections of the distribution system and opening flushing valves or, more commonly, fire hydrants to cause a large volume of flow to pass through the isolated pipeline and suspend the settled sediment. The major environmental aspect of water pipe flushing is the discharge of flushed water, which may be high in suspended solids, residual chlorine, and other contaminants that can harm surface water bodies. Recommended measures to prevent, minimize, and control impacts from flushing of mains include:

- Discharge the flush water into a municipal sewerage system with adequate capacity;
- Discharge the flush water into a separate storm sewer system with storm water management measures such as a detention pond, where solids can settle and residual chlorine consumed before the water is discharged;
- Minimize erosion during flushing, for example by avoiding discharge areas that are susceptible to erosion and spreading the flow to reduce flow velocities.

9. Sanitation

A sanitation system comprises the facilities and services used by households and communities for the safe management of their excreta (feces and urine). A sanitation system collects excreta and creates and effective barrier to human contact; transports it to a suitable location; stores and/or treats it; and reuses it or returns it to the environment. In addition to excreta, sanitation systems may also carry household wastewater and storm water (The excess water from rainfall that does not naturally percolate into the soil).Transport, storage, and disposal facilities may also manage wastes from industries, commercial establishments, and institutions.

10. Fecal Sludge and Septage Collection

In communities not served by sewerage systems, sanitation may be based on on-site systems, such as pit latrines, bucket latrines or flush toilets connected to septic tanks. While pit and bucket latrines must be emptied frequently (typically daily to weekly), solids that accumulate in septic systems (septage) must also be removed periodically, usually every 2 to 5 years depending on design and usage to maintain proper function and prevent plugging, overflows, and the resulting release of septic tank contents. If suitable facilities for storage, handling and treatment of fecal sludge are not available, it may be indiscriminately dumped into the environment or used in unhygienic manner in agriculture. Recommended measures to prevent, minimize, and control releases of septage and other fecal sludge include:

- Promote and facilitate correct septic tank design and improvement of septic tank maintenance. Septic tank design should balance effluent quality and maintenance needs;
- Consider provision of systematic, regular collection of fecal sludge and septic waste;
- Use appropriate collection vehicles. A combination of vacuum tanker trucks and smaller hand-pushed vacuum tugs may be needed to service all households;
- Facilitate discharge of fecal sludge and septage at storage and treatment facilities so that untreated septage is not discharged to the environment.

11. Sewerage

Where population density or local conditions preclude effective on-site sanitation systems (e.g., septic tanks and drain fields), sewage is typically conveyed via a system of pipes, pumps, and other associated infrastructure (sewerage) to a centralized storage and/or treatment system. Solids and liquids may be transported to a centralized location, or sewage solids may be collected in and periodically removed from on-site interceptor tanks (see Septage and Fecal Sludge Collection, above) while the liquids are transported to a centralized location for storage, treatment, or disposal. Users of the sewerage system may include industry and institutions, as well as households. Greywater (water from laundry, kitchen, bath, and other domestic activities that normally does not contain excreta) is sometimes collected and managed separately from sewage. Though greywater is generally less polluted than domestic or industrial wastewater, it may still contain high levels of pathogenic microorganisms, suspended solids and substances such as oil, fat, soaps, detergents, and other household chemicals and can have negative impacts on human health as well as soil and groundwater quality. The most significant potential environmental impacts associated with wastewater collection arise from:

- Domestic wastewater discharges
- Industrial wastewater discharges
- Leaks and overflows

12. Domestic Wastewater Discharges

Uncontrolled discharge of domestic wastewater, including sewage and greywater, into aquatic systems can lead to, among other things, microbial and chemical contamination of the receiving water, oxygen depletion, increased turbidity, and eutrophication. Wastewater discharge onto streets or open ground can contribute to spread of disease, odors, contamination of wells, deterioration of streets, etc. Measures to protect the environment as well as public health include:

- Provide systems for effective collection and management of sewage and greywater (separately or combined);
- If greywater is managed separate from sewage, implement greywater source control measures to avoid use and discharge of problematic substances, such as oil and grease, large particles or chemicals.

13. Industrial Wastewater Discharges

Industrial users of a sewerage system can discharge industrial wastewaters to the sewer system. Some industrial wastes can cause fire and explosion hazards in the sewerage system and treatment facility, disrupt biological and other processes at the treatment facility or affect worker health and safety; some waste components may not be effectively treated, and may be stripped to the atmosphere, discharged with treated effluent or partition into treatment plant residuals rendering it potentially hazardous. Recommended measures to prevent minimize, and control industrial discharges to the sewerage system include:

- Treatment or pre-treatment to neutralize or remove toxic chemicals should ideally take place at the industrial facility itself, prior to discharge of the effluent to the sewer or water body. Consider collaboration with public authorities in the implementation of a source control program for industrial and commercial users to ensure that any wastewater discharged to the sewer system can be effectively treated. Examples of problematic discharges include: flammable, reactive, explosive, corrosive, or radioactive substances; noxious or malodorous materials; medical or infectious wastes; solid or viscous materials that could cause obstruction to the flow or operation of the treatment plants; toxic substances; non-biodegradable oils; and pollutants that could result in the emission of hazardous gases;
- Collaborate with public authorities in the regular inspection of industrial user facilities and collect samples of wastewater discharges to the sewerage system to ensure compliance with the source control program;
- Conduct surveillance monitoring at sewer maintenance and of the influent to the wastewater treatment facilities;
- Investigate upstream sources of pollutants causing treatment plant upsets or interference;
- Facilitate public reporting of illicit discharges and connections.

14. Leaks and Overflows

Leaks and overflows from the sewerage system can cause contamination of soil, groundwater, and surface water. Depending on the elevation of groundwater, leaks in gravity mains may also allow groundwater into the sewer system, increasing the volume of wastewater requiring treatment and potentially causing flooding and treatment bypass. Overflows occur when the collection system cannot manage the volume of wastewater, for example due to high flows during rain events or as the result of power loss, equipment malfunctions, or blockages. The excess flows may contain raw sewage, industrial wastewater, and polluted runoff. Recommended measures to prevent, minimize, and control leaks and overflows include:

- Consider the installation of separate sewer systems for domestic wastewater and storm water runoff in the overall planning and design of new sewerage systems;
- When on-site sanitation systems where excreta are mixed with water predominate, consider use of small-diameter sewerage system to collect water effluent from septic systems or interceptor tanks;

- Limit the sewer depth where possible (e.g., by avoiding routes under streets with heavy traffic). For shallower sewers, small inspection chambers can be used in lieu of manholes;
- Use appropriate locally available materials for sewer construction. Spun concrete pipes can be appropriate in some circumstances but can suffer corrosion from hydrogen sulfide if there are blockages and/or insufficient slope;
- Ensure sufficient hydraulic capacity to accommodate peak flows and adequate slope in gravity mains to prevent buildup of solids and hydrogen sulfide generation;
- Design manhole covers to withstand anticipated loads and ensure that the covers can be readily replace if broken to minimize entry of garbage and silt into the system;
- Equip pumping stations with a backup power supply, such as a diesel generator, to ensure uninterrupted operation during power outages, and conduct regular maintenance to minimize service interruptions. Consider redundant pump capacity in critical areas;
- Establish routine maintenance program, including:
    a. Development of an inventory of system components, with information including age, construction materials, drainage areas served, elevations, etc
    b. Regular cleaning of grit chambers and sewer lines to remove grease, grit, and other debris that may lead to sewer backups. Cleaning should be conducted more frequently for problem areas. Cleaning activities may require removal of tree roots and other identified obstructions
    c. Inspection of the condition of sanitary sewer structures and identifying areas that need repair or maintenance. Items to note may include cracked/deteriorating pipes; leaking joints or seals at manhole; frequent line blockages; lines that generally flow at or near capacity; and suspected infiltration or exfiltration
    d. Monitoring of sewer flow to identify potential inflows and outflows
- Conduct repairs prioritized based on the nature and severity of the problem. Immediate clearing of blockage or repair is warranted where an overflow is currently occurring or for urgent problems that may cause an imminent overflow (e.g. pump station failures, sewer line ruptures, or sewer line blockages);
- Review previous sewer maintenance records to help identify “hot spots” or areas with frequent maintenance problems and locations of potential system failure, and conduct preventative maintenance, rehabilitation, or replacement of lines as needed;
- When a spill, leak, and/or overflow occurs, keep sewage from entering the storm drain system by covering or blocking storm drain inlets or by containing and diverting the sewage away from open channels and other storm drain facilities (using sandbags, inflatable dams, etc.). Remove the sewage using vacuum equipment or use other measures to divert it back to the sanitary sewer system.

15. Wastewater and Sludge Treatment and Discharge

Sewage will normally require treatment before it can be safely discharged to the environment. The degree and nature of wastewater and sludge treatment depends on applicable standards and the planned disposal or use of the liquid effluent and sludge and the application method. The various treatment processes may reduce suspended solids (which can clog rivers, channels, and drip irrigation pipes); biodegradable organics (which are consumed by microorganisms and can result in reduced oxygen levels in the receiving water); pathogenic bacteria and other disease-causing organisms; and nutrients (which stimulate the growth of undesirable algae that, as they die, can result in increased loads of biodegradable organics). Wastewater discharge and use options include discharge to natural or artificial watercourses or water bodies; discharge to treatment ponds or wetlands (including aquiculture); and direct use in agriculture (e.g., crop irrigation). In all cases, the receiving water body use (e.g. navigation, recreation, irrigation, or drinking) needs to be considered together with its assimilative capacity to establish a site-specific discharge quality that is consistent with the most sensitive use. The most significant environmental impacts related to wastewater and sludge treatment, discharge, and use include:

- Liquid effluents
- Solid waste
- Air emissions and odors
- Hazardous chemicals
- Ecological impacts

16. Liquid Effluents

Treated wastewater (liquid effluents) may be reused for irrigation or other purposes or disposed subject to regulatory oversight. If not re-used, treated wastewater can be discharged to the sea; rivers; large surface water bodies; smaller, closed surface water bodies; and wetlands and lagoons. Recommended measures to prevent, minimize, and control liquid effluents include:

- Minimize bypass of the treatment system by using separate storm water and wastewater systems, if possible, and providing capacity sufficient to treat peak flows;
- Implement an industrial source control program which includes monitoring and effective regulatory enforcement;
- Collaborate with public officials to select appropriate treatment technologies, considering factors such as the quality and quantity of raw wastewater and its variability; available land area for the treatment facility; and resources for capital expenditures, operation, maintenance, and repair; availability of skilled operators, operator training, maintenance personnel, treatment chemicals, and replacement parts;13
- Design, construct, operate, and maintain wastewater treatment facilities and achieve effluent water quality consistent with applicable national requirements or internationally accepted standards14 and consistent with effluent water quality goals based on the assimilative capacity and the most sensitive end use of the receiving water;15,16

- Consider discharge of treated wastewater to natural or constructed wetlands, which can buffer the impact from discharge on the aquatic environment, unless the wetland itself would be degraded by the discharge;
- Treat greywater, if collected separately from sewage, to remove organic pollutants and reduce the levels of suspended solids, pathogenic organisms and other problematic substances to acceptable levels based on applicable national and local regulations. Greywater lines and point of use stations should be clearly marked to prevent accidental use for potable water quality applications;
- Based on an assessment of risks to human health and the environment, consider re-use of treated effluent, especially in areas with limited raw water supplies. Treated wastewater quality for land application or other uses should be consistent with the relevant public health-based guidance from the World Health Organization (WHO) and applicable national requirements.

17. Solid Waste

Solids removed from wastewater collection and treatment systems may include sludge and solids from cleaning of drainage and sewer collection systems (including seepage systems), screening solids, and sludge from various unit operations used for wastewater treatment. Recommended strategies for the management of solid wastes include:

- Select appropriate sludge treatment technologies, considering, for example, the quantity and sources of sludge; available resources for capital expenditures, training, operations and maintenance; availability of skilled operators, maintenance personnel, etc.; and the desired disposal methods or end uses of the treated solids. Sludge treatment technologies are discussed in Annex A;
- Land application or other beneficial re-use of wastewater treatment plant residuals should be considered but only based on an assessment of risks to human health and the environment. Quality of residuals for land application should be consistent with the relevant public health-based guidance from the World Health Organization (WHO) and applicable national requirements;
- Processing, disposal and re-use of wastewater treatment plant residuals should be consistent with applicable national requirements or, in their absence, internationally accepted guidance and standards.

18. Air Emissions and Odors

Air emissions from wastewater treatment operations may include hydrogen sulfide, methane, ozone (in the case of ozone disinfection), volatile organic compounds (such as from industrial discharges), gaseous or volatile chemicals used for disinfection processes (e.g., chlorine and ammonia), and bioaerosols. Odors from treatment facilities can also be a nuisance to workers and the surrounding community. Measures related to management of air emissions from drinking water treatment systems, discussed above, are also generally applicable to wastewater treatment facilities. In addition, the following measures are recommended to prevent, minimize, and control air emissions and odors:

- Cover emission points (e.g., aeration basins, clarifiers, sludge thickeners, tanks, and channels), and vent emissions to control systems (e.g., compost beds, biofilters, chemical scrubbers, etc.) as needed to reduce odors and otherwise meet applicable national requirements and internationally accepted guidelines;

- Where necessary, consider alternate aeration technologies or process configurations to reduce volatilization.

19. Hazardous Chemicals

Wastewater treatment often includes the use of hazardous chemicals, such as strong acids and bases for pH control, chlorine or other compounds used for disinfection, etc. Environmental impacts and mitigation measures discussed above for disinfection in drinking water treatment are also generally applicable to disinfection in wastewater treatment facilities. Additional guidance on chemicals management is provided in the General EHS Guidelines.

1.2 Occupational Health and Safety

Occupational health and safety impacts during the construction and decommissioning of Water and Sanitation facilities are common to other large industrial projects and are addressed in the General EHS Guidelines. Occupational health and safety impacts associated with the operational phase of water and sanitation projects primarily include the following:

- Accidents and injuries
- Chemical exposure
- Hazardous Atmosphere
- Exposure to pathogens and vectors
- Noise

Accidents and Injuries

Work at water and sanitation facilities is often physically demanding and may involve hazards such as open water, trenches, slippery walkways, working at heights, energized circuits, and heavy equipment. Work at water and sanitation facilities may also involve entry into confined spaces, including manholes, sewers, pipelines, storage tanks, wet wells, digesters, and pump stations. Methane generated from anaerobic biodegradation of sewage can lead to fires and explosions. Mitigation measures for accidents and injuries are addressed in the General EHS Guidelines. In addition, the following procedures are recommended to prevent, minimize, and control accidents and injuries at water and sanitation facilities:

- Install railing around all process tanks and pits. Require use of a life line and personal flotation device (PFD) when workers are inside the railing, and ensure rescue buoys and throw bags are readily available;
- Use PFDs when working near waterways;
- Implement a confined spaces entry program that is consistent with applicable national requirements and internationally accepted standards. Valves to process tanks should be locked to prevent accidental flooding during maintenance;
- Use fall protection equipment when working at heights;
- Maintain work areas to minimize slipping and tripping hazards;

- Use proper techniques for trenching and shoring;
- Implement fire and explosion prevention measures in accordance with internationally accepted standards;
- When installing or repairing mains adjacent to roadways, implement procedures and traffic controls, such as:
    a. Establishment of work zones so as to separate workers from traffic and from equipment as much as possible
    b. Reduction of allowed vehicle speeds in work zones;
    c. Use of high-visibility safety apparel for workers in the vicinity of traffic
    d. For night work, provision of proper illumination for the work space, while controlling glare so as not to blind workers and passing motorists
- Locate all underground utilities before digging.

Chemical Exposure and Hazardous Atmospheres

Water and wastewater treatment involve use of potentially hazardous chemicals, including strong acids and bases, chlorine, sodium and calcium hypochlorite, and ammonia. Water may contain radioactive substances and heavy metals, which typically accumulate in the water treatment sludge.

Potential sources of exposure to radionuclides include: pumps and piping where mineral scales accumulate; lagoons, and flocculation and sedimentation tanks where residual sludges accumulate; filters, pumping stations, and storage tanks where scales and sludges accumulate; facilities where filter backwash, brines, or other contaminated water accumulates; facilities that are enclosed (radon); residuals processing or handling areas; and land disposal or application areas where residuals are shoveled, transported, or disposed. Wastewater may contain potentially hazardous chemicals depending on the source water quality, drinking water treatment processes, and industries discharging to the sewer, including chlorinated organic solvents and pesticides, PCBs, polycyclic aromatics, petroleum hydrocarbons, flame retardants, nitrosamines, heavy metals, asbestos, dioxins, and radioactive materials. In addition, workers may be exposed to hydrogen sulfide, methane, carbon monoxide, chloroform, and other chemicals generated during wastewater treatment. Oxygen may be displaced or consumed by microorganisms, thus resulting in an oxygen deficient environment in areas where wastewater or wastewater residues are processed.

Prudent handling and storage of hazardous chemicals, as described in General EHS Guidelines and in Section 1.1, above, will help to minimize potential risks to workers. In addition, the following procedures are recommended to prevent, minimize, and control chemical exposure at water and sanitation facilities include:

- Implement a training program for operators who work with chlorine and ammonia regarding safe handling practices and emergency response procedures;
- Provide appropriate personal protective equipment (including, for example, self-contained breathing apparatus) and training on its proper use and maintenance.
- Prepare escape plans from areas where there might be a chlorine or ammonia emission;

- Install safety showers and eye wash stations near the chlorine and ammonia equipment and other areas where hazardous chemicals are stored or used;
- If source water contains radioactive substances, locate water treatment units and water treatment sludge areas as far as possible from common areas (e.g., offices);
- Conduct radiation surveys at least annually, especially in areas where radionuclides are removed;
- Limit wastes entering the sewer system to those that can be effectively treated in the wastewater treatment facility and reduce the amount of air-strippable hazardous compounds entering the system by controlling industrial discharges (e.g., by permit or similar system). Analyze incoming raw wastewater to identify hazardous constituents;
- Ventilate enclosed processing areas and ventilate equipment, such as pump stations, prior to maintenance.
- Use personal gas detection equipment while working in a wastewater facility;
- Continuously monitor air quality in work areas for hazardous conditions (e.g. explosive atmosphere, oxygen deficiency);
- Periodically sample air quality in work areas for hazardous chemicals. If needed to meet applicable occupational health national requirements or internationally accepted standards, install engineering controls to limit worker exposure, for example collection and treatment of off-gases from air stripping;
- Prohibit eating, smoking, and drinking except in designated areas;
- Rotate personnel among the various treatment plant operations to reduce inhalation of air-stripped chemicals, aerosols, and other potentially hazardous materials.

Pathogens and Vectors

Workers and staff at wastewater and sludge treatment facilities and fields where treated wastewater or sludge is applied, as well as operators of sludge collection vehicles, can be exposed to the many pathogens contained in sewage. Processing of sewage can generate bioaerosols which are suspensions of particles in the air consisting partially or wholly of microorganisms, such as bacteria, viruses, molds, and fungi. These microorganisms can remain suspended in the air for long periods of time, retaining viability or infectivity. Workers may also be exposed to endotoxins, which are produced within a microorganism and released upon destruction of the cell and which can be carried by airborne dust particles. Vectors for sewage pathogens include insects (e.g. flies), rodents (e.g. rats) and birds (e.g. gulls). Recommended measures to prevent, minimize, and control exposure to pathogens and vectors include:

Wastewater and Sludge Treatment

- Include in safety training program for workers, safe handling and personal hygiene practices to minimize exposure to pathogens and vectors;
- Use vacuum trucks or tugs for removal of fecal sludge instead of manual methods;
- Provide and require use of suitable personal protective clothing and equipment to prevent contact with wastewater (e.g., rubber gloves, aprons, boots, etc.). Especially

provide prompt medical attention and cover any skin trauma such as cuts and abrasions to prevent infection and use protective clothing and goggles to prevent contact with spray and splashes;

- Provide areas for workers to shower and change clothes before leaving work and provide laundry service for work clothes. This practice also helps to minimize chemical and radionuclide exposure;
- Encourage workers at wastewater facilities to wash hands frequently;
- Provide worker immunization (e.g. for Hepatitis B and tetanus) and health monitoring, including regular physical examinations;
- Reduce aerosol formation and distribution, for example by:
  a. Planting trees around the aeration basin to shield the area from wind and to capture the droplets and particles
  b. Using diffused aeration rather than mechanical aeration and using finer bubbles for aeration
  c. Reducing aeration rate, if possible
  d. Use of floating covers on the mixed liquor of the aeration basin
  e. Suppression of droplets just above the surface, (e.g. by installing a screen or mesh above the basin);
  f. Collection of droplets (e.g. by sedimentation, scrubber, electrostatic precipitator, or fabric filter)
  g. Disinfection of airborne particles (e.g., by using ultraviolet lights)
  h. Use of submerged effluent collector (such as pipes with orifices) rather than weirs
- Avoid handling screenings by hand to prevent needle stick injuries;
- Maintain good housekeeping in sewage processing and storage areas;
- Advise individuals with asthma, diabetes, or suppressed immune systems not to work at wastewater treatment facilities, especially composting facilities, facility because of their greater risk of infection.

Land Application

- Consider use of drip irrigation of treated wastewater, which minimizes worker exposure and the amount of water needed. Avoid use of spray irrigation of treated wastewater, if possible;
- Provide field workers with personal protective equipment, such as rubber gloves and waterproof shoes;
- Provide access to safe drinking water and sanitation (including hand washing) facilities;
- Provide worker health monitoring, including regular physical examinations;
- Control vectors and intermediate hosts.

Noise

High noise levels can be present in the vicinity of operating machinery and flowing water at water and sanitation facilities. Impacts and mitigation measures are similar to those at other industrial facilities, and are addressed in the General EHS Guidelines.

1.3 Community Health and Safety

Community health and safety impacts during the construction of water and sanitation projects include some which are common to those of other industry sectors and are therefore discussed in the General EHS Guideline. Community health and safety impacts associated with operation of water and sanitation projects are discussed separately below.

1.3.1 Drinking Water

Water Intake (Water Supply Protection)

Both surface water and groundwater supplies can become contaminated with potentially toxic substances of natural and anthropogenic origins, including pathogens, toxic metals (e.g. arsenic), anions (e.g. nitrate), and organic compounds. Such contamination might result from natural sources, actions or releases that are routine (e.g. discharges within permit limits), accidental (e.g. from a spill), or intentional (e.g. sabotage). Recommended measures to protect the quality of the water supply include:

- Determine the area that contributes water to the source (e.g. watershed of a stream or recharge area for groundwater), identify potential sources of contamination with the area, and collaborate with public authorities in the implementation of management approaches to protect the source water quality, such as:
    a. Zoning ordinance provisions
    b. Facility inspection or hazardous material survey program
    c. Information to businesses concerning applicable requirements
    d. Environmental permits checklist for new businesses;
    e. Strategic monitoring within area
    f. Development and implementation of educational campaigns to promote best management practices that reduce the risk of water contamination
    g. Incorporation of surface water protection into regional land use planning
- Evaluate the vulnerability of the water source to disruption or natural events, and implement appropriate security measures as necessary, such as:
    a. Continuously monitor raw water for surrogate parameters (such as pH, conductivity, total organic carbon [TOC], and toxicity)
    b. Inspect sites at random times
    c. For reservoirs and lakes, implement a neighborhood watch program with local park staff and other community users of the reservoir/lake
    d. Equip wellheads with intrusion alarms

Water Treatment

The most significant potential community health and safety impacts associated with water treatment include:

- Drinking water quality and supply
- Hazardous chemicals

Drinking Water Quality and Supply

An adequate supply of clean drinking water is critical to community health and hygiene. Recommended measures related to water treatment include:

- Ensure that treatment capacity is adequate to meet anticipated demand;
- Construct, operate and maintain the water treatment facility in accordance with national requirements and internationally accepted standards26 to meet national water quality standards or, in their absence, WHO Guidelines for Drinking Water Quality;
- Evaluate the vulnerability of the treatment system and implement appropriate security measures, such as:
  a. Background checks of employees
  b. Perimeter fencing and video surveillance
  c. Improve the electrical power feeds to the facilities. Redundant electrical power systems significantly reduce the vulnerability risk to essential operations

Hazardous Chemicals

Hazardous chemical associated with drinking water treatment and mitigation measures associated with minimizing potential impacts to the environment and to workers are discussed in Sections 1 and 2, respectively. If a worst-case release scenario could affect the general public, prepare and implement a release prevention program for major hazards as described in the General EHS Guidelines. The prevention program should include identification of hazards, written operating procedures, training, maintenance, accident investigation, and an emergency response plan.

Water Distribution

The water distribution system is a critical component in delivery of safe potable water. Even if water is effectively treated to remove contaminants and destroy pathogens, waterborne diseases outbreaks can occur because of deficiencies in the water distribution system. Recommended measures to prevent or minimize potential community health risks associated with the water distribution system include:

- Construct, operate, and manage the water distribution system in accordance with applicable national requirements and internationally accepted standards;
- Construct and maintain the distribution system so that it acts as a barrier and prevents external contamination from entering the water system by, for example:
  a. Inspecting storage facilities regularly, and rehabilitate or replace storage facilities when needed. This may include draining and removing sediments, applying rust proofing, and repairing structures
  b. Ensuring that all installation, repair, replacement, and rehabilitation work conforms to requirements for sanitary protection and materials quality
  c. Testing material, soil, and water quality and implementing best practices to prevent corrosion, such as cathodic protection
  d. Preventing cross- connections with sewerage systems.

e. Separating water lines and sewer pressure mains (e.g., at least 10 ft apart or in separate trenches, with the sewer line at least 18 inches below the water line)

- Maintain adequate water pressure and flow throughout the system, for example by:
  a. Implementing a leak detection and repair program (see section 1.1)
  b. Reducing residence time in pipes
  c. Maintaining positive residual pressure of at least 20
  d. pounds per square inch (psi)
  e. Monitoring hydraulic parameters, such as inflows, outflows, and water levels in all storage tanks, discharge flows and pressures for pumps, flows and/or pressure for regulating valves, and pressure at critical points, and using system modeling to assess the hydraulic integrity of the system
- Prevent introduction of contamination from the distribution system itself, for example by:
  a. Minimizing microbial growth and biofilm development (e.g. by ensuring adequate residual disinfection levels). Collect samples from several locations throughout the distribution system, including the farthest point, and test for both free and combined chlorine residual to ensure that adequate chlorine residual is maintained
  b. Choosing residual disinfectant (e.g. chlorine or chloramines) to balance control of pathogens and formation of potentially hazardous disinfection byproducts (Chemical disinfectants can react with organic and inorganic precursors to form potentially harmful byproducts. Disinfection byproducts (DBP) can be controlled through DBP precursor control and removal, or through modified disinfection practice. However, the risks to health from these byproducts at the levels at which they occur in drinking-water are extremely small in comparison with the risk associated with inadequate disinfection.)
  c. Using construction materials that do not contribute to release undesirable metals and other substance or interact with residual disinfectants

1.3.2 Sanitation

Measures to minimize potential community health risks can be implemented both in the collection and treatment of wastewater and sludge.

Wastewater and Septage Collection

Collection of sewage and transportation away from residential areas, while not alone sufficient to protect public health, is nevertheless generally the most important aspect of sanitation. Therefore, provision of collection services, or ensuring that collection services are available, is of primary concern. Effective design and operation of a sewerage system, as addressed in Section 1.1, can minimize the potential for community exposure and health impacts from raw wastewater and sludge collection, for example by:

- Preventing sewerage system overflows;

- Preventing buildup of potentially toxic and explosive gasses in the sewer.

Wastewater and Sludge Treatment

Potential community health and safety impacts associated with wastewater and sludge treatment facilities include:

- Liquid effluents
- Air emissions and odors
- Physical hazards

Liquid Effluents

Treated wastewater effluents are typically discharged to surface water or re-used for irrigation or other purposes. In many cases, direct or indirect human contact with treated wastewater is likely. Therefore, adequate wastewater treatment to remove contaminants and, especially, microorganisms and pathogens, is important not only to prevent adverse environmental impacts, but to protect public health as well.

Air Emissions and Odors

Odors from wastewater treatment facilities can be a nuisance to the neighboring community. Bioaerosols can also carry disease-causing microorganisms. Furthermore, releases of hazardous gases, such as chlorine, could adversely affect nearby residents. In addition, the following measures are recommended to prevent, minimize, and control community exposure to dust and odors from waste management facilities:

- Provide adequate buffer area, such as trees, or fences, between processing areas and potential receptors;
- Avoid siting facilities near densely populated neighborhoods and installations with potentially sensitive receptors, such as hospitals and schools. Site facilities downwind from potential receptors, if possible.

Physical Hazards

Visitors and trespassers at wastewater treatment facilities may be subject to many of the hazards for site workers. Recommended measures to prevent, minimize, and control physical hazards to the community include:

- Restrict access to waste management facilities by implementing security procedures, such as:
    a. Perimeter fencing of adequate height and suitable material, with lockable site access gate
    b. Security cameras at key access points, and security alarms fitted to buildings and storage areas; and
    c. Use of a site visitor register
- Light the site where necessary. As this may cause light nuisance to neighbors, the lighting installations should be selected to minimize ambient light pollution.

Land Application

Use of treated wastewater in agriculture can pose public health risks. Hazards associated with crops irrigated with treated wastewater include excreta-related pathogens and toxic chemicals that may be present in the wastewater. The following methods are recommended to protect consumers:

- Treat wastewater and sludge used for land application in a manner consistent with WHO Guidelines for the Safe Use of Wastewater, Excreta and Greywater and applicable national requirements;
- Stop irrigation with treated wastewater two weeks prior to harvesting;
- Limit irrigation with treated wastewater to crops that are cooked before eating;
- Restrict public access to hydraulic structures carrying wastewater and to fields irrigated with treated wastewater.

2.0 Performance Indicators and Industry Benchmarks

2.1 Environmental Performance Guidelines

Drinking Water

Water quality of potable water supply systems should meet nationally legislated drinking water standards or, in their absence, the most recent World Health Organization (WHO) Guidelines for Drinking Water Quality throughout the distribution network.

Sanitation

Effluent Guidelines: The choice of sanitation technology and design of wastewater treatment begin with a determination of the required level and type of treatment. Project-specific effluent guidelines for sanitation projects should be established based on a clear definition of health objectives and a comprehensive evaluation of alternatives, considering appropriate treatment technologies; quality and quantity of raw wastewater and its variability; available land area for the treatment facility; resources for capital expenditures, training, operation, maintenance, and repair; and availability of skilled operators, maintenance personnel, treatment chemicals, and replacement parts. The selected approach should achieve effluent water quality consistent with applicable national requirements or internationally accepted and with effluent water quality goals based on the assimilative capacity and the most sensitive end use of the receiving water. Treatment standards usually are either technology standards, which specify the treatment technologies or processes that must be used to meet water quality objectives, or effluent standards, which specify the physical, biological, and chemical quality of the effluent to be produced by the treatment. Effluent standards often set limits on allowable concentrations of biochemical oxygen demand (BOD), chemical oxygen demand (COD), total suspended solids (TSS), nitrogen, phosphorous, etc.

Treated Wastewater Re-use and Sludge Management: Treated wastewater and sludge quality for land application should be consistent with WHO Guidelines for the Safe Use of Wastewater, Excreta and Greywater and applicable national requirements. Potential impact on soil, groundwater, and surface water, in the context of protection, conservation and long term sustainability of water and land resources should be assessed when land is used as part of any wastewater treatment system. Sludge from a waste treatment plant needs to be evaluated on a case-by-case basis to establish whether it constitutes a hazardous or a non-hazardous waste and managed accordingly as described in the Waste Management section of this document.

Environmental Monitoring

Environmental monitoring programs for this sector should be implemented to address all activities that have been identified to have potentially significant impacts on the environment, during normal operations and upset conditions. Environmental monitoring activities should be based on direct or indirect indicators of emissions, effluents, and resource use applicable to the particular project. Monitoring frequency should be sufficient to provide representative data for the parameter being monitored using internationally recognized standards and procedures. Monitoring should be conducted by trained individuals following monitoring and record-keeping procedures and using properly calibrated and maintained equipment. Monitoring data should be analyzed and reviewed at regular intervals and compared with the operating standards so that any necessary corrective actions can be taken. Additional guidance on applicable sampling and analytical methods for emissions and effluents is provided in the General EHS Guidelines.

2.2 Occupational Health and Safety Performance

Occupational Health and Safety Guidelines

Occupational health and safety performance should be evaluated against internationally published exposure guidelines, of which examples include the Threshold Limit Value (TLV®) occupational exposure guidelines and Biological Exposure Indices (BEIs®) published by American Conference of Governmental Industrial Hygienists (ACGIH), the United States National Institute for Occupational Health and Safety (NIOSH), Permissible Exposure Limits (PELs) published by the Occupational Safety and Health Administration of the United States (OSHA), Indicative Occupational Exposure Limit Values published by European Union member states, or other similar sources.

Accident and Fatality Rates

Projects should try to reduce the number of accidents among project workers (whether directly employed or subcontracted) to a rate of zero, especially accidents that could result in lost work time, different levels of disability, or even fatalities. Facility rates may be benchmarked against the performance of facilities in this sector in developed countries through consultation with published sources (e.g. US Bureau of Labor Statistics and UK Health and Safety Executive).

Occupational Health and Safety Monitoring

The working environment should be monitored for occupational hazards relevant to the specific project. Monitoring should be designed and implemented by credentialed professionals experienced in water and sanitation as part of an occupational health and safety monitoring program. Facilities should also maintain a record of occupational accidents and diseases and dangerous occurrences and accidents. Additional guidance on occupational health and safety monitoring programs is provided in the General EHS Guidelines.

Annex A: General Description of Industry Activities

A.1 Drinking Water Supply

Access to water of an adequate quality is essential for public health and hygiene. A drinking water supply system typically includes the following elements:

- A water source, such as a river, lake, reservoir, or groundwater aquifer where water collects, as well as the surrounding watershed or recharge area that supplies water to the source and a means of extracting and transporting water from the source to a point of treatment.
- A treatment facility for water purification.
- Treated water storage facilities and a distribution system from to deliver treated water from storage to consumption (at houses, fire hydrants, industrial use points, etc).

Water Sources

Traditional sources for potable water treatment include groundwater resources and surface water. Where surface or groundwater of adequate quality is unavailable, other sources of water including seawater, brackish water, etc. may be used to produce potable water.

Groundwater: Groundwater is recharged from and flows to the surface naturally, and provides a long- term reservoir in the natural water cycle, with residence times ranging from days to millennia. Groundwater quality varies depending on the source, but generally has good clarity because of the natural filtering of groundwater as it passes through porous soil layers. In general, deep groundwater has low concentrations of pathogenic bacteria but may be rich in dissolved solids, especially carbonates and sulfates of calcium and magnesium. The bacteriological quality of shallow groundwater can be variable depending on the nature of the recharge area. A variety of soluble materials may be present including potentially toxic metals such as zinc, copper, and arsenic.

Surface Water: Surface water quality is highly dependent on the source. Upland lakes and reservoirs are typically located in the headwaters of river systems upstream of human habitation. Bacteria and pathogen levels are usually low, but some bacteria, protozoa or algae will be present. Where uplands are forested or peaty, humic acids can color the water. Many upland surface water sources have low pH. Rivers, canals, and low-land reservoirs generally have higher bacterial concentrations and may also contain algae, suspended solids, and a variety of dissolved constituents.

Other Water Sources: Other water sources include seawater and brackish water, which contain high concentrations of dissolved solids, which must be removed to make the water suitable for domestic, agricultural, and industrial uses.

Water Treatment

Treatment required to render water suitable for human consumption varies depending on the water source, but may include removal of suspended solids, removal of dissolved materials, and disinfection.

Removal of Suspended Solids

Suspended solids are usually removed by sedimentation and/or filtration. Coagulation, flocculation, and sedimentation may be used as pretreatment to enhance the effectiveness and minimize the cost of subsequent filtration. Coagulation involves adding chemicals to the water, such as pH buffers and coagulants, to facilitate subsequent treatment steps. The chemically treated water is sent into a basin where the suspended particles can collide and form heavier particles called floc. Gentle agitation and appropriate retention times facilitate this process. The velocity of water is then decreased so that suspended material can settle out of the water stream by gravity. The floc can also be removed directly during filtration. Common filtration methods include slow sand filters, diatomaceous earth filters, and direct filtration systems. Smaller water treatment systems might also use membrane and cartridge filtration systems.

- A slow sand filter comprises a bed of fine sand approximately 3 to 4 feet deep supported by a 1-foot layer of gravel and an underdrain system. Slow sand filters are relatively inexpensive to install, are simple to operate and reliable, and are to achieve greater than 99.9 percent Giardia cyst removal. However, these filters are not suitable for water with high turbidity, and the filter surface requires maintenance. Extensive land is required due to rates of flow (0.03 to 0.10 gallons per minute per square foot [gal/min/ft2] of filter bed area). Slow sand filters do not require00 coagulation/flocculation and may not require sedimentation.
- Diatomaceous earth filtration, also known as precoat or diatomite filtration, relies on a layer of diatomaceous earth approximately 1/8-inch thick placed on a septum or filter element. Septa may be placed in pressure vessels or operated under a vacuum in open vessels. Diatomaceous earth filters are simple to operate and are effective in removing cysts, algae, and asbestos. They have been chosen for projects with limited initial capital, and for emergency or standby capacity to service large seasonal increases in demand. Diatomaceous filters are most suitable for water with low bacterial counts and low turbidity (less than 10 nephelometric turbidity units [NTU]). Coagulant and filter aids are required for effective virus removal. Operation of diatomaceous earth filters generates spent filter cake.
- Direct filtration systems are similar to conventional systems, but omit sedimentation, and some multiple-stage filtration systems can eliminate the need for chemical coagulation as well. Direct filtration may include several combinations of treatment processes. Dual- and mixed-media filters may be used to effectively process higher influent turbidities. Effective direct filtration performance ranges from 90 to 99 percent for virus removal and from 10 to 99.99 percent for Giardia removal. Direct filtration is most applicable for systems with high quality and seasonally consistent influent supplies. The influent generally should have turbidity of less than 5 to 10 NTU and color of less than 20 to 30 units.

- Membrane filtration uses pressure to force water through a thin membrane. Contaminants are retained on the high-pressure side and frequently must be removed by reversing the flow and flushing the waste. The membrane technologies are relatively simple to install and, for groundwater sources that do not need pretreatment, the systems require little more than a feed pump, a cleaning pump, the membrane modules, and holding tanks. The operation of membrane systems can be highly automated. Membrane processes can be used for removal of bacteria and other microorganisms, particulate material, and natural organic material. However, membrane efficiency can be reduced by fouling. Periodic chemical cleaning may be required to remove persistent contaminants.
- Cartridge filtration forces water through porous media to remove particles; pore sizes suitable for producing potable water range from 0.2 to 1.0 µm. Pretreatment with a roughing filter prior to cartridge filtration is sometimes necessary to prevent the rapid fouling of the cartridges. Cartridge filters may be suitable for removing microbes and turbidity in small systems. These systems are easy to operate and maintain. Polypropylene cartridges become fouled relatively quickly and must be replaced with new units; therefore, cartridge filtration systems are generally practical only for raw water with low turbidity. Although these filter systems are operationally simple, they are not automated and can require relatively large operating budgets. The filter media may require periodic cleaning.

Removal of Dissolved Contaminants

Some water sources must be treated to remove dissolved materials, which are not affected by coagulation and filtration, to achieve water of adequate quality. High concentrations of metals such as calcium and magnesium contribute to “hard” water, and resulting scaling problems. Dissolved metals such as iron and manganese can adversely affect the water’s taste and cause stains and buildup of metal oxide particles in water tanks and pipelines. Radionuclides, nitrates, and toxic metals, such as copper and arsenic, can cause health impacts. Dissolved organic compounds can also cause adverse aesthetic and health impacts. Treatment methods include lime softening, oxidation, ion exchange, reverse osmosis, electrodialysis, aeration, and activated carbon filtration.

- Lime softening involves raising the pH of the water to precipitate calcium carbonate and magnesium hydroxide using lime or hydrated lime. The resulting precipitate is removed by settling or filtration. Following filtration, the pH is lowered by addition of carbon dioxide, which is usually generated by on-site fossil fuel combustion. In addition to removing calcium and magnesium, lime softening can also remove iron and manganese, heavy metals, arsenic, radionuclides (uranium, radium 226, and radium 228), and certain organic compounds. Lime softening is best suited to groundwater sources, which have relatively stable water quality. The combination of variable source water quality and the complexity of the chemistry of lime softening generally may make lime softening too complex for small systems that use surface water sources. Excessively soft water can cause corrosion in pipes. This corrosion can shorten the service life of pipes and household appliances and can result in toxic materials, such as lead and cadmium, being dissolved in drinking water.

- Oxidation can be used to remove metals such as iron and manganese by formation of insoluble species that can be then filtered from the water. Oxidation can also be used to destroy certain organic contaminants. The most common chemical oxidants used in water treatment include chlorine, chlorine dioxide, potassium permanganate, and ozone. Oxidation using chlorine or potassium permanganate is frequently applied in small groundwater systems. The dosing is relatively easy, requires simple equipment, and is relatively inexpensive.
- Chlorination is widely used for oxidation of divalent iron and manganese. However, the formation of trihalomethanes (THMs) may be a problem. As an oxidant, potassium permanganate (KMnO4) is normally more expensive than chlorine and ozone, but for iron and manganese removal, it has been reported to be as efficient and it requires considerably less equipment and capital investment. The dose of potassium permanganate, however, must be carefully controlled. Ozone may be used for iron and manganese oxidation, but may not be effective for oxidation in the presence of humic or fulvic materials. Oxygen can also be used as an oxidant, provided iron is not complexed with humic materials or other large organic molecules. The presence of other oxidizable species in water hinders oxidation of the desired reduced compounds.
- Ion exchange can be used to remove any charged (i.e., ionic) species from water, but is usually used to remove hardness and nitrates. Removal is accomplished through adsorption of contaminant ions onto a resin exchange medium. Water is usually pretreated to reduce the suspended solids and total dissolved solids (TDS) load to the ion-exchange unit. Ion exchange can be used with fluctuating flow rates. Ion exchange waste is highly concentrated and requires careful disposal. Ion exchange units also are sensitive to the presence of competing ions. For example, influent with high levels of hardness will compete with other cations (positive ions) for space on the exchange medium, and the exchange medium must be regenerated more frequently.
- Reverse osmosis (RO) removes contaminants from water using a semi-permeable membrane that permits only water, and not dissolved ions (such as sodium and chloride), to pass through its pores. Raw water is subject to a high pressure that forces pure water through the membrane, leaving contaminants behind in a brine solution. RO can effectively remove nearly all inorganic contaminants from water. It removes more than 70 percent of arsenic (III), arsenic (IV), barium, cadmium, chromium (III), chromium (VI), fluoride, lead, mercury, nitrite, selenium (IV), selenium (VI), and silver, and properly operated units can attain up to 96 percent removal rates. RO can also effectively remove radium, natural organic substances, pesticides, and microbiological contaminants. RO is particularly effective when used in series; water passing through multiple units can achieve near zero effluent contaminant concentrations. RO systems are relatively insensitive to flow and TDS concentration, and therefore are suitable for small systems with a high

degree of seasonal fluctuation in water demand. Operational simplicity and automation allow for less operator attention and make RO suitable for small system applications. However, RO tends to have high capital and operating costs, and a high level of pretreatment is required in some cases to prevent fouling. Reverse osmosis is also used for desalination of seawater and other water sources with high quantities of dissolved solids. Pure desalination water is usually acidic and corrosive to pipes, so it typically mixed with other sources of water that are piped onsite or else adjusted for pH, hardness, and alkalinity before being piped offsite. The product water recovery relative to input water flow is 15 to 50 percent for most seawater desalination plants (i.e., for every 100 gallons of seawater, 15 to 50 gallons of pure water would be produced along with brine water containing dissolved solids). The brine and other liquid wastes from desalination plants may contain all or some of the following constituents: high salt concentrations, chemicals used during defouling of plant equipment and pretreatment, and toxic metals (which may be present if the discharge water was in contact with metallic materials used in construction of the plant facilities). Liquid wastes may be discharged directly into the ocean, combined with other discharges (e.g., power plant cooling water or sewage treatment plant effluent) before ocean discharge, discharged into a sewer for treatment in a sewage treatment plant, or evaporated (with the remaining solids disposed of in a landfill). Desalination plants also produce a small amount of solid waste (e.g., spent pretreatment filters and solid particles that are filtered out in the pretreatment process).

- Electrodialysis uses an electrical charge and a semi-permeable membrane to remove charged species. The membranes are designed to allow either positively or negatively charged ions to pass through the membrane; thus ions move from the product water stream through a membrane to the two reject water streams. The reject stream is typically 20–90 percent of feed flow. Electrodialysis can remove most dissolved ions, and is very effective in removing fluoride and nitrate, and can also remove barium, cadmium, and selenium. Electrodialysis is relatively insensitive to flow and TDS level, and low effluent concentration possible. These systems tend to have high capital and operating costs, and may require a high level of pretreatment.
- Aeration (air stripping) can be used to remove volatile compounds and radon from source water. The volatilized contaminants are released to the atmosphere, with or without treatment. Aeration systems that might be suitable for drinking water systems include packed column aeration, diffused aeration, multiple- tray aeration, and mechanical aeration. A small system might be able to use a simple aerator constructed from relatively common materials instead of a specially designed aerator system.
- Activated carbon removes contaminants through adsorption, primarily a physical process in which dissolved contaminants adhere to the porous surface of the carbon particles. Activated carbon removes many organic contaminants as well as taste and odor from water supplies. Organics that are not readily adsorbed by

activated carbon include alcohols; low molecular weight aliphatics (including vinyl chloride), ketones, acids, and aldehydes; sugars and starches; and very high-molecular weight or colloidal organics. Radon removal by activated carbon is not feasible at the treatment plant scale. Activated carbon is replaced periodically when the surface area is saturated and can no longer effectively adsorb contaminants. However, the adsorption process can be reversed relatively easily, allowing regeneration and re-use of the activated carbon.

Disinfection

Water systems add disinfectants to destroy microorganisms that can cause disease in humans. The most commonly used disinfection agents include chlorine, chloramines, ozone, and ultraviolet light. Other disinfection methods include chlorine dioxide, potassium permanganate, and nano-filtration. Primary disinfection achieves the desired level of microorganism kill or inactivation, while secondary disinfection maintains a disinfectant residual in the finished water that prevents the regrowth of microorganisms.

- Chlorine is very effective for removing almost all microbial pathogens and is appropriate as both a primary and secondary disinfectant. Chlorine can be used in the form of chlorine gas, sodium hypochlorite, or calcium hypochlorite. Chlorine gas is usually supplied as a liquid in high-pressure cylinders, and it can also be generated onsite by electrolysis of sodium chloride solution. Sodium hypochlorite is usually stored in an aqueous solution, and diluted before use. Calcium hypochlorite is usually stored as a solid that is usually dissolved in water before use. The chlorination chemical is usually injected into the water supply line and a controlled rate. Chlorine reacts with organic material naturally present in many water sources to form harmful chemical by-products, principally trihalomethanes.
- Chloramine is an effective bactericide that produces lower levels of trihalomethanes than chlorine. Chloramines are generated on site by injecting chlorine (gaseous solution or sodium hypochlorite) into the supply main followed immediately by injection of ammonia (gaseous solution or as ammonium hydroxide). Chloramine is a weak disinfectant, and is much less effective against viruses or protozoa than free chlorine. Chloramine is often used as a secondary disinfectant to prevent bacterial re-growth in a distribution system.
- Ozone, an allotrope of oxygen having 3 atoms to each molecule, is a powerful oxidizing and disinfecting agent. Ozone gas is unstable and must be generated on site by passing dry air through a system of high-voltage electrodes. Ozonation requires a shorter contact time than does chlorine. Ozone does not directly produce halogenated organic materials unless a bromide ion is present. A secondary disinfectant, such as chloramine, is required because ozone does not maintain an adequate residual in water. The capital costs of ozonation systems are relatively high, and operation and maintenance are relatively complex.
- Ultraviolet (UV) radiation is generated by a special lamp. When it penetrates the cell wall of an organism, the cell's genetic material is disrupted and the cell is unable to reproduce, effectively destroying bacteria and viruses. As with ozone, a secondary disinfectant must be used to prevent re-growth of microorganisms. UV

radiation can be attractive as a primary disinfectant for small systems because it is readily available, it produces no known toxic residuals, it requires short contact times, and the equipment is easy to operate and maintain. However, UV radiation may not inactivate Giardia lamblia or Cryptosporidium cysts. UV radiation is unsuitable for water with high levels of suspended solids, turbidity, color, or soluble organic matter because these materials can react with or absorb the UV radiation, reducing the disinfection performance.

Water Distribution and Storage

Water distribution systems include all of the components necessary to carry drinking water from a centralized treatment plant or well supplies by means of gravity storage feed or pumps through distribution pumping networks to the consumers, including distribution and equalization storage. These systems consist of pipes, pumps, valves, storage tanks, reservoirs, meters, fittings, and other hydraulic appurtenances. Distribution systems are designed and operated to deliver water of quality acceptable for human consumption and of sufficient quantity to meet all the needs of the customers. Many distributions also provide sufficient capacity for non-potable uses, including irrigation, landscaping, and fire suppression. Most water distribution pipes are constructed of ductile iron, prestressed concrete, polyvinyl chloride, reinforced plastic, and steel. In the past, unlined cast iron and asbestos cement pipes were also used, and may be important components of existing systems.

Water distribution systems may have a branch or loop network topology, or a combination of both. In a branch system, smaller pipes branch off or larger ones throughout the system such that water can take only one pathway from the source to the consumer. A loop system comprises connected pipe loops throughout the service area such that water can take several pathways from the source to the consumer. In a loop system, if any one section of water distribution main fails or needs repair, that section can be isolated without disrupting all users on the network. Most water distribution networks include both loop and branch components. Decentralized treatment systems, which provide additional treatment near the point of use depending on the customers' needs, have been implemented in trials, and may be utilized more in the future. Dual distribution systems that provide separate mains for potable and non-potable water (e.g., reclaimed water used for irrigation, fire protection) are used in some communities.

- Storage tanks and reservoirs are used to provide storage capacity to meet fluctuations in demand, to provide reserve supply for fire suppression and other emergency needs, to stabilize pressures in the distributions system, to increase operating convenience an provide flexibility in pumping, to provide water during source or pump failures, and to blend different water sources. Elevated tanks are used most frequently, but other types of tanks and reservoirs include inground tanks and open or closed reservoirs. The water distribution system needs energy in the form of pressure to deliver the treated water. That energy can be supplied by a pump, by gravity feed from a water source (such as a reservoir or a water tower) at a higher elevation, or, in smaller systems, by compressed air.

- Valves are used to isolate sections of the network for maintenance and repair. Control valves are used to control the flow and pressure in the distribution system.

Ideally, the water quality should not change between the time it leaves the treatment plant and the time it is consumed. However, substantial changes can occur to finished water in the distribution system as the result of complex physical, chemical, and biological reactions. For example, tanks sized to provide adequate supply for fire suppression needs may have low turnover rates and low levels of disinfectant residual, leading to biofilm growth and other biological changes in the water such as nitrification. Design and operation of the distribution system can minimize such effects.

A.2 Sanitation

Sanitation systems protect human health and the environment by isolating, and in some manner treating, sewage waste. For rural areas, on-site sanitation systems, ranging from pit latrines to flush toilets and septic systems, are the most common. As population density increases, more complicated, centralized collection, storage, and treatment systems are needed.

Sludge Collection

On-site sanitation systems such as bucket latrines and septic systems require periodic removal of solids for proper functioning. The first stage of proper management of fecal sludge is collection and transport to a storage or treatment facility. Collection may be accomplished by manual means (e.g. with shovels and buckets), or with mechanical equipment. Mechanical equipment for septage collection include truckmounted vacuum tanks of 3 to 6 m3 capacity and small, handpushed vacuum tugs of 350 to 500 L. In houses situated close to a road, the septic tank can be emptied with the large truck and the septage can directly be hauled to the treatment site. If the house is situated in a narrow lane, a mini-vacuum- tug can be used. In that case, an intermediate storage tank (3 to 6 m^3) can be placed in the closest point accessible by truck, and the septage is transferred to the tank from the vacuum tug in several trips. This storage tank can then transferred to another emptying site or to the treatment site. One unit of equipment, either large or small, can serve 2 to 3 septic tanks per day or approximately 500 per year.

Sewerage

Sewers are closed conduits, usually circular in cross section, which carry wastewater. Sewerage refers to systems of sewers and includes pump stations, overflows, and other associated infrastructure. Most sewers are designed to carry either sewage or storm water, but many are combined sewers, which carry both sewage and storm water. Sewers may carry wastewater from residential, commercial, and industrial users, to storage, discharge, or wastewater treatment. Because industrial liquid waste may contain a wide range of chemicals, solvents, and other contaminants that cannot be effectively removed by the centralized wastewater treatment plant, industries are often required to pre- treat their liquid wastes prior to discharging to sewer.

Design and sizing of sewerage systems considers population served, commercial and industrial flows, flow peaking characteristics, and wet weather flows. Besides the projected sewage flow, the size and characteristics of the watershed are the overriding design considerations for combined sewers. Often, combined sewers cannot handle the volume of storm water runoff, resulting in combined sewer overflows, which are typically discharged to surface water with little if any treatment. Although separate sewer systems are intended to transport only sewage, all sewer systems have some degree of inflow and infiltration of surface water and groundwater. Inflow and infiltration are affected by antecedent moisture conditions, which also represent an important design consideration in separate sewer systems.

A typical method of conveyance used in sewer systems is to transport wastewater by gravity along a downward-sloping pipe gradient. These sewers, known as conventional gravity sewers, are designed so that the slope and size of the pipe is adequate to maintain flow towards the discharge point without surcharging manholes or pressurizing the pipe. Conventional gravity sewers are typically used in urban areas with consistently sloping ground because excessively hilly or flat areas result in deep excavations and drive up construction costs. Sewage pumping or lift stations may be necessary as a result of the slope requirements for conventional gravity sewers, which result in a system terminus (i.e., low spot) at the tail of the sewer, where sewage collects and must be pumped or lifted to a collection system.

Pumping and lift stations substantially increase the cost of the collection system. Manholes associated with conventional gravity sewers may be a source of inflow and infiltration, increasing the volume of wastewater to be carried, as well as the size of pipes and lift/pumping stations. Alternative wastewater collection systems can be cost effective for areas where traditional collection systems are too expensive to install and operate. For example, pressure sewers are sometimes used in sparsely populated or suburban areas in which conventional collection systems would be expensive. These systems generally use smaller diameter pipes with a slight slope or follow the surface contour of the land, reducing excavation and construction costs.

Pressure sewers differ from conventional gravity collection systems because they break down large solids in the pumping station before they are transported through the collection system. Their watertight design and the absence of manholes eliminate extraneous flows into the system. Thus, alternative sewer systems may be preferred in areas that have high groundwater that could seep into the sewer, increasing the amount of wastewater to be treated. They also protect groundwater sources by keeping wastewater in the sewer. The disadvantages of alternative sewage systems include increased energy demands, higher maintenance requirements, and greater on-lot costs. In areas with varying terrain and population density, a combination of sewer types may be appropriate.

Two major types of pressure sewer systems are the septic tank effluent pump (STEP) system and the grinder pump (GP). Neither requires any modification to plumbing inside the house. In STEP systems, wastewater flows into a conventional septic or interceptor tank to capture solids. The liquid effluent flows to a holding tank containing a pump and control devices. The effluent is then pumped and transferred for treatment.

Retrofitting existing septic tanks in areas served by septic tank/drain field systems would seem to present an opportunity for cost savings, but a large number (often a majority) must be replaced or expanded over the life of the system because of insufficient capacity, deterioration of concrete tanks, or leaks. In a GP system, sewage flows to a vault where a grinder pump grinds the solids and discharges the sewage into a pressurized pipe system. GP systems do not require a septic tank but may require more horsepower than STEP systems because of the grinding action. GP systems produce wastewater with higher TSS, which may not be acceptable at a downstream treatment facility.

Wastewater Treatment

Sewage treatment includes physical, chemical, and biological processes to remove physical, chemical, and biological contaminants. Its objective is to produce treated effluent and a solid waste or sludge that is suitable for discharge or reuse back into the environment. Typically, sewage treatment involves up to three stages, called primary, secondary and tertiary (or advanced) treatment.

- **Primary Treatment**
  Primary treatment is designed to remove gross, suspended and floating solids from raw sewage. This stage is sometimes referred to as mechanical treatment, although chemicals are often used to accelerate the sedimentation process. Preliminary screening removes large suspended and floating objects. After the wastewater has been screened, it may flow into a grit chamber where sand, grit, cinders, and small stones settle to the bottom. Removing the grit and gravel that washes off streets or land during storms is very important, especially in cities with combined sewer systems. Large amounts of grit and sand entering a treatment plant can cause serious operating problems, such as excessive wear of pumps and other equipment, clogging of aeration devices, or taking up capacity in tanks that is needed for treatment. The grit and screenings removed by these processes must be periodically collected and disposed of (e.g., by landfilling or incineration). With the screening completed and the grit removed, wastewater still contains dissolved organic and inorganic constituents along with suspended solids. Additional suspended solids may be removed by sedimentation or gravity settling, chemical coagulation, or filtration. The removed solid material is called primary sludge.
  Primary treatment can reduce the BOD of the incoming wastewater by 20 – 30 percent and the total suspended solids by 50 – 60 percent. Primary treatment is usually the first stage of wastewater treatment. In some cases, treatment plants begin with primary treatment and add other treatment stages as wastewater load grows, as the need for treatment increases, and as resources become available.
  - **Secondary Treatment**
    Secondary treatment uses biological processes to remove about 85 percent of the dissolved organic matter that escapes primary treatment. Secondary treatment technologies include fixed-film processes, activated sludge and other suspended growth processes, extended aeration systems, membrane biological reactors,

aerated lagoons, pond and constructed wetland systems, and other forms of treatment that use biological activity to break down organic matter.

- In attached growth (or fixed-film) processes, the microbial growth occurs on the surface of stone or plastic media. Wastewater passes over the media along with air to provide oxygen. Attached growth process units include trickling filters, biotowers, and rotating biological contactors.
- In suspended growth processes, the microbial growth is suspended in an aerated water mixture where the air (or oxygen) is pumped in, or the water is agitated sufficiently to allow oxygen transfer. Suspended growth process units include variations of activated sludge, oxidation ditches, and sequencing batch reactors. The suspended growth process speeds up the work of aerobic bacteria and other microorganisms that break down the organic matter in the sewage by providing a rich aerobic environment where the microorganisms suspended in the wastewater can work more efficiently. From the aeration tank, the treated wastewater flows to a sedimentation tank (secondary clarifier), where the excess biomass is removed. Some of the biomass is recycled to the head end of the aeration tank, while the remainder is "wasted" from the system. The waste biomass and settled solids are treated before disposal or reuse as biosolids. Activated sludge and related processes can be appropriate where high removal of organic pollution is required, funds and skilled personnel are available for operation and maintenance, and land is scarce or expensive. The system typically needs some form or primary treatment, such as screening and sedimentation. When properly operated and maintained, the process is generally free of flies and odors. However, most activated sludge processes are more costly to operate than attached growth processes and a steady energy supply is required. The effectiveness of the activated sludge process can be adversely affected by elevated levels of toxic compounds in wastewater. Therefore, an industrial pretreatment program may be needed to control pollutants from the industrial users that may pass through or interfere with treatment processes, contaminate sewage sludge, or create hazardous condition in the sewerage or treatment system such as formation of explosive or toxic gases. General considerations for activated sludge process design include wastewater characteristics, local environmental conditions (including temperature), possible presence of inhibitory substances (such as may be present in industrial effluents), oxygen transfer requirements and reaction kinetics (retention time in the system).
- Extended aeration is a variation on the basic activated sludge process that uses a relatively low flow rate and long aeration time. The aerated sewage is formed into a brown floc-like sludge, which settles out in a separate settling tank. Thus, clear treated effluent is drawn off the top of the settling tank and sludge is drawn off the bottom of the tank. The advantage of this system is that the sludge is stable and needs no further treatment except dewatering. However, power demands are high because of the long period of aeration, thus the system is generally suitable for small plants.

- Membrane biological reactors (MBR) or bio-membrane systems includes a semi-permeable membrane barrier system either submerged or in conjunction with an activated sludge process. This technology guarantees removal of all suspended and some dissolved pollutants. The limitation of MBR systems is directly proportional to nutrient reduction efficiency of the activated sludge process. MBR systems can achieve high effluent quality and use little land area. However, the MBR process is sophisticated and the cost of building and operating a MBR is usually higher than conventional wastewater treatment.
- Ponds and wetlands are simple and robust wastewater treatment options with low operation and maintenance costs and demands. Ponds are classified as anaerobic (reactions take place without oxygen), facultative (in which the processes may or may not use oxygen), and maturation (in which the pond provides additional treatment in the presence of oxygen and sunlight to further reduce pollutants before discharge). Pond and wetland systems are influenced by natural conditions, such as wind, temperature, rainfall, solar radiation, and seepage, as well as by physical factors such as surface area, water depth, short-circuiting, pH, toxic materials, and oxygen. Site-specific problems may include a high groundwater table, flooding, steep topography, and habitat for vectors such as mosquitoes.

a. Anaerobic waste stabilization ponds are open basins in which wastewater is treated in the absence of oxygen. Solids settle to the bottom of the pond, where they are digested. Anaerobic ponds can be used as a first stage to treat wastewater prior to secondary treatment in other systems such as facultative ponds or constructed wetlands. Anaerobic ponds are normally rectangular basins with a depth of at least 3 meters and ideally 4 meters. Sludge must be removed from the ponds periodically (e.g., by draining and removal as a solid or by a float-mounted sludge pump). A well-designed anaerobic pond can remove up to about 60 percent of BOD and COD in warm conditions.
b. Facultative ponds are large shallow basins (about 1.5 to 1.8 meters deep) that facilitate a combination of anaerobic and aerobic processes. Treatment takes place through a combination of physical and biological processes, and can be complex.
c. Maturation ponds are similar to facultative ponds but smaller, and are typically placed in series after facultative ponds. Maturation ponds are more efficient than most other treatment processes at removing both bacteria and parasitic worm eggs. Facultative and maturation ponds might be considered when sufficient land is available, pathogen levels need to be reduced, and/or the inflow may occasionally include large volumes of storm water runoff.

- Constructed wetlands are engineered wetland systems that can treat a variety of waste effluents, including domestic wastewater, agricultural runoff, storm water, and even industrial effluents. Treatment occurs through a combination of biological and physical processes, including sedimentation, precipitation, adsorption, assimilation by the plants, and microbiological activity. The system is designed to flow by gravity, minimizing the need for pumps and electrical devices. Flow may be either vertical or horizontal, and for horizontal flow wetlands, may be either above or below the surface. Most constructed wetlands in developing countries are of the horizontal sub-surface flow type. Above-surface flow is generally avoided because it provides breeding areas for mosquitoes. Constructed wetlands might be used when there is a need for higher effluent quality than can be achieved by anaerobic treatment alone. Constructed wetland treatment typically requires 3 – 5 m2 per person when treating full-strength sewage; the land area requirement can be reduced by preliminary anaerobic treatment.

- **Tertiary Treatment**

The treatment processes used to reduce the BOD of sewage waste are secondary treatment processes. Tertiary treatment is any practice beyond secondary treatment and is designed to remove non-biodegradable organic pollutants and mineral nutrients such as nitrogen and phosphorus salts. Tertiary treatment can remove more than 99 percent of impurities from the wastewater, and is capable of producing effluent of nearly drinking water quality. An example of tertiary treatment is the modification of conventional secondary treatment to remove additional phosphorous and nitrogen. Activated carbon filters are commonly used for tertiary treatment.

- **Disinfection**

Disinfection can be the final step before discharge of the effluent. Chlorine is the most widely used disinfectant but ozone and ultraviolet radiation are also frequently used for wastewater effluent disinfection. However, some environmental authorities are concerned that chlorine residuals in the effluent can cause adverse impacts. Dechlorination of treated wastewater may be appropriate to achieve desired water quality parameters.

Wastewater Re-Use

Wastewater is increasingly used for agriculture, especially in areas of water scarcity, population increase, and related demands for food, as wastewater provides a source of both water and nutrients. Wastewater can also be a reliable source of water throughout the year. The wastewater is applied to the land and moves through the soil where the natural filtering action of the soil along with microbial activity and plant uptake removes most contaminants. Part of the water evaporates or is used by plants. The remainder is either collected via drains or wells for surface discharge or allowed to percolate into the groundwater. Much of the water and most of the nutrients are used by the plants, while other pollutants are transferred to the soil by adsorption, where many are mineralized or broken down over time by microbial action. The wastewater, which is sometimes disinfected before application, depending on the end use of the crop and the irrigation method, can be applied to the land by spraying, flooding, drip irrigation, or ridge and furrow irrigation. The method selected depends on cost considerations, terrain, and the type of crops. Drip irrigation systems discharge water through small holes in pipes laid along the ground and, therefore, pretreatment to remove suspended solids is necessary for these systems so as not to clog the holes.

Sludge Treatment and Disposal

- **Sludge Treatment**

The most common sludge treatment systems include anaerobic digestion and thermophilic anaerobic digestion.

a. Anaerobic digesters are large fermentation tanks which are continuously operated under anaerobic conditions. Anaerobic decomposition could be used for direct treatment of sewage, but it is economically favorable to treat the waste aerobically. Large scale anaerobic digesters are usually used for processing of the sludge produced by primary and secondary treatments. It is also used for the treatment of industrial effluents which have very high BOD levels. The mechanisms for mechanical mixing, heating, gas collection, sludge addition and removal of stabilized sludge are incorporated into the design of large-scale anaerobic digesters. Anaerobic digestion uses a large variety of nonmethanogenic anaerobic bacteria. In the first part of the process, complex organic materials are broken down and in the next step, methane is generated. The final products of anaerobic digestion are approximately 70% methane and 30% carbon dioxide, microbial biomass, and a nonbiodegradable residue. Fully digested sludge has little readily biodegradable organic matter. It generally does not have objectionable odors, and about 50% of the solids are inorganic.
b. Thermophilic anaerobic digestion takes place at higher temperatures, typically 50-70ºC, compared with standard anaerobic digestion, which most commonly is carried out at about 20-45ºC. Thermophilic anaerobic digestion can be faster, requiring only about two weeks to complete, compared with 15 to 30 days for standard anaerobic digestion. However, thermophilic digestion is more expensive, requires more energy and is less stable than the mesophilic process.
c. Extended aeration secondary treatment systems also serve to aerobically digest the sewage sludge. In addition, sludge from conventionally activated sludge processes can be treated aerobically by introducing air, rather than encouraging an oxygen-depleted environment as in anaerobic digestion. Because the aerobic digestion occurs much faster than anaerobic digestion, the capital costs of aerobic digestion are lower. However, the operating costs are characteristically much greater for aerobic digestion because of energy costs for aeration needed to add oxygen to the process.
d. Composting is also an aerobic process that involves mixing the wastewater solids with sources of carbon such as sawdust, straw or wood chips. In the presence of oxygen, bacteria digest both the wastewater solids and the added carbon source and, in doing so, produce a large amount of heat.

- **Sludge Disposal and Use**

Following stabilization (e.g. by anaerobic digestion, thermophilic anaerobic digestion, aerobic digestion, or extended aeration processes), the sludge can be dewatered and disposed of in a landfill or incinerator, or subject to further processing for beneficial uses. There are concerns about sludge incineration because of air pollutants in the emissions, along with the high cost of supplemental fuel, making this a less attractive and less commonly constructed means of sludge treatment and disposal. However, incineration may be appropriate if the composition of the sludge (e.g., because of industrial discharges to the sewer system) precludes other disposal or use option.

Both anaerobic and aerobic sludge digestion processes can result in the destruction of disease-causing microorganisms and parasites to a sufficient level to allow the resulting digested solids to be safely applied to land used as a soil amendment material (with similar benefits to peat) or used for agriculture as a fertilizer, provided that levels of toxic constituents are sufficiently low.

C. EHS Guidelines for Waste Management Facilities

1. Applicability

The EHS Guidelines for Waste Management cover facilities or projects dedicated to the management of municipal solid waste and industrial waste, including waste collection and transport; waste receipt, unloading, processing, and storage; landfill disposal; physico-chemical and biological treatment; and incineration projects. Industry-specific waste management activities applicable, for example, to medical waste, municipal sewage, cement kilns, and others are covered in the relevant industry-sector EHS Guidelines, as is the minimization and reuse of waste at the source. This document is organized according to the following sections:

Section 1.0 — Industry-Specific Impacts and Management
Section 2.0 — Performance Indicators and Monitoring
Annex A — General Description of Industry Activities

This document covers the most common commercial methods of waste management. It does not cover other activities such as the management of radioactive wastes, co-incineration at combustion plants, or deep well injection.

1.0 Industry-Specific Impacts and Management

The following section provides a summary of the most significant EHS issues associated with Waste Management, which occur during the operational and decommissioning phases, along with recommendations for mitigating these impacts. Recommendations for the management of EHS impacts common to most large industrial facilities during the construction phase are provided in the General EHS Guidelines, as are other operational phase issues, such as noise, common to many industrial activities.

1.1 Environment

Municipal solid waste (MSW) is typically managed separately from industrial hazardous and non-hazardous wastes; therefore, environmental impacts associated with management of MSW and industrial wastes are addressed separately below.

1.1.1 Municipal Solid Waste

Municipal solid waste (MSW) is generally defined as the wastes (other than sewage and air emissions) generated in and usually collected by a municipality. MSW is extremely variable in composition, depending on the income and lifestyle of the generators. As shown in Table 31, MSW includes household refuse, institutional wastes, street sweepings, commercial wastes, as well as construction and demolition debris. MSW may include paper and packaging materials; foodstuffs; vegetable matter such as yard debris; metal; rubber; textiles; and potentially hazardous materials such as batteries, electrical components, paint, bleach, and medicines. MSW may also contain varying amounts of industrial wastes from small industries, as well as dead animals and fecal matter. Environmental impacts and associated mitigation measures applicable to MSW collection and transport; waste receipt, unloading, processing, and storage; biological treatment; incineration; and landfilling are described below.

Table 32: Sources and Types of Municipal Solid Waste

Source	Typical Waste Generators	Types of Solid Waste
Residential	Single and multifamily dwellings	Food waste, paper, cardboard, plastic, textiles, leather, yard waste, wood, glass, metal, ash, special waste (e.g., bulky items, consumer electronics, white goods, batteries, oil, tires) and household hazardous waste.
Industrial	Light and heavy manufacturing, fabrication, construction sites, power and chemical plants	Housekeeping waste, packaging, food waste, construction and demolition materials, hazardous waste, ash, special waste.
Commercial	Stores, hotels, restaurants, markets, office buildings.	Paper, cardboard, plastic, wood, food waste, glass, metal, special waste, hazardous waste.
Institutional	Schools, hospitals, prisons, government centers.	Same as commercial
Construction and Demolition	New construction sites, road repair, renovation sites, demolition of buildings.	Wood, steel, concrete, dirt, etc.
Municipal Services	Street cleaning, landscaping, parks, beaches, other recreational areas, water and wastewater treatment plants.	Street sweepings; landscape and tree trimmings; general waste from parks, beaches and other recreational areas; sludge from water and wastewater treatment plants.
Process	Heavy and light manufacturing, refineries, chemical plants, power plants, mineral extraction and processing	Industrial process waste, scrap materials, off-specification products, slag, tailings.

Waste Collection and Transport

Litter and clandestine dumping

The causes of littering and clandestine dumping in urban areas occur because of inadequate availability of litter bins along walkways, inadequate public awareness of their responsibilities as urban dwellers, and inadequate refuse collection service. Littering occurs everywhere and often into drains, while clandestine dumping is commonly on vacant lots, public spaces, or along waterways. Accumulated waste may attract disease vectors, contribute to clogging of drainage and sewerage networks, make waste readily accessible to neighborhood animals and birds, and pollute waterways. Recommended management strategies to minimize litter and clandestine dumping include:

- Encourage use of containers or bags for waste at the point of collection for each household and establishment;
- Implement a regular collection schedule with sufficient frequency to avoid accumulation of garbage;
- Use vehicles appropriate for the geographic conditions and waste types to maximize reliability of collection (e.g., compactor trucks may be appropriate for neighborhoods with wide streets and low-density trash, while smaller vehicles may be appropriate for neighborhoods with narrow streets and higher-density garbage);
- Encourage separation of recyclable materials at the point of generation, so that the collection points do not become sorting points for informal sector waste pickers;
- Cover collection and transfer vehicles along the entire route of transport to avoid windblown litter;
- Clean vehicles used for waste hauling before transportation of any goods, including compost;
- Encourage residents to put waste out at designated times and locations;
- Where possible, blocking off access to dumping sites and fining illegal dumpers.

Air Emissions

Air emissions from MSW collection and transport include, dust and bio-aerosols, odors, and vehicle emissions.

- Dust, Bio-aerosols, and Odors

  Dust can include nuisance dust, hazardous dust (e.g., containing asbestos or silica), and bioaerosols (i.e., particles in the air consisting wholly or partially of microorganisms). Bioaerosols are of particular concern to the health of waste workers and have been show to be the source of reduced pulmonary function and increased respiratory disease for those in immediate proximity to waste sweeping and collection activities. Recommended management strategies to minimize dust, bio-aerosols, and odors include:

  a. Establishing frequent waste collection schedules;
  b. Instituting a washing program for waste collection vehicles for company-owned waste collection and transfer containers;
  c. Promoting the use of bags to reduce the odors from soiling of waste collection and transport equipment.

- Vehicle Emissions

  Emissions from on-road vehicles may be regulated through national or regional programs. In the absence of these, specific measures to prevent, minimize, and control vehicle air emissions during waste collection and transport include the following:

a. Optimize waste collection routes to minimize distance traveled and overall fuel use and emissions
b. Implement transfer stations for small vehicles to consolidate waste into large vehicles for transportation to a treatment or disposal facility;
c. Waste collection and transport vehicle owners and operators should implement the equipment manufacturers' recommended engine maintenance, along with the mechanical maintenance for the safe operation of the vehicle, including proper tire pressure.;
d. Drivers should also be instructed on the benefits of driving practices which reduce both the risk of accidents and fuel consumption, including measured acceleration and driving within safe speed limits (working with garbage truck drivers can save as much as 25% on fuel use and reduce maintenance by 15%).

Additional fleet management recommendations are presented in the General EHS Guidelines.

Waste Receipt, Unloading, Processing and Storage

Control of the incoming waste stream is necessary to ensure safe and effective processing, treatment, and disposal of the waste and the quality of end products (e.g., compost). While procedures may vary depending on the nature of the waste and necessary processing methods, recommended measures include:

- Visually evaluate, weigh, and document incoming waste loads;
- Reject or, if the facility is equipped to process the waste, segregate potentially hazardous materials or wastes identified, including infectious waste, and manage as a hazardous or infectious waste, as applicable;
- Analyze suspected hazardous materials before acceptance so that they are segregated relative to compatibility and so that they can be adequately treated and disposed of;
- If possible, isolate size reduction equipment (e.g., shredders or grinders) in an explosion-proof area with proper ventilation and pressure relief to reduce the impacts of potential explosions that could be caused by materials such as gas cylinders and ignitable liquids that may be present in MSW. Visual inspection of the incoming waste, along with sorting and removal procedures, can minimize this potential hazard;
- Separate recoverable secondary materials for recycling and organic waste for composting to the extent practical.

Contaminated Runoff

Leachate from waste piles caused by exposure to precipitation and from residual liquids in the waste itself may contain organic matter, nutrients, metals, salts, pathogens, and hazardous chemicals. If allowed to migrate, leachate can contaminate soil, surface water, and groundwater potentially causing additional impacts such as eutrophication and acidification of surface water and contamination of water supplies. Recommended contaminated runoff management strategies include:

- When siting, consider the proximity of waste handling and storage areas to water supply wells for people and animals, irrigation canals, and surface water bodies that support aquatic life and the ability to prevent contaminated leachate and drainage from entering surface and ground water;
- Use impermeable materials for roads, waste processing and storage areas, and vehicle washing areas, and install curbs to prevent runoff to permeable areas;
- Collect runoff and leachate from areas used for waste storage, and treat runoff to meet applicable environmental standards before discharge to surface water or the municipal sewage system (e.g., screen to remove large material, install silt traps to remove particulates, and remove separate-phase liquids with an oil/water separator). Discharge to the municipal sewage system (via pipe or tanker truck), where available, is preferred for runoff from waste storage and handling areas;
- Re-use collected water in on-site disposal processes to the extent practical or store with collected leachate awaiting treatment.

In addition, management strategies for contaminated runoff from vehicles include:

- Cover containers during transport,
- Ensure vehicle equipment is designed to collect drainage and that it is held in a sump container until the vehicle reaches a safe discharge location.

Litter

The following measures are recommended to prevent, minimize, and control litter and solid waste during waste receipt, unloading, processing, and storage:

- Provide adequate storage for waste not immediately treated or disposed of;
- Implement good housekeeping procedures;
- Consider use of enclosed/covered areas for waste tipping, shredding, compacting, etc.;
- Install catch fences and netting to trap windblown litter.

Air Emissions

The following measures are recommended to prevent, minimize, and control vehicle emissions and emissions of dust, odors, and bioaerosols during waste receipt, unloading, processing, and storage:

- Select vehicles and containers that minimize air emissions during waste loading and unloading;
- Design drop-off points to minimize queuing of vehicles;
- Sweep waste management areas and roads frequently and use water spray for dust control where needed;
- Pre-treat wastes as needed (e.g., solidification, encapsulation, or wetting sufficient to reduce dust but without forming leachate);
- Use enclosed waste handling and storage areas for malodorous wastes or wastes that generate hazardous dust (e.g., asbestos). Enclosed waste storage and handling areas are preferred for all wastes;
- Use extraction system to remove dust from working areas, buildings, and storage vessels, and treat as needed to control particulate emissions (e.g., bag filter);

- Remove, treat, or dispose of all biological/malodorous wastes in an expeditious manner;
- Use odor-neutralizing sprays where necessary;
- Use negative pressure in processing buildings and appropriate air filtration (e.g., biofilter) to remove odor.

Noise and Vibration

Principal sources of noise and vibration include truck traffic; loading equipment (e.g., cranes, wheeled loaders), stationary compactors, balers, grinders, and other treatment and conveyance systems. Recommended noise management strategies include:

- Construct a buffer zone between the facility and the external environment or locate facilities away from sensitive receptors;
- Include noise and vibration considerations during design, including use of models to predict noise levels at specified noise-sensitive locations, using standardized sound power levels for construction plant;
- Maintain site roads in good condition to reduce noise and vibration from vehicle movements;
- Use acoustic screens around fixed/mobile plant and equipment;
- Select equipment that has low noise emission levels;
- Fit silencing equipment to plant, e.g. baffles/mufflers;
- Use buildings to contain inherently noisy fixed plant equipment (e.g., locate waste shredder in the tipping hall, and enclose tipping hall on all sides) and consider use of sound-insulating materials in construction.

Biological Treatment

Biological treatment includes composting with other organic materials for the preparation of soil products (i.e., aerobic treatment), and anaerobic digestion. To maximize the usability of end products, waste should not be accepted that contains organics that are contaminated by potentially hazardous chemicals (e.g., PCBs, chlordane and other pesticides, heavy metals and metalloids) and/or pathogenic substances and micro-organisms (e.g., prions, viruses, bacteria, and parasites) that will not be rendered harmless by the process or may constitute a health or environmental risk. This may include certain clinical waste and other related wastes of clinical origin, and diseased carcasses, or contaminants classified as hazardous or industrial wastes.

Leachate and Runoff

Leachate and runoff from waste storage and processing areas may contain organic material (biochemical oxygen demand (BOD)), phenols, nitrates, phosphorous, dissolved metals and other contaminants. If treated wood is processed, wood preservative chemicals, such as creosote and chromated copper arsenate, and their degradation products may be present. Municipal waste may contain human and animal fecal matter and blood which have a wide range of disease microorganisms. Some household chemicals can possess hazardous properties; examples include pesticides, solvents, paints, batteries, used oils, pharmaceuticals, etc.

The following measures are recommended to prevent, minimize, and control leachate generation and discharge from biological treatment operations:

- Install a drainage layer underneath the processing area to provide adequate leachate drainage from composting organics. This may consist of a bed of coarse material such as wood chips, or alternatively the processing platform may permanently incorporate a drainage layer designed to withstand the loading, working and removal of material. For small-scale compost facilities or in dry areas, an adsorbent material can be incorporated in the compost and at the base of the pile;
- The material processing or storage areas of the facility should have a leachate barrier system that forms a secure barrier between the groundwater, soil, and substrata and the composting or stored organics, as well as systems for collecting and treating leachate;
- Design and maintain the slope and orientation of windrows and/or leachate drains such that free drainage of leachate to a collection drain is facilitated and ponding of leachate is avoided; shape the piles and windrows to maximize runoff and hence reduce infiltration;
- Store leachate in a lined earthen basin or in aboveground storage tanks;
- For anaerobic digestion, maximize recycling of wastewater to the reactor;
- Measure total organic carbon (TOC), chemical oxygen demand (COD), nitrogen (N), phosphorus (P) and chlorine (Cl) levels in the inlet and outlet flows from an anaerobic digester. When a better control of the process is required, or a better quality of the waste output, monitoring of additional parameters may be necessary;
- Operate an anaerobic digester under thermophilic digestion conditions, in order to increase the pathogen destruction, biogas production rate (hence higher energy recovery) and the retention time;
- Maintain ideal composting conditions such as:

a. Carbon: nitrogen (C:N) ratio between 25:1 and 35:1
b. Moisture content of 50 to 60 percent of total weight during treatment (and less than 50 percent for marketing following screening)
c. Balance between particle size and void space to promote rapid decomposition. Void space should be sufficient to achieve a 10 to 15 percent oxygen level within the pile in aerobic systems
d. Optimum temperature levels which can range between 32 and 60 degrees Celsius. Pathogen destruction can be achieved by attaining and maintaining a temperature of 55 degrees Celsius for three days in a vessel composting system or 15 days in a windrow system
e. pH of between 6 and 8.

Air Emissions

Releases to the air can include direct stack emissions and fugitive emissions associated with biological processes, as well as emissions from burning of biogas. Direct air emissions can include bioaerosols, particulate matter/dust, ammonia, amines, volatile organic compounds (VOCs), sulfides, odors, etc. The following measures are recommended to prevent, minimize, and control air emissions from biological treatment:

- Use mist spray to keep down dusts, especially during and prior to loading or other handling procedures.
- Use windrow turning equipment that is specially designed to minimize air emissions, as opposed to wheeled loaders or conveyor loaders that drop wastes into piles.
- For highly odorous wastes, use closed feed bunkers constructed with a vehicle sluice; for less odor-intensive wastes, use automated and rapid action doors (opening times of the doors being kept to a minimum) in combination with an appropriate exhaust air collection device resulting in an under pressure in the treatment hall.
- Enclose leachate drains to reduce the emission of odors.
- Minimize the amount of water added to compost (e.g., by covering compost material) to avoid anaerobic conditions that can cause hydrogen sulfide odors if the compost mixture contains sulfur-containing materials.

Biomass and biogas combustion emissions depend on the type of biomass material and combustion method and can include particulate matter, nitrogen oxide (NO_X), sulfur oxide (SO_X), carbon monoxide (CO), hydrogen sulfide (H_2S), and VOCs. When using biomass or biogas as a fuel source for power generation, reference should be made to the General EHS Guidelines for emissions guideline values and the selection of appropriate emissions prevention and control techniques.

Fire

Biodegradable wastes can be combustible and aerobic degradation can produce sufficient heat to cause spontaneous combustion in certain circumstances. Wastes can, in some instances, also contain ashes and other readily ignitable materials that burst into flame under wind conditions, or when contacting flammables. In landfills, methane is generated by anaerobic digestion and can potentially ignite if it encounters an ignition source within or external to the landfill. Methane in landfill gas can become trapped in underground cavities, and even move along geologic discontinuities, to pose a risk of explosion. Recommended fire prevention and control strategies include:

- For composting, avoid conditions that can lead to spontaneous combustion (e.g., moisture between 25 – 45 percent and temperatures above about 93ºC. This can be achieved for example by keeping windrows less than about 3 m high and turning them when the temperature exceeds 60ºC);
- Collect biogas for use or treatment (e.g. energy recovery or flaring);
- Provide a fire alarm system, including temperature sensors in the waste being treated;
- Design the facility for access by firefighting equipment, including clear aisles among windrows and access to an adequate water supply.

MSW Incineration Facilities

Air Emissions

Air emissions from incineration depend on the specific waste composition and the presence and effectiveness of air pollution control systems. Polluting emissions may include carbon dioxide (CO_2), CO, NO_X, sulfur dioxide (SO_2), particulate matter, ammonia, amines, acids (HCL, HF), VOCs, dioxins/furans, polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), metals (Hg), and sulfides, etc., depending on the waste content and combustion conditions. The following measures are recommended to prevent, minimize and control air emissions:

- Conduct waste segregation and/or presorting□□□□□□□□□ incineration of wastes that contain metals and metalloids that may volatilize during combustion and be difficult to control through air emission technology (e.g., mercury and arsenic);
- Follow applicable national requirements and □□□□□□□□□□□□□□□□ recognized standards for incinerator design and operating conditions, mainly rapid quenching of the flue gas after leaving all combustion chambers and before entering any dry particulate matter air pollution control device but also combustion temperature, residence time, and turbulence. Standards for stationary incinerators which include temperature and afterburner exit gas quenching (i.e. rapid temperature reduction) requirements are preferred in order to nearly eliminate dioxins and furans;
- Introduce wastes into the incinerator only after the optimum temperature is reached in the final combustion chamber.
- The waste charging system should be interlocked with the temperature monitoring and control system to prevent waste additions if the operating temperature falls below the required limits;
- Minimize the uncontrolled ingress of air into the combustion chamber via waste loading or other routes;
- Optimize furnace and boiler geometry, combustion air injection, and, if used, NO_X control devices using flow modeling;
- Optimize and control combustion conditions by the control of air (oxygen) supply, distribution and temperature, including gas and oxidant mixing; the control of combustion temperature level and distribution; and the control of raw gas residence time;
- Implement maintenance and other procedures to minimize planned and unplanned shutdowns;
- Avoid operating conditions in excess of those that are required for efficient destruction of the waste;
- Use auxiliary burner(s) for start-up and shut-down and for maintaining the required operational combustion temperatures (according to the waste concerned) at all times when unburned waste is in the combustion chamber.
- Use a boiler to transfer the flue-gas energy for the production of electricity and/or supply of steam/heat, if practical;
- Use primary (combustion-related) NO_X control measures and/or selective catalytic reduction (SCR) or selective non-catalytic reduction (SNCR) systems, depending on the emissions levels required;
- Use flue gas treatment system for control of acid gases, particulate matter, and other air pollutants;

- Minimize formation of dioxins and furans by ensuring that particulate control systems do not operate in the 200 to 400 degrees Celsius temperature range; identifying and controlling incoming waste composition; using primary (combustion-related) controls; using designs and operation conditions that limit the formation of dioxins, furans, and their precursors; and using flue gas controls;
- Consider the application of waste- to-energy or anaerobic digestion technologies to help off-set emissions associated with fossil fuel based power generation.

Ash and Other Residuals

Combustion of solid wastes generates ash and other material remaining after incineration. Solid wastes may also be generated from treatment of wastewater from flue gas treatment (FGT). The following measures are recommended to prevent, minimize and control solid waste from incineration:

- Design the furnace to, as far as possible, physically retain the waste within the combustion chamber (e.g. narrow grate bar spacing for grates, rotary or static kilns for appreciably liquid wastes), and use a waste throughput rate that provides sufficient agitation and residence time of the waste in the furnace at sufficiently high temperatures, including any ash burn-out areas, in order to achieve a total organic carbon (TOC) value in the ash residues of below 3 wt percent and typically between 1 and 2 wt percent.
- Manage bottom ash separately from fly ash and other flue gas treatment residues to avoid contamination of the bottom ash for its potential recovery;
- Separate remaining ferrous and non- ferrous metals from bottom ash as far as practicably and economically viable, for their recovery;
- Treat bottom ash on or off-site (e.g., by screening and crushing) to the extent that is required to meet the specifications set for its use or at the receiving treatment or disposal site (e.g., to achieve a leaching level for metals and salts that is in compliance with the local environmental conditions at the place of use);
- Bottom ash and residuals should be managed based on their classification as hazardous or non-hazardous materials. Hazardous ash should be managed and disposed of as hazardous waste. Non-hazardous ash may be disposed of in an MSW landfill or considered for recycling in construction materials.

Water Effluents

Cooling systems generate cooling tower blowdown, which is addressed in the General EHS Guidelines. In addition, flue gas treatment generates wastewaters requiring treatment and disposal. To prevent, minimize, and control water effluents, wastewater from flue gas treatment should be treated as necessary, e.g., using filtration coagulation, precipitation, and filtration to remove heavy metals, and neutralization.

Noise

Principal sources include exhaust fans and resulting in noise from the outlet of the stack; cooling system (for evaporation cooling and especially for air cooling); and turbine generators. Measures to address noise impacts are addressed in the General EHS

Guidelines. Additional recommended measures to prevent, minimize, and control noise from incineration include use of silencers on air coolers and chimneys, as necessary.

Landfilling

A sanitary landfill is a carefully engineered, structurally stable formation of segregated waste cells separated by soil cover material, with base and side slopes designed to minimize infiltration and facilitate collection of leachate. Landfills are sited, designed and operated to isolate the wastes from the surrounding environment, particularly groundwater. Even after closure, landfills required long-term care, including maintenance of the cap system, collection and treatment of leachate, collection and flaring or utilization of landfill gas, and monitoring of groundwater so that the waste remains isolated. Thus, the EHS impacts of eventual decommissioning or closure and long term operation and maintenance of a landfill need to be considered in the system design. Specific closure procedures should focus on the preservation of the long- term integrity and security of the site, preferably with a minimum of maintenance.

Landfill operators, working in coordination with local regulatory authorities, should explore and implement opportunities to minimize the landfill disposal of municipal wastes which contain metals, such as mercury, which may be released due to crushing of waste materials. Segregation and presorting of these materials should be performed to the extent feasible.

Landfill Siting

The location of the landfill should take into account potential impacts associated with releases of polluting substances including the following:

- Proximity to residential, recreation, agricultural, natural protected areas, or wildlife habitat and areas prone to scavenging wildlife, as well as other potentially incompatible land uses;
    a. Residential development should be typically further than 250 meters from the perimeter of the proposed landfill cell development to minimize the potential for migration of underground gaseous emissions
    b. Visual impacts should be minimized by evaluating locational alternatives
    c. Siting should be further than 3 km of a turbojet airport and 1.6 km of a piston-type airport or as permitted by the aviation authority fully considering potential threats to air safety due to attraction and presence of birds
- Proximity and use of groundwater and surface water resources;
    a. Private or public drinking, irrigation, or livestock water supply wells located downgradient of the landfill boundaries should be further than 500 meters from the site perimeter, unless alternative water supply sources are readily and economically available and their development is acceptable to regulatory authorities and local communities
    b. Areas within the landfill boundaries should be located outside of the 10-year groundwater recharge area for existing or pending water supply development.
    c. Perennial stream should not be located within 300 meters downgradient of the proposed landfill cell development, unless diversion, culverting or channeling

is economically and environmentally feasible to protect the stream from potential contamination.

- Site geology and hydrogeology;
    a. Landfills should be located in gently sloped topography, amenable to development using the cell (bund) method, with slopes which minimize the need for earthmoving to obtain the correct leachate drainage slope of about 2%
    b. Groundwater's seasonally high table level (i.e., 10 year high) should be at least 1.5 meters below the proposed base of any excavation or site preparation to enable landfill cell development
    c. Suitable soil cover material should be available on-site to meet the needs for intermediate (minimum of 30 cm depth) and final cover (minimum of 60 cm depth), as well as bund construction (for the cell method of landfill operation). Preferably, the site would have adequate soil to also meet required cover needs (usually a minimum of 15 cm depth of soil). Daily cover needs can be alternatively met by using removable tarps, other relatively inert materials (i.e., compost residuals), or by removing the previously laid daily soil cover at the start of each day for reuse at the end of the same day. For purposes of siting, assume that at least 1 cubic meter of daily, intermediate, and final compacted soil cover is needed for every 6 cubic meters of compacted refuse.
- Potential threats to landfill site integrity from natural hazards such as floods, landslides, and earthquakes:
    a. Landfills should be sited outside of a floodplain subject to 10-year floods and, if within areas subject to a 100-year flood, amenable to an economic design which would eliminate the potential for washout
    b. There should be no significant seismic risk within the region of the landfill which could cause destruction of berms, drains or other civil works, or require unnecessarily costly engineering measures; otherwise, side slopes should be adjusted accordingly to prevent failure in the event of seismic activity
    c. No fault lines or significantly fractured geologic structure should be present within 500 meters of the perimeter of the proposed landfill cell development which would allow unpredictable movement of gas or leachate
    d. There should be no underlying limestone, carbonate, fissured or other porous rock formations which would be incompetent as barriers to leachate and gas migration, where the formations are more than 1.5 meter in thickness and present as the uppermost geologic unit above sensitive groundwaters.

Leachate Generation

Landfill leachate contains dissolved constituents derived from the interstitial waters of the disposed waste as well as its degradation products. It also may contain some suspended solids, including pathogens. If not collected and treated, leachate can migrate from the landfill and contaminate soil, groundwater, and surface water. Leachate and site monitoring are used to confirm that the engineered landfill systems effectively isolate the waste, both during operation of the landfill and after closure. Leachate from a MSW landfill typically is very high in nitrogen (as ammonium), chloride, and potassium, as well as dissolved biological oxygen demand and chemical oxygen demand organics. The following measures are recommended to prevent, minimize, and control leachate generation from MSW landfills:

- Site landfills in areas with stable geology and avoid siting near particularly vulnerable or sensitive ecosystems and groundwater and surface water resources;
- Design and operate the landfill in accordance with applicable national requirements and internationally recognized standards to minimize leachate generation, including the use of low-permeability landfill liners to prevent migration of leachate as well as landfill gas, a leachate drainage and collection system, and landfill cover (daily, intermediate, and final) to minimize infiltration. Liner systems for MSW landfills can consist of a combination of geological barrier with an overlying bottom liner and leachate drainage layer. Permeability and thickness requirements may range from a hydraulic conductivity of 1×10^{-7} centimeters/second for a 0.6-meter layer of compacted soil overlaid by a 30-mil flexible membrane liner (60-mil if made from high density polyethylene (HDPE)) to a 1 meter thickness and hydraulic conductivity of 1×10^{-9} meters/second for the combined geological barrier and liner system with a 0.5 meter drainage layer;
- Treat leachate onsite and/or discharge to municipal wastewater system. Potential treatment methods include aerated lagoons, activated sludge, anaerobic digestion, artificial wetlands, re-circulation, membrane filtration, ozone treatment, peat beds, sand filters, and methane stripping;
- Minimize the daily exposed working face and use perimeter drains and landfill cell compaction, slopes and daily cover materials to reduce infiltration of rainfall into the deposited waste;
- Prevent run-on of precipitation into the active area of the landfill (e.g., by use of berms or other diversions); systems should be designed to handle the peak discharge from a 25-year storm;
- Collect and control run-off from the active area of the landfill; the system should be designed to handle the discharge from a 24-hour, 25-year storm. Runoff is typically treated together with leachate from the site.

Groundwater and Leachate Monitoring

Recommended measures for groundwater and leachate monitoring include the following:

- Measure and record the quantity and quality of leachate generated. Changes in leachate quantity or quality not attributable to weather or other factors may indicate changes in the liner, leachate collection, or landfill cover systems;
- Install groundwater monitoring wells outside the landfill perimeter at locations and depths sufficient to evaluate whether leachate is migrating from the landfill into the uppermost groundwater unit. This groundwater monitoring network should usually include, at a minimum, one monitoring well located in the upgradient groundwater flow direction from the landfill and two monitoring wells located in the down gradient direction. The groundwater monitoring system should be consistent with applicable national regulations and internationally recognized standards.

- Regularly sample the monitoring wells and analyze for constituents, selected based on:
  a. The types, quantities, and concentrations of constituents in wastes managed in the landfill
  b. The mobility, stability, and persistence of waste constituents their reaction products in the unsaturated zone beneath the waste management area
  c. The detectability of indicator parameters, waste constituents, and reaction products in ground water;
  d. The constituent concentrations in the groundwater background.

Landfill Gas Emissions

MSW contains significant portions of organic materials that produce a variety of gaseous products when dumped, compacted, and covered in landfills. Oxygen in a landfill is quickly depleted, resulting in anaerobic bacterial decomposition of the organic materials and the production of primarily carbon dioxide and methane. Carbon dioxide is soluble in water and tends to dissolve in the leachate. Methane, which is less soluble in water and lighter than air, tends to migrate out of the landfill, resulting in landfill gas that is typically about 60 percent methane and 40 percent CO2, with trace amounts of other gases. Some MSW landfills are designed to maximize anaerobic degradation and production of landfill gas, which can be burned for energy. In addition, operation of landfills can generate dust and odors. Landfill gas is not generated, or in lesser quantities, if the waste material is primarily inert, such as construction debris.

Recommended methods to control and monitor landfill gas emissions include the following:

- Include landfill gas collection system designed and operated in accordance with applicable national requirements and recognized international standards including recovery and pre-use processing or thermal destruction through an efficient flaring facility. Flare design depends on the type of flare system which may include open flares or enclosed flares. Retention time and temperature necessary to achieve highly efficient combustion of landfill gas ranges from 0.6-1.0 seconds at 850 degrees Celsius to 0.3 seconds at 1000 degrees Celsius in enclosed flares. Open flares operate at lower combustion temperatures. Prevent condensation from accumulating in extraction systems by arranging the pipe work to fall to a removal point such as a knock out-pot.
- Use landfill gas as fuel if practical, or treat before discharge (e.g., by using enclosed flare or thermal oxidation if methane content is less than about 3 percent by volume).
- Use gas blowers (boosters) of sufficient capacity for the predicted gas yield and constructed of materials appropriate for landfill gas duty; blowers should be protected by flame arrestors at both gas inlet and outlet.
- Install and regularly sample boreholes surrounding the landfill to monitor for migration of landfill gas.

Carbon financing may also be considered, including opportunities implemented through the host- country Joint Implementation of the United Nations Framework Convention on Climate Change. Recommended methods to control dust and odor emissions include the following:

- Compact and cover waste promptly after discharge from the vehicle delivering the waste
- Minimize open tipping face area
- Dispose of odorous sludge in covered trenches
- Restrict acceptance of loads known to be particularly odorous
- Restrict tipping activities during periods of adverse weather (e.g., wind toward sensitive receptors)
- Seal sump covers
- Aerate leachate storage areas

Litter

Wind, vehicles, and vermin can disperse MSW, potentially attracting vermin, contributing to transmission of diseases, and adversely affecting wildlife and neighboring communities. The following measures are recommended to prevent, minimize, and control dispersal of litter:

- Avoid siting of facilities in particularly exposed, windy areas
- Provide perimeter planting, landscaping, or fences to reduce wind;
- Pin waste by use of dozers and landfill compactors immediately after discharge from the vehicles delivering the waste;
- Use soil or artificial cover materials so that deposited waste is held in place. More frequent application of cover may be required during high winds or in exposed areas;
- Use scaring techniques or natural predators to control scavenging birds;
- Provide an emergency tipping area/foul weather cell for lightweight wastes such as paper;
- Construct temporary banks and bunds immediately adjacent to the tipping area, install strategically placed mobile catch fences close to the tipping area or on the nearest downwind crest, and/or fully enclose of the tipping area within a mobile litter net system;
- Install wind fencing upwind of the tipping area to reduce the wind strength as it crosses the facility ;
- Temporarily close the facility to specific or all waste or vehicle types when weather conditions are particularly adverse.

Closure and Post-Closure

Landfill facility operators should plan for the closure and postclosure care of the facility. Such planning should take place as early as possible in the project cycle so that potential closure and post-closure issues are incorporated in the financial and technical planning. Closure and post-closure planning activities should include the following elements:

- Development of a closure plan which specifies the necessary environmental objectives and controls (including technical specifications), future land use (as defined in consultation with local communities and government agencies), closure schedule, financial resources, and monitoring arrangements;
- Evaluation, selection, and application of closure methods consistent with post-closure use and which should include the placement of a final cover to prevent further impacts to human health and the environment;
- Application of final cover components that are consistent with post closure use and local climatic conditions. The final cover should provide long term environmental protection by preventing direct or indirect contact of living organisms with the waste materials and their constituents; minimize infiltration of precipitation into the waste and the subsequent generation of leachate; control landfill gas migration; and minimize long term maintenance needs.
- Financial instruments in place to cover the costs of closure and post-closure care and monitoring.

1.1.2 Industrial Hazardous Waste

Hazardous wastes may be so defined because they share the properties of a hazardous material (e.g. ignitability, corrosivity, reactivity, or toxicity), or other physical, chemical, or biological characteristics which may pose a potential risk to human health or the environment if improperly managed. Wastes may also be defined as “hazardous” by local regulations or international conventions, based on the origin of the waste and its inclusion in hazardous waste lists.

Waste Collection and Transport

Transportation of industrial hazardous waste is a specialized activity requiring appropriate equipment and suitably trained staff. Recommended measures to prevent spills and releases during waste transport and to facilitate emergency response if an accident should occur are provided in the General EHS Guidelines. Additional recommendations specifically applicable to hazardous waste collection and transport operations include:

- Follow applicable national regulations and internationally accepted standards for packaging, labeling, and transport of hazardous materials and wastes;
- Use tanks and containers specially designed and manufactured to incorporate features appropriate for the wastes they are intended to carry;
- If drums or other containers are used to transport waste, containers should be in good condition and compatible with the waste and are adequately secured in the transport vehicle;
- Adequately label all transport tanks and containers to identify the contents, hazards, and actions required in various emergency situations.

Waste Receipt, Unloading, Processing and Storage

Because of the potential inherent hazards of the waste, it is especially important for industrial hazardous waste management facilities to understand and control the nature of the waste that is accepted for storage, treatment, or disposal. Failure to adequately identify and classify incoming waste could result in inadequate treatment or disposal or unintended reactions that could release hazardous substances or cause fires or explosions. Therefore, recommended measures to control waste receipts and general measures to mitigate risks at industrial hazardous waste management facilities include:

- Establish and maintain a close relationship with the waste generator to understand the process generating the waste and to monitor any changes in the process or waste characteristics;
- Sufficient personnel with the requisite qualifications should be available and on duty at all times. All personnel should undergo specific job training;
- Obtain a thorough understanding of the incoming waste. Such knowledge needs to take into account the waste characteristics and variability, the origin of the waste, the treatment and disposal under consideration, the nature of the waste residuals, if any, that may be generated during treatment, and potential risks associated with waste treatment and disposal;
- Implement a pre-acceptance procedure that includes, as applicable, tests of the incoming waste and documentation of the waste source (e.g., the processes producing the waste, including the variability of the process), and identifying the appropriate treatment/disposal;
- Implement an acceptance procedure that includes, as applicable, procedures that limit the acceptance of waste to only that which can be effectively managed including effective disposal or recovery of residuals from waste treatment. Only accept waste if the necessary storage, treatment capacity, and disposition of any treatment residuals (e.g. acceptance criteria of the output by another treatment or disposal facility) are assured. The reception facility should include a laboratory to analyze incoming waste samples at the speed required by facility operations to determine if the waste is acceptable;
- In the case of treatment, analyze the waste out according to the relevant parameters important for the receiving facility (e.g. landfill or incinerator).

Spills and Releases

Overfills, vehicle accidents, and tank and piping failures can lead to releases during waste storage and handling. Mitigation measures, including physical protection, overfill protection, tank integrity, and secondary containment for tanks are addressed in the General EHS Guidelines. Additional recommended measures include:

- Segregate hazardous wastes and materials from non-hazardous wastes and materials;
- Separate incompatible wastes, such as certain alkaline and acidic wastes that would release toxic gases if mixed; keep records of testing; store waste in separate drums or vessels based on their hazard classification;
- Lock out valves controlling material and waste transfer when not in use;
- Waste containers should be suitably labeled to include details of their contents and that their locations are recorded in a tracking system;
- Transfer or decant only one type of material at any one time;

- Conduct regular training and exercises for site staff regarding emergency procedures;
- Provide sufficient firewater containment to prevent uncontrolled discharge of water off site in the event of a fire.

Fires and Explosions

Industrial hazardous wastes can be flammable and reactive; therefore, special precautions are needed when handling these wastes to prevent accidents. Recommended measures to prevent and prepare for fires and explosions are presented in the General EHS Guidelines. Additional recommended measures include:

- Fire fighting equipment appropriate to the type of waste received at the site should be available;
- Minimize the storage of flammable liquids on site (e.g. fuel, flammable wastes);
- Use of a nitrogen atmosphere for organic waste liquid with a low flashpoint stored in tanks;
- Perform crushing and shredding operations under full encapsulation and under an inert or exhausted atmosphere for drums and containers containing flammable or highly volatile substances;
- Provide an emergency tipping area for waste loads identified to be on fire or otherwise deemed to be an immediate risk;
- Prepare and annually review a fire risk assessment.

Air Emissions

Air emissions may include releases of particulate matter and VOCs from storage vessels and waste processing equipment. Hazardous waste incineration facilities should minimize leaks from hazardous waste transfer equipment (e.g. pumps, piping, etc) through the implementation of leak detection and repair program. Additional guidance on VOC emissions prevention and control is addressed in the General EHS Guidelines. Guidance on emissions prevention and control is also addressed above under the MSW section.

Water Effluents

Storage and processing operations may generate wash water and runoff from waste management areas. General measures for runoff control are addressed under MSW above and in the General EHS Guidelines. In addition, the following methods are recommended for prevention, minimization, and control of water effluents:

- Collect and treat wash water and runoff from waste storage and handling areas as potentially hazardous, unless analytical tests determine otherwise;
- Segregate runoff from areas storing incompatible wastes.

Biological and Physico-Chemical Treatment

Biological and physico-chemical treatment processes destroy, separate, concentrate, or contain waste materials to minimize potential environmental, health, and safety hazards and to facilitate environmentally sound management of the wastes. These treatments are usually applied to aqueous solutions or sludge. Many of the treatment processes are effective only for specific waste types, and can be compromised by constituents from other waste streams; therefore, waste acceptance procedures discussed above are especially important. Many of the processes in this sector incorporate sophisticated equipment technology requiring highly-trained staff. General recommended procedures for biological treatment are addressed under MSW, above. General recommended procedures to prevent, minimize, and control potential environmental impacts from chemical treatment include:

- Design and operate facilities in accordance with applicable national requirements and internationally accepted standards;
- Prepare a quality control plan, which may include a definition of personnel rolls, responsibilities, qualifications, inspection procedures and documentation;
- Clearly define the objectives and the expected reaction chemistry for each treatment process;
- Assess each new set of reactions and proposed mixes of wastes and reagents in a laboratory-scale test prior to waste treatment;
- Specifically design and operate the reactor vessel so that it is fit for its intended purpose;
- Monitor the reaction so that it is under control and proceeding towards the anticipated result.

Air Emissions

Air emissions associated with storage and transfer operations are discussed above. Additional recommended measures to prevent, minimize, and control air emissions include:

- Enclose treatment and reaction vessels so that they are vented to the air via an appropriate scrubbing or other air emission abatement system;
- Install gas detectors (e.g. suitable for detecting HCN, H_2S, and NO_X) and implement safety measures to prevent releases of potentially toxic gases;
- Link the air space above filtration and dewatering processes to the main air pollution abatement system of the plant, if such a system is in place.

Water Effluents

Waste water from biological and chemical processes includes runoff and leachate (addressed above), pollution control residuals, and waste residuals (e.g., separated aqueous fractions of waste s). General measures for runoff control are addressed under MSW above and in the General EHS Guidelines. Recommended measures to prevent, minimize, and control water effluents include:

- Add flocculation agents to the sludge and waste water to be treated to accelerate the sedimentation process and to facilitate the further separation of solids or, where practical, use evaporation (which avoids the use of flocculation agents);
- Preventing the mixing of wastes or other streams that contain metals and complexing agents.

Waste Residuals

Biological and chemical treatments typically generate solid waste residuals that must be disposed of. Recommended measures to prevent, minimize, and control solid wastes include:

- Restrict the acceptance of wastes to be treated by solidification/immobilization to those not containing high levels of VOCs, odorous components, solid cyanides, oxidizing agents, chelating agents, high TOC wastes, and compressed gas cylinders.
- Minimize the solubility of metals and reduce the leaching of toxic soluble salts by a suitable combination of water washing, evaporation, re-crystallization, and acid extraction when immobilization is used to treat solid waste containing hazardous compounds prior to landfilling.
- Based on the waste residual's physical and chemical characteristics, solidify, vitrify, melt, or fuse wastes as required/necessary prior to landfill disposal.
- Test the leachability of inorganic compounds (e.g., by using the standardized European Committee for Standardization (CEN) or U.S. EPA leaching procedures) for waste to be landfilled.

Hazardous Waste Incineration

Incineration involves several integrated process operations, including feed control and preparation, combustion, and management of combustion products (e.g., flue gases and ash). Incineration reduces the volume and weight of waste and destroys nearly all of the organic compounds in the waste, but also generate s air emissions and waste residues that must be appropriately managed. To minimize potential environmental, health, and safety impacts, the following general measures should be considered:

- Design and operate incinerators in accordance with applicable national requirements and internationally accepted standards. These standards typically require destruction efficiencies of 99.99 percent to 99.9999 percent, depending on the hazard characteristics of the waste;
- Implement stringent waste selection procedures so that only wastes that can be effectively managed are accepted. Note that mercury should be excluded from the waste feed to the maximum extent possible;
- Continuously monitor incinerator parameters including waste feed rate, total hydrocarbons, temperature (measured at the end of the residence zone), and CO and oxygen (measured at the stack);
- Install an automatic system to prevent feeding of hazardous waste to the incinerator when operating conditions deviate from the acceptable range (e.g., during startup and shutdown or upset conditions).

Air Emissions

Air emissions depend on the waste-feed composition and may include NO_X, SO_2, CO_2, metals, acids, and products of incomplete combustion, most notably polychlorinated dibenzo-p-dioxins and - furans (PCDDs and PCDFs). Recommended measures to prevent, minimize, and control air emissions include:

- Continuously monitor CO and O_2 to evaluate proper combustion conditions;

- Closely track chlorine content of the waste feed and the feed rates of these and other potential pollutants;
- Periodically monitor concentrations of PCDDs, PCDFs, other combustion products, and heavy metals in flue gas;
- Reduce the generation and emission of PCDDs and PCDFs, if/when chlorine containing wastes are incinerated, by ensuring rapid cooling of flue gas as well as good turbulence of the combustion gas, high temperature, adequate oxygen content, and adequate residence time. De-NOX systems can also reduce PCDD and PCDF emissions;
- Additional emission controls (e.g., activated carbon) should be installed if necessary;
- Treat combustion gases to remove metals and acid gases (e.g., by wet scrubbers);
- Control fugitive emissions from the combustion zone (e.g., by sealing the combustion zone or maintaining the combustion zone pressure below atmospheric pressure);
- Minimize fugitive emissions of ash (e.g., use of closed systems to handle fine dry material and use of closed containers for transfer to the disposal site).
- Consider the application of waste- to-energy technologies to help conserve resources and off-set emissions associated with fossil fuel based power generation. As previously noted, the possibility of applying waste-to-energy technologies depends on a number of issues which may include the project design specifications established by SGs as well as laws applicable to the generation and sale electricity.

Water Effluents

Many air pollution control devices use water for gas cleaning, and generate wastewater that contains the pollutants removed from the flue gas. Recommended measures to prevent, minimize, and control water effluents include:

- Periodically monitor concentrations of PCDDs and PCDFs if/when chlorine containing wastes are incinerated, and other combustion products and heavy metals in wastewater;
- Minimize discharge of process wastewater to the extent possible while maintaining required air emission control;
- Treat wastewater before discharge (e.g., using settling, precipitation of metals, and neutralization).

Ash and Residues

Incinerator bottom ash contains metal oxides and halides, which can have significant water solubility (halides) and can potentially constitute a hazardous waste. Fly ash can absorb water-soluble incomplete combustion products from the flue gas. Thus, conta minants may readily leach from untreated incinerator waste residuals. Recommended measures to prevent, minimize, and control solid wastes include:

- Treat ash and other solid residue from incineration of industrial hazardous wastes as hazardous unless it can be demonstrated that they are not hazardous;
- Periodically monitor concentrations of PCDDs, PCDFs, other combustion products, and heavy metals in pollution control residues, and ash or slag;

- Reduce the potential for leaching from ash residues (e.g., by solidification or vitrification) prior to final disposition.

Landfilling

Hazardous constituents in landfilled industrial hazardous wastes can potentially migrate from the landfill as leachate or in the gas phase. Therefore, design and operation criteria are particularly important for landfills that accept industrial hazardous waste so that the waste remains contained during the operating life of the landfill, including after closure of the landfill. General recommended measures to prevent, minimize, and control potential environmental impacts from landfilling of industrial hazardous wastes include:

- Design and operate the landfill in accordance with applicable national requirements and internationally accepted standards;
- Divide the landfill into different cells to separate wastes with different properties;
- Maintain records of the wastes received, including sources, analytical results, and quantity;
- Record on a map the location and dimensions of each landfill cell and the approximate location of each hazardous waste type within the landfill cell.

Leachate Generation

Storm water controls are addressed under MSW landfills, above, and in the General EHS Guidelines. In addition, recommended measures to prevent, minimize, and control leachate generation include:

- Install a liner system, preferably consisting of two or more liners with a leachate collection system above and between the liners, to prevent migration of wastes out of the landfill to the adjacent subsurface soil or ground water or surface water at anytime during the active life of the landfill and after closure, as long as the wastes remain hazardous. The liners should be:
    a. Constructed of low-permeability materials that have appropriate chemical properties and sufficient strength and thickness to prevent failure due to pressure gradients, physical contact with the waste or leachate to which they are exposed, climatic conditions, the stress of installation, and the stress of daily operation;
    b. Placed upon a foundation or base capable of providing support to the liner and resistance to pressure gradients above and below the liner to prevent failure of the liner due to settlement, compression, or uplift;
    c. Installed to cover all surrounding earth likely to be in contact with the waste or leachate.
- Install a leachate collection and removal system immediately above the upper liner to collect and remove leachate from the landfill so that leachate depth over the liner does not exceed 30 cm. The leachate collection and removal system should be:
    a. Constructed of materials that are chemically resistant to the waste managed in the landfill and the leachate expected to be generated and of sufficient strength and thickness to prevent collapse under the pressures exerted by overlying wastes, waste cover materials, and by any equipment used at the landfill;

b. Designed and operated to function without clogging through the scheduled closure of the landfill.

- In a two-liner system, install a leak detection system between the liners. This leak detection system should be capable of detecting, collecting, and removing leaks of hazardous constituents at the earliest practicable time through all areas of the top liner likely to be exposed to waste or leachate;
- At final closure of the landfill or upon closure of any cell, cover the landfill or cell with a final cover designed and constructed to:
    a. Provide long-term minimization of migration of liquids through the closed landfill;
    b. Function with minimum maintenance;
    c. Promote drainage and minimize erosion or abrasion of the cover;
    d. Accommodate settling and subsidence so that the cover's integrity is maintained; and
    e. Have a permeability less than or equal to the permeability of any bottom liner system or natural subsoils.

Groundwater and Leachate Monitoring

Groundwater monitoring is addressed under MSW landfills, above. In addition, recommended measures for leachate and site inspections and monitoring include:

- During construction, inspect the liners for uniformity, damage, and imperfections.
- Inspect the landfill regularly (e.g., after storms and weekly during operation and quarterly after closure) to detect evidence of any of deterioration, malfunctions, or improper operation of run-on and run-off control systems, such as erosion of the final cover; proper functioning of wind dispersal control systems, where present; and the presence of leachate in and proper functioning of leachate collection and removal systems.

Landfill Gas

If biodegradable wastes are disposed of, landfill gas can be generated and should be controlled and monitored, as described for MSW landfills, above.

Closure and Post-Closure

Landfill facility operators should plan for the closure and post-closure care of the facility as described previously (see Municipal Solid Waste – Landfills).

1.1.3 Industrial Non-Hazardous Waste

Solid industrial non-hazardous wastes are defined through national legislation as they originate from industrial sources but do not meet the definition of hazardous waste with regards to their specific origin with in the industrial process or its characteristics. Examples of non-hazardous industrial wastes include any garbage, refuse, or sludge from a waste treatment plant, water supply treatment plant, or air pollution control facility, and other discarded material, including solid, liquid, semisolid, or contained gaseous material resulting from industrial operations; inert construction/demolition materials; refuse, such as metal scrap and empty containers; and residual waste from industrial operations, such as boiler slag, clinker and fly ash.

Waste Collection and Transport

Transportation of industrial non-hazardous waste requires appropriate equipment and suitably trained staff, and mitigation measures described above for hazardous waste can be generally applicable to industrial non-hazardous waste. Additional recommended measures to prevent, minimize, and control potential environmental risks associated with waste collection and transport include:

- Vehicles and other equipment used for collection industrial non-hazardous wastes should not be used for collection of MSW without prior cleaning to remove waste residues.
- Vehicles and other equipment used for collection industrial non-hazardous wastes should not be used for distribution of goods (e.g., mulch).

Waste Receipt, Unloading, Processing, and Storage

As with MSW and industrial hazardous waste, facilities managing industrial non-hazardous waste should understand and control the nature of the waste that is accepted for storage, treatment, or disposal so that the waste can be managed safely and effectively. Waste acceptance and analysis procedures should be implemented considering the nature and expected variability of the incoming waste streams, and generally should be similar to measures suggested for industrial hazardous waste management facilities, described above.

Biological and Physico-Chemical Treatment

Treatment of non-hazardous industrial waste can help to reduce the volume and toxicity of waste prior to disposal. Treatment can also make a waste amenable for reuse or recycling. Consequently, a facility managing non-hazardous industrial waste might elect to apply treatment. For example, treatment might be incorporated to address small quantity VOC emissions from a waste management unit, or a facility might elect to treat a waste so that a less stringent waste management system design could be used. Treatment and post- treatment waste management methods can be selected to minimize environmental impact, keeping in mind that treatment residuals, such as sludge, are wastes themselves that will need to be managed. In general, recommended mitigation measures are similar to those for industrial hazardous waste treatment facilities, discussed above.

Incineration

Incineration might be considered for industrial non-hazardous wastes, including solids, and especially liquids, with heat value that can be recovered during incineration. Recommended mitigation measures for industrial hazardous waste incineration facilities, discussed above, should be considered and adopted for industrial non-hazardous incineration facilities as appropriate, based on the nature of the incoming waste stream.

Landfilling

Industrial non-hazardous waste landfills, like other landfill facilities, depend on waste containment, including leachate collection and treatment (and where appropriate, gas management) to control potential hazards associated with the waste. Industrial non-hazardous waste landfills might accept only one type of waste (i.e., monofills), or a variety of wastes. The nature of the incoming wastes will determine whether the design and controls are more similar to MSW or industrial hazardous waste landfills. In addition to measures discussed for MSW and industrial hazardous waste landfills, the following measures are recommended to prevent, minimize, and control potential environmental impacts associated with industrial nonhazardous waste landfills.

- Comply with applicable national and local requirements and internationally accepted standards for industrial non-hazardous waste landfills, including provisions for monitoring;
- Do not dispose of putrescible wastes, unless the facility is equipped to manage these types of wastes, with landfill gas collection and treatment systems and degradation products will not interact with the other industrial wastes in a manner that would increase their toxicity or mobility ;
- Do not dispose of liquids, explosive wastes, radioactive or nuclear materials, or medical wastes together with non-hazardous industrial wastes or by landfilling;
- Design the landfill systems, including selection of liner and cover materials, so that industrial wastes and degradation products are contained;
- Monitor groundwater and surface water quality in the vicinity of the facility in a manner similar to that recommended for industrial hazardous waste management facilities;
- Develop and follow a written schedule for inspecting monitoring equipment, safety and emergency equipment, and operating and structural equipment (such as dikes and sump pumps) that are important to preventing, detecting, or responding to potential environmental or human health hazards;
- Implement a training program so that facility personnel are able to respond effectively to emergencies by familiarizing them with emergency procedures, emergency equipment, and emergency systems.

1.2 Occupational Health and Safety

Occupational health and safety impacts during the construction and decommissioning of waste management facilities are common to other large industrial projects and are addressed in the General EHS Guidelines. The most significant occupational health and safety impacts typically associated with workers at waste management facilities occur during the operational phase and include:

- Accidents and injuries
- Chemical exposure
- Exposure to pathogens and vectors

Accidents and Injuries

Physical hazards encountered at waste management facilities are similar to those at other large industrial projects and are addressed in the General EHS Guidelines. Solid waste workers are particularly prone to accidents involving trucks and other moving equipment, so traffic management systems and traffic controllers are recommended. Accidents include slides from unstable disposal piles, cave-ins of disposal site surfaces, fires, explosions, being caught in processing equipment, and being run over by mobile equipment. Other injuries occur from heavy lifting, contact with sharps, chemical burns, and infectious agents. Smoke, dusts, and bioaerosols can lead to injuries to eyes, ears, and respiratory systems.

Mitigation measures for accidents and injuries are partially addressed in the General EHS Guidelines. In addition, the following procedures are recommended to prevent, minimize and control accidents and injuries at waste management facilities:

- In landfills, conduct compaction of wastes in thin layers using heavy equipment and place regular cover material over each compacted layer of waste, so that any underground fires within a waste cell are not able to spread throughout the landfill and lead to significant cave-ins;
- Ventilate landfill gas so that underground fires and explosions do not occur;
- Use maximum side slopes of 3:1 in non-seismic areas and lower slopes (e.g., 5:1) in seismic areas, with regular drainage of water so that saturated conditions do not develop and lead to slope subsidence;
- Provide workers with appropriate protective clothing, gloves, respiratory face masks and slip-resistant shoes for waste transport workers and hard-soled safety shoes for all workers to avoid puncture wounds to the feet. For workers near loud equipment, include noise protection. For workers near heavy mobile equipment, buckets, cranes, and at the discharge location for collection trucks, include provision of hard hats;
- Provide all landfill equipment with enclosed air conditioned cabs and roll-over protection;
- Provide refuse collection vehicles and landfill equipment with audible reversing alarms and visible reversing lights;
- Improve the storage of solid wastes at the source so that the loads to be collected are well contained and not too heavy;
- Locate exhaust pipes on waste collection vehicles so that exhaust does not discharge into the breathing zone of workers on the riding steps;
- Design collection routes to minimize, or possibly eliminate, crossing traffic that is going in the opposite direction;
- Provide two-hand constant-pressure controls for collection vehicles with compaction mechanisms;
- Restrict access to disposal sites such that only safety-trained personnel with protective gear are permitted to high-risk areas;
- Segregate people from operating trucks in recycling and transfer stations;
- Use automated systems to sort and transfer waste to the extent practical in order to minimize contact with the waste;
- Provide workers with communications tools, such as radios. Special signaling codes have been developed for communications on landfill sites;

- Minimize sorting from the ground by providing conveyor belts and/or tables that facilitate sorting;
- Establish engineering and materials norms for special facility and stationary equipment design requirements that minimize exposure to hazards (e.g., ventilation, air conditioning, enclosed conveyor belts, low loading and sorting heights, non- skid flooring, safety rails on stairs and walkways, spill protection and containment, noise control, dust suppression, gas alarm systems, fire alarm and control systems, and evacuation facilities).

Chemical Exposure

Chemical hazards encountered at waste management facilities are similar to those at other large industrial facilities, such as toxic and asphyxiating gases, and are addressed in the General EHS Guidelines. However, the full composition of wastes and their potential hazards is often unknown. Even municipal solid waste (MSW) often contains hazardous chemicals, such as heavy metals from discarded batteries, lighting fixtures, paints, and inks. The following procedures are recommended to prevent, minimize, and control chemical exposure at waste management projects:

- Control and characterize incoming waste (see waste receipt, unloading, processing and storage);
- Provide adequate personnel facilities, including washing areas and areas to change clothes before and after work;
- Ventilate enclosed processing areas (e.g., dust in waste size reduction areas, VOCs driven off by high temperatures during composting);
- Monitor breathing zone air quality in work areas at processing, transfer and disposal facilities. Direct-reading instruments that measure methane and oxygen deficiency are of primary importance; these include combustible gas indicators, flame ionization detectors, and oxygen meters. At waste treatment/disposal facilities, volatile organics should also be analyzed in the biodegradation gases being collected and/or vented. In waste handling, sorting, and composting facilities, monitoring for organic dust is needed;
- Prohibit eating, smoking, and drinking except in designated areas;
- Provide air filtered and air conditioned cabs for heavy mobile equipment used at landfills as necessary.

Dust

Waste processing can generate nuisance and hazardous dust, including organic dust. General mitigation measures for dust are also addressed in the General EHS Guidelines.

Pathogens and Vectors

Workers can be exposed to pathogens contained in manure and animal excreta found in MSW from the disposal of sludge, carcasses, diapers, and yard trimmings containing domestic animal waste. Uncontrolled dumping of MSW attracts rats, flies, and other insects that can transmit diseases. Processing of MSW can also generate bioaerosols, suspensions of particles in the air consisting partially or wholly of microorganisms, such as bacteria, viruses, molds, and fungi. These microorganisms can remain suspended in the air for long periods of time, retaining viability or infectivity. Workers may also be exposed to endotoxins, which are produced within a microorganism and released upon destruction of the cell and which can be carried by airborne dust particles. The following measures are recommended to prevent, minimize and control pathogens and vectors:

- Provide and require use of suitable personal protective clothing and equipment;
- Provide worker immunization and health monitoring (e.g. for Hepatitis B and tetanus);
- Maintain good housekeeping in waste processing and storage areas;
- Use automatic (non- manual) waste handling methods if practical;
- For landfills, promptly emplace, compact and cover of wastes in defined cells, especially for waste with the potential to attract vermin and flies, such as food wastes (especially animal by-products if accepted at the facility) and tannery wastes;
- Clean and wash with disinfectant the cabins of heavy mobile equipment used at regular intervals;
- For composting, maintain aerobic conditions and proper temperatures in the windrows. Isolate workers from sporedispersing components of the composting process such as mechanical turning (e.g., by using tractors or front-end loaders with enclosed air-conditioned or heated cabs). Aeration systems are preferred over manual turning;
- Maintain adequate temperature and retention time in biological treatment systems to achieve pathogen destruction (e.g., 55ºC for at least 3 consecutive days in most compost situations and 55ºC for 15 days in windrows);
- Grade the area properly to prevent ponding (to minimize insect breeding areas);
- Use integrated pest-control approaches to control vermin levels, treating infested areas, such as exposed faces and flanks with insecticide, if necessary;
- Provide and require use of dust masks or respirators under dry and dusty conditions (e.g., when compost is being turned). Charcoal-filled respirators also reduce odor perception;
- Provide prompt medical attention for cuts and bruises. Cover open wounds to prevent contact with the incoming loads or feedstock;
- Fully enclose the waste management site with fencing so that no livestock or wildlife is able to come in contact with the waste, which contains significant potential to enable the spread of livestock and zoonotic disease, as well as spillover disease to wildlife. Provide daily cover of wastes to minimize the attraction to birds, which can become infected with avian influenza and other bird diseases that can then be carried off-site.

1.3 Community Health and Safety

Community health and safety issues related to the construction of waste management projects may include emissions from the solid wastes and construction site issues which are addressed in the General EHS Guidelines. Community health and safety impacts which occur during the operational and decommissioning phases of waste management facilities may include:

- General occupational and environmental health issues associated with waste scavenging
- Physical, chemical, and biological hazards
- Litter
- Noise
- Dust and odors

General Occupational and Environmental Health Issues Associated with Waste Scavenging

The presence of informal sector workers laboring in municipal or mixed waste disposal sites in search of commercially valuable materials is a common place occurrence in developing countries. The causes and dynamics are the result of complex social, cultural, labor, and economic factors that are clearly outside of the scope of this guidance document. However, the following principles should be considered in managing the occupational, health, and safety risks of informal labor:

- Waste scavenging should not be allowed under any circumstances in hazardous and non-hazardous industrial waste management facilities;
- Facilities dedicated to the management of MSW should work with government entities in the development of simple infrastructure that can allow for the sorting of waste, helping groups of scavengers form cooperatives or other forms of micro-enterprises, or formally contracting them to provide this function. The outright displacement of scavenging workers as an occupational health and safety management strategy, without the provision of viable alternatives, should be avoided;
- Operators of existing facilities with scavenging workers should exercise commercially viable means of formalizing their work through the creation of management programs that include:
    a. Allowing only registered adults on the site, excluding children and domestic animals. Striving to provide alternatives to access to childcare and education to children;
    b. Providing protective gear, such as shoes. face masks, and gloves;
    c. Arranging the disposal layout and provide sorting facilities to improve access to recyclables while reducing their contact with other operations, thus minimizing potential hazards;
    d. Providing water supply for washing and areas for changing clothes;
    e. Implementing education campaigns regarding sanitation, hygiene, and care of domestic animals;
    f. Providing a worker health surveillance program including regular vaccination and health examinations.

Physical, Chemical, and Biological Hazards

Visitors and trespassers at waste management facilities may be subject to many of the hazards described for site workers. In particular, waste pickers, looking for recyclable materials and food scraps for animal feeding, often work informally at waste transfer and disposal sites, especially MSW facilities, typically living adjacent to the site in poor housing conditions, with minimal basic infrastructure for clean water and sanitation. Waste pickers may be encounter numerous risks, including contact with human fecal matter, paper that may have become saturated with toxic materials, bottles with chemical residues, metal containers with residue pesticides and solvents, needles and bandages (containing pathogenic organisms) from hospitals, and batteries containing heavy metals. Exhaust fumes of waste collection trucks traveling to and from disposal sites, dust from disposal operations, and open burning of waste all contribute to potential occupational health problems. Recommended measures to prevent, minimize and control physical, chemical, and biological hazards to the community include:

- Restrict access to waste management facilities by implementing security procedures, such as:
    a. Perimeter fencing of adequate height and suitable material, e.g. chain link, stock proof palisade;
    b. Lockable site access gate and buildings;
    c. Security cameras at key access points linked to recording equipment and remote access CCTV, where required;
    d. Security alarms fitted to buildings and storage areas;
    e. Review of site security measures annually or whenever a security breach is reported
    f. Use of a site visitor register;
    g. Immediate repair of fencing/access points if damaged; and
    h. Lighting of site during night time where necessary. As this may cause light nuisance to neighbors, the lighting installations should be selected to minimize ambient light pollution

Litter

Uncollected garbage and litter spread beyond the waste management facility boundaries by wind, vermin, and vehicles can directly spread disease; attract rats, flies, and other vectors; and expose the community to hazardous substances. Scavenging birds, such as gulls and crows, commonly congregate on landfill sites accepting household waste. They disturb newly tipped and partially covered waste whilst searching for food, and lead to complaints from adjoining residents and landowners about food scraps, excreta and other waste dropped away from the landfill. Litter control is addressed in Section 1.1, above.

Noise

Noise is typically generated by waste processing and treatment equipment as well as vehicular traffic on the site and bringing waste and materials to and from the facility. Sources of noise and abatement measures are addressed in Section 1.1, above, and the General EHS Guideline. In addition, facility operators should coordinate hours of operation with adjacent land uses.

Dust and Odors

Dust and odors from waste management facilities can be a nuisance to the neighboring community. Organic dust can also carry disease-causing microorganisms. Dust and odor controls are addressed in Section 1.1 and in the General EHS Guidelines. In addition, the following measures are recommended to prevent, minimize, and control community exposure to dust and odors from waste management facilities:

- Provide adequate buffer area, such as hills, trees, or fences, between processing areas and potential receptors.
- Avoid siting facilities near densely populated neighborhoods and installations with potentially sensitive receptors, such as hospitals and schools. Site facilities downwind from potential receptors, if possible.

2.0 Performance Indicators and Industry Benchmarks

2.1 Environmental Performance

Emissions and Effluents

Emissions and effluent standards values both from national and international regulations are assumed to be achievable under normal operating conditions in appropriately designed and operated facilities through the application of pollution prevention and control techniques discussed in the preceding sections of this document. These levels should be achieved at all times. Deviation from these levels in consideration of specific, local project conditions should be justified in the environmental assessment. Effluent guidelines are applicable for direct discharges of treated effluents to surface waters for general use. Site-specific discharge levels may be established based on the availability and conditions in the use of publicly operated sewage collection and treatment systems or, if discharged directly to surface waters, on the receiving water use classification as described in the General EHS Guideline. These levels should be achieved, without dilution, at least 95 percent of the time that the plant or unit is operating, to be calculated as a proportion of annual operating hours. Deviation from these levels in consideration of specific, local project conditions should be justified in the environmental assessment.

Environmental Monitoring

Environmental monitoring programs for this sector should be implemented to address all activities that have been identified to have potentially significant impacts on the environment, during normal operations and upset conditions. Environmental monitoring activities should be based on direct or indirect indicators of emissions, effluents, and resource use applicable to the particular project.

Monitoring frequency should be sufficient to provide representative data for the parameter being monitored. Monitoring should be conducted by trained individuals following monitoring and record-keeping procedures and using properly calibrated and maintained equipment. Monitoring data should be analyzed and reviewed at regular intervals and compared with the operating standards so that any necessary corrective actions can be taken. Additional guidance on applicable sampling and analytical methods for emissions and effluents is provided in the General EHS Guidelines.

2.2 Occupational Health and Safety Performance

Occupational Health and Safety Guidelines

Occupational health and safety performance should be evaluated against internationally published exposure guidelines, of which examples include the Threshold Limit Value (TLV®) occupational exposure guidelines and Biological Exposure Indices (BEIs®) published by American Conference of Governmental Industrial Hygienists (ACGIH), the United States National Institute for Occupational Health and Safety (NIOSH), Permissible Exposure Limits (PELs) published by the Occupational Safety and Health Administration of the United States (OSHA), Indicative Occupational Exposure Limit Values published by European Union member states, or other similar sources.

Accident and Fatality Rates

Projects should try to reduce the number of accidents among project workers (whether directly employed or subcontracted) to a rate of zero, especially accidents that could result in lost work time, different levels of disability, or even fatalities. Facility rates may be benchmarked against the performance of facilities in this sector in developed countries through consultation with published sources.

Occupational Health and Safety Monitoring

The working environment should be monitored for occupational hazards relevant to the specific project. Monitoring should be designed and implemented by credentialed professionals as part of an occupational health and safety monitoring program. Facilities should also maintain a record of occupational accidents and diseases and dangerous occurrences and accidents. Additional guidance on occupational health and safety monitoring programs is provided in the General EHS Guidelines.

Annex A: General Description of Industry Activities

Description and Definition of Wastes

- **Municipal Solid Waste**
  Municipal Solid Waste (MSW) typically includes household refuse, institutional wastes, street sweepings, commercial wastes, as well as construction and demolition debris. MSW is extremely variable in composition, depending on the income and lifestyle of the generators. MSW may include paper and packaging materials; foodstuffs; vegetable matter such as yard debris; metal; rubber; textiles; and potentially hazardous materials such as batteries, electrical components, paint, bleach, and medicines. In developing countries, MSW may also contain varying amounts of industrial wastes from small industries, as well as dead animals and fecal matter. In general, and the content of organic waste in developing countries (up to 70 – 80 percent) is higher than in industrialized countries, and the content of packaging waste is lower, making MSW in developing countries relatively dense and moist.
- **Industrial Waste**

The waste categories generated within the industrial enterprises depend on the manufacturing processes and waste management practices. In some cases, sector-specific waste arising within industrial facilities is disposed of at the municipal landfill. These types of waste may consist of slag from iron works and steel mills, ashes, residues from flue gas cleaning, bark, wood, sawdust, cutting fluids, waste oil, organic waste from food industry, and sludges (organic and non-organic). Some of the waste types generated within the industries can be hazardous.

Waste Collection and Transportation

Household waste typically is collected from individual households at the curbside or from neighborhood collection stations with dedicated containers or bins. Collection vehicles may range from horse-drawn carts, to pickup trucks, to back-loaded and compacting vehicles with a capacity of about 6 – 10 cubic meters (or up to 10 tons). One of the most common problems in developing countries has traditionally been the lack of household waste collection service in low-income neighborhoods with poor road infrastructure; in these settings, smaller vehicles are usually most effective. Depending on the type, characteristics, volume, and compatibility of different categories of hazardous waste, generators may store them in containers, bins, drums, or aboveground or underground tanks, etc. These types of wastes are typically transported to the treatment or disposal facilities in trucks (for drums, bins or containers) or if larger volumes in tanker trucks.

- **Transfer Stations**

  Transfer stations serve as collection points for garbage and brush trucks to transfer their loads to other long haul vehicles. The small collection trucks unload the waste onto a concrete floor or into a hopper; the waste is then compacted further and loaded into containers (typically with a capacity of 20 cubic meters) or directly into specially designed semi-trailers. As a rule of thumb, to optimize and reduce the number of trips to the treatment/disposal facility, transfer stations might be preferred if the distance to the treatment/disposal facility exceeds 30 km. In some cases, the distance to the treatment/disposal facility can be shorter and still be viable if the road conditions are poor.
- **Reception of Waste**
  When the collection vehicles or the long haul vehicles reach the treatment or disposal facility, the waste should be inspected visually and controlled that the paperwork corresponds to the actual load. In some cases, samples of the waste are taken and analyzed, (e.g., if the waste will be treated biologically where the end-product is utilized and there are demands for low contaminant concentrations such as heavy metals).

Waste Treatment and Disposal

Biological Treatment

- **Composting**

Generally speaking, the purpose of the composting process is to decompose organic solids in the presence of air and humidity, producing a humic substance valuable as soil conditioner. Economic advantages include the reduction in the volume of waste deposited in landfills (extending the life of the landfill and avoiding or delaying the construction of additional ones), and the generation of commercially valuable agricultural nutrients. Waste categories that are ideal for composting are park, yard and garden waste, paper, paper packaging, food scraps, animal manure and other types of organic waste. If animal waste is composted, the waste should be hygienized prior to composting. There are several methods available for central composting; the most common and simple is windrow composting where the waste is distributed in rows with the application of oxygen from underlying active or passive ventilation systems. Other methods include closed systems such as drums, tunnel, and membrane methods. The operational conditions and odor generation of closed systems are typically easier to control and are definite advantages over open treatment methods.

- **Anaerobic Digestion**

  Anaerobic digestion facilities are ideal for the treatment of the same types of organic waste that can be composted including wastes from households food scraps, paper tissue, garden waste like grass cuttings, leaves; food processing waste such as vegetables, cheese, meat, sugar; manure and animal waste; slaughterhouse waste; sewage sludge; and crop waste. The quality requirements of the incoming waste to the digestion facility are typically higher than in composting requiring a more homogenized and heterogeneous waste. Organic waste is treated in closed containers in the absence of air enhancing the generation of biogas (about 55-70 % methane) which can be recovered for subsequent use as a fuel source. The semi-solid residue (digestate) is normally treated through aerobic digestion and may be used as agricultural fertilizer.

Chemical and Physical Treatment

Chemical and physical treatment methods are varied and complex but may include: absorption, evaporation, distillation, filtration, chemical oxidation/reduction, neutralization, precipitation, solvent extraction, stripping / desorption, membrane-based separation, ion exchange, and solidification. Treatment systems may include one of these or a combination of multiple treatment operations. As most of these systems operate on a continual basis, they require a reliable, preferably homogenous source of material.

Incineration

Thermal treatment in incineration facilities can be used for all types of organic waste, including hazardous waste and mixed household waste. MSW incinerators reduce the volume of waste by about 90% and the weight by approximately 75%, while hazardous waste incinerators may achieve much higher waste volume and weight reductions, depending on the inorganic content of the wastes. Some incinerators today in operation are waste-to-energy facilities, which may use the combustion process to generate steam and electricity. Waste-to-energy facilities can be either mass burn or refuse-derived-fuel facilities. Incineration facilities typically range in size from

15,000 tons of waste per year to 500,000 tons per year. In mass burn facilities, wastes are injected into the boiler without any pre-processing or sorting of non-combustible materials. Most mass burning facilities use grate incinerators and operated at temperatures of at least 850ºC with higher temperatures applied to hazardous wastes. Flue gas treatment is typically required regardless of the type of incineration system. Residual wastes generated from the incineration process include slag, ashes, and flue gas treatment residues.

Landfilling

Landfilling can be used for most waste categories, but ideally only for inert material. A modern sanitary landfill is an engineered facility for the disposal of municipal solid waste designed and operated to minimize public health and environmental impacts. The typical landfill consists of several cells in which the waste is systematically placed. Compactors may be used to reduce the waste volume and to enhance the build-up of the cells. The landfill base usually consists of a liner that minimizes the leakage of liquid waste materials from the landfill into the groundwater system. As the waste is built up in layers it is covered daily to prevent paper, dust or odors from escaping into the environment. The leachate that is generated can be collected and treated. If organic waste is landfilled, landfill gas will be generated and may be collected and utilized or flared.

D. EHS Guidelines for Perennial Crop Production

Applicability

This document includes information relevant to large-scale plantation crops and outgrower systems and focuses on the primary production and harvesting through farming and plantation forestry of major multi-year food, fiber, energy, ornamental, and pharmaceutical crops, located in both temperate and tropical regions. It includes tree crops (such as olives, citrus, coffee, rubber, eucalypts, and cacao) as well as banana, sugarcane, and palm oil. It does not include the processing of raw materials into semi-finished and finished products.

Industry-Specific Impacts and Management

Farm or forest management plans often serve as an underlying framework for the management of environmental and social risks and impacts for perennial crop production. A farm or forest management plan would normally cover, among other things, the risks and issues presented in this document.

- **Environment**

  Environmental issues in plantation crop production primarily include the following:

  a. Soil Conservation and Management

     Physical and chemical degradation of soils may result from unsuitable management techniques, such as use of inappropriate machinery or earthworks associated with plantation preparation and infrastructure development. Chemical degradation of soil may result from insufficient or inappropriate use of mineral fertilizers, failure to recycle nutrients contained in crop residues, and failure to correct changes in soil pH that result from long-term use of nitrogen fertilizers and excessive use of poor-quality water, resulting in salinization.

Soil erosion may result from poor crop canopy closure after land preparation and lack of soil conservation structures on sloping land planted with perennial crops. Soil loss prevention practices include appropriate use of the following techniques:

i. Practice reduced and zero tillage (often known as “low till” or “no till”), as well as direct seeding and planting, to minimize damage to soil structure, conserve soil organic matter, and reduce soil erosion.
ii. Minimize soil compaction, damage, or disturbance by using appropriate land preparation machinery at the right time of year.
iii. Use cover crops,3 intercropping along contours with legumes4 to create multi-species shelterbelts, and/or windbreaks to reduce evapotranspiration and soil loss through wind and water erosion.
iv. Replenish soil organic matter by recycling crop residues, compost, and manures.
v. Implement earthworks when weather conditions pose the lowest risk of causing environmental damage.
vi. Employ erosion control management practices (e.g., contour and strip planting, terracing, discontinuous trenching, intercropping with trees, and grass barriers) in sloping areas.
vii. Draw up mitigation plans for planting or harvest operations that must take place during unsuitable periods.
viii. Use flow control weirs and diversion canals to reduce erosion in areas with field drainage.
ix. Restrict the width of roads to the minimum that will provide the means for efficient and safe transport.

b. The following approaches are recommended to maintain soil productivity over the long term:

i. Cultivate crops that are suited or adapted to the local climate and soil conditions and adopt good agronomic practices5 to optimize crop productivity.
ii. Collect meteorological data on precipitation, evapotranspiration, temperature, sunlight, and use information to inform and guide agronomic and silviculture management techniques.
iii. Use soil maps and soil survey results to determine crop suitability and appropriate soil management practices.
iv. Develop and implement a soil monitoring and management plan that includes soil and terrain mapping and erosion risk identification.
v. Conduct regular surveys to monitor soil structure and chemistry in order to identify areas where remedial action is required.
vi. Recycle and/or incorporate organic materials (e.g., crop residues, compost, and manures) to replenish soil organic matter and improve soil water-holding capacity.

vii. Minimize the use of pesticides by implementing a pest and disease early warning system, by using biological pest and disease control methods, and by implementing control measures before outbreaks require large-scale control.

c. Nutrient Management

Nutrient management strategies should aim to maintain and/or improve soil fertility and optimize crop yield while minimizing off-site environmental impact (e.g., contamination of groundwater resources and eutrophication of surface water resources from surface runoff and leaching of nutrients). Consider the following practices:

i. Use green manures, cover crops, or mulching techniques to maintain soil cover, reduce the loss of nutrients, replenish soil organic matter, and capture and/or conserve moisture.
ii. Incorporate nitrogen-fixing legume crop plants and cover crops in the cropping cycle.
iii. Draw up balanced fertilizer programs for each soil management unit based on fertility results, soil and leaf analysis, and crop assessment.
iv. Assess EHS risks associated with the nutrient management plan and mitigating strategies to minimize potential adverse EHS impacts.
v. Time the application of crop nutrients to maximize uptake and minimize nutrient runoff.
vi. Assess soil pH periodically and apply soil amendments (e.g., agricultural lime) to correct changes in soil pH as required to ensure that nutrients are available for plant uptake.
vii. Conduct periodic soil analysis to detect changes in soil fertility, inform decisions on fertilizer application rates, and avoid unsustainable nutrient depletion and over-fertilization.
viii. Establish and respect setbacks from watercourses—including appropriate buffer zones, strips, or other “no-treatment” areas along water sources, rivers, streams, ponds, lakes, and ditches—to act as a filter for potential nutrient runoff from the land.
ix. Select and maintain fertilizer application equipment to ensure desired application rates are used and overbroadcasting of solid fertilizers as well as overspraying of liquid fertilizers are minimized.
x. Implement nutrient planning and documentation, which includes the use of a fertilizer logbook to record the following information:
    1. Dates of purchase, dates of use, amount of fertilizer and nutrient used (kg/ha), purpose of use, and crop growth stage.
    2. Weather conditions before, during, and after application.
    3. Methods used to minimize nutrient loss (e.g., incorporation into the soil, split applications, irrigation after application).

d. Provide farm operators with training in nutrient management following published principles and agricultural practice manuals.

e. Ensure that all personnel are trained in and use appropriate management procedures for the storage, handling, and application of all types of fertilizers, including organic wastes.
f. Personal Protective Equipment (PPE) should be used according to the Safety Data Sheets (SDS) of the product or to a risk assessment of the fertilizer product. SDS should be available at each management unit.

g. Crop Residue and Solid Waste Management

In all plantation systems, residues can be recycled beneficially to improve soil organic matter and soil structure, as well as to reduce soil loss. In addition to annual or intermittent residues, many plantation crops also result in major residues at the end of their commercial life. These residues are valuable sources of organic matter and carbon and can lead to the extended release of nutrients during the development (growth) phase of the next crop cycle. Prevention and control strategies for potential risks and impacts include the following:

i. Develop and implement a residue management plan in combination with results from nutrient management research and planning.
ii. Recycle residues and other organic materials by leaving the materials on site or through composting (and spreading).
iii. Consider the potential for harboring and spreading pests and diseases before implementing this practice.
iv. Disperse (or mulch) large vegetative structures (e.g., trunks, branches), unless there are compelling habitat and biodiversity benefits identified in the Biodiversity Management Plan.
v. Consider using crop residues for other beneficial purposes—such as animal feed, bedding, or thatching—when leaving residues in the field is neither practical nor appropriate.
vi. In cases where crop residues are in excess of those needed for nutrient management, consider using as a thermal energy source for agriculture processing or for the generation of heat and/or power. Relatively high atmospheric emissions (such as of particulate matter and carbon monoxide (CO)) are possible when using crop residues for thermal combustion; their handling, storage, and processing may present risks of fire, such as from spontaneous combustion of improperly stored damp residues or explosion of combustible dust. Strategies to prevent and control risks and impacts include:
    1. In the planning phase, obtain physical and chemical data on the fuel and implement advice from a qualified specialist.
    2. Undertake tests with the "new" residual biomass fuel prior to introducing it, and demonstrate that expert advice and feedback have been followed.
    3. Adopt management practices in line with General EHS Guidelines in managing risks for fire and explosion.
    4. Avoid using harmful residual chemicals at end of crop life when preparing for removal.

Non-crop wastes from the production systems (e.g., pesticide containers, waste pesticides, and packaging) often have the potential to contribute to adverse health, safety, or environmental impacts. Considerations for the prevention and control of potential impacts from these wastes include:

a. Ensure all packaging for pesticides and herbicides is returned to the farm or forest after use and properly stored until final disposal.
b. Do not burn packaging, plastics, or other solid waste. Dispose of this waste in designated waste disposal facilities or by recycling. Manage solid waste in accordance with the General EHS Guidelines.
c. Consider large container and/or bulk systems for fuels, oils, fertilizers, and chemicals to reduce the volume of waste containers.
d. Examine alternative product formulations and packaging (e.g., biodegradable material).
e. Manage expired and unwanted pesticides as hazardous wastes in accordance with the General EHS Guidelines and Food and Agriculture Organization (FAO) Guidelines for the Management of Small Quantities of Unwanted and Obsolete Pesticides.

h. Water Management

Water management for plantation crop production should aim to conserve the quantity and quality of water resources while optimizing crop yield. Surface or groundwater resources used for irrigation should be managed in accordance with the principles of Integrated Resource Water Management, consistent with the following recommendations:

i. Determine rain or water irrigation requirements of the crop, based on internationally recognized guidelines, while recognizing seasonal variations and regional norms. When irrigation is practiced, develop an appropriate irrigation plan and schedule, and monitor consumption and compare regularly with these targets which should be based on available supplies of water.
ii. Maintain soil structure and soil organic matter. Use of crop residues and mulches will assist in maintaining soil organic matter levels, retaining soil humidity, and reducing surface evaporation.
iii. Maximize the retention of rainwater through appropriate “rain harvesting” techniques, which may include:
    1. Diverting water flow from roads and paths toward crops, thus storing water in the soil and reducing the effect of short dry spells.
    2. Storing runoff from rainy periods for use during dry spells by using tanks, ponds, cisterns and earth dams.
    3. Controlling weeds through the use of cover crops, mulching, or herbicides to encourage beneficial but low-water-use soil cover plants.
    4. Maintain protective vegetation in canals and drainage systems to reduce canal bank scouring and slow runoff.

When irrigation is used, implement irrigation water conservation techniques, such as:

1. Ensure regular maintenance of the irrigation system, as well as that of its associated channels and infrastructure.
2. Maintain a water management logbook that records the time and quantity of rainfall evaporation, as well as the amount of irrigation applied and soil

moisture levels (%), in order to verify both that irrigation is being used according to crop need and to develop an understanding of long-term trends in water use.

3. Reduce evaporation by avoiding irrigation during periods when evaporation is elevated (e.g., in periods of higher temperatures, reduced humidity, or high winds). Use trickle or drip irrigation techniques (if practical), or install "under canopy" rather than overhead sprinklers.
4. Reduce evapotranspiration by using shelterbelts and windbreaks.
5. Reduce seepage losses in supply channels by lining them or using closed pipes.
6. Consider collecting storm water through catchments.
7. Employ a cutback furrow irrigation technique, slowing or stopping irrigation water well before the water reaches the end of the furrow and discharges to the environment.
8. If herbicides are used, ensure they are applied at the appropriate time of year to most effectively control undesirable vegetation and reduce its water consumption.

The following measures are recommended to prevent and control the contamination of water sources:

1. Avoid over-irrigation, which may result in the leaching of nutrients and contaminants.
2. Ensure appropriate soil moisture by active monitoring of soil humidity.
3. Use harvesting methods or other appropriate measures to minimize the amount of debris deposited in streams.
4. Establish and respect setbacks and buffer zones in riparian areas. Buffer widths should be based on the specific risk, land management regime, and slope of the area.
5. Remove harvest debris from streams and consider the use of debris traps, such as trash lines, where possible.

Sediments may become a significant pollutant due to their physical and chemical properties. Suspended sediments in surface water carry pollutants such as pesticides, nutrients, and trace metals, affecting water quality. Sediment loading reduces storage and flow capacities of streams, lakes, and reservoirs; may adversely affect water supplies; and increases the risk of flooding. Soil loss prevention practices are presented in the "Soil Conservation and Management" section.

i. Pest Management

The primary aim of pest management should not be to eradicate all organisms, but to manage "pests", including insect pests, diseases, and weeds that may negatively affect plantation crops so that they remain at levels beneath an economically and environmentally damaging threshold. Pests should be managed through a process of integrated pest management (IPM) that combines chemical and non-chemical approaches to minimize pest impact, while also minimizing the impact of such measures on the environment. Pesticides should be used only to the extent necessary under an IPM and integrated vector management (IVM) approach, and only after other pest management practices have either failed or proven inefficient. The following steps should be considered and documented in an integrated pest/vector management plan:

a. Identify the main pests affecting crops in the region, assess the risks to the operation, and determine whether a strategy and capacity is in place.
b. Where possible, apply early-warning mechanisms for pests and diseases (i.e., pest and disease forecasting techniques).
c. Select resistant varieties and use the cultural and biological control of pests, diseases and weeds to minimize dependence on pesticide (chemical) control options. An effective IPM regime should:

1. Identify and assess pests, threshold levels, and control options (including those listed below), as well as risks associated with these control options.
2. Rotate crops to reduce the presence of insects, disease, or weeds in the soil or crop ecosystems.
3. Support beneficial bio-control organisms—such as insects, birds, mites, and microbial agents—to perform biological control of pests (e.g., by providing a favorable habitat, such as bushes for nesting sites and other original vegetation that can house pest predators and parasites).
4. Favor manual, mechanical weed control and/or selective weeding.
5. Use animals to graze areas and manage plant coverage.
6. Employ mechanical controls—such as traps, barriers, light, and sound—to kill, relocate, or repel pests.
7. Use pesticides to complement these approaches, not replace them.
8. Prior to procuring any pesticide, assess the nature and degree of associated risks and effectiveness, taking into account the proposed use and the intended users.

j. Use and Management of Pesticides

Where pesticide use is warranted, in order to prevent, reduce, or control the potential contamination of soils, wildlife, groundwater, or surface water resources caused by accidental spills during transfer, mixing, storage, and application, pesticides should be stored, handled, and applied in a manner consistent with the recommendations for hazardous materials management presented in the General EHS Guidelines.

A pesticide management plan (PMP) that includes procedures for the selection, procurement, storage, handling, and ultimate destruction of all out-of-date stocks should be prepared in accordance with FAO guidelines and should be consistent with country commitments under the Stockholm, Rotterdam, and Basel Conventions. The PMP prescribes the type of pesticides to be used, as well as the purpose of their use, and outlines best practice for the procurement and storage of all pesticides. Personnel must have appropriate training—including certification, where relevant—to handle and apply pesticides safely. In particular:

- Ensure that any pesticides used are manufactured, formulated, packaged, labeled, handled, stored, disposed of, and applied according to the FAO's International Code of Conduct on Pesticide Management.
- Do not purchase, store, use, or trade pesticides that fall under the World Health Organization's (WHO) Recommended Classification of Pesticides by Hazard Classes

1a (extremely hazardous) and 1b (highly hazardous), or Annexes A and B of the Stockholm Convention.

- Do not use pesticides listed in WHO Hazard Class II (moderately hazardous), unless the project has appropriate controls established with respect to the manufacture, procurement, or distribution and/or use of these chemicals. These chemicals should not be accessible to personnel without proper training, equipment, and facilities in which to handle, store, apply, and dispose of these products properly.
- Preferentially, use selective pesticides, where appropriate, rather than broad-spectrum products to minimize impacts on non-target species.

Recommended pesticide storage practices include:

- Store all pesticides in a lockable, bunded container or store that has sufficient space in which to capture any spills without contaminating the environment. Stores should be set away from water sources, residential and built-up areas, as well as livestock and food storage areas.
- Procure spill kits and institute suitable control measures in case of accidental spillage.
- Store all pesticides in their original, labeled containers and ensure that storage instructions are followed.
- Keep a register of all pesticides procured, recording when they were received, the amount used, the amount remaining in store, and their location.
- Keep SDS at appropriate locations in storage facilities.
- Warehouses must have appropriate ventilation, secondary containment, and emergency showers and kits.

Recommended pesticide handling practices:

- Operators must read, understand, and follow product label directions for mixing, safety, application, and disposal; use trained personnel for critical operations (e.g., mixing, transfers, filling tanks, and application).
- Insist that correct PPE (e.g., gloves, overalls, eye protection) for each exposure route18 listed in the SDS be worn at all times when handling and applying pesticides.
- Mandate that any mixing and filling of pesticide tanks occur in a designated filling area.

1. This should be set away from watercourses and drains.
2. If on concrete, water should be collected in a separate sump and disposed of as a hazardous waste.
3. Ensure that spills are cleaned up immediately using appropriate spill kits; spills should not be washed away into watercourses or drains.

Recommended application:

a. Give preference to the application method with the lowest EHS risk and ensure non target organisms are not affected.
b. Select pesticide application technologies and practices designed to minimize off-site movement or runoff (e.g., low-drift nozzles, using the largest droplet size and lowest pressure that are suitable for the product).

c. Establish buffer zones around watercourses, residential and built-up neighborhoods, as well as livestock and food storage areas.
d. For the aerial application of pesticides, the boundaries of target areas should be clearly demarcated and all possible nearby communities, livestock, and rivers should be identified in the flight plan. The aerial application of pesticides should not be conducted where there is potential for contamination of organic or otherwise certifiable production.
e. Ensure that all equipment is in good condition and properly calibrated to apply the correct dosage.
f. Insist that applications occur under suitable weather conditions; avoid wet weather and windy conditions.

Recommended disposal:

a. Any unused dilute pesticide that cannot be applied to the crop, along with rinse water, and out-of-date or no-longer approved pesticides, should be disposed of as a hazardous waste, as per FAO guidelines.
b. Empty pesticide containers, foil seals, and lids should be triple rinsed, and washings used in the pesticide tank should be sprayed back onto the field or disposed of as hazardous waste in a manner consistent with FAO guidelines and according to the manufacturer's directions. Containers should be stored safely and securely under cover prior to their safe disposal; they should not be used for other purposes.

k. Fertilizers
   a. Store fertilizers in their original packaging and in a dedicated location that can be locked and properly identified with signs, access to which is limited to authorized persons.
   b. Ensure that SDS and inventories are available at fertilizer storage facilities and available to first responders when necessary.
   c. Only purchase and store minimal fertilizer requirements, and use older fertilizers first.
   d. Keep fertilizer stores separate from pesticides and machinery (e.g., fuels, ignition, or heat sources).
   e. Know and understand each crop’s fertilizer requirements and only apply what is required, when it is required, to minimize losses to the environment.
   f. Implement a suitable training program for personnel that are transporting, handling, loading, storing, and applying fertilizers.
l. Biodiversity and Ecosystems

   Perennial crop production has the potential to have a direct and indirect impact on biodiversity and ecosystems. Key direct impacts relate to habitat conversion or degradation, water usage, pollution, introduction of invasive species, inappropriate cultivation techniques, and quality and or availability of priority ecosystem services. Indirect impacts relate to in-migration, and induced changes to access for traditional land uses (including hunting, fishing, and recreation). Impacts and associated mitigation activities related to biodiversity and ecosystems are primarily specific to the crops, techniques, and existing land use context at any specific site.

Impact avoidance should be the goal. Appropriate site selection, including expansion planning, is the single most important impact avoidance measure available to plantation crop production. Early screening can improve macro-level project site selection so as to avoid selecting areas with high biodiversity values, such as critical or natural habitat, areas with high conservation values (HCV), those modified habitats that contain significant biodiversity value (such as previously abandoned farmland that has subsequently developed into secondary forest), or provisioning or regulating ecosystem services. Such screening can thus help with scoping of priorities for further assessment, if complete avoidance is not possible, thus reducing unnecessary biodiversity and/or ecosystem impacts and costs in the future. Screening should be conducted to identify species and sites of importance within the broader region or landscape. Tools, such as the Integrated Biodiversity Assessment Tool (IBAT), can facilitate access to key international data sets. Sites of local, regional, and international importance may include: nationally and internationally protected areas, Important Bird Areas (IBA), Key Biodiversity Areas (KBAs), Alliance for Zero Extinction (AZE) areas, Ramsar Sites (Wetlands of International Importance), along with known congregatory sites and unique or threatened ecosystems.

Screening should consider any existing spatial data and landscape mapping as part of the literature review and desktop analysis. Key sources for biodiversity or ecosystem information include Strategic Environmental Assessments (SEA), National Biodiversity Strategies and Action Plans (NBSAP),relevant sector plans (including those that may be impacted, such as eco-tourism or fisheries), and conservation plans.

Conversion of existing critical, natural, or HCV habitats into agriculture should be avoided wherever possible and planting on modified habitats or degraded lands should be promoted. This should be informed by an assessment of existing modified habitats or degraded lands suitable for crop production or restoration, to reduce risks and costs associated with biodiversity impacts or further reduction of ecosystem services.

The farm- or forest-level management plan should be informed by an assessment of biodiversity values of importance, including species, sites, and habitats. This should, at a minimum, consider the farm/forest management unit, but in cases of higher risk, expected landscape connectivity or wildlife movement issues should consider a broader landscape unit based on the specific needs of biodiversity values in question. Very large management units, particularly where conversion or planting will be managed in smaller sub-units (e.g., multiple compartments or a phased approach), may not find a single comprehensive assessment to be practically feasible. In such cases, a desktop assessment, including analysis of satellite data supported by targeted groundtruthing, can be used to scope areas of potentially modified, natural, and critical habitat, as well as to identify potential set-asides and restoration areas that could mitigate possible impacts on biodiversity values across the full management unit. Groundtruthing can be practically implemented at the level of smaller sub-units (e.g., refining existing set-asides or establishing new ones). Perennial crops subject to international standards and certification systems now routinely employ tools to identify, delimit, and manage areas of HCV. Such areas should be clearly established on maps and within management plans. It is important that the conversion or planting schedule for these sub- units allow sufficient time (one to two years) to allow for assessment, analysis, and development of an appropriate management plan based on this information.

Some biodiversity values will require on-site management to maintain viability on-site and within the larger landscape. These include maintaining, establishing, or restoring corridors (e.g., riparian areas, movement corridors for wildlife), set-asides (e.g., important breeding or feeding sites), and buffer zones (e.g., to minimize off-site disturbance to neighboring riparian areas and wetlands, protected areas, and other important sites). The number, extent, and location of these areas should be informed by the assessment process and not simply by the prevalence of areas in which development is not feasible (e.g., steep slopes). Active management (e.g., access control, hunting reduction, and enrichment planting with indigenous species) and monitoring may be required in some situations to maintain required biodiversity values.

Developers should seek to avoid the introduction of invasive species, as well as control and reduce their further spread. This includes sourcing planting material (e.g., seeds, tube stock) from reliable suppliers who can provide evidence of purity.

Developers should use planting material that does not contain seeds from invasive alien species and that complies with local quarantine and hygiene regulations, implementing machinery cleaning programs when moving between fields to remove soil and seeds that may carry invasive or alien species.

m. Genetically Modified Crops (GM Crops)

A Genetically Modified Organism (GMO) is defined as a living organism that possesses a novel combination of genetic material obtained through the use of modern biotechnology. Environmental concerns related to the introduction of GM crops should be addressed and appropriate assessment conducted to demonstrate that human and environmental risks (if any) are acceptable.

The introduction of GM perennial crops should be conducted in compliance with the host country's regulatory framework. If such a regulatory framework does not exist in the host country, the applicability of the Cartagena Protocol on Biosafety25 should be verified and used to scientifically evaluate the potential impacts and risks related to a specific crop's introduction, including its invasive potential, and identify appropriate mitigation measures. The next steps in the risk assessment are to evaluate the likelihood of the events occurring, the consequences if it happens, and whether the overall risks (i.e., consequence and likelihood) are acceptable or manageable.

n. Energy Use

Energy is used in perennial crop production for site preparation, cultivation, management, irrigation, harvesting, transport, lighting, heating, cooling, and ventilation. Recommendations to reduce energy use and increase efficiency are presented in the General EHS Guidelines. Additional recommended strategies include:

a. Select energy-efficient machinery and equipment (e.g., tractors, ventilation systems, drying and storage systems, cooling devices) and consider on-board fuel-use monitors.
b. Consider implementing training programs to make operators aware of energy-efficient practices when using machinery (e.g., switching off engines when waiting to load) and when driving.

Irrigation energy use can be significant: the following techniques are recommended for efficient use of energy in irrigation systems:

a. Develop an irrigation plan that is appropriate for climate, season, soil conditions, plant materials, and grading. This plan should include optimum scheduling, monitoring, and recording systems so that energy usage and efficiencies can be examined. An irrigation logbook or database should be maintained so that quantitative measures are recorded (e.g., kWh electricity per cubic meter applied, fuel usage as liter per cubic meter applied).
b. Regularly maintain the irrigation system and associated infrastructure, such as supply channels and water storage.
c. Select efficient pumps.
d. Ensure properly matched pumps, systems, and power sources by keeping a good record of the amount of water pumped and the energy used to ensure suitability.

o. Air Quality

Atmospheric emissions are primarily associated with emissions of combustion by-products—including carbon dioxide (CO_2), sulfur dioxide (SO_2), nitrogen oxide (NO_X), and particulate matter (PM) —resulting from the operation of mechanized equipment or from combustion by-products from the disposal or destruction of crop residues or processing by-products. The impacts of these pollutants depend on the local context, including the proximity to communities, sensitivity of ecosystems, concentrations of the pollutant, topography, and meteorology. Air-quality issues, including management of mechanized farm equipment, should be managed according to recommendations in the General EHS Guidelines for mobile and stationary sources. Specific recommendations for perennial crop production to prevent and control air emissions are:

a. Avoid open burning for land preparation, weed control, and post-harvest treatments. Evaluate controlled burning in energy production facilities to extract thermal energy for beneficial use.
b. Where burning is unavoidable, potential impacts should be identified and weather conditions monitored to schedule burning in an effort to minimize impacts.

c. Prohibit burning of pesticide-treated agricultural wastes and by-products (e.g., pesticide containers) to avoid unintended emissions of persistent organic pollutants (POPs).
d. Adopt IPM strategies to avoid and reduce use of pesticides and associated drift.
e. Monitor and minimize ammonia emissions resulting from nitrogen fertilizer and manure use.
f. Note certain types of nitrogen fertilizer have higher ammonia emissions associated with their use than others. Consider incorporating fertilizer at planting to minimize ammonia emissions.
g. Reduce the risk of fire by reducing the build-up of potential fuel sources and controlling weeds and invasive species. Where controlled burns of residues are necessary, ensure optimal conditions for the low risk of spread and low impact on existing air quality.
h. Consider in-field systems and logistics that reduce the usage of high-emission equipment (e.g., the use of cable transport systems instead of tractors).
i. Evaluate the substitution of no- or low-emission energy sources for combustion methods. Ensure proper maintenance and operation of combustion equipment (irrigation engines, boilers, tractor engines, heaters, etc.) and consider replacing old units or retrofitting air emission controls.
j. Modify field operations where possible (e.g., reducing the number of in-field passes with machinery, reduced tillage operations, or improved logistics to minimize travel distances).
k. Modify timing of operations, where possible, to coincide with favorable atmospheric conditions and reduced risk of air pollution.
l. Establish cover crops where possible; retain residues, and reduce tillage intensity to avoid dust and soil degradation due to wind erosion. Where water supplies are ample, water application to cropped areas and access roads may reduce the risk of airborne dust.
m. Establish natural wind barriers—such as vegetative field borders, hedgerows, herbaceous wind barriers, and tree/shrub establishment—to intercept airborne particulate matter and droplets, which may also include contaminants.

p. Greenhouse Gas (GHG) Emissions

Perennial crop production produces GHG emissions, including methane, nitrous oxide, and carbon dioxide from different stages in the production cycle. Carbon is also stored in the crop's residual biomass above and below ground, as well as in the soil ecosystem. The primary sources of GHG emissions during site preparation for perennial crops will be carbon dioxide associated with land use change. During the production phase, emissions are nitrous oxide from fertilizer use and carbon dioxide from on-farm fuel and electricity use. Emissions from fertilizer come from both the manufacture of the product and from the application of the product to the crop, with both activities resulting in nitrous oxide emissions, which have a high global warming potential. These emissions should be managed through resource-efficient farming.

The following are recommended measures for minimizing GHG emissions from crop production:

i. Identify sources of on-farm GHG emissions and establish a GHG management plan that includes methods of mitigating emissions and a monitoring program.
ii. Follow the nutrient management plan to ensure that the nutrient balance is right for maximum crop uptake, the quantity of nitrogen matches crop needs, and the timing of application coincides with active growth stages.
iii. Consider using a fertilizer recommendation system to help with planning.
iv. Where available, use abated nitrogen fertilizers, which have lower GHG emissions associated with their manufacture, or use nitrification or urease inhibitors, which reduce soil emissions.
v. Reduce fossil energy use through adopting energy-efficient production and management practices.
vi. Where feasible, consider using renewable energy (e.g., solar, wind, biofuel) for crop drying or to power irrigation pumps.

The loss of stored carbon in the land occurs primarily during harvest and plantation establishment. Land use changes, such as converting grassland or forest to crop production areas, are responsible for the release of GHG emissions in the form of carbon dioxide. If the existing vegetation is burned as part of site preparation activities for the new land use, both methane and nitrous oxide will be emitted during the combustion process, in addition to carbon dioxide.

When converting land, the potential impact on GHG emissions should be assessed and measures implemented to reduce and mitigate this impact.

The following activities and strategies can prevent and control GHG emissions:

a. Avoid conversion of high-carbon stock areas, such as natural forest and peatlands/wetlands.
b. Avoid open burning of biomass during site preparation, field operations, and post-harvest.
c. Protect soils from the loss of organic matter by implementing good soil conservation management practices.
d. Increase soil organic carbon stocks through land management techniques.
e. Maintain and rehabilitate degraded areas and vegetative buffer zones to increase carbon stocks.
f. Consider increasing the rate of sequestration with species/clone selection.

- **Occupational Health and Safety**

  In developing suitable plans for mitigating environmental, health, and safety risks associated with all plantation crops, the hierarchy of controls should be followed as a means to limit workplace risk. Occupational health and safety (OHS) issues associated with plantation crop production include the following:

  a. Physical hazards

     i. Operational and workplace hazards

        Operational hazards include:

1. Slips, trips, and falls (inadequate workplace) resulting in sprains, strains, and fractures;
2. Ergonomics hazards from manual handling, lifting weights, or repetitive movements;
3. Sharp and moving objects in the workplace (e.g., foot injuries from thorns on oil palm fronds and fruit); and
4. Over-exposure to noise, vibration, and extreme or adverse weather conditions.

ii. Machinery and vehicles

Accidents may occur in the use of machines and vehicles, including worker transportation, farm tractors, harvesting and felling machinery, and a variety of other machines used on plantations and in forests. These may include vehicle collisions; vehicle and machinery roll-overs; uncontrolled movement resulting in personal injury (e.g., crushing by moving vehicles); damage or loss of asset; injury, entrapment, or death due to faulty or unguarded equipment and machinery (e.g., moving parts and pinch points on machinery and vehicles); entrapment due to unplanned starting, activation, or engagement of equipment (e.g., rollers); or injury during inspection or repair of vehicles (e.g., vehicle lift not secured while personnel working underneath). Most fatal accidents are associated with crushing by vehicles or equipment. Where plantation crops are harvested by hand, many of the injuries are hand-tool related. By far the largest numbers of logging accidents occurring annually are associated with felling operations. Workers may also be exposed to associated risks, such as the noise produced by the machines they operate. Occupational safety and health impacts and controls relating to equipment and vehicle operation and repair are discussed in the General EHS Guidelines. Physical hazards resulting from felling activities are discussed in the Forest Harvesting Operations EHS Guidelines.

iii. Confined and restricted space entry

Occupational health and safety hazards associated with confined and restricted spaces on plantations (e.g., processing bins and silos, product storage bins, water tanks, inadequately ventilated buildings, areas treated with pesticides, etc.) include risk of asphyxiation; explosions due to gas, dust, or fumes (e.g., residual petroleum fumes); and entrapment or enclosure within the confined space. Serious injury or fatality can result from inadequate preparation when entering a confined space or in attempting a rescue from a confined space. Entry into all confined spaces should be restricted and subject to permitted supervision by properly trained persons, as described in the General EHS Guidelines. Restricted areas should be clearly marked and clearly conveyed to personnel and contractors.

iv. Risk of fire and explosion

Fire safety should be managed according to the General EHS Guidelines. Additional sector-specific risks include fires resulting from the combustion of stored oil or crop residues, which can lead to a loss of property or cause possible injury to or fatality of project workers. National or international safety standards should be used in the design, operation, and maintenance of facilities, where applicable. Management plans and operating procedures should include comprehensive strategies for the prevention, detection, and suppression of fires within plantation perimeters and adjacent properties, including:

1. Description of primary detection methods, tools, and protocols;
2. Ability to communicate with field staff, contractors, and communities;
3. Measures for reducing fuel loading;
4. Means to access and contain fires within plantation premises;
5. Proper placement of appropriate fire suppression equipment; and
6. Training of staff, contractors, and communities in fire prevention and suppression actions.

b. Biological hazards

Occupational health and safety hazards associated with crop production may include contact with venomous animals, such as stinging insects, spiders, scorpions, snakes, disease vectors (e.g., mosquitoes, ticks), and with certain wild mammals (e.g., tigers, wild pigs). Recommended mitigation measures include:

i. Wear appropriate protective clothing, such as a long-sleeved shirt, long pants, hat, gloves, and boots.
ii. Inspect and shake out any clothing, shoes, or equipment (including PPE) before use.
iii. Remove or reduce tall grasses, debris, and rubble from around the outdoor work areas.
iv. Control water accumulation.
v. Use insect repellent.
vi. On-site first-aid equipment (including, for example, antivenom serum) and trained personnel should be available, as well as procedures for emergency evacuation.
vii. Use observation and sighting records so workers know areas where there are dangerous animals. Install fencing and other exclusion methods for larger animals and use armed guards/spotters to protect workers from large animals (e.g. elephants, tigers, wild boar).

c. Chemical hazards

Occupational health and safety impacts associated with pesticides are similar to those for other hazardous substances, and their prevention and control are discussed in the General EHS Guidelines. Potential exposures to pesticides include:

i. Dermal contact (e.g., in storage rooms or from leaking containers or splashes/spillage);
ii. Inhalation during preparation, mixing, and application; and
iii. Ingestion by swallowing the pesticide or contaminated foodstuffs.

The effect of such impacts may increase due to climatic conditions, such as wind (which may increase the chance of contaminant drift), elevated temperatures, or high humidity (which may be a deterrent to the use of PPE by the operator, thereby increasing the risk of exposure). Recommendations to minimize risks associated with pesticides and chemicals include (in addition to those listed in Section 1.1):

iv. Use alternative products or methods with a lower OHS risk profile (such as using lower toxicity rated products, or using safer application methods, such as shielded sprayers, incorporation, or low-volume equipment).
v. Train personnel on hazardous product management and storage. Include training on how to read labels and the SDS and to understand the risks associated with all hazardous products, including pesticides, fertilizers, and crop-processing products.
vi. Train operators and support personnel to apply pesticides and ensure that these personnel have received the necessary certifications29—or equivalent training where such certifications are not required—so that they are competent.
vii. Monitor and proactively manage all stages of pesticide and chemical purchase, storage, mixing, usage, and disposal. Maintain accurate records and analyze these records for any evidence of undue exposure or misuse of hazardous products.
viii. Respect pre- and post-treatment (re-entry) intervals to avoid operator exposure to pesticide residues in production areas and on roadside landings and logging decks.
ix. Ensure that product withholding periods are observed to minimize the risk of chemicals or their by-products entering the value chain.
x. Ensure hygiene practices are followed (in accordance with FAO30 regulations and the project pesticide management plan) to avoid exposure of personnel or family members to pesticide or chemical residues.

Re-entry into plantation areas that have been treated with pesticides and fungicides should be guided by information provided by the chemical manufacturer, normally included in the SDS.

- **Community Health and Safety**
  Community health and safety issues during the production of plantation crops may arise due to land use changes or to the loss of natural buffer areas (such as wetlands, mangroves, and upland forests that mitigate the effects of natural hazards, such as flooding, landslides, and fire) that may result in increased vulnerability and community safety-related risks and impacts. The diminution or degradation of natural resources may result in health-related risks and impacts. Hazardous products, including pesticides, may affect community health in the same ways that they affect individual operators: through dermal contact, ingestion, or inhalation of harmful products or chemicals. Risk of exposure to hazardous products can be minimized by ensuring that the plantation group is following guidelines for the transportation, storage, handling, usage, and disposal of those products. Risks also arise from:

a. Potential exposure to pesticides (e.g., spray drift, improper disposal and use of packaging and containers) and presence of pesticides or by-products in potentially harmful concentrations in foodstuffs and postharvest products.
b. Potential exposure to pathogens and noxious odors associated with the use of manure.
c. Potential exposure to air emissions from fires, burning of crop waste, residues, or solid waste (e.g., packaging).
d. Increased risk of vehicle or machinery injuries on roads and access routes around the community.

While odors from manure—especially during application—are not generally hazardous, they can be a serious source of discomfort to the community. Avoid burning of residual crop and other wastes, which create harmful air emissions that may adversely impact surrounding communities.

Specific recommendations to minimize risks to communities include:

e. Monitor and record all potentially harmful products and activities and manage them to minimize the risk to communities. Regularly audit and update operating procedures and ensure that personnel are suitably trained.
f. Implement best practice guidelines for management of potentially harmful products, and follow the General EHS Guidelines.
g. Avoid the aerial application of pesticides and give priority to other management strategies, if possible.
h. Do not apply pesticides, chemicals, or manure if meteorological conditions are likely to result in adverse impacts in surrounding communities.
i. Use biological or lower-risk-profile products, if available.
j. Respect pre-harvest intervals and post-harvest withholding periods for products that have been treated with pesticides to avoid unacceptable levels of residues. Do not store or transport pesticides and fertilizers with food (human or livestock foodstuffs) or beverages (including drinking water).
k. Ensure that animals and unauthorized people are not present in the areas where pesticides or other potentially harmful products are handled, stored, or applied.
l. Store manure and crop protection products as far away from dwellings as possible, and use measures, such as covering the manure, to reduce odors and atmospheric emissions.

Performance Indicators Monitoring

Environment

Environmental monitoring programs for this sector should be implemented to address all activities that have been identified to have potentially significant impacts on the environment, during both normal operations and upset conditions. Environmental monitoring activities should be based on direct or indirect indicators of emissions, effluents, and resource use applicable to the particular project. They should include monitoring of community impacts—such as those from waste, discharges, and emissions from any processing activities—through a well-designed monitoring program.

Monitoring frequency should be sufficient to provide representative data for the parameter being monitored. Monitoring should be conducted by trained individuals following monitoring and record-keeping procedures. Equipment should be properly calibrated and maintained. Monitoring data should be analyzed and reviewed at regular intervals and compared with the operating standards, so that any necessary corrective actions can be taken. Additional guidance on applicable sampling and analytical methods for emissions and effluents is provided in the General EHS Guidelines.

Table 33: Core performance indicators for perennial crop production systems

No.	Performance Indicator	Examples of Measurement	Monitoring Criteria
1.	Farm or forest management plan	Yes/ No	A site-specific farm or forest management plan is available for review and updated annually.
2.	Water quality (on-site and off-site water supplies)	Biochemical oxygen demand (BOD) (mg/L), pH, Total suspended solids (TSS) (mg/L), turbidity (Nephelometric Turbidity Unit), nutrients (mg/L), or other potential pollutants	Water quality parameters should not deteriorate from baseline measurement levels. For off-site water supplies, measurement and monitoring according to vulnerable areas and key risks (such as earthworks) should take place and plans may include measurement of TSS at discharge, but also in the upstream and downstream river/stream (mg/l).
3.	Water resource efficiency	Liters per hectare and liters per ton of product	Projects should aim to measure and improve water resource efficiency (e.g., liters/ha and liters/t of product) and assess on a seasonal basis whether water use is in line with water availability within the watershed.
4.	Soil erosion and soil erosion risk	tons per hectare per year	Projects should aim to reduce erosion hazard rating levels, which should be assessed annually based on topography and slope; ground cover; exposed and bare soil; evidence of sheet, gully, and/or rill erosion; recent sedimentation; silt deposition in streams; and

			exposed plant roots.
5.	Nutrient application and management	kg nutrient per ha	• Soil maps appropriate to culture are available • Soil analysis indicating nutrient deficiencies are available • Fertility prescriptions are in place and supported
6.	Use and effectiveness of pesticides	Active ingredient usage per ton of market product and/or per hectare treated	System in place that allows effective identification of phytosanitary problems and effective treatment.
7.	Pesticide residues on site soil	Active ingredient in g/ha	These parameters should be below applicable tolerance levels.
8.	Pesticide residues on produce	Active ingredient in µg/kg of product	These parameters should be below maximum residue levels.
9.	Energy use	MJ/t product, kWh consumed, kWh/ha crop, kWh/t crop product	Projects should aim to show improvements in energy efficiency. Systems to monitor and report energy use and efficiency should be implemented.
10.	GHG emissions and carbon stocks	t carbon stocks, gCO_2eq/t product	Projects should aim to install appropriate monitoring systems to record changes in GHG emissions (t carbon stocks, gCO_2eq/t product), including those changes associated with above- and below-ground carbon stocks (e.g., as part of harvest planning in forest management plans) and soil carbon stocks. CO_2, CH_4 can be measured using fixed or portable meters that are located near sources.
11.	Particulate matter	Depositional dust (g/m^2/month), PM_{10}, $PM_{2.5}$	Strategically placed depositional dust gauges or $PM_{2.5}/PM_{10}$ air quality monitoring equipment, e.g., TEOM (Tapered Element Oscillating Microbalance), especially near sensitive receptors (e.g., clinic near a busy harvest road).

Occupational Health and Safety

Occupational health and safety performance should be evaluated against internationally published exposure guidelines, examples of which include the Threshold Limit Value (TLV®) occupational exposure guidelines and Biological Exposure Indices (BEIs®), published by the American Conference of Governmental Industrial Hygienists (ACGIH); the Pocket Guide to Chemical Hazards, published by the United States National Institute for Occupational Health and Safety (NIOSH); Permissible Exposure Limits (PELs), published by the Occupational Safety and Health Administration of the United States (OSHA); Indicative Occupational Exposure Limit Values, published by European Union member states, or other similar sources.

- **Accident and Fatality Rates**
  Projects should try to reduce the number of accidents among project workers (whether directly employed or subcontracted) to a rate of zero, especially accidents that could result in lost work time, different levels of disability, or even fatalities. Facility rates may be benchmarked against the performance of facilities in this sector in developed countries through consultation with published sources.
- **Occupational Health and Safety Monitoring**
  The working environment should be monitored for occupational hazards relevant to the specific project. Monitoring should be designed and implemented by accredited professionals as part of an occupational health and safety monitoring program. Facilities should also maintain a record of occupational accidents and diseases and dangerous occurrences and accidents. Additional guidance on occupational health and safety monitoring programs is provided in the General EHS Guidelines.

Where pesticides are used, the health conditions of the workers who handle pesticides should be monitored through periodic health exams that include clinical assessment and blood/urine testing of relevant bio-indicator parameters (e.g., for organo-phosphates, cholinesterase, and alkylphosphates).

General Description of Industry Activities

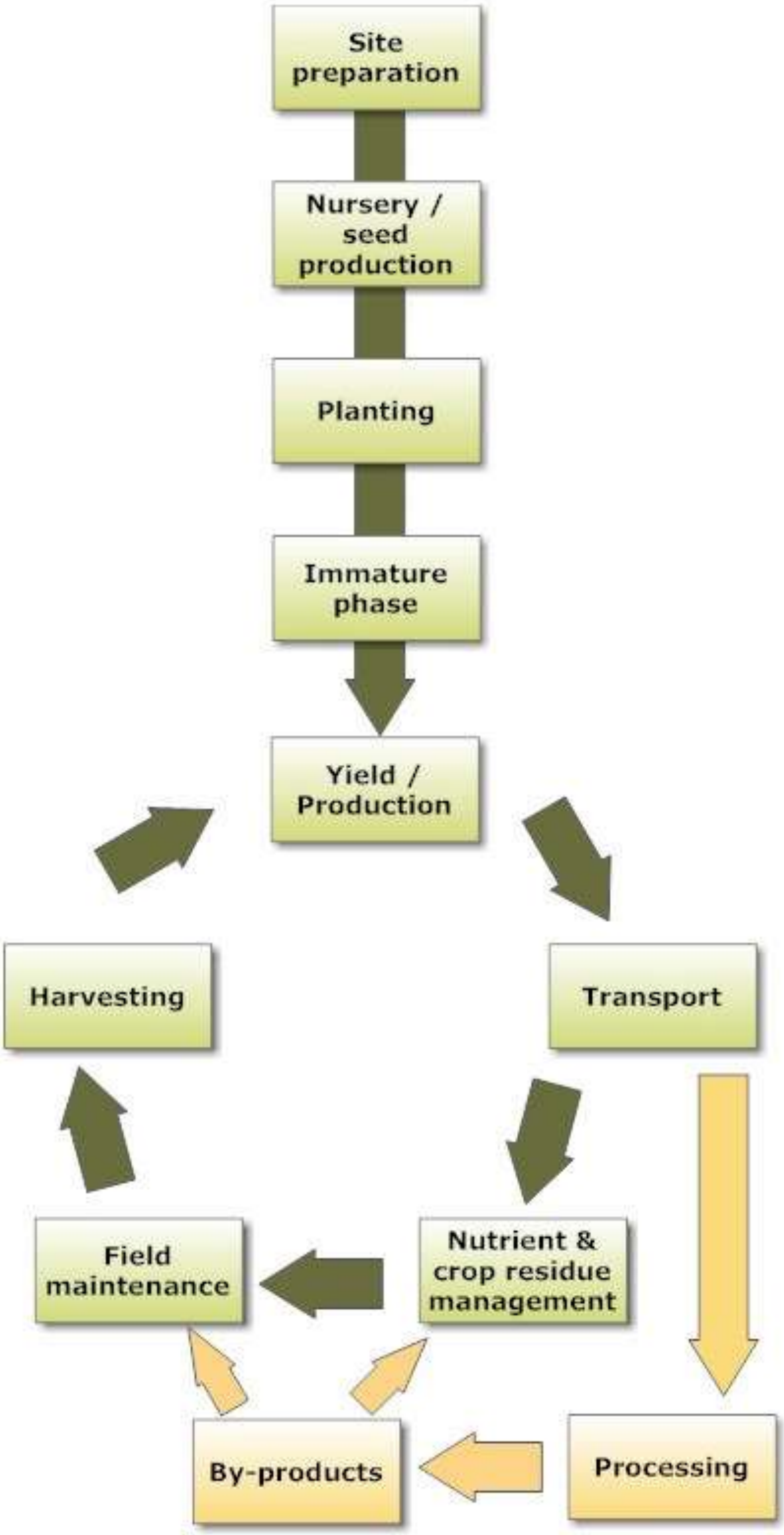
The production of perennial crops consists of planting useful crops and modifying the environment to provide them with optimum conditions for growth. The life cycle of a plantation is normally longer than one growing season. For example: olive trees may be productive for several hundred years; modern oil palm, coconut, and rubber plantations are productive for 20 to 30 years; but sugar cane crops are only grown for one or two seasons. Perennial crops belong to many different plant classifications and families. Products from palms include palm oil and coconuts; products from tree crops include citrus fruits, rubber, and cacao; products from bushes include coffee and tea; products from herbs include bananas; and sugar cane is derived from a member of the grass family. Tropical forestry plantations include species such as Eucalyptus and Pinus. Temperate and boreal plantations are varied and many include spruce, pine, and fir.

The optimal growing conditions (including nutrient and water needs) and threats (including diseases and insects) differ for each crop. This is also the case for the utilization of the crop, which varies from human consumption to industrial uses.

Modification of the environment ranges from minimal to intensive depending on the particular crop, growing conditions (soil, climate, diseases, weeds, and insects), and management techniques. The land area used for plantation crops and the scale of the production output are a factor of the above considerations, in addition to the use of fertilizer, water, and pesticides. It is the management of these latter factors that is of particular concern for environmental protection, as well as for occupational and community health and safety. However, achieving sustainable intensification and increased productivity per unit of land may be the most important factor in both reducing the expansion of plantation crops into natural areas and ensuring the adequate provision of foodstuffs for communities.

As illustrated in the schematic diagram in **Figure 4**, the agricultural operations for plantation crops are divided into soil preparation, nursery (or planting material/seed production), planting, and tending before the crop starts to yield productively.

Figure 4: Generalized perennial crop production cycle



Site Planning and Preparation

Site preparation involves preparing and improving the soil and the surrounding borders specifically for plantation crops, including removing undesired plants, enhancing water supply and drainage systems, adding nutrients to the soil and regulating pH, and establishing various mitigation measures in view of potential threats from flooding, runoff, and erosion. This is the phase in which land use is assessed, topographic and terrain models are established, natural vs modified habitats are mapped, species and sites of high biodiversity value (including critical habitat and HCV areas) are identified, roads are planned, community receptors are identified, and watercourses are protected, etc.

Tractor-drawn equipment and heavy machinery (e.g., bulldozers, excavators) are often used to remove existing vegetation. Cleared vegetation can be left to form a mulch to help improve soil quality, rather than burned.

Following clearing, a period of six to eight weeks passes before the land may be selectively sprayed with herbicides, to reduce vegetation, and the plantation crop is then sown or planted.

Planting or Sowing

Depending on the type of plantation crop and soil conditions, the planting seedbed and planting rows are prepared to maximize early growth, to reduce soil exposure, and to optimize early yields from the crops. The choice of appropriate tools and equipment will ensure a successful crop, with minimum impact on the local environment. Sowing equipment and methods range from tractor-drawn implements (e.g., sugar cane) to manual planting by digging planting holes and inserting a juvenile plant (sapling) (e.g., oil palm, coconut, cacao, rubber, forestry), or to partially or fully mechanized planting methods (e.g., sugar cane, forestry).

The inter-row areas should be planted with suitable cover plants (e.g., legumes, food, or fodder crops) to protect the exposed soil, cycle organic matter and nutrients, and maintain desirable soil structure and conditions.

Weed Control

Weed control is the botanical component of pest control, which attempts to stop weeds, especially noxious or injurious weeds, from competing with plantation crops. Weed control is normally conducted mechanically through harrowing or other forms of plowing, the use of mulch or plastic barriers, or the use of chemical herbicides.

Immature (Growing) Phase

In the plantation crop's immature phase, the planted rows and access paths are kept clear of undesired vegetation and fire risk is managed to optimize early growth and prevent unplanned damage. Returning crop residues from harvesting, thinning, pruning, and processing to the inter-rows, and establishing vegetative cover crops in trees or palm and bush plantations, minimize soil and environmental impacts. Other activities in this phase to promote optimal growth include shaping the plantation crop canopy and structure (for example, pruning branches to form the trees or bushes and to assist future harvesting), irrigation, and the application of pesticides and nutrients.

Some plantations apply intercropping techniques to maximize harvest output. For example, olive tree plantations may also cultivate other crops, such as tomatoes and potatoes, between the rows of olive trees.

Harvesting, Transport, and Postharvest

Once the crop reaches the mature stage of growth, it is carefully harvested. Harvesting of plantation crops involves digging, cutting, picking, or other methods to remove the crops from the ground, stalks, vines, bushes, or trees. Some are harvested by hand (e.g., oil palm, coconut, cacao, rubber) where there is adequate labor availability and/or mechanized methods are not available. Other crops may be harvested by machine (e.g., sugar cane, coffee), and some utilize both methods (e.g., forestry). For some crops, such as sugar cane and forestry, prescribed fire may be conducted to improve access to the crop and reduce fuel loading, although this practice is declining worldwide as the value of crop residues and effective residue management methods are demonstrated and effective methods of residue management are developed.

After the harvest, the crop is stored on site in a controlled environment and may undergo certain preprocessing activities, such as washing (to remove pesticide residues) and drying.

Plantation crops destined for use as processed foods (e.g., olives, palm oil) and products (e.g., forestry timbers) are likely to undergo extensive processing, and this may require significant water use (e.g., washing of food crops such as olives). Crops such as coffee and cacao require fermentation and drying onsite before transport to the processing plant is possible. Crops such as oil palm and rubber undergo processing to extract the marketable fractions (e.g., palm oil, palm kernel, fiber) of the yield.

The processed plantation products are then prepared for market transport using a wide variety of forms, including:

a. Consumer packaging: the produce is packed using various materials, including corrugated cardboard, paper, and plastic/fabric packaging materials, to protect it until it reaches the consumer (e.g., fresh bananas) or additional processing facilities (e.g., coffee beans being sent for roasting and grinding).
b. Small bulk containers: bulk containers including large crates (e.g., copra from coconuts), small tanks (e.g., refined coconut oil), or large reinforced cardboard containers (e.g., citrus fruit destined for juicing plants).
c. Break bulk systems: the products are packaged in lots that can be handled and these are then packed inside larger bulk handling in containers (e.g., bags of copra and bundles of timber are packed inside shipping containers). These large consignments are then broken down into smaller packages at the destination for further transport and distribution.
d. Bulk handling: typically, large tankers (e.g., palm oil, raw coconut oil), shipping containers (e.g., processed timber, bags of cacao or coffee), and freighters/ships (e.g., copra, timber).

The potential pollution outputs of harvesting and post-harvesting activities include air emissions from harvesting equipment and crop residue burning, wastewater contamination with organic wastes and pesticides from crop washing, wastewater and waste product from processing, and damaged packaging materials.

Replanting Phase

Once the marketable component is harvested and/or the yield declines, a plantation is then prepared for the next cropping phase. Activities include:

- Review of the site and replanning for the next crop cycle (including community and EHS);
- Establishment of a nursery (e.g., oil palm, cacao, rubber, forestry) or seed crop (e.g., sugar cane) to provide planting material for the next rotation;
- Removal and mulching of the existing crop in-situ;
- Site preparation, including lining of new planting rows in the inter-rows;
- Soil and nutrient management in preparation for the new crop;
- Managing pests and diseases, if needed;
- Replanting or propagating from rootstock; and
- Restoration of infrastructure, such as irrigation systems, roads, bridges, and harvesting access paths.

When the plantation crop reaches maturity, the leaf area usually provides significant ground cover to limit weed growth, and weed control activities may not be necessary. A well-established canopy provides soil protection from raindrop impact and erosion. On slopes, the planting density should not be too dense to prevent light and rainfall penetration, which would limit protective inter-row vegetation establishment.

Water Consumption

Water consumption per crop can be calculated and compared with a theoretical standard value. In practice, the requirements for water depend on crop species, soil type, evaporation, and water conservation practices. The Food and Agriculture Organization (FAO) provides guidance on water management and how to calculate appropriate irrigation. CropWat is a computer program for the calculation of crop water requirements and irrigation requirements based on soil, climate, and crop data that can help design and manage irrigation schemes.

Crop-specific evapotranspiration factors (crop coefficients—Kc) form the basis of crop water calculations. **Table 33** shows the single-crop coefficients for selected crops. It is provided for illustrative purposes only and demonstrates that water requirements vary over the growing season, influencing the risks and impacts of a particular project. The total water requirements are therefore affected by the length and time of the growing season, which must also be considered when estimating whether crop water requirements are in line with water availability.

The risks and impacts associated with water use should consider the status of the river basin within which the project is located.

Table 34: Indicative Single-Crop Coefficients (Kc) for Selected Crops

	Initial[1]	**Mid**[2]	**End**[3]
Banana	0.5–1.0	1.1–1.2	1–1.10
Sugarcane	0.40	1.25	0.75

	Initial[1]	Mid[2]	End[3]
Oil Palm	0.95	1.0	1.0
Cacao	1.0	1.2	1.0
Coffee[4]	0.9–1.05	0.95–1.10	0.95–1.10
Rubber	0.95	1.0	1.0
Tea	0.95–1.1	1.0–1.15	1–1.15
Citrus[5]	0.5–0.7	0.45–0.65	0.55–0.7
Citrus[6]	0.75–0.85	0.7–0.85	0.75–0.85
Olives	0.65	0.7	0.7

Notes:
[1]Crop coefficient during the initial crop development stage. These values are subject to the effects of large variations in wetting frequencies.
[2]Crop coefficient in the mid-season.
[3]Crop coefficient at the end of the season.
[4]Lower values are bare ground, higher values are with weeds.
[5]No ground cover 20–70% canopy.
[6]With active ground cover or weeds.

E. EHS Guidelines for Ports, Harbors and Terminals

Applicability

The EHS Guidelines for Ports, Harbors, and Terminals are applicable to commercial ports, harbors, and terminals for cargo and passengers transfer. Shipping (including repair and maintenance of ships), fuel terminals, or railways are addressed in separate industry sector EHS Guidelines, specifically the EHS Guidelines for Shipping, Crude Oil and Petroleum Product Storage, Railways, respectively. Annex A provides a summary of industry sector activities. This document is organized according to the following sections:

Section 1.0 — Industry-Specific Impacts and Management
Section 2.0 — Performance Indicators and Monitoring
Annex A — General Description of Industry Activities

Industry-Specific Impacts and Management

The following section provides a summary of EHS issues primarily associated with port and terminal construction and operations, along with recommendations for their management. Recommendations for the management of EHS issues common to most large industrial and infrastructure projects, including siting and cumulative impact considerations, are provided in the General EHS Guidelines.

1.1 Environment

Environmental issues in port and terminal construction and operation primarily include the following:

a. Dredged materials management
b. Air emissions
c. General waste reception
d. Wastewater
e. Solid waste management
f. Hazardous materials and oil management

g. Noise
h. Biodiversity

Dredged Materials Management

Construction and maintenance dredging, and dredge spoil disposal, may impact habitats and pose a significant hazard to human health and the environment, particularly if the sediments are contaminated by historical deposition and accumulation of hazardous materials, whether due to on-site or off-site activities. The following recommendations should be adopted to avoid, minimize, or control impacts from dredged materials, as part of Marine Dredging Management Plan.

Dredge Planning Activities

- Dredging should only be conducted if necessary, and based on an assessment of the need for new infrastructure components or port navigation access to create or maintain safe navigations channels, or, for environmental reasons, to remove contaminated materials to reduce risks to human health and the environment;
- Prior to initiation of dredging activities, materials should be evaluated for their physical, chemical, biological, and engineering properties to inform the evaluation of dredge materials reuse or disposal options.

Dredging

- Excavation and dredging methods should be selected to minimize suspension of sediments, minimize destruction of benthic habitat, increase the accuracy of the operation, and maintain the density of the dredge material, especially if the dredge material includes contaminated areas. There are several dredging methods which are commonly used depending on the depth of the sediments and environmental concerns such as the need to minimize sediment suspension and increase dredging accuracy.
- Areas sensitive for marine life such as feeding, breeding, calving, and spawning areas should be identified. Where sensitive species are present, dredging (and blasting) should be conducted in a manner so as to avoid fish migration or spawning seasons, routes, and grounds;
- Use techniques (e.g. silt curtains), to minimize adverse impacts on aquatic life from the re-suspension of sediments;
- Inspection and monitoring of dredging activities should be conducted to evaluate the effectiveness of impact prevention strategies, and re-adjusted where necessary.

Disposal of Dredged Material

- Dredged material should be analyzed in order to select appropriate disposal options (e.g. land reclamation, open water discharge, or contained disposal). Beneficial reuse of uncontaminated, dredged material should be considered (e.g.

for wetland creation or enhancements, habitat restoration, or creation of public access / recreational facilities);

- Use of submerged discharges should be considered for hydraulic disposal of dredged material;
- Use of lateral containment in open water disposal should be considered. Use of borrow pits or dikes reduces the spread of sediments and effects on benthic organisms;
- se of cap containment sediments with clean materials should be considered. Level bottom capping or combinations of borrow pits / dikes with capping reduces the underwater spread of contaminated material;
- Confined disposal facilities should be used, either nearshore or upland, when open water disposal is not feasible or desirable. If dredge spoil is contaminated, confined disposal facilities should include liners or other hydraulic containment design options to prevent leaching of contaminants into adjacent surface or groundwater bodies. Treatment of dewatering liquids (e.g. metals and persistent organic pollutants) may be required prior to discharge. Site-specific discharge quality standards should be established depending on the type and toxicity of the effluents and the discharge location;
- Since much sediment contamination originates from land use practices in the surrounding watershed, port managers should work with national and local authorities, as well as facility owners and operators in the watershed, to reduce sources of key contaminants. This may involve informing the authorities as to the difficulties in disposal of dredged material; actively participating in watershed protection programs sponsored by local or state agencies or in surface water discharge permitting efforts, if any, for sources in the port's watershed; and actively participating in zoning procedures.

Air Emissions

The most significant sources of air pollutants from port operations include combustion emissions from ships' propulsion and auxiliary engines and boilers, mainly consisting of sulfur dioxide (SO2), nitrogen oxides (NOX), greenhouse gases (e.g. carbon dioxide [CO2] and carbon monoxide [CO]), fine particulate matter [PM], and volatile organic compounds [VOC]), followed by combustion source emissions from vehicles and land-based engines and boilers contributing similar pollutants.

Volatile organic compounds (VOC) may also be emitted from fuel storage and transfer. Storage and handling of dry bulk cargo, as well as from onshore construction activities and vehicle traffic on unpaved roads, may also contribute to particulate matter emissions.

Recommended air emissions management strategies include:

Combustion Sources

- Developing air quality management procedures applicable to ship operators, such as:

a. Maintaining emissions of NOx and SOx within the limits established by international regulations 9
b. Using low-sulfur fuels in port, if feasible, or as required by international regulations
c. Navigation of port access areas at partial power, achieving full power only after leaving the port area
d. Avoiding or limiting the practice of blowing soot from tubes or flues on steam boilers while in port or during unfavorable atmospheric conditions
e. If the port provides onshore power for vessels to reduce shipboard power use during loading / unloading activities, requiring vessels to shut down power plants (go "cold iron") if docked above a specified time threshold

- Depending on the need to address local air quality concerns, operators should develop air quality management procedures for application to land-based activities which may include:
  a. Keeping transfer equipment (e.g. cranes, forklifts, and trucks) in good working condition
  b. Upgrading the land vehicle fleet with less-polluting trucks and vehicles, and using alternative fuels and fuel mixtures
  c. Encouraging reduction in engine idling during on- and off-loading activities
  d. Encouraging storage planning to avoid or minimize restorage
  e. and reshuffling of cargo

Where practicable, designing new facilities to minimize travel distance from ships off-loading and on-loading facilities to storage areas.

Volatile Organic Compounds

VOC emissions from fuel storage and transfer activities should be minimized by means of equipment selection, such as the use of floating top storage tanks or vapor recovery systems for fuel storage, loading / offloading, and fueling activities (depending on the type of material to be stored), and adoption of management practices such as limiting or eliminating loading / unloading during poor air quality episodes or implementing tank and piping leak detection and repair programs. Additional prevention and control recommendations for VOC emissions applicable to fuel storage and handling are provided in the General EHS Guidelines and the EHS Guidelines for Crude Oil and Petroleum Product Terminals.

Dust

- Dry bulk materials storage and handling facilities should be designed to minimize or control dust emissions, including:
  a. Storing pulverized coal and pet-coke in silos
  b. Installing dust suppression mechanisms (e.g. water spray or covered storage areas)
  c. Using telescoping chutes to eliminate the need for slingers

d. Using vacuum collectors at dust-generating activities
e. Using slurry transport, pneumatic or continuous screw conveyors, and covering other types of conveyors
f. Minimizing free fall of materials
g. Minimizing dry cargo pile heights and containing piles with perimeter walls
h. Removing materials from the bottom of piles to minimize dust re-suspension
i. Ensuring hatches are covered when material handling is not being conducted
j. Covering transport vehicles
k. Regularly sweeping docks and handling areas, truck/rail storage areas, and paved roadway surfaces

- Additional dust prevention and control recommendations applicable to construction and operational phase activities are provided in the General EHS Guidelines.

Wastewater

Water effluents associated with port activities may include stormwater and sewage from port operations, as well as sewage, ballast water (e.g. from oil tankers), bilge water, and vessel cleaning wastewater from ships. Ship sewage and wastewater contains high levels of BOD and Coliform bacteria, with trace concentrations of constituents such as pharmaceuticals, and typically low pH levels. Wash water may contain residues such as oil. Pollutants in bilge water contain elevated levels of BOD, COD, dissolved solids, oil, and other chemicals that accumulate as the result of routine operations.

Port Sewage and Stormwater

Stormwater and sewage from port facilities should be managed according to the recommendations provided in the General EHS Guidelines. Additional recommendations specific to stormwater and wastewater from port facilities include:

- Avoiding installation of storm drainage catch basins that discharge directly into surface waters, using containment basins in areas with a high risk of accidental releases of oil or hazardous materials (e.g. fueling or fuel transfer locations), and oil / grit or oil / water separators in all runoff collection areas. Oil / water separators and trapping catch basins should be maintained regularly to keep them operational. Recovered contaminated solids or liquids disposed of as hazardous materials (see the General EHS Guidelines);
- Installing filter mechanisms (e.g. draining swabs, filter berms, drainage inlet protection, sediment traps and sediment basins) to prevent sediment and particulates from reaching the surface water.

Ship Wastewater

- Port operators should provide collection, storage, and transfer and / or treatment services, and facilities of sufficient capacity and type for all wastewater generated by vessels at the port in accordance with MARPOL and national regulations:
  a. Oily waste and wastewater should be collected in barges, vehicles, or central collection systems and storage tanks. The capacity of oily waste collection should be established based on applicable MARPOL provisions
  b. Wastewater with noxious chemicals from bulk tank cleaning should be collected through appropriate onsite or off-site treatment prior to discharge.
  c. Incompatible substances should not be mixed in the collection system. Treatment methods should be established based on the effluent characteristics
  d. Sewage from ships should be collected and treated onsite or off-site according to the recommendations provided in the General EHS Guidelines
- Smaller vessels used for harbor services should be equipped with recycling or chemical toilets, or holding tanks, that can be discharged to shore facilities.

Waste Management

The type and amount of solid and liquid wastes associated with port operations may vary significantly depending on the nature of port operations and the types of ships serviced. Wastes originating at the port may include inert solid waste from cargo packaging and from administrative offices, as well as hazardous or potentially hazardous waste associated with vehicle maintenance operations (e.g. used lubricating oils and engine degreasing solvents). Wastes originating from ships may include oily sludge (addressed above under "Wastewater"), inert materials such as food packaging, and food waste. Guidance applicable to port generated wastes, whether hazardous or non-hazardous, is discussed in the General EHS Guidelines. Specific pollution prevention, minimization, and control recommendations for ship-generated wastes received by port facilities is outlined below.

General Waste Reception

Port facilities should provide adequate means of receiving and managing effluents and wastes to meet its own needs and those of visiting ships and for which the port is designed to service. The provision of waste reception facilities should be developed in coordination with the SGss according to their commitments to the MARPOL Convention as port states. Port waste reception facilities should provide adequate capacity to receive port and ship generated wastes including appropriately sized and located receptacles, and the capacity to deal with seasonal fluctuations.

Ship Wastes

- Information should be available for ship captains to identify solid waste reception facilities and acceptable handling procedures at ports;

- Discharge of solid waste from vessels should be prohibited while in port in accordance with MARPOL and national regulations. More stringent restrictions should be considered, if necessary, to protect the port environment;
- A collection and disposal system should be developed for ship-generated garbage for ships alongside and at anchor, consistent with the International Maritime Organization (IMO) Comprehensive Manual on Port Reception Facilities. Closable skips should be provided at the berths and towed or self-propelled barges fitted with skips should be used to collect garbage from ships at anchor;
- Food waste from ships delivered to the port should be managed according to applicable local regulations intended to protect human and animal health. Local requirements may include rendering, incineration, or landfilling of food waste and mixed waste containing food waste.

Hazardous Materials and Oil Management

Hazardous materials at ports include large volumes of hazardous cargo, as well as oil and fuels and hazardous substances used in port activities including vessel, vehicle, and grounds maintenance. Spills may occur due to accidents (e.g. collisions, groundings, fires), equipment failure (e.g. pipelines, hoses, flanges), or improper operating procedures during cargo transfer or fueling, and involve crude oils, refined products or residual fuels, liquid substances, and substances in packaged form. Additionally, equipment maintenance may involve the use of potentially hazardous materials including solvents and lubricants. General hazardous materials management is addressed in the General EHS Guidelines. Additional recommended prevention, minimization, and control techniques specific to ports include the following.

Spill Prevention

- Oil and chemical-handling facilities should be located with consideration of natural drainage systems and environmentally-sensitive areas (e.g. mangroves, corals, aquaculture projects, and beaches, providing physical separation / distance whenever possible);
- Ports should include secondary containment for above ground liquid storage tanks and tanker truck loading and unloading areas;
- Hazardous materials storage and handling facilities should be constructed away from active traffic and protect storage areas from vehicle accidents. Covered and ventilated temporary storage areas should be provided for leaking hazardous cargo and designed to facilitate collection of leaks and spills (e.g. slope surface to allow capture of spills, use valved catch basins that allow spills and releases to enter a dead-end sump from which spilled materials can be pumped);
- Fuel dispensing equipment should be equipped with "breakaway" hose connections that provide emergency shutdown of flow should the fueling connection be broken by movement. Fueling equipment should be inspected daily to ensure all components are in satisfactory condition.

Spill Control Planning

- Port operators should prepare a spill prevention, control, and countermeasure plan consistent with the IMO Manual on Oil Pollution Section II - Contingency Planning, which:
  a. Identifies areas within the port that are sensitive to spills and releases of hazardous materials and locations of any water intakes (e.g. cooling water for shore-based industries)
  b. Outlines responsibility for managing spills, releases, and other pollution incidents, including reporting and alerting mechanisms to ensure any spillage is reported promptly to the Port Authorities and personnel are informed to take appropriate action
  c. Includes provision of specialized oil spill response equipment (e.g. containment booms, recovery devices, and oil recovery or dispersant application vessels)
  d. Includes training of response personnel in deployment of equipment, and testing of the contingency plan through regular reporting and alerting exercises and less frequent deployment of the specialized spill response equipment
  e. Includes training of response personnel in animal welfare techniques related to spills

Dangerous Goods Handling

Ports should implement systems for the proper screening, acceptance, and transport of dangerous cargo based on localand international standards and regulations, including the following elements:

- Establishment of segregated and access-controlled storage areas with the means to collect or contain accidental releases;
- Requesting Dangerous Goods Manifests for hazardous materials whether in transit, loading or unloading to and from ships, including proper shipping (technical) name, hazard class, United Nations number, and packing group;22
- Training staff in relevant aspects of dangerous goods management including screening and acceptance of dangerous goods at the port;
- Emergency response procedures specific to dangerous goods.

Noise

Noise sources in ports include cargo handling, vehicular traffic, and loading / unloading containers and ships. Atmospheric conditions that may affect noise levels include humidity, wind direction, and wind speed. Vegetation, such as trees, and walls may reduce noise levels. Maximum allowable log equivalent ambient noise levels that should not be exceeded and general recommendations for prevention and control of noise are described in the General EHS Guidelines.

Biodiversity

Construction and maintenance dredging, disposal of dredge spoil, construction of piers, wharves, breakwaters, and other water-side structures, and erosion may lead to short and long-term impacts on aquatic and shoreline habitats. Direct impacts may include the physical removal or covering of sea floor, shore, or land-side habitat, in addition to changes to water flow patterns and related sedimentation rates and patterns, while indirect impacts may result from changes to water quality from sediment suspension or discharges of stormwater and wastewater. Additionally, the discharge of ballast water and sediment from ships during port operations may result in the introduction of invasive aquatic species. Recommended measures to prevent and control these impacts include the following:

- Potential impacts to shoreline vegetation, wetlands, coral reefs, fisheries, bird life, and other sensitive aquatic and near-shore habitat habitats during port construction and operation should be fully assessed with special consideration for areas of high biodiversity value or those required for the survival of critically endangered or endangered flora and fauna. The depth of the port should be considered at the design phase in terms of habitat destruction and the amount and nature of dredging required. Additionally, specific prevention and mitigation measures should be adopted for blasting activities which can cause considerable impacts to marine organisms and their habitats during construction;
- Port facilities that conduct cleaning or repair of ballast tanks should be equipped with adequate reception facilities able to prevent the introduction of invasive species. Treatment technologies may include those applied to other effluents accepted in port reception facilities or more specific methods such as filtration, sterilization (e.g. using ozone or ultraviolet light), or chemical treatment (e.g. biocides).
- Ports should provide ship operators with details on the port, state, or port authority ballast water management requirements, including the availability, location, and capacities of reception facilities, as well as with information on local areas and situations where ballast water uptake should be avoided.

Additional guidance on the avoidance or minimization of impacts to habitats during design and construction activities is presented in the General EHS Guidelines.

1.2 Occupational Health and Safety

Occupational health and safety issues during the construction and decommissioning of ports are common to those of most large infrastructure and industrial facilities and their prevention and control is discussed in the General EHS Guidelines. These issues include, among others, exposure to dust and hazardous materials that may be present in construction materials and demolition waste (e.g. asbestos), hazardous materials in other building components (e.g. PCB and mercury in electrical equipment), and physical hazards associated with the use of heavy equipment, or the use of explosives. Specific occupational health and safety issues relevant to port operations primarily include the following:

- Physical hazards
- Chemical hazards
- Confined spaces
- Exposure to organic and inorganic dust
- Exposure to noise

General Approach

Port operation activities should be conducted in accordance with applicable international regulations and standards, including:

- International Labour Organization (ILO) Code of Practice for Safety and Health in Ports (2005);
- General Conference of the International ILO Convention concerning Occupational Safety and Health in Dock Work, C-152, (1979);
- General Conference of the ILO Recommendation concerning Occupational Safety and Health in Dock Work, R-160;
- IMO Code of Practice for Solid Bulk Cargo (BC Code);
- International Code for the Construction and Equipment of Ships carrying Dangerous Chemicals in Bulk (IBC Code);
- International Code for the Safe Carriage of Grain in Bulk (International Grain Code);
- Code of Practice for the Safe Loading and Unloading of Bulk Carriers (BLU Code);
- International Maritime Dangerous Goods Code (IMDG Code).

Physical Hazards

The main sources of physical hazards at ports are associated with cargo handling and use of associated machinery and vehicles. General recommendations for managing physical hazards are addressed in the General EHS Guidelines. Additional prevention, minimization, and control techniques specific to ports include the following:

- Implementation of applicable recommendations from the above-referenced international codes of practice, including:
    a. Separation of people from vehicles and making vehicle passageways one-way, to the extent practical
    b. Locating means of access to ensure suspended loads do not pass overhead, to the extent practical
    c. Constructing the surface of port areas to be: of adequate strength to support the heaviest expected loads; level, or with only a slight slope; free from holes,

cracks, depressions, unnecessary curbs, or other raised objects; continuous; and skid resistant

d. Providing safe access arrangements suitable for the sizes and types of vessels calling at their facilities. These access arrangements should include guard rails and / or properly secured safety nets to prevent workers from falling into the water between the ship's side and the adjacent quay
e. Effectively guarding every weatherdeck and 'tweendeck' hatchway to an adequate height when open
f. Avoiding placing cargo on, or allowing passage of vehicles over, any hatch cover that is not of adequate strength for that purpose
g. As far as is reasonably practicable, preventing workers from working in the part of a hold where a trimming machine or grab is operational
h. Inspecting and approving all slings before use
i. Clearly marking (indicating its own weight) all lifting beams and frames, vacuum lifting, or magnetic lifting device which does not form an integral part of a lifting appliance and every other item of loose gear weighing more than 100 kilograms (kg)
j. o Inspecting disposable pallets and similar disposable devices before use and avoiding re-use of such disposable devices
k. Equipping lifting appliances with means of emergency escape from the driver's cabin and a safe means for the removal of an injured or ill driver

- Risk of free fall of materials should be minimized by installing telescoping arm loaders and conveyors;
- Materials handling operations should follow a simple, linear layout to reduce the need for multiple transfer points.

Chemical Hazards

Port workers may be exposed to chemical hazards especially if their work entails direct contact with fuels or chemicals, or depending on the nature of bulk and packaged products transferred in port activities. Work with fuels may present a risk of exposure to volatile organic compounds (VOC) via inhalation or skin contact during normal use or in the case of spills. Fuels, flammable liquid cargo, and flammable dust may also present a risk of fire and explosions. Recommended measures to prevent, minimize, and control risk of exposure to chemical hazards is provided in the General EHS Guidelines.

Confined Spaces

As in any industry sector, confined space hazards can be potentially fatal. The potential for accidents among port workers may vary among port facilities and activities, including cargo handling, and may include ship cargo holds, silos, sewage tanks, and water tanks. Port operators should implement confined space entry procedures as described in the General EHS Guidelines. With specific reference to access into cargo holds, confined space entry programs should include procedures that prevent or minimize the use of combustion equipment, including fueling activities, in the interior of cargo holds and that provide for alternative means of egress.

Dust

Potential exposure to fine particulates is associated with handling of dry cargo (depending on type of cargo handled, e.g. china clay, grain, and coal) and from roads. Occupational health and safety impacts associated with nuisance dust in ports are similar to those for other industries, and their prevention and control are discussed in the General EHS Guidelines. Specific recommendations for prevention, minimization, and control of dust generation are identified in this document under “Air Emissions”.

Noise

Noise sources in ports may include cargo handling, including vehicular traffic, and loading / unloading containers and ships. Occupational exposures should be managed as described in the General EHS Guidelines.

1.3 Community Health and Safety

Community health and safety issues during the construction of ports are common to those of most large infrastructure or industrial facilities, and are discussed in the General EHS Guidelines. These impacts include, among others, dust, noise, and vibration from construction vehicle transit, and communicable diseases associated with the influx of temporary construction labor.
The following operational phase issues are specific to ports:

- Port marine safety
- Port security
- Visual impacts

Port Marine Safety

Port operators have certain key responsibilities necessary for the safe operation of ships ranging from passenger safety to the safe access and maneuvering of chemicals and oil transporting ships inside the harbor and port areas. Port operators should therefore implement a Safety Management System (SMS) able to effectively identify and correct unsafe conditions. This safety system should include procedures to regulate the safe movement of vessels within the harbor (including pilotage procedures), protect the general public from dangers arising from marine activities at the harbor, and prevent events that may result in injury to workers, the public, or the environment. The Safety Management System should include comprehensive emergency preparedness and response plans that provide a coordinated response based on the port and community resources required to manage the nature and severity of the emergency event.

Port Security

Port operators should have a clear understanding of their responsibilities, including international legal and technical obligations to provide security to passengers, crews, and personnel in port. In accordance with applicable international legal requirements, port security arrangements (e.g. access control) may be established through the completion of a Port Facility Security Assessment of port operations followed by the appointment of a Port Facility Security Officer and the preparation of a Port Facility Security Plan depending on the outcome of the risk assessment.

Visual Impacts

Permanent and temporary installations and ships can result in visual changes to the landscape. One of the most significant changes attributable to ports is night illumination, depending on its proximity to sensitive land uses such as residential or tourist areas, as well as bulk storage facilities. Excessive illumination may also result in changes to invertebrate flight paths and settlement / breeding patterns. Visual impacts, including excessive background illumination, should be prevented during the port planning process or managed during operations through the installation of natural visual barriers such as vegetation or light shades, as applicable. The location and color of bulk storage facilities also should be selected with consideration of visual impacts.

2.0 Performance Indicators and Monitoring

2.1 Environment

Emissions and Effluent Guidelines

A port is different from a traditional industry since it has few stationary effluents (wastewater and stormwater) and thus it is difficult to continuously monitor most emissions and effluents. Sanitary wastewater and storm water discharge quality is addressed in the General EHS Guidelines. Combustion source emissions guidelines associated with steam and power-generation activities from sources with a capacity equal to or lower than 50 Megawatt thermal (MWth) are addressed in the General EHS Guidelines. Larger power source emissions are addressed in the EHS Guidelines for Thermal Power. Guidance on ambient considerations based on the total load of emissions is provided in the General EHS Guidelines.

Environmental Monitoring

Environmental monitoring programs for this sector should be implemented to address all activities that have been identified to have potentially significant impacts on the environment, during normal operations and upset conditions. Environmental monitoring activities should be based on direct or indirect indicators of emissions, effluents, and resource use applicable to the particular project. Monitoring frequency should be sufficient to provide representative data for the parameter being monitored. Monitoring should be conducted by trained individuals following monitoring and record-keeping procedures and using properly calibrated and maintained equipment. Monitoring data should be analyzed and reviewed at regular intervals and compared with the operating standards so that any necessary corrective actions can be taken. Additional guidance on applicable sampling and analytical methods for emissions and effluents is provided in the General EHS Guidelines. Additional recommended monitoring approaches include the European Sea Ports Organization's (ESPO) Self Diagnosis Methodology that ports can use to audit their environmental strengths and weaknesses (ESPO 2003). ESPO recommends that ports carry out the assessment annually.

2.2 Occupational Health and Safety

Occupational Health and Safety Guidelines

Occupational health and safety performance should be evaluated against internationally published exposure guidelines, of which examples include the Threshold Limit Value (TLV®) occupational exposure guidelines and Biological Exposure Indices (BEIs®) published by American Conference of Governmental Industrial Hygienists (ACGIH),31 the Pocket Guide to Chemical Hazards published by the United States National Institute for Occupational Health and Safety (NIOSH),32 Permissible Exposure Limits (PELs) published by the Occupational Safety and Health Administration of the United States (OSHA),33 Indicative Occupational Exposure Limit Values published by European0020Union member states,34 or other similar sources.

Accident and Fatality Rates

Projects should try to reduce the number of accidents among project workers (whether directly employed or subcontracted) to a rate of zero, especially accidents that could result in lost work time, different levels of disability, or even fatalities. Facility rates may be benchmarked against the performance of facilities in this sector in developed countries through consultation with published sources (e.g. US Bureau of Labor Statistics and UK Health and Safety Executive).

Occupational Health and Safety Monitoring

The working environment should be monitored for occupational hazards relevant to the specific project. Monitoring should be designed and implemented by accredited professionals36 as part of an occupational health and safety monitoring program. Facilities should also maintain a record of occupational accidents and diseases and dangerous occurrences and accidents. Additional guidance on occupational health and safety monitoring programs is provided in the General EHS Guidelines.

Annex A: General Description of Industry Activities

A harbor is a stretch of water where vessels can anchor, or secure to buoys or alongside wharves to obtain protection (by natural or artificial features) from storms and rough water. A port is a commercial harbor or commercial part of a harbor with terminals, quays, wharves, enclosed docks, and facilities for transferring cargo from shore to vessel or vessel to shore. This includes onshore facilities and structures for receiving, handling, holding, consolidating, and loading or delivering waterborne shipments or passengers. Port may include terminals, which serve a single function (e.g. containers, bulk shipments of cement, iron ore, grain) or are operated by a single company. Ports may also provide ship support facilities and services, including waste management and effluent discharge, maintenance of vehicles and equipment, painting and other vessel maintenance. Ports are located either in marine and estuarine zones or on rivers at inland sites far from the sea and may range in size from small harbors accommodating pleasure craft to large international ports covering several miles of waterfront. Most ports are controlled by government-owned port authorities and governed by national and local legislation tailored to meet the needs of each port. Under these laws and regulations, the port authority is responsible for administering ports and coastal waters within its jurisdiction and safe navigation of vessels therein. Port ownership and operation typically falls into three categories:

- Operating ports, where the port authority itself operates the majority of activities;
- Landlord ports, where the port provides basic services and infrastructure and tenants conduct the majority of activities
- Combination ports, where the port authority may operate some activities and tenants operate other activities

Operating ports have direct responsibility for managing components of its operations that may affect the environment. While landlord ports generally do not have direct control over the activities of their tenants, they have a significant stake in tenants' activities and the impact of those activities on the environment.

Onshore Construction

Onshore construction typically includes site preparation and development, the removal of any existing vegetation, and the grading and excavation of soils for the installation of structural foundations and site utilities that are typical of industrial development projects. Port development may include construction of new infrastructure and / or rehabilitation of existing infrastructure, such as piers and buildings. Onshore facilities typically include:

- Cargo storage and handling facilities (e.g. crane tracks and bridges for loading / unloading cargo, pipelines, roads, railway lines, and other areas for cargo distribution, storage and stacking areas, above-ground and underground storage tanks, warehouses, and silos);
- Facilities for embarking / debarking of passengers (e.g. parking areas and administration buildings);
- Vessel support facilities (e.g. to store and supply water, power, food and oil / used oil);

- Drainage networks;
- Waste management and effluent treatment and discharge systems (e.g. including wastewater / sewage, oil contaminated wastewater, and ballast water);
- Port administration buildings;
- Equipment maintenance and repair facilities (e.g. vehicle maintenance bays);
- Flood defenses (e.g. gates and dikes) in ports exposed to high water and flood risks).

Waterside Construction

Waterside facilities include berthing facilities (e.g. harbor basins, approaches, access channels, locks, harbor dams, and breakwaters), cargo handling and ferry facilities (e.g. goods transfer quays and piers, shoreline protection, and landing bridges), shipbuilding berths, and fitting quays or wharfs and dry docks. Offshore construction activities specific to ports include preparing the waterside including dredging (and disposal of dredged material); excavation and blasting; and filling and other work related to the construction of quays, piers, harbor basins, access channels, dams, breakwaters, and dry docks.

Capital Dredging and Disposal of Dredged Material

Capital dredging for new ports includes the excavation of sediments to increase depth of berths and navigation channels for access by larger vessels. Sediments, even in new port developments, may contain contaminants. Much of this contamination originates from land-use practices in the adjacent watershed and is transported by rivers and surface runoff to lakes, bays, and the sea, where certain contaminants, such as polychlorinated biphenyls (PCB), polycyclic aromatic hydrocarbons (PAH), metals, and pesticides, tend to concentrate in the sediments. In areas affected by sedimentation from rivers, estuaries, and land runoff, sediments are usually deposited over a period of time. Therefore, concentrations of contaminants can vary substantially over a vertical profile of the dredge cut. Typically, the upper layer is organic-rich and fine-grained, and is the most contaminated. The deeper materials are typically coarse-grained or hard-pan materials that are less contaminated. However, historical contamination (e.g. from previous shipyards and spills) can result in contamination even in these materials. Material dredged from channels or outer harbor areas tend to be relatively coarse-grained and uncontaminated, although the nature of the materials is a function of the historical activities within the region. Sediment quality can be assessed by sampling and testing. The re-suspension of sediment during the dredging or the excavation process may be reduced by selecting an appropriate dredging method:

- Grab or clamshell dredgers collect sediments in a crane mounted bucket helping to keep material consolidated (e.g. lower water content)
- Bucket dredgers pick up sediment by mechanical means, often with many buckets attached to a wheel or chain
- Backhoe dredgers are shore-based or “pontoon mounted” diggers used in shallow waters and confined spaces

- Trailing suction hopper dredgers are typically used for maintenance dredging in coastal areas. Sediments from seabed are pumped through trailing drag-heads into a reception tank (hopper)
- Water-injection dredgers inject water in a small jet under low pressure into the seabed to bring up sediment in suspension as a turbidity current that flows downslope before being moved by a second burst of water from the dredger, or carried away by sea currents Non-contaminated, dredged materials can usually be disposed of in open waters or used to counter shoreline erosion, for beach nourishment or as fill materials, although a license from national authorities is typically required for discharge of dredged material. Contaminated sediments are generally placed in confined disposal sites located either on land or in the water.

Excavation / Blasting and Disposal of Crushed Material

Installation of pier columns / piles and other underwater foundations and construction of harbor basins and access channels may require excavation of sediment and underlying material. Soft material can be excavated using conventional means such as flight augers, however, excavation of hard materials often involves blasting. Foundations can penetrate natural low-permeability layers and facilitate vertical migration of saline water and contaminants. As with dredging, these construction activities also cause turbidity and generate crushed material and other debris requiring disposal. The use of explosives usually releases nitrogen and blasted material into the water. Other contaminants, including metals and petroleum products, may also be released from sediments. Uncontaminated material can be disposed of in open water, or used to construct breakwaters and other features, or for land reclamation. Contaminated material may need to be placed in a confined disposal facility.

Construction of Piers, Breakwaters, Bulkheads, and Other Structures

Piers, wharves, and similar structures create the ship berths and provide the platforms for waterside cargo handling. These structures are typical constructed of concrete, steel, or lumber treated with chromated copper arsenate (CCA) or creosote as a preservative. Preservatives can leach from treated lumber, and use of CCA-treated lumber is being phased out due to toxicity concerns. Filled structures, such as breakwaters, are crucial elements of port design and constitute sizable areas of artificial shoreline often projected into a bay, harbor, or estuary. Rubble mound breakwaters are commonly used and constructed by dumping rocks (or debris) of various size distributions from dump truck, barges, or from fall pipes by barges.

Onshore Operations

Land-based operations at ports include cargo handling; fuel and chemical storage and handling; passenger embarking/disembarking; ship support services; waste and wastewater management; vehicle and equipment maintenance; and buildings and grounds maintenance.

Cargo Handling

Cargo handling includes unloading, storage / stacking and loading of dry and liquid cargo. Cargo typically includes containers, dry bulk, liquid bulk, and general cargo. Cargo handling includes use of vehicular traffic such as harbor vessels, trucks, buses, and trains and on-dock cranes, terminal trucks, and track cranes. Bulk cargo may be transferred using cranes with grab buckets and front-end loaders, or pneumatic continuous ship loaders and unloaders, or belt conveyors.

Chemical and Petroleum Storage and Handling

Hazardous cargo, such as oil, liquefied gas, pesticides, and industrial chemicals, may require specific handling facilities or areas within the port, including separation from other cargo by cofferdam, void space, cargo pump room, or empty tanks. Pipe systems are required for handling bulk fuels and liquid chemicals. Hazardous cargo may be released through leaks and spill during transfer and storage, contaminating soil, surface water, or groundwater. Volatile organic chemicals may also evaporate and be released to the air.

Embarking / Disembarking of Passengers

Passenger terminals may be required within the port area for embarking / disembarking passengers, including provision of parking facilities and temporary holding areas.

Ship Support Services

A port may offer ship support services such as solid waste and wastewater reception, electricity supply, fuels, and fresh water. The port or a separate company located within the port area may offer ship fuels and fuel may be supplied by bunker boats. Fresh water may also be offered and pumped onboard ships.

Waste and Wastewater

Port operations generate and manage their own waste and wastewater. Solid waste may be generated from property upkeep and administrative operations while wastewater may originate from storm drainage and from domestic wastewater and sewage. However, the most significant sources of wastes and wastewater are ships and government-owned port authorities are often responsible for providing receiving facilities for these and other waste streams. The following sections summarize the types of ship-generated wastes that must be managed in these shore-based facilities.

Solid Waste

Waste materials generated on vessels and at the port include plastic, paper, glass, metal, and food wastes. Hazardous wastes generated on vessels and by maintenance activities include waste oil, batteries, paints, solvents, and pesticides. Ports typically manage collection and storage of hazardous and nonhazardous wastes, with transportation, treatment, and disposal managed by third parties. The port may provide reception facilities for waste such as containers, general-use skips, and bins.

Water Effluents

Water effluents generated by ships include sewage, tank cleaning water, bilge water, and ballast water. Water effluents are typically collected and transported using trucks or pipes within the port area. Ports may collect and treat the wastewater before discharging to surface water, or to on-site water treatment systems, or municipal sewage treatment plants.

Waterside Operations

Ship Berthing

Ships may enter and leave the port under their own power or assisted by tugboats. While berthed in the harbor, vessels need an ongoing source of power for cargo handling, climate control, communications, and other daily operations. Power can be supplied by the ships' engines or supplied by shore-based utilities. Most vessels are powered by diesel engines, although some vessels may be steam powered. Air emissions from vessels consist primarily of particulate matter, carbon monoxide, sulfur dioxide, and nitrogen oxides from propulsion and auxiliary boilers and engines. Coal-fired boilers generate a large quantity of particulate matter. Heavy particulate matter emissions are also generated when carbon deposits are blown from coal- and oil-fired boilers.

Maintenance Dredging

Maintenance dredging involves the routine removal of material/sediment in harbor basins, access channels, and dams. This activity is important to maintain or improve depths and widths and ensure safe access for the ships as well as efficient navigation depth in the neighborhoods and dock gates to ensure access to basins and dry docks. Maintenance dredging may take place continuously or once every few years, depending on the port.

Vessel Repair and Maintenance

Vessel repair and maintenance, including repainting, is typically conducted in a dry dock. Chemical stripping agents used for paint removal commonly contain methylene chloride, although less hazardous alternatives, such as dibasic esters, semiaqueous terpene-based products, aqueous solutions of caustic soda, and detergent-based strippers, are available. Abrasive blasting may also be used to remove old paint. Steel shot is most often used as a blasting agent, although plastic shot may be used. Paint is usually applied by spray or by hand. Antifouling paints used on hulls are solvent-based containing heavy metals or organometalic biocides to minimize growth of marine organisms on ships' hulls. Water-based paints are generally used on areas of the vessel that are not immersed in water. Other repair work might include sheet metal work and metal finishing, among others. Wastes produced from vessel repairs and maintenance include oils, oil emulsifiers, paints, solvents, detergents, bleach, dissolved heavy metals, antifouling paint scrapings, and sandblasting waste. In the case of metal finishing operations, wastewater may also contain cyanide, heavy metal sludge, and corrosive acids and alkalis.

F. EHS Guidelines for Health Care Facilities

Applicability

The EHS Guidelines for Health Care Facilities include information relevant to the management of EHS issues associated with health care facilities (HCF) which includes a diverse range of facilities and activities involving general hospitals and small inpatient primary care hospitals, as well as outpatient, assisted living, and hospice facilities. Ancillary facilities may include medical laboratories and research facilities, mortuary centers, and blood banks and collection services. Annex A provides a description of activities in this sector. This document is organized according to the following sections:
Section 1.0 — Industry-Specific Impacts and Management
Section 2.0 — Performance Indicators and Monitoring
Section 3.0 — References

Annex A — General Description of Industry Activities

1.0 Industry-Specific Impacts and Management

The following section provides a summary of EHS issues associated with health care facilities (HCF) which occur during the operations phase, along with recommendations for their management. Recommendations for the management of EHS impacts common to most large industrial facilities during the construction and decommissioning phases are provided in the General EHS Guidelines.

HCF Design Considerations

The design and functional layout of an HCF should ensure the following: separation of clean / sterilized and dirty / contaminated materials and people flows; development and inclusion of adequate disinfection / sterilization procedures and facilities; adequate space for the storage of recyclable materials (e.g. cardboard and plastic) for pickup; selection of heating, ventilation, and air conditioning (HVAC) systems that provide isolation and protection from airborne infections; design of water systems to provide adequate supplies of potable water to reduce risks of exposure to Legionella and other waterborne pathogens; provision of hazardous material and waste storage and handling areas; treatment and exhaust systems for hazardous and infectious agents; and selection of easily cleaned building materials that do not support microbiological growth, are slip-resistant, nontoxic, and non-allergenic, and do not include volatile organic compound (VOC)-emitting paints and sealants. Internationally recognized guidelines for design and construction of hospitals and HCFs include the American Institute of Architects (AIA) and the Facility Guidelines Institute (FGI), the American Society for Healthcare Engineering (ASHE) of the American Hospital Association (AHA), and the Green Guide for Health Care (www.gghc.org). These guidelines should be used to verify the adequacy of planning for new HCFs or renovation of existing facilities.

1.1 Environmental

Environmental issues associated with HCF include the following:

- Waste management
- Emissions to air
- Wastewater discharges

Waste Management

Waste from health care facilities (HCF) can be divided into two separate groups. The first consists of general waste, similar in composition to domestic waste, generated during administrative, housekeeping, and maintenance functions. The second group consists of specific categories of hazardous health care waste, as detailed in Table 1 below. Health care facilities should establish, operate and maintain a health care waste management system (HWMS) adequate for the scale and type of activities and identified hazards. Facility operators should undertake regular assessment of waste generation quantities and categories to facilitate waste management planning, and investigate opportunities for waste minimization on a continuous basis. In addition to the guidance provided on solid and hazardous waste management in the General EHS Guidelines, the HWMS should include the following components:

Waste Minimization, Reuse, and Recycling

Facilities should consider practices and procedures to minimize waste generation, without sacrificing patient hygiene and safety considerations, including:

- Source reduction measures:
    a. Consider options for product / material substitution to avoid products containing hazardous materials that require the product to be disposed as hazardous or special waste (e.g. mercury3 or aerosol cans), and preferring products with less packaging or products that weigh less than comparable products that perform the same function
    b. Use of physical rather than chemical cleaning practices (e.g. using microfiber mops and cloths), where such practices do not affect disinfection and meet relevant standards for hygiene and patient safety
- Waste toxicity reduction measures5:

    a. Consider options for product / material substitution for equipment containing mercury or other hazardous chemicals; products that may become hazardous waste when disposed; products made of polyvinyl chloride (PVC6); halogenated compounds; products that off-gas volatile organic compounds (VOCs), or products that contain persistent, bio-accumulative and toxic (PBT) compounds; products that contain substances which are carcinogenic, mutagenic or reproductive toxins (CMR)

- Use of efficient stock management practices and monitoring (e.g. for chemical and pharmaceutical stocks), including:
    a. Small / frequent orders for products that spoil quickly and strict monitoring of expiry dates
    b. Complete use of old product before new stock is used
- Maximization of safe equipment reuse practices, including:
    a. Reuse of equipment following sterilization and disinfection (e.g. sharps containers)

Waste Segregation Strategies

At the point of generation, waste should be identified and segregated. Non-hazardous waste, such as paper and cardboard, glass, aluminum and plastic, should be collected separately and recycled. Food waste should be segregated and composted. Infectious and / or hazardous wastes should be identified and segregated according to its category using a color-coded system, as detailed in Table 1 below. If different types of waste are mixed accidentally, waste should be treated as hazardous. Other segregation considerations include the following:

- Avoid mixing general health care waste with hazardous health care waste to reduce disposal costs;
- Segregate waste containing mercury for special disposal. Management of mercury containing products and associated waste should be conducted as part of a plan involving specific personnel training in segregation and clean up procedures;
- Segregate waste with a high content of heavy metals (e.g. cadmium, thallium, arsenic, lead) to avoid entry into wastewater streams;
- Separate residual chemicals from containers and remove to proper disposal containers to reduce generation of contaminated wastewater. Different types of hazardous chemicals should not be mixed;
- Establish procedures and mechanisms to provide for separate collection of urine, feces, blood, vomits, and other wastes from patients treated with genotoxic drugs. Such wastes are hazardous and should be treated accordingly (see Table 1);
- Aerosol cans and other gas containers should be segregated to avoid disposal via incineration and related explosion hazard;
- Segregate health care products containing PVC9 to avoid disposal via incineration (see Air Emissions below) or in landfills.

On-site Handling, Collection, Transport and Storage

- Seal and replace waste bags and containers when they are approximately three quarters full. Full bags and containers should be replaced immediately;
- Identify and label waste bags and containers properly prior to removal (see Table 1);
- Transport waste to storage areas on designated trolleys / carts, which should be cleaned and disinfected regularly;
- Waste storage areas should be located within the facility and sized to the quantities of waste generated, with the following design considerations:
  a. Hard, impermeable floor with drainage, and designed for cleaning / disinfection with available water supply
  b. Secured by locks with restricted access
  c. Designed for access and regular cleaning by authorized cleaning staff and vehicles
  d. Protected from sun, and inaccessible to animals / rodents
  e. Equipped with appropriate lighting and ventilation
  f. Segregated from food supplies and preparation areas
  g. Equipped with supplies of protective clothing, and spare bags / containers
- Unless refrigerated storage is possible, storage times between generation and treatment of waste should not exceed the following:
  a. Temperate climate: 72 hours in winter, 48 hours in summer
  b. Warm climate: 48 hours during cool season, 24 hours during hot season
- Store mercury separately in sealed and impermeable containers in a secure location;
- Store cytotoxic waste separately from other waste in a secure location;
- Store radioactive waste in containers to limit dispersion, and secure behind lead shields.

Transport to External Facilities

- Transport waste destined for off-site facilities according to the guidelines for transport of hazardous wastes / dangerous goods in the General EHS Guidelines;
- Transport packaging for infectious waste should include an inner, watertight layer of metal or plastic with a leak-proof seal. Outer packaging should be of adequate strength and capacity for the specific type and volume of waste;
- Packaging containers for sharps should be puncture-proof;
- Waste should be labeled appropriately, noting the substance class, packaging symbol (e.g. infectious waste, radioactive waste), waste category, mass / volume, place of origin within hospital, and final destination;
- Transport vehicles should be dedicated to waste and the vehicle compartments carrying waste sealed.

Treatment and Disposal Options

Facilities receiving hazardous health care waste should have all applicable permits and capacity to handle specific types of health care waste. Wastes from each category should be treated according to the treatment methods and technologies described in Table 1. When selecting a waste disposal technology, operators should consider other potential health and environmental issues that may be generated by the treatment. The main types of treatment and disposal technologies and techniques available for health care waste are described below. Incineration is a high temperature dry oxidation process to reduce organic, combustible waste to significantly smaller quantities of inorganic, incombustible matter. Incineration may produce gaseous air emissions, ash residues, and wastewater. Depending on the amount of waste generated and the other factors, HCFs may operate on-site incinerators, or waste may be transported to an off-site incineration facility. Incinerators should have permits to accept health care waste and be properly operated and maintained. Health care waste should be disposed of using pyrolytic or rotary kiln incinerators. Single chamber incinerators should only be used in emergency situations (e.g. acute outbreaks of communicable disease) when other incineration options for infectious waste are not available. Further guidance on incineration is contained in the 'Emissions to Air' section, below.

Chemical disinfection involves the addition of chemicals to kill pathogens in health care waste. Waste should be mechanically shredded prior to treatment. Treatment involves the use and handling of hazardous chemicals, in addition to disposal of hazardous residues following treatment.

Wet thermal treatment disinfects waste by exposing shredded waste to high temperatures / pressure steam inside an exposure tank. Wastewater discharges and odor may result. Autoclaving is a type of wet thermal disinfection process typically used to sterilize reusable medical equipment. Dry thermal disinfection involves the shredding, heating, and compacting waste in a rotating auger. Air emissions and wastewater may be generated, and residues require disposal.

Microwave irradiation involves the destruction of microorganisms through the microwave heating action of water contained within the waste. Following irradiation, waste is compacted and disposed of as part of the municipal waste stream. Contaminated wastewater may also be generated.

Land disposal involves the disposal of health care waste into landfill facilities. Properly designed and operated sanitary landfills will protect against air and groundwater contamination. Disposal of waste into open dumps is not considered good practice and should be avoided. Pretreatment of waste prior to land disposal may involve encapsulation (filling containers with waste and an immobilizing material and sealing the containers).

Inertization involves mixing waste with substances (e.g. cement) to minimize leaching of toxic waste into ground or surface water.

Emissions to Air

Sources of air emissions at HCFs may include exhaust air from heating, ventilation, and air conditioning (HVAC) systems, ventilation of medical gases and fugitive emissions released from sources such as medical waste storage areas, medical technology areas, and isolation wards. Emissions may include exhaust from medical waste incineration if this waste management option is selected by the facility. Infectious and pathological waste, selected pharmaceuticals (combustibility to be determined from the manufacturer's specifications) and chemicals, and sharps may be combusted in a pyrolytic incineration facility designed for this purpose. The types of waste incinerated typically include a heterogeneous mix of some, or all, of the following: human and animal infected anatomical waste; absorbents; alcohol, disinfectants; glass; fecal matter; gauze, pads, swabs, garments, paper, and cellulose; plastics, PVC, and syringes; sharps and needles; and fluids and residuals.
In addition, air emissions may result from combustion related to power generation. Recommended prevention and control for power generation combustion source emissions are addressed in the General EHS Guidelines.

Exhaust air (e.g. from medical technology areas [MTAs], including isolation wards, laboratories, and waste storage and treatment facilities) may be potentially contaminated with biological agents, pathogens, or other toxic materials, and should be treated by conveying the exhaust air to combustion air to render it non-toxic and non-contagious before discharge. Condensate and blowdown liquids should be classified as health care wastewater and treated accordingly (see 'Wastewater' below). A stack sufficiently tall to eliminate odor nuisances and optimize dispersion should be used. Stack heights for all waste treatment facilities should be determined in accordance with guidance provided in the General EHS Guidelines.

Incineration

Large general hospitals may be equipped with their own incinerator plant, which is the major source of emissions to air and wastewater. Typically, only a relatively small portion of medical waste should be incinerated, and the need for a hospital waste incinerator (HWI) should be carefully evaluated against other technologies and techniques for waste management and disposal discussed above. Pollutants potentially emitted from HWIs include:

a. Heavy metals;
b. Organics in the flue gas, which can be present in the vapor phase or condensed or absorbed on fine particulates;
c. Various organic compounds (e.g. polychlorinated dibenzo-p-dioxins and furans [PCDD/Fs], chlorobenzenes, chloroethylenes, and polycyclic aromatic

hydrocarbons [PAHs]), which are generally present in hospital waste or can be generated during combustion and post-combustion processes;

d. Hydrogen chloride (HCl) and fluorides, and potentially other halogens-hydrides (e.g. bromine and iodine);
e. Typical combustion products such as sulfur oxides (SOX), nitrogen oxides (NOX), volatile organic compounds including non-methane VOCs) and methane (CH_4), carbon monoxide (CO), carbon dioxide (CO_2), and nitrous oxide (N_2O).

Infectious and pathological waste, selected pharmaceuticals (combustibility to be determined from the manufacturer's specifications) and chemicals, and sharps may be combusted in a pyrolytic incineration facility designed for this purpose. The types of waste incinerated typically include a heterogeneous mix of some, or all, of the following: human and animal infected anatomical waste; absorbents; alcohol, disinfectants; glass; fecal matter; gauze, pads, swabs, garments, paper, and cellulose; plastics, PVC, and syringes; sharps and needles; and fluids and residuals.

Pollution prevention and control measures include:

- Application of waste segregation and selection including removal of the following items from waste destined for incineration: halogenated plastics (e.g. PVC), pressurized gas containers, large amounts of active chemical waste, silver salts and photographic / radiographic waste, waste with high heavy metal content (e.g. broken thermometers, batteries), and sealed ampoules or ampoules containing heavy metals;

Type of waste	Summary of treatment and disposal options / notes
Infectious waste: Includes waste suspected to contain pathogens (e.g. bacteria, viruses, parasites, or fungi) in sufficient concentration or quantity to cause disease in susceptible hosts. Includes pathological and anatomical material (e.g. tissues, organs, body parts, human fetuses, animal carcasses, blood, and other body fluids), clothes, dressings, equipment / instruments, and other items that may have come into contact with infectious materials.	**Waste Segregation Strategy**: Yellow or red colored bag / container, marked "infectious" with international infectious symbol. Strong, leak proof plastic bag, or container capable of being autoclaved. **Treatment**: Chemical disinfection; Wet thermal treatment; Microwave irradiation; Safe burial on hospital premises; Sanitary landfill; Incineration (Rotary kiln; pyrolytic incinerator; single-chamber incinerator; drum or brick incinerator) • Highly infectious waste, such as cultures from lab work, should be sterilized using wet thermal treatment, such as autoclaving. • Anatomical waste should be treated using Incineration (Rotary kiln; pyrolytic incinerator; single-chamber incinerator; drum or brick incinerator
Sharps: Includes needles, scalpels, blades, knives,	**Waste Segregation Strategy**: Yellow or red color code, marked "Sharps". Rigid, impermeable, puncture-proof

infusion sets, saws, broken glass, and nails etc.	container (e.g. steel or hard plastic) with cover. Sharps containers should be placed in a sealed, yellow bag labeled “infectious waste”. **Treatment**: Chemical disinfection; Wet thermal treatment; Microwave irradiation; Encapsulation; Safe burial on hospital premises; Incineration (Rotary kiln; pyrolytic incinerator; single-chamber incinerator; drum or brick incinerator)
Pharmaceutical waste: Includes expired, unused, spoiled, and contaminated pharmaceutical products, drugs, vaccines, and sera that are no longer needed, including containers and other potentially contaminated materials (e.g. drug bottles vials, tubing etc.).	**Waste Segregation Strategy**: Brown bag / container. Leak-proof plastic bag or container. **Treatment**: Sanitary landfill; Encapsulation; Discharge to sewer; Return expired drugs to supplier; Incineration (Rotary kiln; pyrolytic incinerator); Safe burial on hospital premises as a last resort. • <u>Small quantities</u>: Landfill disposal acceptable, however cytotoxic and narcotic drugs should not be landfilled. Discharge to sewer only for mild, liquid pharmaceuticals, not antibiotics or cytotoxic drugs, and into a large water flow. Incineration acceptable in pyrolytic or rotary kiln incinerators, provided pharmaceuticals do not exceed 1 percent of total waste to avoid hazardous air emissions. Intravenous fluids (e.g. salts, amino acids) should be landfilled or discharged to sewer. Ampoules should be crushed and disposed of with sharps. • <u>Large quantities</u>: Incineration at temperatures exceeding 1200 °C. Encapsulation in metal drums. Landfilling not recommended unless encapsulated in metal drums and groundwater contamination risk is minimal.
Genotoxic / cytotoxic waste: Genotoxic waste may have mutagenic, teratogenic, or carcinogenic properties, and typically arises from the feces, urine, and vomit of patients receiving cytostatic drugs, and from treatment with chemicals and radioactive materials. Cytotoxic drugs are	**Waste Segregation Strategy**: See above for “infectious waste”. Cytotoxic waste should be labeled “Cytotoxic waste”. **Treatment**: Return expired drugs to supplier; Chemical degradation; Encapsulation; Inertization; Incineration (Rotary kiln, pyrolytic incinerator); • Cytotoxic waste should not be landfilled or discharged to sewer systems. • Incineration is preferred disposal option. Waste should be returned to supplier where incineration is

commonly used in oncology and radiology departments as part of cancer treatments.	not an option. Incineration should be undertaken at specific temperatures and time specifications for particular drugs. Most municipal or single chamber incinerators are not adequate for cytotoxic waste disposal. Open burning of waste is not acceptable. • Chemical degradation may be used for certain cytotoxic drugs – See Pruss et al. (1999) Annex 2 for details. • Encapsulation and inertization should be a last resort waste disposal option**.**
Chemical waste: Waste may be hazardous depending on the toxic, corrosive, flammable, reactive, and genotoxic properties. Chemical waste may be in solid, liquid, or gaseous form and is generated through use of chemicals during diagnostic / experimental work, cleaning, housekeeping, and disinfection. Chemicals typically include formaldehyde, photographic chemicals, halogenated and nonhalogenated solventsd, organic chemicals for cleaning / disinfecting, and various inorganic chemicals (e.g. acids and alkalis).	**Waste Segregation Strategy**: Brown bag / container. Leak-proof plastic bag or container resistant to chemical corrosion effects. **Treatment**: Return unused chemicals to supplier; Encapsulation; Safe burial on hospital premises; Incineration (Pyrolytic incinerator); • Facilities should have permits for disposal of general chemical waste (e.g. sugars, amino acids, salts) to sewer systems. • Small hazardous quantities: Pyrolytic incineration, encapsulation, or landfilling. • Large hazardous quantities: Transported to appropriate facilities for disposal, or returned to the original supplier using shipping arrangements that abide by the Basel Convention. Large quantities of chemical waste should not be encapsulated or landfilled.
Radioactive waste: Includes solid, liquid, and gaseous materials that have been contaminated with radionuclides. Radioactive waste originates from activities such as organ imaging, tumor localization, radiotherapy, and research / clinical laboratory procedures, among others, and may include glassware,	**Waste Segregation Strategy**: Lead box, labeled with the radioactive symbol. **Treatment**: Radioactive waste should be managed according to national requirements and current guidelines from the International Atomic Energy Agency. IAEA (2003). Management of Waste from the Use of Radioactive Materials in Medicine, Industry and Research. IAEA Draft Safety Guide DS 160, 7 February 2003.

syringes, solutions, and excreta from treated patients.	
Waste with high content of heavy metals: Batteries, broken thermometers, blood pressure gauges, (e.g. mercury and cadmium content).	**Waste Segregation Strategy**: Waste containing heavy metals should be separated from general health care waste. **Treatment**: Safe storage site designed for final disposal of hazardous waste. Waste should not be burned, incinerated, or landfilled. Transport to specialized facilities for metal recovery.
Pressurized containers: Includes containers / cartridges / cylinders for nitrous oxide, ethylene oxide, oxygen, nitrogen, carbon dioxide, compressed air and other gases.	**Waste Segregation Strategy**: Pressurized containers should be separated from general health care waste. **Treatment**: Recycling and reuse; Crushing followed by landfill • Incineration is not an option due to explosion risks • Halogenated agents in liquid form should be disposed of as chemical waste, as above.
General health care waste (including food waste and paper, plastics, cardboard):	**Waste Segregation Strategy**: Black bag / container. Halogenated plastics such as PVC should be separated from general health care facility waste to avoid disposal through incineration and associated hazardous air emissions from exhaust gases (e.g. hydrochloric acids and dioxins). **Treatment**: Disposal as part of domestic waste. Food waste should be segregated and composted. Component wastes (e.g. paper, cardboard, recyclable plastics [PET, PE, PP], glass) should be segregated and sent for recycling.

- Incinerators should have permits issued by authorized regulatory agencies and be operated and maintained by trained employees to ensure proper combustion temperature, time, and turbulence specifications necessary for adequate combustion of waste. This includes implementation of operational controls including combustion and flue gas outlet temperatures (combustion temperatures should be above 850 ncinerators should need to be quenched very quickly to avoid formation and reformation of POPs) as well as use of flue gas cleaning devices meeting international standards. Secondary air pollution control measures for hospital waste incinerators include the following:
- Wet scrubbers to control acid gas emissions (e.g. hydrochloric acid [HCl)], sulfur dioxide [SO2, and fluoride compounds]). A caustic scrubbing solution will increase the efficiency for SO2 control;

- Control of particulate matter may be achieved through use of cyclones, fabric filters, and / or electrostatic precipitators (ESP). Efficiencies depend on the particle size distribution of the particulate matter from the combustion chamber. Particulate matter from hospital incinerators is commonly between 1.0 to 10 micrometers (µm). ESPs are generally less efficient than baghouses in controlling fine particulates and metals from HWI;
- Control of volatile heavy metals depends on the temperature at which the control device operates. Fabric filters and ESP typically operate at relatively high temperatures and may be less effective than those that operate at lower temperatures. Venturi quenches and venturi scrubbers are also used to control heavy metal emissions. The volatile heavy metals usually condense to form a fume (less than 2 µm) that is only partially collected by pollution control equipment;
- Management of incineration residues such as fly ash, bottom ash and liquid effluents from flue gas cleaning as a hazardous waste (see General EHS Guidelines) as they may contain high concentrations of POPs.

Wastewater Process Wastewater

Wastewater from HCFs often has a quality similar to urban wastewater. Contaminated wastewater may result from discharges from medical wards and operating theaters (e.g. body fluids and excreta, anatomical waste), laboratories (e.g. microbiological cultures, stocks of infectious agents), pharmaceutical and chemical stores; cleaning activities (e.g. waste storage rooms), and x-ray development facilities. Wastewater may also result from treatment disposal technologies and techniques, including autoclaving, microwave irradiation, chemical disinfection, and incineration (e.g. treatment of flue gas using wet scrubbers which may contain suspended solids, mercury, other heavy metals, chlorides, and sulfates). Depending on the effectiveness of hazardous waste management practices (in particular waste segregation strategies described above), hazardous health care wastes may enter the wastewater stream, including microbiological pathogens (wastewater with a high content of enteric pathogens, including bacteria, viruses, and helminthes /parasitic worms), hazardous chemicals, pharmaceuticals, and radioactive isotopes. Pollution prevention measures to minimize the generation of wastewater include the following:

- Waste segregation measures should be employed to minimize entry of solid waste into the wastewaster stream, including:
  a. Procedures and mechanisms for separate collection of urine, feces, blood, and vomit from patients treated with genotoxic drugs to avoid their entry into the wastewater stream (as described above under waste segregation for hazardous and other wastes);
  b. Collection of large quantities of pharmaceuticals for separate treatment or return to manufacturer (see Table 1). Small quantities of mild, liquid
  c. pharmaceuticals, excluding antibiotics or cytotoxic drugs, may be discharged to sewer systems with a large water flow.

Municipal Wastewater Treatment

If wastewater is discharged to sanitary sewage treatment systems, the HCF should ensure that wastewater characteristics are in compliance with all applicable permits, and that the municipal facility is capable of handling the type of effluent discharged, as discussed in the General EHS Guidelines.

On-site Wastewater Treatment

In cases where wastewater is not discharged to sanitary sewage systems, HCF operators should ensure that wastewater receives on-site primary and secondary treatment, in addition to chlorine disinfection. Techniques for treating wastewater in this sector include source segregation and pretreatment for removal / recovery of specific contaminants such as radio isotopes, mercury, etc.; skimmers or oil water separators for separation of floatable solids; filtration for separation of filterable solids; flow and load equalization; sedimentation for suspended solids reduction using clarifiers; biological treatment, typically aerobic treatment, for reduction of soluble organic matter (BOD); biological or chemical nutrient removal for reduction in nitrogen and phosphorus; chlorination of effluent when disinfection is required; dewatering and disposal of residuals as hazardous medical / infectious waste. Additional engineering controls may be required for (i) removal of active ingredients (antibiotics and miscellaneous pharmaceutical products, among other hazardous constituents), and (ii) containment and treatment of volatile constituents and aerosols stripped from various unit operations in the wastewater treatment system. Wastewater generated from use of wet scrubbers to treat air emissions should be treated through chemical neutralization, flocculation, and sludge settling. Sludge should be considered hazardous, and may be treated off-site in a hazardous waste facility, or encapsulated in drums with mortar and landfilled. Sludge treatment should include anaerobic digestion to ensure destruction of helminthes and pathogens. Alternatively, it can be dried in drying beds before incineration with solid infectious wastes.

Other Wastewater Streams & Water Consumption

Guidance on the management of non-contaminated wastewater from utility operations, non-contaminated stormwater, and sanitary sewage is provided in the General EHS Guidelines. Contaminated streams should be routed to the treatment system for industrial process wastewater. Recommendations to reduce water consumption, especially where it may be a limited natural resource, are provided in the General EHS Guidelines.

1.2 Occupational Health and Safety

Occupational health and safety impacts during the construction and decommissioning of health care facilities (HCF) are common to those of most civil construction facilities and their prevention and control is discussed in the General EHS Guidelines. General health and safety hazards occurring in HCFs include manual handling injuries, such as sprains and strains from lifting and carrying patients; falls, trips, and slips; injuries caused by moving objects; and mental stress. These and other typical physical hazards are discussed in the General EHS Guidelines. HCF health and safety hazards may affect health care providers, cleaning and maintenance personnel, and workers involved in waste management handling, treatment, and disposal. Industry specific hazards include the following:

- Exposure to infections and diseases
- Exposure to hazardous materials / waste
- Exposure to radiation
- Fire safety

Exposure to Infections / Diseases

Health care providers and personnel may be exposed to general infections, blood-borne pathogens, and other potential infectious materials (OPIM)19 during care and treatment, as well as during collection, handling, treatment, and disposal of health care waste.
The following measures are recommended to reduce the risk of transferring infectious diseases to health care providers:

- Formulate an exposure control plan for blood-borne pathogens;
- Provide staff members and visitors with information on infection control policies and procedures;
- Establish Universal / Standard Precautions22 to treat all blood and other potentially infectious materials with appropriate precautions, including:
    a. Immunization for staff members as necessary (e.g. vaccination for hepatitis B virus)
    b. Use of gloves, masks, and gowns
    c. Adequate facilities for hand washing24. Hand washing is the single most important procedure for preventing infections (e.g. nosocomial and community). Hand washing should involve use of soap / detergent, rubbing to cause friction, and placing hands under running water. Washings of hands should be undertaken before and after direct patient contacts and contact with patient blood, body fluids, secretions, excretions, or contact with equipment or articles contaminated by patients. Washing of hands should also be undertaken before and after work shifts; eating; smoking; use of personal protective equipment (PPE); and use of bathrooms. If hand washing is not possible, appropriate antiseptic hand cleanser and clean cloths / antiseptic towelettes should be provided. Hands should then be washed with soap and running water as soon as practical
    d. Procedures and facilities for handling dirty linen and contaminated clothing, and preparing and handling food
    e. Appropriate cleaning and waste disposal practices for the health care workplace

- The following recommendations should be implemented when using and handling of needles / sharps:
  a. Use safer needle devices and needleless devices to decrease needlestick or other sharps exposures
  b. Do not bend, recap, or remove contaminated needles and other sharps unless such an act is required by a specific procedure or has no feasible alternative
  c. Do not shear or break contaminated sharps
  d. Have needle containers available near areas where needles may be found
  e. Discard contaminated sharps immediately or as soon as feasible into appropriate containers
  f. Used disposable razors should be considered contaminated waste and disposed of in appropriate sharps containers
- Establish policies to exclude animals from facility property. In addition to the above recommendations, the following measures are applicable to personnel involved in waste management to reduce the risk of transferring infectious diseases:
- Implement immunization for staff members, as necessary (e.g. vaccination for hepatitis B virus, tetanus immunization);
- Provide adequate supplies of PPE for personnel involved in waste management including: overalls / industrial aprons, leg protectors, boots, heavy duty gloves, helmets, visors / face masks and eye protection (especially for cleaning of hazardous spills), and respirators (for spills or waste involving toxic dust or incinerator residue) as necessary;
- Provide washing facilities for personal hygiene, particularly at waste storage locations.

Exposure to Hazardous Materials and Waste

HCF workers may be exposed to hazardous materials and wastes, including glutaraldehyde (toxic chemical used to sterilize heat sensitive medical equipment), ethylene oxide gas (a sterilant for medical equipment), formaldehyde, mercury (exposure from broken thermometers), chemotherapy and antineoplastic chemicals, solvents, and photographic chemicals, among others. In addition to the guidance provided above, hazardous materials and wastes should be handled according to occupational health and safety guidance provided in the General EHS Guidelines.

Waste Anesthetic Gas (WAG) Exposure

Health care workers may be at risk of toxic exposure to nitrous oxide; the halogenated agents halothane (fluothane), enflurane (ethrane), isoflurane (forane); and other substances typically used as inhalation anesthetics. Recommended measures to control exposure to waste anesthetic gas (WAG used in the operating room for example) include use of a scavenging unit attached to the anesthesia unit. The scavenging unit may have a charcoal filter that absorbs halogenated anesthetic gases, but not nitrous oxide. Spent charcoal filters should be disposed of as hazardous waste. If there is no scavenging unit, or if the scavenging unit does not have a filter, vacuum lines are used to collect WAGs which are subsequently vented outside and dispersed.

Radiation

Occupational radiation exposure may result from equipment emitting X-rays and gamma rays (e.g. CT scanners), radiotherapy machines, and equipment for nuclear medicine activities. HCF operators should develop a comprehensive plan to control radiation exposure in consultation with the affected workforce. This plan should be refined and revised as soon as practicable on the basis of assessments of actual radiation exposure conditions, and radiation control measures should be designed and implemented accordingly. Recommendations to prevent and control exposure to radiation are discussed in the General EHS Guidelines.

Fire Safety

The risk of fire in health care facilities is significant due to the storage, handling, and presence of chemicals, pressurized gases, boards, plastics, and other flammable substrates. Fire safety recommendations applicable to occupational areas are presented under 'Occupational Health and Safety' in the General EHS Guidelines. Recommendations applicable to buildings accessible to the public, including health care facilities,

are presented under 'Life and Fire Safety' in the General EHS Guidelines. Additional recommendations for fire safety include:

- Installation of smoke alarms and sprinkler systems;
- Maintenance of all fire safety systems in proper working order, including self-closing doors in escape routes and ventilation ducts with fire safety flaps;
- Training of staff for operation of fire extinguishers and evacuation procedures;
- Development of facility fire prevention or emergency response and evacuation plans with adequate guest information (this information should be displayed in obvious locations and clearly written in relevant languages).

1.3 Community Health and Safety

Community health and safety issues during the construction, operations, and decommissioning of HCFs are generally common to those of most industrial facilities, and are discussed in the General EHS Guidelines. Community hazards associated with health care facility environments, particularly related to hazardous health care waste, necessitate that members of the public receive adequate information regarding potential infection hazards within the facility, and at associated waste disposal sites (e.g. landfills). Guidance on community disease transmission is provided in the General EHS Guidelines.

2.0 Performance Indicators and Industry Benchmarks

2.1 Environmental Performance

Emissions and Effluent Guidelines

Tables 2 and 3 present emission and effluent guidelines for this sector. Guideline values for process emissions and effluents in this sector are indicative of good international industry practice as reflected in relevant standards of countries with recognized regulatory frameworks. These guidelines are achievable under normal operating conditions in appropriately designed and operated facilities through the application of pollution prevention and control techniques discussed in the preceding sections of this document. Emissions guidelines are applicable to process emissions. Combustion source emissions guidelines associated with steam- and power-generation activities from sources with a capacity equal to or lower than 50 megawatt thermals (MWth) are addressed in the General EHS Guidelines with larger power source emissions addressed in the EHS Guidelines for Thermal Power. Guidance on ambient considerations based on the total load of emissions is provided in the General EHS Guidelines. Effluent guidelines are applicable for direct discharges of treated effluents to surface waters for general use. Site-specific discharge levels may be established based on the availability and conditions in the use of publicly operated sewage collection and treatment systems or, if discharged directly to surface waters, on the receiving water use classification as described in the General EHS Guidelines. These levels should be achieved, without dilution, at least 95 percent of the time that the plant or unit is operating, to be calculated as a proportion of annual operating hours. Deviation from these levels in consideration of specific, local project conditions should be justified in the environmental assessment.

Table 2 Effluent levels of health care facilities

Pollutants	Units	Guideline Value
pH	S.U	6 - 9
Biochemical oxygen demand (BOD_5)	mg/L	50
Chemical oxygen demand (COD)	mg/L	250
Oil and grease	mg/L	10
Total suspended solid (TSS)	mg/L	50
Cadmium (Cd)	mg/L	0.05
Chromium (Cr)	mg/L	0.5
Lead (Pb)	mg/L	0.1
Mercury (Hg)	mg/L	0.01
Chlorine, total residual	mg/L	0.2
Phenols	mg/L	0.5
Total coliform bateria	MPN[a] / 100ml	400
Polychlorinated dibenzodioxin and dibenzofuran (PCDD/F)	Ng/L	0.1
Temperature increase	°C	<3[b]

Notes:
[a] MPN = Most Probable Number
[b] At the edge of a scientifically established mixing zone which takes into account ambient water quality, receiving water use, potential receptors and assimilative capacity

Table 3 Air emission levels for hospital waste incineration facilities

Pollutants	Units	Guideline Value
Total Particulate matter (PM)	mg/Nm^3	10
Total organic carbon (TOC)	mg/Nm^3	10
Hydrogen Chloride (HCl)	mg/Nm^3	10
Hydrogen Fluoride (HF)	mg/Nm^3	1
Sulfur dioxide (SO_2)	mg/Nm^3	50
Carbon Monoxide (CO)	mg/Nm^3	50
NO_x	mg/Nm^3	200-400[a]
Mercury (Hg)	mg/Nm^3	0.05
Cadmium + Thallium (Cd + Tl)	mg/Nm^3	0.05
Sb, As, Pb, Cr, Co, Cu, Mn, Ni and V	mg/Nm^3	0.5
Polychlorinated dibenzodioxin and dibenzofuran (PCDD/F)	ng/Nm^{3}TEQ	0.1

Notes:
a. 200 mg/m3 for new plants or for existing incinerators with a nominal capacity exceeding 6 tonnes per hour; 400 mg/m3 for existing incinerators with a nominal capacity of 6 tonnes per hour or less
b. Oxygen level for incinerators is 7 percent.

Environmental Monitoring

Environmental monitoring programs for this sector should be implemented to address all activities that have been identified to have potentially significant impacts on the environment, during normal operations and upset conditions. Environmental monitoring activities should be based on direct or indirect indicators of emissions, effluents, and resource use applicable to the particular project. Monitoring frequency should be sufficient to provide representative data for the parameter being monitored. Monitoring should be conducted by trained individuals following monitoring and record-keeping procedures and using properly calibrated and maintained equipment.
Monitoring data should be analyzed and reviewed at regular intervals and compared with the operating standards so that any necessary corrective actions can be taken. Additional guidance on applicable sampling and analytical methods for emissions and effluents is provided in the General EHS Guidelines.

Resource Consumption, Energy Use, and Waste Generation

Environmental performance of hospital installations should also be evaluated against internationally published benchmarks for resource consumption, energy use and waste generation. If inefficiencies are identified, the comparison with published benchmarks should be followed by a detailed audit or survey to identify potential opportunities for improvement, without compromising the objective of providing quality, safe, health care.26

2.2 Occupational Health and Safety

Occupational Health and Safety Guidelines Occupational health and safety performance should be evaluated against internationally published exposure guidelines, of which examples include the Threshold Limit Value (TLV®) occupational exposure guidelines and Biological Exposure Indices (BEIs®) published by American Conference of Governmental Industrial Hygienists (ACGIH),27 the Pocket Guide to Chemical Hazards published by the United States National Institute for Occupational Health and Safety (NIOSH),28 Permissible Exposure Limits (PELs) published by the Occupational Safety and Health Administration of the United States (OSHA),29 Indicative Occupational Exposure Limit Values published by European Union member states,30 or other similar sources.

Accident and Fatality Rates

Projects should try to reduce the number of accidents among project workers (whether directly employed or subcontracted) to a rate of zero, especially accidents that could result in lost work time, different levels of disability, or even fatalities. Facility rates may be benchmarked against the performance of facilities in this sector in developed countries through consultation with published sources (e.g. US Bureau of Labor Statistics and UK Health and Safety Executive). Occupational Health and Safety Monitoring The working environment should be monitored for occupational hazards relevant to the specific project. Monitoring should be designed and implemented by accredited professionals as part of an occupational health and safety monitoring program. Facilities should also maintain a record of occupational accidents and diseases and dangerous occurrences and accidents. Additional guidance on occupational health and safety monitoring programs is provided in the General EHS Guidelines.

Annex A: General Description of Industry Activities

The Health Care Facilities (HCF) sector includes a diverse range of facilities and activities involving general hospitals, small inpatient primary care hospitals, outpatient facilities, assisted iving facilities, and hospice facilities. Ancillary facilities may include medical laboratories and research facilities, mortuary centers, and blood banks and collection services. The HCF sector involves close contact among patients, health care providers, and support staff; extensive use of sharps and instruments designed for diagnostic and curative (invasive and noninvasive) procedures; and utilization of pharmaceutical, chemical, radiological, and other agents for diagnosis, treatment, cleaning, and disinfection. The basic infrastructure elements / activities of HCF facilities are to improve the health of patients, prevent transmission of infections among patients and staff, and control impacts to environment, health, and safety including maintenance of sanitary conditions; use of appropriate disinfection and sterilization techniques; provision of potable water and clean air for all operations; and nosocomial infection control. The medical technology area (MTA) is the central focus of a hospital / clinic. Typically, it is not present in outpatient facilities, assisted living facilities for elderly or handicapped persons, or hospice facilities. Dedicated patient and services areas (P&SA) are of major significance in hospitals and clinics, as well as in assisted living facilities for elderly or handicapped persons, and hospice facilities.

Typically an HCF needs between 60 to 100 square meters (m2) per bed, in addition to an area of equal or similar size for parking and facility access. With periodic upgrading of technologies, the relevant investment involved ranges from US$175,000 to 500,000 per bed in developed countries, and in developing countries may range from US$175,000-200,000 per bed. As part of day-to-day operations, HCFs generate a variety of wastes, including air emissions, wastewater effluents, health care waste (e.g. infectious, pathologic, and chemical wastes), and municipal solid waste. Average electricity consumption for an HCF is influenced by its design criteria, particularly by the availability or need for specific services. These may include a dedicated heating plant or in-house services such as kitchens and laundries, which may require outsourcing if unavailable in the HCF. The energy consumption of a general hospital is almost double that consumed by all other types of buildings, mostly because of MTA energy needs.