YOMA BANK

Environmental & Social (E&S) Policy

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1. Introduction

Many Yoma Bank ("the Bank") **business** customers are increasingly facing challenges from operating and competing in a climate of enhanced Environmental and Social (E&S) responsibility. If not properly managed, a customer's E&S impacts may result in:

- Operational disruptions, reduced cash flow and profits;
- Legal fines and penalties;
- Liability for damages caused;
- Diminished value of property taken as collateral; and
- Damage to reputation.

In some cases, our customer's ability to successfully adapt to the new climate will determine whether they succeed or fail. The Bank seeks to help customers successfully manage these risks. To the extent that some of our customers may face difficulties in the future, staff need to be aware of how best to protect the Bank from credit losses.

Although E&S risk management is primarily the responsibility of our customers, we need to understand these risks to properly manage Bank exposure. It will also help protect the Bank from losses resulting from customer pollution or labor problems and from potentially larger cleanup liabilities which banks could face due to legal uncertainties in Myanmar.

Accordingly, the information contained in this Policy is intended to incorporate E&S risk management into lending analysis and decision-making, and to help our customers establish responsible practices.

2. Policy and Objectives

The Bank seeks to minimize the adverse impacts of its lending activities on human health, the environment, workers and affected communities. To this end, the Bank will **not** invest in business activities that involve:

- Production or trade in any product or activity deemed illegal under Myanmar laws or regulations or international conventions and agreements, or subject to international bans, such as pharmaceuticals, pesticides/herbicides, ozone depleting substances, PCBs, wildlife or products regulated under the Convention on International Trade in Endangered Species (CITES) of Wild Fauna and Flora.
- Production or trade in weapons and munitions.
- Production or trade in alcoholic beverages (excluding beer and wine).
- Production or trade in tobacco[1].
- 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 the radioactive source would be trivial and/or adequately shielded.
- Production or trade in unbonded asbestos fibers. This does not apply to purchase and use of bonded asbestos cement sheeting where the asbestos content is less than 20%.
- Production or activities involving harmful or exploitative forms of child labor or forced labor.
- Involuntary resettlement of communities or persons.
- Significant conversion or degradation of natural and/or critical habitats and/or any activities in legally protected or internationally recognized areas.
- Production, harvesting, or trade in wood or other forestry products from plantation and natural forests other than from legal and sustainable origin.
- Harvesting of wild fish populations or other aquatic species other than from legal and sustainable origin.
- Drift net fishing in the marine environment using nets in excess of 2.5 km in length.
- Adverse impacts on land, natural resources, or critical cultural heritage subject to traditional ownership or under customary use by indigenous peoples.
- Significant alteration, damage, or removal of any critical cultural heritage.

Those activities in which the Bank invests will: (i) comply with all applicable environmental, health, safety, and labor laws and regulations of Myanmar and local authorities; (ii) apply technically and financially feasible resource efficiency and

[1] The Bank can lend up to 5% of the lending portfolio for certain excluded items including tobacco related loans. A business group with income of less than 20% of certain excluded or tobacco related activities can borrow from the Bank provided the purpose of the loan is not for certain excluded or tobacco related activities and repayment is clearly identified as coming from non-excluded or non-tobacco products. Such loans will not count as part of the certain excluded item items or tobacco lending limit.

pollution prevention principles and techniques (i.e., Good International Industry Practice, or GIIP)[2] that are best suited to minimize adverse impacts on human health and the environment; and (iii) operate consistent with labor and working condition requirements of the International Labor Organization (ILO) Conventions.

In addition, for transactions entailing project finance and long-term corporate finance, the Bank will assess E&S risks against the relevant IFC Performance Standards and require its borrowers to comply with these Standards.

Further guidance and detail on good industry practice for pollution control and occupational health and safety (OHS) is provided in Appendix A.

This Policy shall be known and understood at all levels of the Bank. The Bank will communicate these policy commitments to the management of prospective borrower companies, and follow the procedures described herein in its role as lender.

[2]Defined as the exercise of professional skill, diligence, prudence and foresight that would be reasonably expected from skilled and experienced professionals engaged in the same type of undertaking under the same or similar circumstances globally. The circumstances that skilled and experienced professionals may find when evaluating the range of pollution prevention and control techniques available to a project may include, but are not limited to, varying levels of environmental degradation and environmental assimilative capacity as well as varying levels of financial and technical feasibility.

3. Procedures

The Policy will be implemented according to the procedures outlined below, and will be coordinated with the operational activities of the Bank as set forth in the "*Credit Procedures and Operations Manual*".

3.1. Policy Screening

Upon identification of a potential lending opportunity, the lending officer will confirm that the proposed business activity being considered is not specifically listed in the Bank E&S Policy. In some cases, to make this determination it may be necessary to further investigate with the customer whether the activity involves any of the listed sensitive environmental or social adverse impacts that are not immediately evident upon initial review. That is, the lending officer, with the assistance of the Environmental and Social Management System (ESMS) Officer, should evaluate the likelihood of whether the activity involves involuntary resettlement, conversion of sensitive environmental habitats, or adverse impacts on indigenous peoples. The lending officer should also require all necessary permits and/or licenses (if any) issued by the relevant authorities for business activity to be financed. A document record of this evaluation should be created and included in the client's credit file, as appropriate. If the proposed investment is a listed excluded activity, the prospective customer will be so informed, and further consideration of lending will be terminated.

3.2. Project Categorization and Risk Review

For loans of 1 billion MMK and above the ESMS Officer should be informed and should identify and highlight apparent E&S risks and impacts as part of the analysis for the project's loan application. For guidance, a complete list of potential risks and impacts of concern is provided in Appendix B. This initial identification should be limited to any information reasonably available – including that provided by the customer, as well as other sources.

Next, to help guide the scope of any further detailed E&S review of the project, the Bank's ESMS Officer will categorize prospective investments according to a three-tiered scale of the level of potential risk of the activity (Category A, B, C). Detailed guidance for categorizing investments is provided in Appendix C. Relevant unit heads should then be notified and the decision documented in the client's credit file accordingly. Prospective investments categorized as high risk (including those classified as Category A) shall be explicitly highlighted owing to the potential for adverse E&S risk, as these may likely require a major commitment of Bank E&S resources.

The level of a subsequent detailed E&S review for a prospective project will be based on the categorization and initial E&S risk profile and potential impacts. For example, whether risk/impact is major (e.g., irreversible, unprecedented, and difficult/costly to mitigate) or moderate (generally site-specific, largely reversible and can be reasonably mitigated). For Category A and some Category B investments, the subsequent E&S review will be conducted by an E&S Officer or contracted to an external consultant or expert, for which the Bank will prepare a Terms of Reference (ToR). Appendix D includes such a typical consultant ToR. Given the relatively limited risk, further E&S review for many Category B and most Category C investments can be conducted directly by the Bank's ESMS Officer.

The further E&S due diligence review will typically consist of: (i) review of all relevant documents and information provided by the client and other sources; and (ii) site reconnaissance comprising visual observations of relevant areas and meetings and interviews with relevant stakeholders (company personnel, governmental officials, other stakeholders, etc.). Upon completion of the review, the findings, conclusions, and recommendations will be presented in the Project E&S Due Diligence (ESDD) Report (see indicative content requirements in Appendix E). The recommendations should include the necessary actions which must be implemented by the borrower for the loan to proceed to financial closure and disbursement. At a minimum,

i. Loans of 1 billion MMK and above but less than the MMK equivalent of US $5 million will consist of a set of mitigation, management, monitoring, and institutional measures to be taken during implementation and operation to address any gaps with the Corrective Action Plan, consisting of this Policy and the EHS Guidelines (Appendix A);

ii. Loans provided to a single client equalling or exceeding the MMK equivalent of US $5 million on an aggregated basis over a period of 36 months will require the borrower's ESMS and labor practices to be consistent with key objectives

of the IFC Performance Standard 1 and IFC Performance Standard 2, commensurate with the level of risk presented by the borrower; and

iii. Project finance and corporate loans with tenor of not less than 36 months and funding-defined assets as part of a project amounting to at least the MMK equivalent of $10 million of total capital cost will require the Bank to access E&S performance against all IFC Performance Standards.

3.3. Closing and Legal Documentation

Recommendations from the project ESDD Report should be thoroughly discussed with relevant unit heads and at the Bank Executive Credit Committee (ECC) together with independent financial and other risk analyses. Where the E&S review recommends corrective actions necessary to mitigate risks, the Bank should use all reasonable efforts to negotiate and agree with the borrower for implementation over a reasonable future time frame. In cases where additional spending may be necessary to implement corrective actions, the Bank and the client should confirm that adequate financial provision will be made to address these instances.

All credit agreements should contain terms and conditions requiring the borrower's business activity to comply with applicable Bank E&S performance targets. These typically consist of standard E&S clauses applicable to all Bank loans, as well as project-specific terms derived from the project ESDD corrective action recommendations. Agreements should also require the borrower to periodically report on the status of implementation of any specific corrective actions that may have been required, as appropriate (see Appendix F). Finally, agreements should require borrowers to immediately report to the Bank any serious accidents or incidents that occur, including a description of the event and its causes, and information on the measures taken to prevent reoccurrence.

3.4. Monitoring

After loan disbursement, the Bank will actively supervise and monitor the E&S performance of each of its portfolio companies, including the status of the implementation of any mitigating measures (or action plan, as appropriate). As noted above, the borrower will be required to report periodically (at least once a year) on its E&S performance, including any significant E&S incidents and implementation of critical mitigating actions. Based on this reporting, the Bank will discuss any outstanding or potential E&S performance issues with the borrower and if needed, agree to additional measures to address them. From time to time, the Bank will also make supervision site visits and consider requiring independent E&S audits (involving external consultants if necessary, see the sample ToR in Appendix D) as part of its overall supervision and monitoring process. A Supervision Report (see Appendix E for an example) should be prepared after each such visit or audit.

A borrower's E&S performance will be taken into account in the Bank's credit grading decisions. This would include any non-compliance with E&S requirements, failure to implement capital improvements to mitigate pollution or labor risks, and/or continuing occurrence of accidents/incidents. The ESMS Officer will discuss breaches with the Bank's Chief Compliance Officer (CCO) and ECC, who will determine actions taken. Such actions could range from changes to loan terms and conditions to the full repayment of the loan.

4. Organization and Responsibilities

The Bank's CEO will have overall responsibility for implementation of the E&S Policy, with the Board playing a supervision function. The CEO will ensure the necessary resources are made available for effective management of E&S performance. Reporting to the Head of CRD, the **ESMS Officer** will implement the day-to-day project-level E&S risk management for lending and portfolio supervision activities. The **ESMS Officer** shall regularly receive copies of all key project documentation from relevant unit heads, lending officers and the CCO, including but not limited to customer loan applications and credit and monitoring reports. The **ESMS Officer** shall also attend ECC meetings, and can call for Bank-wide meetings to discuss any policy- or lending-related issues. He/she shall ensure Bank lending officers and legal counsels are all trained in E&S Policy, and will build and maintain a file of **qualified E&S consultants** who can be called upon to assist in E&S due diligence or reviews.

5. Reporting

The results of borrower-specific E&S due diligence and portfolio performance monitoring will be periodically aggregated and summarized for senior management of the Bank. The ESMS Officer, in coordination with the CCO, will prepare periodic reports on key E&S issues surrounding the Bank's portfolio. These include providing inputs to Bank internal monitoring reporting documents such as credit reports. The Bank will develop and maintain a **watch list** of portfolio companies with significant E&S performance issues and regularly provide status updates to the Bank's senior management team.

APPENDICES

A. IFC Environmental, Health and Safety (EHS) Guidelines

The EHS Guidelines are technical reference documents with general and industry-specific examples of Good International Industry Practice (GIIP). The EHS Guidelines contain the performance levels and measures that are generally considered to be achievable in new facilities by existing technology at reasonable costs.

A1. Environmental

A1.1 Air Emissions and Ambient Air Quality

Projects with significant[3,4]sources of air emissions, and potential for significant impact to ambient air quality, should prevent or minimize impact by ensuring that:

- Emissions do not result in pollutant concentrations that reach or exceed relevant ambient quality guidelines and standards[5] by applying national legislated standards, or in their absence, the current WHO Air Quality Guidelines[6] (see Annex A1.1.1), or other internationally recognized sources[7];

- 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% of the applicable air quality standards to allow additional, future sustainable development in the same airshed.[8]

At facility level, impact 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[9] structures, and terrain features.

Point sources of emissions are characterized by the release of air pollutants typically associated with the combustion of fossil fuels such as nitrogen oxides (NO_x), 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 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 A1.1.2. Additional recommendations regarding stack height and emissions from small combustion facilities are provided in Annex A1.1.3.

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[3] Significant sources of point and fugitive emissions are considered to be general sources which, for example, can contribute a net emissions increase of one or more of the following pollutants within a given airshed: PM10: 50 tons per year (tpy); NOx: 500 tpy; SO2: 500 tpy; or as established through national legislation; and combustion sources with an equivalent heat input of 50 MWth or greater. The significance of emissions of inorganic and organic pollutants should be established on a project-specific basis taking into account toxic and other properties of the pollutant.

[4] United States Environmental Protection Agency, Prevention of Significant Deterioration of Air Quality, 40 CFR Ch. 1 Part 52.21. Other references for establishing significant emissions include the European Commission. 2000. "Guidance Document for EPER implementation." http://ec.europa.eu/environment/ippc/eper/index.htm; and Australian Government. 2004. "National Polluant Inventory Guide." http://www.npi.gov.au/handbooks/pubs/npiguide.pdf

[5] Ambient air quality standards are ambient air quality levels established and published through national legislative and regulatory processes, and ambient quality guidelines refer to ambient quality levels primarily developed through clinical, toxicological, and epidemiological evidence (such as those published by the World Health Organization).

[6] Available at World Health Organization (WHO). http://www.who.int/en

[7] For example the United States National Ambient Air Quality Standards (NAAQS) (http://www.epa.gov/air/criteria.html) and the relevant European Council Directives (Council Directive 1999/30/EC of 22 April 1999 / Council Directive 2002/3/EC of February 12 2002).

[8] US EPA Prevention of Significant Deterioration Increments Limits applicable to non-degraded airsheds.

[9] "Nearby" generally considers an area within a radius of up to 20 times the stack height.

Annex A1.1.1 – WHO Ambient Air Quality Guidelines[10],[11]

	Averaging Period	Guideline value in µg/m^3
Sulfur dioxide (SO_2)	24-hour 10 minute	125 (Interim target-1) 50 (Interim target-2) 20 (guideline) 500 (guideline)
Nitrogen dioxide (NO_2)	1-year 1-hour	40 (guideline) 200 (guideline)
Particulate Matter PM_{10}	1-year 24-hour	70 (Interim target-1) 50 (Interim target-2) 30 (Interim target-3) 20 (guideline) 150 (Interim target-1) 100 (Interim target-2) 75 (Interim target-3) 50 (guideline)
Particulate Matter $PM_{2.5}$	1-year 24-hour	35 (Interim target-1) 25 (Interim target-2) 15 (Interim target-3) 10 (guideline) 75 (Interim target-1) 50 (Interim target-2) 37.5 (Interim target-3) 25 (guideline)
Ozone	8-hour daily maximum	160 (Interim target-1) 100 (guideline)

[10]World Health Organization (WHO).Air Quality Guidelines Global Update, 2005. PM 24-hour value is the 99th percentile.
[11] Interim targets are provided in recognition of the need for a staged approach to achieving the recommended guidelines.

Annex A1.1.2 – Illustrative Point Source Air Emissions Prevention and Control Technologies

Principal Sources and Issues	General Prevention / Process Modification Approach	Control Options	Reduction Efficiency (%)	Gas Condition	Comments
Particulate Matter (PM)					
Main sources are the combustion of fossil fuels and numerous manufacturing processes that collect PM through air extraction and ventilation systems. Volcanoes, ocean spray, forest fires and blowing dust (most prevalent in dry and semiarid climates) contribute to background levels.	Fuel switching (e.g. selection of lower sulfur fuels) or reducing the amount of fine particulates added to a process.	Fabric Filters	99 - 99.7%	Dry gas, temp <400F	Applicability depends on flue gas properties including temperature, chemical properties, abrasion and load. Typical air to cloth ratio range of 2.0 to 3.5 cfm/ft^2 Achievable outlet concentrations of 23 mg/Nm^3
		Electrostatic Precipitator (ESP)	97 – 99%	Varies depending on particle type	Precondition gas to remove large particles. Efficiency dependent on resistivity of particle. Achievable outlet concentration of 23 mg/Nm^3
		Cyclone	74 – 95%	None	Most efficient for large particles. Achievable outlet concentrations of 30 - 40 mg/Nm^3
		Wet Scrubber	93 – 95%	None	Wet sludge may be a disposal problem depending on local infrastructure. Achievable outlet concentrations of 30 - 40 mg/ Nm^3
Sulfur Dioxide (SO_2)					
Mainly produced by the combustion of fuels such as oil and coal and as a by-product from some chemical production or wastewater treatment processes.	Control system selection is heavily dependent on the inlet concentration. For SO2 concentrations in excess of 10%, the stream is passed through an acid plant not only to lower the SO2 emissions but also to generate high grade sulfur for sale. Levels below 10% are not rich enough for this process and should therefore utilize absorption or 'scrubbing,' where SO2 molecules are captured into a liquid phase or adsorption, where SO2molecules are captured on the surface of a solid adsorbent.	Fuel Switching	>90%		Alternate fuels may include low sulfur coal, light diesel or natural gas with consequent reduction in particulate emissions related to sulfur in the fuel. Fuel cleaning or beneficiation of fuels prior to combustion is another viable option but may have economic consequences.
		Sorbent Injection	30% - 70%		Calcium or lime is injected into the flue gas and the SO_2 is adsorbed onto the sorbent
		Dry Flue Gas Desulfurization	70%-90%		Can be regenerable or throwaway.
		Wet Flue Gas Desulfurization	>90%		Produces gypsum as a by-product

Annex A1.1.2: Illustrative Point Source Air Emissions Prevention and Control Technologies (continued)

Oxides of Nitrogen (NOx)		**Percent Reduction by Fuel Type**			**Comments**
Associated with combustion of fuel. May occur in several forms of nitrogen oxide; namely nitric oxide (NO), nitrogen dioxide (NO_2) and nitrous oxide (N_2O), which is also a greenhouse gas. The term NOx serves as a composite between NO and NO_2 and emissions are usually reported as NOx. Here the NO is multiplied by the ratio of molecular weights of NO_2 to NO and added to the NO_2 emissions. Means of reducing NOx emissions are based on the modification of operating conditions such as minimizing the resident time at peak temperatures, reducing the peak temperatures by increasing heat transfer rates or minimizing the availability of oxygen.	**Combustion modification** (Illustrative of boilers)	**Coal**	**Oil**	**Gas**	These modifications are capable of reducing NOx emissions by 50 to 95%. The method of combustion control used depends on the type of boiler and the method of firing fuel.
	Low-excess-air firing	10–30	10–30	10–30	
	Staged Combustion	20–50	20–50	20–50	
	Flue Gas Recirculation	N/A	20–50	20–50	
	Water/Steam Injection	N/A	10–50	N/A.	
	Low-NOx Burners	30–40	30–40	30–40	
	Flue Gas Treatment	**Coal**	**Oil**	**Gas**	Flue gas treatment is more effective in reducing NOx emissions than are combustion controls. Techniques can be classified as SCR, SNCR, and adsorption. SCR involves the injection of ammonia as a reducing agent to convert NOx to nitrogen in the presence of a catalyst in a converter upstream of the air heater. Generally, some ammonia slips through and is part of the emissions. SNCR also involves the injection of ammonia or urea based products without the presence of a catalyst.
	Selective Catalytic Reduction (SCR)	60–90	60–90	60–90	
	Selective Non-Catalytic Reduction (SNCR)	N/A	30–70	30–70	

Note: Compiled by IFC based on inputs from technical experts.

Annex A1.1.3. - Small Combustion Facilities Emissions Guidelines(3MWth – 50MWth) – (in mg/Nm3 or as indicated)

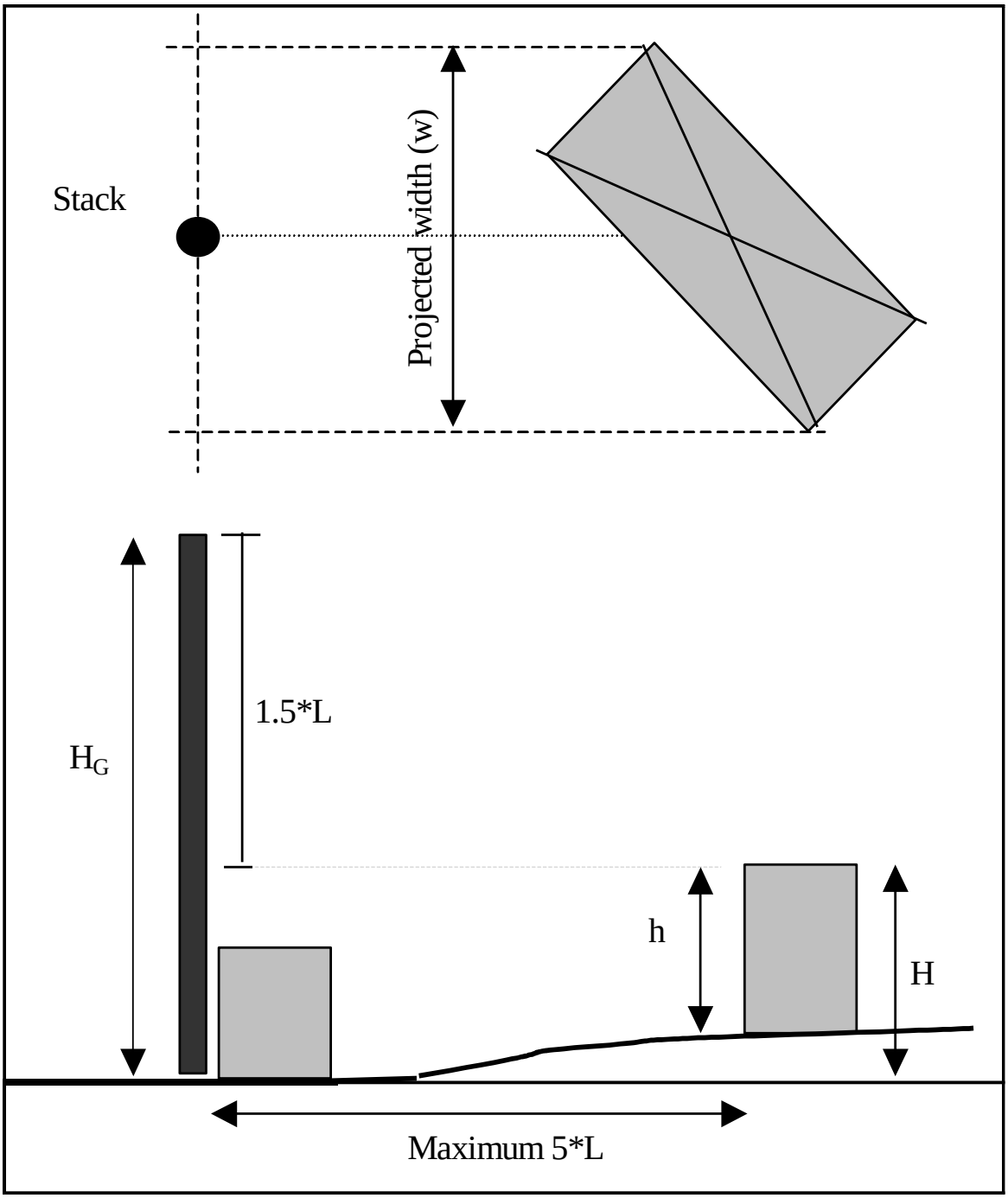
Combustion Technology/ Fuel	Particulate Matter (PM)	Sulfur Dioxide (SO_2)	Nitrogen Oxides (NOx)	Dry Gas, Excess O_2 Content (%)
Engine				
Gas	N/A	N/A	200 (Spark Ignition) 400 (Dual Fuel) 1,600 (Compression Ignition)	15
Liquid	50 or up to 100 if justified by project specific considerations (e.g. Economic feasibility of using lower ash content fuel, or adding secondary treatment to meet 50, and available environmental capacity of the site)	1.5 percent Sulfur or up to 3.0 percent Sulfur if justified by project specific considerations (e.g. Economic feasibility of using lower S content fuel, or adding secondary treatment to meet levels of using 1.5 percent Sulfur, and available environmental capacity of the site)	If bore size diameter [mm] < 400: 1460 (or up to 1,600 if justified to maintain high energy efficiency.) If bore size diameter [mm] ≥ 400: 1,850	15
Turbine				
Natural Gas ≥3MWth to < 15MWth	N/A	N/A	42 ppm (Electric generation) 100 ppm (Mechanical drive)	15
Natural Gas ≥15MWth to < 50MWth	N/A	N/A	25 ppm	15
Fuels other than Natural Gas ≥3MWth to < 15MWth	N/A	0.5 percent Sulfur or lower percent Sulfur (e.g. 0.2 percent Sulfur) if commercially available without significant excess fuel cost	96 ppm (Electric generation) 150 ppm (Mechanical drive)	15
Fuels other than Natural Gas ≥15MWth to < 50MWth	N/A	0.5% S or lower % S (0.2%S) if commercially available without significant excess fuel cost	74 ppm	15
Boiler				
Gas	N/A	N/A	320	3
Liquid	50 or up to 150 if justified by environmental assessment	2000	460	3
Solid	50 or up to 150 if justified by environmental assessment	2000	650	6

Notes: -N/A/ - no emissions guideline; Higher performance levels than these in the Table should be applicable to facilities located in urban / industrial areas with degraded airsheds or close to ecologically sensitive areas where more stringent emissions controls may be needed.; MWth is heat input on HHV basis; Solid fuels include biomass; $Nm^3$is at one atmosphere pressure, 0°C.; MWth category is to apply to the entire facility consisting of multiple units that are reasonably considered to be emitted from a common stack except for NOx and PM limits for turbines and boilers. Guideline values apply to facilities operating more than 500 hours per year with an annual capacity utilization factor of more than 30 percent.

Annex A1.1.4 - GIIP Stack Height
(Based on United States 40 CFR, part 51.100 (ii)).

$H_G = H + 1.5L$; where

H_G = Good Engineering Practice (GEP) stack height measured from the ground level elevation at the base of the stack.
H = Height of nearby structure(s) above the base of the stack.
L =Lesser dimension, height (h) or width (w), of nearby structures.
"Nearby structures" = Structures within/touching a radius of 5L but less than 800 m.



Annex A1.1.5 - Examples of VOC Emissions Controls

Equipment Type	Modification	Approximate Control Efficiency (%)
Pumps	Seal-less design[12]	100
	Closed-vent system[13]	90
	Dual mechanical seal with barrier fluid maintained at a higher pressure than the pumped fluid	100
Compressors	Closed-vent system	90
	Dual mechanical seal with barrier fluid maintained at a higher pressure than the compressed gas	100
Pressure Relief Devices	Closed-vent system[14]	Variable
	Rupture disk assembly	100
Valves	Seal-less design	100
Connectors	Weld together	100
Open-ended Lines	Blind, cap, plug, or second valve	100
Sampling Connections	Closed-loop sampling	100
Note: Examples of technologies are provided for illustrative purposes. The availability and applicability of any particular technology will vary depending on manufacturer specifications.		

Annex A1.1.6 - Fugitive Particulate Matter (PM) Emissions Controls

Control Type	Control Efficiency
Chemical Stabilization	0% - 98%
Hygroscopic salts Bitumens/adhesives	60% - 96%
Surfactants	0% - 68%
Wet Suppression – Watering	12% - 98%
Speed Reduction	0% - 80%
Traffic Reduction	Not quantified
Paving (Asphalt / Concrete)	85% - 99%
Covering with Gravel, Slag, or "Road Carpet"	30% - 50%
Vacuum Sweeping	0% - 58%
Water Flushing/Broom Sweeping	0% - 96%

[12] Seal-less equipment can be a large source of emissions in the event of equipment failure.

[13] Actual efficiency of a closed-vent system depends on percentage of vapors collected and efficiency of control device to which the vapors are routed.

[14] Control efficiency of closed vent-systems installed on a pressure relief device may be lower than other closed-vent systems.

A1.2 Wastewater and Ambient Water Quality

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.[15] Receiving water use[16] and assimilative capacity[17], taking other sources of discharges to the receiving water into consideration, should also influence the acceptable pollution loadings and effluent discharge quality.

Discharges of industrial wastewater, sanitary wastewater, wastewater from utility operations or stormwater into public or private wastewater treatment systems should 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.

Septic systems are commonly used for treatment and disposal of domestic sanitary sewage in areas with no sewage 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 installed in areas with sufficient soil percolation for the design wastewater loading rate, and 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.

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 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 and may exhibit thermal characteristics (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 approaches typically used in the treatment of industrial wastewater are summarized in Annex A1.2.1. 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, and 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.

[15] An example is the US EPA National Recommended Water Quality Criteria http://www.epa.gov/waterscience/criteria/wqcriteria.html

[16] Examples of receiving water uses as may be designated by local authorities include: drinking water (with some level of treatment), recreation, aquaculture, irrigation, general aquatic life, ornamental, and navigation. Examples of health-based guideline values for receiving waters include World Health Organization (WHO) guidelines for recreational use (http://www.who.int/water_sanitation_health/dwq/guidelines/en/index.html)

[17] The assimilative capacity of the receiving water body depends on numerous factors including, but not limited to, the total volume of water, flow rate, flushing rate of the water body and the loading of pollutants from other effluent sources in the area or region. A seasonally representative baseline assessment of ambient water quality may be required for use with established scientific methods and mathematical models to estimate potential impact to the receiving water from an effluent source.

Annex A1.2.1 - 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/m^3)	Biological - Anaerobic	Suspended growth, attached growth, hybrid
Lo - BOD (<2 Kg/m^3)	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, Chemical, Physical, Adsorption	Aerobic/anoxic biological treatment, chemical hydrolysis and air 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

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 absence of this, disposal has to be consistent with protection of public health, safety and conservation and long term sustainability of water and land resources.

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 or, in their absence, the indicative guideline values applicable to sanitary wastewater discharges shown in Annex A1.2.2.

- 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 this, disposal must be consistent with protection of public health, safety and conservation and long term sustainability of water and land resources.

Annex A1.2.2 – Indicative Values for Treated Sanitary Sewage Discharges[a]

Pollutants	Units	Guideline Value
pH	pH	6 – 9
BOD	mg/l	30
COD	mg/l	125
Total nitrogen	mg/l	10
Total phosphorus	mg/l	2
Oil and grease	mg/l	10
Total suspended solids	mg/l	50
Total coliform bacteria	MPN[b] / 100 ml	400[a]
Notes: [a]Not applicable to centralized, municipal, wastewater treatment systems which are included in EHS Guidelines for Water and Sanitation. [b]MPN = Most Probable Number		

A1.3 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.

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 below). The Plan should be tailored to the hazards associated with the project.

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.

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 available capacity.
- Provision of overfill or over pressure vents that allow controlled release to a capture point.

Reactive, flammable, and explosive materials should 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 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 construction materials 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.

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.

Leak detection may be used in conjunction with secondary containment, particularly in high-risk locations[18]. Leak detection is especially important in situations where secondary containment is not feasible or practicable, such as in long pipe runs.

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 Underground Storage Tanks (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; 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.

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** should be prepared to cover the following:[19]

- *Planning Coordination*. Procedures should be prepared for informing the public and emergency response agencies, documenting first aid and emergency medical treatment.

- Taking emergency response actions.

- 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.

A1.4 Waste Management

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 or refuse.

[18] High-risk locations are places where the release of product from the storage system could result in the contamination of drinking water source or those located in water resource protection areas as designated by local authorities.

[19] For a comprehensive treatment of the development of emergency response plans in conjunction with communities refer to the Awareness and Preparedness for Emergencies at Local Level (APELL) Guidelines available at: http://www.uneptie.org/pc/apell/publications/handbooks.html

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 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. Waste 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. Waste management should be addressed through a waste management system that addresses issues linked to waste minimization, generation, transport, disposal, and monitoring.

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 non-hazardous 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 wastes should always be segregated from non-hazardous 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 GIIP for the waste being handled.

- Ensuring compliance with applicable local and international regulations[20].

Hazardous waste should be stored so as to prevent or control accidental releases to air, soil, and water resources in locations 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.

[20] International requirements may include host-country commitments under the Basel Convention on the Control of Transboundary Movements of Hazardous Waste and their disposal (http://www.basel.int/) and Rotterdam Convention on the prior Inform Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade (http://www.pic.int/).

- Provide adequate ventilation where volatile wastes are stored.

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.

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.

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.

A1.5 Noise

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.[21] The preferred method for controlling noise from stationary sources is to implement noise control measures at source.[22] 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 and 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 vibration isolation for mechanical equipment.

[21] A point of reception or receptor may be defined as any point on the premises occupied by persons where extraneous noise and/or vibration are received. Examples of receptor locations may include: permanent or seasonal residences; hotels / motels; schools and daycares; hospitals and nursing homes; places of worship; and parks and campgrounds.

[22] At the design stage of a project, equipment manufacturers should provide design or construction specifications in the form of *"Insertion Loss Performance"* for silencers and mufflers, and *"Transmission Loss Performance"* for acoustic enclosures and upgraded building construction.

- 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.

Noise impacts should not exceed the levels presented in Annex A1.5.1, or result in a maximum increase in background levels of 3 dBat the nearest receptor location off-site.

Annex A1.5.1 – Noise Level Guidelines[23]

	One Hour L_{Aeq}(dBA)	
Receptor	Daytime 07:00 - 22:00	Nighttime 22:00 - 07:00
Residential; institutional; educational[24]	55	45
Industrial; commercial	70	70

A1.6 Contaminated Land

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.

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. 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:
    - Ex situ biological treatment (e.g., excavation and composting);
    - Ex situ physical/chemical treatment (e.g., excavation and stabilization);
    - Containment (e.g. landfill); and
    - Natural attenuation.

[23] Guidelines values are for noise levels measured out of doors. Source: Guidelines for Community Noise, World Health Organization (WHO), 1999.
[24] For acceptable indoor noise levels for residential, institutional, and educational settings refer to WHO (1999).

- Groundwater, surface water, and leachate:
    - In situ biological treatment (aerobic and/or aerobic);
    - Ex situ biological, physical, and or chemical treatment (i.e., groundwater extraction and treatment);
    - Containment (e.g., slurry wall or sheet pile barrier); and
    - Natural attenuation.
- Soil vapor intrusion:
    - Soil vapor extraction to reduce VOC contaminant source in soil;
    - Installation of a sub-slab depressurization system to prevent migration of soil vapor into the building;
    - Creating a positive pressure condition in buildings; and
    - 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); and Imposing health advisory or prohibiting certain practices leading to exposure such as fishing, crab trapping, shellfish collection.

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; paving over contaminated soil; using an interception trench and pump, and treat technologies to prevent contaminated groundwater from discharging into fish streams.

A2. Occupational Health and Safety (OHS)

Employers and supervisors are obliged to implement all reasonable precautions to protect the health and safety of workers. Companies should hire contractors that have the technical capability to manage the OHS issues of their employees, extending the application of hazard management activities through formal procurement agreements.

A2.1 General Facility Design and Operation

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.

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.

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**.

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.

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.

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.

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.

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.

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.

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.

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. *Legionnellapneumophilia*) or breeding of vectors (e.g. mosquitoes and flies) of public health concern.

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.

A2.2 Communication and 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 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. 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.

A 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.

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. 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.

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.

A2.3 Physical Hazards

Physical hazards represent potential for accident, 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 to disabling, catastrophic, and/or fatal. Multiple exposures over prolonged periods can result in disabling injuries of comparable significance and consequence.

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; 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 or maintenance; designing and installing equipment, where feasible, to enable routine service, such as lubrication, without removal of the guarding devices or mechanisms.

Noise limits for different working environments are provided in Annex A2.3.1. 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).

Annex A2.3.1. – Noise Limits for Various Working Environments

Location /activity	Equivalent level $LA_{eq},8h$	Maximum $LA_{max},fast$
Heavy Industry (no demand for oral communication)	85 dB(A)	110 dB(A)

Light industry (decreasing demand for oral communication)	50-65 dB(A)	110 dB(A)
Open offices, control rooms, service counters or similar	45-50 dB(A)	-
Individual offices (no disturbing noise)	40-45 dB(A)	-
Classrooms, lecture halls	35-40 dB(A)	-
Hospitals	30-35 dB(A)	40 dB(A)

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.

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.

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; 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.

Welding creates an extremely bright and intense light that may seriously injure 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; 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.

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.
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.

Injuries due to ergonomic factors, such as **repetitive motion, over-exertion, 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.

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.

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 Annex A2.3.2.

Annex A2.3.2. – Minimum Limits for Workplace Illumination Intensity

Location / Activity	Light Intensity
Emergency light	10 lux
Outdoor non working areas	20 lux
Simple orientation and temporary visits (machine storage, garage, warehouse)	50 lux
Workspace with occasional visual tasks only (corridors, stairways, lobby, elevator, auditorium, etc.)	100 lux
Medium precision work (simple assembly, rough machine works, welding, packing, etc.)	200 lux
Precision work (reading, moderately difficult assembly, sorting, checking, medium bench and machine works, etc.), offices.	500 lux
High precision work (difficult assembly, sewing, color inspection, fine sorting etc.)	1,000 – 3,000 lux

A2.4 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. training workers in the use of the available information (such as MSDSs), safe work practices, and appropriate use of Personal Protective Equipment (PPE).

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 environmental concentrations below those recommended by the ACGIH[25] as TWA-TLV's (Time Weighted Average - Threshold Limit Value); developing and implementing work practices to minimize release of contaminants into the work environment.

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: (i) storing flammables away from ignition sources and oxidizing materials; (ii) 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; (iii) where the flammable material is mainly comprised of dust, providing electrical spark detection, and, if needed, quenching systems; and (iv) 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.

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. 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.

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.

[25] American Conference of Governmental Industrial Hygienists (ACGIH), 2005.

A2.5 Personal Protective Equipment (PPE)

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. Annex A2.5.1 presents general examples of occupational hazards and types of PPE available for different purposes.

Annex A2.5.1. – Summary of Recommended Personal Protective Equipment According to Hazard

Objective	Workplace Hazards	Suggested PPE
Eye and face protection	Flying particles, molten metal, liquid chemicals, gases or vapors, light radiation.	Safety glasses with side-shields, protective shades, etc.
Head protection	Falling objects, inadequate height clearance, and overhead power cords.	Plastic helmets with top and side impact protection.
Hearing protection	Noise, ultra-sound.	Hearing protectors (ear plugs or ear muffs).
Foot protection	Falling or rolling objects, pointed objects. Corrosive or hot liquids.	Safety shoes and boots for protection against moving & falling objects, liquids and chemicals.
Hand protection	Hazardous materials, cuts or lacerations, vibrations, extreme temperatures.	Gloves made of rubber or synthetic materials (Neoprene), leather, steel, insulating materials, etc.
Respiratory protection	Dust, fogs, fumes, mists, gases, smokes, vapors.	Facemasks with appropriate filters for dust removal and air purification (chemicals, mists, vapors and gases). Single or multi-gas personal monitors, if available.
	Oxygen deficiency.	Portable or supplied air (fixed lines). On-site rescue equipment.
Body/leg protection	Extreme temperatures, hazardous materials, biological agents, cutting and laceration.	Insulating clothing, body suits, aprons etc. of appropriate materials.

A2.6 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.[26]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:

- 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.

- Prior to entry into a permit-required confined space:

    - Process or feed lines into the space should be disconnected or drained, and blanked and locked-out.

    - Mechanical equipment in the space should be disconnected, de-energized, locked-out, and braced, as appropriate.

    - The atmosphere within the confined space should be tested to assure the oxygen content is between 19.5percent 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.

[26] US OSHA CFR 1910.146

- 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.

A2.7 Monitoring

OHS 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 OHS monitoring program should include: safety inspection, testing and calibration; surveillance of the working environment; surveillance of workers health; and training.

The employer should establish procedures and systems for reporting and recording: occupational accidents and diseases; 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: occupational injuries and near misses; suspected cases of occupational disease; 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: establish what happened; determine the cause of what happened; and identify measures necessary to prevent a recurrence.

Occupational accidents and diseases should, at a minimum, be classified according to Annex A2.7.1. 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.

Annex A2.7.1. – Occupational Accident Reporting

a. Fatalities (number)	**b. Non-fatal injuries** (number) [27]	**c. Total time lost** non-fatal injuries(days)
a.1 Immediate	**b.1** Less than one day	
a.2 Within a month	**b.2** Up to 3 days	**c.1** Category b.2
a.3 Within a year	**b.3** More than 3 days	**c.2** Category b.3

A3. 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.

A3.1 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.

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. 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 the WHO Drinking Water Guidelines. 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.[28]

[27] The day on which an incident occurs is not included in b.2 and b.3.

[28] World Health Organization (WHO) defines 100 liters/capita/day as the amount required to meet all consumption and hygiene needs. Additional information on lower service levels and potential impacts on health are described in "Domestic Water Quantity, Service Level and Health" 2003. http://www.who.int/water_sanitation_health/diseases/wsh0302/en/index.html

A3.2 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; or 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 codes[29] to ensure structures are designed and constructed in accordance with sound architectural and engineering practice, including aspects of fire prevention and response.

International codes, such as those compiled by the International Code Council (ICC)[30], 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.

A3.3 Life and Fire Safety (L&FS)

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[31], 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. These guidelines apply to buildings that are accessible to the public.

The nature and extent of life and fire safety systems required will depend on the building type, structure, construction, occupancy, and exposures. Fire prevention addresses the identification of fire risks and ignition sources, and measures needed to limit fast fire and smoke development. Means of egress includes all design measures that facilitate a safe evacuation by residents and/or occupants in case of fire or other emergency. Detection and alarm systems encompass all measures, including communication and public address systems needed to detect a fire and alert. Compartmentation involves all measures to prevent or slow the spread of fire and smoke. Fire suppression and control includes all automatic and manual fire protection installations.

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). National or regional building regulations typically contain fire safety codes and standards[32] or these standards are found in separate Fire Codes.[33,34] Generally, such codes and regulations incorporate further compliance requirements with respect to methodology, practice, testing, and other codes and standards[35]. Such nationally referenced material constitutes the acceptable fire life safety code.

[29] ILO-OSH, 2001. http://www.ilo.org/public/english/protection/ safework/cops/english/download/e000013.pdf
[30] ICC, 2006.
[31] US NFPA. http://www.nfpa.org/
[32] For example, Australia, Canada, South Africa, United Kingdom
[33] Réglementation Incendie [des ERP]
[34] USA NFPA, 2006.
[35] Prepared by National Institutes and Authorities such as American Society for Testing and Materials (ASTM), British Standards (BS), German Institute of Standardization (DIN), and French Standards (NF)

A3.4 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[36]. Road safety initiatives proportional to the scope and nature of project activities should include: adoption of best transport safety practices and regular maintenance of vehicles.

A3.5 Transport of Hazardous Materials

Projects should have procedures in place that ensure compliance with local laws and international requirements applicable to the transport of hazardous materials, including: UN Model Regulations[37] of other international standards as well as local requirements for land transport. The procedures for transportation of hazardous materials (Hazmats) should include:

- Proper labeling of containers, including quantity of the contents, hazards, and shipper contact information.
- 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.
- 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.
- Ensuring adequate transport vehicle specifications.
- Training employees involved in the transportation of hazardous materials regarding proper shipping procedures and emergency procedures.
- Using labeling and placarding (external signs on transport vehicles), as required.
- Providing the necessary means for emergency response on call 24 hours/day.

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.

A3.6 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 OHS.

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.

[36] Additional information on vulnerable users of public roads in developing countries is provided by Peden et al., 2004.
[37] United Nations. Transport of Dangerous Goods - Model Regulations. 14th Revised Edition. Geneva 2005. http://www.unece.org/

- Checklists (role and action list and equipment checklist).

- Business Continuity and Contingency.

A4. Construction and Decommissioning

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.

A4.1 Environment

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: (i) ensure activities with the greatest potential to generate noise are planned during periods of the day that will result in least disturbance; (ii) use noise control devices, such as temporary noise barriers and deflectors for impact and blasting activities, and exhaust muffling devices for combustion engines; and (iii) avoid or minimize project transportation in community areas.

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:

- Scheduling to avoid heavy rainfall periods (i.e., during the dry season) to the extent practical.

- Contouring and minimizing length and steepness of slopes.

- Mulching to stabilize exposed areas.

- Re-vegetating areas promptly.

- Designing channels and ditches for post-construction flows.

- 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.

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 and 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.

- Avoiding open burning of 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, and spill cleanup materials from oil and fuel spills. Techniques for preventing and controlling non-hazardous and hazardous construction site solid waste include those already discussed in Section A1.

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 are discussed in Section A1.

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.

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 A1.
- Preparation of a management plan to manage obsolete, abandoned, hazardous materials or oil consistent with the approach to hazardous waste management described in Section A1.

Successful implementation of any management strategy may require identification and cooperation with whoever is responsible and liable for the contamination.

A4.2 Occupational Health and Safety (OHS)

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 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. **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. For the prevention of slips and falls minimize these conditions.

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 hazard[38]:

- Training and use of temporary fall prevention devices, such as rails or other barriers.
- Training and use of personal fall arrest systems, such as full body harnesses and energy absorbing lanyards.

[38] Additional information on identification of fall hazards and design of protection systems can be found in the United States Occupational Health and Safety Administration's (US OSHA) web site: http://www.osha.gov/SLTC/fallprotection/index.html

- Use of control zones and safety monitoring systems to warn workers of their proximity to fall hazard zones.

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 designated and restricted waste drop or discharge zones, and/or a chute for safe movement of wastes.
- Conducting sawing, cutting, grinding, sanding, chipping or chiseling with proper guards and anchoring as applicable.
- Use of temporary fall protection measures in scaffolds and out edges of elevated work surfaces, such as hand rails and toe.
- Evacuating work areas during blasting operations.
- Wearing appropriate PPE, such as safety glasses with side shields, face shields, hard hats, and safety shoes.

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.
- Ensuring the visibility of personnel through their use of high visibility vests when working.
- Ensuring moving equipment is outfitted with audible back-up alarms.
- Using inspected and well-maintained lifting devices that are appropriate when lifting them to higher job-site elevations.

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.

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 A2 the occupational hazards associated with **confined spaces and excavations** in construction and decommissioning sites should be prevented according to the following recommendations: use of excavation dewatering, side-walls support, and slope gradient adjustments that eliminate or minimize the risk of collapse, entrapment, or drowning; safe means of access and egress from excavations, such as graded slopes, graded access route, or stairs and ladders; avoid the operation of combustion equipment for prolonged periods inside excavations areas where other workers are required to enter unless the area is actively ventilated.

A4.3 Community Health and Safety

Risk management strategies to protect the community from hazards associated with construction 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.

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 A3 (Traffic Safety).

B. List of Potential EHS Risks

B1. Environmental

1.1 Air Emissions and Ambient Air Quality

1.2 Wastewater Discharges and Water Quality

1.3 Hazardous Materials Management

1.4 Waste Management

1.5 Noise

1.6 Contaminated Land

B2. Occupational Health and Safety

2.1 General Facility Working Conditions (Structural Integrity, Workspace and Exit, Fire Precautions, Lavatories and Showers, Potable Water Supply, Clean Eating Area, Lighting, Safe Access, First Aid, Air Supply, Work Environment Temperature, Signage and Equipment Labeling)

2.2 Employee Communication and Training

2.3 Physical Hazards

2.4 Chemical Hazards

2.5 Personal Protective Equipment (PPE)

2.6 Confined Space

B3. Community Health and Safety

3.1 Water Quality and Availability

3.2 Structural Safety of Project Infrastructure

3.3 Life and Fire Safety (L&FS)

3.4 Traffic Safety

3.5 Transport of Hazardous Materials

3.6 Emergency Preparedness and Response

B4. Construction and Decommissioning

4.1 Environment (Noise, Soil Erosion, Fugitive Dust, Solid Waste, Hazardous Materials Releases, Wastewater Discharges, Contaminated Land)

4.2 Occupational Health and Safety

4.3 Community Health and Safety

C. Environmental and Social Categorization Guidance

The Bank uses E&S categorization to reflect the relative magnitude of E&S risks and impacts[39] of prospective investments based on information available at the time of the Bank's ESDD. These categories are defined as follows:

- **Category A (High)**: Business activities with potential significant adverse environmental or social risks and/or impacts that are diverse, irreversible, or unprecedented;

- **Category B (Moderate)**: Business activities with potential limited adverse environmental or social risks and/or impacts that are few in number, generally site-specific, largely reversible, and readily addressed through mitigation measures; and

- **Category C (Low)**: Business activities with minimal or no adverse environmental or social risks and/or impacts.

The categorization approach considers the assessment of the E&S risk related to the inherent, generic aspects of an industrial sector or commercial activity excluding management or mitigation measures, as well as the context of the investment's likely geographic setting.

Where little is known about the physical attributes, site, and impacts of the investment and/or the E&S footprint of the business activity cannot be well enough understood/defined at the time of the Bank's ESDD, the Bank will determine the E&S category based on risks inherent to the particular sector, as well as on the likelihood of a development taking place and on what can be reasonably known about the E&S characteristics of the business activity's likely geographical setting.

Consequently, it is expected that investments which involve sectors that are of inherent high risk and are expected to generate significant amounts of pollution or activities with significant occupational or community health and safety hazards will be categorized as A. More limited pollution generating activities, and/or activities posing limited occupational or community hazards will be categorized as B. Activities posing minimal pollution or occupational hazards will be categorized as C.

Pollution risks encompass: air emissions; wastewater discharges; releases of hazardous material stored and used on-site; waste disposal practices; historically contaminated land; and noise. Excessive amounts of energy and water use in manufacturing processes may also present concern. Occupational health and safety risks are generally associated with the physical, chemical, and biological hazards found in the workplace. Community health and safety risks surround: water quality and availability; building structural and life and fire safety; traffic safety; transport of hazardous materials; and emergency preparedness and response.

[39]E&S impacts refer to any potential change to the physical, natural, or cultural environment; impacts on surrounding community; and/or health of community or workers resulting from the business activity to be supported. E&S risk refers to a combination of probability of certain hazard occurrence and severity of impacts resulting from such an occurrence. In making categorization decision the Bank will take into consideration the following characteristics of severity of impact(s) a) major and permanent, b) major but temporary, c) minor but permanent, d) minor but temporary, c) no impact; and the following characteristics of probability of impact(s) occurrence: a) common occurrence, b) known to occur, c) could occur, d) not expected to occur, e) extremely unlikely to occur.

D. Consultant ToR – ESDD and Supervision

This template can be used as a guide for developing a Terms of Reference (ToR) for a consultant to perform certain aspects of the E&S appraisal of prospective investments of the Bank, as well as ongoing supervision of the investment portfolio.

D1. Introduction

The purpose of this ToR is to ensure that the consultant performs the E&S review of a prospective investment, and later, the ongoing evaluation and supervision of portfolio companies according to the Bank's E&S management policies and procedures.

It is Bank policy that the activities in which the Bank invests will: (i) comply with all applicable environmental, health, safety and labor laws and regulations of Myanmar and local authorities; (ii) apply technically and financially feasible resource efficiency and pollution prevention principles and techniques (i.e., GIIP) that are best suited to minimize adverse impacts on human health and the environment; and (iii) operate consistent with the labor and working condition requirements of the International Labor Organization (ILO) Conventions.

D2. Consultant Qualifications

The consultant must have substantial experience in the E&S review of companies located in Southeast Asia, with particular focus on the support of project finance activities. He/she must be thoroughly knowledgeable of the Bank's E&S management policies and procedures, including GIIP in relation to pollution prevention, occupational health and safety, and community health and safety.

D3. Scope of Work

The consultant will conduct the E&S appraisal of a prospective investment, as well as the ongoing supervision of E&S performance of a portfolio company consistent with the Bank's policies and procedures. For new project appraisals, the four tasks include:

1. **Preliminary Review.** Review all available information and documentation related to company E&S impacts and risks. Prepare a list of additional information and/or questions that will be needed to continue the appraisal.

2. **Site Visit and Further Review.** Conduct site inspections, review facility-based records, and interview key staff, including both company personnel and relevant stakeholders (regulatory officials, community leaders, suppliers and customers).

3. **E&S Performance Gaps and Necessary Corrective Actions Analyses.** Analyze company E&S performance in relation to the Bank's E&S policy and GIIP, addressing as appropriate, air emissions, wastewater discharges, hazardous materials and waste management, noise, contaminated land, occupational health and safety, and community health and safety risks of the business activity. Identify these gaps and any corresponding improvement measures necessary to meet GIIP. Prioritize these and recommend acceptable and justified implementation schedules.

4. **Due Diligence Documentation.** Prepare a report (see Appendix E) summarizing the results of the E&S due diligence (ESDD). The ESDD report shall include a summary of the impacts and risks associated with the investment, including the related performance gaps and corresponding corrective actions that will be necessary in order for the Bank to lend to the prospective borrower.

For supervision of the Bank's borrowers, the three tasks include:

1. **Review Monitoring Reports.** Review periodic documentation submitted by the company regarding implementation of any corrective actions included as conditions of investment, as well as overall E&S performance. Also, review information submitted by the company concerning significant incidents or fatalities. Identify any follow-up corrective actions that might be necessary.

2. **Site Visit and Further Review (Optional).** Where directed by the Bank, conduct site visits to confirm E&S performance and/or to investigate incidents. Identify any follow-up corrective actions that might be necessary.

3. **Supervision Documentation.** Prepare a report summarizing the findings of the supervision activity.

D4. Schedule

The consultant shall submit a draft *[Due Diligence/Supervision]* Report by *[insert date].* The final Report shall be submitted within 2 weeks after receiving comments from the Bank on the draft report. All reports should be written and prepared in English and delivered in electronic and hard copy.

E. E&S Due Diligence and Supervision Findings Summary Formats

E1. Due Diligence Summary Report

1. **Company Description** (including the site, E&S setting and surrounding land uses).

2. **Company Environmental and Social Management Systems** (the processes by which the Company manages E&S performance, including community engagement activities).

3. **Significant Environmental and Social Impacts and Risks** (summarized according to the topics covered by the applicable pollution, OHS, and community health and safety risk issues of concern in relation to GIIP – air emissions, wastewater discharges, hazardous materials management, waste management, noise, contaminated land, occupational hazards, community water quality and availability, life and fire safety, traffic safety, hazardous materials transport, and emergency preparedness and response).

4. **Recommended Corrective Actions** (for performance gaps, recommend corrective actions corresponding schedules, indicate priorities, and advise as to how to incorporate these into the Investment Agreement).

E.2 Supervision Report

1. Company Business Status (i.e., construction, operation, expansion, shut-down).

2. Status of E&S Corrective Action Implementation.

3. E&S Performance (ongoing compliance with Myanmar laws and GIIP).

4. Significant Incidents and Other Issues.

F. General Credit Agreement E&S Clauses

"The Borrower has not received nor is aware of any existing or threatened complaint, order, directive, claim, citation or notice from any Authority under applicable Myanmar law and local requirements which has, or could reasonably be expected to have, a Material Adverse Effect or any material impact on the implementation or operation of the Project";

"Design, construct, operate, maintain and monitor the project in compliance with the Government of Myanmar and local requirements, as well as the Bank's E&S Policy";

"Use all reasonable efforts to ensure the E&S performance of the Project is in compliance with the Bank's E&S Policy";

"Implement the environmental mitigation and management measures specified in the [*Corrective Action Plan*]";

"[Specify any particular conditions of disbursement addressing certain corrective actions recommended for the project]";

"Within [90] days after the end of each Financial Year, deliver to the Bank the Annual Monitoring Report consistent with the requirements of this Agreement confirming compliance with the Action Plan, the social and environmental covenants set forth in [Section __], or, as the case may be, identifying any non-compliance or failure, and the actions being taken to remedy any such deficiency";

"Within three days after its occurrence, notify the Bank of any social, labor, health and safety, security or environmental incident, accident or circumstance having, or which could reasonably be expected to have, any material impact on the implementation or operation of the Project in compliance with the Bank's E&S Policy or a Material Adverse Effect, specifying in each case the nature of the incident, accident, or circumstance and the impact or effect arising or likely to arise therefrom, and the measures the Borrower is taking or plans to take to address them and to prevent any future similar event; and keep the Fund informed of the on-going implementation of those measures";

"[Specify additional covenants – e.g., additional monitoring or reporting requirements, or provisions addressing certain corrective actions recommended for the project]";