

1-21-2011

Energy Security and Efficiency Enhancement Project - ENVIRONMENTAL MANAGEMENT FRAMEWORK

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Ministry of Energy and Mining

Development Bank of Jamaica

Energy Security and Efficiency Enhancement Project

ENVIRONMENTAL MANAGEMENT FRAMEWORK

January 21, 2011

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1 INTRODUCTION

The Jamaican Energy Security and Efficiency Enhancement Project is designed to provide a comprehensive support to the implementation of the Government of Jamaica's (GoJ's) energy policy and strategy covering the 2010-2030 period.

Potential environmental and social impacts related to the implementation of the Project may be associated with the energy efficiency and renewable energy investments financed through the proposed line of credit managed by the Development Bank of Jamaica (DBJ) and included in Component 2 of the Project. Other activities supported by the Project, such as the undertaking of prefeasibility, feasibility and other studies also need to review and assess potential environmental and social impacts of the activities and alternatives considered. Chapter 2 provides a description of the Project.

The Development Bank of Jamaica (DBJ), through its Approved Financial Institutions (AFIs), will finance and implement a variety of small-scale energy efficiency and renewable energy sub-projects throughout the country. These projects are expected to have generally positive social impacts, albeit some could result in minor adverse environmental impacts that would be mostly local and reversible. The DBJ in consultation with its AFIs have developed this Environmental Management Framework (EMF) to manage these potential adverse impacts and also to ensure compliance with the requirements of Jamaican laws and the World Bank's environment safeguard policies.

The Office of Utility Regulations, the Center of Excellence for Renewable Energy (of PCJ), the LNG Project Unit, will also carry out prefeasibility, feasibility and other studies (economic, financial, regulatory, etc) required to implement the National Energy Policy. Potential and social environmental impacts would need to be assessed on a case-by-case basis.

This document presents the Environmental Management Framework (EMF) for the Energy Security and Efficiency Enhancement Project. The purpose of the Environmental Management Framework (EMF) is to manage the potential adverse impacts by establishing a guide consisting of a set of methodologies, procedures and measures to facilitate adequate environmental management, including risk management and environmental impacts, directed to the group of works to be financed with the Project and whose specific location is unknown and may change over Project implementation.

The EMF will provide guidance to the sub-project sponsors (sub-borrowers) and the Development Bank of Jamaica's Approved Financial Institutions (AFIs) to ensure the environmental assessment be carried out in compliance with the Guidelines for Conducting Environmental Impact Assessments (EIA), other environmental regulations and laws of Jamaica, and in accordance with the World Bank Environmental Assessment (EA) policies and procedures as specified in the World Bank environmental safeguard policy. It will also be use as a reference document for assessing the potential environmental and social impacts of investment alternatives or strategies that are assessed.

Thus, the EMF becomes an integral part of the Project's Operational Manual (OM) and is applicable to all investments financed by the AFIs, regardless of its funding source or implementing agency.

The main objectives of the EMF are to:

- establish procedures for screening all proposed sub-projects for their potential adverse environmental impacts;
- specify measures for managing, mitigating and monitoring environmental impacts during project implementation and operation; and
- outline the training and capacity-building arrangements needed to successfully implement the provisions of the EMF.

The EMF procedure covers the following ten aspects of preparation and construction phase, and one aspect of implementation phase. Each of the aspects is described below along with the requirements and responsibilities for each aspect (Table 1).

Table 1. Environmental Management Framework (EMF) Procedures

Project Phase	EMF Procedure
Sub-Project Preparation and Construction Phase	1. Sub-project Review and Categorization
	2. Sub-project Review and Categorization
	3. Environmental Assessment (EA) Documentation
	4. Applicable Environmental Standards
	5. Environmental Management System
	6. Public Consultation and Disclosure
	7. Grievance Mechanism
	8. Review and Approval of EA
	9. Related Conditions and Responsibilities
Implementation Phase	10. Monitoring and Reporting

The EMF covers the following elements: (i) a brief description of the Project and components for which the EMF is required; (ii) operating requirements; (iii) screening procedures for the EMF; (iv) implementation arrangements; (v) consultation process; (vi) arrangements for monitoring and reporting; and (viii) training and capacity building.

2 PROJECT DESCRIPTION

2.1 Project background

The Jamaican Energy Security and Efficiency Enhancement Project is designed to increase energy efficiency and security through implementing Jamaica's National Energy Policy. The key goals of the energy policy are to: (a) increase Jamaica's energy security by diversifying the energy matrix; (b) enhance Jamaica's economic competitiveness and performance by improving the efficiency of the energy sector, and by minimizing end-users energy costs; and (c) reduce Greenhouse Gas (GHG) emissions from the energy sector.

Specific Project goals are to build capacity, to provide international best practice to the government and support its energy cost reduction and diversification efforts through investments in liquefied natural gas, energy efficiency (EE) measures, renewable energy (RE) investments, and to reduce GHG emissions from the energy sector

To achieve these goals, the Project will support GoJ in: (a) strengthening the energy sector regulatory and institutional framework to improve sector performance, increase private investment and transition to cleaner fuels (Component 1); (b) realization of Jamaica's Energy Efficiency (EE) and Renewable Energy (RE) potential (Component 2); and (c) providing resources for the implementation of GOJ energy program and of the Project (Component 3).

Component 1 will consist of provision of experts' advice, training and preparation of prefeasibility/feasibility studies, in particular for developing electricity generation projects and a sound LNG project. Prefeasibility/feasibility studies financed by the Project will include an assessment of the potential environmental and social impacts.

Component 2 will finance the delivery of testing and labeling equipment for electrical appliances, investments in energy efficiency (EE) and renewable energy (RE) projects in private industries and SMEs, and investment promotion activities of small hydro sites to mobilize investors. The financing of testing and labeling equipment will support the expansion of the appliances labeling (and testing) program of the Bureau of Standards. The financing for the EE and RE sub-projects (subcomponent 2.2) will be provided by selected local financial institutions (Approved Financial Institutions – AFIs) drawing from a line of credit established by the Development Bank of Jamaica (DBJ) with a portion of the proceeds from the World Bank credit to the government. The financing will be provided for the purpose of investing in technologies or upgrades that significantly enhance energy efficiency (EE) or use of renewable energy (RE).

The EMF will be used for Component 1, for the preparation of prefeasibility/feasibility studies (subcomponent 1.3 and 1.4), and Component 2, for the testing and labeling of equipment for electrical appliances and for energy efficiency (subcomponent 2.1), for renewable energy sub-projects to be financed by DBJs Line of Credit (subcomponent 2.4), and for relevant studies for investment promotion of selected small hydro sites (subcomponent 2.2). The EMF will guide the environmental management plans as required.

2.2 Social Context

Jamaica's population is dispersed 43.3 percent between the main urban areas of St. Catherine, Kingston and St. Andrew, and the remaining 56.8 percent of the population is shared among the remaining 11 parishes. However, economic and social developments within rural areas have not kept pace with urban areas. The Jamaica Survey of Living Conditions (2006) indicated the distribution of poverty was significantly greater in rural areas; 21.2 percent within the Kingston Metropolitan Region, 13.1 percent in other towns, and, 65.7 percent in rural areas. Typically, rural areas have more population aged 0-14, while the urban areas have a slight majority of persons aged 15-64 years. This reflects the usual urban migration from rural areas as individuals seek employment and educational opportunities that are limited within rural areas.

As for electricity coverage rates, Jamaica has a high electricity coverage rate of about 92 percent (slightly below the 94 percent average for the Latin America region). Of the 590,000 electricity customers 525,000 are residential. Despite the high coverage rate, its consumption per household is rather low and has increased only slowly by 1.7 percent per year, driven mainly by the increase in household numbers. Electricity tariffs are among the most expensive in the region due to the imported fossil fuel dominated matrix that relies mainly on heavy fuel oil and diesel.¹

The Energy Security and Efficiency Enhancement Project will support private sector sponsored sub-projects in energy efficiency (EE) and renewable energy (RE) provided by selected local financial institutions (AFI's) drawing from a line of credit established by the DBJ. Under this mechanism small and medium enterprises (SME) may have access to initial funding and technical expertise to support development of the EE and RE sub-projects. The requirements to access the credit line will be made public to inform potential users. The project will be national in coverage and the areas of implementation will not be defined at the time of Project Appraisal.

2.3 Description of potential sub-projects financed through the Labeling Program and the Line of Credit

The Project's geographical scope is Jamaica. It includes: (a) US\$9.5 million for financing technical assistance/preparation support for: (i) upgrading of the energy sector regulatory framework and for strengthening the sector institutions; and (ii) delineating projects, selecting developers and mobilizing financing for new power generating units, implementing the LNG strategy and developing small hydroelectric sites; (b) US\$1 million to extend the Bureau of Standard testing/labeling facilities; and: (b) US\$4.5 million for supporting energy efficiency and renewable energies investments by private sector small and medium enterprises (SMEs).

Extension of the testing and labeling program for electrical appliances of the Bureau of Standards with the objective of increasing the energy efficiency of refrigerators, freezers and air-conditioning units. Additional testing chambers will be installed within the Bureau of Standards existing office building in Kingston; no major equipment will be discarded.

¹ In Jamaica diesel was almost three times as expensive as alternative fuels in 2008.

Line of Credit/Revolving Fund component of the Project. Potential investments financed through the line of credit could include, but not be limited to, RE and EE investments in solar panels, solar water heaters, retrofitting/replacement of lighting equipment, air conditioning facilities, chillers, etc. and are expected to be relatively small (US\$150-200,000). They will only be known once the SMEs proposals are assessed by the local financial institutions (AFIs), by the Development Bank of Jamaica (DBJ) and, as appropriate, by the National Environmental and Planning Agency (NEPA).

These types of RE and EE investments have either minor or no adverse environmental impacts and provide environmental benefits (reductions in local pollution such as dust and sulfur dioxide emissions or reductions in emissions of greenhouse gases such as carbon dioxide). Therefore the project has been assigned a World Bank Environmental Category “B”.

The sub-projects are owned by private enterprises (SMEs). They will be appraised and financed by the AFIs. Once the sub-project appraisal has been completed, the AFI will request DBJ financing. Section VI describes the implementation arrangements in more detail. DBJ will carry out its own review and will provide sub-project financing on a first-come first-serve basis. DBJ will inter alia ensure that the sub-projects are in compliance with the national regulations (NEPA) and with the World Bank requirements.

2.4 Description of Potential Prefeasibility, Feasibility and Other Studies Financed by the Project

Prefeasibility/feasibility studies and other studies for small hydros and other energy infrastructure (renewable and non renewable such as the power generating units and the LNG project) will be financed by the Project, and depending on its typology, will include an assessment of the potential environmental impacts consistent with Jamaica and World Bank requirements. Advisory support for prefeasibility and/or feasibility studies or other planning studies with possible environmental implications, such as the LNG plant feasibility studies or the prefeasibility and feasibility studies of small hydroelectric sites, should be assessed and the requirements clearly spelled out in the Terms-of-Reference (ToRs) associated with each activities. A review of potential downstream effects or rapid risk assessment should be prepared and the associated costs of any environmental and social work that would have to be carried-out in addition to, or part of, the proposed study should be assessed prior to embarking on it. The studies will also include the principles and procedures for planning and implementation to comply with Bank and national policies

Recognizing that there are a variety of study types with varying degrees of environmental implications it is important that the prefeasibility, feasibility studies and other studies demonstrate an appropriate consideration for promoting environmental objectives, as well as minimizing related risks of future plans, policies and programs. To address environmental issues associated with the desired outcome of the prefeasibility and/or feasibility study, detailed ToRs will be developed during implementation which will include the evaluation of various environmental issues of importance.

A set of guiding principles should encompass the following concepts:

- (i) Integrate environmental and social objectives into the prefeasibility/feasibility study process. These studies often provide a significant opportunity to integrate environmental and social objectives as an integral part of the planning process. As such, ToRs to incorporate environmental and social objectives into the studies, plans and policy formulation should be included within the scope of work;
- (ii) Promote transparency through stakeholder participation and public information disclosure. Since many studies promote improved planning, this provides an excellent opportunity to promote broad stakeholder engagement and participation. As appropriate, strategic planning initiatives this could include focus groups, citizen consultations, expert panels, public hearings, etc. at all phases of the studies;
- (iii) Promote use of innovative environmental and social assessments such as SEA. Studies supporting policies, plans and programs are ideally suited to apply new and innovative techniques of strategic environmental analysis. Studies can provide an ideal vehicle for this longer term analytical approach and there currently exists a strong interest and demand among counterpart agencies and line ministries;
- (iv) Promote systematic and comprehensive analysis of alternatives. Where studies support the development of specific investment plans, such as for large scale infrastructure, studies should be used to meaningfully explore alternatives at various levels, including assessing the relative impacts of those alternatives. Such alternatives analysis could be explicit in an SEA or could be carried out as part of other master planning or strategic studies.
- (v) Promote environmental and social capacity building and institutional strengthening. Studies can provide an opportunity to build counterpart capacity for integrating environmental and social concerns into their work. This could be done through direct support to line agencies. Support for capacity building could come in the form of policy strengthening, training, support for operations, technical standards setting, monitoring and reporting among others.

3. OPERATING REQUIREMENTS

3.1 Safeguards and Regulatory Framework

Several documents outline the standards to which DBJ currently subscribes with respect to funding sub-projects and which are applicable to the Energy Security and Efficiency Enhancement Project. These documents include: ISO 14001 which has requirements set out in the Environmental Management System Manual (EMS) and the Environmental Policy and Management System (EPMS); and the International Bank for Reconstruction and Development's (IBRD) Environmental and Social Safeguards.

In addition to the provisions of these documents, DBJ has to comply with the requirements of relevant national environmental, planning including building, and social regulations and standards specific to the sub-project being funded. These regulations and standards arise mainly from the requirements of the National Environmental and Planning Agency (NEPA) and its partner regulatory agencies, as well as Local Authority.

The AFIs will have to ensure compliance of SME sub-projects with the above regulations.

3.2 National Regulatory Requirements

DBJ Environmental Safeguards

ISO 14001 specifies the actual requirements for an environmental management system. Aspects of the respective operations over which the project proponent has control and over which it can be expected to have an influence need to be identified and the potential impacts assessed. The DBJ's *Environmental Policy and Management System (EPMS)*² highlights the procedures and policies that are designed to ensure that the projects implemented meet the highest financial quality and environmental standards as required by ISO 14001. It outlines the environmental policy which speaks to environmental protection and sound business practices as critical components. It also establishes the procedures for screening all sub-projects for any potential adverse environmental impact and outlines how the system will operate and be maintained through planning.

NEPA Requirements

Since 2001 NEPA has been the main regulatory body with respect to regulations of the Environment and Land Development and Utilization. The agency was created through the merge of the Natural Resources Conservation Authority (NCRA), the Town Planning Department and the Land Development Utilization Commission.

The following Legislation from NEPA was reviewed to help guide development of the Project's screening criteria:

² Jamaica Development Bank (JDB). *Environmental Policy and Management System*.

- Beach Control Act 1956³
- The Town and Country Planning Authority Act
- The Local Improvement Act
- The Natural Resources Conservation Act
- The Natural Resources Conservation (Permits and Licences) Regulations 1966 (Amended 2004)

The **NRCA Act** was enacted in 1991 to provide a framework for the effective management of the physical environment of Jamaica. It provides for the management, conservation and protection of the natural resources of Jamaica. The NRCA is given wide functions and duties including the development, implementation and monitoring of plans and programmes relating to the management of the environment and to formulate standards and codes of practice for the improvement and the maintenance of the quality of the environment.

The NRCA Act also provides for (i) the designation of protected areas (section 33); (ii) environmental impact assessments (section 10); and (iii) the promulgation of Ministerial orders to protect the environment (section 32). The Act also empowers the establishment of standards for environmental protection (section 4(1) (d)), the management of waste (section 38), the management of national parks, marine parks (section 5), other protected areas and public beaches (section 4).

The **Watershed Protection Act** (1963)⁴ administered under NEPA, is intended to ensure proper land use in vital watershed areas, reduce soil erosion, maintain optimum levels of ground water, and promote regular flows in waterways. This Act would apply to any water use ventures or enterprises that would take place in an area considered a vital watershed or catchment area.

NEPA has also produced a **National Watershed Policy**⁵ which seeks to address strategies to ensure the sustainable use and development of watersheds, by defining opportunities for the people, government and non-government organizations, and for the international community to participate in the interest of water supply and biodiversity. Among the twelve guiding principles to the Policy, are:

- Design, planning and implementation of watershed management interventions;
- Special attention to people in watershed areas and their environment;
- Integral protection and production functions for land and water resources;
- Assessment of land use impacts and rehabilitation of damages;
- Compromise and complementarities rather than confrontation and contradiction in resolving conflicts of interest; and
- Co-operation among agencies and the public to manage watersheds effectively.

The **Water Resources Act** gives the Water Resources Authority (WRA) the responsibility for planning and management of water resources. WRA can also be proactive by declaring proposed

³ Government of Jamaica. *Beach Control Act, 1956*

⁴ National Environment and Planning Agency (NEPA). *The Watershed Protection Act (1963)*

⁵ National Environment and Planning Agency (NEPA). *National Watershed Policy*

industrial areas Water Quality Control Areas and putting in place the standards and conditions to protect water quality. The Act allows the WRA to declare a water quality zone to protect water quality in the public's interest.

3.3 World Bank Environmental Safeguards Policies

The World Bank has ten environmental and social policies which are known as safeguard policies. Five of these policies, the Environmental Assessment (OP 4.01), Natural Habitats (OP 4.04), Forestry (OP 4.36), Pest Management (OP 4.09), and Safety of Dams (OP 4.37), apply to prefeasibility and/or feasibility studies and the EE and RE sub-projects under the Energy Security and Efficient Enhancement Project, and are briefly described below.

Environmental Assessment (OP 4.01):⁶ Four categories of projects are noted in the policy: Category A, B, C, and FI. Environmental Assessments (EA) are required of all project types with the exception of Category C projects. The Energy Security and Efficient Enhancement Project is classified by the Bank as a Category B project, because the size and nature of the sub-projects are not expected to have significant negative environmental impacts. The Project triggers OP 4.01, and the EA should examine the sub-project's potential negative and positive environmental impacts and recommend appropriate environmental mitigation plans (Annex 2 provides more details). The EAs are intended to help ensure that projects are environmentally sound and sustainable and to improve decision making. This assessment will also examine alternatives to potential adverse environmental impacts and enhance positive impacts. Terms of Reference for providing technical assistance or supporting studies for the preparation of energy projects should include, where appropriate, technical expertise to address potential environmental and social implications on a case-by-case basis – depending upon the gravity of potential environmental or social impacts.

Natural Habitats (OP 4.04):⁷ The World Bank emphasizes that projects should not pose a threat or lead to the degradation of natural habitats. They promote the conservation of Natural Habitats and encourage measures that protect, maintain and rehabilitate natural habitats and their function for long-term sustainable development. The Project is not expected to impact critical natural habitats. However, the policy is triggered as a precaution. The EMF will include screening procedures to ensure that potential SME sub-projects will not involve unprecedented or significant conversion of natural habitats (Annex 3 provides more details). The technical assessments and recommendations for possible investments will take into account any potential implications for, or risks to, natural habitats.

Forestry (OP 4.36):⁸ The aim of this policy is to reduce deforestation, enhance the environmental contribution of forested areas, promote afforestation, reduce poverty, and encourage economic development. This safeguard is being triggered as a precaution to allow flexibility for potential EE or RE investments that might involve management of natural forest areas. No logging operations will be supported under the Project.

⁶ The World Bank Operational Manual. 1999. *Operational Policies 4.01 Environmental Assessment*

⁷ The World Bank Operational Manual. 2001. *Operational Policies 4.04 Natural Habitats*

⁸ The World Bank Operational Manual. 2002. *Operational Policies 4.36 Forests*

Pest Management (OP 4.09):⁹ The World Bank encourages Integrated Pest Management (IPM) to minimize/prevent the use of harmful biocides. The IPM approach takes into consideration biological control, cultural practices and the development of crop pesticides. Although no consensus exists on its precise definition, the World Bank's Operational Policy 4.09 defines integrated pest management as a mix of farmer-driven, ecologically based pest control practices that seeks to reduce reliance on synthetic chemical pesticides. This safeguard is triggered as a precaution to allow flexibility to potential EE or RE investments and related facilities that may, among other things, store pesticides. No procurement of pesticides will be supported under this Project. Pesticides that could be stored would not be those that are on the exclusion list, which are the Class 1A pesticides. Annex 4 provides details on screening procedures to identify risks associated with pest management in SMEs supported by the Project.

Safety of Dams (OP 4.37):¹⁰ The World Bank emphasizes that for the life of any dam, the owner is responsible for ensuring that appropriate measures are taken and sufficient resources provided for the safety of the dam, irrespective of its funding sources or construction status. Because there are serious consequences if a dam does not function properly or fails, the Bank is concerned about the safety of new dams it finances and existing dams on which a Bank-financed project is directly dependent. While the Energy Security and Efficiency Enhancement Project will not support the construction, expansion or rehabilitation of dams, this policy is triggered as prefeasibility and/or feasibility studies for the construction, expansion or rehabilitation of dams could be financed by the Project. In such situation, the Terms of Reference for the studies (prefeasibility, feasibility studies and other studies) will include an assessment of dam safety measures and the potential environmental and social impacts of the sub-project, as well as the alternatives considered, as stipulated by the Bank's Safety of Dams Policy (OP 4.37).

3.4 Environmental, Health and Safety Standards of the World Bank Group

The Environmental, Health, and Safety (EHS) Guidelines are technical reference documents with general and industry-specific examples of Good International Industry Practice (GIIP). The development of any sub-project under the Energy Security and Efficient Enhancement Project should apply the EHS Guidelines, which are designed to be used together with the relevant Industry Sector EHS Guidelines, in particular under the Oil and Gas, and Power Industry section (www.ifc.org/ifcext/enviro.nsf/Content/EnvironmentalGuidelines), which provide guidance to users on EHS issues in specific industry sectors.

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. Application of the EHS Guidelines to existing facilities may involve the establishment of site-specific targets, with an appropriate timetable for achieving them. The applicability of the EHS Guidelines should be tailored to the hazards and risks established for each sub-project on the basis of the results of an environmental assessment in which site-specific variables, such as local country context, assimilative capacity of the environment, and other sub-project factors, are taken into account.

⁹ The World Bank Operational Manual, 1998, *Operational Policies 4.09 Pest Management*

¹⁰ The World Bank Operations Manual, 2001, *Operational Policies 4.37 Safety of Dams*

The applicability of specific technical recommendations should be 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 assessment of 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. This justification should demonstrate that the choice for any alternate performance levels is protective of human health and the environment (see Annex 5 for more details).

3.5 Environmental Management Plan (EMP)

The main difference between Jamaican national environmental requirements for the types of infrastructure sub-projects financed by the AFIs and those of the World Bank is the preparation and use of an Environmental Management Plan (EMP). An EMP sets out project specific mitigation measures and corresponding monitoring requirements. The use of generic EMPs for small-scale renewable energy and energy efficiency projects with minor adverse environmental impacts (as in this case) has become internationally accepted good practice, and EMPs are often adapted as Standard Operating Procedures (SOP).

A sub-project's Environmental Management Plan (EMP) consists of the set of mitigation, monitoring, and institutional measures to be taken during implementation and operation to eliminate adverse environmental and social impacts, offset them, or reduce them to acceptable levels. The plan also includes the actions needed to implement these measures.¹¹ To prepare an EMP, the AFIs and its Environmental Assessment design team need to: (a) identify the set of responses to potentially adverse impacts; (b) determine requirements for ensuring that those responses are made effectively and in a timely manner; and (c) describe the means for meeting those requirements. More specifically, the EMP includes the following components:

- *Mitigation* - The EMP identifies feasible and cost-effective measures that may reduce potentially significant adverse environmental impacts to acceptable levels. The plan includes compensatory measures if mitigation measures are not feasible, cost-effective, or sufficient. Specifically, the EMP: (a) identifies and summarizes all anticipated significant adverse environmental impacts; (b) describes--with technical details--each mitigation measure, including the type of impact to which it relates and the conditions under which it is required (e.g., continuously or in the event of contingencies), together with designs, equipment descriptions, and operating procedures, as appropriate; (c) estimates any potential environmental impacts of these measures; and (d) provides linkage with any other mitigation plans (e.g., for involuntary resettlement plan) required for the project.
- *Monitoring* - Environmental monitoring during project implementation provides information about key environmental aspects of the project, particularly the environmental impacts of the project and the effectiveness of mitigation measures. Such

¹¹ The EMP is sometimes known as an "action plan."

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

- *Capacity Development and Training* - To support timely and effective implementation of environmental project components and mitigation measures, the EMP draws on the EA's assessment of the existence, role, and capability of environmental units of the implementing agencies. If necessary, the EMP recommends the establishment or expansion of such units, and the training of staff, to allow implementation of EA recommendations. Specifically, the EMP provides a specific description of institutional arrangements--who is responsible for carrying out the mitigatory and monitoring measures (e.g., for operation, supervision, enforcement, monitoring of implementation, remedial action, financing, reporting, and staff training). To strengthen environmental management capability in the agencies responsible for implementation, most EMPs cover one or more of the following additional topics: (a) technical assistance programs, (b) procurement of equipment and supplies, and (c) organizational changes.
- *Implementation Schedule and Cost Estimates* - For all three aspects (mitigation, monitoring, and capacity development), the EMP provides: (a) an implementation schedule for measures that must be carried out as part of the project, showing phasing and coordination with overall project implementation plans; and (b) the capital and recurrent cost estimates and sources of funds for implementing the EMP. These figures are also integrated into the total project cost tables.
- *Integration of EMP with Project* - The Bank expects the plan to be specific in its description of the individual mitigation and monitoring measures and its assignment of institutional responsibilities, and it must be integrated into the project's overall planning, design, budget, and implementation. Such integration is achieved by establishing the EMP within the project so that the plan will receive funding and supervision along with the other components.

4. SCREENING PROCEDURES

4.1 Screening Criteria

Some site-specific issues may present environmental risks and/or impacts. For example, proximity to a high water table area would have potential effect on the design and operation of sanitation systems such as soakaway pits or tile fields. In such cases, there should be a consideration of alternatives or the project application will be rejected due to the unsuitable site conditions. Therefore, a site screening mechanism is needed to identify sites that are potentially unsuitable due to site-specific environmental conditions.

In addition, the land on which a project is to be located must comply with the zoning requirements of NEPA and relevant local planning legislation. NEPA has developed a screening form that may be consulted for other environmental and planning considerations.

As for specific energy efficiency sub-projects, any facility that proposed an investment must either have all the necessary environmental licences, permits and no outstanding unpaid environmental fees or fines for the facility as a whole. However, if the proposed investment is required to enable the facility to meet their environmental requirement or eliminate environmental liabilities it could be considered as a candidate for investment

4.2 Screening Process

Each project must be screened by the respective DBJ project and environment officer, early in the project cycle, for potential environmental impacts and land requirements. Table 2 below must be used only as a reference to make a preliminary decision whether NEPA permit to construct and operate or licence to discharge treated effluent to the environment and/or an EMP is required. This decision must be confirmed by the DBJ Environment Officer (EO) to be designated, after reviewing additional site specific information as detailed in the attached Form “Checklist for Screening Site Specific Issues”.

Table 2: EE and RE Sub-project Categories and Regulatory and Other Environmental Requirements

PROJECT CATEGORIES	PROJECT TYPES	NEPA Permit ¹² Yes/No (Y/N)	EMP ¹³ Yes/No (Y/N)	NOTES
SOLAR PANEL and WATER HEATING	<ul style="list-style-type: none"> Installation of solar panels for energy supply and solar water heating 	N	Y	.
LIGHTING	<ul style="list-style-type: none"> EE lighting retrofitting pilots 	N	N	
AIR CONDITIONING	<ul style="list-style-type: none"> AC systems (chillers and others) to be installed in 			

¹² This means an environmental permit.

¹³ Environmental Management Plans (EMPs)

PROJECT CATEGORIES	PROJECT TYPES	NEPA Permit ¹² Yes/No (Y/N)	EMP ¹³ Yes/No (Y/N)	NOTES
	buildings/offices, etc.			

Sub-projects not subject to finance by the Project

The Energy Security and Efficiency Enhancement Project will not finance the following type of subprojects (To complete):

- Category I. Sub-projects that do not support the objectives of reducing the costs of the energy used to provide products or services.

Examples of sub-projects in Category I are: Retrofitting of lighting with inefficient bulbs.

- Category II. Sub-projects that do not produce renewable energies i.e energy that is replenished naturally... (such as solar, wind, hydro, biomass, biofuels etc.).

Examples of sub-projects in Category II are: Installation of a diesel generator to produce energy.

4.3 Checklist for Environmental Risk Criteria

This Form is to be completed for all AFI financed sub-project by the **designated Environmental Officer**, small and medium enterprise development officers and/or community representatives. If critical issues are identified, then the AFI's **designated Environmental Officer (EO)** must perform a detail investigation. The responses to the questions must be completed and transferred to the system if completed in the field.

Environmental Risk Criteria Screening Sheet

- Sub-Project Name:**
Date of Site Visit:
Location:
Sub-Project Type:
Parish:

	CRITERIA	Minor or No Impact	Modest Impact	High Impact	Comment
1	Does the existing enterprise have a valid operating permit, licences, approvals etc.? <i>If not, will the investment be used to correct this condition?</i>				
2	Does the existing enterprise meet all Jamaican environmental regulations regarding air, water and solid waste management? <i>If not, will the investment be used</i>				

	<i>to correct this condition?</i>				
3.	Does the existing enterprise have any significant outstanding environmental fees, fines or penalties or any other environmental liabilities (e.g. pending legal proceedings involving environmental issues etc.) <i>If so, will the investment be used to correct this condition?</i>				
4.	Have there been any complaints raised by local affected groups or NGOs regarding conditions at the facility? <i>If so, will the investment be used to remedy these complaints?</i>				
	CRITERIA	Minor or No Impact	Modest Impact	High Impact	Comment
5.	Will the sub-project generate water effluents that: <ul style="list-style-type: none"> • violate Jamaican effluent standards • result in a long term violation of Jamaican water quality standards • contaminate public drinking water supply <ul style="list-style-type: none"> • contaminate underground water resources • harm fish or aquatic ecosystems • contaminate a natural habitat or protected area • are difficult, expensive, or hard to control • are inconsistent with WB Environmental Health and Safety (EHS) Guidelines or recommendations • alter downstream river basin characteristics 				

	CRITERIA	Minor or No Impact	Modest Impact	High Impact	Comment
6.	<p>Will the sub-project generate air emissions that:</p> <ul style="list-style-type: none"> • violate Jamaican air emission standards • result in a long term violation of Jamaican air quality standards • release pollutants that affect downwind sensitive receptors (hospitals, schools, population centers, sensitive crops etc.) • harm sensitive ecosystems (e.g. forests) • impact a natural habitat or protected area • are difficult, expensive, or hard to control • are inconsistent with EHS Guidelines or recommendations 				
7.	<p>Will the sub-project generate noise levels that:</p> <ul style="list-style-type: none"> • violate Jamaican noise standards • impact particularly sensitive receptors (natural habitats, hospitals, schools, local population centers) • are inconsistent with EHS Guidelines or recommendations 				

	CRITERIA	Minor or No Impact	Modest Impact	High Impact	Comment
8.	<ul style="list-style-type: none"> • Will the subproject consume, store, produce or utilize hazardous materials that: • require special permits or licences • require licenced or trained personnel • are outlawed or banned in EU or Western countries • are difficult, expensive, or hard to manage • are inconsistent with EHS Guidelines or recommendations 				
9.	Will the sub-project be located within or close to officially protected areas or areas under consideration by the Government for official protection status?				
10.	Will the sub-project potentially impact areas of known local, regional or national cultural heritage significance? (During the public consultation, the local population should be asked to provide information about any sites or structures, which are not on any official list, but which they consider to be of significance and which they think should be protected)				
11.	Has the local population or any NGOs expressed concern about or opposition to the sub-projects' environmental aspects				

4.4 National Environmental Permits and Licences Processes

Jamaican national environmental regulatory requirements are prescribed by the Natural Resources Conservation Permits & Licence System (P&L), which came in to effect in January 1997 and is administered by the National Environment and Planning Agency (NEPA).¹⁴ It is a mechanism to ensure that all Jamaican facilities and development projects meet the relevant standards and procedures to minimize adverse environmental impacts during construction and operation of a facility. See Figure 1 for a flow diagram of NEPA's environmental permit and licence system.

When new projects are introduced, AFI approaches NEPA to obtain advice with respect to the specific national regulatory requirements (environmental permit to construct and operate, and if needed licence to discharge treated effluent) for the various EE and RE sub-projects to be financed by them. NEPA will then indicate or confirm the sub-projects that would require an environmental permit. AFI is then required to submit an application for the appropriate environmental permits and licences to NEPA, together with a detailed Project Information Form (PIF). NEPA, after review of the application, will grant an environmental permit, sometimes with terms and conditions, or may require the preparation of a scoped Environmental Impact Assessment (EIA) prior to granting the environmental permit. If an EIA is required for the sub-project, then its ToRs and the actual EIA study must be sent to the World Bank requesting the no objection of the Task Team Leader and the Project's Environmental Specialist.

The sub-borrower will submit the Jamaican EIA documentation to the appropriate Jamaican environmental authorities for review and approval. *Only after receiving an official approval from the Jamaican environmental authorities, will the sub-project be eligible for consideration for a loan from the AFIs and the Project's Line of Credit.*

¹⁴ This EMF only deals with the environmental permits needed from NEPA. Other type of permits outside NEPA are beyond the scope of this EMF.

Figure 1: Flow Diagram of Environmental Permit Application Process

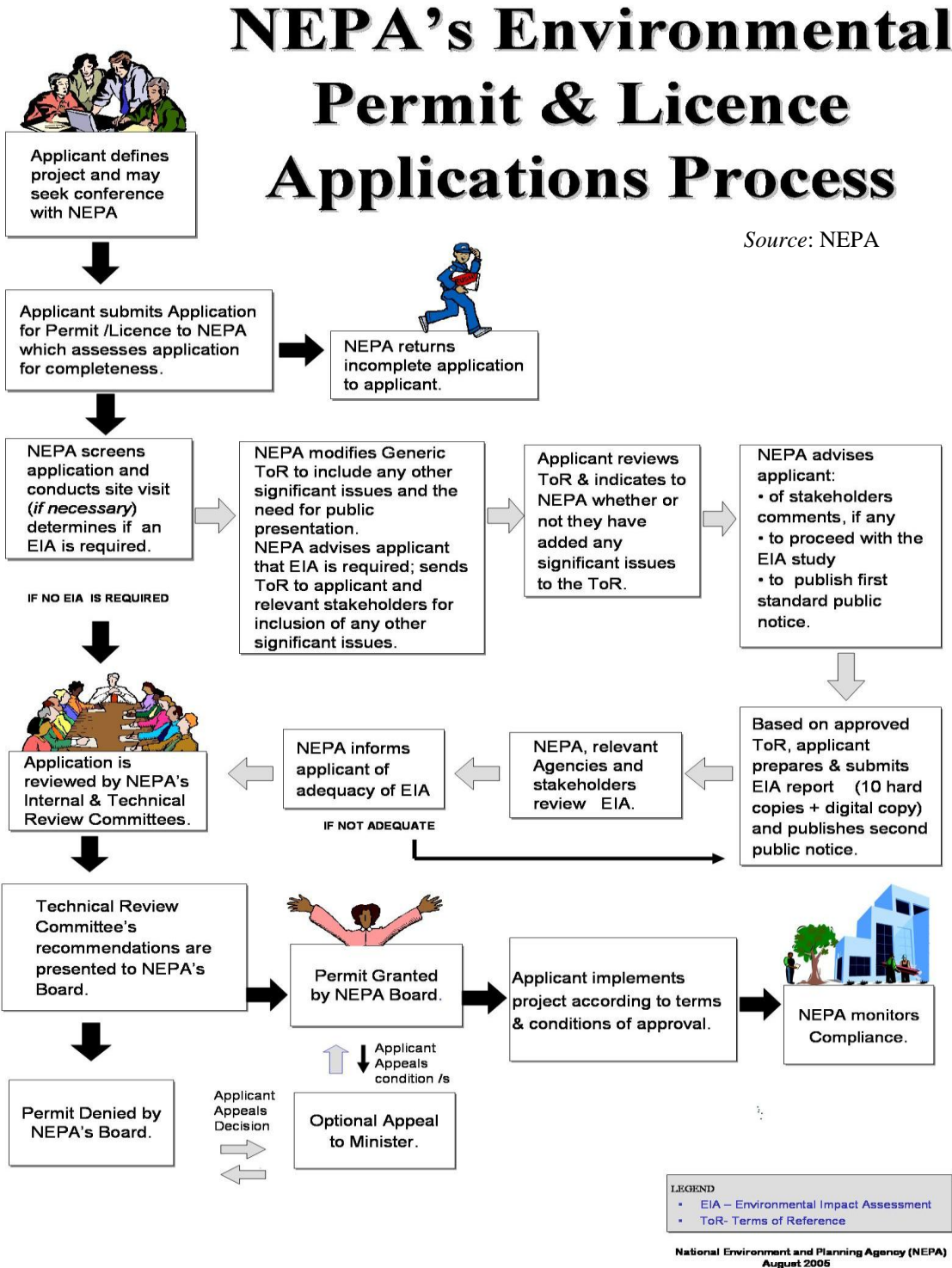
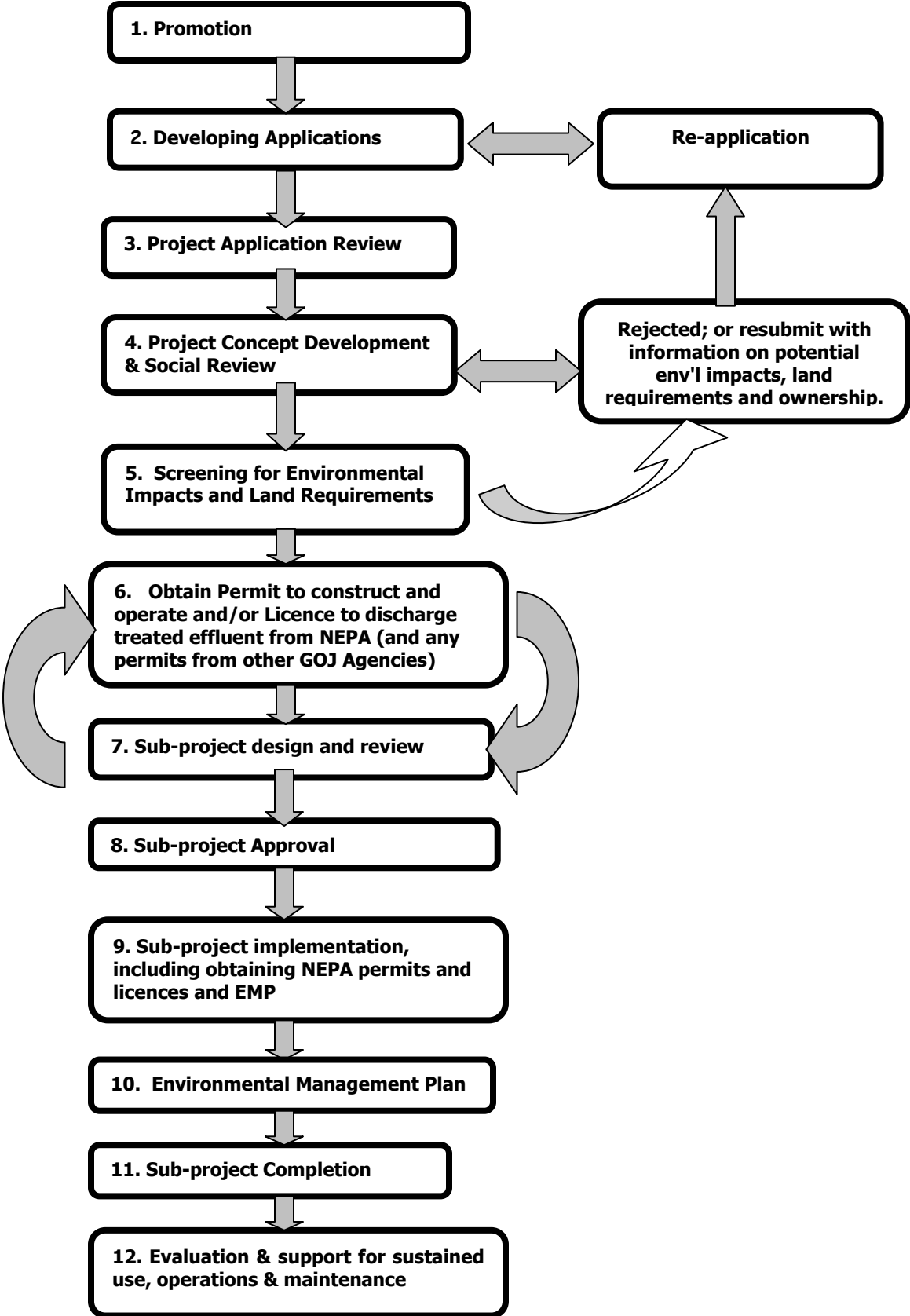


Figure 2 Integration of Screening with DBJ Project Cycle



5 IMPLEMENTATION ARRANGEMENTS

5.1 Implementation Responsibility

Implementation of sub-projects, including ensuring that all environmental requirements of the World Bank environmental safeguard policies are properly implemented, is under the overall responsibility of the AFIs and DBJ. The provisions of this EMF will apply regardless of the implementing agency, and AFIs and DBJ will retain ultimate responsibility for the good environmental management of all the sub-projects.

The AFIs will designate qualified environmental staff to manage environmental risk and ensure that the procedures specified in the Environmental Management Framework and the Environmental Management Plans, as appropriate, are properly followed during implementation. AFIs designated Environmental Officer (EO) will support its staff with all technical reviews or any other activities to ensure satisfactory implementation of the EMF and, if appropriate, EMPs. Each AFI will interact directly with their private sector clients (most likely SMEs) and will be responsible for sub-project appraisal and for the due diligence on environmental safeguard matters. Once the sub-project appraisal has been completed, the AFI will propose the sub-project for DBJ's financing.

DBJ will assume overall responsibility for the implementation of the Line of Credit and will be the Bank's main interlocutor. DBJ will review the sub-project documentation and as appropriate will release Line of Credit resources to the AFIs. DBJ will be responsible for collecting information (on a quarterly basis or more frequently as needed) from the participating accredited financial intermediaries (AFIs) and maintaining data regarding environmental licences and permits, EMP preparation and other due diligence actions, for recording site visit of selected sub-projects, and for reporting to the Bank through MEM. The first five EE/RE sub-projects will be reviewed by the Bank prior to their approval by DBJ/AFIs.

The World Bank environmental safeguard specialists will provide training to perform the tasks required under the EMF in the identification and management of environmental risk in project evaluation and implementation.

5.2 Implementing NEPA Requirements

Based on the results of the screening, AFIs staff (Project Officer in consultation with Environmental Officer (EO)) will prepare the necessary application to NEPA for a permit or licence where applicable. The sub-project proposal may be presented to the Development Centre, NEPA for preliminary review and guidance prior to the submission of requisite applications. The application requires the submission of a detailed Project Information Form (PIF) and relevant supporting information as per checklist Appendix. NEPA reviews the application and determines whether: (i) a scoped Environmental Impact Assessment must be prepared before a permit is issued, or (ii) a permit is issued by NEPA with General and Specific Conditions. See Section 4.3 for the detailed flow diagram of NEPA's environmental permit application process. If needed, the SME proceeds with the preparation of a scoped EIA and it will be AFIs responsibility to ensure compliance with it.

Once NEPA has issued a permit to construct or operate and or licence to discharge treated effluent, AFIs should ensure that the general and specific conditions and any requirements resulting from a scoped EIA including the mitigation measures identified, where applicable, are fully integrated into the design and the contract documents of the specific project. Depending on the nature of NEPA requirements, this may be done through an alternative design, special design features or modifications, an EMP, special contract clauses.

NEPA may also require preparation of specific plans, special monitoring and reporting actions, and normally will carry out periodic monitoring of the implementation of the project to make sure the NEPA requirements are being met.

The nature of the activities may require the preparation and submission of emergency response plans, environmental monitoring plans, closure plans, fugitive dust control plans, hazardous waste management plans and methods of solid waste handling and disposal and effluent treatment and disposal for approval during the review period or within a specified timeline after the instrument is granted.

5.3 Implementing EMP Requirements

A standard generic EMP will be prepared for the sub-projects, based on the expected likely environmental impacts during the sub-project's construction phase as well as during implementation (see Section 3.4 for the generic EMPs content). Further to the results of the project screening, the applicable EMP(s) must be incorporated into the bidding and contract documents. Some projects may have additional requirements for mitigation and monitoring in response to issues identified during site screening, which shall also be specified in the contract documents. Table 3 provides a reference of potential environmental impacts and should be used as reference only as specific project impacts will be analyzed on a case-by-case basis.

Table 3: Environmental Management Plans to Mitigate Adverse Impacts during Construction and Implementation of sub-projects

(If a permit to construct was received from NEPA, then the following generic mitigation measures and monitoring requirements should be amended to include the general and specific terms and conditions issued by NEPA)

Activities	Potential Impacts	Mitigation Measures	Responsibility for Mitigation	Monitoring Requirements	Responsibility for Monitoring and Supervision
Construction of New and or Rehabilitation of Existing Buildings (Schools, Health Centers, Recreation Facilities and Community Facilities including provision of on-site water supply and sanitation services)					
Solar Panels and Solar Water Heating	Electrical wiring and waste disposal Management of battery disposal	<ol style="list-style-type: none"> 1. If works are conducted, there will be a designated area for collecting waste from the installation of solar panels that will be kept clean; it will be cleared at least once a week to ensure adequate use of the area during PV installation. 2. The sub-project design will clearly stipulate responsibilities for collecting old batteries and for its adequate management. The designated area for keeping old batteries will not be in close proximity or adjacent to environmentally risky areas such as drainage lines, gullers, or rivers to avoid pollution. 	Contractor	<p>Confirmation on disposal of electric cabling at an approved site to monitored fortnightly during its installation.</p> <p>Confirmation on disposal of battery at an approved site to be monitored at a semester basis.</p>	<p>Technical supervision staff.</p> <p>Spot checks by EO</p>
Retrofitting / replacement of lighting equipment	Disposal of materials and old lighting equipment Disposal of EE lighting equipment.	<ol style="list-style-type: none"> 1. All waste must be disposed in an approved landfill or dump site, in consultation with the National Solid Waste Management Authority (NSWMA). 2. A mechanism for safe disposal of EE lighting equipment must be clearly designated which will not be in close proximity to environmentally risk areas. Systematic collection ensures that the various materials, including mercury, are recovered and recycled or disposed of in an environmentally sound way. 	Contractor	Confirmation on disposal of solid wastes at an approved site to be monitored fortnightly.	Technical supervision staff.
Air Conditioning facilities, chillers, etc.	Disposal of construction rubbish from installation of AC equipment.	<ol style="list-style-type: none"> 1. All waste must be disposed in an approved landfill or dump site, in consultation with the National Solid Waste Management Authority (NSWMA). 2. Contractor to make suitable arrangements for use of 	Contractor Contractor	Check that arrangements have been made	Technical supervision staff.

Activities	Potential Impacts	Mitigation Measures	Responsibility for Mitigation	Monitoring Requirements	Responsibility for Monitoring and Supervision
	Sanitary facilities for workers Nuisance from noise	sanitary facilities for his workers, or in the case of large worksites, they should be equipped with portable chemical toilets, which must be supplied and serviced by an approved contractor. 3. Give notice to nearby residents and limit work to daytime hours.	Contractor	Confirmation that portable toilets are supplied on site.	
Biomass		2.			

6 CONSULTATION AND DISCLOSURE

The Project's Environmental Framework has been available to the general public, and develop a seamless two-way interaction with the public and relevant non-governmental, family and/or beneficiaries and/or affected population in an objective, clear, transparent and timely manner. The levels of information and consultation have been developed in accordance with the communication needs for audiences and Project stages, and were developed with specific guidelines and protocols consistent with national legislation and policies of World Bank safeguards policies governing the Project.

The purpose of the public consultation(s) is (are) to solicit views of groups or individuals who may be affected by the sub-project regarding environmental concerns. Consultation should include the recording of significant environmental issues identified by the affected groups or people, recommendations and next steps. Any significant issues established during the public consultation should be addressed by the EA documentation. Public disclosure provides affected groups or individuals the opportunity to examine the final approved EA document so they can review the mitigation measures agreed upon and the responsible parties for implementing them.

In order to ensure that consultation, disclosure, and community engagement continue throughout the sub-project construction and operation phases, the sub-borrower will, consistent with the risks and adverse impacts of the project, establish a grievance mechanism as part of its environmental management system. This should allow the sub-borrower to receive and facilitate the resolution of concerns and grievance about the sub-projects environmental performance raised by the affected communities or individuals. Table 4 shows the key environment-related consultation and disclosure actions during project preparation and implementation. It also shows the outputs or results of these actions.

Table 4. Key Environmental Consultation and Disclosure Actions during Project Preparation

Step in Project Cycle as per Operations Manual	Actions for Screening and Environmental Management	Output / Results
Promotion	- community leaders to publicize intention to apply for project funding ¹⁵	- There is adequate awareness in the community about the project
Developing sub-project application	- DBJ to hold consultation on local priorities and needs - Community / Groups to participate and contribute	- Local and specific environmental concerns and constraints are considered
Sub-project Concept Development	- Wide cross-section of community / groups to participate in site screening process	- Alternatives have been considered and environmental feasibility is ascertained
Sub-project Design and Review	- DBJ to publicly display designs for min. 2 weeks - Community / Group reviews designs and "signs off"	- Ensures that designs are environmentally appropriate, among other criteria

¹⁵ This step and the corresponding actions are not needed when a community has been selected for a project, such as was the case for the Inner City Basic Services for the Poor Project.

Sub-project Implementation (after contract award and signing)	<ul style="list-style-type: none"> - DBJ to arrange for sign board providing project details - DBJ to organize Project Information Meeting held in and with community - Community / Groups to attend and participate actively - Community (where applicable) to monitor work and progress of contractor - DBJ and community / Groups to participate actively in PSC meetings 	<ul style="list-style-type: none"> - Information on contract and contractor is disclosed - Community is made aware of its role in implementation - Community has channel for providing feed-back - Community makes sure that EMPs are complied with
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NEPA Consultation Process

There are usually two forms of public involvement in the Environmental Impact Assessment (EIA) process. The first is direct involvement of the affected public or community in public consultations during the EIA study. These consultations allow the developer to provide information to the public about the project and to determine what issues the public wishes to see addressed. The extent and results of these consultations are included in the documented EIA report.

The second level of involvement takes place after the EIA report and addendum, if any, have been prepared after the applicant has provided the information needed for adequate review by NEPA and the public.

Public involvement in the review process is in keeping with Principle 7 of the United Nations Environment Programme (UNEP) decision published as Goals and Principles of Environmental Impact Assessment.¹⁶

Environmental Management Framework Consultations

As part of the consultation process, a video conference was held in December 2010 between the Environment and Social Specialists of the World Bank and the Development Bank of Jamaica to discuss the draft Environmental Management Framework and the Involuntary Resettlement Policy Framework. The safeguard documentation (EMF and IRPF) was disclosed on the websites of MEM, DBJ, NEPA and the World Bank InfoShop on January 5, 2011.

On January 12, 2011 an Information Consultation Session was held on Project related Environmental and Social Safeguards, in particular, the draft Environmental Management Framework and the Involuntary Resettlement Policy Framework to support the US\$5 million line of credit for the proposed Energy Security and Efficiency Enhancement Project (P112780) for Jamaica. The meeting was a follow up consultation with the AFIs who will be the implementing agents of the program. For more details on the Consultation issues and results, please see Annex 10.

¹⁶ Decision 14/25 of the Governing Council of UNEP, of 17, June, 1987.

7 MONITORING AND REPORTING

The AFIs will have the main responsibility for monitoring the application and use of the EMF. During the usual sub-project supervision activities, the AFI will check with local environmental authorities to determine if the sub-project implementation is meeting all specified EMF and EMP requirements. It will also perform supervision site visits to the sub-projects to confirm the EMPs are being adequately implemented. A supervision report covering the environmental management issues should be included in the overall site visit report. The AFI's designated EO will prepare quarterly and annual reports on the key steps, outputs and results of the environmental management actions taken for all sub-projects throughout the project cycle.

As part of the normal reporting, the AFIs will request each sub-borrower to include a section on environmental performance with respect to the sub-project investment, including any critical mitigating actions taken and any significant environmental incidents. However, if during a site visit, the AFIs determines that environmental management procedures are not being followed adequately, the AFIs should request more frequent reporting (semi-annually or quarterly) until the sub-borrower demonstrates that the situation has been corrected. The AFIs/DBJ will include an environmental section in every report prepared for the World Bank. As appropriate, the section will discuss details of any environmental issues that have occurred during the reporting period and the actions taken by the AFIs and/or any of their sub-borrowers to resolve them.

Problems and issues arising during the use of the EMF will be flagged and brought to the attention of Management and for their action. Copies of the quarterly and annual EM monitoring reports will also be sent to NEPA and to the World Bank. A permit or licence may be suspended or revoked if any of its terms or conditions is breached, or if the holder fails to submit any documents and information as the Authority may require. The undertaking of a prescribed activity without the holding of an appropriate Permit will bring substantial penalties, on conviction in a court of law. The Bank will also review these reports during the periodic supervision missions. The following steps will be monitored for all projects:

Table 5. Key Environmental Consultation and Disclosure Actions during Project Preparation

Stage in Project Cycle	Action	Result / Outcome
Project Concept Development	Site Screening	Acceptance
		Rejection
Project Appraisal	Project Screening	NEPA Environmental Permit/Licence Required
		EMP Required
		None
Project Implementation	NEPA Env'l Permit	With scoped EIA including mitigation measures
		With general terms and specific conditions
	EMP	Included with contract
	EMP implemented	With problems or issues
		With complaints
	With residual impacts	
Operation	Maintenance Plan	Environmental Requirements
	NEPA Env'l Permit Conditions	Monitoring and reporting

8 TRAINING AND CAPACITY BUILDING

Although the AFIs designated Environmental Officer (EO) has good knowledge and experience with Jamaican national regulatory requirements, the officer may need some specific training in the policy areas of environmental assessment¹⁷ as applied by the World Bank.¹⁸ The World Bank will assist to identify appropriate external training opportunities for the EO.¹⁹ Suitable national training should also be part of the capacity building of the EO and alternate EO.

The designated EO is also responsible for the organization and provision of training sessions, including a training plan and its modules, in environmental screening and environmental management for AFIs project officers, field supervision staff, small and medium enterprise development officers and selected community representatives to familiarize them with the principles and procedures as set out in the EMF.

¹⁷ Similarly, training is also needed in land acquisition and involuntary resettlement safeguard policies for AFIs and DBJ. This will be dealt with on the Involuntary Resettlement Policy Framework,

¹⁸ Both this EMF, and an Involuntary Resettlement Policy Framework that has been prepared in parallel, are in part based on the international approaches and standards.

¹⁹ It may be possible to combine any external EA training with training in Involuntary Resettlement that is offered periodically by the World Bank.

ANNEX 1

DBJ Environmental Policy and Management System

The DBJ aims to be the premier development finance institution in Jamaica mobilizing resources to support investment toward national economic growth and sustainable development. To that end, DBJ is committed to:

- Environmental support in all areas of its operations;
- Continuously support the improvement of environmental performance through an environmental management system;
- Ensuring environmentally responsible financial investment and development;
- Fostering environmental due diligence within associated financial institutions (AFI's) with respect to risk and impact assessment and management;
- Compliance with relevant laws, regulations and standards within Jamaica;
- Promotion of the environmental policy and management system among all members of the AFIs/DBJ through training and awareness programmes;
- Supporting the Sustainable Development Policy of the Government of Jamaica.

I. Generic Environmental Checklist

1. Environmental Management

- (a) Responsibility for environmental management.
- (b) Level of expertise in environmental matters (technical and regulatory), among staff and management.
- (c) Types of environmental data collected/reported, whether for internal or regulatory use.
- (d) Environmental policies/practices, and details of any past/planned initiatives, including copies of any relevant studies or reports (e.g. full/partial implementation of ISO 14000 Environmental Management System).
- (e) Environmental, health and safety training practices for employees.

2. Process Information

- (a) Range of processes carried out on site (e.g. cleaning, blending, mixing, chemical processes, painting).
- (b) Main inputs and outputs of each process, and intermediate, waste or by-products, their source and destination, whether hazardous/toxic or legally controlled.
- (c) Anticipated significant changes in operation.

3. Site Information

- (a) Site layout, including outline description and condition of site and buildings, and position and topography.
- (b) Current use of all areas of property and facilities, and outline history of previous uses.
- (c) Adjacent properties, operations and any sources of pollution, including the relative significance of these sources.
- (d) Ownership of land, buildings and equipment, and any specific restrictions (by owner/planning authority) on development site.

- (e) Underlying geology/hydrology, location of nearby watercourses and recipients of natural run-off from the site, if known.
- (f) Provision of site utilities, particularly electrical power, air and oxygen, and water in all forms.
- (g) Existence of/opportunity for energy efficiency program or measures.
- (h) Any known contamination of the site from current or previous uses, or from neighbouring activities.
- (i) History of complaints by local residents or other local industrial concerns. Frequency and nature of complaints to the site.
- (j) Any protected building/features of historical interest.

4. Handling and Storage of Raw Materials and Products

- (a) Main solid raw and intermediate materials stored on site, and quantities. Hazardous nature of any materials.
- (b) Main liquid or gaseous raw and intermediate materials/products stored on site, and containment method (e.g. bulk tanks, silos, pressurised cylinders), quantities and typical duration of storage. Hazardous nature of any materials (e.g. toxic, polluting, flammable, explosive). Regulatory storage requirements, emergency plan /precautions.

5. Solid and Hazardous Waste Information

- (a) Sources and quantities of all waste types.
- (b) Type, source, categorization and disposal method for all hazardous waste types.
- (c) Location, type and method of any waste disposed of or stored on site.
- (d) Method and responsibility for off-site treatment or disposal of each type of waste.
- (e) Costs and viability of waste disposal methods.
- (f) Waste disposal contractors used and compliance with permit/regulatory requirements.
- (g) Current methods of waste minimization, reuse or recycling and future potential.

6. Water Use Information

- (a) Sources (e.g. public supply, on-site borehole) uses and overall consumption of water.
- (b) Permits covering water supply and use.
- (c) Current and likely future costs, availability and quality of water.
- (d) Opportunities for water conservation, recycling. Monitoring methods used.

7. Effluent and Wastewater Discharges

- (a) Sources and content of effluent from production processes.
- (b) Other sources of effluent such as rain runoff from vehicle loading or maintenance areas, staff canteen, cleaning.
- (c) Methods of collection, storage or treatment of waste water on-site.
- (d) Discharge points, destination of all treated or untreated effluent types (e.g. municipal sewer, drainage ditches, river, lake soak-away to ground).
- (e) Monitoring of effluent quality/quantity, and of surface water quality contaminants.
- (f) Permits covering waste water discharges, and history of compliance with these requirements.
- (g) Current and anticipated regulatory requirements or company plans for water treatment and any associated capital costs.

(h) Opportunities for reducing wastewater volume or contamination levels.

8. Air Emissions

- (a) Sources, volumes and composition of all emissions to air, whether from chimneys, vents, exhausts and, or, as blown dust, and whether gas vapour, dust, fume or odour. Include combustion sources and all process equipment, and occasional/diffuse sources such as dust from vehicles or quarrying.
- (b) Regulatory requirements and control measures in place to limit air emissions.
- (c) Prevailing wind direction across site and identification of downwind areas affected by any emissions.
- (d) Permits covering air emissions, and history of compliance with these requirements.
- (e) Current and anticipated regulatory requirements or company plans for air emissions treatment and any associated capital costs.
- (f) Presence of CFCs in equipment on site, and financial impact of replacement.
- (g) Opportunities for reducing emissions to air.

9. Health and Safety, Hygiene

- (a) Noise exposure, monitoring and control methods, regarding both neighbours and staff.
- (b) Accident history and any associated claims, liability or prosecution.
- (c) Relations with regulatory bodies, and any outstanding actions/requirements and associated cost.
- (d) Compliance with hygiene requirements in production and distribution and sales (mainly relevant in food industry).

10. Documentation Summary

- (a) Environmental permits and licences covering air, water, waste, storage on site, as intended under:
 - Water use/abstraction permit
 - Wastewater discharge permit
 - Air emissions permit
 - Permit for storage of hazardous substances
- (b) Company and regulatory monitoring reports showing extent of compliance with environmental permits, and any relevant communications with/from regulatory authorities regarding legal breaches, improvements required, fines, etc.
- (c) Environmental Impact Assessment approval (for new, large, high environmental impact operations only).
- (d) Company environmental, health and safety policy and/or procedures.
- (e) Capital expenditure plans for environmental, health and safety expenditure, particularly to achieve compliance with forthcoming (i.e. in progress), or anticipated environmental experts, customers or other bodies.

11. Indirect Environmental Issues, Including Supplier and Product Issues

- (a) Environmental compliance status of and pressures on main suppliers and customers.
- (b) Source of all main raw materials and their environmental impact and acceptability, (e.g. environmental impact of resource extraction, use of scarce resource), which may result in change in cost, quantity or reliability of supply, or impact on reputation.

- (c) Environmental requirement of customers.
- (d) Environmental acceptability of products in all existing or planned markets, whether domestic or export, including end of life environmental impact of end product.
- (e) Acceptability of product packaging in all markets.
- (f) Opportunities for improving environmental acceptability or raw materials, product or packaging, for example, by opting for more sustainable sources or product or packaging which can easily be recycled or reused.
- (g) Any environmental problems affecting the reputation of a competitor or the industry generally, which might affect the company by association.

Annual Environmental Report

1. Breakdown of portfolio by type of transaction, industry sector and environmental risk classification. List medium and high environmental risk clients.
2. Describe how environmental procedures have been integrated into the transaction approval process.
 1. Give details of any transaction rejected on environmental grounds, in particular, for actual or perceived non-compliance.
 2. Give details of any other transaction rejected on environmental or health and safety grounds.
 3. Give details of any material environmental issues associated with borrowers during the reporting period, in particular:
 - (a) Any accidents / litigation / complaints.
 - (b) Any incidents of non-compliance with applicable environmental and health and safety regulations and standards, such as fines, penalties or excess fees for non-compliance.
 - (c) Any incidents of non-compliance by borrowers with environmental covenants/conditionality imposed by the Bank.
 4. Give details of any loans/investments/guarantees etc. used to finance environmental improvements, such as; energy efficiency, waste minimization, switch to cleaner technology, reduction of permit fees or fines due to environmental improvements.
 5. Give details of any bad loans due to environmental problems.
 6. Describe how the borrowers' environmental performance is monitored (e.g. site visit by Bank staff; inspection by environmental/health authorities; copies of updated permits, reports from the borrower).
 7. Specify name and position of the individual(s) formally responsible for the implementation of the environmental procedures.
 8. State any difficulties and/or constraints related to the implementation of the environmental procedures.

Environmental Clauses

The (...) shall conduct its business and operations with due regard to environmental factors;

- (a) [and in accordance with internationally recognized occupational health and safety practices]
- (b) [and in accordance with good international industry practices];
- (c) [including compliance with environmental and health and safety laws and regulations applicable in Jamaica].

Without limiting the generality of the foregoing, the Client shall;

- (a) ensure that potentially adverse environmental effects, from wastewater effluent, surface drainage and air emissions, and any other potential damage to the natural environmental, receive due consideration in the operation, and maintenance of project facilities;
- (b) ensure that appropriate health and safety and environmental protection measures, are being used in connection with the implementation and operation of the (...) facilities.

Monitoring and Reporting on Environmental Performance

(...) shall submit to the Bank, as soon as available, but in any event within (...) days after the end of the (financial) year, an annual report on environmental and worker health and safety matters relating to the project and its operations, in a form satisfactory to the Bank, which shall include copies of any information on environment matters that the Company may have to make available to the authorities and, in any event:

- (a) The current status of environmental and worker health and safety permits, licences or other approvals required for (...) operations [including copies of renewals or modifications of any such approvals].
- (b) A summary of incidents of non-compliance with the application environmental law, [including legal or administrative action or proceedings involving the Client or fines, penalties or increased charges imposed on the Client].
- (c) Progress made on the implementation of the environmental management systems.
- (d) Worker health protection and safety initiatives [including training programmes] taken by the Client.
- (e) Public complaints/representation, if any.

The report shall state the steps taken or proposed by (...) to address any problems in the above areas, and shall identify the person at the company with overall responsibility for environmental health and safety matters.

(...) shall furnish to the Bank immediate notice of any incident or accident relating to its operations, and likely to have a highly adverse effect on the environment or worker health and safety. In particular, such adverse effect is deemed to have occurred;

- (a) Where the applicable law requires notification of the accident/incident to the authorities;
- (b) Where the accident/incident involves fatality of workers or multiple serious injury requiring hospitalisation;
- (c) Where it has become public knowledge inter alia through coverage in the media.

Site Visit Environmental Checklist

Set out below is a site visit checklist, for use as preparation for a site visit. The checklist should be used in conjunction with the relevant sub-sectoral guideline from NEPA or other application regulatory agency, to ask relevant question of the company management during the site visit.

Site Visit Checklist

- (1) Key Processes (List the key processes, using the appropriate sub-sectoral guideline)
- (2) Environmental Risks (List the key issues form appropriate sub-sectoral guideline and discuss how management control these risks)
- (3) Environmental Opportunities (List the key opportunities, from the appropriate sub-sectoral guideline, and discuss these with management if appropriate)
- (4) Indicators of Management or Existence of Environmental Issues
Use this list as a check for indication of the existence or environmental issues of their good/poor management as you go around the site.
 - Level of housekeeping in general (good or bad)
 - Nature of air emission form chimney or stacks (clean or dirty), and adequacy of treatment of emissions.
 - Odour of site (no odour or strong odour)
 - Noise level (high or low)
 - Eye irritation (clean or dusty)
 - Past use of land (could indicate contamination of ground)
 - Storage of hazardous or polluting materials, by-products or waste (check method of disposal for environmental impact)
 - Underground storage of liquids (difficult to see leakage but ask about how management control possibility of leaks).
 - Proximity to residential areas (close or distant).
 - Proximity to polluting source e.g. neighbouring industry (could contaminate customer's property)
 - Proximity to water courses (indicates likelihood of contamination by accident/leakage).
 - Health and safety record (good or bad).
- (5) Financial Issues
 - What are the annual costs for user fees, past fines/penalties?

- What is the required capital or operational investment costs for environmental improvements in the short/long term?
- Are environmental costs incorporated into the business plan and other financial projections?

(6) Legal Issues

- Have there been any environmental notices or orders served on the company which restrict business activities?
- Does the company have all the required environmental permits?
- Is the company compliant with environmental impact assessment requirements?
- Is the company aware of their legal obligations in the future through for example, changes in environmental legislation due to accession to the EU? Has the company made plans to comply with this legislation?

(7) Reputational Issues

- Is the company exposed to reputational risk through its activities or local impact on the environment (e.g. trading in a hazardous product, high local emissions disturbing the local community)?
- What steps has the company taken to control its reputation on environmental issues (for example, public information on environmental management, open days for local community groups)?

(8) Market Issues

- What are the environmental standards or expectations of the company's market; is the customer meeting these, and how might they change in the future?
- Is the company reliant on the environmental standard of any supplied product and, if so, can the customer rely on this supply in the future?

(9) Managerial Issues

- Is there someone with responsibility for environmental matters?
- Do they seem well informed and able to manage their environmental responsibilities?
- Do they produce documentation in a timely fashion (e.g. for yourselves)?

(10) Conclusions and Recommendations

Add any conclusion and recommendation, including:

- Any further environmental appraisal required of the environmental appraisal process);
- Any further information promised by the company.

Annex 2:
WORLD BANK ENVIRONMENTAL ASSESSMENT POLICY (OP 4.01)

OP 4.01 - Environmental Assessment

These policies were prepared for use by World Bank staff and are not necessarily a complete treatment of the subject.

OP 4.01
January, 1999

1. The Bank² requires environmental assessment (EA) of projects proposed for Bank financing to help ensure that they are environmentally sound and sustainable, and thus to improve decision making.
2. EA is a process whose breadth, depth, and type of analysis depend on the nature, scale, and potential environmental impact of the proposed project. EA evaluates a project's potential environmental risks and impacts in its area of influence;³ examines project alternatives; identifies ways of improving project selection, siting, planning, design, and implementation by preventing, minimizing, mitigating, or compensating for adverse environmental impacts and enhancing positive impacts; and includes the process of mitigating and managing adverse environmental impacts throughout project implementation. The Bank favors preventive measures over mitigatory or compensatory measures, whenever feasible.
3. EA takes into account the natural environment (air, water, and land); human health and safety; social aspects (involuntary resettlement, indigenous peoples, and physical cultural resources);⁴ and transboundary and global environmental aspects.⁵ EA considers natural and social aspects in an integrated way. It also takes into account the variations in project and country conditions; the findings of country environmental studies; national environmental action plans; the country's overall policy framework, national legislation, and institutional capabilities related to the environment and social aspects; and obligations of the country, pertaining to project activities, under relevant international environmental treaties and agreements. The Bank does not finance project activities that would contravene such country obligations, as identified during the EA. EA is initiated as early as possible in project processing and is integrated closely with the economic, financial, institutional, social, and technical analyses of a proposed project.
4. The borrower is responsible for carrying out the EA. For Category A projects,⁶ the borrower retains independent EA experts not affiliated with the project to carry out the EA.⁷ For Category A projects that are highly risky or contentious or that involve serious and multidimensional environmental concerns, the borrower should normally also engage an advisory panel of independent, internationally recognized environmental specialists to advise on all aspects of the project relevant to the EA.⁸ The role of the advisory panel depends on the degree to which project preparation has progressed, and on the extent and quality of any EA work completed, at the time the Bank begins to consider the project.
5. The Bank advises the borrower on the Bank's EA requirements. The Bank reviews the findings and recommendations of the EA to determine whether they provide an adequate basis for processing the project for Bank financing. When the borrower has completed or partially completed EA work prior to the Bank's involvement in a project, the Bank reviews the EA to ensure its consistency with this policy. The Bank may, if appropriate, require additional EA work, including public consultation and disclosure.
6. The *Pollution Prevention and Abatement Handbook*⁹ describes pollution prevention and abatement measures and emission levels that are normally acceptable to the Bank. However, taking into account borrower country legislation and local conditions, the EA may recommend alternative emission levels and approaches to pollution prevention and abatement for the project. The EA report must provide full and detailed justification for the levels and approaches chosen for the particular project or site.

EA Instruments

7. Depending on the project, a range of instruments can be used to satisfy the Bank's EA requirement: environmental impact assessment (EIA), regional or sectoral EA, environmental audit, hazard or risk assessment, and environmental management plan (EMP).¹⁰ EA applies one or more of these instruments, or elements of them, as appropriate. When the project is likely to have sectoral or regional impacts, sectoral or regional EA is required.¹¹

Environmental Screening

8. The Bank undertakes environmental screening of each proposed project to determine the appropriate extent and type of EA. The Bank classifies the proposed project into one of four categories, depending on the type, location, sensitivity, and scale of the project and the nature and magnitude of its potential environmental impacts.

(a) *Category A*: A proposed project is classified as Category A if it is likely to have significant adverse environmental impacts that are sensitive,¹² diverse, or unprecedented. These impacts may affect an area broader than the sites or facilities subject to physical works. EA for a Category A project examines the project's potential negative and positive environmental impacts, compares them with those of feasible alternatives (including the "without project" situation), and recommends any measures needed to prevent, minimize, mitigate, or compensate for adverse impacts and improve environmental performance. For a Category A project, the borrower is responsible for preparing a report, normally an EIA (or a suitably comprehensive regional or sectoral EA) that includes, as necessary, elements of the other instruments referred to in para. 7.

(b) *Category B*: A proposed project is classified as Category B if its potential adverse environmental impacts on human populations or environmentally important areas—including wetlands, forests, grasslands, and other natural habitats—are less adverse than those of Category A projects. These impacts are site-specific; few if any of them are irreversible; and in most cases mitigatory measures can be designed more readily than for Category A projects. The scope of EA for a Category B project may vary from project to project, but it is narrower than that of Category A EA. Like Category A EA, it examines the project's potential negative and positive environmental impacts and recommends any measures needed to prevent, minimize, mitigate, or compensate for adverse impacts and improve environmental performance. The findings and results of Category B EA are described in the project documentation (Project Appraisal Document and Project Information Document).¹³

(c) *Category C*: A proposed project is classified as Category C if it is likely to have minimal or no adverse environmental impacts. Beyond screening, no further EA action is required for a Category C project.

(d) *Category FI*: A proposed project is classified as Category FI if it involves investment of Bank funds through a financial intermediary, in subprojects that may result in adverse environmental impacts.

EA for Special Project Types

Sector Investment Lending

9. For sector investment loans (SILs),¹⁴ during the preparation of each proposed subproject, the project coordinating entity or implementing institution carries out appropriate EA according to country requirements and the requirements of this policy.¹⁵ The Bank appraises and, if necessary, includes in the SIL components to strengthen, the capabilities of the coordinating entity or the implementing institution to (a) screen subprojects, (b) obtain the necessary expertise to carry out EA, (c) review all findings and results of EA for

individual subprojects, (d) ensure implementation of mitigation measures (including, where applicable, an EMP), and (e) monitor environmental conditions during project implementation.¹⁶ If the Bank is not satisfied that adequate capacity exists for carrying out EA, all Category A subprojects and, as appropriate, Category B subprojects—including any EA reports—are subject to prior review and approval by the Bank.

Financial Intermediary Lending

10. For a financial intermediary (FI) operation, the Bank requires that each FI screen proposed subprojects and ensure that sub borrowers carry out appropriate EA for each subproject. Before approving a subproject, the FI verifies (through its own staff, outside experts, or existing environmental institutions) that the subproject meets the environmental requirements of appropriate national and local authorities and is consistent with this OP and other applicable environmental policies of the Bank.¹⁷

11. In appraising a proposed FI operation, the Bank reviews the adequacy of country environmental requirements relevant to the project and the proposed EA arrangements for subprojects, including the mechanisms and responsibilities for environmental screening and review of EA results. When necessary, the Bank ensures that the project includes components to strengthen such EA arrangements. For FI operations expected to have Category A subprojects, prior to the Bank's appraisal each identified participating FI provides to the Bank a written assessment of the institutional mechanisms (including, as necessary, identification of measures to strengthen capacity) for its subproject EA work.¹⁸ If the Bank is not satisfied that adequate capacity exists for carrying out EA, all Category A subprojects and, as appropriate, Category B subprojects—including EA reports—are subject to prior review and approval by the Bank.¹⁹

Emergency Operations under OP 8.00

12. The policy set out in OP 4.01 normally applies to emergency operations processed under [OP/BP 8.00, Rapid Response to Crises and Emergencies](#). However, when compliance with any requirement of this policy would prevent the effective and timely achievement of the objectives of an emergency operation, the Bank may exempt the project from such a requirement. The justification for any such exemption is recorded in the loan documents. In all cases, however, the Bank requires at a minimum that (a) the extent to which the emergency was precipitated or exacerbated by inappropriate environmental practices be determined as part of the preparation of such projects, and (b) any necessary corrective measures be built into either the emergency operation or a future lending operation.

Institutional Capacity

13. When the borrower has inadequate legal or technical capacity to carry out key EA-related functions (such as review of EA, environmental monitoring, inspections, or management of mitigatory measures) for a proposed project, the project includes components to strengthen that capacity.

Public Consultation

14. For all Category A and B projects proposed for IBRD or IDA financing, during the EA process, the borrower consults project-affected groups and local nongovernmental organizations (NGOs) about the project's environmental aspects and takes their views into account.²⁰ The borrower initiates such consultations as early as possible. For Category A projects, the borrower consults these groups at least twice: (a) shortly after environmental screening and before the terms of reference for the EA are finalized; and (b) once a draft EA report is prepared. In addition, the borrower consults with such groups throughout project implementation as necessary to address EA-related issues that affect them.²¹

Disclosure

15. For meaningful consultations between the borrower and project-affected groups and local NGOs on all Category A and B projects proposed for IBRD or IDA financing, the borrower provides relevant material in a timely manner prior to consultation and in a form and language that are understandable and accessible to the groups being consulted.

16. For a Category A project, the borrower provides for the initial consultation a summary of the proposed project's objectives, description, and potential impacts; for consultation after the draft EA report is prepared, the borrower provides a summary of the EA's conclusions. In addition, for a Category A project, the borrower makes the draft EA report available at a public place accessible to project-affected groups and local NGOs. For SILs and FI operations, the borrower/FI ensures that EA reports for Category A subprojects are made available in a public place accessible to affected groups and local NGOs.

17. Any separate Category B report for a project proposed for IDA financing is made available to project-affected groups and local NGOs. Public availability in the borrowing country and official receipt by the Bank of Category A reports for projects proposed for IBRD or IDA financing, and of any Category B EA report for projects proposed for IDA funding, are prerequisites to Bank appraisal of these projects.

18. Once the borrower officially transmits the Category A EA report to the Bank, the Bank distributes the summary (in English) to the executive directors (EDs) and makes the report available through its InfoShop. Once the borrower officially transmits any separate Category B EA report to the Bank, the Bank makes it available through its InfoShop.²² If the borrower objects to the Bank's releasing an EA report through the World Bank InfoShop, Bank staff (a) do not continue processing an IDA project, or (b) for an IBRD project, submit the issue of further processing to the EDs.

Implementation

19. During project implementation, the borrower reports on (a) compliance with measures agreed with the Bank on the basis of the findings and results of the EA, including implementation of any EMP, as set out in the project documents; (b) the status of mitigatory measures; and (c) the findings of monitoring programs. The Bank bases supervision of the project's environmental aspects on the findings and recommendations of the EA, including measures set out in the legal agreements, any EMP, and other project documents.²³

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1. The 1998 Pollution Prevention and Abatement Handbook is being updated. For complete reference, consult the [World Bank Group Environmental Health and Safety Guidelines](#). The EHS Guidelines are intended as living documents and may be amended and supplemented from time to time. Please check the website [<http://www.ifc.org/ifcext/enviro.nsf/Content/EnvironmentalGuidelines>] for the most recent version.
 2. "Bank" includes IBRD and IDA; "EA" refers to the entire process set out in OP/BP 4.01; "loans" includes IDA credits and IDA grants; "borrower" includes, for guarantee operations, a private or public project sponsor receiving from another financial institution a loan guaranteed by the Bank; and "project" covers all operations financed by Bank loans or guarantees except development policy lending (for which the environmental provisions are set out in OP/BP 8.60, *Development Policy Lending*, and also includes projects under adaptable lending-adaptable program loans (APLs) and learning and innovation loans (LILs)-and projects and components funded under the Global Environment Facility. The project is described in Schedule 2 to the Loan/Credit Agreement. This policy applies to all components of the project, regardless of the source of financing
 3. For definitions, see [Annex A](#). The area of influence for any project is determined with the advice of environmental specialists and set out in the EA terms of reference.
 4. See OP/BP 4.12, *Involuntary Resettlement*; OP/BP 4.10, *Indigenous Peoples*; and OP/BP 4.11, *Physical Cultural Resources*.
 5. Global environmental issues include climate change, ozone-depleting substances, pollution of international waters, and adverse impacts on biodiversity.
 6. For screening, see para. 8.
 7. EA is closely integrated with the project's economic, financial, institutional, social, and technical analyses to ensure that (a) environmental considerations are given adequate weight in project selection, siting, and design decisions; and (b) EA does not delay project processing. However, the borrower ensures that when individuals or entities are engaged to carry out EA activities, any conflict of interest is avoided. For example, when an independent EA is required, it is not carried out by the consultants hired to prepare the engineering design.

8. The panel (which is different from the dam safety panel required under [OP/BP 4.37, *Safety of Dams*](#)) advises the borrower specifically on the following aspects: (a) the terms of reference for the EA, (b) key issues and methods for preparing the EA, (c) recommendations and findings of the EA, (d) implementation of the EA's recommendations, and (e) development of environmental management capacity.
9. See footnote 1.
10. These terms are defined in [Annex A](#).
11. Annexes Guidance on the use of sectoral and regional EA is available in [EA Sourcebook Updates 4 and 15](#).
12. A potential impact is considered "sensitive" if it may be irreversible (e.g., lead to loss of a major natural habitat) or raise issues covered by [OP 4.04, *Natural Habitats*](#); [OP/BP 4.10, *Indigenous Peoples*](#); [OP/BP 4.11, *Physical Cultural Resources*](#) or [OP 4.12, *Involuntary Resettlement*](#).
13. When the screening process determines, or national legislation requires, that any of the environmental issues identified warrant special attention, the findings and results of Category B EA may be set out in a separate report. Depending on the type of project and the nature and magnitude of the impacts, this report may include, for example, a limited environmental impact assessment, an environmental mitigation or management plan, an environmental audit, or a hazard assessment. For Category B projects that are not in environmentally sensitive areas and that present well-defined and well-understood issues of narrow scope, the Bank may accept alternative approaches for meeting EA requirements: for example, environmentally sound design criteria, siting criteria, or pollution standards for small-scale industrial plants or rural works; environmentally sound siting criteria, construction standards, or inspection procedures for housing projects; or environmentally sound operating procedures for road rehabilitation projects.
14. SILs normally involve the preparation and implementation of annual investment plans or subprojects as time slice activities over the course of the project.
15. In addition, if there are sectorwide issues that cannot be addressed through individual subproject EAs (and particularly if the SIL is likely to include Category A subprojects), the borrower may be required to carry out sectoral EA before the Bank appraises the SIL.
16. Where, pursuant to regulatory requirements or contractual arrangements acceptable to the Bank, any of these review functions are carried out by an entity other than the coordinating entity or implementing institution, the Bank appraises such alternative arrangements; however, the borrower/coordinating entity/implementing institution remains ultimately responsible for ensuring that subprojects meet Bank requirements.
17. The requirements for FI operations are derived from the EA process and are consistent with the provisions of para. 6 of this OP. The EA process takes into account the type of finance being considered, the nature and scale of anticipated subprojects, and the environmental requirements of the jurisdiction in which subprojects will be located.
18. Any FI included in the project after appraisal complies with the same requirement as a condition of its participation.
19. The criteria for prior review of Category B subprojects, which are based on such factors as type or size of the subproject and the EA capacity of the financial intermediary, are set out in the legal agreements for the project.
20. For the Bank's approach to NGOs, see [GP 14.70, *Involving Nongovernmental Organizations in Bank-Supported Activities*](#).
21. For projects with major social components, consultations are also required by other Bank policies--for example, [OP/BP 4.10, *Indigenous Peoples*](#), and [OP/BP 4.12, *Involuntary Resettlement*](#).
22. For a further discussion of the Bank's disclosure procedures, see [The World Bank Policy on Disclosure of Information](#). Specific requirements for disclosure of resettlement plans and indigenous peoples development plans are set out in [OP/BP 4.10, *Indigenous Peoples*](#), and [OP/BP 4.12, *Involuntary Resettlement*](#).
23. See [OP/BP 13.05, *Project Supervision*](#).

Annex 3:
WORLD BANK NATURAL HABITATS POLICY (OP 4.04)

OP 4.04 - Natural Habitats

These policies were prepared for use by World Bank staff and are not necessarily a complete treatment of the subject.

OP 4.04
June, 2001

1. The conservation of natural habitats,¹like other measures that protect and enhance the environment, is essential for long-term sustainable development. The Bank²therefore supports the protection, maintenance, and rehabilitation of natural habitats and their functions in its economic and sector work, project financing, and policy dialogue. The Bank supports, and expects borrowers to apply, a precautionary approach to natural resource management to ensure opportunities for environmentally sustainable development.

Economic and Sector Work

2. The Bank's economic and sector work includes identification of (a) natural habitat issues and special needs for natural habitat conservation, including the degree of threat to identified natural habitats (particularly critical natural habitats), and (b) measures for protecting such areas in the context of the country's development strategy. As appropriate, Country Assistance Strategies and projects incorporate findings from such economic and sector work.

Project Design and Implementation

3. The Bank promotes and supports natural habitat conservation and improved land use by financing projects designed to integrate into national and regional development the conservation of natural habitats and the maintenance of ecological functions. Furthermore, the Bank promotes the rehabilitation of degraded natural habitats.

4. The Bank does not support projects that, in the Bank's opinion, involve the significant conversion or degradation³of critical natural habitats.

5. Wherever feasible, Bank-financed projects are sited on lands already converted (excluding any lands that in the Bank's opinion were converted in anticipation of the project). The Bank does not support projects involving the significant conversion of natural habitats unless there are no feasible alternatives for the project and its siting, and comprehensive analysis demonstrates that overall benefits from the project substantially outweigh the environmental costs. If the environmental assessment⁴indicates that a project would significantly convert or degrade natural habitats, the project includes mitigation measures acceptable to the Bank. Such mitigation measures include, as appropriate, minimizing habitat loss (e.g., strategic habitat retention and post-development restoration) and establishing and maintaining an ecologically similar protected area. The Bank accepts other forms of mitigation measures only when they are technically justified.

6. In deciding whether to support a project with potential adverse impacts on a natural habitat, the Bank takes into account the borrower's ability to implement the appropriate conservation and mitigation measures. If there are potential institutional capacity problems, the project includes components that develop the capacity of national and local institutions for effective environmental planning and management. The mitigation measures specified for the project may be used to enhance the practical field capacity of national and local institutions.

7. In projects with natural habitat components, project preparation, appraisal, and supervision arrangements include appropriate environmental expertise to ensure adequate design and implementation of mitigation measures.

8. This policy applies to subprojects under sectoral loans or loans to financial intermediaries.⁵ Regional environmental sector units oversee compliance with this requirement.

Policy Dialogue

9. The Bank encourages borrowers to incorporate into their development and environmental strategies analyses of any major natural habitat issues, including identification of important natural habitat sites, the ecological functions they perform, the degree of threat to the sites, priorities for conservation, and associated recurrent-funding and capacity-building needs.

10. The Bank expects the borrower to take into account the views, roles, and rights of groups, including local nongovernmental organizations and local communities, affected by Bank-financed projects involving natural habitats, and to involve such people in planning, designing, implementing, monitoring, and evaluating such projects. Involvement may include identifying appropriate conservation measures, managing protected areas and other natural habitats, and monitoring and evaluating specific projects. The Bank encourages governments to provide such people with appropriate information and incentives to protect natural habitats.

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1. See definitions in [Annex A](#).
 2. "Bank" includes IBRD and IDA, "loans" includes IDA credits and IDA grants, "borrower" includes, for guarantee operations, a private or public project sponsor receiving from another financial institution a loan guaranteed by the Bank; and "project" includes all operations financed by Bank loans (including projects under adaptable lending-adaptable program loans [APLs] and learning and innovation loans [LILs]) or guarantees except programs supported under development policy lending (with respect to which environmental considerations are set out in [OP/BP 8.60, Development Policy Lending](#)) and debt and debt service operations. The project financed by a Bank loan is described in Schedule 2 to the Loan/Development Credit Agreement for that project. The term project includes all components of the project, regardless of the source of financing. The term project also includes projects and components funded under the Global Environment Facility (GEF), but does not include GEF projects executed by organizations identified by the GEF Council as eligible to work with the GEF through expanded opportunities for project preparation and implementation (such organizations include, inter alia, regional development banks and UN agencies such as FAO and UNIDO).
 3. For definitions, see [Annex A](#).
 4. See [OP/BP 4.01, Environmental Assessment](#).
 5. See [OP/BP 4.01, Environmental Assessment, for environmental assessment in subprojects](#).
 6. See [OP/BP 4.10, Indigenous Peoples, when local communities include indigenous peoples](#).

Annex 4:
WORLD BANK PEST MANAGEMENT POLICY (OP 4.09)

Even though the project will not support the procurement of pesticides, it is possible that support to sub-projects may lead to a substantial increase in pesticide use with a subsequent increase in health and environmental risks, or that SMEs supported under the project may maintain or expand their present pest management practices that are unsustainable, are not based on an IPM approach, and/or pose significant health and environmental risks. IPM aims to address the root cause of a pest problem through agro-ecosystem management, where necessary combined with treatment of the pest itself, while threshold applications of pesticides primarily focus on the pest alone.

IPM good practice centers on the following three elements:

- (i) **Prioritize healthy crops.** The focus should be on cultural practices aimed at keeping a crop healthy. Selection of varieties that are resistant or tolerant to pests is an important aspect. Attention to soil, nutrient and water management is part of growing a healthy crop. Many IPM programs therefore adopt a holistic approach and consider a wider range of agro-ecological parameters related to crop production.
- (ii) **Manage the agro-ecosystem** in such a way that pests remain below economic damaging levels, rather than attempt to eradicate the pest. Prevention of pest build up and encouragement of natural mortality of the pest is the first line of defense to protect the crop. Non-chemical practices are used to make the field and the crop inhospitable to the insect pest species and hospitable to their natural enemies, and to prevent conditions favorable to the buildup of weeds and diseases.
- (iii) **Decisions to apply external inputs as supplementary controls are made locally, are based on monitoring of pest incidence and are site-specific.** External inputs may include predators or parasites (bio-control), labor to remove the pest manually, pest attracting lures, pest traps, or pesticides. The choice of external input varies for each situation. Pesticides are generally used if economically viable non-chemical pest control inputs are not available or failed to control the pest. They are applied only when field monitoring shows that a pest population has reached a level that is likely to cause significant economic damage and the use of pesticides is cost-effective in terms of having a positive effect on net farm profits. Selection of products and application techniques should aim to minimize adverse effects on non-target species, people and the environment.

To identify risk associated with pest management in SMEs supported by the Project, DBJ will work with AFIs to ensure that the following is considered when screening applicants:

- Ascertain that pest management activities by the SME are based on integrated approaches (IPM in agricultural projects) and reduce reliance on synthetic chemical pesticides.
- Ensure that health and environmental hazards associated with pest management, especially the use of pesticides, are minimized and can be properly managed by the user through an appropriate management system.

- Verify that Class Ia pesticides - these have extremely hazardous active ingredients and are listed in *The WHO Recommended Classification of Pesticides by Hazard*- are not in use by the SME.

If support is provided to an SME that cannot document the above minimum standards, and as necessary, DBJ should support institutional capacity development to (i) enhance implementation of IPM-based pest crop protection, and (ii) regulate and monitor the distribution and use of pesticides prior to providing said SME with support.

Introduction

The Environmental, Health, and Safety (EHS) Guidelines are technical reference documents with general and industry-specific examples of Good International Industry Practice (GIIP)¹. When one or more members of the World Bank Group are involved in a project, these EHS Guidelines are applied as required by their respective policies and standards. These **General EHS Guidelines** are designed to be used together with the relevant **Industry Sector EHS Guidelines** which provide guidance to users on EHS issues in specific industry sectors. For complex projects, use of multiple industry-sector guidelines may be necessary. A complete list of industry-sector guidelines can be found at:

www.ifc.org/ifcext/enviro.nsf/Content/EnvironmentalGuidelines

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. Application of the EHS Guidelines to existing facilities may involve the establishment of site-specific targets, with an appropriate timetable for achieving them. The applicability of the EHS Guidelines should be tailored to the hazards and risks established for each project on the basis of the results of an environmental assessment² in which site-specific variables, such as host country context, assimilative capacity of the environment, and other project factors, are taken into account. The applicability of specific technical recommendations should be

¹ 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.

² For IFC, such assessment is carried out consistent with Performance Standard 1, and for the World Bank, with Operational Policy 4.01.

based on the professional opinion of qualified and experienced persons. When host country regulations differ from the levels and measures presented in the EHS Guidelines, projects are expected to achieve whichever is more stringent. If less stringent levels or measures than those provided in these EHS Guidelines are appropriate, in view of specific project circumstances, a full and detailed justification for any proposed alternatives is needed as part of the site-specific environmental assessment. This justification should demonstrate that the choice for any alternate performance levels is protective of human health and the environment.

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General Approach to the Management of EHS Issues at the Facility or Project Level

Effective management of environmental, health, and safety (EHS) issues entails the inclusion of EHS considerations into corporate- and facility-level business processes in an organized, hierarchical approach that includes the following steps:

Identifying EHS project hazards³ and associated risks⁴ as early as possible in the facility development or project cycle, including the incorporation of EHS considerations into the site selection process, product design process, engineering planning process for capital requests, engineering work orders, facility modification authorizations, or layout and process change plans.

Involving EHS professionals, who have the experience, competence, and training necessary to assess and manage EHS impacts and risks, and carry out specialized environmental management functions including the preparation of project or activity-specific plans and procedures that incorporate the technical recommendations presented in this document that are relevant to the project.

Understanding the likelihood and magnitude of EHS risks, based on:

- The nature of the project activities, such as whether the project will generate significant quantities of emissions or effluents, or involve hazardous materials or processes;
- The potential consequences to workers, communities, or the environment if hazards are not adequately managed, which may depend on the proximity of project activities to

people or to the environmental resources on which they depend.

Prioritizing risk management strategies with the objective of achieving an overall reduction of risk to human health and the environment, focusing on the prevention of irreversible and / or significant impacts.

Favoring strategies that eliminate the cause of the hazard at its source, for example, by selecting less hazardous materials or processes that avoid the need for EHS controls.

When impact avoidance is not feasible, incorporating engineering and management controls to reduce or minimize the possibility and magnitude of undesired consequences, for example, with the application of pollution controls to reduce the levels of emitted contaminants to workers or environments.

Preparing workers and nearby communities to respond to accidents, including providing technical and financial resources to effectively and safely control such events, and restoring workplace and community environments to a safe and healthy condition.

Improving EHS performance through a combination of ongoing monitoring of facility performance and effective accountability.

³ Defined as "threats to humans and what they value" (Kates, et al., 1985).

⁴ Defined as "quantitative measures of hazard consequences, usually expressed as conditional probabilities of experiencing harm" (Kates, et. al., 1985)

1.0 Environmental

1.1 Air Emissions and Ambient Air Quality

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the spatial characteristic of the source including point sources, fugitive sources, and mobile sources and, further, by process, such as combustion, materials storage, or other industry sector-specific processes.

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

- Energy use efficiency
- Process modification
- Selection of fuels or other materials, the processing of which may result in less polluting emissions
- Application of emissions control techniques

Applicability and Approach

This guideline applies to facilities or projects that generate emissions to air at any stage of the project life-cycle. It complements the industry-specific emissions guidance presented in the Industry Sector Environmental, Health, and Safety (EHS) Guidelines by providing information about common techniques for emissions management that may be applied to a range of industry sectors. This guideline provides an approach to the management of significant sources of emissions, including specific guidance for assessment and monitoring of impacts. It is also intended to provide additional information on approaches to emissions management in projects located in areas of poor air quality, where it may be necessary to establish project-specific emissions standards.

Emissions of air pollutants can occur from a wide variety of activities during the construction, operation, and decommissioning phases of a project. These activities can be categorized based on

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

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



Ambient Air Quality

General Approach

Projects with significant^{5,6} sources of air emissions, and potential for significant impacts to ambient air quality, should prevent or minimize impacts by ensuring that:

Emissions do not result in pollutant concentrations that reach or exceed relevant ambient quality guidelines and standards⁹ by applying national legislated standards, or in their absence, the current WHO Air Quality Guidelines¹⁰ (see Table 1.1.1), or other internationally recognized sources¹¹;

Emissions do not contribute a significant portion to the attainment of relevant ambient air quality guidelines or standards. As a general rule, this Guideline suggests 25 percent of the applicable air quality standards to allow

additional, future sustainable development in the same airshed.¹²

At facility level, impacts should be estimated through qualitative or quantitative assessments by the use of baseline air quality assessments and atmospheric dispersion models to assess potential ground level concentrations. Local atmospheric, climatic, and air quality data should be applied when modeling dispersion, protection against atmospheric downwash, wakes, or eddy effects of the source, nearby¹³ structures, and terrain features. The dispersion model applied should be internationally recognized, or comparable. Examples of acceptable emission estimation and dispersion modeling approaches for point and fugitive sources are

Table 1.1.1: WHO Ambient Air Quality Guidelines^{7, 8}

	Averaging Period	Guideline value in mg/m ³
Sulfur dioxide (SO₂)	24-hour	125 (Interim target-1) 50 (Interim target-2) 20 (guideline)
	10 minute	500 (guideline)
Nitrogen dioxide (NO₂)	1-year	40 (guideline)
	1-hour	200 (guideline)
Particulate Matter PM₁₀	1-year	70 (Interim target-1) 50 (Interim target-2) 30 (Interim target-3) 20 (guideline)
	24-hour	150 (Interim target-1) 100 (Interim target-2) 75 (Interim target-3) 50 (guideline)
Particulate Matter PM_{2.5}	1-year	35 (Interim target-1) 25 (Interim target-2) 15 (Interim target-3) 10 (guideline)
	24-hour	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)

⁵ 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); NO_x: 500 tpy; SO₂: 500 tpy; or as established through national legislation; and combustion sources with an equivalent heat input of 50 MWh 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.

⁶ 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 Pollutant Inventory Guide." <http://www.npi.gov.au/handbooks/pubs/npiguide.pdf>

⁷ World Health Organization (WHO). Air Quality Guidelines Global Update, 2005. PM 24-hour value is the 99th percentile.

⁸ Interim targets are provided in recognition of the need for a staged approach to achieving the recommended guidelines.

⁹ 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).

¹⁰ Available at World Health Organization (WHO). <http://www.who.int/en>

¹¹ 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).

¹² US EPA Prevention of Significant Deterioration Increments Limits applicable to non-degraded airsheds.

included in Annex 1.1.1. These approaches include screening models for single source evaluations (SCREEN3 or AIRSCREEN), as well as more complex and refined models (AERMOD OR ADMS). Model selection is dependent on the complexity and geomorphology of the project site (e.g. mountainous terrain, urban or rural area).

Projects Located in Degraded Airsheds or Ecologically Sensitive Areas

Facilities or projects located within poor quality airsheds¹⁴, and within or next to areas established as ecologically sensitive (e.g. national parks), should ensure that any increase in pollution levels is as small as feasible, and amounts to a fraction of the applicable short-term and annual average air quality guidelines or standards as established in the project-specific environmental assessment. Suitable mitigation measures may also include the relocation of significant sources of emissions outside the airshed in question, use of cleaner fuels or technologies, application of comprehensive pollution control measures, offset activities at installations controlled by the project sponsor or other facilities within the same airshed, and buy-down of emissions within the same airshed.

Specific provisions for minimizing emissions and their impacts in poor air quality or ecologically sensitive airsheds should be established on a project-by-project or industry-specific basis. Offset provisions outside the immediate control of the project sponsor or buy-downs should be monitored and enforced by the local agency responsible for granting and monitoring emission permits. Such provisions should be in place prior to final commissioning of the facility / project.

Point Sources

Point sources are discrete, stationary, identifiable sources of emissions that release pollutants to the atmosphere. They are typically located in manufacturing or production plants. Within a given point source, there may be several individual 'emission points' that comprise the point source.¹⁵

Point sources are characterized by the release of air pollutants typically associated with the combustion of fossil fuels, such as nitrogen oxides (NO_x), sulfur dioxide (SO₂), carbon monoxide (CO), and particulate matter (PM), as well as other air pollutants including certain volatile organic compounds (VOCs) and metals that may also be associated with a wide range of industrial activities.

Emissions from point sources should be avoided and controlled according to good international industry practice (GIIP) applicable to the relevant industry sector, depending on ambient conditions, through the combined application of process modifications and emissions controls, examples of which are provided in Annex 1.1.2. Additional recommendations regarding stack height and emissions from small combustion facilities are provided below.

Stack Height

The stack height for all point sources of emissions, whether 'significant' or not, should be designed according to GIIP (see Annex 1.1.3) to avoid excessive ground level concentrations due to downwash, wakes, and eddy effects, and to ensure reasonable diffusion to minimize impacts. For projects where there are multiple sources of emissions, stack heights should be established with due consideration to emissions from all other project sources, both point and fugitive. Non-significant sources of emissions,

¹³ "Nearby" generally considers an area within a radius of up to 20 times the stack height.

¹⁴ An airshed should be considered as having poor air quality if nationally legislated air quality standards or WHO Air Quality Guidelines are exceeded significantly.

¹⁵ Emission points refer to a specific stack, vent, or other discrete point of pollution release. This term should not be confused with point source, which is a regulatory distinction from area and mobile sources. The characterization of point sources into multiple emissions points is useful for allowing more detailed reporting of emissions information.

including small combustion sources,¹⁶ should also use GIIP in stack design.

Small Combustion Facilities Emissions Guidelines

Small combustion processes are systems designed to deliver electrical or mechanical power, steam, heat, or any combination of these, regardless of the fuel type, with a total, rated heat input capacity of between three Megawatt thermal (MWth) and 50 MWth.

The emissions guidelines in Table 1.1.2 are applicable to small combustion process installations operating more than 500 hours per year, and those with an annual capacity utilization of more than 30 percent. Plants firing a mixture of fuels should compare emissions performance with these guidelines based on the sum of the relative contribution of each applied fuel¹⁷. Lower emission values may apply if the proposed facility is located in an ecologically sensitive airshed, or airshed with poor air quality, in order to address potential cumulative impacts from the installation of more than one small combustion plant as part of a distributed generation project.

¹⁶ Small combustion sources are those with a total rated heat input capacity of 50MWth or less.

¹⁷ The contribution of a fuel is the percentage of heat input (LHV) provided by this fuel multiplied by its limit value.

Table 1.1.2 - 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 (NO _x)	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] > or = 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; Nm³ 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 NO_x and PM limits for turbines and boilers. Guidelines values apply to facilities operating more than 500 hours per year with an annual capacity utilization factor of more than 30 percent.

Fugitive Sources

Fugitive source air emissions refer to emissions that are distributed spatially over a wide area and not confined to a specific discharge point. They originate in operations where exhausts are not captured and passed through a stack. Fugitive emissions have the potential for much greater ground-level impacts per unit than stationary source emissions, since they are discharged and dispersed close to the ground. The two main types of fugitive emissions are Volatile Organic Compounds (VOCs) and particulate matter (PM). Other contaminants (NO_x, SO₂ and CO) are mainly associated with combustion processes, as described above. Projects with potentially significant fugitive sources of emissions should establish the need for ambient quality assessment and monitoring practices.

Open burning of solid wastes, whether hazardous or non-hazardous, is not considered good practice and should be avoided, as the generation of polluting emissions from this type of source cannot be controlled effectively.

Volatile Organic Compounds (VOCs)

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

Equipment modifications, examples of which are presented in Annex 1.1.4;

Implementing a leak detection and repair (LDAR) program that controls fugitive emissions by regularly monitoring to detect leaks, and implementing repairs within a predefined time period.¹⁸

For VOC emissions associated with handling of chemicals in open vats and mixing processes, the recommended prevention and control techniques include:

- Substitution of less volatile substances, such as aqueous solvents;
- Collection of vapors through air extractors and subsequent treatment of gas stream by removing VOCs with control devices such as condensers or activated carbon absorption;
- Collection of vapors through air extractors and subsequent treatment with destructive control devices such as:
 - Catalytic Incinerators: Used to reduce VOCs from process exhaust gases exiting paint spray booths, ovens, and other process operations
 - Thermal Incinerators: Used to control VOC levels in a gas stream by passing the stream through a combustion chamber where the VOCs are burned in air at temperatures between 700° C to 1,300° C
 - Enclosed Oxidizing Flares: Used to convert VOCs into CO₂ and H₂O by way of direct combustion

Use of floating roofs on storage tanks to reduce the opportunity for volatilization by eliminating the headspace present in conventional storage tanks.

Particulate Matter (PM)

The most common pollutant involved in fugitive emissions is dust or particulate matter (PM). This is released during certain operations, such as transport and open storage of solid materials, and from exposed soil surfaces, including unpaved roads.

¹⁸ For more information, see Leak Detection and Repair Program (LDAR), at: <http://www.lidar.net>

Recommended prevention and control of these emissions sources include:

Use of dust control methods, such as covers, water suppression, or increased moisture content for open materials storage piles, or controls, including air extraction and treatment through a baghouse or cyclone for material handling sources, such as conveyors and bins;

Use of water suppression for control of loose materials on paved or unpaved road surfaces. Oil and oil by-products is not a recommended method to control road dust. Examples of additional control options for unpaved roads include those summarized in Annex 1.1.5.

Ozone Depleting Substances (ODS)

Several chemicals are classified as ozone depleting substances (ODSs) and are scheduled for phase-out under the Montreal Protocol on Substances that Deplete the Ozone Layer.¹⁹ No new systems or processes should be installed using CFCs, halons, 1,1,1-trichloroethane, carbon tetrachloride, methyl bromide or HBFCs. HCFCs should only be considered as interim / bridging alternatives as determined by the host country commitments and regulations.²⁰

Mobile Sources – Land-based

Similar to other combustion processes, emissions from vehicles include CO, NO_x, SO₂, PM and VOCs. Emissions from on-road and off-road vehicles should comply with national or regional

¹⁹ Examples include: chlorofluorocarbons (CFCs); halons; 1,1,1-trichloroethane (methyl chloroform); carbon tetrachloride; hydrochlorofluorocarbons (HCFCs); hydrobromofluorocarbons (HBFCs); and methyl bromide. They are currently used in a variety of applications including: domestic, commercial, and process refrigeration (CFCs and HCFCs); domestic, commercial, and motor vehicle air conditioning (CFCs and HCFCs); for manufacturing foam products (CFCs); for solvent cleaning applications (CFCs, HCFCs, methyl chloroform, and carbon tetrachloride); as aerosol propellants (CFCs); in fire protection systems (halons and HBFCs); and as crop fumigants (methyl bromide).

²⁰ Additional information is available through the Montreal Protocol Secretariat web site available at: <http://ozone.unep.org/>

programs. In the absence of these, the following approach should be considered:

Regardless of the size or type of vehicle, fleet owners / operators should implement the manufacturer recommended engine maintenance programs;

Drivers should be instructed on the benefits of driving practices that reduce both the risk of accidents and fuel consumption, including measured acceleration and driving within safe speed limits;

Operators with fleets of 120 or more units of heavy duty vehicles (buses and trucks), or 540 or more light duty vehicles²¹ (cars and light trucks) within an airshed should consider additional ways to reduce potential impacts including:

- Replacing older vehicles with newer, more fuel efficient alternatives
- Converting high-use vehicles to cleaner fuels, where feasible
- Installing and maintaining emissions control devices, such as catalytic converters
- Implementing a regular vehicle maintenance and repair program

Greenhouse Gases (GHGs)

Sectors that may have potentially significant emissions of greenhouse gases (GHGs)²² include energy, transport, heavy industry (e.g. cement production, iron / steel manufacturing, aluminum smelting, petrochemical industries, petroleum refining, fertilizer manufacturing), agriculture, forestry and waste management. GHGs may be generated from direct emissions

²¹ The selected fleet size thresholds are assumed to represent potentially significant sources of emissions based on individual vehicles traveling 100,000 km / yr using average emission factors.

²² The six greenhouse gases that form part of the Kyoto Protocol to the United Nations Framework Convention on Climate Change include carbon dioxide (CO₂); methane (CH₄); nitrous oxide (N₂O); hydrofluorocarbons (HFCs); perfluorocarbons (PFCs); and sulfur hexafluoride (SF₆).

from facilities within the physical project boundary and indirect emissions associated with the off-site production of power used by the project.

Recommendations for reduction and control of greenhouse gases include:

- Carbon financing;²³
- Enhancement of energy efficiency (see section on 'Energy Conservation');
- Protection and enhancement of sinks and reservoirs of greenhouse gases;
- Promotion of sustainable forms of agriculture and forestry;
- Promotion, development and increased use of renewable forms of energy;
- Carbon capture and storage technologies;²⁴
- Limitation and / or reduction of methane emissions through recovery and use in waste management, as well as in the production, transport and distribution of energy (coal, oil, and gas).

Monitoring

Emissions and air quality monitoring programs provide information that can be used to assess the effectiveness of emissions management strategies. A systematic planning process is recommended to ensure that the data collected are adequate for their intended purposes (and to avoid collecting unnecessary data). This process, sometimes referred to as a data quality objectives process, defines the purpose of collecting the data, the

decisions to be made based on the data and the consequences of making an incorrect decision, the time and geographic boundaries, and the quality of data needed to make a correct decision.²⁵ The air quality monitoring program should consider the following elements:

Monitoring parameters: The monitoring parameters selected should reflect the pollutants of concern associated with project processes. For combustion processes, indicator parameters typically include the quality of inputs, such as the sulfur content of fuel.

Baseline calculations: Before a project is developed, baseline air quality monitoring at and in the vicinity of the site should be undertaken to assess background levels of key pollutants, in order to differentiate between existing ambient conditions and project-related impacts.

Monitoring type and frequency: Data on emissions and ambient air quality generated through the monitoring program should be representative of the emissions discharged by the project over time. Examples of time-dependent variations in the manufacturing process include batch process manufacturing and seasonal process variations. Emissions from highly variable processes may need to be sampled more frequently or through composite methods. Emissions monitoring frequency and duration may also range from continuous for some combustion process operating parameters or inputs (e.g. the quality of fuel) to less frequent, monthly, quarterly or yearly stack tests.

Monitoring locations: Ambient air quality monitoring may consist of off-site or fence line monitoring either by the project sponsor, the competent government agency, or by collaboration between both. The location of ambient air

²³ Carbon financing as a carbon emissions reduction strategy may include the host government-endorsed Clean Development Mechanism or Joint Implementation of the United Nations Framework Convention on Climate Change.

²⁴ Carbon dioxide capture and storage (CCS) is a process consisting of the separation of CO₂ from industrial and energy-related sources; transport to a storage location; and long-term isolation from the atmosphere, for example in geological formations, in the ocean, or in mineral carbonates (reaction of CO₂ with metal oxides in silicate minerals to produce stable carbonates). It is the object of intensive research worldwide (Intergovernmental Panel on Climate Change (IPCC), Special Report, Carbon Dioxide Capture and Storage (2006).

²⁵ See, for example, United States Environmental Protection Agency, Guidance on Systematic Planning Using the Data Quality Objectives Process EPA QA/G-4, EPA/240/B-06/001 February 2006.

quality monitoring stations should be established based on the results of scientific methods and mathematical models to estimate potential impact to the receiving airshed from an emissions source taking into consideration such aspects as the location of potentially affected communities and prevailing wind directions.

Sampling and analysis methods: Monitoring programs should apply national or international methods for sample collection and analysis, such as those published by the International Organization for Standardization,²⁶ the European Committee for Standardization,²⁷ or the U.S. Environmental Protection Agency.²⁸ Sampling should be conducted by, or under, the supervision of trained individuals. Analysis should be conducted by entities permitted or certified for this purpose. Sampling and analysis Quality Assurance / Quality Control (QA/QC) plans should be applied and documented to ensure that data quality is adequate for the intended data use (e.g., method detection limits are below levels of concern). Monitoring reports should include QA/QC documentation.

Monitoring of Small Combustion Plants Emissions

Additional recommended monitoring approaches for **boilers**:

Boilers with capacities between =3 MWth and < 20 MWth:

- Annual Stack Emission Testing: SO₂, NO_x and PM. For gaseous fuel-fired boilers, only NO_x. SO₂ can be calculated based on fuel quality certification if no SO₂ control equipment is used.

²⁶ An on-line catalogue of ISO standards relating to the environment, health protection, and safety is available at: <http://www.iso.org/iso/en/CatalogueListPage.CatalogueList?ICS1=13&ICS2=&ICS3=&scopelist=>

²⁷ An on-line catalogue of European Standards is available at: <http://www.cen.eu/catweb/cwen.htm> .

²⁸ The National Environmental Methods Index provides a searchable clearinghouse of U.S. methods and procedures for both regulatory and non-regulatory monitoring purposes for water, sediment, air and tissues, and is available at <http://www.nemi.gov/>.

- If Annual Stack Emission Testing demonstrates results consistently and significantly better than the required levels, frequency of Annual Stack Emission Testing can be reduced from annual to every two or three years.
- Emission Monitoring: None

Boilers with capacities between =20 MWth and < 50 MWth

- Annual Stack Emission Testing: SO₂, NO_x and PM. For gaseous fuel-fired boilers, only NO_x. SO₂ can be calculated based on fuel quality certification (if no SO₂ control equipment is used)
- Emission Monitoring: SO₂. Plants with SO₂ control equipment: Continuous. NO_x: Continuous monitoring of either NO_x emissions or indicative NO_x emissions using combustion parameters. PM: Continuous monitoring of either PM emissions, opacity, or indicative PM emissions using combustion parameters / visual monitoring.

Additional recommended monitoring approaches for **turbines**:

- Annual Stack Emission Testing: NO_x and SO₂ (NO_x only for gaseous fuel-fired turbines).
- If Annual Stack Emission Testing results show constantly (3 consecutive years) and significantly (e.g. less than 75 percent) better than the required levels, frequency of Annual Stack Emission Testing can be reduced from annual to every two or three years.
- Emission Monitoring: NO_x: Continuous monitoring of either NO_x emissions or indicative NO_x emissions using combustion parameters. SO₂: Continuous monitoring if SO₂ control equipment is used.

Additional recommended monitoring approaches for **engines**:

- Annual Stack Emission Testing: NO_x, SO₂ and PM (NO_x only for gaseous fuel-fired diesel engines).

- If Annual Stack Emission Testing results show constantly (3 consecutive years) and significantly (e.g. less than 75 percent) better than the required levels, frequency of Annual Stack Emission Testing can be reduced from annual to every two or three years.
- Emission Monitoring: NO_x: Continuous monitoring of either NO_x emissions or indicative NO_x emissions using combustion parameters. SO₂: Continuous monitoring if SO₂ control equipment is used. PM: Continuous monitoring of either PM emissions or indicative PM emissions using operating parameters.

Annex 1.1.1 – Air Emissions Estimation and Dispersion

Modeling Methods

The following is a partial list of documents to aid in the estimation of air emissions from various processes and air dispersion models:

Australian Emission Estimation Technique Manuals
<http://www.npi.gov.au/handbooks/>

Atmospheric Emission Inventory Guidebook, UN / ECE / EMEP and the European Environment Agency
<http://www.aeat.co.uk/netcen/airqual/TFEI/unece.htm>

Emission factors and emission estimation methods, US EPA Office of Air Quality Planning & Standards
<http://www.epa.gov/ttn/chief>

Guidelines on Air Quality Models (Revised), US Environmental Protection Agency (EPA), 2005
http://www.epa.gov/scram001/guidance/guide/appw_05.pdf

Frequently Asked Questions, Air Quality Modeling and Assessment Unit (AQMAU), UK Environment Agency
http://www.environment-agency.gov.uk/subjects/airquality/236092/?version=1&lang=_e

OECD Database on Use and Release of Industrial Chemicals
<http://www.olis.oecd.org/ehs/urchem.nsf/>



Annex 1.1.2 – 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 of 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 (SO₂)					
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 SO ₂ concentrations in excess of 10%, the stream is passed through an acid plant not only to lower the SO ₂ 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 SO ₂ molecules are captured into a liquid phase or adsorption, where SO ₂ molecules 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 1.1.2: Illustrative Point Source Air Emissions Prevention and Control Technologies (continued)

Oxides of Nitrogen (NO _x)		Percent Reduction by Fuel Type			Comments	
<p>Associated with combustion of fuel. May occur in several forms of nitrogen oxide; namely nitric oxide (NO), nitrogen dioxide (NO₂) and nitrous oxide (N₂O), which is also a greenhouse gas. The term NO_x serves as a composite between NO and NO₂ and emissions are usually reported as NO_x. Here the NO is multiplied by the ratio of molecular weights of NO₂ to NO and added to the NO₂ emissions.</p> <p>Means of reducing NO_x 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.</p>	Combustion modification (Illustrative of boilers)	Coal	Oil	Gas	<p>These modifications are capable of reducing NO_x emissions by 50 to 95%. The method of combustion control used depends on the type of boiler and the method of firing fuel.</p>	
	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-NO _x Burners	30–40	30–40	30–40		
		Flue Gas Treatment	Coal	Oil	Gas	<p>Flue gas treatment is more effective in reducing NO_x 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 NO_x 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.</p>
	Selective Catalytic Reduction (SCR)	60–90	60–90	60–90		
	Selective Non-Catalytic Reduction (SNCR)	N/A	30–70	30–70		
<p>Note: Compiled by IFC based on inputs from technical experts.</p>						

Annex 1.1.3 - Good International Industry Practice (GIIP) Stack Height

(Based on United States 40 CFR, part 51.100 (ii)).

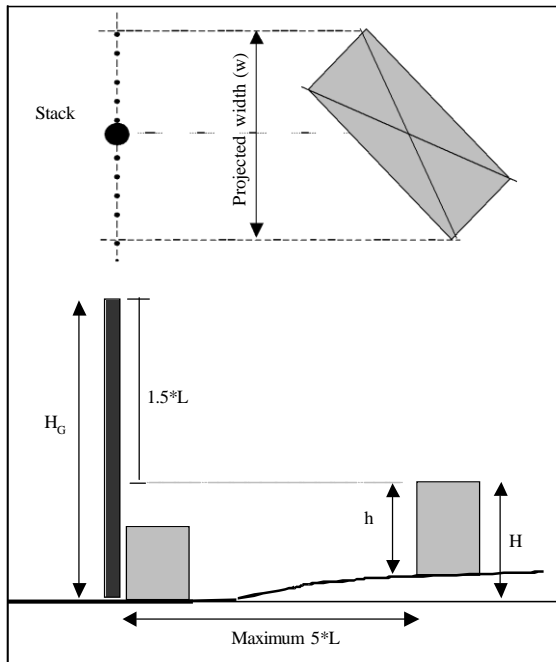
$H_G = H + 1.5L$; where

H_G = 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 1.1.4 - Examples of VOC Emissions Controls

Equipment Type	Modification	Approximate Control Efficiency (%)
Pumps	Seal-less design	100 ²⁹
	Closed-vent system	90 ³⁰
	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	Variable ³¹
	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.		

²⁹ Seal-less equipment can be a large source of emissions in the event of equipment failure.

³⁰ Actual efficiency of a closed-vent system depends on percentage of vapors collected and efficiency of control device to which the vapors are routed.

³¹ Control efficiency of closed vent-systems installed on a pressure relief device may be lower than other closed-vent systems.

Annex 1.1.5 - Fugitive 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%

1.2 Energy Conservation

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Applicability and Approach

This guideline applies to facilities or projects that consume energy in process heating and cooling; process and auxiliary systems, such as motors, pumps, and fans; compressed air systems and heating, ventilation and air conditioning systems (HVAC); and lighting systems. It complements the industry-specific emissions guidance presented in the Industry Sector Environmental, Health, and Safety (EHS) Guidelines by providing information about common techniques for energy conservation that may be applied to a range of industry sectors.

Energy management at the facility level should be viewed in the context of overall consumption patterns, including those associated with production processes and supporting utilities, as well as overall impacts associated with emissions from power sources. The following section provides guidance on energy management with a focus on common utility systems often representing technical and financially feasible opportunities for improvement in energy conservation. However, operations

should also evaluate energy conservation opportunities arising from manufacturing process modifications.

Energy Management Programs

Energy management programs should include the following elements:

- Identification, and regular measurement and reporting of principal energy flows within a facility at unit process level
- Preparation of mass and energy balance;
- Definition and regular review of energy performance targets, which are adjusted to account for changes in major influencing factors on energy use
- Regular comparison and monitoring of energy flows with performance targets to identify where action should be taken to reduce energy use
- Regular review of targets, which may include comparison with benchmark data, to confirm that targets are set at appropriate levels

Energy Efficiency

For any energy-using system, a systematic analysis of energy efficiency improvements and cost reduction opportunities should include a hierarchical examination of opportunities to:

- Demand/Load Side Management by reducing loads on the energy system
- Supply Side Management by:
 - Reduce losses in energy distribution
 - Improve energy conversion efficiency
 - Exploit energy purchasing opportunities
 - Use lower-carbon fuels

Common opportunities in each of these areas are summarized below.³²

Process Heating

Process heating is vital to many manufacturing processes, including heating for fluids, calcining, drying, heat treating, metal heating, melting, melting agglomeration, curing, and forming³³.

In process heating systems, a system heat and mass balance will show how much of the system's energy input provides true process heating, and quantify fuel used to satisfy energy losses caused by excessive parasitic loads, distribution, or conversion losses. Examination of savings opportunities should be directed by the results of the heat and mass balance, though the following techniques are often valuable and cost-effective.

Heating Load Reduction

- Ensure adequate insulation to reduce heat losses through furnace/oven etc. structure
- Recover heat from hot process or exhaust streams to reduce system loads
- In intermittently-heated systems, consider use of low thermal mass insulation to reduce energy required to heat the system structure to operating temperature
- Control process temperature and other parameters accurately to avoid, for example, overheating or overdrying
- Examine opportunities to use low weight and/or low thermal mass product carriers, such as heated shapers, kiln cars etc.

- Review opportunities to schedule work flow to limit the need for process reheating between stages
- Operate furnaces/ovens at slight positive pressure, and maintain air seals to reduce air in-leakage into the heated system, thereby reducing the energy required to heat unnecessary air to system operating temperature
- Reduce radiant heat losses by sealing structural openings and keep viewing ports closed when not in use
- Where possible, use the system for long runs close to or at operating capacity
- Consider use of high emissivity coatings of high temperature insulation, and consequent reduction in process temperature
- Near net weight and shape heat designs
- Robust Quality assurance on input material
- Robust Scheduled maintenance programs

Heat Distribution Systems

Heat distribution in process heating applications typically takes place through steam, hot water, or thermal fluid systems.

Losses can be reduced through the following actions:

- Promptly repair distribution system leaks
- Avoid steam leaks despite a perceived need to get steam through the turbine. Electricity purchase is usually cheaper overall, especially when the cost to treat turbine-quality boiler feed water is included. If the heat-power ratio of the distribution process is less than that of power systems, opportunities should be considered to increase the ratio; for example, by using low-pressure steam to drive absorption cooling systems rather than using electrically-driven vapor-compression systems.
- Regularly verify correct operation of steam traps in steam systems, and ensure that traps are not bypassed. Since

³² Additional guidance on energy efficiency is available from sources such as Natural Resources Canada (NRCAN <http://oee.nrcan.gc.ca/commercial/financial-assistance/new-buildings/mnecb.cfm?attr=20>); the European Union (EUROPA. <http://europa.eu.int/scadplus/leg/en/s15004.htm>), and United States Department of Energy (US DOE, <http://www.eere.energy.gov/consumer/industry/process.html>).

³³ US DOE. <http://www.eere.energy.gov/consumer/industry/process.html>

steam traps typically last approximately 5 years, 20% should be replaced or repaired annually

Insulate distribution system vessels, such as hot wells and de-aerators, in steam systems and thermal fluid or hot water storage tanks

Insulate all steam, condensate, hot water and thermal fluid distribution pipework, down to and including 1" (25 mm) diameter pipe, in addition to insulating all hot valves and flanges

In steam systems, return condensate to the boiler house for re-use, since condensate is expensive boiler-quality water and valuable beyond its heat content alone

Use flash steam recovery systems to reduce losses due to evaporation of high-pressure condensate

Consider steam expansion through a back-pressure turbine rather than reducing valve stations

Eliminate distribution system losses by adopting point-of-use heating systems

Energy Conversion System Efficiency Improvements

The following efficiency opportunities should be examined for process furnaces or ovens, and utility systems, such as boilers and fluid heaters:

Regularly monitor CO, oxygen or CO₂ content of flue gases to verify that combustion systems are using the minimum practical excess air volumes

Consider combustion automation using oxygen-trim controls

Minimize the number of boilers or heaters used to meet loads. It is typically more efficient to run one boiler at 90% of capacity than two at 45%. Minimize the number of boilers kept at hot-standby

Use flue dampers to eliminate ventilation losses from hot boilers held at standby

Maintain clean heat transfer surfaces; in steam boilers, flue gases should be no more than 20 K above steam temperature)

In steam boiler systems, use economizers to recover heat from flue gases to pre-heat boiler feed water or combustion air

Consider reverse osmosis or electro dialysis feed water treatment to minimize the requirement for boiler blowdown
Adopt automatic (continuous) boiler blowdown

Recover heat from blowdown systems through flash steam recovery or feed-water preheat

Do not supply excessive quantities of steam to the de-aerator

With fired heaters, consider opportunities to recover heat to combustion air through the use of recuperative or regenerative burner systems

For systems operating for extended periods (> 6000 hours/year), cogeneration of electrical power, heat and /or cooling can be cost effective

Oxy Fuel burners

Oxygen enrichment/injection

Use of turbolators in boilers

Sizing design and use of multiple boilers for different load configurations

Fuel quality control/fuel blending

Process Cooling

The general methodology outlined above should be applied to process cooling systems. Commonly used and cost-effective measures to improve process cooling efficiency are described below.

Load Reduction

Ensure adequate insulation to reduce heat gains through cooling system structure and to below-ambient temperature refrigerant pipes and vessels

Control process temperature accurately to avoid overcooling

Operate cooling tunnels at slight positive pressure and maintain air seals to reduce air in-leakage into the cooled system, thus reducing the energy required to cool this unnecessary air to system operating temperature

Examine opportunities to pre-cool using heat recovery to a process stream requiring heating, or by using a higher temperature cooling utility

In cold and chill stores, minimize heat gains to the cooled space by use of air curtains, entrance vestibules, or rapidly opening/closing doors. Where conveyors carry products into chilled areas, minimize the area of transfer openings, for example, by using strip curtains

Quantify and minimize “incidental” cooling loads, for example, those due to evaporator fans, other machinery, defrost systems and lighting in cooled spaces, circulation fans in cooling tunnels, or secondary refrigerant pumps (e.g. chilled water, brines, glycols)

Do not use refrigeration for auxiliary cooling duties, such as compressor cylinder head or oil cooling

While not a thermal load, ensure there is no gas bypass of the expansion valve since this imposes compressor load while providing little effective cooling

In the case of air conditioning applications, energy efficiency techniques include:

- Placing air intakes and air-conditioning units in cool, shaded locations
- Improving building insulation including seals, vents, windows, and doors

- Planting trees as thermal shields around buildings
- Installing timers and/or thermostats and/or enthalpy-based control systems
- Installing ventilation heat recovery systems³⁴

Energy Conversion

The efficiency of refrigeration service provision is normally discussed in terms of Coefficient of Performance (“COP”), which is the ratio of cooling duty divided by input power. COP is maximized by effective refrigeration system design and increased refrigerant compression efficiency, as well as minimization of the temperature difference through which the system works and of auxiliary loads (i.e. those in addition to compressor power demand) used to operate the refrigeration system.

System Design

If process temperatures are above ambient for all, or part, of the year, use of ambient cooling systems, such as provided by cooling towers or dry air coolers, may be appropriate, perhaps supplemented by refrigeration in summer conditions.

Most refrigeration systems are electric-motor driven vapor compression systems using positive displacement or centrifugal compressors. The remainder of this guideline relates primarily to vapor-compression systems. However, when a cheap or free heat source is available (e.g. waste heat from an engine-driven generator—low-pressure steam

³⁴ More information on HVAC energy efficiency can be found at the British Columbia Building Corporation (Woolliams, 2002. http://www.greenbuildingsbc.com/new_buildings/pdf_files/greenbuild_strategy_es_guide.pdf), NRCAN's EnerGuide (<http://oee.nrcan.gc.ca/equipment/english/index.cfm?PrintView=N&Text=N>) and NRCAN's Energy Star Programs (<http://oee.nrcan.gc.ca/energystar/english/consumers/heating.cfm?text=N&printview=N#AC>), and the US Energy Star Program (http://www.energystar.gov/index.cfm?c=guidelines.download_guidelines).

that has passed through a back-pressure turbine), absorption refrigeration may be appropriate.

Exploit high cooling temperature range: precooling by ambient and/or 'high temperature' refrigeration before final cooling can reduce refrigeration capital and running costs.

High cooling temperature range also provides an opportunity for countercurrent (cascade) cooling, which reduces refrigerant flow needs.

Keep 'hot' and 'cold' fluids separate, for example, do not mix water leaving the chiller with water returning from cooling circuits.

In low-temperature systems where high temperature differences are inevitable, consider two-stage or compound compression, or economized screw compressors, rather than single-stage compression.

Minimizing Temperature Differences

A vapor-compression refrigeration system raises the temperature of the refrigerant from somewhat below the lowest process temperature (the evaporating temperature) to provide process cooling, to a higher temperature (the condensing temperature), somewhat above ambient, to facilitate heat rejection to the air or cooling water systems. Increasing evaporating temperature typically increases compressor cooling capacity without greatly affecting power consumption. Reducing condensing temperature increases evaporator cooling capacity and substantially reduces compressor power consumption.

Elevating Evaporating Temperature

Select a large evaporator to permit relatively low temperature differences between process and evaporating temperatures. Ensure that energy use of auxiliaries (e.g. evaporator fans) does not outweigh compression savings. In air-cooling applications, a design temperature difference of 6-10 K between leaving air temperature and evaporating

temperature is indicative of an appropriately sized evaporator. When cooling liquids, 2K between leaving liquid and evaporating temperatures can be achieved, though a 4K difference is generally indicative of a generously-sized evaporator.

Keep the evaporator clean. When cooling air, ensure correct defrost operation. In liquid cooling, monitor refrigerant/process temperature differences and compare with design expectations to be alert to heat exchanger contamination by scale or oil.

Ensure oil is regularly removed from the evaporator, and that oil additions and removals balance.

Avoid the use of back-pressure valves.

Adjust expansion valves to minimize suction superheat consistent with avoidance of liquid carry-over to compressors.

Ensure that an appropriate refrigerant charge volume is present.

Reducing Condensing Temperature

Consider whether to use air-cooled or evaporation-based cooling (e.g. evaporative or water cooled condensers and cooling towers). Air-cooled evaporators usually have higher condensing temperatures, hence higher compressor energy use, and auxiliary power consumption, especially in low humidity climates. If a wet system is used, ensure adequate treatment to prevent growth of *legionella* bacteria.

Whichever basic system is chosen, select a relatively large condenser to minimize differences between condensing and the heat sink temperatures. Condensing temperatures with air cooled or evaporative condensers should not be more than 10K above design ambient condition, and a 4K approach in a liquid-cooled condenser is possible.

Avoid accumulation of non-condensable gases in the condenser system. Consider the installation of refrigerated non-condensable purgers, particularly for systems operating below atmospheric pressure.

Keep condensers clean and free from scale. Monitor refrigerant/ambient temperature differences and compare with design expectations to be alert to heat exchanger contamination.

Avoid liquid backup, which restricts heat transfer area in condensers. This can be caused by installation errors such as concentric reducers in horizontal liquid refrigerant pipes, or “up and over” liquid lines leading from condensers.

In multiple condenser applications, refrigerant liquid lines should be connected via drop-leg traps to the main liquid refrigerant line to ensure that hot gases flow to all condensers.

Avoid head pressure control to the extent possible. Head pressure control maintains condensing temperature at, or near, design levels. It therefore prevents reduction in compressor power consumption, which accompanies reduced condensing temperature, by restricting condenser capacity (usually by switching off the condenser, or cooling tower fans, or restricting cooling water flow) under conditions of less severe than design load or ambient temperature conditions. Head pressure is often kept higher than necessary to facilitate hot gas defrost or adequate liquid refrigerant circulation. Use of electronic rather than thermostatic expansion valves, and liquid refrigerant pumps can permit effective refrigerant circulation at much reduced condensing temperatures.

Site condensers and cooling towers with adequate spacing so as to prevent recirculation of hot air into the tower.

Refrigerant Compression Efficiency

Some refrigerant compressors and chillers are more efficient than others offered for the same duty. Before purchase, identify the operating conditions under which the compressor or chiller is likely to operate for substantial parts of its annual cycle. Check operating efficiency under these conditions, and ask for estimates of annual running cost. Note that refrigeration and HVAC systems rarely run for extended periods at design conditions, which are deliberately extreme. Operational efficiency under the most commonly occurring off-design conditions is likely to be most important.

Compressors lose efficiency when unloaded. Avoid operation of multiple compressors at part-load conditions. Note that package chillers can gain coefficient of performance (COP) when slightly unloaded, as loss of compressor efficiency can be outweighed by the benefits of reduced condensing and elevated evaporating temperature. However, it is unlikely to be energy efficient to operate a single compressor-chiller at less than 50% of capacity.

Consider turndown efficiency when specifying chillers. Variable speed control or multiple compressor chillers can be highly efficient at part loads.

Use of thermal storage systems (e.g., ice storage) can avoid the need for close load-tracking and, hence, can avoid part-loaded compressor operation.

Refrigeration System Auxiliaries

Many refrigeration system auxiliaries (e.g. evaporator fans and chilled water pumps) contribute to refrigeration system load, so reductions in their energy use have a double benefit. General energy saving techniques for pumps and fans, listed in the next section of these guidelines, should be applied to refrigeration auxiliaries.

Additionally, auxiliary use can be reduced by avoidance of part-load operation and in plant selection (e.g. axial fan evaporative condensers generally use less energy than equivalent centrifugal fan towers).

Under extreme off-design conditions, reduction in duty of cooling system fans and pumps can be worthwhile, usually when the lowest possible condensing pressure has been achieved.

Compressed Air Systems

Compressed air is the most commonly found utility service in industry, yet in many compressed air systems, the energy contained in compressed air delivered to the user is often 10% or less of energy used in air compression. Savings are often possible through the following techniques:

Load reduction

Examine each true user of compressed air to identify the air volume needed and the pressure at which this should be delivered.

Do not mix high volume low pressure and low volume high pressure loads. Decentralize low volume high-pressure applications or provide dedicated low-pressure utilities, for example, by using fans rather than compressed air.

Review air use reduction opportunities, for example:

- Use air amplifier nozzles rather than simple open-pipe compressed air jets
- Consider whether compressed air is needed at all
- Where air jets are required intermittently (e.g. to propel product), consider operating the jet via a process-related solenoid valve, which opens only when air is required
- Use manual or automatically operated valves to isolate air supply to individual machines or zones that are not in continuous use

- Implement systems for systematic identification and repair of leaks
- All condensate drain points should be trapped. Do not leave drain valves continuously 'cracked open'
- Train workers never to direct compressed air against their bodies or clothing to dust or cool themselves down.

Distribution

Monitor pressure losses in filters and replace as appropriate

Use adequately sized distribution pipework designed to minimize pressure losses

1.3 Wastewater and Ambient Water Quality

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Applicability and Approach

This guideline applies to projects that have either direct or indirect discharge of process wastewater, wastewater from utility operations or stormwater to the environment. These guidelines are also applicable to industrial discharges to sanitary sewers that discharge to the environment without any treatment. Process wastewater may include contaminated wastewater from utility operations, stormwater, and sanitary sewage. It provides information on common techniques for wastewater management, water conservation, and reuse that can be applied to a wide range of industry sectors. This guideline is meant to be complemented by the industry-specific effluent guidelines presented in the Industry Sector Environmental, Health, and Safety (EHS) Guidelines. Projects with the potential to generate process wastewater, sanitary (domestic) sewage, or stormwater should incorporate the necessary precautions to avoid, minimize, and control adverse impacts to human health, safety, or the environment.

In the context of their overall ESHS management system, facilities should:

Understand the quality, quantity, frequency and sources of liquid effluents in its installations. This includes knowledge about the locations, routes and integrity of internal drainage systems and discharge points

Plan and implement the segregation of liquid effluents principally along industrial, utility, sanitary, and stormwater categories, in order to limit the volume of water requiring specialized treatment. Characteristics of individual streams may also be used for source segregation.

Identify opportunities to prevent or reduce wastewater pollution through such measures as recycle/reuse within their facility, input substitution, or process modification (e.g. change of technology or operating conditions/modes).

Assess compliance of their wastewater discharges with the applicable: (i) discharge standard (if the wastewater is discharged to a surface water or sewer), and (ii) water quality standard for a specific reuse (e.g. if the wastewater is reused for irrigation).

Additionally, the generation and discharge of wastewater of any type should be managed through a combination of:

Water use efficiency to reduce the amount of wastewater generation

Process modification, including waste minimization, and reducing the use of hazardous materials to reduce the load of pollutants requiring treatment

If needed, application of wastewater treatment techniques to further reduce the load of contaminants prior to discharge, taking into consideration potential impacts of cross-media transfer of contaminants during treatment (e.g., from water to air or land)

When wastewater treatment is required prior to discharge, the level of treatment should be based on:

Whether wastewater is being discharged to a sanitary sewer system, or to surface waters

National and local standards as reflected in permit requirements and sewer system capacity to convey and treat wastewater if discharge is to sanitary sewer

Assimilative capacity of the receiving water for the load of contaminant being discharged wastewater if discharge is to surface water

Intended use of the receiving water body (e.g. as a source of drinking water, recreation, irrigation, navigation, or other)

Presence of sensitive receptors (e.g., endangered species) or habitats

Good International Industry Practice (GIIP) for the relevant industry sector

General Liquid Effluent Quality

Discharge to Surface Water

Discharges of process wastewater, sanitary wastewater, wastewater from utility operations or stormwater to surface water should not result in contaminant concentrations in excess of local ambient water quality criteria or, in the absence of local criteria, other sources of ambient water quality.³⁵ Receiving water use³⁶ and assimilative capacity³⁷, taking other sources of discharges to

³⁵ An example is the US EPA National Recommended Water Quality Criteria <http://www.epa.gov/waterscience/criteria/wqcriteria.html>

³⁶ 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)

³⁷ 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 receiving water into consideration, should also influence the acceptable pollution loadings and effluent discharge quality. Additional considerations that should be included in the setting of project-specific performance levels for wastewater effluents include:

Process wastewater treatment standards consistent with applicable Industry Sector EHS Guidelines. Projects for which there are no industry-specific guidelines should reference the effluent quality guidelines of an industry sector with suitably analogous processes and effluents;

Compliance with national or local standards for sanitary wastewater discharges or, in their absence, the indicative guideline values applicable to sanitary wastewater discharges shown in Table 1.3.1 below;

Temperature of wastewater prior to discharge does not result in an increase greater than 3°C of ambient temperature at the edge of a scientifically established mixing zone which takes into account ambient water quality, receiving water use and assimilative capacity among other considerations.

Discharge to Sanitary Sewer Systems

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

Meet the pretreatment and monitoring requirements of the sewer treatment system into which it discharges.

Not interfere, directly or indirectly, with the operation and maintenance of the collection and treatment systems, or pose a risk to worker health and safety, or adversely impact

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.

characteristics of residuals from wastewater treatment operations.

Be discharged into municipal or centralized wastewater treatment systems that have adequate capacity to meet local regulatory requirements for treatment of wastewater generated from the project. Pretreatment of wastewater to meet regulatory requirements before discharge from the project site is required if the municipal or centralized wastewater treatment system receiving wastewater from the project does not have adequate capacity to maintain regulatory compliance.

Land Application of Treated Effluent

The quality of treated process wastewater, wastewater from utility operations or stormwater discharged on land, including wetlands, should be established based on local regulatory requirements.

Where land is used as part of the treatment system and the ultimate receptor is surface water, water quality guidelines for surface water discharges specific to the industry sector process should apply.³⁸ Potential impact on soil, groundwater, and surface water, in the context of protection, conservation and long term sustainability of water and land resources should be assessed when land is used as part of any wastewater treatment system.

Septic Systems

Septic systems are commonly used for treatment and disposal of domestic sanitary sewage in areas with no sewerage collection networks, Septic systems should only be used for treatment of sanitary sewage, and unsuitable for industrial wastewater treatment. When septic systems are the selected form of wastewater disposal and treatment, they should be:

Properly designed and installed in accordance with local regulations and guidance to prevent any hazard to public health or contamination of land, surface or groundwater.

Well maintained to allow effective operation.

Installed in areas with sufficient soil percolation for the design wastewater loading rate.

Installed in areas of stable soils that are nearly level, well drained, and permeable, with enough separation between the drain field and the groundwater table or other receiving waters.

Wastewater Management

Wastewater management includes water conservation, wastewater treatment, stormwater management, and wastewater and water quality monitoring.

Industrial Wastewater

Industrial wastewater generated from industrial operations includes process wastewater, wastewater from utility operations, runoff from process and materials staging areas, and miscellaneous activities including wastewater from laboratories, equipment maintenance shops, etc.. The pollutants in an industrial wastewater may include acids or bases (exhibited as low or high pH), soluble organic chemicals causing depletion of dissolved oxygen, suspended solids, nutrients (phosphorus, nitrogen), heavy metals (e.g. cadmium, chromium, copper, lead, mercury, nickel, zinc), cyanide, toxic organic chemicals, oily materials, and volatile materials, as well as from thermal characteristics of the discharge (e.g., elevated temperature). Transfer of pollutants to another phase, such as air, soil, or the sub-surface, should be minimized through process and engineering controls.

Process Wastewater – – Examples of treatment approaches typically used in the treatment of industrial wastewater are summarized in Annex 1.3.1. While the choice of treatment

³⁸ Additional guidance on water quality considerations for land application is available in the WHO Guidelines for the Safe Use of Wastewater, Excreta and Greywater. Volume 2: Wastewater Use in Agriculture http://www.who.int/water_sanitation_health/wastewater/gsuweg2/en/index.html

technology is driven by wastewater characteristics, the actual performance of this technology depends largely on the adequacy of its design, equipment selection, as well as operation and maintenance of its installed facilities. Adequate resources are required for proper operation and maintenance of a treatment facility, and performance is strongly dependent on the technical ability and training of its operational staff. One or more treatment technologies may be used to achieve the desired discharge quality and to maintain consistent compliance with regulatory requirements. The design and operation of the selected wastewater treatment technologies should avoid uncontrolled air emissions of volatile chemicals from wastewaters. Residuals from industrial wastewater treatment operations should be disposed in compliance with local regulatory requirements, in the absence of which disposal has to be consistent with protection of public health and safety, and conservation and long term sustainability of water and land resources.

Wastewater from Utilities Operations - Utility operations such as cooling towers and demineralization systems may result in high rates of water consumption, as well as the potential release of high temperature water containing high dissolved solids, residues of biocides, residues of other cooling system anti-fouling agents, etc. Recommended water management strategies for utility operations include:

Adoption of water conservation opportunities for facility cooling systems as provided in the Water Conservation section below;

Use of heat recovery methods (also energy efficiency improvements) or other cooling methods to reduce the temperature of heated water prior to discharge to ensure the discharge water temperature does not result in an increase greater than 3°C of ambient temperature at the edge of a scientifically established mixing zone which takes into

account ambient water quality, receiving water use, potential receptors and assimilative capacity among other considerations;

Minimizing use of antifouling and corrosion inhibiting chemicals by ensuring appropriate depth of water intake and use of screens. Least hazardous alternatives should be used with regards to toxicity, biodegradability, bioavailability, and bioaccumulation potential. Dose applied should accord with local regulatory requirements and manufacturer recommendations;

Testing for residual biocides and other pollutants of concern should be conducted to determine the need for dose adjustments or treatment of cooling water prior to discharge.

Stormwater Management - Stormwater includes any surface runoff and flows resulting from precipitation, drainage or other sources. Typically stormwater runoff contains suspended sediments, metals, petroleum hydrocarbons, Polycyclic Aromatic Hydrocarbons (PAHs), coliform, etc. Rapid runoff, even of uncontaminated stormwater, also degrades the quality of the receiving water by eroding stream beds and banks. In order to reduce the need for stormwater treatment, the following principles should be applied:

Stormwater should be separated from process and sanitary wastewater streams in order to reduce the volume of wastewater to be treated prior to discharge

Surface runoff from process areas or potential sources of contamination should be prevented

Where this approach is not practical, runoff from process and storage areas should be segregated from potentially less contaminated runoff

Runoff from areas without potential sources of contamination should be minimized (e.g. by minimizing the area of impermeable surfaces) and the peak discharge rate should

be reduced (e.g. by using vegetated swales and retention ponds);

Where stormwater treatment is deemed necessary to protect the quality of receiving water bodies, priority should be given to managing and treating the first flush of stormwater runoff where the majority of potential contaminants tend to be present;

When water quality criteria allow, stormwater should be managed as a resource, either for groundwater recharge or for meeting water needs at the facility;

Oil water separators and grease traps should be installed and maintained as appropriate at refueling facilities, workshops, parking areas, fuel storage and containment areas.

Sludge from stormwater catchments or collection and treatment systems may contain elevated levels of pollutants and should be disposed in compliance with local regulatory requirements, in the absence of which disposal has to be consistent with protection of public health and safety, and conservation and long term sustainability of water and land resources.

Sanitary Wastewater

Sanitary wastewater from industrial facilities may include effluents from domestic sewage, food service, and laundry facilities serving site employees. Miscellaneous wastewater from laboratories,

medical infirmaries, water softening etc. may also be discharged to the sanitary wastewater treatment system. Recommended sanitary wastewater management strategies include:

Segregation of wastewater streams to ensure compatibility with selected treatment option (e.g. septic system which can only accept domestic sewage);

Segregation and pretreatment of oil and grease containing effluents (e.g. use of a grease trap) prior to discharge into sewer systems;

If sewage from the industrial facility is to be discharged to surface water, treatment to meet national or local standards for sanitary wastewater discharges or, in their absence, the indicative guideline values applicable to sanitary wastewater discharges shown in Table 1.3.1;

If sewage from the industrial facility is to be discharged to either a septic system, or where land is used as part of the treatment system, treatment to meet applicable national or local standards for sanitary wastewater discharges is required.

Sludge from sanitary wastewater treatment systems should be disposed in compliance with local regulatory requirements, in the absence of which disposal has to be consistent with protection of public health and safety, and conservation and long term sustainability of water and land resources.

Table 1.3.1 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		

Emissions from Wastewater Treatment Operations

Air emissions from wastewater treatment operations may include hydrogen sulfide, methane, ozone (in the case of ozone disinfection), volatile organic compounds (e.g., chloroform generated from chlorination activities and other volatile organic compounds (VOCs) from industrial wastewater), gaseous or volatile chemicals used for disinfection processes (e.g., chlorine and ammonia), and bioaerosols. Odors from treatment facilities can also be a nuisance to workers and the surrounding community. Recommendations for the management of emissions are presented in the Air Emissions and Ambient Air Quality section of this document and in the EHS Guidelines for Water and Sanitation.

Residuals from Wastewater Treatment Operations

Sludge from a waste treatment plant needs to be evaluated on a case-by-case basis to establish whether it constitutes a hazardous

or a non-hazardous waste and managed accordingly as described in the Waste Management section of this document.

Occupational Health and Safety Issues in Wastewater Treatment Operations

Wastewater treatment facility operators may be exposed to physical, chemical, and biological hazards depending on the design of the facilities and the types of wastewater effluents managed. Examples of these hazards include the potential for trips and falls into tanks, confined space entries for maintenance operations, and inhalation of VOCs, bioaerosols, and methane, contact with pathogens and vectors, and use of potentially hazardous chemicals, including chlorine, sodium and calcium hypochlorite, and ammonia. Detailed recommendations for the management of occupational health and safety issues are presented in the relevant section of this document. Additional guidance specifically applicable to wastewater treatment systems is provided in the EHS Guidelines for Water and Sanitation.

Monitoring

A wastewater and water quality monitoring program with adequate resources and management oversight should be developed and implemented to meet the objective(s) of the monitoring program. The wastewater and water quality monitoring program should consider the following elements:

Monitoring parameters: The parameters selected for monitoring should be indicative of the pollutants of concern from the process, and should include parameters that are regulated under compliance requirements;

Monitoring type and frequency: Wastewater monitoring should take into consideration the discharge characteristics from the process over time. Monitoring of discharges from processes with batch manufacturing or seasonal process variations should take into consideration of time-dependent

variations in discharges and, therefore, is more complex than monitoring of continuous discharges. Effluents from highly variable processes may need to be sampled more frequently or through composite methods. Grab samples or, if automated equipment permits, composite samples may offer more insight on average concentrations of pollutants over a 24-hour period. Composite samplers may not be appropriate where analytes of concern are short-lived (e.g., quickly degraded or volatile).

Monitoring locations: The monitoring location should be selected with the objective of providing representative monitoring data. Effluent sampling stations may be located at the final discharge, as well as at strategic upstream points prior to merging of different discharges. Process discharges should not be diluted prior or after treatment with the objective of meeting the discharge or ambient water quality standards.

Data quality: Monitoring programs should apply internationally approved methods for sample collection, preservation and analysis. Sampling should be conducted by or under the supervision of trained individuals. Analysis should be conducted by entities permitted or certified for this purpose. Sampling and Analysis Quality Assurance/Quality Control (QA/QC) plans should be prepared and, implemented. QA/QC documentation should be included in monitoring reports.

Annex 1.3.1 - 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

1.4 Water Conservation

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Applicability and Approach

Water conservation programs should be implemented commensurate with the magnitude and cost of water use. These programs should promote the continuous reduction in water consumption and achieve savings in the water pumping, treatment and disposal costs. Water conservation measures may include water monitoring/management techniques; process and cooling/heating water recycling, reuse, and other techniques; and sanitary water conservation techniques.

General recommendations include:

- Storm/Rainwater harvesting and use
- Zero discharge design/Use of treated waste water to be included in project design processes
- Use of localized recirculation systems in plant/facility/shops (as opposed to centralized recirculation system), with provision only for makeup water
- Use of dry process technologies e.g. dry quenching
- Process water system pressure management
- Project design to have measures for adequate water collection, spill control and leakage control system

Water Monitoring and Management

The essential elements of a water management program involve:

- Identification, regular measurement, and recording of principal flows within a facility;
- Definition and regular review of performance targets, which are adjusted to account for changes in major factors affecting water use (e.g. industrial production rate);
- Regular comparison of water flows with performance targets to identify where action should be taken to reduce water use.

Water measurement (metering) should emphasize areas of greatest water use. Based on review of metering data, 'unaccounted' use—indicating major leaks at industrial facilities—could be identified.

Process Water Reuse and Recycling

Opportunities for water savings in industrial processes are highly industry-specific. However, the following techniques have all been used successfully, and should be considered in conjunction with the development of the metering system described above.

Washing Machines: Many washing machines use large quantities of hot water. Use can increase as nozzles become enlarged due to repeated cleaning and /or wear. Monitor machine water use, compare with specification, and replace nozzles when water and heat use reaches levels warranting such work.

Water reuse: Common water reuse applications include countercurrent rinsing, for example in multi-stage washing

and rinsing processes, or reusing waste water from one process for another with less exacting water requirements. For example, using bleaching rinse water for textile washing, or bottle-washer rinse water for bottle crate washing, or even washing the floor. More sophisticated reuse projects requiring treatment of water before reuse are also sometimes practical.

Water jets/sprays: If processes use water jets or sprays (e.g. to keep conveyors clean or to cool product) review the accuracy of the spray pattern to prevent unnecessary water loss.

Flow control optimization: Industrial processes sometimes require the use of tanks, which are refilled to control losses. It is often possible to reduce the rate of water supply to such tanks, and sometimes to reduce tank levels to reduce spillage. If the process uses water cooling sprays, it may be possible to reduce flow while maintaining cooling performance. Testing can determine the optimum balance.

- If hoses are used in cleaning, use flow controls to restrict wasteful water flow
- Consider the use of high pressure, low volume cleaning systems rather than using large volumes of water sprayed from hosepipes
- Using flow timers and limit switches to control water use
- Using 'clean-up' practices rather than hosing down

Building Facility Operations

Consumption of building and sanitary water is typically less than that used in industrial processes. However, savings can readily be identified, as outlined below:

Compare daily water use per employee to existing benchmarks taking into consideration the primary use at

the facility, whether sanitary or including other activities such as showering or catering

Regularly maintain plumbing, and identify and repair leaks

Shut off water to unused areas

Install self-closing taps, automatic shut-off valves, spray nozzles, pressure reducing valves, and water conserving fixtures (e.g. low flow shower heads, faucets, toilets, urinals; and spring loaded or sensed faucets)

Operate dishwashers and laundries on full loads, and only when needed

Install water-saving equipment in lavatories, such as low-flow toilets

Cooling Systems

Water conservation opportunities in cooling systems include:

Use of closed circuit cooling systems with cooling towers rather than once-through cooling systems

Limiting condenser or cooling tower blowdown to the minimum required to prevent unacceptable accumulation of dissolved solids

Use of air cooling rather than evaporative cooling, although this may increase electricity use in the cooling system

Use of treated waste water for cooling towers

Reusing/recycling cooling tower blowdown

Heating Systems

Heating systems based on the circulation of low or medium pressure hot water (which do not consume water) should be closed. If they do consume water, regular maintenance should be conducted to check for leaks. However, large quantities of water may be used by steam systems, and this can be reduced by the following measures:

Repair of steam and condensate leaks, and repair of all failed steam traps

Return of condensate to the boilerhouse, and use of heat exchangers (with condensate return) rather than direct steam injection where process permits

Flash steam recovery

Minimizing boiler blowdown consistent with maintaining acceptably low dissolved solids in boiler water. Use of reverse osmosis boiler feed water treatment substantially reduces the need for boiler blowdown

Minimizing deaerator heating

1.5 Hazardous Materials Management

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Applicability and Approach

These guidelines apply to projects that use, store, or handle any quantity of hazardous materials (Hazmats), defined as materials that represent a risk to human health, property, or the environment due to their physical or chemical characteristics. Hazmats can be classified according to the hazard as explosives; compressed gases, including toxic or flammable gases; flammable liquids; flammable solids; oxidizing substances; toxic materials; radioactive material; and corrosive substances. Guidance on the transport of hazardous materials is covered in Section 3 of this document.

When a hazardous material is no longer usable for its original purpose and is intended for disposal, but still has hazardous properties, it is considered a *hazardous waste* (see Section 1.4).

This guidance is intended to be applied in conjunction with traditional occupational health and safety and emergency preparedness programs which are included in Section 2.0 on Occupational Health and Safety Management, and Section 3.7 on Emergency Preparedness and Response. Guidance on the Transport of Hazardous Materials is provided in Section 3.5.

This section is divided into two main subsections:

General Hazardous Materials Management: Guidance applicable to all projects or facilities that handle or store any quantity of hazardous materials.

Management of Major Hazards: Additional guidance for projects or facilities that store or handle hazardous materials at, or above, threshold quantities³⁹, and thus require special treatment to prevent accidents such as fire, explosions, leaks or spills, and to prepare and respond to emergencies.

The overall objective of hazardous materials management is to avoid or, when avoidance is not feasible, minimize uncontrolled releases of hazardous materials or accidents (including explosion and fire) during their production, handling, storage and use. This objective can be achieved by:

³⁹ For examples, threshold quantities should be those established for emergency planning purposes such as provided in the US Environmental Protection Agency. *Protection of Environment* (Title Threshold quantities are provided in the US Environmental Protection Agency. *Protection of Environment* (Title 40 CFR Parts 68, 112, and 355).

Establishing hazardous materials management priorities based on hazard analysis of risky operations identified through Social and Environmental Assessment;

Where practicable, avoiding or minimizing the use of hazardous materials. For example, non-hazardous materials have been found to substitute asbestos in building materials, PCBs in electrical equipment, persistent organic pollutants (POPs) in pesticides formulations, and ozone depleting substances in refrigeration systems;

Preventing uncontrolled releases of hazardous materials to the environment or uncontrolled reactions that might result in fire or explosion;

Using engineering controls (containment, automatic alarms, and shut-off systems) commensurate with the nature of hazard;

Implementing management controls (procedures, inspections, communications, training, and drills) to address residual risks that have not been prevented or controlled through engineering measures.

General Hazardous Materials Management

Projects which manufacture, handle, use, or store hazardous materials should establish management programs that are commensurate with the potential risks present. The main objectives of projects involving hazardous materials should be the protection of the workforce and the prevention and control of releases and accidents. These objectives should be addressed by integrating prevention and control measures, management actions, and procedures into day-to-day business activities. Potentially applicable elements of a management program include the following:

Hazard Assessment

The level of risk should be established through an on-going assessment process based on:

The types and amounts of hazardous materials present in the project. This information should be recorded and should include a summary table with the following information:

- Name and description (e.g. composition of a mixture) of the Hazmat
- Classification (e.g. code, class or division) of the Hazmat
- Internationally accepted regulatory reporting threshold quantity or national equivalent⁴⁰ of the Hazmat
- Quantity of Hazmat used per month
- Characteristic(s) that make(s) the Hazmat hazardous (e.g. flammability, toxicity)

Analysis of potential spill and release scenarios using available industry statistics on spills and accidents where available

Analysis of the potential for uncontrolled reactions such as fire and explosions

Analysis of potential consequences based on the physical-geographical characteristics of the project site, including aspects such as its distance to settlements, water resources, and other environmentally sensitive areas

Hazard assessment should be performed by specialized professionals using internationally-accepted methodologies such as Hazardous Operations Analysis (HAZOP), Failure Mode and Effects Analysis (FMEA), and Hazard Identification (HAZID).

Management Actions

The management actions to be included in a Hazardous Materials Management Plan should be commensurate with the level of

⁴⁰ Threshold quantities are provided in the US Environmental Protection Agency. *Protection of Environment* (Title 40 CFR Parts 68, 112, and 355).

potential risks associated with the production, handling, storage, and use of hazardous materials.

Release Prevention and Control Planning

Where there is risk of a spill of uncontrolled hazardous materials, facilities should prepare a spill control, prevention, and countermeasure plan as a specific component of their Emergency Preparedness and Response Plan (described in more detail in Section 3.7). The plan should be tailored to the hazards associated with the project, and include:

- Training of operators on release prevention, including drills specific to hazardous materials as part of emergency preparedness response training
- Implementation of inspection programs to maintain the mechanical integrity and operability of pressure vessels, tanks, piping systems, relief and vent valve systems, containment infrastructure, emergency shutdown systems, controls and pumps, and associated process equipment
- Preparation of written Standard Operating Procedures (SOPs) for filling USTs, ASTs or other containers or equipment as well as for transfer operations by personnel trained in the safe transfer and filling of the hazardous material, and in spill prevention and response
- SOPs for the management of secondary containment structures, specifically the removal of any accumulated fluid, such as rainfall, to ensure that the intent of the system is not accidentally or willfully defeated
- Identification of locations of hazardous materials and associated activities on an emergency plan site map
- Documentation of availability of specific personal protective equipment and training needed to respond to an emergency
- Documentation of availability of spill response equipment sufficient to handle at least initial stages of a spill and a list of

external resources for equipment and personnel, if necessary, to supplement internal resources

Description of response activities in the event of a spill, release, or other chemical emergency including:

- Internal and external notification procedures
- Specific responsibilities of individuals or groups
- Decision process for assessing severity of the release, and determining appropriate actions
- Facility evacuation routes
- Post-event activities such as clean-up and disposal, incident investigation, employee re-entry, and restoration of spill response equipment.

Occupational Health and Safety

The Hazardous Materials Management Plan should address applicable, essential elements of occupational health and safety management as described in Section 2.0 on Occupational Health and Safety, including:

- Job safety analysis to identify specific potential occupational hazards and industrial hygiene surveys, as appropriate, to monitor and verify chemical exposure levels, and compare with applicable occupational exposure standards⁴¹
- Hazard communication and training programs to prepare workers to recognize and respond to workplace chemical hazards. Programs should include aspects of hazard identification, safe operating and materials handling procedures, safe work practices, basic emergency procedures, and special hazards unique to their jobs.

⁴¹ Including: Threshold Limit Value (TLV®) occupational exposure guidelines and Biological Exposure Indices (BEIs®), American Conference of Governmental Industrial Hygienists (ACGIH), <http://www.acgih.org/TLV/>; U.S. National Institute for Occupational Health and Safety (NIOSH), <http://www.cdc.gov/niosh/npg/>; Permissible Exposure Limits (PELs), U.S. Occupational Safety and Health Administration (OSHA), http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARD_S&p_id=9992; Indicative Occupational Exposure Limit Values, European Union, http://europe.osha.eu.int/good_practice/risks/ds/oel/; and other similar sources.

Training should incorporate information from Material Safety Data Sheets⁴² (MSDSs) for hazardous materials being handled. MSDSs should be readily accessible to employees in their local language.

Definition and implementation of permitted maintenance activities, such as hot work or confined space entries

Provision of suitable personal protection equipment (PPE) (footwear, masks, protective clothing and goggles in appropriate areas), emergency eyewash and shower stations, ventilation systems, and sanitary facilities

Monitoring and record-keeping activities, including audit procedures designed to verify and record the effectiveness of prevention and control of exposure to occupational hazards, and maintaining accident and incident investigation reports on file for a period of at least five years

Process Knowledge and Documentation The

Hazardous Materials Management Plan should be incorporated into, and consistent with, the other elements of the facility ES/OHS MS and include:

Written process safety parameters (i.e., hazards of the chemical substances, safety equipment specifications, safe operation ranges for temperature, pressure, and other applicable parameters, evaluation of the consequences of deviations, etc.)

Written operating procedures

Compliance audit procedures

Preventive Measures

Hazardous Materials Transfer

Uncontrolled releases of hazardous materials may result from small cumulative events, or from more significant equipment failure associated with events such as manual or mechanical transfer between storage systems or process equipment.

Recommended practices to prevent hazardous material releases from processes include:

Use of dedicated fittings, pipes, and hoses specific to materials in tanks (e.g., all acids use one type of connection, all caustics use another), and maintaining procedures to prevent addition of hazardous materials to incorrect tanks

Use of transfer equipment that is compatible and suitable for the characteristics of the materials transferred and designed to ensure safe transfer

Regular inspection, maintenance and repair of fittings, pipes and hoses

Provision of secondary containment, drip trays or other overflow and drip containment measures, for hazardous materials containers at connection points or other possible overflow points.

Overfill Protection

Overfills of vessels and tanks should be prevented as they are among the most common causes of spills resulting in soil and water contamination, and among the easiest to prevent.

Recommended overfill protection measures include:

Prepare written procedures for transfer operations that includes a checklist of measures to follow during filling operations and the use of filling operators trained in these procedures

Installation of gauges on tanks to measure volume inside

Use of dripless hose connections for vehicle tank and fixed connections with storage tanks

⁴² MSDSs are produced by the manufacturer, but might not be prepared for chemical intermediates that are not distributed in commerce. In these cases, employers still need to provide workers with equivalent information.

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 overflow protection (float valve)

Pumping less volume than available capacity into the tank or vessel by ordering less material than its available capacity

Provision of overflow or over pressure vents that allow controlled release to a capture point

Reaction, Fire, and Explosion Prevention Reactive, flammable, and explosive materials should also be managed to avoid uncontrolled reactions or conditions resulting in fire or explosion. Recommended prevention practices include:

Storage of incompatible materials (acids, bases, flammables, oxidizers, reactive chemicals) in separate areas, and with containment facilities separating material storage areas

Provision of material-specific storage for extremely hazardous or reactive materials

Use of flame arresting devices on vents from flammable storage containers

Provision of grounding and lightning protection for tank farms, transfer stations, and other equipment that handles flammable materials

Selection of materials of construction compatible with products stored for all parts of storage and delivery systems, and avoiding reuse of tanks for different products without checking material compatibility

Storage of hazardous materials in an area of the facility separated from the main production works. Where proximity is unavoidable, physical separation should be provided using structures designed to prevent fire, explosion, spill, and other emergency situations from affecting facility operations

Prohibition of all sources of ignition from areas near flammable storage tanks

Control Measures

Secondary Containment (Liquids)

A critical aspect for controlling accidental releases of liquid hazardous materials during storage and transfer is the provision of secondary containment. It is not necessary for secondary containment methods to meet long term material compatibility as with primary storage and piping, but their design and construction should hold released materials effectively until they can be detected and safely recovered. Appropriate secondary containment structures consist of berms, dikes, or walls capable of containing the larger of 110 percent of the largest tank or 25 percent of the combined tank volumes in areas with above-ground tanks with a total storage volume equal or greater than 1,000 liters and will be made of impervious, chemically resistant material. Secondary containment design should also consider means to prevent contact between incompatible materials in the event of a release.

Other secondary containment measures that should be applied depending on site-specific conditions include:

Transfer of hazardous materials from vehicle tanks to storage in areas with surfaces sufficiently impervious to avoid loss to the environment and sloped to a collection or a containment structure not connected to municipal wastewater/stormwater collection system

Where it is not practical to provide permanent, dedicated containment structures for transfer operations, one or more alternative forms of spill containment should be provided, such as portable drain covers (which can be deployed for the duration of the operations), automatic shut-off valves on storm water basins, or shut off valves in drainage or sewer facilities, combined with oil-water separators

Storage of drummed hazardous materials with a total volume equal or greater than 1,000 liters in areas with impervious surfaces that are sloped or bermed to contain a minimum of 25 percent of the total storage volume

Provision of secondary containment for components (tanks, pipes) of the hazardous material storage system, to the extent feasible

Conducting periodic (e.g. daily or weekly) reconciliation of tank contents, and inspection of visible portions of tanks and piping for leaks;

Use of double-walled, composite, or specially coated storage and piping systems particularly in the use of underground storage tanks (USTs) and underground piping. If double-walled systems are used, they should provide a means of detecting leaks between the two walls.

Storage Tank and Piping Leak Detection

Leak detection may be used in conjunction with secondary containment, particularly in high-risk locations⁴³. Leak detection is especially important in situations where secondary containment is not feasible or practicable, such as in long pipe runs. Acceptable leak detection methods include:

Use of automatic pressure loss detectors on pressurized or long distance piping

Use of approved or certified integrity testing methods on piping or tank systems, at regular intervals

Considering the use of SCADA⁴⁴ if financially feasible

⁴³ 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.

⁴⁴ Supervisory Control and Data Acquisition

Underground Storage Tanks (USTs)⁴⁵

Although there are many environmental and safety advantages of underground storage of hazardous materials, including reduced risk of fire or explosion, and lower vapor losses into the atmosphere, leaks of hazardous materials can go undetected for long periods of time with potential for soil and groundwater contamination. Examples of techniques to manage these risks include:

Avoiding use of USTs for storage of highly soluble organic materials

Assessing local soil corrosion potential, and installing and maintaining cathodic protection (or equivalent rust protection) for steel tanks

For new installations, installing impermeable liners or structures (e.g., concrete vaults) under and around tanks and lines that direct any leaked product to monitoring ports at the lowest point of the liner or structure

Monitoring the surface above any tank for indications of soil movement

Reconciling tank contents by measuring the volume in store with the expected volume, given the stored quantity at last stocking, and deliveries to and withdrawals from the store

Testing integrity by volumetric, vacuum, acoustic, tracers, or other means on all tanks at regular intervals

Considering the monitoring groundwater of quality down gradient of locations where multiple USTs are in use

Evaluating the risk of existing UST in newly acquired facilities to determine if upgrades are required for USTs that will be continued to be used, including replacement with new systems or permanent closure of abandoned USTs.

Ensuring that new USTs are sited away from wells,

⁴⁵ Additional details on the management of USTs is provided in the EHS Guidelines for Retail Petroleum Stations.

reservoirs and other source water protection areas and floodplains, and maintained so as to prevent corrosion.

Management of Major Hazards

In addition to the application of the above-referenced guidance on prevention and control of releases of hazardous materials, projects involving production, handling, and storage of hazardous materials *at or above threshold limits*⁴⁶ should prepare a Hazardous Materials Risk Management Plan, in the context of its overall ES/OHS MS, containing all of the elements presented below.⁴⁷ The objective of this guidance is the prevention and control of catastrophic releases of toxic, reactive, flammable, or explosive chemicals that may result in toxic, fire, or explosion hazards.⁴⁸

Management Actions

Management of Change: These procedures should address:

- The technical basis for changes in processes and operations
- The impact of changes on health and safety
- Modification to operating procedures
- Authorization requirements
- Employees affected
- Training needs

Compliance Audit: A compliance audit is a way to evaluate compliance with the prevention program requirements for each process. A compliance audit covering each element of

the prevention measures (see below) should be conducted at least every three years and should include:

- Preparation of a report of the findings
- Determination and documentation of the appropriate response to each finding
- Documentation that any deficiency has been corrected

Incident Investigation: Incidents can provide valuable information about site hazards and the steps needed to prevent accidental releases. An incident investigation mechanism should include procedures for:

- Initiation of the investigation promptly
- Summarizing the investigation in a report
- Addressing the report findings and recommendations
- A review of the report with staff and contractors

Employee Participation: A written plan of action should describe an active employee participation program for the prevention of accidents.

Contractors: There should be a mechanism for contractor control which should include a requirement for them to develop hazardous materials management procedures that meet the requirements of the hazardous materials management plan. Their procedures should be consistent with those of the contracting company and the contractor workforce should undergo the same training. Additionally, procedures should require that contractors are:

- Provided with safety performance procedures and safety and hazard information
- Observe safety practices
- Act responsibly
- Have access to appropriate training for their employees
- Ensure that their employees know process hazards and applicable emergency actions

⁴⁶ Threshold quantities should be those established for emergency planning purposes such as provided in the US Environmental Protection Agency. *Protection of Environment* (Title 40 CFR Parts 300-399 and 700 to 789).

⁴⁷ For further information and guidance, please refer to International Finance Corporation (IFC) Hazardous Materials Risk Management Manual. Washington, D.C. December 2000.

⁴⁸ The approach to the management of major hazards is largely based on an approach to Process Safety Management developed by the American Institute of Chemical Engineers.

- Prepare and submit training records for their employees to the contracting company
- Inform their employees about the hazards presented by their work
- Assess trends of repeated similar incidents
- Develop and implement procedures to manage repeated similar incidents

Training: Project employees should be provided training on Hazmat management. The training program should include:

- A list of employees to be trained
- Specific training objectives
- Mechanisms to achieve the objectives (i.e., hands-on workshops, videos, etc.)
- The means to determine whether the training program is effective
- Training procedures for new hires and refresher courses for existing employees

Preventive Measures

The purpose of preventive measures is to ensure that safety-related aspects of the process and equipment are considered, limits to be placed on the operations are well known, and accepted standards and codes are adopted, where they apply.

Process Safety Information: Procedures should be prepared for each hazardous materials and include:

- Compilation of Material Safety Data Sheets (MSDS)
- Identification of maximum intended inventories and safe upper/lower parameters
- Documentation of equipment specifications and of codes and standards used to design, build and operate the process

Operating Procedures: SOPs should be prepared for each step of all processes or operations within the project (e.g.

initial startup, normal operations, temporary operations, emergency shutdown, emergency operations, normal shutdown, and start-up following a normal or emergency shutdown or major change). These SOPs should include special considerations for Mazmats used in the process or operations (e.g. temperature control to prevent emissions of a volatile hazardous chemical; diversion of gaseous discharges of hazardous pollutants from the process to a temporary storage tank in case of emergency).

Other procedures to be developed include impacts of deviations, steps to avoid deviations, prevention of chemical exposure, exposure control measures, and equipment inspections.

Mechanical Integrity of process equipment, piping and instrumentation: Inspection and maintenance procedures should be developed and documented to ensure mechanical integrity of equipment, piping, and instrumentation and prevent uncontrolled releases of hazardous materials from the project. These procedures should be included as part of the project SOPs. The specific process components of major interest include pressure vessels and storage tanks, piping systems, relief and vent systems and devices, emergency shutdown systems, controls, and pumps. Recommended aspects of the inspection and maintenance program include:

- Developing inspection and maintenance procedures
- Establishing a quality assurance plan for equipment, maintenance materials, and spare parts
- Conducting employee training on the inspection and maintenance procedures
- Conducting equipment, piping, and instrumentation inspections and maintenance
- Identifying and correcting identified deficiencies

- Evaluating the inspection and maintenance results and, if necessary, updating the inspection and maintenance procedures
- Reporting the results to management.

Hot Work Permit: Hot work operations – such as brazing, torch-cutting, grinding, soldering, and welding – are associated with potential health, safety, and property hazards resulting from the fumes, gases, sparks, and hot metal and radiant energy produced during hot work. Hot work permit is required for any operation involving open flames or producing heat and/or sparks. The section of SOPs on hot work should include the responsibility for hot work permitting, personal protection equipment (PPE), hot work procedures, personnel training, and recordkeeping.

Pre-Start Review: Procedures should be prepared to carry out pre-start reviews when a modification is significant enough to require a change in safety information under the management of change procedure. The procedures should:

- Confirm that the new or modified construction and/or equipment meet design specifications
- Ensure that procedures for safety, operation, maintenance, and emergency are adequate
- Include a process hazard assessment, and resolve or implement recommendations for new process
- Ensure that training for all affected employees is being conducted

Emergency Preparedness and Response

When handling hazardous materials, procedures and practices should be developed allowing for quick and efficient responses to accidents that could result in human injury or damage to the environment. An Emergency Preparedness and Response Plan,

incorporated into and consistent with, the facility's overall ES/OHS MS, should be prepared to cover the following:⁴⁹

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.

Community Involvement and Awareness

When hazardous materials are in use above threshold quantities, the management plan should include a system for community awareness, notification and involvement that should be commensurate with the potential risks identified for the project during the hazard assessment studies. This should include mechanisms for sharing the results of hazard and risk assessment studies in a timely, understandable and culturally sensitive manner with potentially affected communities that provides a means for public feedback. Community involvement activities should include:

Availability of general information to the potentially affected community on the nature and extent of project operations, and the prevention and control measures in place to ensure no effects to human health

⁴⁹ 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>

The potential for off-site effects to human health or the environment following an accident at planned or existing hazardous installations

Specific and timely information on appropriate behavior and safety measures to be adopted in the event of an accident including practice drills in locations with higher risks

Access to information necessary to understand the nature of the possible effect of an accident and an opportunity to contribute effectively, as appropriate, to decisions concerning hazardous installations and the development of community emergency preparedness plans.

1.6 Waste Management

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Applicability and Approach

These guidelines apply to projects that generate, store, or handle any quantity of waste across a range of industry sectors. It is not intended to apply to projects or facilities where the primary business is the collection, transportation, treatment, or disposal of wastes. Specific guidance for these types of facilities is presented in the Environmental Health and Safety (EHS) Guidelines for Waste Management Facilities.

A waste is any solid, liquid, or contained gaseous material that is being discarded by disposal, recycling, burning or incineration. It can be byproduct of a manufacturing process or an obsolete commercial product that can no longer be used for intended purpose and requires disposal.

Solid (non-hazardous) wastes generally include any garbage, refuse. Examples of such waste include domestic trash and garbage; inert construction / demolition materials; refuse, such as metal scrap and empty containers (except those previously used to contain hazardous materials which should, in principle, be managed as a hazardous waste); and

residual waste from industrial operations, such as boiler slag, clinker, and fly ash.

Hazardous waste shares the properties of a hazardous material (e.g. ignitability, corrosivity, reactivity, or toxicity), or other physical, chemical, or biological characteristics that may pose a potential risk to human health or the environment if improperly managed. Wastes may also be defined as “hazardous” by local regulations or international conventions, based on the origin of the waste and its inclusion on hazardous waste lists, or based on its characteristics.

Sludge from a waste treatment plant, water supply treatment plant, or air pollution control facility, and other discarded material, including solid, liquid, semisolid, or contained gaseous material resulting from industrial operations needs to be evaluated on a case-by-case basis to establish whether it constitutes a hazardous or a non-hazardous waste.

Facilities that generate and store wastes should practice the following:

- Establishing waste management priorities at the outset of activities based on an understanding of potential Environmental, Health, and Safety (EHS) risks and impacts and considering waste generation and its consequences

- Establishing a waste management hierarchy that considers prevention, reduction, reuse, recovery, recycling, removal and finally disposal of wastes.

- Avoiding or minimizing the generation waste materials, as far as practicable

- Where waste generation cannot be avoided but has been minimized, recovering and reusing waste

Where waste can not be recovered or reused, treating, destroying, and disposing of it in an environmentally sound manner

Definition of procedures and operational controls for on-site storage

Definition of options / procedures / operational controls for treatment and final disposal

General Waste Management

The following guidance applies to the management of non-hazardous and hazardous waste. Additional guidance specifically applicable to hazardous wastes is presented below. Waste management should be addressed through a Waste management system that addresses issues linked to waste minimization, generation, transport, disposal, and monitoring.

Waste Management Planning

Facilities that generate waste should characterize their waste according to composition, source, types of wastes produced, generation rates, or according to local regulatory requirements. Effective planning and implementation of waste management strategies should include:

- Review of new waste sources during planning, siting, and design activities, including during equipment modifications and process alterations, to identify expected waste generation, pollution prevention opportunities, and necessary treatment, storage, and disposal infrastructure

- Collection of data and information about the process and waste streams in existing facilities, including characterization of waste streams by type, quantities, and potential use/disposition

- Establishment of priorities based on a risk analysis that takes into account the potential EHS risks during the waste cycle and the availability of infrastructure to manage the waste in an environmentally sound manner

- Definition of opportunities for source reduction, as well as reuse and recycling

Waste Prevention

Processes should be designed and operated to prevent, or minimize, the quantities of wastes generated and hazards associated with the wastes generated in accordance with the following strategy:

- Substituting raw materials or inputs with less hazardous or toxic materials, or with those where processing generates lower waste volumes

- Applying manufacturing process that convert materials efficiently, providing higher product output yields, including modification of design of the production process, operating conditions, and process controls⁵⁰

- Instituting good housekeeping and operating practices, including inventory control to reduce the amount of waste resulting from materials that are out-of-date, off-specification, contaminated, damaged, or excess to plant needs

- Instituting procurement measures that recognize opportunities to return usable materials such as containers and which prevents the over ordering of materials

- Minimizing hazardous waste generation by implementing stringent waste segregation to prevent the commingling of non-hazardous and hazardous waste to be managed

⁵⁰ Examples of waste prevention strategies include the concept of Lean Manufacturing found at <http://www.epa.gov/epaoswer/hazwaste/minimize/lean.htm>

Recycling and Reuse

In addition to the implementation of waste prevention strategies, the total amount of waste may be significantly reduced through the implementation of recycling plans, which should consider the following elements:

- Evaluation of waste production processes and identification of potentially recyclable materials
- Identification and recycling of products that can be reintroduced into the manufacturing process or industry activity at the site
- Investigation of external markets for recycling by other industrial processing operations located in the neighborhood or region of the facility (e.g., waste exchange)
- Establishing recycling objectives and formal tracking of waste generation and recycling rates
- Providing training and incentives to employees in order to meet objectives

Treatment and Disposal

If waste materials are still generated after the implementation of feasible waste prevention, reduction, reuse, recovery and recycling measures, waste materials should be treated and disposed of and all measures should be taken to avoid potential impacts to human health and the environment. Selected management approaches should be consistent with the characteristics of the waste and local regulations, and may include one or more of the following:

- On-site or off-site biological, chemical, or physical treatment of the waste material to render it 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 Waste Management

Hazardous wastes should always be segregated from non-hazardous wastes. If generation of hazardous waste can not be prevented through the implementation of the above general waste management practices, its management should focus on the prevention of harm to health, safety, and the environment, according to the following additional principles:

- Understanding potential impacts and risks associated with the management of any generated hazardous waste during its complete life cycle
- Ensuring that contractors handling, treating, and disposing of hazardous waste are reputable and legitimate enterprises, licensed by the relevant regulatory agencies and following good international industry practice for the waste being handled
- Ensuring compliance with applicable local and international regulations⁵¹

Waste Storage

Hazardous waste should be stored so as to prevent or control accidental releases to air, soil, and water resources in area location where:

⁵¹ 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/>)

Waste is stored in a manner that prevents the commingling or contact between incompatible wastes, and allows for inspection between containers to monitor leaks or spills. Examples include sufficient space between incompatibles or physical separation such as walls or containment curbs

Store in closed containers away from direct sunlight, wind and rain

Secondary containment systems should be constructed with materials appropriate for the wastes being contained and adequate to prevent loss to the environment

Secondary containment is included wherever liquid wastes are stored in volumes greater than 220 liters.

The available volume of secondary containment should be at least 110 percent of the largest storage container, or 25 percent of the total storage capacity (whichever is greater), in that specific location

Provide adequate ventilation where volatile wastes are stored.

Hazardous waste storage activities should also be subject to special management actions, conducted by employees who have received specific training in handling and storage of hazardous wastes:

Provision of readily available information on chemical compatibility to employees, including labeling each container to identify its contents

Limiting access to hazardous waste storage areas to employees who have received proper training

Clearly identifying (label) and demarcating the area, including documentation of its location on a facility map or site plan

Conducting periodic inspections of waste storage areas and documenting the findings

Preparing and implementing spill response and emergency plans to address their accidental release (additional information on Emergency Plans is provided in Section 3 of this document)

Avoiding underground storage tanks and underground piping of hazardous waste

Transportation

On-site and Off-site transportation of waste should be conducted so as to prevent or minimize spills, releases, and exposures to employees and the public. All waste containers designated for off-site shipment should be secured and labeled with the contents and associated hazards, be properly loaded on the transport vehicles before leaving the site, and be accompanied by a shipping paper (i.e., manifest) that describes the load and its associated hazards, consistent with the guidance provided in Section 3.4 on the Transport of Hazardous Materials.

Treatment and Disposal

In addition to the recommendations for treatment and disposal applicable to general wastes, the following issues specific to hazardous wastes should be considered:

Commercial or Government Waste Contractors

In the absence of qualified commercial or government-owned waste vendors (taking into consideration proximity and transportation requirements), facilities generating waste should consider using:

Have the technical capability to manage the waste in a manner that reduces immediate and future impact to the environment

Have all required permits, certifications, and approvals, of applicable government authorities

Have been secured through the use of formal procurement agreements

In the absence of qualified commercial or government-owned waste disposal operators (taking into consideration proximity and transportation requirements), project sponsors should consider using:

Installing on-site waste treatment or recycling processes

As a final option, constructing facilities that will provide for the environmental sound long-term storage of wastes on-site (as described elsewhere in the General EHS Guidelines) or at an alternative appropriate location up until external commercial options become available

Small Quantities of Hazardous Waste

Hazardous waste materials are frequently generated in small quantities by many projects through a variety of activities such as equipment and building maintenance activities.

Examples of these types of wastes include: spent solvents and oily rags, empty paint cans, chemical containers; used lubricating oil; used batteries (such as nickel-cadmium or lead acid); and lighting equipment, such as lamps or lamp ballasts. These wastes should be managed following the guidance provided in the above sections.

Monitoring

Monitoring activities associated with the management of hazardous and non-hazardous waste should include:

Regular visual inspection of all waste storage collection and storage areas for evidence of accidental releases and to verify that wastes are properly labeled and stored. When significant quantities of hazardous wastes

are generated and stored on site, monitoring activities should include:

- Inspection of vessels for leaks, drips or other indications of loss
- Identification of cracks, corrosion, or damage to tanks, protective equipment, or floors
- Verification of locks, emergency valves, and other safety devices for easy operation (lubricating if required and employing the practice of keeping locks and safety equipment in standby position when the area is not occupied)
- Checking the operability of emergency systems
- Documenting results of testing for integrity, emissions, or monitoring stations (air, soil vapor, or groundwater)
- Documenting any changes to the storage facility, and any significant changes in the quantity of materials in storage

Regular audits of waste segregation and collection practices

Tracking of waste generation trends by type and amount of waste generated, preferably by facility departments
Characterizing waste at the beginning of generation of a new waste stream, and periodically documenting the characteristics and proper management of the waste, especially hazardous wastes

Keeping manifests or other records that document the amount of waste generated and its destination

Periodic auditing of third party treatment, and disposal services including re-use and recycling facilities when significant quantities of hazardous wastes are managed by third parties. Whenever possible, audits should include site visits to the treatment storage and disposal location

Regular monitoring of groundwater quality in cases of Hazardous Waste on site storage and/or pretreatment and disposal

Monitoring records for hazardous waste collected, stored, or shipped should include:

- Name and identification number of the material(s) composing the hazardous waste
- Physical state (i.e., solid, liquid, gaseous or a combination of one, or more, of these)
- Quantity (e.g., kilograms or liters, number of containers)
- Waste shipment tracking documentation to include, quantity and type, date dispatched, date transported and date received, record of the originator, the receiver and the transporter
- Method and date of storing, repacking, treating, or disposing at the facility, cross-referenced to specific manifest document numbers applicable to the hazardous waste
- Location of each hazardous waste within the facility, and the quantity at each location

1.7 Noise

Applicability

This section addresses impacts of noise beyond the property boundary of the facilities. Worker exposure to noise is covered in Section 2.0 on Occupational Health and Safety.

Prevention and Control

Noise prevention and mitigation measures should be applied where predicted or measured noise impacts from a project facility or operations exceed the applicable noise level guideline at the most sensitive point of reception.⁵² The preferred method for controlling noise from stationary sources is to implement noise control measures at source.⁵³ Methods for prevention and control of sources of noise emissions depend on the source and proximity of receptors. Noise reduction options that should be considered include:

- Selecting equipment with lower sound power levels
- Installing silencers for fans
- Installing suitable mufflers on engine exhausts and compressor components
- Installing acoustic enclosures for equipment casing radiating noise
- Improving the acoustic performance of constructed buildings, apply sound insulation
- Installing acoustic barriers without gaps and with a continuous minimum surface density of 10 kg/m² in order to minimize the transmission of sound through the

- barrier. Barriers should be located as close to the source or to the receptor location to be effective
- Installing vibration isolation for mechanical equipment
- Limiting the hours of operation for specific pieces of equipment or operations, especially mobile sources operating through community areas
- Re-locating noise sources to less sensitive areas to take advantage of distance and shielding
- Siting permanent facilities away from community areas if possible
- Taking advantage of the natural topography as a noise buffer during facility design
- Reducing project traffic routing through community areas wherever possible
- Planning flight routes, timing and altitude for aircraft (airplane and helicopter) flying over community areas
- Developing a mechanism to record and respond to complaints

Noise Level Guidelines

Noise impacts should not exceed the levels presented in Table 1.7.1, or result in a maximum increase in background levels of 3 dB at the nearest receptor location off-site.

⁵² 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.

⁵³ 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.

Table 1.7.1- Noise Level Guidelines⁵⁴

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

Highly intrusive noises, such as noise from aircraft flyovers and passing trains, should not be included when establishing background noise levels.

Monitoring

Noise monitoring⁵⁶ may be carried out for the purposes of establishing the existing ambient noise levels in the area of the proposed or existing facility, or for verifying operational phase noise levels.

Noise monitoring programs should be designed and conducted by trained specialists. Typical monitoring periods should be sufficient for statistical analysis and may last 48 hours with the use of noise monitors that should be capable of logging data continuously over this time period, or hourly, or more frequently, as appropriate (or else cover differing time periods within several days, including weekday and weekend workdays). The type of acoustic indices recorded depends on the type of noise being monitored, as established by a noise expert. Monitors should be located approximately 1.5 m above the ground and no closer than 3

m to any reflecting surface (e.g., wall). In general, the noise level limit is represented by the background or ambient noise levels that would be present in the absence of the facility or noise source(s) under investigation.

⁵⁴ Guidelines values are for noise levels measured out of doors. Source: Guidelines for Community Noise, World Health Organization (WHO), 1999.

⁵⁵ For acceptable indoor noise levels for residential, institutional, and educational settings refer to WHO (1999).

⁵⁶ Noise monitoring should be carried out using a Type 1 or 2 sound level meter meeting all appropriate IEC standards.

1.8 Contaminated Land

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Applicability and Approach

This section provides a summary of management approaches for land contamination due to anthropogenic releases of hazardous materials, wastes, or oil, including naturally occurring substances. Releases of these materials may be the result of historic or current site activities, including, but not limited to, accidents during their handling and storage, or due to their poor management or disposal.

Land is considered contaminated when it contains hazardous materials or oil concentrations above background or naturally occurring levels.

Contaminated lands may involve surficial soils or subsurface soils that, through leaching and transport, may affect groundwater, surface water, and adjacent sites. Where subsurface contaminant sources include volatile substances, soil vapor may also become a transport and exposure medium, and create potential for contaminant infiltration of indoor air spaces of buildings.

Contaminated land is a concern because of:

The potential risks to human health and ecology (e.g. risk of cancer or other human health effects, loss of ecology);

The liability that it may pose to the polluter/business owners (e.g., cost of remediation, damage of business reputation and/or business-community relations) or affected parties (e.g. workers at the site, nearby property owners).

Contamination of land should be avoided by preventing or controlling the release of hazardous materials, hazardous wastes, or oil to the environment. When contamination of land is suspected or confirmed during any project phase, the cause of the uncontrolled release should be identified and corrected to avoid further releases and associated adverse impacts.

Contaminated lands should be managed to avoid the risk to human health and ecological receptors. The preferred strategy for land decontamination is to reduce the level of contamination at the site while preventing the human exposure to contamination.

To determine whether risk management actions are warranted, the following assessment approach should be applied to establish whether the three risk factors of ‘Contaminants’, ‘Receptors’, and ‘Exposure Pathways’ co-exist, or are likely to co-exist, at the project site under current or possible future land use:

Contaminant(s): Presence of hazardous materials, waste, or oil in any environmental media at potentially hazardous concentrations

Receptor(s): Actual or likely contact of humans, wildlife, plants, and other living organisms with the contaminants of concern

Exposure pathway(s): A combination of the route of migration of the contaminant from its point of release (e.g., leaching into potable groundwater) and exposure routes

(e.g., ingestion, transdermal absorption), which would allow receptor(s) to come into actual contact with contaminants

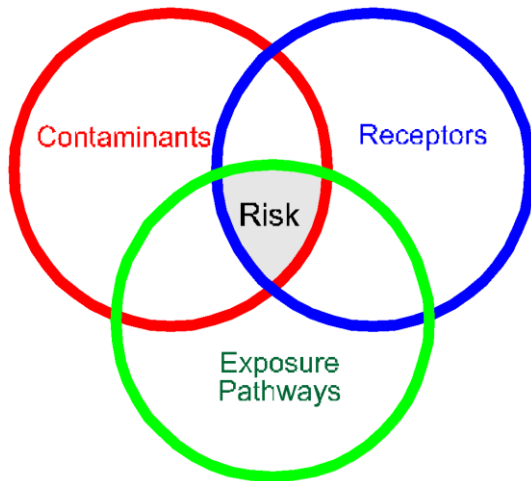


FIGURE 1.8.1: Inter-Relationship of Contaminant Risk Factors

When the three risk factors are considered to be present (in spite of limited data) under current or foreseeable future conditions, the following steps should be followed (as described in the remaining parts of this section):

- 1) Risk screening;
- 2) Interim risk management;
- 3) Detailed quantitative risk assessment; and
- 4) Permanent risk reduction measures.

Risk Screening

This step is also known as “problem formulation” for environmental risk assessment. Where there is potential evidence of contamination at a site, the following steps are recommended:

Identification of the location of suspected highest level of contamination through a combination of visual and historical operational information;

Sampling and testing of the contaminated media (soils or water) according to established technical methods applicable to suspected type of contaminant^{57,58};

Evaluation of the analytical results against the local and national contaminated sites regulations. In the absence of such regulations or environmental standards, other sources of risk-based standards or guidelines should be consulted to obtain comprehensive criteria for screening soil concentrations of pollutants.⁵⁹

Verification of the potential human and/or ecological receptors and exposure pathways relevant to the site in question

The outcome of risk-screening may reveal that there is no overlap between the three risk-factors as the contaminant levels identified are below those considered to pose a risk to human health or the environment. Alternatively, interim or permanent

⁵⁷ BC MOE. http://www.env.gov.bc.ca/epd/epdpa/contam_sites/guidance

⁵⁸ Massachusetts Department of Environment. <http://www.mass.gov/dep/cleanup>

⁵⁹ These may include the USEPA Region 3 Risk-Based Concentrations (RBCs). <http://www.epa.gov/reg3hwmd/risk/human/index.htm>. These RBCs are considered acceptable for specific land use and contaminant exposure scenarios as they have been developed by governments using risk assessment techniques for use as general targets in the site remediation. Separate PRGs have been developed or adopted for soil, sediment or groundwater, and often a distinction is made between land uses (as noted earlier) because of the need for more stringent guidelines for residential and agricultural versus commercial/industrial landuse. The RBC Tables contains Reference Doses (RfDs) and Cancer Slope Factors (CSFs) for about 400 chemicals. These toxicity factors have been combined with “standard” exposure scenarios to calculate RBCs—chemical concentrations corresponding to fixed levels of risk (i.e., a Hazard Quotient (HQ) of 1, or lifetime cancer risk of 1E-6, whichever occurs at a lower concentration) in water, air, fish tissue, and soil for individual chemical substances. The primary use of RBCs is for chemical screening during baseline risk assessment (see EPA Regional Guidance EPA/903/R-93-001, “Selecting Exposure Routes and Contaminants of Concern by Risk-Based Screening”). Additional useful soil quality guidelines can also be obtained from Lijzen et al. 2001.

risk reduction measures may need to be taken with, or without, more detailed risk assessment activities, as described below.

Interim Risk Management

Interim risk management actions should be implemented at any phase of the project life cycle if the presence of land contamination poses an “imminent hazard”, i.e., representing an immediate risk to human health and the environment if contamination were allowed to continue, even a short period of time. Examples of situations considered to involve imminent hazards include, but are not restricted to:

- Presence of an explosive atmosphere caused by contaminated land

- Accessible and excessive contamination for which short-term exposure and potency of contaminants could result in acute toxicity, irreversible long term effects, sensitization, or accumulation of persistent biocumulative and toxic substances

- Concentrations of pollutants at concentrations above the Risk Based Concentrations (RBCs⁶⁰) or drinking water standards in potable water at the point of abstraction

Appropriate risk reduction should be implemented as soon as practicable to remove the condition posing the imminent hazard.

Detailed Risk Assessment

As an alternative to complying with numerical standards or preliminary remediation goals, and depending on local regulatory requirements, a detailed site-specific, environmental risk assessment may be used to develop

strategies that yield acceptable health risks, while achieving low level contamination on-site. An assessment of contaminant risks needs to be considered in the context of current and future land use, and development scenarios (e.g., residential, commercial, industrial, and urban parkland or wilderness use).

A detailed quantitative risk assessment builds on risk screening (problem formulation). It involves first, a detailed site investigation to identify the scope of contamination.⁶¹ Site investigation programs should apply quality assurance/quality control (QA/QC) measures to ensure that data quality is adequate for the intended data use (e.g., method detection limits are below levels of concern). The site investigation in turn should be used to develop a *conceptual site model* of how and where contaminants exist, how they are transported, and where routes of exposure occur to organisms and humans. The risk factors and conceptual site model provide a framework for assessing contaminant risks.

Human or ecological risk assessments facilitate risk management decisions at contaminated sites. Specific risk assessment objectives include:

- Identifying relevant human and ecological receptors (e.g., children, adults, fish, wildlife)

- Determining if contaminants are present at levels that pose potential human health and/or ecological concerns (e.g., levels above applicable regulatory criteria based on health or environmental risk considerations)

- Determining how human or ecological receptors are exposed to the contaminants (e.g., ingestions of soil, dermal contact, inhalation of dust)

⁶⁰ For example, USEPA Region 3 Risk-Based Concentrations (RBCs). <http://www.epa.gov/reg3hwmd/risk/human/index.htm>.

⁶¹ Examples include processes defined by the American Society of Testing and Materials (ASTM) Phase II ESA Process; the British Columbia Ministry of Environment Canada (BC MOE) http://www.env.gov.bc.ca/epd/epdpa/contam_sites/guidance; and the Massachusetts Department of Environment <http://www.mass.gov/dep/cleanup>.

Identifying the types of adverse effects that might result from exposure to the contaminants (e.g., effect on target organ, cancer, impaired growth or reproduction) in the absence of regulatory standards

Quantifying the magnitude of health risks to human and ecological receptors based on a quantitative analysis of contaminant exposure and toxicity (e.g. calculate lifetime cancer risk or ratios of estimated exposure rates compared to safe exposure rates)

Determining how current and proposed future land use influence the predicted risks (e.g. change of land use from industrial to residential with more sensitive receptors such as children)

Quantifying the potential environmental and/or human health risks from off-site contaminant migration (e.g., consider if leaching and groundwater transport, or surface water transport results in exposure at adjacent lands/receptors)

Determining if the risk is likely to remain stable, increase, or decrease with time in the absence of any remediation (e.g., consider if the contaminant is reasonably degradable and likely to remain in place, or be transported to other media)⁶²

Addressing these objectives provides a basis to develop and implement risk reduction measures (e.g., clean-up, on-site controls) at the site. If such a need exists, the following additional objectives become relevant:

Determining where, and in what conceptual manner, risk reduction measures should be implemented

Identifying the preferred technologies (including engineering controls) needed to implement the conceptual risk reduction measures

Developing a monitoring plan to ascertain whether risk reduction measures are effective

Considering the need and appropriateness for institutional controls (e.g. deed restriction, land use restrictions) as part of a comprehensive approach

Permanent Risk Reduction Measures The *risk factors* and *conceptual site model* within the contaminant risk approach described also provide a basis to manage and mitigate environmental contaminant health risks. The underlying principle is to reduce, eliminate, or control any or all of the three risk factors illustrated in Figure 1.8.1. A short list of examples of risk mitigation strategies is provided below, although actual strategies should be developed based on site- specific conditions, and the practicality of prevailing factors and site constraints. Regardless of the management options selected, the action plan should include, whenever possible, *contaminant source reduction* (i.e., net improvement of the site) as part of the overall strategy towards managing health risks at contaminated sites, as this alone provides for improved environmental quality.

Figure 1.8.2 presents a schematic of the inter-relationship of risk factors and example strategies to mitigate contaminant health risk by modifying the conditions of one or more risk factors to ultimately reduce contaminant exposure to the receptor. The selected approach should take into consideration the technical and financial feasibility (e.g. operability of a selected technology given the local availability of technical expertise and equipment and its associated costs).

Example risk mitigation strategies for contaminant source and exposure concentrations include:

⁶² An example of a simplified quantitative risk assessment method is the ASTM E1739-95(2002) Standard Guide for Risk-Based Corrective Action Applied at Petroleum Release Sites and the ASTM E2081-00(2004)e1 Standard Guide for Risk-Based Corrective Action (at chemical release sites).

Soil, sediment, and sludge:

- In situ biological treatment (aerobic or anaerobic)
- In situ physical/chemical treatment (e.g., soil vapor extraction with off-gas treatment, chemical oxidation)
- In situ thermal treatment (e.g., steam injection, 6-phase heating)
- Ex situ biological treatment (e.g., excavation and composting)
- Ex situ physical/chemical treatment (e.g., excavation and stabilization)
- Ex situ thermal treatment (e.g., excavation and thermal desorption or incineration)
- Containment (e.g. landfill)
- Natural attenuation
- Other treatment processes

Groundwater, surface water, and leachate:

- In situ biological treatment (aerobic and/or aerobic)
- In situ physical/chemical treatment (e.g., air sparging, zero-valent iron permeable reactive barrier)
- Ex situ biological, physical, and or chemical treatment (i.e., groundwater extraction and treatment)
- Containment (e.g., slurry wall or sheet pile barrier)
- Natural attenuation
- Other treatment processes

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

- Installation (during building construction) of an impermeable barrier below the building and/or an alternative flow pathway for soil vapor beneath building foundations (e.g., porous media and ventilation to shunt vapors away from building)

Example risk mitigation strategies for receptors include:

Limiting or preventing access to contaminant by receptors (actions targeted at the receptor may include signage with instructions, fencing, or site security)

Imposing health advisory or prohibiting certain practices leading to exposure such as fishing, crab trapping, shellfish collection

Educating receptors (people) to modify behavior in order to reduce exposure (e.g., improved work practices, and use of protective clothing and equipment)

Example risk mitigation strategies for exposure pathways include:

Providing an alternative water supply to replace, for example, a contaminated groundwater supply well

Capping contaminated soil with at least 1m of clean soil to prevent human contact, as well as plant root or small mammal penetration into contaminated soils

Paving over contaminated soil as an interim measure to negate the pathway of direct contact or dust generation and inhalation

Using an interception trench and pump, and treat technologies to prevent contaminated groundwater from discharging into fish streams

The above-reference containment measures should also be considered for immediate implementation in situations where source reduction measures are expected to take time.

Occupational Health and Safety Considerations

Investigation and remediation of contaminated lands requires that workers be mindful of the occupational exposures that could arise from working in close contact with contaminated soil or other environmental media (e.g., groundwater, wastewater, sediments, and soil vapor). Occupational health and safety precautions should be exercised to minimize exposure, as described in Section 2 on Occupational Health and Safety. In addition, workers on contaminated sites should receive special health and safety training specific to contaminated site investigation and remediation activities.⁶³

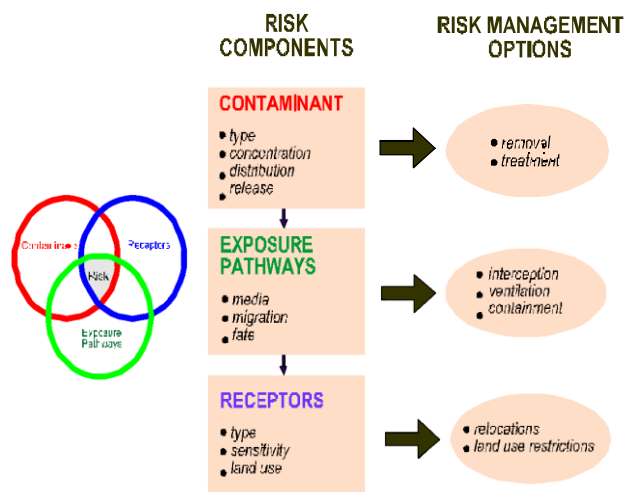


FIGURE 1.8.2: Inter-Relationship of Risk Factors and Management Options

⁶³ For example, US Occupational Safety and Health Agency (OSHA) regulations found at 40 CFR 1910.120. http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STAN DARDS&p_id=9765

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Applicability and Approach

Employers and supervisors are obliged to implement all reasonable precautions to protect the health and safety of workers. This section provides guidance and examples of reasonable precautions to implement in managing principal risks to occupational health and safety. Although the focus is placed on the operational phase of projects, much of the guidance also applies to construction and decommissioning activities. Companies should hire contractors that have the technical capability to manage the occupational health and safety issues of their employees, extending the application of the hazard management activities through formal procurement agreements.

Preventive and protective measures should be introduced according to the following order of priority:

Eliminating the hazard by removing the activity from the work process. Examples include substitution with less hazardous chemicals, using different manufacturing processes, etc;

Controlling the hazard at its source through use of engineering controls. Examples include local exhaust ventilation, isolation rooms, machine guarding, acoustic insulating, etc;

Minimizing the hazard through design of safe work systems and administrative or institutional control measures. Examples include job rotation, training safe work procedures, lock-out and tag-out, workplace monitoring, limiting exposure or work duration, etc.

Providing appropriate personal protective equipment (PPE) in conjunction with training, use, and maintenance of the PPE.

The application of prevention and control measures to occupational hazards should be based on comprehensive job

safety or job hazard analyses. The results of these analyses should be prioritized as part of an action plan based on the likelihood and severity of the consequence of exposure to the identified hazards. An example of a qualitative risk ranking or analysis matrix to help identify priorities is described in Table 2.1.1.

2.1 General Facility Design and Operation

Integrity of Workplace Structures

Permanent and recurrent places of work should be designed and equipped to protect OHS:

Surfaces, structures and installations should be easy to clean and maintain, and not allow for accumulation of hazardous compounds.

Buildings should be structurally safe, provide appropriate protection against the climate, and have acceptable light and noise conditions.

Fire resistant, noise-absorbing materials should, to the extent feasible, be used for cladding on ceilings and walls.

Floors should be level, even, and non-skid.

Heavy oscillating, rotating or alternating equipment should be located in dedicated buildings or structurally isolated sections.

Severe Weather and Facility Shutdown

Work place structures should be designed and constructed to withstand the expected elements for the region and have an area designated for safe refuge, if appropriate.

Standard Operating Procedures (SOPs) should be developed for project or process shut-down, including an evacuation plan. Drills to practice the procedure and plan should also be undertaken annually.

Table 2.1.1. Risk Ranking Table to Classify Worker Scenarios Based on Likelihood and Consequence

Likelihood	Consequences				
	Insignificant 1	Minor 2	Moderate 3	Major 4	Catas- trophic 5
A. Almost certain	L	M	E	E	E
B. Likely	L	M	H	E	E
C. Moderate	L	M	H	E	E
D. Unlikely	L	L	M	H	E
E. Rare	L	L	M	H	H

Legend
E: extreme risk; immediate action required
H: high risk; senior management attention needed
M: moderate risk; management responsibility should be specified
L: low risk; manage by routine procedures

Workspace and Exit

The space provided for each worker, and in total, should be adequate for safe execution of all activities, including transport and interim storage of materials and products. Passages to emergency exits should be unobstructed at all times. Exits should be clearly marked to be visible in total darkness. The number and capacity of emergency exits should be sufficient for safe and orderly evacuation of the greatest number of people present at any time, and there should be a minimum two exits from any work area.



Facilities also should be designed and built taking into account the needs of disabled persons.

Fire Precautions

The workplace should be designed to prevent the start of fires through the implementation of fire codes applicable to industrial settings. Other essential measures include:

Equipping facilities with fire detectors, alarm systems, and fire-fighting equipment. The equipment should be maintained in good working order and be readily accessible. It should be adequate for the dimensions and use of the premises, equipment installed, physical and chemical properties of substances present, and the maximum number of people present.

Provision of manual firefighting equipment that is easily accessible and simple to use

Fire and emergency alarm systems that are both audible and visible

The IFC Life and Fire Safety Guideline should apply to buildings accessible to the public (See Section 3.3).

Lavatories and Showers

Adequate lavatory facilities (toilets and washing areas) should be provided for the number of people expected to work in the facility and allowances made for segregated facilities, or for indicating whether the toilet facility is "In Use" or "Vacant". Toilet facilities should also be provided with adequate supplies of hot and cold running water, soap, and hand drying devices.

Where workers may be exposed to substances poisonous by ingestion and skin contamination may occur, facilities for showering and changing into and out of street and work clothes should be provided.

Potable Water Supply

Adequate supplies of potable drinking water should be provided from a fountain with an upward jet or with a sanitary means of collecting the water for the purposes of drinking. Water supplied to areas of food preparation or for the purpose of personal hygiene (washing or bathing) should meet drinking water quality standards.

Clean Eating Area

Where there is potential for exposure to substances poisonous by ingestion, suitable arrangements are to be made for provision of clean eating areas where workers are not exposed to the hazardous or noxious substances.

Lighting

Workplaces should, to the degree feasible, receive natural light and be supplemented with sufficient artificial illumination to promote workers' safety and health, and enable safe equipment operation. Supplemental 'task lighting' may be required where specific visual acuity requirements should be met.

Emergency lighting of adequate intensity should be installed and automatically activated upon failure of the principal artificial light source to ensure safe shut-down, evacuation, etc.

Safe Access

Passageways for pedestrians and vehicles within and outside buildings should be segregated and provide for easy, safe, and appropriate access.

Equipment and installations requiring servicing, inspection, and/or cleaning should have unobstructed, unrestricted, and ready access.

Hand, knee and foot railings should be installed on stairs, fixed ladders, platforms, permanent and interim floor openings, loading bays, ramps, etc.

Openings should be sealed by gates or removable chains
Covers should, if feasible, be installed to protect against falling items
Measures to prevent unauthorized access to dangerous areas should be in place

First Aid

The employer should ensure that qualified first-aid can be provided at all times. Appropriately equipped first-aid stations should be easily accessible throughout the place of work
Eye-wash stations and/or emergency showers should be provided close to all workstations where immediate flushing with water is the recommended first-aid response
Where the scale of work or the type of activity being carried out so requires, dedicated and appropriately equipped first-aid room(s) should be provided. First aid stations and rooms should be equipped with gloves, gowns, and masks for protection against direct contact with blood and other body fluids
Remote sites should have written emergency procedures in place for dealing with cases of trauma or serious illness up to the point at which patient care can be transferred to an appropriate medical facility.

Air Supply

Sufficient fresh air should be supplied for indoor and confined work spaces. Factors to be considered in ventilation design include physical activity, substances in use, and process-related emissions. Air distribution systems should be designed so as not to expose workers to draughts
Mechanical ventilation systems should be maintained in good working order. Point-source exhaust systems required for maintaining a safe ambient environment should have local indicators of correct functioning.
Re-circulation of contaminated air is not acceptable. Air inlet filters should be kept clean and free of dust and

microorganisms. Heating, ventilation and air conditioning (HVAC) and industrial evaporative cooling systems should be equipped, maintained and operated so as to prevent growth and spreading of disease agents (e.g. *Legionella pneumophila*) or breeding of vectors (e.g. mosquitoes and flies) of public health concern.

Work Environment Temperature

The temperature in work, rest room and other welfare facilities should, during service hours, be maintained at a level appropriate for the purpose of the facility.

2.2 Communication and Training

OHS Training

Provisions should be made to provide OHS orientation training to all new employees to ensure they are apprised of the basic site rules of work at / on the site and of personal protection and preventing injury to fellow employees.
Training should consist of basic hazard awareness, site-specific hazards, safe work practices, and emergency procedures for fire, evacuation, and natural disaster, as appropriate. Any site-specific hazard or color coding in use should be thoroughly reviewed as part of orientation training.

Visitor Orientation

If visitors to the site can gain access to areas where hazardous conditions or substances may be present, a visitor orientation and control program should be established to ensure visitors do not enter hazard areas unescorted.

New Task Employee and Contractor Training

The employer should ensure that workers and contractors, prior to commencement of new assignments, have received adequate training and information enabling them to

understand work hazards and to protect their health from hazardous ambient factors that may be present.

The training should adequately cover:

- Knowledge of materials, equipment, and tools
- Known hazards in the operations and how they are controlled
- Potential risks to health
- Precautions to prevent exposure
- Hygiene requirements
- Wearing and use of protective equipment and clothing
- Appropriate response to operation extremes, incidents and accidents

Basic OHS Training

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.

Workers with rescue and first-aid duties should receive dedicated training so as not to inadvertently aggravate exposures and health hazards to themselves or their co-workers. Training would include the risks of becoming infected with blood-borne pathogens through contact with bodily fluids and tissue.

Through appropriate contract specifications and monitoring, the employer should ensure that service providers, as well as contracted and subcontracted labor, are trained adequately before assignments begin.

Area Signage

Hazardous areas (electrical rooms, compressor rooms, etc), installations, materials, safety measures, and emergency exits, etc. should be marked appropriately.

Signage should be in accordance with international standards and be well known to, and easily understood by workers, visitors and the general public as appropriate.

Labeling of Equipment

All vessels that may contain substances that are hazardous as a result of chemical or toxicological properties, or temperature or pressure, should be labeled as to the contents and hazard, or appropriately color coded.

Similarly, piping systems that contain hazardous substances should be labeled with the direction of flow and contents of the pipe, or color coded whenever the pipe passing through a wall or floor is interrupted by a valve or junction device.

Communicate Hazard Codes

Copies of the hazard coding system should be posted outside the facility at emergency entrance doors and fire emergency connection systems where they are likely to come to the attention of emergency services personnel. Information regarding the types of hazardous materials stored, handled or used at the facility, including typical maximum inventories and storage locations, should be shared proactively with emergency services and security personnel to expedite emergency response when needed. Representatives of local emergency and security services should be invited to participate in periodic (annual) orientation tours and site inspections to ensure familiarity with potential hazards present.

2.3 Physical Hazards

Physical hazards represent potential for accident or injury or illness due to repetitive exposure to mechanical action or work activity. Single exposure to physical hazards may result in a wide range of injuries, from minor and medical aid only, to disabling, catastrophic, and/or fatal. Multiple exposures over prolonged

periods can result in disabling injuries of comparable significance and consequence.

Rotating and Moving Equipment

Injury or death can occur from being trapped, entangled, or struck by machinery parts due to unexpected starting of equipment or unobvious movement during operations. Recommended protective measures include:

Designing machines to eliminate trap hazards and ensuring that extremities are kept out of harm's way under normal operating conditions. Examples of proper design considerations include two-hand operated machines to prevent amputations or the availability of emergency stops dedicated to the machine and placed in strategic locations. Where a machine or equipment has an exposed moving part or exposed pinch point that may endanger the safety of any worker, the machine or equipment should be equipped with, and protected by, a guard or other device that prevents access to the moving part or pinch point. Guards should be designed and installed in conformance with appropriate machine safety standards.⁶⁴

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, in conformance with a standard such as CSA Z460 Lockout or equivalent ISO or ANSI standard

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

⁶⁴ For example: CSA Z432.04 Safe Guarding of Machinery, CSA Z434 Robot Safety, ISO 11161 Safety of Machinery – Integrated Manufacturing Systems or ISO 14121 Safety of Machinery – Principals of Risk Management or equivalent ANSI standard.

Noise

Noise limits for different working environments are provided in Table 2.3.1.

No employee should be exposed to a noise level greater than 85 dB(A) for a duration of more than 8 hours per day without hearing protection. In addition, no unprotected ear should be exposed to a peak sound pressure level (instantaneous) of more than 140 dB(C).

The use of hearing protection should be enforced actively when the equivalent sound level over 8 hours reaches 85 dB(A), the peak sound levels reach 140 dB(C), or the average maximum sound level reaches 110dB(A). Hearing protective devices provided should be capable of reducing sound levels at the ear to at least 85 dB(A).

Although hearing protection is preferred for any period of noise exposure in excess of 85 dB(A), an equivalent level of protection can be obtained, but less easily managed, by limiting the duration of noise exposure. For every 3 dB(A) increase in sound levels, the 'allowed' exposure period or duration should be reduced by 50 percent.⁶⁵

Prior to the issuance of hearing protective devices as the final control mechanism, use of acoustic insulating materials, isolation of the noise source, and other engineering controls should be investigated and implemented, where feasible. Periodic medical hearing checks should be performed on workers exposed to high noise levels

Vibration

Exposure to hand-arm vibration from equipment such as hand and power tools, or whole-body vibrations from surfaces on which the worker stands or sits, should be controlled through choice of equipment, installation of vibration dampening pads or devices, and limiting the duration of exposure. Limits for vibration and

⁶⁵ The American Conference of Governmental Industrial Hygienists (ACGIH), 2006

action values, (i.e. the level of exposure at which remediation should be initiated) are provided by the ACGIH⁶⁶. Exposure levels should be checked on the basis of daily exposure time and data provided by equipment manufacturers.

Electrical

Exposed or faulty electrical devices, such as circuit breakers,

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)

panels, cables, cords and hand tools, can pose a serious risk to workers. Overhead wires can be struck by metal devices, such as poles or ladders, and by vehicles with metal booms. Vehicles or grounded metal objects brought into close proximity with overhead wires can result in arcing between the wires and the object, without actual contact. Recommended actions include:

Marking all energized electrical devices and lines with warning signs

Locking out (de-charging and leaving open with a controlled locking device) and tagging-out (warning sign placed on the lock) devices during service or maintenance

Checking all electrical cords, cables, and hand power tools for frayed or exposed cords and following manufacturer recommendations for maximum permitted operating voltage of the portable hand tools

Double insulating / grounding all electrical equipment used in environments that are, or may become, wet; using equipment with ground fault interrupter (GFI) protected circuits

Protecting power cords and extension cords against damage from traffic by shielding or suspending above traffic areas
 Appropriate labeling of service rooms housing high voltage equipment ('electrical hazard') and where entry is controlled or prohibited (see also Section 3 on Planning, Siting, and Design);

Establishing "No Approach" zones around or under high voltage power lines in conformance with Table 2.3.2

Rubber tired construction or other vehicles that come into direct contact with, or arcing between, high voltage wires may need to be taken out of service for periods of 48 hours and have the tires replaced to prevent catastrophic tire and wheel assembly failure, potentially causing serious injury or death;

Conducting detailed identification and marking of all buried electrical wiring prior to any excavation work

⁶⁶ ACGIH, 2005

Table 2.3.2. No Approach Zones for High Voltage Power Lines	
Nominal phase-to-phase voltage rating	Minimum distance
750 or more volts, but no more than 150,000 volts	3 meters
More than 150,000 volts, but no more than 250,000 volts	4.5 meters
More than 250,000 volts	6 meters

Eye Hazards

Solid particles from a wide variety of industrial operations, and / or a liquid chemical spray may strike a worker in the eye causing an eye injury or permanent blindness. Recommended measures include:

Use of machine guards or splash shields and/or face and eye protection devices, such as safety glasses with side shields, goggles, and/or a full face shield. Specific Safe Operating Procedures (SOPs) may be required for use of sanding and grinding tools and/or when working around liquid chemicals. Frequent checks of these types of equipment prior to use to ensure mechanical integrity is also good practice. Machine and equipment guarding should conform to standards published by organizations such as CSA, ANSI and ISO (see also Section 2.3 on Rotating and Moving Equipment and 2.7 on Personal Protective Equipment).

Moving areas where the discharge of solid fragments, liquid, or gaseous emissions can reasonably be predicted (e.g. discharge of sparks from a metal cutting station, pressure relief valve discharge) away from places expected to be occupied or transited by workers or visitors. Where machine or work fragments could present a hazard to transient workers or passers-by, extra area guarding or proximity restricting systems should be implemented, or PPE required for transients and visitors.

Provisions should be made for persons who have to wear prescription glasses either through the use overglasses or prescription hardened glasses.

Welding / Hot Work

Welding creates an extremely bright and intense light that may seriously 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. Additional methods may include the use of welding barrier screens around the specific work station (a solid piece of light metal, canvas, or plywood designed to block welding light from others). Devices to extract and remove noxious fumes at the source may also be required.

Special hot work and fire prevention precautions and Standard Operating Procedures (SOPs) should be implemented if welding or hot cutting is undertaken outside established welding work stations, including 'Hot Work Permits, stand-by fire extinguishers, stand-by fire watch, and maintaining the fire watch for up to one hour after welding or hot cutting has terminated. Special procedures are required for hotwork on tanks or vessels that have contained flammable materials.

Industrial Vehicle Driving and Site Traffic

Poorly trained or inexperienced industrial vehicle drivers have increased risk of accident with other vehicles, pedestrians, and equipment. Industrial vehicles and delivery vehicles, as well as private vehicles on-site, also represent potential collision scenarios. Industrial vehicle driving and site traffic safety practices include:

Training and licensing industrial vehicle operators in the safe operation of specialized vehicles such as forklifts, including safe loading/unloading, load limits

Ensuring drivers undergo medical surveillance

Ensuring moving equipment with restricted rear visibility is outfitted with audible back-up alarms

Establishing rights-of-way, site speed limits, vehicle inspection requirements, operating rules and procedures (e.g. prohibiting operation of forklifts with forks in down position), and control of traffic patterns or direction

Restricting the circulation of delivery and private vehicles to defined routes and areas, giving preference to 'one-way' circulation, where appropriate

Working Environment Temperature

Exposure to hot or cold working conditions in indoor or outdoor environments can result temperature stress-related injury or death. Use of personal protective equipment (PPE) to protect against other occupational hazards can accentuate and aggravate heat-related illnesses. Extreme temperatures in permanent work environments should be avoided through implementation of engineering controls and ventilation. Where this is not possible, such as during short-term outdoor work, temperature-related stress management procedures should be implemented which include:

Monitoring weather forecasts for outdoor work to provide advance warning of extreme weather and scheduling work accordingly

Adjustment of work and rest periods according to temperature stress management procedures provided by ACGIH⁶⁷, depending on the temperature and workloads

Providing temporary shelters to protect against the elements during working activities or for use as rest areas

Use of protective clothing

Providing easy access to adequate hydration such as drinking water or electrolyte drinks, and avoiding consumption of alcoholic beverages

Ergonomics, Repetitive Motion, Manual Handling

Injuries due to ergonomic factors, such as repetitive motion, 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. Controls may include:

Facility and workstation design with 5th to 95th percentile operational and maintenance workers in mind

Use of mechanical assists to eliminate or reduce exertions required to lift materials, hold tools and work objects, and requiring multi-person lifts if weights exceed thresholds

Selecting and designing tools that reduce force requirements and holding times, and improve postures

Providing user adjustable work stations

Incorporating rest and stretch breaks into work processes, and conducting job rotation

Implementing quality control and maintenance programs that reduce unnecessary forces and exertions

Taking into consideration additional special conditions such as left handed persons

Working at Heights

Fall prevention and protection measures should be implemented whenever a worker is exposed to the hazard of falling more than two meters; into operating machinery; into water or other liquid; into hazardous substances; or through an opening in a work surface. Fall prevention / protection measures may also be warranted on a case-specific basis when there are risks of falling from lesser heights. Fall prevention may include:

⁶⁷ ACGIH, 2005

Installation of guardrails with mid-rails and toe boards at the edge of any fall hazard area

Proper use of ladders and scaffolds by trained employees Use of fall prevention devices, including safety belt and lanyard travel limiting devices to prevent access to fall hazard area, or fall protection devices such as full body harnesses used in conjunction with shock absorbing lanyards or self- retracting inertial fall arrest devices attached to fixed anchor point or horizontal life-lines

Appropriate training in use, serviceability, and integrity of the necessary PPE

Inclusion of rescue and/or recovery plans, and equipment to respond to workers after an arrested fall

Illumination

Work area light intensity should be adequate for the general purpose of the location and type of activity, and should be

Table 2.3.3. 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

supplemented with dedicated work station illumination, as needed.

The minimum limits for illumination intensity for a range of locations/activities appear in Table 2.3.3.

Controls should include:

- Use of energy efficient light sources with minimum heat emission

- Undertaking measures to eliminate glare / reflections and flickering of lights

- Taking precautions to minimize and control optical radiation including direct sunlight. Exposure to high intensity UV and IR radiation and high intensity visible light should also be controlled

- Controlling laser hazards in accordance with equipment specifications, certifications, and recognized safety standards. The lowest feasible class Laser should be applied to minimize risks.

2.4 Chemical Hazards

Chemical hazards represent potential for illness or injury due to single acute exposure or chronic repetitive exposure to toxic, corrosive, sensitizing or oxidative substances. They also represent a risk of uncontrolled reaction, including the risk of fire and explosion, if incompatible chemicals are inadvertently mixed. Chemical hazards can most effectively be prevented through a hierarchical approach that includes:

- Replacement of the hazardous substance with a less hazardous substitute

- Implementation of engineering and administrative control measures to avoid or minimize the release of hazardous substances into the work environment keeping the level of exposure below internationally established or recognized limits

- Keeping the number of employees exposed, or likely to become exposed, to a minimum

Communicating chemical hazards to workers through labeling and marking according to national and internationally recognized requirements and standards, including the International Chemical Safety Cards (ICSC), Materials Safety Data Sheets (MSDS), or equivalent. Any means of written communication should be in an easily understood language and be readily available to exposed workers and first-aid personnel

Training workers in the use of the available information (such as MSDSs), safe work practices, and appropriate use of PPE

Air Quality

Poor air quality due to the release of contaminants into the work place can result in possible respiratory irritation, discomfort, or illness to workers. Employers should take appropriate measures to maintain air quality in the work area. These include:

Maintaining levels of contaminant dusts, vapors and gases in the work environment at concentrations below those recommended by the ACGIH⁶⁸ as TWA-TLV's (threshold limit value)—concentrations to which most workers can be exposed repeatedly (8 hours/day, 40 hrs/week, week-after-week), without sustaining adverse health effects.

Developing and implementing work practices to minimize release of contaminants into the work environment including:

- Direct piping of liquid and gaseous materials
- Minimized handling of dry powdered materials;
- Enclosed operations
- Local exhaust ventilation at emission / release points
- Vacuum transfer of dry material rather than mechanical or pneumatic conveyance
- Indoor secure storage, and sealed containers rather than loose storage

Where ambient air contains several materials that have similar effects on the same body organs (additive effects), taking into account combined exposures using calculations recommended by the ACGIH⁶⁹

Where work shifts extend beyond eight (8) hours, calculating adjusted workplace exposure criteria recommended by the ACGIH⁷⁰

Fire and Explosions

Fires and or explosions resulting from ignition of flammable materials or gases can lead to loss of property as well as possible injury or fatalities to project workers. Prevention and control strategies include:

Storing flammables away from ignition sources and oxidizing materials. Further, flammables storage area should be:

- Remote from entry and exit points into buildings
- Away from facility ventilation intakes or vents
- Have natural or passive floor and ceiling level ventilation and explosion venting
- Use spark-proof fixtures
- Be equipped with fire extinguishing devices and self-closing doors, and constructed of materials made to withstand flame impingement for a moderate period of time

Providing bonding and grounding of, and between, containers and additional mechanical floor level ventilation if materials are being, or could be, dispensed in the storage area

Where the flammable material is mainly comprised of dust, providing electrical grounding, spark detection, and, if needed, quenching systems

⁶⁸ ACGIH, 2005

⁶⁹ ACGIH, 2005.

⁷⁰ ACGIH, 2005.

Defining and labeling fire hazards areas to warn of special rules (e.g. prohibition in use of smoking materials, cellular phones, or other potential spark generating equipment)
Providing specific worker training in handling of flammable materials, and in fire prevention or suppression

Corrosive, oxidizing, and reactive chemicals

Corrosive, oxidizing, and reactive chemicals present similar hazards and require similar control measures as flammable materials. However, the added hazard of these chemicals is that inadvertent mixing or intermixing may cause serious adverse reactions. This can lead to the release of flammable or toxic materials and gases, and may lead directly to fires and explosions. These types of substances have the additional hazard of causing significant personal injury upon direct contact, regardless of any intermixing issues. The following controls should be observed in the work environment when handling such chemicals:

Corrosive, oxidizing and reactive chemicals should be segregated from flammable materials and from other chemicals of incompatible class (acids vs. bases, oxidizers vs. reducers, water sensitive vs. water based, etc.), stored in ventilated areas and in containers with appropriate secondary containment to minimize intermixing during spills. Workers who are required to handle corrosive, oxidizing, or reactive chemicals should be provided with specialized training and provided with, and wear, appropriate PPE (gloves, apron, splash suits, face shield or goggles, etc). Where corrosive, oxidizing, or reactive chemicals are used, handled, or stored, qualified first-aid should be ensured at all times. Appropriately equipped first-aid stations should be easily accessible throughout the place of work, and eye-wash stations and/or emergency showers should be provided close to all workstations where the recommended first-aid response is immediate flushing with water

Asbestos Containing Materials (ACM)

The use of asbestos containing materials (ACM) should be avoided in new buildings or as a new material in remodeling or renovation activities. Existing facilities with ACM should develop an asbestos management plan which clearly identifies the locations where the ACM is present, its condition (e.g. whether it is in friable form with the potential to release fibers), procedures for monitoring its condition, procedures to access the locations where ACM is present to avoid damage, and training of staff who can potentially come into contact with the material to avoid damage and prevent exposure. The plan should be made available to all persons involved in operations and maintenance activities. Repair or removal and disposal of existing ACM in buildings should only be performed by specially trained personnel⁷¹ following host country requirements, or in their absence, internationally recognized procedures.⁷²

2.5 Biological Hazards

Biological agents represent potential for illness or injury due to single acute exposure or chronic repetitive exposure. Biological hazards can be prevented most effectively by implementing the following measures:

If the nature of the activity permits, use of any harmful biological agents should be avoided and replaced with an agent that, under normal conditions of use, is not dangerous or less dangerous to workers. If use of harmful agents can not be avoided, precautions should be taken to keep the risk of exposure as low as possible and maintained below internationally established and recognized exposure limits.

⁷¹ Training of specialized personnel and the maintenance and removal methods applied should be equivalent to those required under applicable regulations in the United States and Europe (examples of North American training standards are available at: <http://www.osha.gov/SLTC/asbestos/training.html>)

⁷² Examples include the American Society for Testing and Materials (ASTM) E 1368 - Standard Practice for Visual Inspection of Asbestos Abatement Projects; E 2356 - Standard Practice for Comprehensive Building Asbestos Surveys; and E 2394 - Standard Practice for Maintenance, Renovation and Repair of Installed Asbestos Cement Products.

Work processes, engineering, and administrative controls should be designed, maintained, and operated to avoid or minimize release of biological agents into the working environment. The number of employees exposed or likely to become exposed should be kept at a minimum.

The employer should review and assess known and suspected presence of biological agents at the place of work and implement appropriate safety measures, monitoring, training, and training verification programs.

Measures to eliminate and control hazards from known and suspected biological agents at the place of work should be designed, implemented and maintained in close co-operation with the local health authorities and according to recognized international standards.

Biological agents should be classified into four groups⁷³:

Group 1: Biological agents unlikely to cause human disease, and consequently only require controls similar to those required for hazardous or reactive chemical substances;

Group 2: Biological agents that can cause human disease and are thereby likely to require additional controls, but are unlikely to spread to the community;

Group 3: Biological agents that can cause severe human disease, present a serious hazard to workers, and may present a risk of spreading to the community, for which there usually is effective prophylaxis or treatment available and are thereby likely to require extensive additional controls;

Group 4: Biological agents that can cause severe human disease, are a serious hazard to workers, and present a high risk of spreading to the community, for which there is usually no effective prophylaxis or treatment available and are thereby likely to require very extensive additional controls.

The employer should at all times encourage and enforce the highest level of hygiene and personal protection, especially for activities employing biological agents of Groups 3 and 4 above. Work involving agents in Groups 3 and 4 should be restricted only to those persons who have received specific verifiable training in working with and controlling such materials.

Areas used for the handling of Groups 3 and 4 biological agents should be designed to enable their full segregation and isolation in emergency circumstances, include independent ventilation systems, and be subject to SOPs requiring routine disinfection and sterilization of the work surfaces.

HVAC systems serving areas handling Groups 3 and 4 biological agents should be equipped with High Efficiency Particulate Air (HEPA) filtration systems. Equipment should readily enable their disinfection and sterilization, and maintained and operated so as to prevent growth and spreading of disease agents, amplification of the biological agents, or breeding of vectors e.g. mosquitoes and flies of public health concern.

⁷³ World Health Organization (WHO) Classification of Infective Microorganisms by Risk Group (2004).

2.6 Radiological Hazards

Radiation exposure can lead to potential discomfort, injury or serious illness to workers. Prevention and control strategies include:

Places of work involving occupational and/or natural exposure to ionizing radiation should be established and operated in accordance with recognized international safety standards and guidelines.⁷⁴ The acceptable effective dose limits appear Table 2.6.1.

Exposure to non-ionizing radiation (including static magnetic fields; sub-radio frequency magnetic fields; static electric fields; radio frequency and microwave radiation; light and near-infrared radiation; and ultraviolet radiation) should be controlled to internationally recommended limits⁷⁵.

Table 2.6.1. Acceptable Effective Dose Limits for Workplace Radiological Hazards

Exposure	Workers (min.19 years of age)	Apprentices and students (16-18 years of age)
Five consecutive year average – effective dose	20 mSv/year	
Single year exposure – effective dose	50 mSv/year	6 mSv/year
Equivalent dose to the lens of the eye	150 mSv/year	50 mSv/year
Equivalent dose to the extremities (hands, feet) or the skin	500 mSv/year	150 mSv/year

⁷⁴ International Basic Safety Standard for protection against Ionizing Radiation and for the Safety of Radiation Sources and its three interrelated Safety Guides.

IAEA. <http://www-ns.iaea.org/standards/documents/default.asp?sub=160>

⁷⁵ For example ACGIH (2005) and International Commission for Non-Ionizing Radiation (ICNIRP).

In the case of both ionizing and non-ionizing radiation, the preferred method for controlling exposure is shielding and limiting the radiation source. Personal protective equipment is supplemental only or for emergency use. Personal protective equipment for near-infrared, visible and ultraviolet range radiation can include appropriate sun block creams, with or without appropriate screening clothing.

2.7 Personal Protective Equipment (PPE)

Personal Protective Equipment (PPE) provides additional protection to workers exposed to workplace hazards in conjunction with other facility controls and safety systems.

PPE is considered to be a last resort that is above and beyond the other facility controls and provides the worker with an extra level of personal protection. Table 2.7.1 presents general examples of occupational hazards and types of PPE available for different purposes. Recommended measures for use of PPE in the workplace include:

Active use of PPE if alternative technologies, work plans or procedures cannot eliminate, or sufficiently reduce, a hazard or exposure

Identification and provision of appropriate PPE that offers adequate protection to the worker, co-workers, and occasional visitors, without incurring unnecessary inconvenience to the individual

Proper maintenance of PPE, including cleaning when dirty and replacement when damaged or worn out. Proper use of PPE should be part of the recurrent training programs for employees

Selection of PPE should be based on the hazard and risk ranking described earlier in this section, and selected according to criteria on performance and testing established

by recognized organizations⁷⁶.

2.8 Special Hazard Environments

Special hazard environments are work situations where all of the previously described hazards may exist under unique or especially hazardous circumstances. Accordingly, extra precautions or rigor in application of precautions is required.

Confined Space

A confined space is defined as a wholly or partially enclosed space not designed or intended for human occupancy and in which a hazardous atmosphere could develop as a result of the contents, location or construction of the confined space or due to work done in or around the confined space. A “permit-required” confined space is one that also contains physical or atmospheric hazards that could trap or engulf the person.⁷⁷

Confined spaces can occur in enclosed or open structures or locations. Serious injury or fatality can result from inadequate preparation to enter a confined space or in attempting a rescue from a confined space. Recommended management approaches include:

Engineering measures should be implemented to eliminate, to the degree feasible, the existence and adverse character of confined spaces.

Permit-required confined spaces should be provided with permanent safety measures for venting, monitoring, and rescue operations, to the extent possible. The area adjoining an access to a confined space should provide ample room for emergency and rescue operations.

Table 2.7.1. 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.

⁷⁶ Examples include the American National Standards Institute (ANSI), <http://www.ansi.org/>; National Institute for Occupational Safety and Health⁷⁶ (NIOSH), <http://www.cdc.gov/niosh/homepage.html>; Canadian Standards Association⁷⁶ (CSA), <http://www.csa.ca/Default.asp?language=english>; Mine Safety and Health Administration⁷⁶ (MSHA), <http://www.msha.gov>.

⁷⁷ US OSHA CFR 1910.146

Access hatches should accommodate 90% of the worker population with adjustments for tools and protective clothing. The most current ISO and EN standards should be consulted for design specifications;

Prior to entry into a permit-required confined space:

- 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 19.5 percent and 23 percent, and that the presence of any flammable gas or vapor does not exceed 25 percent of its respective Lower Explosive Limit (LEL).
- If the atmospheric conditions are not met, the confined space should be ventilated until the target safe atmosphere is achieved, or entry is only to be undertaken with appropriate and additional PPE.

Safety precautions should include Self Contained Breathing Apparatus (SCBA), life lines, and safety watch workers stationed outside the confined space, with rescue and first aid equipment readily available.

Before workers are required to enter a permit-required confined space, adequate and appropriate training in confined space hazard control, atmospheric testing, use of the necessary PPE, as well as the serviceability and integrity of the PPE should be verified. Further, adequate and appropriate rescue and / or recovery plans and equipment should be in place before the worker enters the confined space.

Lone and Isolated Workers

A lone and isolated worker is a worker out of verbal and line of sight communication with a supervisor, other workers, or other

persons capable of providing aid and assistance, for continuous periods exceeding one hour. The worker is therefore at increased risk should an accident or injury occur.

Where workers may be required to perform work under lone or isolated circumstances, Standard Operating Procedures (SOPs) should be developed and implemented to ensure all PPE and safety measures are in place before the worker starts work. SOPs should establish, at a minimum, verbal contact with the worker at least once every hour, and ensure the worker has a capability for summoning emergency aid. If the worker is potentially exposed to highly toxic or corrosive chemicals, emergency eye-wash and shower facilities should be equipped with audible and visible alarms to summon aid whenever the eye-wash or shower is activated by the worker and without intervention by the worker.

2.9 Monitoring

Occupational health and safety monitoring programs should verify the effectiveness of prevention and control strategies. The selected indicators should be representative of the most significant occupational, health, and safety hazards, and the implementation of prevention and control strategies. The occupational health and safety monitoring program should include:

Safety inspection, testing and calibration: This should include regular inspection and testing of all safety features and hazard control measures focusing on engineering and personal protective features, work procedures, places of work, installations, equipment, and tools used. The inspection should verify that issued PPE continues to provide adequate protection and is being worn as required. All instruments installed or used for monitoring and recording of working environment parameters should be regularly tested and calibrated, and the respective records maintained.

Surveillance of the working environment: Employers should document compliance using an appropriate combination of

portable and stationary sampling and monitoring instruments. Monitoring and analyses should be conducted according to internationally recognized methods and standards. Monitoring methodology, locations, frequencies, and parameters should be established individually for each project following a review of the hazards. Generally, monitoring should be performed during commissioning of facilities or equipment and at the end of the defect and liability period, and otherwise repeated according to the monitoring plan.

Surveillance of workers health: When extraordinary protective measures are required (for example, against biological agents Groups 3 and 4, and/or hazardous compounds), workers should be provided appropriate and relevant health surveillance prior to first exposure, and at regular intervals thereafter. The surveillance should, if deemed necessary, be continued after termination of the employment.

Training: Training activities for employees and visitors should be adequately monitored and documented (curriculum, duration, and participants). Emergency exercises, including fire drills, should be documented adequately. Service providers and contractors should be contractually required to submit to the employer adequate training documentation before start of their assignment.

Accidents and Diseases monitoring

The employer should establish procedures and systems for reporting and recording:

- 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
- Identify measures necessary to prevent a recurrence

Occupational accidents and diseases should, at a minimum, be classified according to Table 2.10.1. Distinction is made between fatal and non-fatal injuries. The two main categories are divided into three sub-categories according to time of death or duration of the incapacity to work. The total work hours during the specified reporting period should be reported to the appropriate regulatory agency.

Table 2.9.1. Occupational Accident Reporting		
a. Fatalities (number)	b. Non-fatal injuries (number) ⁷⁸	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

⁷⁸ The day on which an incident occurs is not included in b.2 and b.3.

3.0 Community Health and Safety

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This section complements the guidance provided in the preceding environmental and occupational health and safety sections, specifically addressing some aspects of project activities taking place outside of the traditional project boundaries, but nonetheless related to the project operations, as may be applicable on a project basis. These issues may arise at any stage of a project life cycle and can have an impact beyond the life of the project.

3.1 Water Quality and Availability

Groundwater and surface water represent essential sources of drinking and irrigation water in developing countries, particularly in rural areas where piped water supply may be limited or unavailable and where available resources are collected by the consumer with little or no treatment. Project activities involving wastewater discharges, water extraction, diversion or

impoundment should prevent adverse impacts to the quality and availability of groundwater and surface water resources.

Water Quality

Drinking water sources, whether public or private, should at all times be protected so that they meet or exceed applicable national acceptability standards or in their absence the current edition of WHO Guidelines for Drinking-Water Quality. Air emissions, wastewater effluents, oil and hazardous materials, and wastes should be managed according to the guidance provided in the respective sections of the General EHS Guidelines with the objective of protecting soil and water resources.

Where the project includes the delivery of water to the community or to users of facility infrastructure (such as hotel hosts and hospital patients), where water may be used for drinking, cooking, washing, and bathing, water quality should comply with national acceptability standards or in their absence the current edition of with WHO Drinking Water Guidelines. Water quality for more sensitive well-being-related demands such as water used in health care facilities or food production may require more stringent, industry-specific guidelines or standards, as applicable. Any dependency factors associated with the deliver of water to the local community should be planned for and managed to ensure the sustainability of the water supply by involving the community in its management to minimize the dependency in the long-term.

Water Availability

The potential effect of groundwater or surface water abstraction for project activities should be properly assessed through a combination of field testing and modeling techniques, accounting for seasonal variability and projected changes in demand in the project area.

Project activities should not compromise the availability of water for personal hygiene needs and should take account of potential future increases in demand. The overall target should be the availability of 100 liters per person per day although lower levels may be used to meet basic health requirements.⁷⁹ Water volume requirements for well-being-related demands such as water use in health care facilities may need to be higher.

3.2 Structural Safety of Project Infrastructure

Hazards posed to the public while accessing project facilities may include:

- Physical trauma associated with failure of building structures
- Burns and smoke inhalation from fires
- Injuries suffered as a consequence of falls or contact with heavy equipment
- Respiratory distress from dust, fumes, or noxious odors
- Exposure to hazardous materials

Reduction of potential hazards is best accomplished during the design phase when the structural design, layout and site modifications can be adapted more easily. The following issues should be considered and incorporated as appropriate into the planning, siting, and design phases of a project:

- Inclusion of buffer strips or other methods of physical separation around project sites to protect the public from major hazards associated with hazardous materials incidents or process failure, as well as nuisance issues related to noise, odors, or other emissions
- Incorporation of siting and safety engineering criteria to prevent failures due to natural risks posed by earthquakes, tsunamis, wind, flooding, landslides and fire. To this end, all

project structures should be designed in accordance with engineering and design criteria mandated by site-specific risks, including but not limited to seismic activity, slope stability, wind loading, and other dynamic loads

Application of locally regulated or internationally recognized building codes⁸⁰ to ensure structures are designed and constructed in accordance with sound architectural and engineering practice, including aspects of fire prevention and response

Engineers and architects responsible for designing and constructing facilities, building, plants and other structures should certify the applicability and appropriateness of the structural criteria employed.

International codes, such as those compiled by the International Code Council (ICC)⁸¹, are intended to regulate the design, construction, and maintenance of a built environment and contain detailed guidance on all aspects of building safety, encompassing methodology, best practices, and documenting compliance. Depending on the nature of a project, guidance provided in the ICC or comparable codes should be followed, as appropriate, with respect to:

- Existing structures
- Soils and foundations
- Site grading
- Structural design
- Specific requirements based on intended use and occupancy
- Accessibility and means of egress
- Types of construction
- Roof design and construction
- Fire-resistant construction
- Flood-resistant construction

⁷⁹ 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

⁸⁰ ILO-OSH, 2001. <http://www.ilo.org/public/english/protection/safework/cops/english/download/e000013.pdf>

⁸¹ ICC, 2006.

Construction materials
Interior environment
Mechanical, plumbing and electrical systems
Elevators and conveying systems
Fire safety systems
Safeguards during construction
Encroachments into public right-of-way

Although major design changes may not be feasible during the operation phase of a project, hazard analysis can be undertaken to identify opportunities to reduce the consequences of a failure or accident. Illustrative management actions, applicable to hazardous materials storage and use, include:

- Reducing inventories of hazardous materials through inventory management and process changes to greatly reduce or eliminate the potential off-site consequences of a release
- Modifying process or storage conditions to reduce the potential consequences of an accidental off-site release
- Improving shut-down and secondary containment to reduce the amount of material escaping from containment and to reduce the release duration
- Reducing the probability that releases will occur through improved site operations and control, and through improvements in maintenance and inspection
- Reducing off-site impacts of releases through measures intended to contain explosions and fires, alert the public, provide for evacuation of surrounding areas, establish safety zones around a site, and ensure the provision of emergency medical services to the public

3.3 Life and Fire Safety (L&FS)

Applicability and Approach

All new buildings accessible to the public should be designed, constructed, and operated in full compliance with local building

codes, local fire department regulations, local legal/insurance requirements, and in accordance with an internationally accepted life and fire safety (L&FS) standard. The Life Safety Code⁸², which provides extensive documentation on life and fire safety provisions, is one example of an internationally accepted standard and may be used to document compliance with the Life and Fire Safety objectives outlined in these guidelines. With regard to these objectives:

Project sponsors' architects and professional consulting engineers should demonstrate that affected buildings meet these life and fire safety objectives.

Life and fire safety systems and equipment should be designed and installed using appropriate prescriptive standards and/or performance based design, and sound engineering practices.

Life and fire safety design criteria for all existing buildings should incorporate all local building codes and fire department regulations.

These guidelines apply to buildings that are accessible to the public. Examples of such buildings include:

- Health and education facilities
- Hotels, convention centers, and leisure facilities
- Retail and commercial facilities
- Airports, other public transport terminals, transfer facilities

Specific Requirements for New Buildings

The nature and extent of life and fire safety systems required will depend on the building type, structure, construction, occupancy, and exposures. Sponsors should prepare a Life and Fire Safety Master Plan identifying major fire risks, applicable codes, standards and regulations, and mitigation measures. The Master

⁸² US NFPA.
<http://www.nfpa.org/catalog/product.asp?category%5Fname=&pid=10106&target%5Fpid=10106&src%5Fpid=&link%5Ftype=search>

Plan should be prepared by a suitably qualified professional, and adequately cover, but not be limited to, the issues addressed briefly in the following points. The suitably qualified professional selected to prepare the Master Plan is responsible for a detailed treatment of the following illustrative, and all other required, issues.

Fire Prevention

Fire prevention addresses the identification of fire risks and ignition sources, and measures needed to limit fast fire and smoke development. These issues include:

- Fuel load and control of combustibles
- Ignition sources
- Interior finish flame spread characteristics
- Interior finish smoke production characteristics
- Human acts, and housekeeping and maintenance

Means of Egress

Means of Egress includes all design measures that facilitate a safe evacuation by residents and/or occupants in case of fire or other emergency, such as:

- Clear, unimpeded escape routes
- Accessibility to the impaired/handicapped
- Marking and signing
- Emergency lighting

Detection and Alarm Systems

These systems encompass all measures, including communication and public address systems needed to detect a fire and alert:

- Building staff
- Emergency response teams
- Occupants
- Civil defense

Compartmentation

Compartmentation involves all measures to prevent or slow the spread of fire and smoke, including:

- Separations
- Fire walls
- Floors
- Doors
- Dampers
- Smoke control systems

Fire Suppression and Control

Fire suppression and control includes all automatic and manual fire protection installations, such as:

- Automatic sprinkler systems
- Manual portable extinguishers
- Fire hose reels

Emergency Response Plan

An Emergency Response Plan is a set of scenario-based procedures to assist staff and emergency response teams during real life emergency and training exercises. This chapter of the Fire and Life Safety Master Plan should include an assessment of local fire prevention and suppression capabilities.

Operation and Maintenance

Operation and Maintenance involves preparing schedules for mandatory regular maintenance and testing of life and fire safety features to ensure that mechanical, electrical, and civil structures and systems are at all times in conformance with life and fire safety design criteria and required operational readiness.

L&FS Master Plan Review and Approval

A suitably qualified professional prepares and submits a Life and Fire Safety (L&FS) Master Plan, including preliminary drawings and specifications, and certifies that the design

meets the requirements of these L&FS guidelines. The findings and recommendations of the review are then used to establish the conditions of a Corrective Action Plan and a time frame for implementing the changes.

The suitably qualified professional conducts a review as part of the project completion test at the time of life and fire safety systems testing and commissioning, and certifies that construction of these systems has been carried out in accordance with the accepted design. The findings and recommendations of the review are used as the basis for establishing project completion or to establish the conditions of a Pre-Completion Corrective Action Plan and a time frame for implementing the changes.

Specific Requirements for Existing Buildings

All life and fire safety guideline requirements for new buildings apply to existing buildings programmed for renovation. A suitably qualified professional conducts a complete life and fire safety review of existing buildings slated for renovation. The findings and recommendations of the review are used as the basis to establish the scope of work of a Corrective Action Plan and a time frame for implementing the changes.

If it becomes apparent that life and fire safety conditions are deficient in an existing building that is not part of the project or that has not been programmed for renovation, a life and fire safety review of the building may be conducted by a suitably qualified professional. The findings and recommendations of the review are used as the basis to establish the scope of work of a Corrective Action Plan and a time frame for implementing the changes.

Other Hazards

Facilities, buildings, plants, and structures should be situated to minimize potential risks from forces of nature (e.g.

earthquakes, tsunamis, floods, windstorms, and fires from surrounding areas).

All such structures should be designed in accordance with the criteria mandated by situation-, climatic-, and geology-specific location risks (e.g. seismic activity, wind loading, and other dynamic loads).

Structural engineers and architects responsible for facilities, buildings, plants and structures should certify the applicability and appropriateness of the design criteria employed.

National or regional building regulations typically contain fire safety codes and standards⁸³ or these standards are found in separate Fire Codes.^{84,85} Generally, such codes and regulations incorporate further compliance requirements with respect to methodology, practice, testing, and other codes and standards⁸⁶. Such nationally referenced material constitutes the acceptable fire life safety code.

3.4 Traffic Safety

Traffic accidents have become one of the most significant causes of injuries and fatalities among members of the public worldwide. Traffic safety should be promoted by all project personnel during displacement to and from the workplace, and during operation of project equipment on private or public roads. Prevention and control of traffic related injuries and fatalities should include the adoption of safety measures that are protective of project workers and of road users, including those who are most vulnerable to road traffic accidents⁸⁷. Road safety initiatives proportional to the scope and nature of project activities should include:

⁸³ For example, Australia, Canada, South Africa, United Kingdom

⁸⁴ Réglementation Incendie [des ERP]

⁸⁵ USA NFPA, 2006.

⁸⁶ 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)

⁸⁷ Additional information on vulnerable users of public roads in developing countries is provided by Peden et al., 2004.

Adoption of best transport safety practices across all aspects of project operations with the goal of preventing traffic accidents and minimizing injuries suffered by project personnel and the public. Measures should include:

- Emphasizing safety aspects among drivers
- Improving driving skills and requiring licensing of drivers
- Adopting limits for trip duration and arranging driver rosters to avoid overtiredness
- Avoiding dangerous routes and times of day to reduce the risk of accidents
- Use of speed control devices (governors) on trucks, and remote monitoring of driver actions

Regular maintenance of vehicles and use of manufacturer approved parts to minimize potentially serious accidents caused by equipment malfunction or premature failure.

Where the project may contribute to a significant increase in traffic along existing roads, or where road transport is a significant component of a project, recommended measures include:

Minimizing pedestrian interaction with construction vehicles
Collaboration with local communities and responsible authorities to improve signage, visibility and overall safety of roads, particularly along stretches located near schools or other locations where children may be present. Collaborating with local communities on education about traffic and pedestrian safety (e.g. school education campaigns)⁸⁸
Coordination with emergency responders to ensure that appropriate first aid is provided in the event of accidents
Using locally sourced materials, whenever possible, to minimize transport distances. Locating associated facilities such as worker camps close to project sites and arranging worker bus transport to minimizing external traffic

⁸⁸Additional sources of information for implementation of road safety measures is available at WHO, 1989, Ross et al., 1991, Tsunokawa and Hoban, 1997, and OECD, 1999

- Ensuring that the volume, nature, integrity and protection of packaging and containers used for

Employing safe traffic control measures, including road signs and flag persons to warn of dangerous conditions

3.5 Transport of Hazardous Materials

General Hazardous Materials Transport

Projects should have procedures in place that ensure compliance with local laws and international requirements applicable to the transport of hazardous materials, including:

- IATA requirements⁸⁹ for air transport
- IMDG Code⁹⁰ sea transport
- UN Model Regulations⁹¹ of other international standards as well as local requirements for land transport
- Host-country commitments under the Basel Convention on the Control of Transboundary Movements of Hazardous Waste and their disposal and Rotterdam Convention on the prior Inform Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade, if applicable to the project activities

The procedures for transportation of hazardous materials (Hazmats) should include:

- Proper labeling of containers, including the identify and 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. The shipping document should establish a chain-of-custody using multiple signed copies to show that the waste was properly shipped, transported and received by the recycling or treatment/disposal facility

⁸⁹ IATA, 2005. www.iata.org

⁹⁰ IMO. www.imo.org/safety

⁹¹ United Nations. Transport of Dangerous Goods - Model Regulations. 14th Revised Edition. Geneva 2005. http://www.unece.org/trans/danger/publi/unrec/rev14/14files_e.html

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

Major Transportation Hazards

Guidance related to major transportation hazards should be implemented in addition to measures presented in the preceding section for preventing or minimizing the consequences of catastrophic releases of hazardous materials, which may result in toxic, fire, explosion, or other hazards during transportation.

In addition to these aforementioned procedures, projects which transport hazardous materials *at or above the threshold quantities*⁹² should prepare a Hazardous Materials Transportation Plan containing all of the elements presented below⁹³.

Hazard Assessment

The hazard assessment should identify the potential hazard involved in the transportation of hazardous materials by reviewing:

The hazard characteristics of the substances identified during the screening stage

The history of accidents, both by the company and its contractors, involving hazardous materials transportation

⁹² Threshold quantities for the transport of hazardous materials are found in the UN – Transport of Dangerous Goods – Model Regulations cited above.

⁹³ For further information and guidance, please refer to International Finance Corporation (IFC) Hazardous Materials Transportation Manual. Washington, D.C. December 2000.

The existing criteria for the safe transportation of hazardous materials, including environmental management systems used by the company and its contractors

This review should cover the management actions, preventive measures and emergency response procedures described below. The hazard assessment helps to determine what additional measures may be required to complete the plan.

Management Actions

Management of Change: These procedures should address:

- The technical basis for changes in hazardous materials offered for transportation, routes and/or procedures
- The potential impact of changes on health and safety
- Modification required to operating procedures
- Authorization requirements
- Employees affected
- Training needs

Compliance Audit: A compliance audit evaluates compliance with prevention requirements for each transportation route or for each hazardous material, as appropriate. A compliance audit covering each element of the prevention measures (see below) should be conducted at least every three years. The audit program should include:

- Preparation of a report of the findings
- Determination and documentation of the appropriate response to each finding
- Documentation that any deficiency has been corrected.

Incident Investigation: Incidents can provide valuable information about transportation hazards and the steps needed to prevent accidental releases. The implementation of incident investigation procedures should ensure that:

- Investigations are initiated promptly
- Summaries of investigations are included in a report
- Report findings and recommendations are addressed

- Reports are reviewed with staff and contractors

Employee Participation: There should be a written plan of action regarding the implementation of active employee participation in the prevention of accidents.

Contractors: The plan should include procedures to ensure that:

- The contractor is provided with safety performance procedures and safety and hazard information
- Contractors observe safety practices
- Verify that the contractor acts responsibly

The plan should also include additional procedures to ensure the contractors will:

- Ensure appropriate training for their employees
- Ensure their employees know process hazards and applicable emergency actions
- Prepare and submit training records
- Inform employees about the hazards presented by their work

Training: Good training programs on operating procedures will provide the employees with the necessary information to understand how to operate safely and why safe operations are needed. The training program should include:

- The list of employees to be trained
- Specific training objectives
- Mechanisms to achieve objectives (i.e. hands-on workshops, videos, etc.)
- Means to determine the effectiveness of the training program
- Training procedures for new hires and refresher programs

Preventive Measures

The plan should include procedures to implement preventive measures specific to each hazardous material offered for transportation, including:

Classification and segregation of hazardous materials in warehouses and transport units

Packaging and packaging testing

Marking and labeling of packages containing hazardous materials

Handling and securing packages containing hazardous materials in transport units

Marking and placarding of transport units

Documentation (e.g. bills of lading)

Application of special provisions, as appropriate

Emergency Preparedness and Response

It is important to develop procedures and practices for the handling of hazardous materials that allow for quick and efficient responses to accidents that may result in injury or environmental damage. The sponsor should prepare an Emergency Preparedness and Response Plan that should cover:

Planning Coordination: This should include procedures for:

- 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 the employees are informed of such changes

Emergency Equipment: The plan should include procedures for using, inspecting, testing, and maintaining emergency response equipment.

Training: Employees should be trained in any relevant procedures

3.6 Disease Prevention

Communicable Diseases

Communicable diseases pose a significant public health threat worldwide. Health hazards typically associated with large development projects are those relating to poor sanitation and living conditions, sexual transmission and vector-borne infections. Communicable diseases of most concern during the construction phase due to labor mobility are sexually-transmitted diseases (STDs), such as HIV/AIDS. Recognizing that no single measure is likely to be effective in the long term, successful initiatives typically involve a combination of behavioral and environmental modifications.

Recommended interventions at the project level include⁹⁴:

Providing surveillance and active screening and treatment of workers

Preventing illness among workers in local communities by:

- Undertaking health awareness and education initiatives, for example, by implementing an information strategy to reinforce person-to-person counseling addressing systemic factors that can influence individual behavior as well as promoting individual protection, and protecting others from infection, by encouraging condom use
- Training health workers in disease treatment
- Conducting immunization programs for workers in local communities to improve health and guard against infection
- Providing health services

Providing treatment through standard case management in on-site or community health care facilities. Ensuring ready

access to medical treatment, confidentiality and appropriate care, particularly with respect to migrant workers

Promoting collaboration with local authorities to enhance access of workers families and the community to public health services and promote immunization

Vector-Borne Diseases

Reducing the impact of vector-borne disease on the long-term health of workers is best accomplished through implementation of diverse interventions aimed at eliminating the factors that lead to disease. Project sponsors, in close collaboration with community health authorities, can implement an integrated control strategy for mosquito and other arthropod-borne diseases that might involve:

Prevention of larval and adult propagation through sanitary improvements and elimination of breeding habitats close to human settlements

Elimination of unusable impounded water

Increase in water velocity in natural and artificial channels

Considering the application of residual insecticide to dormitory walls

Implementation of integrated vector control programs

Promoting use of repellents, clothing, netting, and other barriers to prevent insect bites

Use of chemoprophylaxis drugs by non-immune workers and collaborating with public health officials to help eradicate disease reservoirs

Monitoring and treatment of circulating and migrating populations to prevent disease reservoir spread

Collaboration and exchange of in-kind services with other control programs in the project area to maximize beneficial effects

Educating project personnel and area residents on risks, prevention, and available treatment

Monitoring communities during high-risk seasons to detect and treat cases

⁹⁴ Additional sources of information on disease prevention include IFC, 2006; UNDP, 2000, 2003; Walley et al., 2000; Kindhauser, 2003; Heymann, 2004.

Distributing appropriate education materials
Following safety guidelines for the storage, transport, and distribution of pesticides to minimize the potential for misuse, spills, and accidental human exposure

3.7 Emergency Preparedness and Response

An emergency is an unplanned event when a project operation loses control, or could lose control, of a situation that may result in risks to human health, property, or the environment, either within the facility or in the local community. Emergencies do not normally include safe work practices for frequent upsets or events that are covered by occupational health and safety.

All projects should have an Emergency Preparedness and Response Plan that is commensurate with the risks of the facility and that includes the following basic elements:

- Administration (policy, purpose, distribution, definitions, etc)
- Organization of emergency areas (command centers, medical stations, etc)
- Roles and responsibilities
- Communication systems
- Emergency response procedures
- Emergency resources
- Training and updating
- Checklists (role and action list and equipment checklist)
- Business Continuity and Contingency

Additional information is provided for key components of the emergency plan, as follows below.

Communication Systems

Worker notification and communication

Alarm bells, visual alarms, or other forms of communication should be used to reliably alert workers to an emergency. Related measures include:

Testing warning systems at least annually (fire alarms monthly), and more frequently if required by local regulations, equipment, or other considerations

Installing a back-up system for communications on-site with off-site resources, such as fire departments, in the event that normal communication methods may be inoperable during an emergency

Community Notification

If a local community may be at risk from a potential emergency arising at the facility, the company should implement communication measures to alert the community, such as:

- Audible alarms, such as fire bells or sirens
- Fan out telephone call lists
- Vehicle mounted speakers
- Communicating details of the nature of the emergency
- Communicating protection options (evacuation, quarantine)
- Providing advise on selecting an appropriate protection option

Media and Agency Relations

Emergency information should be communicated to the media through:

- A trained, local spokesperson able to interact with relevant stakeholders, and offer guidance to the company for speaking to the media, government, and other agencies
- Written press releases with accurate information, appropriate level of detail for the emergency, and for which accuracy can be guaranteed

Emergency Resources

Finance and Emergency Funds

A mechanism should be provided for funding emergency activities.

Fire Services

The company should consider the level of local fire fighting capacity and whether equipment is available for use at the facility in the event of a major emergency or natural disaster. If insufficient capacity is available, fire fighting capacity should be acquired that may include pumps, water supplies, trucks, and training for personnel.

Medical Services

The company should provide first aid attendants for the facility as well as medical equipment suitable for the personnel, type of operation, and the degree of treatment likely to be required prior to transportation to hospital.

Availability of Resources

Appropriate measures for managing the availability of resources in case of an emergency include:

Maintaining a list of external equipment, personnel, facilities, funding, expert knowledge, and materials that may be required to respond to emergencies. The list should include personnel with specialized expertise for spill clean-up, flood control, engineering, water treatment, environmental science, etc., or any of the functions required to adequately respond to the identified emergency

Providing personnel who can readily call up resources, as required

Tracking and managing the costs associated with emergency resources

Considering the quantity, response time, capability, limitations, and cost of these resources, for both site-specific emergencies, and community or regional emergencies
Considering if external resources are unable to provide sufficient capacity during a regional emergency and whether additional resources may need to be maintained on-site

Mutual Aid

Mutual aid agreements decrease administrative confusion and provide a clear basis for response by mutual aid providers.

Where appropriate, mutual aid agreements should be maintained with other organizations to allow for sharing of personnel and specialized equipment.

Contact List

The company should develop a list of contact information for all internal and external resources and personnel. The list should include the name, description, location, and contact details (telephone, email) for each of the resources, and be maintained annually.

Training and Updating

The emergency preparedness facilities and emergency response plans require maintenance, review, and updating to account for changes in equipment, personnel, and facilities. Training programs and practice exercises provide for testing systems to ensure an adequate level of emergency preparedness. Programs should:

Identify training needs based on the roles and responsibilities, capabilities and requirements of personnel in an emergency

Develop a training plan to address needs, particularly for fire fighting, spill response, and evacuation

Conduct annual training, at least, and perhaps more frequent training when the response includes specialized equipment, procedures, or hazards, or when otherwise mandated

Provide training exercises to allow personnel the opportunity to test emergency preparedness, including:

- Desk top exercises with only a few personnel, where the contact lists are tested and the facilities and communication assessed
- Response exercises, typically involving drills that allow for testing of equipment and logistics
- Debrief upon completion of a training exercise to assess what worked well and what aspects require improvement
- Update the plan, as required, after each exercise. Elements of the plan subject to significant change (such as contact lists) should be replaced
- Record training activities and the outcomes of the training

Business Continuity and Contingency

Measures to address business continuity and contingency include:

Identifying replacement supplies or facilities to allow business continuity following an emergency. For example, alternate sources of water, electricity, and fuel are commonly sought.

Using redundant or duplicate supply systems as part of facility operations to increase the likelihood of business continuity.

Maintaining back-ups of critical information in a secure location to expedite the return to normal operations following an emergency.

4.0 Construction and Decommissioning

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Applicability and Approach

This section provides additional, specific guidance on prevention and control of community health and safety impacts that may occur during new project development, at the end of the project life-cycle, or due to expansion or modification of existing project facilities. Cross referencing is made to various other sections of the General EHS Guidelines.

4.1 Environment Environment

Noise and Vibration

During construction and decommissioning activities, noise and vibration may be caused by the operation of pile drivers, earth moving and excavation equipment, concrete mixers, cranes and the transportation of equipment, materials and people. Some recommended noise reduction and control strategies to consider in areas close to community areas include:

Planning activities in consultation with local communities so that activities with the greatest potential to generate noise are

planned during periods of the day that will result in least disturbance

Using noise control devices, such as temporary noise barriers and deflectors for impact and blasting activities, and exhaust muffling devices for combustion engines.

Avoiding or minimizing project transportation through community areas

Soil Erosion

Soil erosion may be caused by exposure of soil surfaces to rain and wind during site clearing, earth moving, and excavation activities. The mobilization and transport of soil particles may, in turn, result in sedimentation of surface drainage networks, which may result in impacts to the quality of natural water systems and ultimately the biological systems that use these waters.

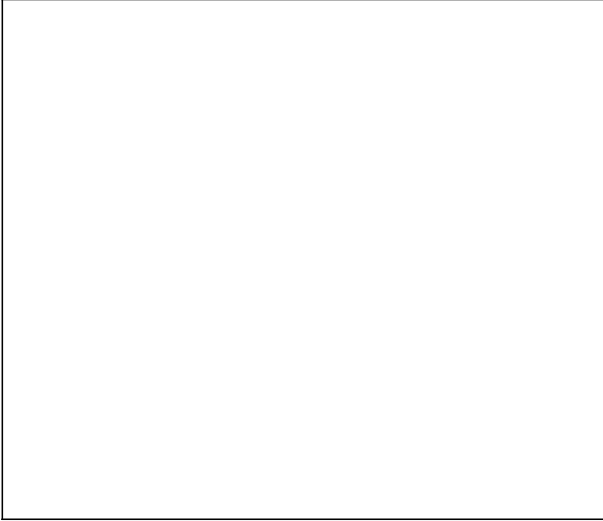
Recommended soil erosion and water system management approaches include:

Sediment mobilization and transport

Reducing or preventing erosion by:

- 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.





Clean runoff management

Segregating or diverting clean water runoff to prevent it mixing with water containing a high solids content, to minimize the volume of water to be treated prior to release

Road design

Limiting access road gradients to reduce runoff-induced erosion

Providing adequate road drainage based on road width, surface material, compaction, and maintenance

Disturbance to water bodies

Depending on the potential for adverse impacts, installing free-spanning structures (e.g., single span bridges) for road watercourse crossings

Restricting the duration and timing of in-stream activities to lower low periods, and avoiding periods critical to biological cycles of valued flora and fauna (e.g., migration, spawning, etc.)

For in-stream works, using isolation techniques such as berming or diversion during construction to limit the exposure of disturbed sediments to moving water

Consider using trenchless technology for pipeline crossings (e.g., suspended crossings) or installation by directional drilling

Structural (slope) stability

Providing effective short term measures for slope stabilization, sediment control and subsidence control until long term measures for the operational phase can be implemented

Providing adequate drainage systems to minimize and control infiltration

Air Quality

Construction and decommissioning activities may generate emission of fugitive dust caused by a combination of on-site excavation and movement of earth materials, contact of construction machinery with bare soil, and exposure of bare soil and soil piles to wind. A secondary source of emissions may include exhaust from diesel engines of earth moving equipment, as well as from open burning of solid waste on-site. Techniques to consider for the reduction and control of air emissions from construction and decommissioning sites include:

Minimizing dust from material handling sources, such as conveyors and bins, by using covers and/or control equipment (water suppression, bag house, or cyclone)

Minimizing dust from open area sources, including storage piles, by using control measures such as installing enclosures and covers, and increasing the moisture content
Dust suppression techniques should be implemented, such as applying water or non-toxic chemicals to minimize dust from vehicle movements

Selectively removing potential hazardous air pollutants, such as asbestos, from existing infrastructure prior to demolition

Managing emissions from mobile sources according to Section 1.1

Avoiding open burning of solid (refer to solid waste management guidance in Section 1.6)

Solid Waste

Non-hazardous solid waste generated at construction and decommissioning sites includes excess fill materials from grading and excavation activities, scrap wood and metals, and small concrete spills. Other non-hazardous solid wastes include office, kitchen, and dormitory wastes when these types of operations are part of construction project activities. *Hazardous solid waste* includes contaminated soils, which could potentially be encountered on-site due to previous land use activities, or small

amounts of machinery maintenance materials, such as oily rags, used oil filters, and used oil, as well as spill cleanup materials from oil and fuel spills. Techniques for preventing and controlling non-hazardous and hazardous construction site solid waste include those already discussed in Section 1.6.

Hazardous Materials

Construction and decommissioning activities may pose the potential for release of petroleum based products, such as lubricants, hydraulic fluids, or fuels during their storage, transfer, or use in equipment. These materials may also be encountered during decommissioning activities in building components or industrial process equipment. Techniques for prevention, minimization, and control of these impacts include:

- Providing adequate secondary containment for fuel storage tanks and for the temporary storage of other fluids such as lubricating oils and hydraulic fluids,

- Using impervious surfaces for refueling areas and other fluid transfer areas

- Training workers on the correct transfer and handling of fuels and chemicals and the response to spills

- Providing portable spill containment and cleanup equipment on site and training in the equipment deployment

- Assessing the contents of hazardous materials and petroleum-based products in building systems (e.g. PCB containing electrical equipment, asbestos-containing building materials) and process equipment and removing them prior to initiation of decommissioning activities, and managing their treatment and disposal according to Sections 1.5 and 1.6 on Hazardous Materials and Hazardous Waste Management, respectively

- Assessing the presence of hazardous substances in or on building materials (e.g., polychlorinated biphenyls, asbestos-containing flooring or insulation) and decontaminating or properly managing contaminated building materials

Wastewater Discharges

Construction and decommissioning activities may include the generation of sanitary wastewater discharges in varying quantities depending on the number of workers involved. Adequate portable or permanent sanitation facilities serving all workers should be provided at all construction sites. Sanitary wastewater in construction and other sites should be managed as described in Section 1.3.

Contaminated Land

Land contamination may be encountered in sites under construction or decommissioning due to known or unknown historical releases of hazardous materials or oil, or due to the presence of abandoned infrastructure formerly used to store or handle these materials, including underground storage tanks. Actions necessary to manage the risk from contaminated land will depend on factors such as the level and location of contamination, the type and risks of the contaminated media, and the intended land use. However, a basic management strategy should include:

- Managing contaminated media with the objective of protecting the safety and health of occupants of the site, the surrounding community, and the environment post construction or post decommissioning

- Understanding the historical use of the land with regard to the potential presence of hazardous materials or oil prior to initiation of construction or decommissioning activities

- Preparing plans and procedures to respond to the discovery of contaminated media to minimize or reduce the risk to health, safety, and the environment consistent with the approach for Contaminated Land in Section 1.6

- Preparation of a management plan to manage obsolete, abandoned, hazardous materials or oil consistent with the approach to hazardous waste management described in Section 1.6.

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

4.2 Occupational Health and Safety

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Over-exertion

Over-exertion, and ergonomic injuries and illnesses, such as repetitive motion, over-exertion, and manual handling, are among the most common causes of injuries in construction and decommissioning sites. Recommendations for their prevention and control include:

- Training of workers in lifting and materials handling techniques in construction and decommissioning projects, including the placement of weight limits above which mechanical assists or two-person lifts are necessary
- Planning work site layout to minimize the need for manual transfer of heavy loads
- Selecting tools and designing work stations that reduce force requirements and holding times, and which promote improved postures, including, where applicable, user adjustable work stations
- Implementing administrative controls into work processes, such as job rotations and rest or stretch breaks

Slips and Falls

Slips and falls on the same elevation associated with poor housekeeping, such as excessive waste debris, loose construction materials, liquid spills, and uncontrolled use of electrical cords and ropes on the ground, are also among the most frequent cause of lost time accidents at construction and decommissioning sites.

Recommended methods for the prevention of slips and falls from, or on, the same elevation include:

- Implementing good house-keeping practices, such as the sorting and placing loose construction materials or demolition debris in established areas away from foot paths
- Cleaning up excessive waste debris and liquid spills regularly
- Locating electrical cords and ropes in common areas and marked corridors
- Use of slip retardant footwear

Work in Heights

Falls from elevation associated with working with ladders, scaffolding, and partially built or demolished structures are among the most common cause of fatal or permanent disabling injury at construction or decommissioning sites. If fall hazards exist, a fall protection plan should be in place which includes one or more of the following aspects, depending on the nature of the fall hazard⁹⁵:

- Training and use of temporary fall prevention devices, such as rails or other barriers able to support a weight of 200 pounds, when working at heights equal or greater than two meters or at any height if the risk includes falling into operating machinery, into water or other liquid, into hazardous substances, or through an opening in a work surface
- Training and use of personal fall arrest systems, such as full body harnesses and energy absorbing lanyards able to support 5000 pounds (also described in this section in Working at Heights above), as well as fall rescue procedures to deal with workers whose fall has been successfully arrested. The tie in point of the fall arresting system should also be able to support 5000 pounds
- Use of control zones and safety monitoring systems to warn workers of their proximity to fall hazard zones, as well as

⁹⁵ 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>



securing, marking, and labeling covers for openings in floors, roofs, or walking surfaces

Struck By Objects

Construction and demolition activities may pose significant hazards related to the potential fall of materials or tools, as well as ejection of solid particles from abrasive or other types of power tools which can result in injury to the head, eyes, and extremities. Techniques for the prevention and control of these hazards include:

- Using a designated and restricted waste drop or discharge zones, and/or a chute for safe movement of wastes from upper to lower levels

- Conducting sawing, cutting, grinding, sanding, chipping or chiseling with proper guards and anchoring as applicable

- Maintaining clear traffic ways to avoid driving of heavy equipment over loose scrap

- Use of temporary fall protection measures in scaffolds and out edges of elevated work surfaces, such as hand rails and toe boards to prevent materials from being dislodged
- Evacuating work areas during blasting operations, and using blast mats or other means of deflection to minimize fly rock or ejection of demolition debris if work is conducted in proximity to people or structures

- Wearing appropriate PPE, such as safety glasses with side shields, face shields, hard hats, and safety shoes

Moving Machinery

Vehicle traffic and use of lifting equipment in the movement of machinery and materials on a construction site may pose temporary hazards, such as physical contact, spills, dust, emissions, and noise. Heavy equipment operators have limited fields of view close to their equipment and may not see pedestrians close to the vehicle. Center-articulated vehicles create a significant impact or crush hazard zone on the outboard side of

a turn while moving. Techniques for the prevention and control of these impacts include:

- Planning and segregating the location of vehicle traffic, machine operation, and walking areas, and controlling vehicle traffic through the use of one-way traffic routes, establishment of speed limits, and on-site trained flag-people wearing high-visibility vests or outer clothing covering to direct traffic

- Ensuring the visibility of personnel through their use of high visibility vests when working in or walking through heavy equipment operating areas, and training of workers to verify eye contact with equipment operators before approaching the operating vehicle

- Ensuring moving equipment is outfitted with audible back-up alarms

- Using inspected and well-maintained lifting devices that are appropriate for the load, such as cranes, and securing loads when lifting them to higher job-site elevations.

Dust

- Dust suppression techniques should be implemented, such as applying water or non-toxic chemicals to minimize dust from vehicle movements

- PPE, such as dust masks, should be used where dust levels are excessive

Confined Spaces and Excavations

Examples of confined spaces that may be present in construction or demolition sites include: silos, vats, hoppers, utility vaults, tanks, sewers, pipes, and access shafts. Ditches and trenches may also be considered a confined space when access or egress is limited. In addition to the guidance provided in Section 2.8 the occupational hazards associated with confined spaces and excavations in construction and decommissioning sites should be prevented according to the following recommendations:

Controlling site-specific factors which may contribute to excavation slope instability including, for example, the use of excavation dewatering, side-walls support, and slope gradient adjustments that eliminate or minimize the risk of collapse, entrapment, or drowning

Providing safe means of access and egress from excavations, such as graded slopes, graded access route, or stairs and ladders

Avoiding the operation of combustion equipment for prolonged periods inside excavations areas where other workers are required to enter unless the area is actively ventilated

Other Site Hazards

Construction and decommissioning sites may pose a risk of exposure to dust, chemicals, hazardous or flammable materials, and wastes in a combination of liquid, solid, or gaseous forms, which should be prevented through the implementation of project-specific plans and other applicable management practices, including:

- Use of specially trained personnel to identify and remove waste materials from tanks, vessels, processing equipment or contaminated land as a first step in decommissioning activities to allow for safe excavation, construction, dismantling or demolition

- Use of specially trained personnel to identify and selectively remove potentially hazardous materials in building elements prior to dismantling or demolition including, for example, insulation or structural elements containing asbestos and Polychlorinated Biphenyls (PCBs), electrical components containing mercury⁹⁶

- Use of waste-specific PPE based on the results of an occupational health and safety assessment, including

- respirators, clothing/protective suits, gloves and eye protection

4.3 Community Health and Safety

General Site Hazards

Projects should implement risk management strategies to protect the community from physical, chemical, or other hazards associated with sites under construction and decommissioning. Risks may arise from inadvertent or intentional trespassing, including potential contact with hazardous materials, contaminated soils and other environmental media, buildings that are vacant or under construction, or excavations and structures which may pose falling and entrapment hazards. Risk management strategies may include:

- Restricting access to the site, through a combination of institutional and administrative controls, with a focus on high risk structures or areas depending on site-specific situations, including fencing, signage, and communication of risks to the local community

- Removing hazardous conditions on construction sites that cannot be controlled affectively with site access restrictions, such as covering openings to small confined spaces, ensuring means of escape for larger openings such as trenches or excavations, or locked storage of hazardous materials

Disease Prevention

Increased incidence of communicable and vector-borne diseases attributable to construction activities represents a potentially serious health threat to project personnel and residents of local communities. Recommendations for the prevention and control of communicable and vector-borne diseases also applicable to

⁹⁶ Additional information on the management and removal of asbestos containing building materials can be found in ASTM Standard E2356 and E1368

construction phase activities are provided in Section 3.6 (Disease Prevention).

Traffic Safety

Construction activities may result in a significant increase in movement of heavy vehicles for the transport of construction materials and equipment increasing the risk of traffic-related accidents and injuries to workers and local communities. The incidence of road accidents involving project vehicles during construction should be minimized through a combination of education and awareness-raising, and the adoption of procedures described in Section 3.4 (Traffic Safety).

Environmental, Health, and Safety (EHS) Guidelines GENERAL EHS GUIDELINES: REFERENCES AND ADDITIONAL SOURCES



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**Annex 6:
SCREENING FORM TO REVIEW ENVIRONMENTAL PERMIT APPLICATIONS**

Application No:

Application Type: **Environmental Permit**

FEATURE	COMMENTS	Ranking of Potential Negative Impact				
		←				
		Adverse (?)	High (5)	Moderate (3)	Low (1)	Negligible/None (0)
Biological Resources						
1. Tree Cover (Size)	Forest Type	Requires > 30% Removal of Trees		11-30% Removal	< 11% Removal	Requires no Tree Removal
2. Vegetation of economic Value		Requires > 30% Removal of Vegetation		Requires 11-30% Removal	Requires < 11% Removal	Requires no Removal of Vegetation
3. Other Vegetation			Requires > 30% Removal of Shrub	11-30% Removal	< 11% Removal	Requires no removal of Shrub
4. Endemic Species		Present / Not sure				Not Present
5. Threatened Species		Present / Not sure				Not Present
6. Endangered Species		Present / Not sure				Not Present
7. Introduction of Alien Invasive Species			Alien Invasive Species to be introduced			No
8. Introduction of Biocontrol Agents			Bio Control Agents to be introduced			No
9. Introduction of Genetically Modified Organisms			Genetically Modified Organisms to be introduced			No
TOTAL FEATURE RATING						

FEATURE	COMMENTS	Ranking of Potential Negative Impact				
		←				
		Adverse (?)	High (5)	Moderate (3)	Low (1)	Negligible/None (0)
Ecosystems/Habitats						
11. Forest	Forest Type	Requires > 30% Clearance		11-30% Clearance	< 11% Clearance	Requires no Clearance
12. Seagrass Bed		Requires > 30% Modification		11-30% Modification	< 11% Modification	Requires no Modification
13. Reef	Reef Type	Requires > ?% Modification				Requires no Modification
14. Other Wetlands (Marshes, Bogs, etc.)			Requires > 30% Modification	11-30% Modification	< 11% Modification	Requires no Modification
15. Dune			Requires > 30% Modification	11-30% Modification	< 11% Modification	Requires no Modification
16. Cave			Requires > 30% Modification	11-30% Modification	< 11% Modification	Requires no Modification
17. Nesting/Breeding /Spawning Sites		Requires > 10% Modification		11-30% Modification	< 11% Modification	Requires no Modification
18. Migratory Route on project site		Present				Not Present
19. Foraging Area on project site						
TOTAL FEATURE RATING						
Land Resources						
20. Zoning			Not zoned for proposed use	-	-	Zoned for proposed use
21. Change of Use		Conversion of Prime Agricultural Lands	Conversion of 'good' Agricultural Lands		Conversion of Marginal Agricultural Lands	No change of Use
22. Project site in Protected Area*		Yes				No
23. Proximity to the Sea						

FEATURE	COMMENTS	Ranking of Potential Negative Impact				
		←				
		Adverse (?)	High (5)	Moderate (3)	Low (1)	Negligible/None (0)
24. Modification to Floor of the Sea or Foreshore						
TOTAL FEATURE RATING						
HAZARD VULNERABILITY						
25. % Project site on slope exceeding 25 ⁰			> 25%	>15% <25%	<15%	Zero
26. Soil Erodibility	[Check database]					
27. Risk of Flooding		Extremely Flood Prone		Flood Prone	Slight Risk	Negligible Risk
29. Fault Line		Present on site				Not Present
30. Susceptible to storm surges						Not susceptible
31. Susceptibility to Landslides			Extremely Susceptible	Susceptible	Slight	Negligible
32. Susceptibility to Bush Fires			Extremely Susceptible	Susceptible	Slight	Negligible
TOTAL FEATURE RATING						
Other Physical Resources						
33. Cays			Project located on Cay			Not Applicable
34. Sand Dunes			Present on site			Not present
35. Karst Topography			Present on site			Not present
36. Limestone Out-cropping			Present on site			Not present
37. Cumulative Effects						

FEATURE	COMMENTS	Ranking of Potential Negative Impact				
		←				
		Adverse (?)	High (5)	Moderate (3)	Low (1)	Negligible/None (0)
TOTAL RATING	FEATURE					
Water Resources						
38. Water Table/ Aquifer			≤1 m below ground	2 m below ground	3 m below ground	5 m below ground
39. Presence of Streams, Rivers			Within 2 Km of site	Within 5 Km of site	Within 10 Km of site	Within 20 Km of site
40. Proximity to Sea			Abutting the coastline			Not Abutting the coastline
41. Presence of Spring, Wells			Within 2 Km of site	Within 5 Km of site	Within 10 Km of site	Within 20 Km of site
43. Volume of Water to be Abstracted from Wells			200 litre/minute pumping capacity			No
44. Effect on Natural Channels			Will impede			Will not impede
45. Potential to contaminate any water body		Adverse	High Potential	Moderate Potential	Low Potential	Negligible
46. Cumulative Effects						
TOTAL RATING	FEATURE					
Air Quality						
47. Effect of project on Ambient Standards			Will cause			
48. Effect of Project on Phase-out Programme						
49. Fugitive Emission			Yes			No
50. Noise			Exceeds 70 Decibels			
51. Vibration						
52. Height of Stacks						
53. Location of stacks						

FEATURE	COMMENTS	Ranking of Potential Negative Impact				
		←				
		Adverse (?)	High (5)	Moderate (3)	Low (1)	Negligible/None (0)
54. Cumulative Effects						
TOTAL FEATURE RATING						
Infrastructure						
55. Access to Electricity/ Energy Source			No			Yes
56. Energy Type			Non-renewable			Renewable
57. Access to Potable Water			No			Yes
58. Is Drainage Plan required?			Yes			No
59. Is Emergency Management Plan required?			Yes			No
60. Is there access to Emergency Response Services?			No			Yes
61. Is a Reclamation/ Restoration Plan required?			Yes			No
62. Adequacy of Raw Material Storage			Inadequate			Adequate
63. Risk of Pollution from Raw Material Transportation			High			Low
64. Parking Facilities			Inadequate			Adequate
65. Setback			Inadequate			Adequate
66. Effect on Traffic Flow			Will impede			Will not impede
67. Risk to Urban Centres			High			Low

FEATURE	COMMENTS	Ranking of Potential Negative Impact				
		←				
		Adverse (?)	High (5)	Moderate (3)	Low (1)	Negligible/None (0)
TOTAL RATING	FEATURE					
WASTES - Solid/Liquid/Hazardous						
71. Land used for disposal of refuse, excreta or hazardous material			Other, Please specify _____ _____ _____			On Approved Site
72. Disposal of Dredged Materials			Proposed Site/methodology not appropriate			Proposed Site/methodology Appropriate
73. Suitability of Sewage System Type to project site			Not Suitable			Suitable
74. Sewage Effluent			Will not meet Standards			Will meet Standards
75. Receiving body for Sewage			Other, Please specify _____ _____ _____			Municipal Sewage Treatment Plant
76. Does the Receiving water body have absorptive capacity?			No			Yes
77. Will Trade Effluent Standards be met?			No			Yes
78. Will Hazardous Waste be generated, handled, stored, transported or disposed of?			Yes			No
79. Risk of any Leach ate release to the Environment			High		Low	None

FEATURE	COMMENTS	Ranking of Potential Negative Impact				
		←				
		Adverse (?)	High (5)	Moderate (3)	Low (1)	Negligible/None (0)
80. Less located less than 1000m from waste dump site.						
TOTAL FEATURE RATING						
Aesthetics						
81. Aesthetic Nature of project			Aesthetically offensive			Aesthetically acceptable
82. Obstruction of Scenic View			Yes			No
83. Destruction/ Degradation of Scenic View			Yes			No
FEATURE RATING						
Socio-economic Sensitivity						
85. Informal settlement			Yes			No
86. Resettlement of households or communities required			Yes			No
87. Availability of Public Transportation						
88. Potential negative impact on Public Health			Yes			No
FEATURE RATING						

FEATURE	COMMENTS	Ranking of Potential Negative Impact				
		←				
		Adverse (?)	High (5)	Moderate (3)	Low (1)	Negligible/None (0)
Cultural / Heritage Resources						
90. Impact on Archaeological/ Historical Site/ Scientific/Monument (Check terminologies)			Yes			No
91. Prescriptive Rights						
TOTALFEATURE RATING						
	Sub-Total					
	TOTAL					

SITE VISIT REPORT (additional Information)

Feature #	Description	
Decision Guide		
EIA Required		
Two or More Adverse Impacts	EIA Required	EIA Report Required. TORs automatically generated.
One Adverse Impact plus 'x'? High Impact	'Limited' EIA Required	EIA Report Required. TORs automatically generated.

Public Presentation Required

Scope and magnitude of the potential impacts

Ecological sensitivity of the area

Public interest in the Project

Application Approved

Less than 'y'? High Impacts

General and Specific Conditions Automatically generated and
Explicit Conditions added

Application Declined

'Y' or more High Impacts

Reasons automatically generated

Annex 7:
THE NATURAL RESOURCES CONSERVATION
(PERMITS AND LICENCES) REGULATIONS 1996 (amended) 2004
(Pursuant to section 9, NRCA Act 1991)

CHECKLIST
Application for Environmental Permit

- Completed Permit Application Form & Project Information Form including:-
 - Tax Registration Number
 - Contact information – Telephone, Cellular phone, Fax, Email
 - For Companies – Company Registration Number; Names of Directors and Company Secretary
- Completed Licence Application Form (if there will be a discharge of Trade or Sewage and or Poisonous or Harmful Substances into the environment).
- Beach Licence Application Form (Licence Under the Beach Control Authority for any Use of the Foreshore, Floor of the Sea and the Water Column).
- Location Map (Drawn to Scale 1:12,500).
- Layout Plan or Site Plan of facility/development Drawn to Scale (including dimensions).
Informative - architectural drawings must be certified by a registered architect, engineering drawings must be certified by a professional engineer and site and subdivision plans must be certified by a commissioned land surveyor.
- Detailed Design of Project including:-
 - the proposed method of wastewater treatment and disposal or similar facility
 - the location and setback of the wastewater treatment and disposal facility on the Subdivision or Layout plan
 - a Gantt chart illustrating the project schedule/ construction schedule for wastewater treatment and disposal facility or similar facility
 - a Sludge / Septage Management Plan for wastewater treatment and disposal facility or similar facility
 - Detailed design of the treatment components.
 - Waste Management Plan and a Closure Plan for Petroleum Storage Facilities or similar facility
- Proof of Ownership
 - A copy of the title or
 - A probated will or,
 - Lease agreement along with a copy of the title and a consent letter.

Informative:

 - If the applicant is not the owner, a letter of authorization from the title holder(s), giving the applicant permission to use the land for the proposed activity, witnessed by a Justice of the Peace along with a copy of the title.
 - If the registered title is held jointly, either all parties must be reflected as applicant OR there should be letter or authorization from the other title holder (s) giving the applicant permission to use the land for the proposed activity.

- ALL CONTRACTORS/AGENTS/CONSULTANTS who are applying for permits and licences on behalf of someone else must submit with each application a letter giving them authority to apply for the permit/licence. The letter must also state the extent of their authority in relation the application and in whose name the permit/licence should be issued. The letter must be signed by all the relevant parties who they represent.
- Project Brief describing the scope and extent of the project
- Drainage Plan
- Surface Discharge Permission letter - **Applicable** where the proposal is to discharge the final effluent into a surface drainage channel owned by another individual.
Informative: In this case, the Applicant is to submit a no objection letter from the owner of this channel.
- Design Report- Applicable only to wastewater treatment and disposal facility or similar facility
- Application Fee of \$2000.00
- Previously submitted to Development Assistance Centre
Informative: Application must be submitted in quadruplicate (4 sets)

Annex 7:
THE NATURAL RESOURCES CONSERVATION AUTHORITY ACT
The Natural Resources Conservation (Permits and Licences) Regulations, 1996
(Amended 2004)
(Pursuant to Section 4 and 12, NRCA Act 1991)

CHECKLIST

- Completed Licence Application Form (4 copies) & Project Information Form (4 copies) **including:-**
 - Tax Registration Number
 - Contact information – Telephone, Cellular phone, Fax, Email
 - For Companies – Company Registration Number; Names of Directors and Company Secretary

- Completed Permit Application Form (**if the project which falls within any of the prescribed categories**). (4 copies)

- Beach Licence Application Form (**Licence Under the Beach Control Authority for any modification to the Foreshore and Floor of the Sea**)

- Location Map (**Drawn to Scale**) (4 copies)
- Layout Plan or Site Plan of facility/development (**including dimensions**) (4 copies)
- Detailed Design of Sewage/Waste Water (Trade Effluent) Facility (**including Discharge Points-Coordinates must be stated**) (4 copies)
- Map indicating the route of the pipeline/drainage channel from the sewage treatment plant to the point of discharge (4 copies).

- Proof of Ownership:
 - A copy of the title or
 - A probated will or,
 - Lease agreement along with a copy of the title and a consent letter.

Informative

 - If the applicant is not the owner, a letter of authorization from the title holder(s), giving the applicant permission to use the land for the proposed activity, witnessed by a Justice of the Peace along with a copy of the title.
 - If the registered title is held jointly, either all parties must be reflected as applicant OR there should be letter or authorization from the other title holder (s) giving the applicant permission to use the land for the proposed activity.
 - ALL CONTRACTORS/AGENTS/CONSULTANTS who are applying for permits and licences on behalf of someone else must submit with each application a letter giving them authority to apply for the permit/licence. The letter must also state the

extent of their authority in relation the application and in whose name the permit/licence should be issued. The letter must be signed by all the relevant parties who they represent.

- Project Brief describing the scope and extent of the project (4 copies)
- Application Fee of \$2000.00
- Previously submitted to Development Assistance Centre

Annex 8:
CONTROL ACT (THE BEACH CONTROL AUTHORITY LICENSING REGULATIONS, 1956) - BEACH LICENCE APPLICATION CHECKLIST
(Licence pursuant to the Beach Control Authority (Licensing) Regulations 1956 (Amendment) 1999 for the Use of the Foreshore and Floor of the Sea and the Water Column)

- Beach Licence Application Form (**must be signed by Applicant and a Justice of the Peace**) (3 copies)
- Completed Environmental Permit Application & Project Information Forms (**if the project which falls within any of the prescribed categories**). (4 copies)
- Completed Environmental Licence Application Form (**if there will be a discharge of Trade or Sewage and or Poisonous or Harmful Substances into the environment**). (4 copies)
- Location Map (**Drawn to Scale 1: 12,500**) (3 copies)
- Layout Plan of the area to be licenced (**including dimensions**) (3 copies)
Informative - architectural drawings must be certified by a registered architect, engineering drawings must be certified by a professional engineer and site plans must be certified by a commissioned land surveyor
- Detail Design of Project (**including the proposed method of sewage treatment and disposal, if applicable**) (2 copies)
- Proof of Ownership
 - A copy of the title or
 - A probated will or,
 - Lease agreement along with a copy of the title and a consent letter.**Informative**
 - If the applicant is not the owner, a letter of authorization from the title holder(s), giving the applicant permission to use the land for the proposed activity, witnessed by a Justice of the Peace along with a copy of the title must be provided.
 - If the registered title is held jointly, either all parties must be reflected as applicant OR there should be letter or authorization from the other title holder (s) giving the applicant permission to use the land for the proposed activity.
 - ALL CONTRACTORS/AGENTS/CONSULTANTS who are applying for permits and licences on behalf of someone else must submit with each application a letter giving them authority to apply for the permit/licence. The letter must also state the extent of their authority in relation the application and in whose name the permit/licence should be issued. The letter must be signed by all the relevant parties who they represent.
- Project Brief to include the no. of rooms if application is in connection with hotel/resort development (2 copies)
- Application Fee of \$1000.00
- TRN
- Contact information – Tele phone, Cellular phone, Fax, Email

- For Companies – Company Registration Number; Names of Directors and Company Secretary
- Erect the NOTICE OF APPLICATION (**Refer to Form B First Schedule**)
 - Provide evidence that signs have been posted, for example, a photograph of the erected sign.
 - Provide evidence that neighbours have been notified by registered mail
- Previously submitted to Development Assistance Centre

Annex 8:
**MINIMUM REQUIRED STANDARDS FOR A TERMS OF REFERENCE (ToR) FOR
AN ENVIRONMENTAL IMPACT ASSESSMENT**

At a Minimum, a **Terms of Reference (ToR)** must outline the aspects of an Environmental Impact Assessment (EIA) which when thoroughly addressed will provide a comprehensive evaluation of the site, in terms of predicted environmental impacts, needed mitigation strategies, potentially viable alternatives to the development proposed and all related legislation.

In reality, significant environmental issues may be site specific and project specific. It is expected that these issues be incorporated accordingly. Sites of special consideration are:

Coastal and Marine Areas: Issues such as coastline stability, seagrass beds, beaches, coral reef, wetlands, seagrass impacts, unique coastal environments, nutrient loading in coastal waters and impact on coastal commercial fishing and underwater cultural heritage such as shipwrecks and sunken cities or sites should be examined.

Upland Areas: Issues such as slope stability, available public transportation, access to basic amenities such as potable water and electricity; impact of drainage from the site on pre existing drainage patterns; the presence of prehistoric and historic sites etc. should be examined.

Sites located within, adjacent to or in the vicinity of areas listed as protected (e.g. under the Wild Life Protection, Forest, Natural Resources Conservation Authority, Fishing Industry or Jamaica National Heritage Trust Acts or designated Ramsar Sites) or having protected species: The main issue(s) of concern are determined by the statutes of the legislation or convention in question and what the convention speaks to. The impact of the development on the specific sensitivities of the protected area should be highlighted (e.g. diversion of water flows, extraction of water, pollution). Mitigation of impacts should assess if the post mitigation status would be acceptable in the protected area context. Alternative sites should be rigorously evaluated.

Biological diversity: loss/impact on population of a species/ecosystems; ecosystem functions; direct or indirect impacts on endemic, protected, and endangered species (e.g. habitat reduction/modification affecting survival; introduction of invasive alien species, and predators); impact on migratory species (e.g. fish and birds); impact on breeding grounds.

Terms of Reference

The Environmental Impact Assessment should include, but not be limited, to the following:

- 1) Objectives
- 2) Complete description of the existing site proposed for development.
- 3) Significant environmental issues of concern through the presentation of baseline data which should include social, cultural and heritage considerations. Assess public perception of the proposed development.
- 4) Policies, Legislation and Regulations relevant to the project.

- 5) Likely impacts of the development on the described environment, including direct, indirect and cumulative impacts, and their relative importance to the design of the development's facilities.
- 6) Mitigation action to be taken to minimise predicted adverse impacts and quantify associated costs.
- 7) Monitoring Plan which should ensure that the mitigation plan is adhered to.
- 8) Alternatives to the project that could be considered at that site or at any other location.
- 9) Conclusions

(See Appendix 1)

To ensure that a thorough environmental impact assessment is carried out, it is expected that the following tasks be undertaken:

Task #1. Project Description

Provide a comprehensive description of the project and its existing setting including project objectives and information on the nature, location/ existing setting, timing, duration, frequency, general layout and size of facility including ancillary buildings, pre-construction activities, construction methods, works and duration, and post construction plans. Note areas to be reserved for construction and areas to be preserved in their existing state as well as activities and features which will introduce risks or generate impact (negative and positive) on the environment.

Sewage treatment system including treated effluent disposal must be clearly outlined as well as solid waste disposal option. In addition, plans for storm water collection and disposal as well as plans for providing utilities and other services should be clearly stated. This should involve the use of maps at appropriate scales, site plans, aerial photographs and other graphic aids and images, as appropriate.

In terms of beach modification, the proposed works on the foreshore and the floor of the sea must be clearly described including but not limited to any seagrass or coral removal and replanting.

A storm surge analysis must be conducted to inform coastal setbacks of buildings and impact mitigation structures/measures.

For projects to be done on a phased basis it is expected that all phases be clearly defined, the relevant time schedules provided and phased maps, diagrams and appropriate visual aids be included.

Task #2. Description of the Environment./Baseline Studies Data Collection and Interpretation

Describe study area/geographical boundaries, and methodology to be utilized for baseline and other data and the length of the study. This task involves the generation of baseline data which is used to describe the study area as follows:

- a) physical environment

- b) biological environment
- c) socio-economic and cultural constraints.

(a) Physical

- i) a detailed description of the existing **soil and geology and geomorphology, landscape, aesthetic values and hydrology**. Special emphasis should be placed on storm water run-off, drainage patterns, aquifer characteristics, effect on groundwater and availability of potable water. Any slope stability issues that could arise should be thoroughly explored.
- ii) **Water quality** of any existing wells, rivers, ponds, streams or coastal waters in the vicinity of the development. Quality Indicators should include but not necessarily be limited to nitrates, phosphates, faecal coliform, and suspended solids.
- iii) **Coastal and Marine** ecosystem, including but not limited to any wetlands including mangroves, seagrass and coral community with indication of its function and value in the project area.
- iv) **Climatic conditions and air quality** in the area of influence including particulate emissions from stationary or mobile sources, NO_x, SO_x, wind speed and direction, precipitation, relative humidity and ambient temperatures,
- v) **Noise levels** of undeveloped site and the ambient noise in the area of influence.
- vii) Obvious sources of existing **pollution** and extent of contamination.
- viii) Availability of **solid waste** management facilities.

(b) Biological

Present a detailed description of the flora and fauna (terrestrial and aquatic) of the area, with special emphasis on rare, threatened, endemic, protected, endangered species. Migratory species wild food crop plants and presence of invasive alien species should also be considered. There may be the need to incorporate micro-organisms to obtain an accurate baseline assessment. Generally, species dependence, habitats/niche specificity, community structure and diversity ought to be considered.

(c) Socio-economic & cultural

Present and projected population; present and proposed land use; planned development activities; issues relating to squatting and relocation; (housing demand and supply) community structure; economic base /employment; distribution of income; goods and services; utilities; recreation; public health and safety; cultural peculiarities, aspirations and attitudes should be explored. The historical importance (heritage, archaeological sites and feature) and other material assets of the area should also be examined. While this analysis is being conducted, it is expected that an assessment of public perception of the proposed development be conducted. This assessment may vary with community structure and may take multiple forms such as public meetings or questionnaires/surveys.

Task #3 – Policy, Legislative and Regulatory Considerations

Outline the pertinent regulations and standards governing environmental quality, safety and health, protection of sensitive areas, protection of endangered species, siting and land use control at the national and local levels. The examination of the legislation should include at minimum, legislation such as the NRCA Act, the Housing Act, the Town and Country Planning Act,

Building Codes and Standards, Development Orders and Plans and the appropriate international convention/protocol/treaty where applicable.

Task #4 – Identification and Assessment/Analysis of Potential Impacts

Identify the significant environmental and public health/safety issues of concern and indicate their relative importance.

Identify the nature, severity, size and extent of potential direct, indirect and cumulative impacts (for terrestrial and aquatic environments) during the pre-construction, construction and operational phases of the development as they relate to,(but are not restricted by) the following:

- change in drainage patterns
- flooding potential
- landscape impacts of excavation and construction
- loss of and damage to geological and palaeontological features
- loss of species and natural features
- habitat loss and fragmentation species
- biodiversity/ecosystem functions
- pollution of potable, coastal, marine, surface and ground water
- air pollution
- capacity and design parameters of proposed sewage treatment facility
- socio-economic and cultural impacts.
- Impact of flooding, loss of natural features, excavation and construction on the historic landscape, architecture and archaeology of the site.
- risk assessment
- noise
- solid waste
- soil
- access to resources such as beaches
- carrying capacity of the proposed site

Identify the interaction between different impacts and impacts of other projects should also be considered. In addition, the impacts that have occurred and those impacts which could still occur as a consequence of the clearing works that were conducted on the site prior to the preparation of the TORs should also be identified and analysed

Distinguish between significant positive and negative impacts, reversible or irreversible direct and indirect, long term and immediate impacts as well as avoidable and irreversible impacts.

Characterize the extent and quality of the available data, explaining significant information deficiencies, assumptions and any uncertainties associated with the predictions of impacts. A major environmental issue is determined after examining the impact (positive and negative) on the environment and having the negative impact significantly outweigh the positive. It is also determined by the number and magnitude of mitigation strategies which need to be employed to reduce the risk(s) introduced to the environment. Project activities and impacts should be represented in matrix form with separate matrices for pre and post mitigation scenarios.

Task #5 – Drainage Assessment

An assessment of Storm Water Drainage should be conducted. The EIA Report should cover, but not limited to:

- i. Drainage for the site during construction, to include mitigation for sedimentation to the aquatic environment
- ii. Drainage for the site during operation, to include mitigation for sedimentation to the aquatic environment
- iii. Drainage control for the gully traversing the property, to include impacts that this drain will have on the aesthetics, water quality and sedimentation of the beach area, etc.

Task #6 Mitigation

Prepare guidelines for avoiding or reducing (e.g. restoration and rehabilitation), as far as possible, any adverse impacts due to proposed usage of the site and utilizing of existing environmental attributes for optimum development. Quantify and assign financial and economic values to mitigating methods.

Task #7 - Environmental Management and Monitoring Plan

Design a plan for the management of the natural, historical and archaeological environments of the project to monitor implementation of mitigatory or compensatory measures and project impacts during construction and occupation/operation of the units/facility. An Environmental Management Plan and Historic Preservation Plan (if necessary) for the long term operations of the site should also be prepared.

An outline monitoring programme should be included in the EIA, and a detailed version submitted to NEPA for approval after the granting of the permit and prior to the commencement of the development. At the minimum the monitoring programme and report should include:

- Introduction outlining the need for a monitoring programme and the relevant specific provisions of the permit and/or licence(s) granted.
- The activity being monitored and the parameters chosen to effectively carry out the exercise.
- The methodology to be employed and the frequency of monitoring.
- The sites being monitored. These may in instances, be pre-determined by the local authority and should incorporate a control site where no impact from the development is expected.
- Frequency of reporting to NEPA

The Monitoring report should also include, at minimum:

- Raw data collected. Tables and graphs are to be used where appropriate
- Discussion of results with respect to the development in progress, highlighting any parameter(s) which exceeds the expected standard(s).
- Recommendations
- Appendices of data and photographs if necessary.

Task #8 - Project Alternatives

Examine alternatives to the project including the no-action alternative. This examination of project alternatives should incorporate the use history of the overall area in which the site is located and previous uses of the site itself. Refer to NEPA guidelines for EIA preparation.

Task #9 Public Participation/Consultation Programme

Conduct a public presentation on the findings of the EIA to inform, solicit and discuss comments from the public on the proposed development.

- Document the public participation programme for the project.
- Describe the public participation methods, timing, type of information to be provided to the public, and stakeholder target groups.
- Summarise the issues identified during the public participation process
- Discuss public input that has been incorporated into the proposed project design; and environmental management systems

Task #9 Statement on Energy Conservation

All findings must be presented in the **EIA report** and must reflect the headings in the body of the ToRs, as well as references.

Ten hard copies and an electronic copy of the report should be submitted to the National Environment and Planning Agency.

The report should include an appendix, as follows.

APPENDIX 1 OUTLINE OF A TYPICAL EIA REPORT

The report should contain an introduction explaining the need for, and context of the project. This document should have the following basic aspects included in the Table of Contents, unless specified otherwise in the Terms of Reference.

- Executive Summary
- Policy, Legal and Administrative Framework
- The EIA Methodology
- Description of the Existing Environment
- Description of the Proposed Project in detail
- Identification and Assessment of Potential Direct, Indirect, Cumulative, Positive and Negative Environmental Impacts
- Physical
- Natural Hazard Risk
- Biological

- Heritage
- Human/Social
- Public Involvement
- Recommended Mitigation Measures
- Identification and Analysis of Alternatives
- Management of the Environmental and Heritage aspects of the Project
- Environmental Management of the Project
- Environmental Quality Objectives
- Training
- Draft Outline Monitoring Programme
- List of References
- Appendices including:
 - Reference documents
 - Photographs/ maps
 - Data Tables
- Glossary of Technical Terms used

Terms of Reference

- Composition of the consulting team (Technical Team that undertook the study/assessment , including name, qualification and roles of team members)
- Notes of Public Consultation sessions with items such as maps, site plans, the study team, photographs, ToR and other relevant information.

Annex 9:
TABLE OF CONTENTS FOR AN ENVIRONMENTAL IMPACT ASSESSMENT (EA)

An environmental assessment (EA) report focuses on the significant environmental issues of a subproject. The report's scope and level of detail should be commensurate with the subproject's potential impacts.

The EA report should include the following items (not necessarily in the order shown):

- (a) *Executive summary.* Concisely discusses significant findings and recommended actions.
- (b) *Policy, legal, and administrative framework.* Discusses the policy, legal, and administrative framework within which the EA is carried out. Explains the environmental requirements of any cofinanciers. Identifies relevant international environmental agreements to which the country is a party.
- (c) *Project description.* Concisely describes the proposed project and its geographic, ecological, social, and temporal context, including any offsite investments that may be required (e.g., dedicated pipelines, access roads, power plants, water supply, housing, and raw material and product storage facilities). Indicates the need for any resettlement plan² (see also subpara. (h)(v) below). Normally includes a map showing the project site and the subproject's area of influence.
- (d) *Baseline data.* Assesses the dimensions of the study area and describes relevant physical, biological, and socioeconomic conditions, including any changes anticipated before the subproject commences. Also takes into account current and proposed development activities within the subproject area but not directly connected to the project. Data should be relevant to decisions about project location, design, operation, or mitigatory measures. The section indicates the accuracy, reliability, and sources of the data.
- (e) *Environmental impacts.* Predicts and assesses the subproject's likely positive and negative impacts, in quantitative terms to the extent possible. Identifies mitigation measures and any residual negative impacts that cannot be mitigated. Explores opportunities for environmental enhancement. Identifies and estimates the extent and quality of available data, key data gaps, and uncertainties associated with predictions, and specifies topics that do not require further attention.
- (f) *Analysis of alternatives.* Systematically compares feasible alternatives to the proposed subproject site, technology, design, and operation--including the "without subproject" situation--in terms of their potential environmental impacts; the feasibility of mitigating these impacts; their capital and recurrent costs; their suitability under local conditions; and their institutional, training, and monitoring requirements. For each of the alternatives, quantifies the environmental impacts to the extent possible, and attaches economic values where feasible. States the basis for selecting the particular project design proposed and justifies recommended emission levels and approaches to pollution prevention and abatement.

(g) *Environmental management plan (EMP)*. Covers mitigation measures, monitoring, and institutional strengthening.

(h) *Appendixes*

(i) List of EA report preparers--individuals and organizations.

(ii) References--written materials, both published and unpublished, used in study preparation.

(iii) Record of interagency and consultation meetings, including consultations for obtaining the informed views of the affected people and local nongovernmental organizations (NGOs). The record specifies any means other than consultations (e.g., surveys) that were used to obtain the views of affected groups and local NGOs.

(iv) Tables presenting the relevant data referred to or summarized in the main text.

(v) List of associated reports.

Annex 10:
AFIs ENVIRONMENTAL AND SOCIAL INFORMATION CONSULTATION SESSION
In preparation for Sub-Component 2.4. Line of Credit for Energy Efficiency (EE) and
Renewable Energy (RE) Financing US\$5 million

On January 12, 2011 an Information Consultation Session was held on Project related Environmental and Social Safeguards, in particular, the draft Environmental Management Framework and the Involuntary Resettlement Policy Framework to support the US\$5 million line of credit for the proposed Energy Security and Efficiency Enhancement Project (P112780) for Jamaica. The meeting was chaired by Jessica Lin (World Bank, LCSEG), representing Michel Layec (TTL, World Bank, LCSEG). In attendance were Mmes/Messrs: Yvonne Lewars, Everton McFadden, Howard Martin, Pauline Nelson, Joan Lawrence (DBJ), Paulette Kolbush, Andrea Bennett (NEPA), Lincoln McIntyre, Colin Yarru (NCB), Lawrence White (NPCB), Garth Sherwood (FCB), Cerilin Hudson (RBTT), Camille Lawson (NPCB), Valerie Crawford (Exim Bank), Dawn Marie Brown (CCMB), Asquith Brown (ScotiaBank). Connected via video were: Valerie Hickey (World Bank, LCSDE) and Fabio Pittaluga (World Bank, LCSSO).

Prior to the meeting, as part of the consultation process, a video conference was held in December 2010 between the Environment and Social Specialists of the World Bank and the Development Bank of Jamaica to discuss the draft Environmental Management Framework and the Involuntary Resettlement Policy prior to disclosure of the documents on the websites of MEM, DBJ, NEPA and the World Bank InfoShop on January 5, 2011. This meeting was a follow up consultation with the AFIs who will be the implementing agents of the program.

Agenda. The meeting agenda included: (a) Introduction by the Chair; (b) Overview of the project description and preparation status; (c) Context for World Bank Safeguards; (d) Discussion of Environmental Management Framework and Involuntary Resettlement Framework with respect to the Project; (e) Question and Answer session; and (f) Next steps. The AFIs specifically sought guidance on how the frameworks would affect the implementation phase of the Project.

Background. The total amount of the loan is US\$15 million. The discussion focused on the Environment and Social Safeguards specific to the US\$5 million line of credit which will be onlent to DBJ and further onlent to Accredited Financial Institutions.

Major Themes. The main themes and issues addressed by the review meeting participants are presented below together with the Chair's conclusions on consensus reached:

1. *Consistency with Jamaica's National Environmental and Social standards as well as Equator Principles and other Standards.* It was emphasized that AFIs must first comply with Jamaica's national standards and that the World Bank safeguards are consistent with Jamaica's regulations. Furthermore, the World Bank emphasized that its safeguard principles are consistent with the broader Equator Principles which were developed mid-2000s to encourage socially responsible lending practices. NEPA is signed on to the Equator Principles. It was also emphasized that the World Bank's

safeguards are consistent with the IFC's performance standards. *It was agreed that the World Bank will send a copy of the Equator Principles to the AFIs.*

2. Waste Disposal. One of the AFIs asked if there were regulations in place to guide them as to where hazardous wastes, if relevant to a sub-project, could be disposed properly. NEPA answered that there are such guidelines in place and that they would guide the AFIs. In fact, it was noted that in order for a Project to apply, they would need to apply first to NEPA for environmental considerations and as such, the NEPA would direct any needed environmental or social actions for the sub-project. It was also emphasized that MEM is the ultimate anchor for the project and that they would be responsible for regulatory changes, if necessary, so it is important to voice concerns during consultation period.
3. Environmental Management Plan. In the situations where an environmental management plan is needed, it was asked how the AFIs could produce such a document. *It was agreed that the World Bank would send a Draft Table of Contents of an Environmental Management Plan that would be inserted into the EMF and that could subsequently be used as a template.*
4. Monitoring Program and Training Protocols. Some AFIs questioned how they could receive further environmental and social training prior to Project implementation. *The DBJ volunteered to take the lead on setting up training for the AFIs by NEPA. The World Bank agreed to send over training tools from the World Bank as well as IFC technical guidance notes.*
5. External Communication about Environmental and Social regulations. AFIs questioned how they could keep abreast of any changes in Jamaica's national environmental or social regulations. It was emphasized that this US\$5 million loan was part of a broader energy Project that is being implemented by MEM and that ultimately it is the MEM's responsibility to disseminate information about energy regulations. *It was agreed that the team would follow up with MEM to ensure that environmental and social regulation dissemination will be part of the External communication plan of the broader project.*

Next Steps. The Chair concluded that the DBJ will facilitate additional consultations between the AFIs and NEPA as part of the Consultation process in preparation for implementation of the loan. The WB team emphasized the importance of the success of this component and stressed that they would send follow up documents with best practice for environmental and social impact mitigation (as outlined above) and that they are also available for assistance throughout the Consultation process as well as during implementation. In addition to the documents that were discussed in this document, the following materials will be made available:

- <http://www.ifc.org/ifcext/sustainability.nsf/Content/EnvSocStandards>
This includes all the resources for IFC clients, including financial intermediaries. It's very private sector oriented, so it would fit squarely with the Jamaica renewable energy project.

- One of its sub-pages, i.e.:
http://www.ifc.org/ifcext/sustainability.nsf/Content/RiskManagement_Training
has an E-Learning module that could be useful for the FI in Jamaica.
- The page with guidance notes for the application of the Performance Standards that gives concrete suggestions on how to turn the policy statements into actions. This is found at:
<http://www.ifc.org/ifcext/sustainability.nsf/Content/PerformanceStandards>
- There is also one sub-page developed specifically for financial institutions managing environmental and social risks. This is at:
<http://www.ifc.org/ifcext/sustainability.nsf/Content/FinancialInstitutions>
- The following site has all the information on EHS (Environmental Health and Safety) Guidelines, as well as the Industry Specific Guidelines (scroll down the same page) we mentioned to them yesterday.
<http://www.ifc.org/ifcext/sustainability.nsf/Content/EHSGuidelines>
- IFC general guidelines for specific industries on Environmental Health and Safety that can provide general guidance on good practice standards.
<http://www.ifc.org/ifcext/sustainability.nsf/Content/EHSGuidelines>