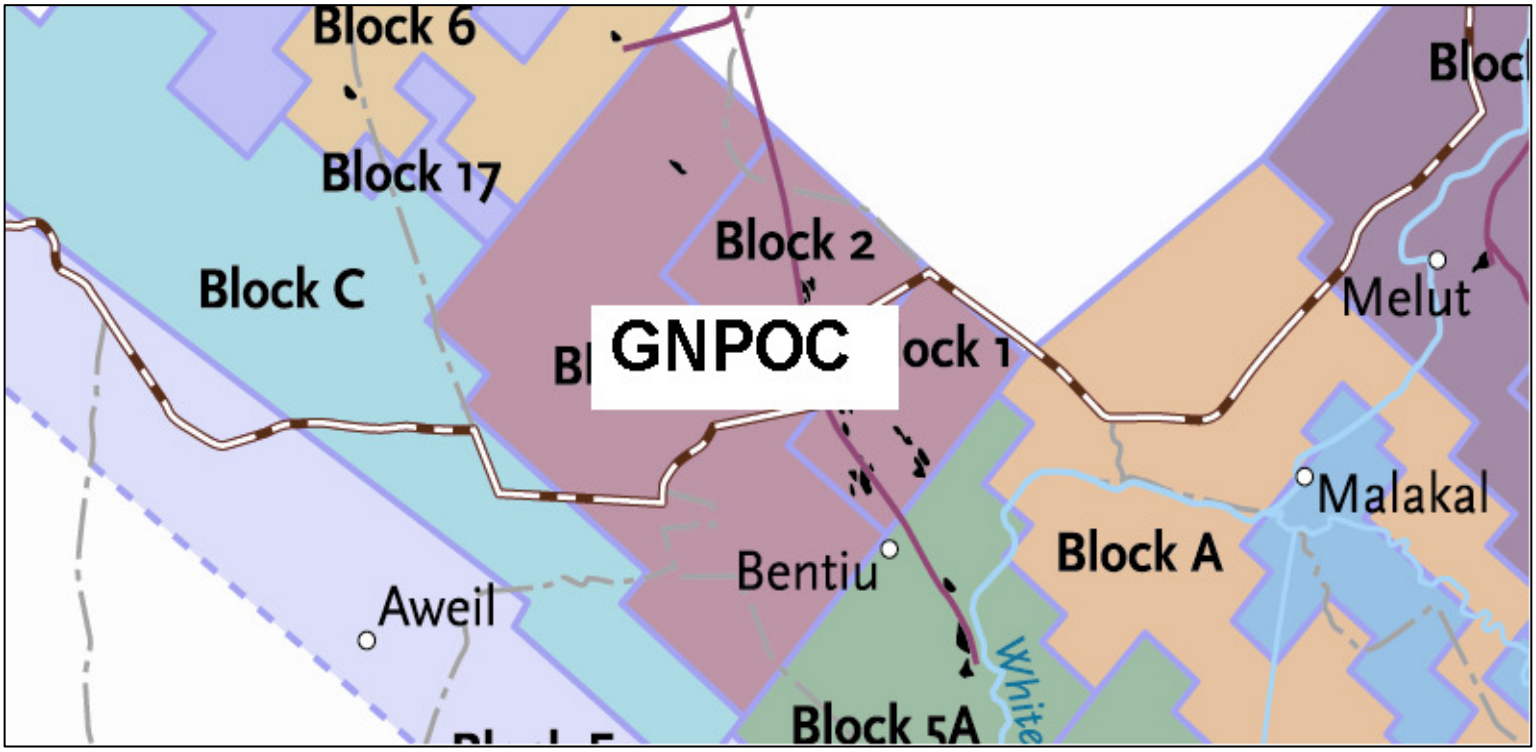
Oil contract updated

Bringing the GNPOC contract in line with the CPA



Oil contract updated

Bringing the GNPOC contract in line with the CPA

A report by IKV Pax Christi

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Utrecht

This report came about in association with IKV Pax Christi, Fatal Transactions and European Coalition on Oil in Sudan (ECOS)

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Foreword

Earlier this year IKV Pax Christi and European Coalition on Oil in Sudan (ECOS) came into possession of a Petroleum Contract of the Greater Nile Petroleum Operating Company (GNPOC). Interest was raised to take a closer look at this document and review how it addresses the interests of the local communities in Sudan. The in 2005 reached Comprehensive Peace Agreement, which bought an end to the long lasting civil war between North and South, provides a guideline for how Petroleum Operations are to be run.
In this report the gaps and inconsistencies between the contract and CPA's Protocol on Wealth Sharing are identified and suggestions to cover these discrepancies are offered using petroleum (model) contracts from all over the world.

This report is a first attempt to gain insight in how the extremely profitable petroleum business can contribute to the welfare and wellbeing of all Sudanese nationals. Although the behaviour of both government and petroleum companies are as important as or of more important than contractual provisions, if a government wants enforceable rights to require certain behaviour, contractual or other legal provisions are necessary. Suggesting updated clauses for two Articles of a Sudanese GNPOC contract, thus provides a starting point for further contract reviewing processes.

Ariane Nooteboom,
Intern IKV PaxChristi

1. Introduction

Worldwide governments of resource rich countries are reviewing oil and mining contracts in order to determine whether the companies have met their contractual commitments, and if their is a need for revision along current national and international developments. Petroleum operations are known to have severe social and environmental impact. People in Sudan have come to learn just that; the industry wreaked their natural environment, not only destroying habitat, wildlife, forests and waters, but also causing starvation and illness (La'O Hamutuk, 2004a).

Earlier this year IKV Pax Christi and European Coalition on Oil in Sudan (ECOS) came into possession of the 1997 Exploration and Production Sharing Agreement (EPSA) between the Government of the Republic of the Sudan and China National Petroleum Corporation (CNPC), Petronas Carigali Overseas SDN BHD, State Petroleum Corporation (SPC) and Sudapet Ltd covering Blocks 1a, 2a and 4. Sources of within the industry confirmed that this contract is currently used by the GNPOC and has not been altered (ECOS & NESI, 2006). With the retrieval of the contract, interest was raised to review how the non-economic regulations are stipulated and what public interests are addressed.

The GNPOC contract was signed in 1997, a time when no legislative framework existed to appropriately control social and environmental impacts of oil exploitation. In March 2005 a framework was provided with the introduction of the Comprehensive Peace Agreement, which set out binding constitutional terms for oil operations. The Protocol on Wealth Sharing (GOS & SPLM/A, 2005:47-62) describes specific guidelines and regulations according to which the petroleum sector is to be run. With the introduction of the CPA the need is raised to review existing Sudanese petroleum contracts, and update them to be in line with the Protocol of Wealth Sharing.

This report will review two non-economic articles and suggest modifications to bring them in accordance with the stipulations of the CPA's Wealth Sharing Protocol.
The content of the report is structured as follows; *first*, the role of petroleum contracts in Sudan is further elaborated on. *Second*, the Protocol on Wealth Sharing of the CPA is described. *Third*, amendments are made in Article XI - Diligent and Workmanlike Operations and Article XVII – Employment and Training of Sudanese Nationals, suggesting newly aligned clauses.

2. The role of Petroleum Contracts

Governments enter into contracts with foreign companies, to develop and sell their oil and gas. Negotiating the right contract is essential to a government's efforts to reap the benefits of its natural resources. The contract terms determine how much a producing nation earns from its natural resources, and often, whether a government will have the regulatory authority to enforce environmental, health, and other standards that apply to the petroleum operators (RW & OSI, 2005).

A government is expected to use its regulatory power to protect the public interest — to ensure, for example, that oil spills do not damage public drinking water. Yet a host government is also expected to create a positive investment climate that promotes economic and job growth while establishing investment laws and penalties for their violation. Host governments need to learn how to balance these competing needs. Further complicating matters is the fact that as a signatory to any contract, the government acts like a normal business, seeking to maximize its revenues. This places the government in the awkward situation of having to regulate itself (RW & OSI, 2005).

2.1 Legal and Contract Structure of Sudan

Petroleum Regime Framework of Sudan (Park, 2006):

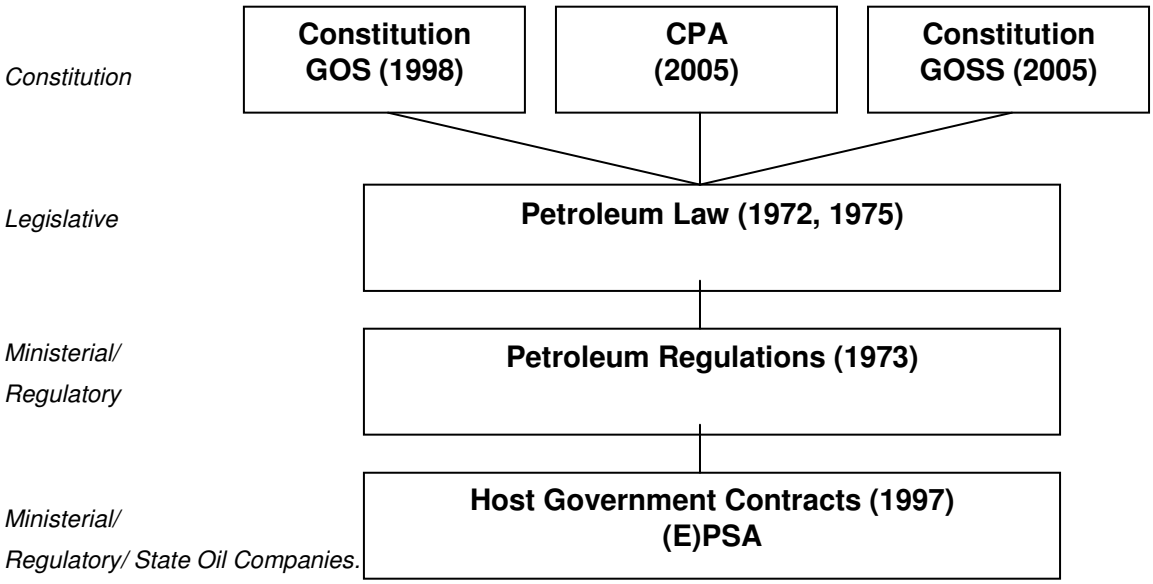

Figure 1: Petroleum Regime Framework of Sudan

On the 1st of July 1998 the Constitution of Sudan came into force after being approved in a referendum. The constitution lays down the fundamental political principles, and establishes

the structure, procedures, powers and duties of the Sudanese Government. Since 2005 this physique is complemented by the Comprehensive Peace Agreement and the newly founded constitution of the Government of Southern Sudan (GOSS) (Lexadin, 2008).

Below the constitutional acts, legislative stipulations can be found. Under Sudanese law for example, all petroleum found in its natural state in the strata of the earth or in the continental shelf is deemed to be the property of the state. The exploration and exploitation of oil resources in the Sudan is regulated by the Petroleum Resources Act, 1972 and the Petroleum Resources Regulations, 1973. These two pieces of legislation regulate the petroleum activities onshore and offshore (Lexadin, 2008).

The 1972 Act provided for the grant of an exclusive exploration license followed, in the case of oil discovery by a lease which gives the exploiter an exclusive right to exploit the discovered oil. In order to render the legal framework for the exploration and exploitation of oil more flexible, the Petroleum Resources Act 1972 was amended in 1975 by the adoption of Section 25. This introduced a drastic change. This new section in its latest version gives the Minister of Energy and Mining, with the approval of the Board of Petroleum Affairs and the consent of the Council of Ministers, the right to make any agreement for the exploration and exploitation of oil in the Sudan. These agreements may be in the form of production sharing agreements (Mbendi, 2008).

2.2 Host Government Concerns

A host government has several key concerns dealing with oil. Within the legal and contract regime a few areas can be distinguished which are of more importance (Palacio das Cinzas's, 2004; Park, 2006).

1. As an economic partner the Government is interested to *receive a fair share of the fiscal "pie"*. It is in the interest of the host government to keep recoverable costs low, as this will lower their revenues.
2. On the other side the Government is to use its regulatory power to *protect the public interest*. In order to do so it should protect environment and people. Therefore, of importance for a government is to:
    a. Protect the environment;
    b. Ensure proper treatment of residents and communities affected by development;
    c. Facilitate local employment, training and transfer of technology;
    d. Purchase of local goods & services; this generates employment in several fields of the service delivery sector and benefits the economy of a country (economical multiplier effect);

e. Have reasonable controls over development activity; Regulatory power to protect public interest can be used when for example damage is inflicted;
f. Establish a local office and notice; Facilitating communication also provides economical benefits to the country by renting the office space, providing staff etc.

2.3 Petroleum Companies Concerns

Companies in petroleum activities are very concerned about six key aspects of the legal and contract regime (Palacio das Cinzas's, 2004; Park, 2006):

1. Similar as the host government, *low costs* and a *fair share of the fiscal pie* have the company's highest priority;
2. To limit the companies costs, *little exploration obligations* are preferable;
3. The *later the payment of revenues to host government*, the more interest over the revenues the petroleum companies can receive;
4. *Right to monetize*; A petroleum company that has made a discovery will want to appraise, develop, produce, market and transport its oil and gas. However, many host government contracts contain provisions requiring government approvals in order to do so. The legal and contract regime must be assessed to determine the risks involved in obtaining the required approvals, and the resource available for the government's failure to do so;
5. *Stability*; A petroleum company will want assurances that the terms and conditions on which it has agreed to invest will remain stable, and will not be subject to unilateral revision by the host government. The company is risking capital –it does not want rules to change, or if they are changed, there should be suitable compensation or adjustment of contract terms. Fiscal stability is the most important aspect of this issue. But some legal and contractual regimes offer full contractual stability, both fiscal and non-fiscal;
6. *Enforceable international arbitration*; International arbitration is now the norm for the resolution of disputes under upstream petroleum contracts. Absent international arbitration, the parties would have to rely on local courts, which in many cases cannot be relied upon to judge fairly between the government and an investor.

2.4 Host Government Contracts

A government can choose between five types of contractual systems it will use to establish the terms of the development process: a concession or license agreement, a joint venture (JV), a production-sharing agreement (PSA), a Service Contract or a Hybrid. A concession often grants an oil company exclusive rights to explore, develop, sell and export oil extracted from a specified area for a fixed amount of time. Companies compete by offering bids, often coupled with signing bonuses, for the license to such rights. A joint venture implies that two or more parties wish to pursue a joint undertaking in some still to be clarified form. Given the open-ended nature of this type of structure, JVs are less commonly used as the basic agreement between an oil company and a host government. PSAs are an "Indonesian formula", in which the state retains ownership of the resources and negotiate a profit-sharing system. When a petroleum company acts as a contractor for the host government, this is called a Service Contract. Hybrid contracts involve attributes of more than one of the above types. Each form of contract has its advantages and disadvantages, especially from a commercial point of view. The details of the contract can vary greatly even between similar types of contracts (RW & OSI, 2005).

Type of agreement	**Exclusive rights to explore and produce**	**Ownership of production**
1. Concession	Private company	Private Company
2. Joint Venture	Shared	Shared
3. Production Sharing	State	Shared
4. Service contract	State	State

Figure 2: Contractual Petroleum Systems

2.5 Production Sharing Agreements

The Government of the Republic of the Sudan (GOS) has entered into Exploration and Production Sharing Agreements (EPSAs), with international petroleum companies to set out the terms under which the firms can exploit oil.

Production Sharing Agreements (PSA), how they are commonly known, are used primarily to determine the share a private company will receive of the natural resources, in Sudan: oil, extracted from a particular country. In PSAs the national oil company awards the execution of exploration and production activities to the international oil company. The oil companies, most often in the form of a Consortium, bears the mineral and financial risk of the initiative and, when successful, recovers capital expenditure and costs incurred in the year (cost oil) by means of a share of production. This production share varies along with monthly production volume. The PSA recognizes that the ownership of natural resources rests in the

state but at the same time permits foreign companies to manage and operate the development of the oil field (RW & OSI, 2005). The complexity of a PSA depends on the soundness of the legal infrastructure of a state. For example, if a country does not possess basic rules governing petroleum operations, the issues normally covered by such a law will have to be addressed in the PSA. In short, the less reliable and/or predictable a state's legal system the more issues must be covered and specified within a PSA (RW & OSI, 2005). Sudan is lacking detailed and adequate laws, rules and regulations for oil exploitation, in the PSAs often nothing is mentioned or only a referral is made to the governing laws, which are in the case of Sudan not sufficient (ECOS & NESI, 2006).

2.5.1 The GNPOC Contract

The contract under revision dates back to 1 March 1997 and is an agreement between The Government of The Republic of The Sudan and China National Petroleum Corporation (CNPC), Petronas Carigali Overseas SDN BHD, State Petroleum Corporation (SPC) and Sudapet Ltd. To operate the assigned blocks the companies formed a joined operating company called the Greater Nile Petroleum Operating Company Limited (GNPOC). CNPC has with 40% the largest participating interest, followed by Petronas with 30%, and state owned oil companies SPC and Sudapet respectively 25% and 5%. Blocks 1a, 2a and 4 are assigned to the companies for the exploration and extraction of petroleum. The exploration activities cover an immense concession area of about 50,000 square kilometres. (GOS, 1997).

In the contract a Production Sharing Agreement structure is adopted, with some "hybrid" aspects apply, as state oil company Sudapet given a "carry", akin to the Joint Venture structure (Park, 2006). The host government is represented by the Minister of Energy and Mining, and is in the contract referred to with the term 'Minister'. The GNPOC Consortium carries the name 'Contractor'.

2.5.2 Contractual Arrangements

Each contract is composed of several articles deciding the terms of the agreement. Generally a similar structure can be found in petroleum contracts, starting with articles deciding on the grants of rights, the work programme and cost recovery. Following articles dealing with information sharing, laws & regulations and force majeure, but also social and environmental concerns dealing with employment, services, and environmental protection are to be set out (RW & OSI, 2005).

In the contract between GOS and GNPOC some of these key issues, which are outlined in more detail in the Protocol on Wealth Sharing of the CPA (GOS & SPLM(A), 2005: 47-62), are not (appropriately) addressed. To bring the EPSA in line with the CPA two

articles dealing with the social and environmental rules and regulations, Articles XI and XVII, are to be reviewed. Both articles fail to cover the guidelines the CPA's Protocol on Wealth Sharing sets out. Article XI is called 'Diligent and Workmanlike Operations', and includes clauses on preventing damage. In addition to damage control, other concerns such as environmental protection, resource conservation, forced relocation, compensation and community involvement are to be included to be in line with the CPA. Environmental regulations, for example, are practically non-existent. Consider the fact that the term 'environment' is only mentioned once in the entire contract and not even in the article that deals with diligent and workmanlike operations. In addition, the involvement of local communities and compensation of caused damage is not arranged in any of the articles. Article XVII deals with the 'Employment and Training of Sudanese Nationals', this Article determines Sudan as the human supply base of petroleum operations. The Protocol on Wealth Sharing (GOS & SPLM(A), 2005: 47-62) states that Southern Sudanese should be equally included in petroleum matters, and efforts is to be undertaken to actively bring Southern Sudan to the same development level as Northern Sudan (GOS & SPLM(A), 2005: 47-62).

3. The CPA: Wealth Sharing

Over the long years of war in Sudan, there were numerous attempts by various external actors, including neighbouring States, concerned donors and other States, as well as the parties themselves, to bring the conflict to an end. In 1993, the Heads of State of the Intergovernmental Authority on Drought and Development (IGADD) became involved in the latest initiative to bring the opposing parties together. This was the beginning of a long process that has led to the signing of the Comprehensive Peace Agreement (CPA) in 2005. Under the mediation of the Intergovernmental Authority on Development (IGAD), the GOS and the SPLM/A signed a series of six agreements in the shape of protocols: The Protocol of Machakos, on security arrangements, on wealth-sharing, on Power-sharing, on the resolution of conflict in southern Kordofan/Nuba Mountains and the Blue Nile States and on the resolution of conflict in Abyei (GOS & SPLM/A, 2005).

The CPA (GOS & SPLM/A, 2005) contains a number of provisions addressing petroleum. It is to be interpreted as interim "constitution", therefore the petroleum provisions of the CPA should be treated as Sudan's "petroleum constitution" which need to be implemented in the subsidiary laws, regulations and contracts. In this report the CPA will be taken as a point of departure.

The petroleum provisions are principally found in Chapter III, Protocol on Wealth Sharing (GOS & SPLM/A, 2005: 47-62). Key sections involving social and environmental provisions are:

1. Guiding Principles on Oil Development
2. National Petroleum Commission
3. Existing Oil Contracts

3. 1 Guiding Principles on Oil Development

On behalf of equitable sharing of common wealth and the ownership of and natural resources, decided is:

1. Provision 3.1.1 (GOS & SPLM/A, 2005: 51):*Sustainable utilization of oil* as a non-renewable natural resource consistent with:

- the national interest and the public good
- the interest of the affected states/regions
- the interests of the local population in affected areas
- national environmental policies, biodiversity conservation guidelines, and cultural heritage protection principles.

2. Provision 3.1.2 (GOS & SPLM/A, 2005: 51): *Empowerment of the appropriate levels of government* to develop and manage, in consultation with local communities.
3. Provision 3.1.5 (GOS & SPLM/A, 2005: 51-52): *Persons enjoying rights in land shall be consulted* and their views shall duly be taken into account in respect of decisions to develop subterranean natural resources from the area in which they have rights, and shall share in the benefits of that development.
4. Provision 3.1.6 (GOS & SPLM/A, 2005: 52): Persons enjoying rights in land are *entitled to compensation* on just terms arising from acquisition or development of land for the extraction of subterranean natural resources from the area in respect of which they have rights.
5. Provision 3.1.7 (GOS & SPLM/A, 2005: 52):The communities in whose areas development of subterranean natural resources occurs have the *right to participate*, through their respective states/regions, in the negotiation of contracts for the development of those resources.
Carrying out these guiding principles is to be done according to Provision 1.10 (GOS & SPLM/A, 2005: 48) using the best known practices in petroleum practices and with the involvement of all stakeholders in the decision process, according to Provision 3.5.2 (GOS & SPLM/A, 2005: 53).

3. 2 Formation of National Petroleum Commission

Provision 3.2 of the Protocol on Wealth Sharing of the CPA (GOS & SPLM/A, 2005: 47-62). establishes the National Petroleum Commission (NPC). Its function is to formulate public policies and guidelines in relation to the development and management of the petroleum sector. It is also to monitor and assess the implementation of those policies to ensure that they work in the best interests of the people of Sudan. The development of strategies and programmes for the petroleum sector is assigned to them. The NPC should negotiate and approve all oil contracts for the exploration and development of oil in the Sudan, and ensure they are consistent with the NPC's principles, policies and guidelines. The Commission is to be seen as the highest authority on petroleum exploitation.

3. 3 Existing Oil Contracts

The Wealth Sharing Protocol of the CPA devotes one section to existing contracts. Two provisions stand out. The first is Provision 4.2 (GOS & SPLM/A, 2005: 53), it states that: "Contracts shall not be subject to re-negotiation". This statement does not apply to this report, as solely amendments to clauses of the contract are suggested. Revising contracts is allowed according to article 4.3 of the Wealth Sharing Protocol (GOS & SPLM(A), 2005: 53), it declares: "if contracts are deemed to have fundamental social and environmental problems

the Government of Sudan will implement necessary remedial measures." Further the EPSA sets out two articles, Article XXVI – Governing Law and Jurisdiction, and Article XXXI – Amendment, Modification and Revision, explicating that amendments can be made in mutual agreement of both parties "to ensure the fair and equitable operation of the agreement in view of changing circumstances in the petroleum industry, and taking into consideration prevailing conditions in Sudan" (GOS, 1997: 47-48). Comparing the EPSA and CPA many gaps and inconsistencies are revealed, amendments need to be made to bring in line the two agreements.

4. EPSA under review

4.1 Methodology

In this report the CPA's Protocol on Wealth Sharing is brought in line with the EPSA of the GNPOC. To facilitate this process the following steps are taken:

First, determined is which non-economic rules and regulations are set out in the contract. The EPSA (GOS, 1997) deals with non-economic rules and regulations in two articles; Article XI – Diligent and Workmanlike Operations and XVII – Employment of Sudanese Nationals, these articles will therefore be reviewed.

Second, the CPA Protocol on Wealth Sharing (GOS & SPLM/A, 2005: 47-62) states that oil operations should be managed according to several guidelines and regulations. Defined is which requirements apply to this particular petroleum contract.

Third, taking the CPA as guide the two articles are reviewed for gaps and inconsistencies with what is set out in the Wealth Sharing Protocol.

Fourth, the discovered discrepancies are translated in(to) contractual clauses using existing (model) contracts from India, Pakistan, Azerbaijan, Kurdistan and Timor Leste.

Fifth, where the existing (model) contracts do not fill the void, an alternative translation is given using international best practices or regulations coming from the CPA's Wealth Sharing Protocol.

Sixth, suggestions for amendments are provided wiping out the discrepancies between CPA and the 1997 GNPOC EPSA. All together this will lead to the proposal of new clauses making the EPSA consistent with the CPA's Protocol on Wealth Sharing.

4.1.1 Comments

There are a few annotations to be made before moving on to the analysis of the contractual clauses.

First, the GNPOC EPSA was retrieved via an international reference library for oil, gas, and mineral laws. Sources from the industry have confirmed that this is the original EPSA of the GNPOC consortium operating blocks 1a, 2a and 4 (ECOS & NESI, 2006). Presumed is that no amendments have been made to this contract, and that applicable Sudanese laws do not otherwise affect the contract, referring to the 1958 Petroleum Resources Development Act & 1959 Regulations and 1972 Petroleum Resources Act & 1973 Regulations.

Second, noted should be that how the Consortium behaves is as important as or more important than the contractual provisions. A poor contractual provision matters little if the Consortiums behaviour reflects a higher standard. However, if a government wants

enforceable rights to require certain behaviour, contractual or other legal provisions are necessary.

Third, the contract is as strong as its enforcement. The government has to have the intention and means to supervise how and if the contractual terms are carried out appropriately.

Fourth, this study solely focuses on revealing and analyzing the discrepancies between Chapter 3: Wealth Sharing of the CPA (GOS & SPLM/A, 2005: 47-62) and contractual clauses from Articles XI and XVII. Several best known practices and (model) petroleum contracts are used to suggest how the gaps and inconsistencies between CPA and EPSA can be covered. The precise effects of amending and revising these contractual provisions has not been researched, and therefore statements on the effectiveness of proposed revisions can not be made. Before revisions are to be considered to be enacted, the effects are to be studied thoroughly.

Fifth, petroleum contracts should complement the law, not substitute it. A contract is a legally binding agreement between parties. In the Petroleum Regime Legislation of the country it stands below the law of the country (Figure 1, page 7). The contract arranges all matters that are not already arranged in the law of the host government. Unfortunately we were not able to get hold of the Sudanese Petroleum Resources Act of 1972, amended in 1975. Therefore we cannot ensure that some sort of overlap exists. However, like stated by Revenue Watch and Open Society Institute (2005: 69) “the less reliable and/or predictable a state’s legal system, the more issues must be covered and specified within a PSA.” Thus, chosen is to be as specific and inclusive as possible.

4.2 Environment, Compensation and Community Involvement

4.2.1. Article XI - Revised Clauses

From Article XI – Diligent and Workmanlike Operations, clause 1, 4 and 6 showed discrepancies with the requirements set out in the CPA Protocol on Wealth Sharing. Each clause is reviewed for parts of the texts that can be maintained, which are invalid and thus can be deleted and what text is to be added to become in line with the CPA Protocol.

The following editing-approach is used:

- Original maintained text: Normal
- Original invalid text ~~Crossed out~~
- New text **Bold**

NB: When referring to 'Contractor' the GNPOC Consortium is meant, and the term 'Minister' refers to the Minister of Energy and Mining of the Government of Sudan.

Article XI

Diligent and Workmanlike Operations

Clause 1: *Diligent and Workmanlike Operations*

(1) Contractor shall conduct its operations ~~in the Contract Area~~ with due diligence and in a workmanlike manner and in accordance with ~~good and sound methods and standards of the petroleum industry~~ **the best known practices in the sustainable utilization and control of natural resources and environmental protection, including:**

(i) IPIECA

(ii) IFC Performance Standards/ EHS Guidelines, World Bank

(iii) Voluntary Principles

(iv) American Petroleum Institute

In addition Contractor shall comply with the requirements of all applicable governing laws.

Environmental Protection/ Natural Resources

(2) Contractor shall take all reasonable measures to **– in all stages of the project cycle: design, construction, operation, and decommissioning (**IFC, 2006)**-** prevent ~~loss or waste of petroleum above or under the ground in any form during drilling, producing, gathering and distributing or storage operations. Without prejudice to the generality of the aforesaid, Contractor shall:~~

~~(a) Take whatever practical measures are necessary to prevent any injurious ingress of water or damage of any kind to any petroleum bearing formation which may be encountered while drilling operations are in progress or upon abandonment of any well shall carefully locate and preserve any fresh water sources discovered in the course of such operations.~~

~~(b) Take all reasonable precautions against fire and any unwarranted wasting of Crude Oil, Gas or water~~. **Environmental Damage and, where some adverse impact on the environment is unavoidable, to minimize such damage and the consequential effects thereof on property and people (**M.P.N.R, 2001; M.P.N.G, 2007**) in and outside the contract area (**IFC, 2006**).**

(3) **Contractor is to protect the environment, incorporating and examining resource conservation and energy efficiency measures in its operations (**IFC, 2006**). Without prejudice to the generality of the aforesaid, Contractor shall:**

(i) keep separate:

(a) each Reservoir discovered in the Contract Area; and

(b) such of the sources of water discovered in the Contract Area as the Minister directs (D.R.T.L, 2004**);**

(ii) ensure drainage patterns are not obstructed and brides, sluices or culverts have to be provided to allow free flow of water (Leek Deng, 2007**);**

(iii) protection of surface and subsurface water, wildlife, fish stocks, grazing, agricultural land and forestry, and all other environmental conditions that effect the lives and livelihoods of inhabitants of Sudan (Leek Deng, 2007; ECOS, 2008**).**

(iv) where the Contract Area is partly located in areas forming part of biosphere reserves and other biologically sensitive areas, passage through these areas shall generally not be permitted. However, if there is no passage, other than through these areas to reach a particular point beyond these areas, permission of the appropriate authorities shall be obtained (M.P.N.R, 2001; M.P.N.G, 2007**);**

(v) maintain in safe and good condition and repair, the Contract Area and all structures, facilities, installations, equipment and other property, and other works, used or to be used in Petroleum Operations (D.R.T.L, 2004**);**

(vi) prevent water or any other matter entering any Reservoir through wells in the Contract Area, except when required by, and in accordance with, the Development Plan and Good Oil Field (D.R.T.L, 2004**);**

Security & Compensation

(4) **Contractor shall ensure adequate compensation for injury to persons or damage to property caused by the effect of Petroleum Operations (**M.P.N.R, 2001; M.P.N.G, 2007**). Without prejudice to the generality of the aforesaid, Contractor shall:**

(a) Ensure the safety, health, and welfare of persons in or affected by Petroleum Operations (D.R.T.L, 2004**), including:**

(i) standards of living of displaced persons are to be replaced;

(ii) adequate housing with security of tenure at resettlement sites should be provided (IFC, 2006**).**

(b) Ensuring that resettlement activities are implemented with appropriate disclosure of information, consultation, and the informed participation of those affected (IFC, 2006**).**

(c) Adequate compensation for persons or damage to property needs to be guaranteed, (M.P.N.R, 2001; GOS & SPLM(A), 2005; IFC, 2006; M.P.N.G, 2007**) including damage occurred to property, crops, loss of harvest, grazing, lands, fishing spots or obstruction of water supply to settlement, as a result of petroleum works (**Leek Deng, 2007**).**

Community Involvement

(5) **Regarding the involvement of local communities, Contractor shall see to that:**

(a) persons enjoying rights in land shall be consulted and their views shall duly be taken into account (GOS & SPLM/A, 2005: 51**);**

(b) affected communities have the right to participate, through their respective states/regions, in the negotiation of contracts for the development of those resources (GOS & SPLM/A, 2005: 52**);**

(c) appropriate disclosure of information, consultation, and the informed participation of those affected and share in the benefits of the Petroleum Operations (IFC, 2006**);**

(d) provide quarterly reports that describe progress with implementation of the environmental procedures on issues that involve ongoing risk to or impacts on affected communities, and on issues that the consultation process has identified as of concern to those communities (IFC, 2006**);**

(e) If the work programme results in material changes in, or additions to, the mitigation measures or actions described in the environmental procedures on issues of concern to the affected communities, the updated mitigation measures or actions will also be disclosed. These reports will be in a format accessible to the affected communities. The frequency of these reports will be proportionate to the concerns of affected communities but not less than annually (IFC, 2006**).**

(f) Persons holding rights in land who are aggrieved by the decision shall seek relief through arbitration or in a court of law (GOS & SPLM/A, 2005:53**).**

Reinforcement

(6) **If the Contractor fails to comply with the clauses under Article XI or contravenes any relevant law, and such failure or contravention results in any Environmental Damage, the Contractor shall forthwith take all necessary and reasonable measures to remedy the failure and the effects thereof. If the Contractor deems it necessary, it may also require the Contractor to discontinue Petroleum Operations in whole or in part until the Contractor has taken such remedial measures or has repaired any damage caused (**M.P.N.R, 2001; M.P.N.G, 2007**).**

Clause 4: *Information Sharing & Recording*

(1) Contractor shall record data regarding the quantities of petroleum and water produced monthly from the Contract area. Such data shall be sent to the Minister within thirty (30) days

after it is obtained. Daily or weekly statistics regarding the production from the Contract Area shall be available at all reasonable times for examination by the Minister.

(2) **Contractor will establish procedures to monitor and measure the effectiveness of the environmental procedures. In addition to recording information to track performance and establishing relevant operational controls, the Contractor should use dynamic mechanisms, such as inspections and audits, where relevant, to verify compliance and progress toward the desired outcomes. For projects with significant impacts that are diverse, irreversible, or unprecedented, the Contractor will retain qualified and experienced external experts to verify its monitoring information. The extent of monitoring should be commensurate with the project's risks and impacts and with the project's compliance requirements. Monitoring should be adjusted according to performance experience and feedback. The Contractor will document monitoring results monthly, and identify and reflect the necessary corrective and preventive actions in an amended work programme. The Contractor will implement these corrective and preventive actions, with consultation with in minister, and follow up on these actions to ensure their effectiveness (**IFC, 2006**). All monitoring documents will be made publicly available.**

Clause 6: *Standards & Procedures*

(1) Contractor shall ~~within six (6) months of the date of signature of the Agreement provide the Minister with standards and procedures for the conduct of Petroleum Operations for review and agreement~~ **carry out environmental impact studies in order:**

(a) to determine at the time of the studies the prevailing situation relating to the environment, human beings and local communities, the flora and fauna in the Contract Area and in the adjoining or neighbouring areas; and

(b) to establish the likely effect including the risks and impacts (IFC, 2007**) on the environment, human beings and local communities, the flora and fauna in the Contract Area and in the adjoining or neighbouring areas in consequence of the relevant phase of Petroleum Operations to be conducted under this Contract, and to submit, for consideration by the Parties, methods and measures contemplated in minimising Environmental Damage and carrying out Site Restoration activities (**M.P.N.G, 2007**).**

(2)**The first of the aforementioned studies shall be carried out in two parts, namely, a preliminary part which must be concluded before commencement of any field work relating to a seismographic or other survey, and a final part relating to drilling in the Exploration Period. The part of the study relating to drilling operations in the Exploration Period shall be approved by the Minister before the commencement of such drilling operations, it being understood that such approval shall not be unreasonably withheld (**M.P.N.G, 2007**).**

(3) **The second of the aforementioned studies shall be completed before commencement of Development Operations and shall be submitted by the Contractor as part of the Development Plan, with specific approval of the Minister being obtained before**

commencement of Development Operations, it being understood that such approval shall not be unreasonably withheld (M.P.N.R, 2001**).**

(4) **The studies mentioned in clause 6 above shall contain proposed environmental guidelines to be followed in order to minimize Environmental Damage and shall include, but not be limited to, the following, to the extent appropriate to the respective study taking into account the phase of operations to which the study relates (**M.P.N.R, 2001; M.P.N.G, 2007**):**

(a) proposed access cutting;
(b) clearing and timber salvage;
(c) wildlife and habitat protection;
(d) fuel storage and handling;
(e) use of explosives;
(f) camps and staging;
(g) liquid and solid waste disposal;
(h) cultural and archaeological sites;
(i) selection of drilling sites;
(j) terrain stabilization;
(k) protection of freshwater horizons;
(l) blowout prevention plan;
(m) flaring during completion and testing of Gas and Oil Wells;
(n) abandonment of Wells;
(o) rig dismantling and site completion;
(p) reclamation for abandonment;
(q) noise control;
(r) debris disposal; and
(s) protection of natural drainage and water flow.

(5) **Subject to the provision of all applicable laws and notifications on protection of environment, any new project or expansion or modernization projects for petroleum operations for which a proposal is submitted by the Contractor, the Minister shall complete the assessment of the project within a period of ninety (90) days from the receipt of the requisite documents and data from the project authorities and completion of public hearing. The decision of the Minister on the proposal of the Contractor for environmental clearance shall be conveyed within thirty (30) days thereafter (**M.P.N.R, 2001; M.P.N.G, 2007**).**

(6) **The Contractor shall ensure that the pertinent completed environmental impact studies are made available to affected local communities, its employees, and its contractors and Subcontractors to develop adequate and proper awareness of the measures and methods of environmental protection to be used in carrying out the Petroleum Operations (**M.P.N.R, 2001; M.P.N.G, 2007**).**

Emergency Response

(7) **The Contractor shall, prior to conducting any drilling activities, prepare and submit for review by the Minister contingency plans for dealing with Oil spills, fires, accidents and emergencies, designed to achieve rapid and effective emergency response. The plans referred to above shall be discussed with the Minister and concerns expressed shall be taken into account (**M.P.N.R, 2001; M.P.N.G, 2007**).**

(a) In the event of an emergency, accident, Oil spill or fire arising from Petroleum Operations affecting the environment, the Contractor shall forthwith notify the Minister and shall promptly implement the relevant contingency plan and perform such Site Restoration as may be necessary in accordance with modern oilfield and petroleum industry practices (M.P.N.R, 2001; M.P.N.G, 2007**).**

(b) In the event of any other emergency or accident arising from the Petroleum Operations affecting the environment, the Contractor shall take such action as may be prudent and necessary in accordance with best known oilfield practices in such circumstances (M.P.N.R, 2001; M.P.N.G, 2007**).**

4.2.2 Terminology

Article XI in general and clause 1 in particular are filled with unspecific terms. Terms like: 'Due diligence', 'workmanlike manner', 'good and sound methods and standards of the petroleum industry', and 'all reasonable measures', are not further specified in the contract and therefore unenforceable and evolving substitute for standard. The first article of all petroleum contracts, including the EPSA under review, starts with defining the meanings of terms used in the contract. It would be of great use to further specify terms that remain unclear and unspecific in Article I – Definitions (GOS, 1997: 3).

Regarding definitions, the CPA states prominently that, not just 'good and sound' practices are to be used, but 'the *best known practices in the sustainable utilization and control of natural resources* shall be followed' (GOS & SPLM(A), 2005: 48). Law and jurisprudence in Sudan do not provide a framework for how to deal with petroleum operations, the CPA states that best known practices can offer guidelines to which operations should be run in the national interest of the country. It needs to be clear which best known practices the Contractor has to abide by. The following four resources provide reporting guidance applicable to the oil industry drawn up by oil companies themselves or international organisations like the United Nations and the World Bank:

- International Petroleum Industry Environmental Conservation Association (IPIECA), www.ipieca.org
- American Petroleum Institute (API)
- Voluntary Principles (Annex 4)

- International Finance Corporation (IFC), Performance Standards/ EHS Guidelines (respectively Annex 5 and 6).

These practices provide a direct reference to what the best known practices in the sustainable utilization and control of natural resources currently are.

4.2.3 Environmental protection

The Comprehensive Peace Agreement (CPA), the IFC and reviewed contracts state that the Contractor should protect environment and conserve natural resources, in addition environmental damage should be prevented and/or minimized (GOS & SPLM(A), 2005; IFC, 2006). To protect and prevent damage to the environment the CPA states that natural resources shall be, in a sustainable manner, utilized and controlled according to the best known practices (GOS & SPLM/A, 2005: 48). This should be consistent with Provision 3.1.1, GOS & SPLM/A, 2005: 51):

1. the national interest and the public good;
2. the interest of the affected states/ regions;
3. the interests of the local population in affected areas;
4. national environment policies, biodiversity conservation guidelines, and cultural heritage protection principles.

In addition, if existing contracts are deemed to have fundamental social and environmental problems the Government of Sudan will implement necessary remedial measures.

Comply with applicable legislation

Other contracts refer to legislative acts covering environmental protection. Article XI does not state that the Contractor should comply with applicable laws of the host-country; this is a general statement that should be emphasized, considering all environmental acts in Sudan (SOCAR, 1996; T.P.D.C., 2000; D.R.T.L., 2004).

Preventing (environmental) damage

Clause 1 describes that measures should be taken to prevent damage. What is stated in this clause can not be seen as wrong or faulty, but it is very deficient. Described should be exactly what measures will be taken, during which phases of operations and with what geographical boundaries. The current clause limits itself to the prevention of loss and waste of Petroleum. Next to the loss of water and waste, other environmental considerations need to be made that are currently not addressed in this article, think of for example drilling mud. Further, not only measures to prevent damage should be taken, but also to minimize it. A more inclusive clause would be of greater use. Moreover, this clause is limited to prevention of loss or waste during drilling, producing, gathering and distributing or storage operations.

These phases primarily belong to the Petroleum operational phase; instead the entire projects lifecycle should be included, so design, construction, operation and decommissioning (IFC, 2006; 2007).
Environmental damage, like water contamination or toxic gasses, does not know any boundaries, therefore it is to be stated that the environment in and outside the contract area has to be protected against damage (IFC, 2006).

Environmental Protection and Conservation of Natural resources
The CPA' Protocol on Wealth Sharing refers various times to the sustainable utilization of natural resources. According to the Governor of Jonglei State, Deng Leek, companies have to take serious steps with respects to drilling on land to protect the surface and ground water from contamination by toxic or saline products (Leek Deng, 2007). Article XI states that any fresh water discoveries should be located and preserved, this description is vague because it does not show how fresh water discoveries should be located and especially what should be done to preserve them. Moreover, it is incorporated into the last part of a sub-clause, the preservation of natural resources is very important for Sudan, and should be more prominently situated in the clause and elaborated on. A model of a Petroleum Operations contract from Timor Leste explicates that Natural resources:
(1) Keep separate each reservoir discovered in the Contract Area and ones discovered;
(2) Prevent water or any other matter entering Reservoir through wells in the contract area (D.R.T.L., 2004);
Additionally the following protection measures can be adapted:
(3) Protection of surface and subsurface water, wildlife, fish stocks, grazing, agricultural land and forestry, and all other environmental conditions that effect the lives and livelihoods of individuals (Leek Deng, 2007; ECOS, 2008);
(4) When constructing access roads or any earth moving works, operators have to ensure drainage patterns are not obstructed and brides, sluices or culverts have to be provided to allow free flow of water (Leek Deng, 2007);
(5) Further, next to fresh water resources there are other natural resources that need protection, like biologically sensitive areas such as forests. These areas can be protected by forbidding passage ways through forests unless there is no other option (M.P.N.G, 2007);
(6) To protect and preserve the environment and natural resources in sustainable manner, long term efficiency should be considered. According to Performance Standard 3 (IFC, 2006) the contract should incorporate resource conservation and energy efficiency measures consistent with the principles of cleaner production.

Issues

- ✓ Comply with all applicable governing laws;
- ✓ Being not precise on what measures will be taken and what will be protected;
- ✓ Protection of environment and prevention of damage not only in some phases of the petroleum project life cycle, but all phases;
- ✓ Pollution does not know any geographical boundaries, therefore measures are to cover as far as the impact stretches;
- ✓ Preservation of natural water resources;
- ✓ Protection of surface and subsurface water, wildlife, fish stocks, grazing, agricultural land and forestry, and all other environmental conditions that effect the lives and livelihoods of individuals;
- ✓ Drainage patterns are not to be obstructed or an alternative have to be provided;
- ✓ Protect biologically sensitive areas;
- ✓ Incorporate resource conservation and energy efficiency measures.

4.2.4 Security & Compensation

In Sudan many villages have been burned to the ground, forcing entire communities to resettle. CPA Provision 3.1.5 and 4.5 (GOS & SPLM/A, 2005:47-62) determine that persons holding rights are entitled to compensation on just terms. The EPSA leaves out measures against forced relocation and compensation of damage. To be in accordance with the CPA the clauses should address (the financing of) issues of forced relocation and compensation for damaged property and persons.

1. The Contractor should ensure safety, health and welfare of persons in or affected by Petroleum Operations (Palacio das Cinzas's, 2004). According to the Performance Standards of the World Bank (IFC, 2007) livelihoods and standards of living of displaced persons are to be replaced, and adequate housing with security of tenure at resettlement sites should be provided.
2. According to the CPA and the IFC the Contractor is to ensure that resettlement activities are implemented with appropriate disclosure of information, consultation, and the informed participation of those affected and share in the benefits of the Petroleum Operations (GOS & SPLM(A), 2005; IFC, 2006).
3. Adequate compensation for persons or damage to property needs to be guaranteed, (M.P.N.R, 2001; GOS & SPLM(A), 2005; IFC, 2006; M.P.N.G, 2007) including damage occurred to property, crops, loss of harvest, grazing, lands, fishing spots or obstruction of water supply to settlement, as a result of petroleum works (Leek Deng, 2007).

Issue

- ✓ Avoid or at least minimize displacement;
- ✓ The safety, health and welfare of persons in or affected by Petroleum Operations;
- ✓ Resettlement activities are to be done with disclosed information, consultation, informed participation, and with a share in benefits for those affected;
- ✓ Compensation for persons or damage to property.

4.2.5 Communities Interest

The involvement of affected groups and communities accounts for an important part of the CPA Protocol on Wealth Sharing (GOS & SPLM/A, 2005:47-62). At least seven provisions describe community involvement in the management of the petroleum sector. As the affected community is currently not included in any way in the EPSA, a new clause should be incorporated. According to the CPA it should include:

1. Persons enjoying rights in land shall be consulted and their views shall duly be taken into account (GOS & SPLM/A, 2005:51).
2. Affected communities have the right to participate, through their respective states/regions, in the negotiation of contracts for the development of those resources (GOS & SPLM/A, 2005:52).
3. Persons holding rights in land who are aggrieved by the decision shall seek relief through arbitration or in a court of law (GOS & SPLM/A, 2005:53).

The Performance Standards of the IFC (2006) add three other complementary conditions:

1. Appropriate disclosure of information, consultation, and the informed participation of those affected and share in the benefits of the Petroleum Operations.
2. To ensure transparency, the Contractor is to provide quarterly reports that describe progress with the implementation of the environmental standards and procedures on issues that involve ongoing risk to or impacts on affected communities (IFC, 2006).
3. Updated mitigation measures or actions are to be disclosed to all stakeholders involved, in a format accessible to the affected communities. The Frequency being twice or more on a yearly base, proportionate to the concerns of affected communities (IFC, 2006; 2007).

Issues

- ✓ Persons enjoying rights in land shall be consulted on their views on Petroleum Operations;
- ✓ Affected communities have the right to participate in the negotiation of the contract;
- ✓ Appropriate disclosure of information, consultation, and the informed participation of affected;

- ✓ Provide periodic reports on implementation of the environmental standards and procedures;
- ✓ Updated mitigation measures or actions will be disclosed twice or more yearly to all stakeholders involved;
- ✓ Aggrieved persons should be able to seek relief through arbitration or in a court of law.

4.2.6 Enforcement

Previously the environmental protection and the minimizing of damage were discussed. A question that arises is what to do if the Contractor fails to comply with relevant law or environmental procedures defined in the contract? Logically, the Contractor shall take all necessary and reasonable measures to remedy the failure and effects thereof. In addition, like stated in the Indian and Pakistani PSA Model (M.P.N.R, 2001), the Government or Minister will get the power to even discontinue Petroleum Operation in whole or part until the Contractor has taken such remedial measures. This is in line with provision 4.3 of the Wealth Sharing Protocol of the CPA (GOS & SPLM/A, 2005: 53) that states that the Government is to take remedial measures if the contract causes social and environmental problems.

Issues

- ✓ Contractor is to take all reasonable measures to remedy failure and effects there of.
- ✓ Minister gets the power to discontinue Petroleum Operations in whole or part if Contractor fails to remedy environmental damage caused.

4.2.7 Information Sharing & Recording

The CPA determines that transparency, accountability, efficiency, equity and fairness in the utilization of resources are to be ensured via a monitoring and evaluation system (GOS & SPLM/A, 2005: 47-62). Clause 4 covers the topic of sharing information, it states that the Contractor receives monthly notification of the quantities of petroleum and gets an insight in the production details of the petroleum operations. This information retrieved will not be sufficient to give an indication whether the environmental standards and procedures are effective. The IFC performance standards (IFC, 2006) hence note that Petroleum operations should be monitored, through procedures to monitor and measure the effectiveness of the environmental standards and procedures and the Contractor will document, monitor results and identify and reflect the necessary corrective and preventive actions and implement these actions, and follow up. To create transparency all monitoring documents will be publicly available. Additionally, for projects with significant impacts the Contractor should retain qualified and experienced external experts to verify its monitoring information (IFC, 2006).

Issues

- ✓ Petroleum Operations are to be monitored. The Contractor will document, monitor results and identify and implement corrective and preventive actions. All monitoring documents will be publicly available.
- ✓ For projects with significant impacts, experienced external experts to verify its monitoring information.

4.2.8 Standards & Procedures

Deciding on standards and procedures jointly with Contractor and Minister, described in clause 6 of Article XI, gives way for the Minister to ensure the national environmental issues are taken into account by the Contractor. However in a country like Sudan, deciding about standards and procedures after operations have commenced (instead of before) and not defining any terms most likely lead to failure to address all environmental concerns in question. The need to be more secure and explicit within the contract is substantive and therefore this clause needs to be made more inclusive and detailed. To make it in accordance with the best known oil practices it needs to be made clear, what should be addressed, how it will be addressed, and what is to be taken into account (D.R.T.L., 2004 ;M.P.N.G., 2007).

The standards and procedures need to be based on an Environmental Impact study to be fully informed about the risks and impacts of the project. In the Environmental impact study the following should be addressed (M.P.N.R., 2001; M.P.N.G., 2007).

a) Determine prevailing situation relating to the environment, human beings and local communities, the flora and fauna in the Contract Area and in the adjoining or neighbouring area. Preliminary part handed in and approved before any field work is commenced, final part handed in and approved prior to drilling operations (M.P.N.R., 2001).

b) Likely effect of Petroleum Operations on the environment, human beings and local communities, the flora and fauna in the Contract Area and in the adjoining or neighbouring areas in consequence of the relevant phase of Petroleum Operations (M.P.N.R., 2001). Together with recommendations as to how such impact can reasonably be minimized (Leek Deng, 2007). Completed and approved prior to the commencement of Development Operations.

Out of transparency concerns mentioned in the CPA (GOS & SPLM/A, 2005:47-62) the study should be made available to its employees, its contractors and subcontractors (M.P.N.R., 2001; M.P.N.G., 2007), and to the affected local communities in a language they can understand (IFC, 2006). Provisions stipulated in contract and established measures and

methods should be included in contracts between Contractor and its Contractors and Subcontractors (M.P.N.R., 2001; M.P.N.G., 2007).

Issues

- ✓ Standards and procedures are timely consulted and international standards and environmental standards and relevant national laws are taken into account;
- ✓ Environmental Impact study to be fully informed about the risks and impacts of the project;
- ✓ Environmental Impact studies should be done prior to, during and after major operations;
- ✓ Made available to its employees, its contractors and subcontractors and to the affected local communities in a language they can understand;
- ✓ Define environmental guidelines, what should be addressed in the standards and procedures.

4.2.9 Emergency Response

Petroleum Operations bring along high risks, therefore it would be in the interest of the local communities if a programme would be set up clarifying what to do when calamities occur. This Emergency response plan addresses the training, resources, responsibilities, communication, procedures, and other aspects required to effectively respond to emergencies associated with project hazards (IFC 2006; 2007). Steps that should be taken are:

1) Prepare and submit plan prior to conducting any drilling activities, plans should be discussed with the government and concerns expressed shall be taken into account (M.P.N.R., 2001; M.P.N.G., 2007).

2) Notify the government forthwith and act promptly (in accordance with best known oil field practices) Site restoration and implement relevant contingency plan.

Issues

- ✓ Be able to effectively respond to calamities, therefore set up an emergency response plan

4.3 Employment and Training of Sudanese Nationals

4.3.1 Article XVII - Revised Clauses

From Article XVII – Employment and Training of Sudanese Nationals, clause 3, 4, 6 and 8 showed discrepancies with the requirement set out in the CPA Protocol on Wealth Sharing. Each clause is reviewed for parts of the texts that can be maintained, which are invalid and thus can be deleted and what text is to be added to become in line with the CPA Protocol.

The following editing-approach is used:

- Original maintained text: Normal
- Original invalid text ~~Crossed out~~
- New text **Bold**

NB: When referring to 'Contractor' the GNPOC Consortium is meant, and the term 'Minister' refers to the Minister of Energy and Mining of the Government of Sudan.

Article XVII

Employment and Training of Sudanese Nationals

-Revised clauses-

Clause 3: *Employment*

Contractor shall select its employees and determine the number thereof with the consultation and approval of the Minister, to be used for operations hereunder (GOS, 1997). **Contractor shall require Operating Company to ensure an equitable representation of all Sudanese population in work force, utilizing affirmative action and extra training.**

Clause 6: *Employment*

Contractor agrees to a goal of having the following proportion of Sudanese nationals, excluding unskilled labour, in its employees in Sudan;

5 years after the Effective Date – 60%
10 years after the Effective Date – 90%

In the event that the Contractor is unable to meet these goals, a detailed report will be submitted to the Minister providing evidence of reasons why the goals were not met (GOS, 1997) **together with a plan including the necessary steps to meet the agreed percentage within 12 months after the agreed dates.**

Clause 4: *Training*

(1) Contractor shall one month after the signature date of the Agreement and upon consultation with the Minister prepare and carry out specialized training programmes for all ~~qualified~~ Sudanese employees (SOCAR, 1996; M.P.N.R, 2001; D.R.T.L, 2004; M.P.N.G, 2007) engaged in Petroleum Operations hereunder with respect to applicable aspects of the petroleum industry. On-the-job training ~~is to be a significant part of the training programme~~ **in the Contractors operations in Sudan and overseas, and practical training at institutions abroad, particularly in the areas of logistical planning for undertaking Petroleum Operations, economic analysis, petroleum accounting and contract administration is to be provided** (T.P.D.C, 2000). Contractor will undertake to replace gradually its expatriate staff by qualified nationals when they become available (GOS, 1997).

(2) **Training programmes should also include scholarships to international education institutions in Sudan to improve understanding of oil industry operations in the Sudan** (Leek Deng, 2007).

Clause 7: *Training*

(7) In order to comply with clause 4 of the Article XVII, **within ninety (90) days after approval of development plan** the Contractor shall ~~among other measures provide on a continuous basis for the training and career development of Sudanese nationals in order to qualify them for skilled, technical, administrative and managerial positions~~ **in consultation with the Minister establish and implement training and career development programmes of staff positions in each phase and level of Petroleum Operations for the remainder of the Calendar Year.** ~~Long term career development plans shall be detailed on yearly programmes, in consultation with the Minister and with his ultimate approval.~~ **Thereafter, no later than 1 October in each Calendar Year, the Contractor shall submit a proposed training and career development plan to the Minister for the following Calendar Year (**T.P.D.C, 2000; D.R.T.L, 2004; M.P.N.G, 2007; K.R.G.I**). All necessary financial means are to be made available for training and education to assure the proportion of Sudanese nationals within the given time limits defined in clause 3 (**Park, 2006**).**

Clause 8: *Transfer of Knowledge*

The Contractor shall **within 90 days of the** ~~after~~ commencement of commercial production ~~undertake on-the-job training~~ **implement a technical assistance programme** (T.P.D.C, 2000; D.R.T.L, 2004; M.P.N.G, 2007; K.R.G.I) for Government employees and officers in the number and the periods to be mutually agreed upon with the Minister. Such training shall include participation in Contractor's and subcontractors' operations (GOS, 1996). **In addition the assistance shall include, but not limited to programmes that cover both technical and management disciplines: geology, geophysics, engineering, project management, accounting, economics and legal, and shall include on-the-job training, secondment and participation in in-house seminars** (Palacio das Cinzas's, 2004).

4.3.2 Employment

All mayor Petroleum Operations are located in the South of Sudan; contrastingly most of the wealth emanating from these operations are to be found in the North of Sudan. The economy of the North is developing significantly faster in comparison to the South. Wealth distribution and in specific human, local and economical capacity building are addressed in several provisions of the CPA. Provisions 1.4, 1.7 and 5.1.1 of the Protocol of Wealth Sharing of the CPA (GOS & SPLM/A, 2005:47-62) state that Southern Sudan should be brought up to the same average level of socio-economic standards as the Northern states by the sharing and allocating wealth of natural resources, and investing in local, human, and economic capacity. The investment in these necessary capacities, such as employment and training, provide for Article XVII to be of influence, since economic growth through employment creation and income generation increases the development of the region and in addition benefits the Southern Sudanese states greatly (IFC, 2006). Clauses 3 and 6, dealing with employment, will facilitate Sudan as the human supply base, this will generate employment and as a result will increase welfare in the region or country as a whole (D.R.T.L., 2004); GOS & SPLM/A, 2005:47-62; IFC, 2006; Leek Deng, 2007).

The approval of the Minister for the personnel hired for the Petroleum Operations, as stated in clause 3 of Article XVII, gives influence to the Minister to exert control over the workforce composition since all employees have to be approved by the Minister. This influence, if used appropriately, can be in the national interest of the country, by for example seeing to it that qualified Southern Sudanese candidates are preferred over expatriate of Northern Sudanese (M.P.N.R., 2001). To make it in accordance with the CPA stipulated should be that equal representation of all the people of the Sudan workforce has to be ensured. To achieve this, affirmative action and extra training for Southern Sudanese are to be utilized (ECOS, 2004).

In order to build human capacity, as the CPA desires, in clause 6 of Article XVII the Contractor agrees to the goal of working towards a workforce with dominantly (90%) Sudanese in a period of 10 years. To give preference to nationals and employ nationals to the maximum extent possible is an essential element of this article and is included in most PSAs in Petroleum Operations all over the world (Pakistan, India, Tanzania, Timor Leste). The detailed report, that should be handed in when the percentages are not met, will provide for a useful document to register progress and consider different approaches. But what will be the consequence if it is not met? Added should be that if the proportion of Sudanese personnel is not met, the Contractor is to take all necessary steps to meet the agreed percentage within a time frame of 12 months after the five or ten years after the Effective date (Park, 2006).

Issues

- ✓ Build human capacity and facilitate economic growth in entire Sudan;
- ✓ Take the necessary steps to meet the agreed on percentage within a time frame of 12 months after the five of ten years after the Effective date.

4.3.3 Training

A large part of Southern Sudan is unemployed, uneducated, and lives in (extreme) poverty. In order to make them suitable and qualified for (skilled) labour, investments need to be made on behalf of education and training (GOS & SPLM/A, 2005). This is why the companies are required to start training programmes for nationals of (Southern) Sudan with immediate effect so those who complete their trainings come back to replace none nationals, who might have come with the companies at the initial stage of operations (Leek Deng, 2007).

Clauses 4 and 7 formulate training concerns regarding Sudanese personnel. Clause 4 sets out that a training programme will be developed, 'all qualified Sudanese employees' will be considered for this programme. This implies that unskilled employees, such as drivers and nurses mentioned in clause 5, will not be eligible for training. The training and career development of just these employees is crucial, as for example it creates knowledge development under nationals and opens the door to higher, better paid jobs in oil operations, thereby creating higher income and as a result economical growth (Palacio das Cinza's, 2004). Instead a rectification should be made to 'all employed Southern Sudanese nationals will be eligible for training'. Moreover, clause 4 notes that training shall be given in the form of 'on-the-job training'. A combination of multiple forms and methods of training would provide for an all-round training with more debt and knowledge (IFC, 2006). Other PSAs from for example Tanzania specified other forms of training, such as on-the-job training both in the Contractors operations in Sudan and overseas, and practical training at institutions abroad, particularly in the areas of logistical planning for undertaking petroleum operations, economic analysis, petroleum accounting and contract administration (T.P.D.C., 2000).

Clause 7 explicates that it will provide a continuous base for training and (long term) career development in order to qualify Sudanese nationals for skilled, technical, administrative and managerial positions. To make this clause 'best known practice proof' the following needs to be made more specific.

1. The term 'continuous base' needs to be specified;
2. When will the training programme be implemented? It states when to hand in a programme and to decide when to consult with the Minister, but omits the implementation part.

3. Described is that only the long term career development plan are to be put in the yearly programmes, not normal training programmes, and possible short term career development plans.
4. The training programmes should also include scholarships to international education institutions to improve understanding of oil industry operations in the Southern Sudan (Leek Deng, 2007).
5. In Article IX regarding bonuses, rentals and other payments clause 9.1 (GOS, 1997: 31) states that 500.000 dollar shall be paid on scholarships, training and technical bonuses. This is a fixed amount (regressive), however the employment commitments are so high, and a greater amount may need to be spent on training and education in order to achieve these commitments (Park, 2006).

   Most important is not to set a fixed amount, but to state that all necessary amount of money is to be made available for training and education to assure the proportion of Sudanese nationals defined in clause 3 of this article.

Issues

- ✓ Training for both skilled and unskilled employees;
- ✓ Multiple forms and methods of training;
- ✓ Specify when the training programme will be implemented;
- ✓ Scholarships to International Education Institutions;
- ✓ All means are to be made available for training and education to assure the proportion of Sudanese nationals defined in clause 3 of this article.

4.3.4 Technical Assistance and Transfer of Technology

CPA Provision 3.1.2 (GOS & SPLM(A), 2005: 51) states: “Empowerment of the appropriate levels of government to develop and manage, in consultation with local communities, the various stages of oil production within the overall framework for the management of petroleum development during the Interim Period.” In line with the CPA, clause 8 mentions the transfer of knowledge to Government employees. In the clause the kind of training (on-the-job), the periods, and the locations are determined. In accordance with the IFC and several model contracts specified is to take into account the kind of knowledge transferred, like to support the local administration in terms of basic physical infrastructure, human resource capacity building and institutional development (Leek Deng, 2007)

Issues

- ✓ Kind of knowledge transferred, Human Resource capacity building and institutional development

Conclusion

For decades many Sudanese have been suffering as a result of petroleum operations. The CPA, as a constitutional framework for the petroleum sector, compel companies to abide by the set up rules under the Protocol of Wealth Sharing and therefore for the first time lay down terms to manage the severe social and environmental impact of petroleum operations.

Both Articles XI and XVII fail to cover the guidelines of the CPA's Protocol on Wealth Sharing. Article XI - Diligent and Workmanlike Operations solely includes clauses preventing damage. In addition to damage control, other concerns such as environmental protection, natural resource conservation, forced resettlement, compensation and community involvement, information sharing procedures, environmental assessments, and an emergency response plan need to be described in order to be in line with the CPA's Protocol on Wealth Sharing.

Article XVII deals with the 'Employment and Training of Sudanese Nationals', this Article determines Sudan as the human supply base of Petroleum Operations. The Protocol on Wealth Sharing states that Southern Sudanese should be equally included in petroleum matters; therefore an equal representation of all Sudanese in the workforce is necessary. To ensure that the workforce will exist out of 90% Sudanese, like stated in the article, extra training and education needs to be offered.

With the review and proposed modifications of Articles XI and XVII this report functions as a start to the discussion on reviewing petroleum contracts in Sudan, which in the future will hopefully instigate further reviewing processes to facilitate a better future for all Sudanese.

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List of Abbreviations

CNPC	Chinese National Petroleum Company
CPA	Comprehensive Peace Agreement
ECOS	European Coalition on Oil in Sudan
GNPOC	Greater Nile Petroleum Operating Company
GONU	Government of National Unity
GOS	Government of the Republic Sudan
GOSS	Government of Southern Sudan
IGAD	Inter-Governmental Authority on Development
IGADD	Intergovernmental Authority on Drought and Development
SPLM/ A	Sudanese People's Liberation Movement/ Army
SUDAPET	Sudan National Petroleum Corporation

Annex 1: Exploration and Production Sharing Agreement, GNPOC (1997), Article XI

Article XI

Diligent and Workmanlike Operations

(1) Contractor shall conduct its operations in the Contract Area with due diligence and in a workmanlike manner and in accordance with good and sound methods and standards of the petroleum industry. Contractor shall take all reasonable measures to prevent loss or waste of petroleum above or under the ground in any form during drilling, producing, gathering and distributing or storage operations. Without prejudice to the generality of the aforesaid, Contractor shall:

(a) Take whatever practical measures are necessary to prevent any injurious ingress of water or damage of any kind to any petroleum bearing formation which may be encountered while drilling operations are in progress or upon abandonment of any well shall carefully locate and preserve any fresh water sources discovered in the course of such operations.

(b) Take all reasonable precautions against fire and any unwarranted wasting of Crude Oil, Gas or water.

(2) Upon completion of the drilling of a prospective well, Contractor shall inform the Minister of the time when the well will be tested and the production rate ascertained.

(3) Except in instances where multiple producing formations in the same well can be produced economically only through a single tubing string, Petroleum shall not be produced from multiple oil carrying zones through one string of tubing at the same time, except with the prior written approval of the Minister.

(4) Contractor shall record data regarding the quantities of petroleum and water produced monthly from the Contract Area. Such data shall be sent to the Minister within thirty (30) days after it is obtained. Daily or weekly statistics regarding the production from the Contract Area shall be available at all reasonable times for examination by the Minister.

(5) Daily drilling records and graphic logs of wells must show the quantity and type of cement and the amount of any other materials used in the well of the purpose of protecting petroleum, gas bearing or fresh water strata.

(6) Contractor shall within six (6) months of the date of signature of the Agreement provide the Minister with standards and procedures for the conduct of Petroleum Operations for review and agreement.

Annex 2: Exploration and Production Sharing Agreement, GNPOC (1997), Article XVII

Article XVII
Employment and Training of Sudanese Nationals

(1) It is the desire of the Minister and Contractor that operations hereunder be conducted in a businesslike manner.

(2) Contractor shall submit a list of the expatriate administrative, professional and technical personnel, which the Contractor intends to employ for the conduct of the operations there under, to the Minister for approval, which approval shall not be unreasonably withheld. The aforesaid list shall be accompanied with the Curriculum Vitae (C.V.) and contract of service for each employee. Upon approval, the selected personnel shall be granted such entry, work and residence permits as may be required by the laws of the Sudan.

(3) Contractor shall select its employees and determine the number thereof with the consultation and approval of the Minister, to be used for operations hereunder.

(4) Contractor shall one month after the signature date of the Agreement and upon consultation with the Minister prepare and carry out specialized training programmes for all qualified Sudanese employees engaged in Petroleum Operations hereunder with respect to applicable aspects of the petroleum industry. On-the-job training is to be a significant part of the training programme. Contractor will undertake to replace gradually its expatriate staff by qualified nationals when they become available.

(5) Contractor will not hire unskilled labour including nurses and drivers – from outside the Sudan as expatriate employees.

(6) Contractor agrees to a goal of having the following proportion of Sudanese nationals, excluding unskilled labour, in its employees in Sudan;

5 years after the Effective Date – 60%
10 years after the Effective Date – 90%

In the event that the Contractor is unable to meet these goals, a detailed report will be submitted to the Minister providing evidence of reasons why the goals were not met.

(7) In order to comply with clause 4 of the Article XVII, the Contractor shall among other measures provide on a continuous basis for the training and career development of Sudanese nationals in order to qualify them for skilled, technical, administrative and managerial positions. Long term career development plans shall be detailed on yearly programmes, in consultation with the Minister and with his ultimate approval.

(8) The Contractor shall after commencement of commercial production undertake on-the-job training of Government employees and officers in the number and the periods to be mutually agreed upon with the Minister. Such training shall include participation in Contractor's and subcontractors' operations.

The Comprehensive Peace Agreement

Between

The Government of The Republic of The Sudan

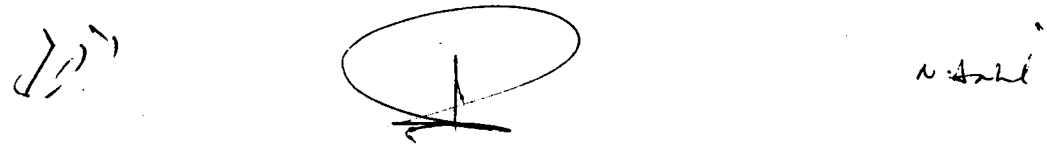
and

The Sudan People's Liberation Movement/Sudan People's Liberation Army

CHAPTER III

WEALTH SHARING

SIGNED AT NAIVASHA, KENYA ON 7TH JANUARY, 2004



1. Guiding Principles in Respect of an Equitable Sharing of Common Wealth

1.1 The Parties agree that the guiding principles and provisions below shall be the basis for the comprehensive text on Wealth Sharing.

1.2 The wealth of Sudan shall be shared equitably so as to enable each level of government to discharge its legal and constitutional responsibilities and duties.

1.3 The National Government shall also fulfil its obligation to provide transfers to the Government of Southern Sudan.

1.4 The sharing and allocation of wealth emanating from the resources of the Sudan shall ensure that the quality of life, dignity and living conditions of all the citizens are promoted without discrimination on grounds of gender, race, religion, political affiliation, ethnicity, language, or region. The sharing and allocation of this wealth shall be based on the premise that all parts of Sudan are entitled to development.

1.5 The Parties agree that Southern Sudan faces serious needs to: (i) be able to perform basic government functions, (ii) build up the civil administration, and (iii) rehabilitate and reconstruct/construct the social and physical infrastructure in a post-conflict Sudan.

1.6 The Parties agree that Nuba Mountains, Southern Blue Nile, Abyei and other war affected areas face serious needs to: (i) be able to perform basic government functions, (ii) establish and build civil administration and (iii) rehabilitate and reconstruct/construct the social and physical infrastructure in a post-conflict Sudan.

1.7 That, without prejudice to the provisions of paragraph 1.3 herein, Southern Sudan, and those areas in need of construction/reconstruction, shall be brought up to the same average level of socio-economic and public services standard as the Northern states. To achieve these objectives will take time and effort to build up local institutional, human and economic capacity. For this purpose, two special funds shall be established as provided herein.

1.8 That revenue sharing should reflect a commitment to devolution of power and decentralisation of decision-making in regard to development, service delivery and governance.

1.9 The development of infrastructure, human resources, sustainable economic development and the capacity to meet human needs shall be conducted within a framework of transparent and accountable government.

1.10 That the best known practices in the sustainable utilization and control of natural resources shall be followed.

1.11 This Agreement sets out the respective types of income, revenue, taxes and other sources of wealth to which the various levels of government are entitled.

1.12 The Parties recognize that the National Government, during the Interim Period, will need to mobilize additional national resources.

1.13 There is a limit on how much additional national resources can be mobilized and part of the national needs in a post-conflict Sudan will have to be met by external assistance.

1.14 The National Government shall not withhold an allocation due to a state/region[1] or the Government of Southern Sudan. Any level of Government may initiate proceedings in the Constitutional Court should any other organ or level withhold monies due to it. The National Government shall make transfers to the Government of Southern Sudan based on the principles established.

1.15 In agreeing to these wealth sharing arrangements the Parties signal to the international community that it will have to play a strong and constructive role in providing post-conflict construction/reconstruction assistance to Sudan, especially to Southern Sudan and other war affected and least developed areas.

1.16 The National Government shall assist the Government of Southern Sudan, during the Pre-Interim Period, in cooperation with international organizations, to develop and implement a program for capacity enhancement in the South. The highest priority should be public finance and intergovernmental relations, including expenditure management to ensure accountability.

2. Ownership of Land and Natural Resources

2.1 Without prejudice to the position of the Parties with respect to ownership of land and subterranean natural resources, including in Southern Sudan, this Agreement is not intended to address the ownership of those resources. The Parties agree to establish a process to resolve this issue.

2.2. The Parties agree that the regulation, management, and the process for the sharing of wealth from subterranean natural resources are addressed below.

2.3. The Parties record that the regulation of land tenure, usage and exercise of rights in land is to be a concurrent competency exercised at the appropriate levels of government.

2.4. Rights in land owned by the Government of Sudan shall be exercised through the appropriate or designated levels of Government.

[1] The issue of nomenclature will be resolved in the power sharing agreement.

2.5. The Parties agree that a process be instituted to progressively develop and amend the relevant laws to incorporate customary laws and practices, local heritage and international trends and practices.

2.6 Without prejudice to the jurisdiction of courts, there shall be established a National Land Commission that shall have the following functions:

2.6.1 Arbitrate between willing contending Parties on claims over land, and sort out such claims.

2.6.2 The party or group making claims in respect of land may make a claim against the relevant government and/or other Parties interested in the land.

2.6.3 The National Land Commission may at its discretion entertain such claims.

2.6.4 The Parties to the arbitration shall be bound by the decision of the National Land Commission on mutual consent and upon registration of the award in a court of law.

2.6.5 The National Land Commission shall apply the law applicable in the locality where the land is situated or such other law as the Parties to the arbitration agree, including principles of equity.

2.6.6 Accept references on request from the relevant government, or in the process of resolving claims, and make recommendations to the appropriate levels of government concerning:

2.6.6.1 Land reform policies;
2.6.6.2 Recognition of customary land rights and/or law.

2.6.7 Assess appropriate land compensation, which need not be limited to monetary compensation, for applicants in the course of arbitration or in the course of a reference from a court.

2.6.8 Advise different levels of government on how to co-ordinate policies on national projects.

2.6.9 Study and record land use practices in areas where natural resource exploitation occurs.

2.6.10 The National Land Commission shall be representative and independent. The composition of the membership and terms of appointment of the National Land Commission shall be set by the legislation constituting it. The Chairperson of the National Land Commission shall be appointed by the Presidency.

2.6.11 The National Land Commission may conduct hearings and formulate its own rules of procedure.

2.6.12 The National Land Commission will have its budget approved by the Presidency and will be accountable to the Presidency for the due performance of its functions.

2.7 In accordance with this Agreement and without prejudice to the jurisdiction of courts, there shall be established a Southern Sudan Land Commission which shall have the following functions:

2.7.1 Arbitrate between willing contending Parties on claims over land, and sort out such claims.

2.7.2 The party or group making claims in respect of land may make a claim against the relevant government and/or other Parties interested in the land.

2.7.3 The Southern Sudan Land Commission may entertain such claims at its discretion.

2.7.4 The Parties to the arbitration shall be bound by the Southern Sudan Land Commission's decision on mutual consent and upon registration of the award in a court of law.

2.7.5 The Southern Sudan Land Commission shall apply the law applicable in the locality where the land is situated or such other law as the Parties to the arbitration agree, including principles of equity.

2.7.6 Accept references on request from the relevant government, or in the process of resolving claims, and make recommendations to the appropriate levels of government concerning:

2.7.6.1 Land reform policies;
2.7.6.2 Recognition of customary land rights and/or law.

2.7.7 Assess appropriate land compensation, which need not be limited to monetary compensation, for applicants in the course of arbitration or in the course of a reference from a court.

2.7.8 Advise different levels of government on how to co-ordinate policies on GOSS projects.

2.7.9 Study and record land use practices in areas where natural resource exploitation occurs.

2.7.10 The Southern Sudan Land Commission shall be representative and independent. The composition of the membership and terms of appointment of the Southern Sudan Land Commission shall be set by the legislation constituting it. The Chairperson of the Southern Sudan Land Commission shall be appointed by the President of the Government of Southern Sudan.

2.7.11 The Southern Sudan Land Commission may conduct hearings and formulate its own rules of procedure.

2.7.12 The Southern Sudan Land Commission shall have its budget approved by the Government of Southern Sudan and shall be accountable to the President of the Government of Southern Sudan for the due performance of its functions.

2.8 The National Land Commission and the Southern Sudan Land Commission shall co-operate and co-ordinate their activities so as to use their resources efficiently.

Without limiting the matters of coordination, the National Land Commission and the Southern Sudan Land Commission may agree:

a) to exchange information and decisions of each Commission;
b) that certain functions of the National Land Commission, including collection of data and research, may be carried out through the Southern Sudan Land Commission;
c) on the way in which any conflict between the findings or recommendations of each Commission may be resolved

2.9 In the case of conflict between the findings or recommendations of the National Land Commission and the Southern Sudan Land Commission, which cannot be resolved by agreement, the two Commissions shall reconcile their positions. Failure to reconcile, the matter shall be referred to the Constitutional Court.

3. Oil Resources

A. Guiding Principles for the management and development of the petroleum sector

3.1 The Parties agree that the basis for an agreed and definitive framework for the management of the development of the petroleum sector during the Interim Period shall include the following:

3.1.1 Sustainable utilization of oil as a non-renewable natural resource consistent with:

a) the national interest and the public good;
b) the interest of the affected states/regions;
c) the interests of the local population in affected areas;
d) national environmental policies, biodiversity conservation guidelines, and cultural heritage protection principles.

3.1.2 Empowerment of the appropriate levels of government to develop and manage, in consultation with the relevant communities, the various stages of oil production within the overall framework for the management of petroleum development during the Interim Period.

3.1.3 Give due attention to enabling policy environment for the flow of foreign direct investment by reducing risks associated with uncertainties regarding the outcome of the referendum on self-determination at the end of the Interim Period.

3.1.4 A stable macroeconomic environment that emphasizes stability of the petroleum sector.

3.1.5 Persons enjoying rights in land shall be consulted and their views

shall duly be taken into account in respect of decisions to develop subterranean natural resources from the area in which they have rights, and shall share in the benefits of that development.

3.1.6 Persons enjoying rights in land are entitled to compensation on just terms arising from acquisition or development of land for the extraction of subterranean natural resources from the area in respect of which they have rights.

3.1.7 The communities in whose areas development of subterranean natural resources occurs have the right to participate, through their respective states/regions, in the negotiation of contracts for the development of those resources.

3.1.8 Regardless of the contention over the ownership of land and associated natural resources, the Parties agree on a framework for the regulation and management of petroleum development in Sudan during the Interim Period.

B. **National Petroleum Commission (NPC)**

3.2 The Parties agree that an independent National Petroleum Commission (NPC) shall be established during the Pre-Interim Period and its decisions shall be by consensus.

3.3 Taking into account the provisions elsewhere in this Agreement, the NPC shall be constituted as follows:

a) The President of the Republic and President of the GOSS as Co-chairs and permanent members;
b) four (4) permanent members representing the National Government;
c) four (4) permanent members representing the GOSS; and
d) not more than three (3) representatives of an oil producing State/Region in which petroleum development is being considered, non-permanent members.

3.4 The NPC shall have the following functions:

3.4.1 Formulate public policies and guidelines in relation to the development and management of the petroleum sector consistent with paragraph 3.1.1.
3.4.2 Monitor and assess the implementation of those policies to ensure that they work in the best interests of the people of Sudan.
3.4.3 Develop strategies and programs for the petroleum sector.
3.4.4 Negotiate and approve all oil contracts for the exploration and development of oil in the Sudan, and ensure they are consistent with the NPC's principles, policies and guidelines.
3.4.5 Develop its internal regulations and procedures.

3.5 In performing the functions referred to in paragraph 3.4 above, the NPC shall take into account relevant considerations, including the following:

3.5.1 The extent to which the contract provides benefits to local communities affected by the development.

3.5.2 The extent to which the views of the state/region and the affected groups are incorporated in the proposed contracts.

3.5.3 If the NPC decides to approve the contract, persons holding rights in land who are aggrieved by the decision shall seek relief through arbitration or in a court of law.

3.5.4 If the non-permanent members of the NPC representing the oil producing State/Region collectively disagree with the decision of the NPC to approve the contract related to their State/Region, the National Minister of Petroleum shall not sign the contract and shall refer the matter to the Council of States/Regions. If the Council of States/Regions rejects the objection by two-thirds ($^2/_3$) majority, the National Minister of Petroleum shall sign the contract. If the Council of States/Regions does not reject the objection by two-thirds ($^2/_3$) majority within 24 sitting days of receiving it, the Council of States/Regions shall remit the objection within that period and by two-thirds ($^2/_3$) majority to a mechanism established by the Council to arbitrate on the objection. The arbitration decision shall be made within six calendar months of referral to arbitration. The arbitration decision shall be binding.

3.5.5. If the NPC approves the contract the National Minister of Petroleum shall sign the contract on behalf of the Government of the Sudan.

3.5.6 In performing functions 3.4.1, 3.4.2, 3.4.3, and 3.4.5 of paragraph 3.4, the NPC shall include only its permanent members.

3.5.7 In performing function 3.4.4 of paragraph 3.4, the NPC shall include its permanent members and representatives of oil producing State/Region in which contracts for the exploration and development of the petroleum are being negotiated and considered for approval.

4. Existing Oil Contracts

4.1 The SPLM shall appoint a limited number of representatives to have access to all existing oil contracts. The representatives shall have the right to engage technical experts. All those who have access to the contracts will sign confidentiality agreements.

4.2 Contracts shall not be subject to re-negotiation.

4.3 If contracts are deemed to have fundamental social and environmental problems the Government of Sudan will implement necessary remedial measures.

4.4 The Parties agree that "existing oil contracts" mean contracts signed before the date of signature of the Comprehensive Peace Agreement.

4.5 Persons whose rights have been violated by oil contracts are entitled to compensation. On the establishment of these violations through due legal process

the Parties to the oil contracts shall be liable to compensate the affected persons to the extent of the damage caused.

5. Guiding Principles for Sharing Oil Revenue

5.1 The Parties agree that the basis for an agreed and definitive framework for the sharing of the wealth emanating from oil resources of Southern Sudan shall include the following:

5.1.1 The framework for sharing wealth from the extraction of natural resources should balance the needs for national development and reconstruction of Southern Sudan.

5.2 The Parties agree that a formula for sharing the revenue from oil resources shall be as set forth in this Agreement.

5.3 For the purposes of this Agreement 'Net revenue from oil' shall be the sum of the net revenue (i) from exports of government oil and (ii) from deliveries of government oil to the refineries. Exports shall be valued at the actual Free on Board (FOB) export prices less the charges to deliver the oil to any export destination including pipeline and management charges. Oil delivered to the refinery shall be valued at the average FOB export prices during the last calendar month in which there was an export sale less the charges that would have been incurred to deliver the oil to any export destination including pipeline and management charges.

5.4 An Oil Revenue Stabilization Account shall be established from government oil net revenue derived from actual export sales above an agreed benchmark price. The benchmark price will be established annually as part of the national budget reflecting changing economic circumstances.

5.5 The Parties agree that at least two percent (2%) of oil revenue shall be allocated to the oil producing states/regions in proportion to output produced in such states/regions.

5.6 After the payment to the Oil Revenue Stabilization Account and to the oil producing states/regions, fifty percent (50%) of net oil revenue derived from oil producing wells in Southern Sudan shall be allocated to the Government of Southern Sudan (GOSS) as of the beginning of the Pre-Interim Period and the remaining fifty percent (50%) to the National Government and States in Northern Sudan.

5.7 A Future Generation Fund shall be established once national oil production reaches two (2) million barrels per day. This production criterion may, as part of the National Government's normal budget process, be reduced down to one (1) million barrels per day.

5.8 The Parties agree that all funds/special accounts referred to in this Agreement and future accounts shall be on-budget operations.

6. Sharing of Non-Oil Revenue

6.1 The National Government shall be entitled to legislate, raise and collect the below-listed taxes and to collect revenue from these sources:

6.1.1 National Personal Income Tax;
6.1.2 Corporate or Business Profit Tax;
6.1.3 Customs Duties and import taxes;
6.1.4 Sea-ports and Airports Revenue;
6.1.5 Service charges;
6.1.6 Oil revenues as set out herein;
6.1.7 National Government Enterprises and projects;
6.1.8 VAT or GST or other retail taxes on goods and services;
6.1.9 Excise Tax;
6.1.10 Any other tax as agreed upon in these negotiations;
6.1.11 Loans, including borrowing from the Central Bank and the public.

6.2 The Government of Southern Sudan shall be entitled to revenue from the following sources and to raise and collect the below-listed taxes:

6.2.1 The National revenue allocation to the Government of Southern Sudan and States/Regions from the National Revenue Fund as set forth in section 7.0 of this Agreement;
6.2.2 Revenue from any of the sources listed as state/region revenue sources referred to in paragraph 6.3 herein;
6.2.3 The Southern Sudan Reconstruction and Development Fund (SSRDF);
6.2.4 Oil revenues as is set out in this Agreement;
6.2.5 Southern Sudan Government Taxes, which do not encroach on the exclusive National Government taxing powers or which are contemplated in the Power Sharing Protocol;
6.2.6 Service charges of the Government of Southern Sudan;
6.2.7 Government of Southern Sudan enterprises and projects;
6.2.8 Grants in Aid and Foreign Aid;
6.2.9 Taxes and levies on small and medium business;
6.2.10 Excise taxes on goods within the region deemed to be luxury consumables;
6.2.11 Southern Sudan Personal Income Tax;
6.2.12 Any other taxes as may be agreed to from time to time;
6.2.13 Loans and Borrowing in accordance with the Monetary Policy, Banking, Currency and Borrowing sections of this Agreement.

6.3 The states/regions shall be entitled to raise and collect the below-listed taxes and revenue from the below listed sources:

6.3.1 State/Regional Land and property tax and royalties;
6.3.2 Service charges for state/regional services;
6.3.3 Licences;
6.3.4 State/Regional Personal Income Tax;
6.3.5 Levies on Tourism;
6.3.6 State/Regional share of oil Revenues as is set out in paragraphs 5.5 and 5.6 of this Agreement;
6.3.7 State/Regional Government projects and state/regional nature parks;
6.3.8 Stamp duties;
6.3.9 Agricultural Taxes;
6.3.10 Grants in Aid and Foreign Aid through the National Government and the GOSS;
6.3.11 Excise taxes;
6.3.12 Border Trade charges or levies in accordance with National Legislation;
6.3.13 Other state/region taxes which do not encroach on national or Southern Sudan Government taxes;
6.3.14 Any other tax as may be agreed to from time to time; and
6.3.15 Loans and borrowing in accordance with the Monetary Policy, Banking, Currency and Borrowing sections of this Agreement.

7. Equalization and Allocation to the National, Southern Sudan and State/Regional Levels of Government in Respect of Revenue Collected Nationally

7.1. All revenues collected nationally for or by the National Government shall be pooled in a National Revenue Fund (NRF) administered by the National Treasury. Such Fund shall embrace all accounts and sub-funds into which monies due to the Government are collected, reported or deposited.

7.2 All the revenues and expenditures of the Government will be on-budget operations and made public.

7.3 Notwithstanding the provisions of paragraphs 5.6, 7.1 and 13.1, the National Government shall allocate fifty percent (50%) of the national non-oil revenue collected in Southern Sudan, as provided for herein under paragraph 6.1 above, to the GOSS to partially meet the development cost and other activities during the Interim Period. The Parties agree to review this arrangement, at mid-term of the Interim Period, with the view of the National Government allocating additional resources to the Government of Southern Sudan.

7.4 As a result of the allocation arrangements in paragraph 7.3 above, the Parties agree to appeal to the international and donor community to help the Government of Southern Sudan by providing post-conflict reconstruction assistance especially at the beginning of the transition.

7.5 The states/regions and the Government of Southern Sudan shall retain and dispose of such other income raised and collected under their own taxing powers.

8. Fiscal and Financial Allocation and Monitoring Commission (FFAMC)

8.1 To ensure transparency and fairness both in regard to the allocation of nationally collected funds to the states/regions and the Government of Southern Sudan, a Fiscal and Financial Allocation and Monitoring Commission shall be established. This body shall be comprised of experts nominated by the various states/regions, the Government of Southern Sudan and the National Government. Decision making arrangements of the FFAMC shall be as agreed to by the Parties.

8.2 The FFAMC shall undertake the following duties and responsibilities:

8.2.1 Monitor and ensure that equalization grants from the National Revenue Fund are promptly transferred to respective levels of government;
8.2.2 Ensure appropriate utilization and sharing of financial resources;
8.2.3 Ensure that resources allocated to war affected areas are transferred in accordance with agreed upon formulae; and
8.2.4 Ensure transparency and fairness in the allocation of funds to the GOSS and states/regions according to established ratios or percentages stipulated in this Agreement.

8.3. The FFAMC shall be composed of representatives from the National Government and the Government of Southern Sudan and States/Regions as follows:

a) Three (3) Representatives of the National Government;
b) Three (3) Representatives of the Government of Southern Sudan (GOSS);
c) All Finance Ministers in all States/Regions of Sudan

8.4 The Chairperson of the FFAMC shall be appointed by the Presidency.

8.5 The FFAMC shall work out its own rules and procedures, which shall be approved by the Presidency.

9. Interstate Commerce

9.1 There shall be no legal impediment to interstate commerce or the flow of goods and services, capital or labour between the states/regions.

10. Government Liabilities

10.1 Any debts/liabilities incurred by any level of government shall be the responsibility of that level of government.

11. Division of Government Assets

11.1 There shall be a fair and equitable division of government assets. An asset shall in the first instance be allocated to the level of government responsible for the function in respect of which the asset is related (e.g. school buildings to the level of government responsible for education). In the event of a dispute, the Parties agree that such dispute shall be referred to a committee comprising a representative of each of the Parties involved in the dispute and a mutually agreed expert.

12. Accounting Standards and Procedures and Fiscal Accountability

12.1 All levels of government shall comply with generally accepted accounting standards and procedures. There shall be institutions at the state/region, Government of Southern Sudan and National levels to ensure that funds are distributed according to the agreed government budget, and properly expended having regard to value for money.

12.2 To ensure the effective operation of such institutions, there shall be independent National and Southern Sudan Audit Chambers, which shall have responsibility for the functions referred to above. The National Audit Chamber shall set auditing standards. Appointments to the National Audit Chamber shall be made by the Presidency and confirmed by the National Assembly.

12.3 All levels of government shall hold all income and revenue received by it in public accounts and subject to public scrutiny and accountability.

13 Financing the Transition

13.1 The National Government shall assist, during the Pre-Interim Period to the extent that it is able, the SPLM/A in the establishment of the new transitional governments at the State/Regional level and the Government of Southern Sudan. The Government of Southern Sudan shall meet the direct costs of establishing these levels of government, with the assistance from the international community.

13.2. Upon signature of a Comprehensive Peace Agreement, the Parties shall establish a Joint National Transition Team to undertake the following:

13.2.1 Prepare budget estimates for the establishment of Governments at the National, Southern Sudan and state/regional levels as provided for by the Peace Agreement;

13.2.2 Organize and prepare relevant documents for the donor conference, including the agenda of the conference, letters of invitations and be a secretariat to the donors' conference;

13.2.3 Develop fund raising strategies, and assist in the identification of potential sources of funds necessary for a smooth and timely commencement of the Interim Period.

14. Monetary Policy, Banking, Currency and Borrowing

A. Monetary Policy, Banking and Currency

14.1. The Parties agree, consistent with the Machakos Protocol of 20th July 2002, to have a dual banking system in Sudan during the Interim Period. An Islamic banking system shall operate in Northern Sudan and conventional banking system shall operate in Southern Sudan.

14.2. The Parties agree that conventional banking facilities are urgently needed in Southern Sudan. The Parties therefore agree to establish, during the Pre-Interim Period, the Bank of Southern Sudan (BOSS) as a branch of Central Bank of Sudan (CBOS) consistent with paragraph 14.1 above.

14.3. The Parties agree to restructure, during the Pre-Interim Period, the CBOS so as to reflect the duality of the banking system in Sudan. The CBOS shall therefore use and develop two sets of banking instruments, one Islamic and the other Conventional, to regulate and supervise the implementation of a single monetary policy through: (i) an Islamic financing window in Northern Sudan under a deputy governor of CBOS using Islamic financing instruments to implement the national monetary policy in Northern Sudan; and (ii) the Bank of Southern Sudan (BOSS), headed by a deputy governor of CBOS, to manage the conventional window using conventional financing instruments in implementing the same national monetary policy in Southern Sudan.

14.4. The CBOS shall be responsible for the conduct of monetary policy. All banking institutions shall be subject to the rules and regulations set by the CBOS.

14.5. The primary responsibility and mandate of the CBOS shall be ensuring price stability, maintaining stable exchange rate, sound banking system and issuance of currency. The monetary policy shall be carried out accordingly relying primarily on market-based instruments instead of administrative allocation of credit.

14.6. The CBOS shall be fully independent in its pursuit of monetary policy.

14.7. The Governor of CBOS and his/her two deputies shall be appointed by the Presidency. The Governor of CBOS shall appoint in consultation with his/her two deputies other senior officers within the Central Bank.

14.8. The Parties agree to establish, during the Pre-Interim Period, an independent Board of Directors (BOD). Decisions of BOD on matters that may affect adversely the interest of either Party to this Agreement shall be by consensus. The BOD shall be responsible to the Presidency on the accountability of the CBOS and shall consist of nine (9) members as follows:

a) Governor of CBOS (Chairperson) and his/her two deputies and;
b) Six highly qualified Sudanese to be appointed by the Presidency taking into account the agreed formula in the Power Sharing Protocol for the institutions of the National Government.

14.9 The CBOS shall adopt a program to issue a new currency as soon as is practical during the Interim Period. The design of the new currency shall reflect the cultural diversity of Sudan. Until a new currency has been issued with the approval of the Parties on the recommendations of the CBOS, the circulating currencies in Southern Sudan shall be recognised.

14.10 The BOSS shall be responsible for chartering and supervising financial institutions in Southern Sudan.

14.11 All financial institutions shall be subject to internationally recognized regulatory and prudential standards for Islamic and conventional finance, as set by the CBOS.

14.12 All financial institutions shall be bound to implement monetary policies set by the CBOS.

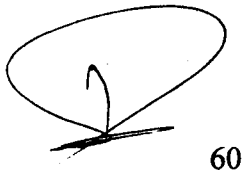
B. **Borrowing**

14.13. The Government of Southern Sudan and the states/regions may borrow money based on their respective credit worthiness. Neither the National Government nor the CBOS shall be required or expected to guarantee borrowing by sub-national governments.

14.14 The GOSS and all sub-national governments shall report financial and fiscal data to the relevant National Government bodies for statistical purposes.

14.15 The Government of Southern Sudan and the states/regions may borrow money from foreign sources based on their respective credit worthiness.

14.16 Foreign borrowing by all sub-national governments shall be done in a manner that does not undermine national macroeconomic policies and shall be consistent with the objective of maintaining external financial viability. All sub-national governments' foreign borrowing transactions shall conform to the CBOS specifications.



15. Reconstruction and Development Funds

A. Southern Sudan Reconstruction and Development Fund (SSRDF)

15.1. There shall be established a Southern Sudan Reconstruction and Development Fund (SSRDF) to solicit, raise and collect funds from domestic and international donors and disburse such funds for the reconstruction and rehabilitation of the infrastructure of the South, for the resettlement and reintegration of internally and externally displaced persons, and to address past imbalances in regional development and infrastructure.

15.2. A monitoring and evaluation system shall be established to ensure accountability, transparency, efficiency, equity and fairness in the utilization of resources.

15.3. The Government of Southern Sudan shall be responsible for expenditure from the fund and shall be entitled to raise additional funds by way of donation from foreign States, multilateral organizations, or other bodies for the purposes of the reconstruction and development of the southern states/regions. The Fund shall be transparently administered and professionally managed subject to an oversight committee appointed by the Government of Southern Sudan but having on it a representative of the National Ministry of Finance and of the National Audit Chamber.

B. National Reconstruction and Development Fund (NRDF)

15.4. There shall be established by the Treasury, a National Reconstruction and Development Fund (NRDF) having the mission of developing the war affected areas and least developed areas outside Southern Sudan and a steering committee with appropriate representation from such areas. A member of the Southern Sudan Ministry of Finance shall be a member of the Steering Committee. A report on the income, expenditure and the projects supported by the fund shall be placed before the National Assembly and the Council of States/Regions, which shall exercise oversight over the Fund.

C. Multi-Donor Trust Funds

15.5. The Parties recognize the need to establish, during the Pre-Interim Period, two Multi-Donor Trust Funds (MDTFs), one for the National Government and one for the Government of Southern Sudan to support urgent recurrent and investment budget costs under clearly stated criteria of eligible financing components. The Trust Funds shall be operational for the Pre-Interim Period, and shall thereafter be transformed into (i) one MDTF dedicated to the Southern Sudan Reconstruction and Development Fund (the "SRRDF"); and (ii) one MDTF dedicated to the National Reconstruction and Development Fund (the "NRDF").

15.6. The MDTFs shall commence immediately to support, among other things, priority areas of capacity building and institutional strengthening and quick start/impact programs identified by the Parties.

15.7. Both funds shall support urgent recurrent and investment budget costs under clearly stated criteria of eligible financing components, and both shall have the right to solicit, raise and collect funds from foreign donors.

15.8. All trust funds shall report the flow of funds to the CBOS.

15.9. To ensure proper accountability for funds disbursed through the MDTFs the Parties shall cause audits to be performed on funds used within six (6) months of the close of the recipient's financial year.

15.10. During the Pre-Interim as well as the Interim Period, funds may be channeled directly to finance activities beneficial to the National Government or the GOSS as the case may be.

15.11. During the Pre-Interim Period, the flow of foreign funds shall be through special accounts established in the Bank of Sudan for areas outside Southern Sudan and for Southern Sudan in a commercial bank in Southern Sudan until the Bank of Southern Sudan is established and operational. For the Interim Period: (i) the flow of foreign funds for the National Fund will go through the CBOS; and (ii) for the Southern Fund, the foreign funds will be disbursed through a special account at the Bank of Southern Sudan designated for the Government of Southern Sudan; or through arrangements as specified in the MDTF.

VOLUNTARY PRINCIPLES ON SECURITY + HUMAN RIGHTS

The Voluntary Principles on Security and Human Rights

INTRODUCTION
Governments of the United States and the United Kingdom, companies in the extractive and energy sectors ("Companies"), and non-governmental organizations, all with an interest in human rights and corporate social responsibility, have engaged in a dialogue on security and human rights.

The participants recognize the importance of the promotion and protection of human rights throughout the world and the constructive role business and civil society – including non-governmental organizations, labor/trade unions, and local communities – can play in advancing these goals. Through this dialogue, the participants have developed the following set of voluntary principles to guide Companies in maintaining the safety and security of their operations within an operating framework that ensures respect for human rights and fundamental freedoms. Mindful of these goals, the participants agree to the importance of continuing this dialogue and keeping under review these principles to ensure their continuing relevance and efficacy.

> *Acknowledging* that security is a fundamental need, shared by individuals, communities, businesses, and governments alike, and acknowledging the difficult security issues faced by Companies operating globally, we recognize that security and respect for human rights can and should be consistent;
>
> *Understanding* that governments have the primary responsibility to promote and protect human rights and that all parties to a conflict are obliged to observe applicable international humanitarian law, we recognize that we share the common goal of promoting respect for human rights, particularly those set forth in the Universal Declaration of Human Rights, and international humanitarian law;
>
> *Emphasizing* the importance of safeguarding the integrity of company personnel and property, Companies recognize a commitment to act in a manner consistent with the laws of the countries within which they are present, to be mindful of the highest applicable international standards, and to promote the observance of applicable international law enforcement principles (e.g., the UN Code of Conduct for Law Enforcement Officials and the UN Basic Principles on the Use of Force and Firearms by Law Enforcement Officials), particularly with regard to the use of force;
>
> *Taking note* of the effect that Companies' activities may have on local communities, we recognize the value of engaging with civil society and host and home governments to contribute to the welfare of the local community while mitigating any potential for conflict where possible;
>
> *Understanding* that useful, credible information is a vital component of security and human rights, we recognize the importance of sharing and understanding our respective experiences regarding, inter alia, best security practices and procedures, country human rights situations, and public and private security, subject to confidentiality constraints;

Acknowledging that home governments and multilateral institutions may, on occasion, assist host governments with security sector reform, developing institutional capacities and strengthening the rule of law, we recognize the important role Companies and civil society can play in supporting these efforts;

We hereby express our support for the following voluntary principles regarding security and human rights in the extractive sector, which fall into three categories, risk assessment, relations with public security, and relations with private security:

RISK ASSESSMENT

The ability to assess accurately risks present in a Company's operating environment is critical to the security of personnel, local communities and assets; the success of the Company's short and long-term operations; and to the promotion and protection of human rights. In some circumstances, this is relatively simple; in others, it is important to obtain extensive background information from different sources; monitoring and adapting to changing, complex political, economic, law enforcement, military and social situations; and maintaining productive relations with local communities and government officials.

The quality of complicated risk assessments is largely dependent on the assembling of regularly updated, credible information from a broad range of perspectives – local and national governments, security firms, other companies, home governments, multilateral institutions, and civil society knowledgeable about local conditions. This information may be most effective when shared to the fullest extent possible (bearing in mind confidentiality considerations) between Companies, concerned civil society, and governments.

Bearing in mind these general principles, we recognize that accurate, effective risk assessments should consider the following factors:

Identification of security risks. Security risks can result from political, economic, civil or social factors. Moreover, certain personnel and assets may be at greater risk than others. Identification of security risks allows a Company to take measures to minimize risk and to assess whether Company actions may heighten risk.

Potential for violence. Depending on the environment, violence can be widespread or limited to particular regions, and it can develop with little or no warning. Civil society, home and host government representatives, and other sources should be consulted to identify risks presented by the potential for violence. Risk assessments should examine patterns of violence in areas of Company operations for educational, predictive, and preventative purposes.

Human rights records. Risk assessments should consider the available human rights records of public security forces, paramilitaries, local and national law enforcement, as well as the reputation of private security. Awareness of past abuses and allegations can help Companies to avoid recurrences as well as to promote accountability. Also, identification of the capability of the above entities to respond to situations of violence in a lawful manner (i.e.,

consistent with applicable international standards) allows Companies to develop appropriate measures in operating environments.

Rule of law. Risk assessments should consider the local prosecuting authority and judiciary's capacity to hold accountable those responsible for human rights abuses and for those responsible for violations of international humanitarian law in a manner that respects the rights of the accused.

Conflict analysis. Identification of and understanding the root causes and nature of local conflicts, as well as the level of adherence to human rights and international humanitarian law standards by key actors, can be instructive for the development of strategies for managing relations between the Company, local communities, Company employees and their unions, and host governments. Risk assessments should also consider the potential for future conflicts.

Equipment transfers. Where Companies provide equipment (including lethal and non-lethal equipment) to public or private security, they should consider the risk of such transfers, any relevant export licensing requirements, and the feasibility of measures to mitigate foreseeable negative consequences, including adequate controls to prevent misappropriation or diversion of equipment which may lead to human rights abuses. In making risk assessments, companies should consider any relevant past incidents involving previous equipment transfers.

INTERACTIONS BETWEEN COMPANIES AND PUBLIC SECURITY

Although governments have the primary role of maintaining law and order, security and respect for human rights, Companies have an interest in ensuring that actions taken by governments, particularly the actions of public security providers, are consistent with the protection and promotion of human rights. In cases where there is a need to supplement security provided by host governments, Companies may be required or expected to contribute to, or otherwise reimburse, the costs of protecting Company facilities and personnel borne by public security. While public security is expected to act in a manner consistent with local and national laws as well as with human rights standards and international humanitarian law, within this context abuses may nevertheless occur.

In an effort to reduce the risk of such abuses and to promote respect for human rights generally, we have identified the following voluntary principles to guide relationships between Companies and public security regarding security provided to Companies:

Security Arrangements

Companies should consult regularly with host governments and local communities about the impact of their security arrangements on those communities.

Companies should communicate their policies regarding ethical conduct and human rights to public security providers, and express their desire that

security be provided in a manner consistent with those policies by personnel with adequate and effective training.

Companies should encourage host governments to permit making security arrangements transparent and accessible to the public, subject to any overriding safety and security concerns.

Deployment and Conduct

The primary role of public security should be to maintain the rule of law, including safeguarding human rights and deterring acts that threaten Company personnel and facilities. The type and number of public security forces deployed should be competent, appropriate and proportional to the threat.

Equipment imports and exports should comply with all applicable law and regulations. Companies that provide equipment to public security should take all appropriate and lawful measures to mitigate any foreseeable negative consequences, including human rights abuses and violations of international humanitarian law.

Companies should use their influence to promote the following principles with public security: (a) individuals credibly implicated in human rights abuses should not provide security services for Companies; (b) force should be used only when strictly necessary and to an extent proportional to the threat; and (c) the rights of individuals should not be violated while exercising the right to exercise freedom of association and peaceful assembly, the right to engage in collective bargaining, or other related rights of Company employees as recognized by the Universal Declaration of Human Rights and the ILO Declaration on Fundamental Principles and Rights at Work.

In cases where physical force is used by public security, such incidents should be reported to the appropriate authorities and to the Company. Where force is used, medical aid should be provided to injured persons, including to offenders.

Consultation and Advice

Companies should hold structured meetings with public security on a regular basis to discuss security, human rights and related work-place safety issues. Companies should also consult regularly with other Companies, host and home governments, and civil society to discuss security and human rights. Where Companies operating in the same region have common concerns, they should consider collectively raising those concerns with the host and home governments.

In their consultations with host governments, Companies should take all appropriate measures to promote observance of applicable international law enforcement principles, particularly those reflected in the UN Code of Conduct for Law Enforcement Officials and the UN Basic Principles on the Use of Force and Firearms.

Companies should support efforts by governments, civil society and multilateral institutions to provide human rights training and education for public security as well as their efforts to strengthen state institutions to ensure accountability and respect for human rights.

Responses to Human Rights Abuses

Companies should record and report any credible allegations of human rights abuses by public security in their areas of operation to appropriate host government authorities. Where appropriate, Companies should urge investigation and that action be taken to prevent any recurrence.

Companies should actively monitor the status of investigations and press for their proper resolution.

Companies should, to the extent reasonable, monitor the use of equipment provided by the Company and to investigate properly situations in which such equipment is used in an inappropriate manner.

Every effort should be made to ensure that information used as the basis for allegations of human rights abuses is credible and based on reliable evidence. The security and safety of sources should be protected. Additional or more accurate information that may alter previous allegations should be made available as appropriate to concerned parties.

INTERACTIONS BETWEEN COMPANIES AND PRIVATE SECURITY

Where host governments are unable or unwilling to provide adequate security to protect a Company's personnel or assets, it may be necessary to engage private security providers as a complement to public security. In this context, private security may have to coordinate with state forces, (law enforcement, in particular) to carry weapons and to consider the defensive local use of force. Given the risks associated with such activities, we recognize the following voluntary principles to guide private security conduct:

Private security should observe the policies of the contracting Company regarding ethical conduct and human rights; the law and professional standards of the country in which they operate; emerging best practices developed by industry, civil society, and governments; and promote the observance of international humanitarian law.

Private security should maintain high levels of technical and professional proficiency, particularly with regard to the local use of force and firearms.

Private security should act in a lawful manner. They should exercise restraint and caution in a manner consistent with applicable international guidelines regarding the local use of force, including the UN Principles on the Use of Force and Firearms by Law Enforcement Officials and the UN Code of Conduct for Law Enforcement Officials, as well as with emerging best practices developed by Companies, civil society, and governments.

Private security should have policies regarding appropriate conduct and the local use of force (e.g., rules of engagement). Practice under these policies should be capable of being monitored by Companies or, where appropriate, by independent third parties. Such monitoring should encompass detailed investigations into allegations of abusive or unlawful acts; the availability of disciplinary measures sufficient to prevent and deter; and procedures for reporting allegations to relevant local law enforcement authorities when appropriate.

All allegations of human rights abuses by private security should be recorded. Credible allegations should be properly investigated. In those cases where allegations against private security providers are forwarded to the relevant law enforcement authorities, Companies should actively monitor the status of investigations and press for their proper resolution.

Consistent with their function, private security should provide only preventative and defensive services and should not engage in activities exclusively the responsibility of state military or law enforcement authorities. Companies should designate services, technology and equipment capable of offensive and defensive purposes as being for defensive use only.

Private security should (a) not employ individuals credibly implicated in human rights abuses to provide security services; (b) use force only when strictly necessary and to an extent proportional to the threat; and (c) not violate the rights of individuals while exercising the right to exercise freedom of association and peaceful assembly, to engage in collective bargaining, or other related rights of Company employees as recognized by the Universal Declaration of Human Rights and the ILO Declaration on Fundamental Principles and Rights at Work.

In cases where physical force is used, private security should properly investigate and report the incident to the Company. Private security should refer the matter to local authorities and/or take disciplinary action where appropriate. Where force is used, medical aid should be provided to injured persons, including to offenders.

Private security should maintain the confidentiality of information obtained as a result of its position as security provider, except where to do so would jeopardize the principles contained herein.

To minimize the risk that private security exceed their authority as providers of security, and to promote respect for human rights generally, we have developed the following additional voluntary principles and guidelines:

Where appropriate, Companies should include the principles outlined above as contractual provisions in agreements with private security providers and ensure that private security personnel are adequately trained to respect the rights of employees and the local community. To the extent practicable, agreements between Companies and private security should require investigation of unlawful or abusive behavior and appropriate disciplinary action. Agreements should also permit termination of the relationship by

Companies where there is credible evidence of unlawful or abusive behavior by private security personnel.

Companies should consult and monitor private security providers to ensure they fulfill their obligation to provide security in a manner consistent with the principles outlined above. Where appropriate, Companies should seek to employ private security providers that are representative of the local population.

Companies should review the background of private security they intend to employ, particularly with regard to the use of excessive force. Such reviews should include an assessment of previous services provided to the host government and whether these services raise concern about the private security firm's dual role as a private security provider and government contractor.

Companies should consult with other Companies, home country officials, host country officials, and civil society regarding experiences with private security. Where appropriate and lawful, Companies should facilitate the exchange of information about unlawful activity and abuses committed by private security providers.

International Finance Corporation's
Performance Standards on
Social & Environmental Sustainability

April 30, 2006

Performance Standards on Social and Environmental Sustainability

April 30, 2006

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Performance Standards on Social and Environmental Sustainability

April 30, 2006

Introduction

1. International Finance Corporation (IFC) applies the Performance Standards to manage social and environmental risks and impacts and to enhance development opportunities in its private sector financing in its member countries eligible for financing.[1] The Performance Standards may also be applied by other financial institutions electing to apply them to projects in emerging markets. Together, the eight Performance Standards establish standards that the client[2] is to meet throughout the life of an investment by IFC or other relevant financial institution:

Performance Standard 1: Social and Environmental Assessment and Management System
Performance Standard 2: Labor and Working Conditions
Performance Standard 3: Pollution Prevention and Abatement
Performance Standard 4: Community Health, Safety and Security
Performance Standard 5: Land Acquisition and Involuntary Resettlement
Performance Standard 6: Biodiversity Conservation and Sustainable Natural Resource Management
Performance Standard 7: Indigenous Peoples
Performance Standard 8: Cultural Heritage

2. Performance Standard 1 establishes the importance of: (i) integrated assessment to identify the social and environmental impacts, risks, and opportunities of projects; (ii) effective community engagement through disclosure of project-related information and consultation with local communities on matters that directly affect them; and (iii) the client's management of social and environmental performance throughout the life of the project. Performance Standards 2 through 8 establish requirements to avoid, reduce, mitigate or compensate for impacts on people and the environment, and to improve conditions where appropriate. While all relevant social and environmental risks and potential impacts should be considered as part of the assessment, Performance Standards 2 through 8 describe potential social and environmental impacts that require particular attention in emerging markets. Where social or environmental impacts are anticipated, the client is required to manage them through its Social and Environmental Management System consistent with Performance Standard 1.

3. In addition to meeting the requirements under the Performance Standards, clients must comply with applicable national laws, including those laws implementing host country obligations under international law.

4. A set of Guidance Notes, corresponding to the Performance Standards, offers helpful guidance on the requirements contained in the Performance Standards, including reference materials, and on good sustainability practices to help clients improve project performance.

[1] IFC will apply the Performance Standards to projects it finances, consistent with the provisions in the accompanying IFC's Policy on Social and Environmental Sustainability. IFC's institutional disclosure of information will be pursuant to IFC's Policy on Disclosure of Information.

[2] The term "client" is used throughout the Performance Standards broadly to refer to the party responsible for implementing and operating the project that is being financed, or the recipient of the financing, depending on the project structure and type of financing. The term "project" is defined in Performance Standard 1.

Performance Standard 1
Social and Environmental Assessment and Management Systems

April 30, 2006

Introduction

1. Performance Standard 1 underscores the importance of managing social and environmental performance throughout the life of a project (any business activity that is subject to assessment and management). An effective social and environmental management system is a dynamic, continuous process initiated by management and involving communication between the client, its workers, and the local communities directly affected by the project (the affected communities). Drawing on the elements of the established business management process of "plan, implement, check, and act," the system entails the thorough assessment of potential social and environmental impacts and risks from the early stages of project development, and provides order and consistency for mitigating and managing these on an ongoing basis. A good management system appropriate to the size and nature of a project promotes sound and sustainable social and environmental performance, and can lead to improved financial, social and environmental project outcomes.

Objectives

- To identify and assess social and environment impacts, both adverse and beneficial, in the project's area of influence
- To avoid, or where avoidance is not possible, minimize, mitigate, or compensate for adverse impacts on workers, affected communities, and the environment
- To ensure that affected communities are appropriately engaged on issues that could potentially affect them
- To promote improved social and environment performance of companies through the effective use of management systems

Scope of Application

2. This Performance Standard applies to projects with social or environmental risks and impacts that should be managed, in the early stages of project development, and on an ongoing basis.

Requirements

Social and Environmental Management System

3. The client will establish and maintain a Social and Environmental Management System appropriate to the nature and scale of the project and commensurate with the level of social and environmental risks and impacts. The Management System will incorporate the following elements: (i) Social and Environmental Assessment; (ii) management program; (iii) organizational capacity; (iv) training; (v) community engagement; (vi) monitoring; and (vii) reporting.

Social and Environmental Assessment

4. The client will conduct a process of Social and Environmental Assessment that will consider in an integrated manner the potential social and environmental (including labor, health, and safety) risks and impacts of the project. The Assessment process will be based on current information, including an accurate project description, and appropriate social and environmental baseline data. The Assessment will consider all relevant social and environmental risks and impacts of the project, including the issues identified in Performance Standards 2 through 8, and those who will be affected by such risks and impacts. Applicable laws and regulations of the jurisdictions in which the project

operates that pertain to social and environmental matters, including those laws implementing host country obligations under international law, will also be taken into account.

5. Risks and impacts will be analyzed in the context of the project's area of influence. This area of influence encompasses, as appropriate: (i) the primary project site(s) and related facilities that the client (including its contractors) develops or controls, such as power transmission corridors, pipelines, canals, tunnels, relocation and access roads, borrow and disposal areas, construction camps; (ii) associated facilities that are not funded as part of the project (funding may be provided separately by the client or by third parties including the government), and whose viability and existence depend exclusively on the project and whose goods or services are essential for the successful operation of the project; (iii) areas potentially impacted by cumulative impacts from further planned development of the project, any existing project or condition, and other project-related developments that are realistically defined at the time the Social and Environmental Assessment is undertaken; and (iv) areas potentially affected by impacts from unplanned but predictable developments caused by the project that may occur later or at a different location. The area of influence does not include potential impacts that would occur without the project or independently of the project.

6. Risks and impacts will also be analyzed for the key stages of the project cycle, including pre-construction, construction, operations, and decommissioning or closure. Where relevant, the Assessment will also consider the role and capacity of third parties (such as local and national governments, contractors and suppliers), to the extent that they pose a risk to the project, recognizing that the client should address these risks and impacts commensurate to the client's control and influence over the third party actions. The impacts associated with supply chains will be considered where the resource utilized by the project is ecologically sensitive, or in cases where low labor cost is a factor in the competitiveness of the item supplied. The Assessment will also consider potential transboundary effects, such as pollution of air, or use or pollution of international waterways, as well as global impacts, such as the emission of greenhouse gasses.

7. The Assessment will be an adequate, accurate, and objective evaluation and presentation of the issues, prepared by qualified and experienced persons. In projects with significant adverse impacts or where technically complex issues are involved, clients may be required to retain external experts to assist in the Assessment process.

8. Depending on the type of project and the nature and magnitude of its risks and impacts, the Assessment may comprise a full-scale social and environmental impact assessment, a limited or focused environmental or social assessment, or straightforward application of environmental siting, pollution standards, design criteria, or construction standards. When the project involves existing business activities, social and/or environmental audits may need to be performed to determine any areas of concern. The types of issues, risks and impacts to be assessed, and the scope of the community engagement (see paragraphs 19 through 23 below) can also vary considerably, depending on the nature of the project, and its size, location, and stage of development.

9. Projects with potential significant adverse impacts that are diverse, irreversible, or unprecedented will have comprehensive social and environmental impact assessments. This assessment will include an examination of technically and financially feasible[1] alternatives to the

[1] "Technical feasibility" is based on whether the proposed measures and actions can be implemented with commercially available skills, equipment and materials, taking into consideration prevailing local factors such as climate, geography, demography, infrastructure, security, governance, capacity and operational reliability. "Financial feasibility" is based on commercial considerations, including the relative magnitude of the incremental

source of such impacts, and documentation of the rationale for selecting the particular course of action proposed. In exceptional circumstances, a regional, sectoral or strategic assessment may be required.

10. Narrower scopes of Assessments may be conducted for projects with limited impacts that are few in number, generally site-specific, largely reversible, and readily addressed through mitigation measures.

11. Projects with minimal or no adverse impacts will not be subject to further assessment beyond their identification as such.

12. As part of the Assessment, the client will identify individuals and groups that may be differentially or disproportionately affected by the project because of their disadvantaged or vulnerable status.[2] Where groups are identified as disadvantaged or vulnerable, the client will propose and implement differentiated measures so that adverse impacts do not fall disproportionately on them and they are not disadvantaged in sharing development benefits and opportunities.

Management Program

13. Taking into account the relevant findings of the Social and Environmental Assessment and the result of consultation with affected communities, the client will establish and manage a program of mitigation and performance improvement measures and actions that address the identified social and environmental risks and impacts (the management program).

14. Management programs consist of a combination of operational policies, procedures and practices. The program may apply broadly across the client's organization, or to specific sites, facilities, or activities. The measures and actions to address identified impacts and risks will favor the avoidance and prevention of impacts over minimization, mitigation, or compensation, wherever technically and financially feasible. Where risks and impacts cannot be avoided or prevented, mitigation measures and actions will be identified so that the project operates in compliance with applicable laws and regulations, and meets the requirements of Performance Standards 1 through 8 (see paragraph 16 below). The level of detail and complexity of this program and the priority of the identified measures and actions will be commensurate with the project's risks and impacts.

15. The program will define desired outcomes as measurable events to the extent possible, with elements such as performance indicators, targets, or acceptance criteria that can be tracked over defined time periods, and with estimates of the resources and responsibilities for implementation. Recognizing the dynamic nature of the project development and implementation process, the program will be responsive to changes in project circumstances, unforeseen events, and the results of monitoring (see paragraph 24 below).

cost of adopting such measures and actions compared to the project's investment, operating and maintenance costs and whether this incremental cost could make the project nonviable to the client.

[2] This status may stem from an individual's or group's race, color, sex, language, religion, political or other opinion, national or social origin, property, birth or other status. The client should also consider factors such as gender, ethnicity, culture, sickness, physical or mental disability, poverty or economic disadvantage, and dependence on unique natural resources.

Action Plan

16. Where the client identifies specific mitigation measures and actions necessary for the project to comply with applicable laws and regulations and to meet the requirements of Performance Standards 1 through 8, the client will prepare an Action Plan. These measures and actions will reflect the outcomes of consultation on social and environmental risks and adverse impacts and the proposed measures and actions to address these, consistent with the requirements under paragraph 21. The Action Plan may range from a brief description of routine mitigation measures to a series of specific plans.[3] The Action Plan will: (i) describe the actions necessary to implement the various sets of mitigation measures or corrective actions to be undertaken; (ii) prioritize these actions; (iii) include the time-line for their implementation; (iv) be disclosed to the affected communities (see paragraph 26); and (v) describe the schedule and mechanism for external reporting on the client's implementation of the Action Plan.

Organizational Capacity

17. The client will establish, maintain, and strengthen as necessary an organizational structure that defines roles, responsibilities, and authority to implement the management program, including the Action Plan. Specific personnel, including management representative(s), with clear lines of responsibility and authority should be designated. Key social and environmental responsibilities should be well defined and communicated to the relevant personnel and to the rest of the organization. Sufficient management sponsorship and human and financial resources will be provided on an ongoing basis to achieve effective and continuous social and environmental performance.

Training

18. The client will train employees and contractors with direct responsibility for activities relevant to the project's social and environmental performance so that they have the knowledge and skills necessary to perform their work, including current knowledge of the host country's regulatory requirements and the applicable requirements of Performance Standards 1 through 8. Training will also address the specific measures and actions required under the management program, including the Action Plan, and the methods required to perform the action items in a competent and efficient manner.

Community Engagement

19. Community engagement is an on-going process involving the client's disclosure of information. When local communities may be affected by risks or adverse impacts from a project, the engagement process will include consultation with them. The purpose of community engagement is to build and maintain over time a constructive relationship with these communities. The nature and frequency of community engagement will reflect the project's risks to and adverse impacts on the affected communities. Community engagement will be free of external manipulation, interference, or coercion, and intimidation, and conducted on the basis of timely, relevant, understandable and accessible information.

[3] For example, Resettlement Action Plans, Biodiversity Action Plans, Hazardous Materials Management Plans, Emergency Preparedness and Response Plans, Community Health and Safety Plans, and Indigenous Peoples Development Plans.

Disclosure

20. Disclosure of relevant project information helps affected communities understand the risks, impacts and opportunities of the project. Where the client has undertaken a process of Social and Environmental Assessment, the client will publicly disclose the Assessment document. If communities may be affected by risks or adverse impacts from the project, the client will provide such communities with access to information on the purpose, nature and scale of the project, the duration of proposed project activities, and any risks to and potential impacts on such communities. For projects with adverse social or environmental impacts, disclosure should occur early in the Social and Environmental Assessment process and in any event before the project construction commences, and on an ongoing basis (see paragraph 26 below).

Consultation

21. If affected communities may be subject to risks or adverse impacts from a project, the client will undertake a process of consultation in a manner that provides the affected communities with opportunities to express their views on project risks, impacts, and mitigation measures, and allows the client to consider and respond to them. Effective consultation: (i) should be based on the prior disclosure of relevant and adequate information, including draft documents and plans; (ii) should begin early in the Social and Environmental Assessment process; (iii) will focus on the social and environmental risks and adverse impacts, and the proposed measures and actions to address these; and (iv) will be carried out on an ongoing basis as risks and impacts arise. The consultation process will be undertaken in a manner that is inclusive and culturally appropriate. The client will tailor its consultation process to the language preferences of the affected communities, their decision-making process, and the needs of disadvantaged or vulnerable groups.

22. For projects with significant adverse impacts on affected communities, the consultation process will ensure their free, prior and informed consultation and facilitate their informed participation. Informed participation involves organized and iterative consultation, leading to the client's incorporating into their decision-making process the views of the affected communities on matters that affect them directly, such as proposed mitigation measures, the sharing of development benefits and opportunities, and implementation issues. The client will document the process, in particular the measures taken to avoid or minimize risks to and adverse impacts on the affected communities.

Grievance Mechanism

23. The client will respond to communities' concerns related to the project. If the client anticipates ongoing risks to or adverse impacts on affected communities, the client will establish a grievance mechanism to receive and facilitate resolution of the affected communities' concerns and grievances about the client's environmental and social performance. The grievance mechanism should be scaled to the risks and adverse impacts of the project. It should address concerns promptly, using an understandable and transparent process that is culturally appropriate and readily accessible to all segments of the affected communities, and at no cost and without retribution. The mechanism should not impede access to judicial or administrative remedies. The client will inform the affected communities about the mechanism in the course of its community engagement process.

Monitoring

24. As an element of its Management System, the client will establish procedures to monitor and measure the effectiveness of the management program. In addition to recording information to track performance and establishing relevant operational controls, the client should use dynamic mechanisms, such as inspections and audits, where relevant, to verify compliance and progress

toward the desired outcomes. For projects with significant impacts that are diverse, irreversible, or unprecedented, the client will retain qualified and experienced external experts to verify its monitoring information. The extent of monitoring should be commensurate with the project's risks and impacts and with the project's compliance requirements. Monitoring should be adjusted according to performance experience and feedback. The client will document monitoring results, and identify and reflect the necessary corrective and preventive actions in the amended management program. The client will implement these corrective and preventive actions, and follow up on these actions to ensure their effectiveness.

Reporting

Internal Reporting

25. Senior management in the client organization will receive periodic assessments of the effectiveness of the management program, based on systematic data collection and analysis. The scope and frequency of such reporting will depend upon the nature and scope of the activities identified and undertaken in accordance with the client's management program and other applicable project requirements.

External Reporting on Action Plans

26. The client will disclose the Action Plan to the affected communities. In addition, the client will provide periodic reports that describe progress with implementation of the Action Plan on issues that involve ongoing risk to or impacts on affected communities, and on issues that the consultation process or grievance mechanism has identified as of concern to those communities. If the management program results in material changes in, or additions to, the mitigation measures or actions described in the Action Plan on issues of concern to the affected communities, the updated mitigation measures or actions will also be disclosed. These reports will be in a format accessible to the affected communities. The frequency of these reports will be proportionate to the concerns of affected communities but not less than annually.

Performance Standard 2
Labor and Working Conditions

April 30, 2006

Introduction

1. Performance Standard 2 recognizes that the pursuit of economic growth through employment creation and income generation should be balanced with protection for basic rights of workers. For any business, the workforce is a valuable asset, and a sound worker-management relationship is a key ingredient to the sustainability of the enterprise. Failure to establish and foster a sound worker-management relationship can undermine worker commitment and retention, and can jeopardize a project. Conversely, through a constructive worker-management relationship, and by treating the workers fairly and providing them with safe and healthy working conditions, clients may create tangible benefits, such as enhancement of the efficiency and productivity of their operations.

2. The requirements set out in this Performance Standard have been in part guided by a number of international conventions negotiated through the International Labour Organization (ILO) and the United Nations (UN).[1]

Objectives

- To establish, maintain and improve the worker-management relationship
- To promote the fair treatment, non-discrimination and equal opportunity of workers, and compliance with national labor and employment laws
- To protect the workforce by addressing child labor and forced labor
- To promote safe and healthy working conditions, and to protect and promote the health of workers

Scope of Application

3. The applicability of this Performance Standard is established during the Social and Environmental Assessment process, while implementation of the actions necessary to meet the requirements of this Performance Standard is managed through the client's Social and Environmental Management System. The assessment and management system requirements are outlined in Performance Standard 1.

4. Throughout this Performance Standard, the term "workers" is used to refer to employees of the client, as well as to certain types of non-employee workers described in paragraph 17. The application of this Performance Standard will vary depending on the type of workers, as follows:

- **Employees**: All the requirements of this Performance Standard, except for the requirements under paragraphs 17 and 18, apply
- **Non-Employee Workers:** The requirements of paragraph 17 apply

5. Supply chain[2] issues are addressed in paragraph 18.

[1] These conventions are:
ILO Convention 87 on Freedom of Association and Protection of the Right to Organize
ILO Convention 98 on the Right to Organize and Collective Bargaining
ILO Convention 29 on Forced Labor
ILO Convention 105 on the Abolition of Forced Labor
ILO Convention 138 on Minimum Age (of Employment)
ILO Convention 182 on the Worst Forms of Child Labor
ILO Convention 100 on Equal Remuneration
ILO Convention 111 on Discrimination (Employment and Occupation)
United Nations Convention on the Rights of the Child, Article 32.1

Requirements

Working Conditions and Management of Worker Relationship

Human Resources Policy

6. The client will adopt a human resources policy appropriate to its size and workforce that sets out its approach to managing employees consistent with the requirements of this Performance Standard. Under the policy, the client will provide employees with information regarding their rights under national labor and employment law, including their rights related to wages and benefits. This policy will be clear and understandable to employees and will be explained or made accessible to each employee upon taking employment.

Working Relationship

7. The client will document and communicate to all employees and workers directly contracted by the client their working conditions and terms of employment, including their entitlement to wages and any benefits.

Working Conditions and Terms of Employment

8. Where the client is a party to a collective bargaining agreement with a workers' organization, such agreement will be respected. Where such agreements do not exist, or do not address working conditions and terms of employment (such as wages and benefits, hours of work, overtime arrangements and overtime compensation, and leave for illness, maternity, vacation or holiday) the client will provide reasonable working conditions and terms of employment that, at a minimum, comply with national law.

Workers' Organizations

9. In countries where national law recognizes workers' rights to form and to join workers' organizations of their choosing without interference and to bargain collectively, the client will comply with national law. Where national law substantially restricts workers' organizations, the client will enable alternative means for workers to express their grievances and protect their rights regarding working conditions and terms of employment.

10. In either case described in paragraph 9, and where national law is silent, the client will not discourage workers from forming or joining workers' organizations of their choosing or from bargaining collectively, and will not discriminate or retaliate against workers who participate, or seek to participate, in such organizations and bargain collectively. Clients will engage with such worker representatives. Worker organizations are expected to fairly represent the workers in the workforce.

Non-Discrimination and Equal Opportunity

11. The client will not make employment decisions on the basis of personal characteristics unrelated to inherent job requirements. The client will base the employment relationship on the principle of equal opportunity and fair treatment, and will not discriminate with respect to aspects of the employment relationship, including recruitment and hiring, compensation (including wages and benefits), working conditions and terms of employment, access to training, promotion, termination of employment or retirement, and discipline. In countries where national law provides for non-discrimination in employment, the client will comply with national law. When national laws are silent on non-discrimination in employment, the client will meet this Performance Standard. Special measures of protection or assistance to remedy past discrimination or selection for a particular job based on the inherent requirements of the job will not be deemed discrimination.

[2] Supply chain refers to both labor and material inputs for the life-cycle of a good or service.

Retrenchment

12. The client will develop a plan to mitigate the adverse impacts of retrenchment on employees, if it anticipates the elimination of a significant number of jobs or a layoff of a significant number of employees. The plan will be based on the principle of non-discrimination and will reflect the client's consultation with employees, their organizations and, where appropriate, the government.

Grievance Mechanism

13. The client will provide a grievance mechanism for workers (and their organizations, where they exist) to raise reasonable workplace concerns. The client will inform the workers of the grievance mechanism at the time of hire, and make it easily accessible to them. The mechanism should involve an appropriate level of management and address concerns promptly, using an understandable and transparent process that provides feedback to those concerned, without any retribution. The mechanism should not impede access to other judicial or administrative remedies that might be available under law or through existing arbitration procedures, or substitute for grievance mechanisms provided through collective agreements.

Protecting the Work Force

Child Labor

14. The client will not employ children in a manner that is economically exploitative, or is likely to be hazardous or to interfere with the child's education, or to be harmful to the child's health or physical, mental, spiritual, moral, or social development. Where national laws have provisions for the employment of minors, the client will follow those laws applicable to the client. Children below the age of 18 years will not be employed in dangerous work.

Forced Labor

15. The client will not employ forced labor, which consists of any work or service not voluntarily performed that is exacted from an individual under threat of force or penalty. This covers any kind of involuntary or compulsory labor, such as indentured labor, bonded labor or similar labor-contracting arrangements.

Occupational Health and Safety

16. The client will provide the workers with a safe and healthy work environment, taking into account inherent risks in its particular sector and specific classes of hazards in the client's work areas, including physical, chemical, biological, and radiological hazards. The client will take steps to prevent accidents, injury, and disease arising from, associated with, or occurring in the course of work by minimizing, so far as reasonably practicable, the causes of hazards. In a manner consistent with good international industry practice,[3] the client will address areas, including: the identification of potential hazards to workers, particularly those that may be life-threatening; provision of preventive and protective measures, including modification, substitution, or elimination of hazardous conditions or substances; training of workers; documentation and reporting of occupational accidents, diseases, and incidents; and emergency prevention, preparedness and response arrangements.

[3] Defined as the exercise of professional skill, diligence, prudence and foresight that would reasonably be expected from skilled and experienced professionals engaged in the same type of undertaking under the same or similar circumstances globally.

Non-Employee Workers

17. For purpose of this Performance Standard, "non-employee workers" refers to workers who are: (i) directly contracted by the client, or contracted through contractors or other intermediaries; and (ii) performing work directly related to core functions essential to the client's products or services for a substantial duration. When the client contracts non-employee workers directly, the client will use commercially reasonable efforts to apply the requirements of this Performance Standard, except for paragraphs 6, 12, and 18. With respect to contractors or other intermediaries procuring non-employee workers, the client will use commercially reasonable efforts to: (i) ascertain that these contractors or intermediaries are reputable and legitimate enterprises; and (ii) require that these contractors or intermediaries apply the requirements of this Performance Standard, except for paragraphs 6, 12, and 13.

Supply Chain

18. The adverse impacts associated with supply chains will be considered where low labor cost is a factor in the competitiveness of the item supplied. The client will inquire about and address child labor and forced labor in its supply chain, consistent with paragraphs 14 and 15 above.

Performance Standard 3
Pollution Prevention and Abatement

April 30, 2006

Introduction

1. Performance Standard 3 recognizes that increased industrial activity and urbanization often generate increased levels of pollution to air, water, and land that may threaten people and the environment at the local, regional, and global level.[1] On the other hand, along with international trade, pollution prevention and control technologies and practices have become more accessible and achievable in virtually all parts of the world. This Performance Standard outlines a project approach to pollution prevention and abatement in line with these internationally disseminated technologies and practices. In addition, this Performance Standard promotes the private sector's ability to integrate such technologies and practices as far as their use is technically and financially feasible and cost-effective in the context of a project that relies on commercially available skills and resources.

Objectives

- To avoid or minimize adverse impacts on human health and the environment by avoiding or minimizing pollution from project activities
- To promote the reduction of emissions that contribute to climate change

Scope of Application

2. The applicability of this Performance Standard is established during the Social and Environmental Assessment process, while implementation of the actions necessary to meet the requirements of this Performance Standard is managed through the client's Social and Environmental Management System. The assessment and management system requirements are outlined in Performance Standard 1.

Requirements

General Requirements

3. During the design, construction, operation and decommissioning of the project (the project life-cycle) the client will consider ambient conditions and apply pollution prevention and control technologies and practices (techniques) that are best suited to avoid or, where avoidance is not feasible, minimize or reduce adverse impacts on human health and the environment while remaining technically and financially feasible and cost-effective.[2] The project-specific pollution prevention and control techniques applied during the project life-cycle will be tailored to the hazards and risks associated with project emissions and consistent with good international industry practice,[3] as

[1] For the purposes of this performance standard, the term "pollution" is used to refer to both hazardous and non-hazardous pollutants in the solid, liquid, or gaseous forms, and is intended to include other forms such as nuisance odors, noise, vibration, radiation, electromagnetic energy, and the creation of potential visual impacts including light.

[2] "Technical feasibility" and "financial feasibility" are defined in Performance Standard 1. "Cost-effectiveness" is based on the effectiveness of reducing emissions relative to the additional cost required to do so.

[3] Defined as the exercise of professional skill, diligence, prudence and foresight that would reasonably be 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.

reflected in various internationally recognized sources, including IFC's Environmental, Health and Safety Guidelines (the EHS Guidelines).

Pollution Prevention, Resource Conservation and Energy Efficiency

4. The client will avoid the release of pollutants or, when avoidance is not feasible, minimize or control the intensity or load of their release. This applies to the release of pollutants due to routine, non-routine or accidental circumstances with the potential for local, regional, and transboundary impacts.[4] In addition, the client should examine and incorporate in its operations resource conservation and energy efficiency measures, consistent with the principles of cleaner production.

Wastes

5. The client will avoid or minimize the generation of hazardous and non-hazardous waste materials as far as practicable. Where waste generation cannot be avoided but has been minimized, the client will recover and reuse waste; where waste can not be recovered or reused, the client will treat, destroy, and dispose of it in an environmentally sound manner. If the generated waste is considered hazardous,[5] the client will explore commercially reasonable alternatives for its environmentally sound disposal considering the limitations applicable to its transboundary movement.[6] When waste disposal is conducted by third parties, the client will use contractors that are reputable and legitimate enterprises licensed by the relevant regulatory agencies.

Hazardous Materials

6. The client will avoid or, when avoidance is not feasible, minimize or control the release of hazardous materials resulting from their production, transportation, handling, storage and use for project activities. The client will avoid the manufacture, trade, and use of chemicals and hazardous materials subject to international bans or phase-outs due to their high toxicity to living organisms, environmental persistence, potential for bioaccumulation, or potential for depletion of the ozone layer,[7] and consider the use of less hazardous substitutes for such chemicals and materials.

Emergency Preparedness and Response

7. The client will be prepared to respond to process upset, accidental, and emergency situations in a manner appropriate to the operational risks and the need to prevent their potential negative consequences. This preparation will include a plan that addresses the training, resources, responsibilities, communication, procedures, and other aspects required to effectively respond to emergencies associated with project hazards. Additional requirements on emergency preparedness and response are found in paragraph 12 of Performance Standard 4.

Technical Guidance

8. The client will refer to the current version of the EHS Guidelines when evaluating and selecting pollution prevention and control techniques for the project. These Guidelines contain the performance levels and measures that are normally acceptable and applicable to projects. When host country regulations differ from the levels and measures presented in the EHS Guidelines, clients will achieve whichever is more stringent. If less stringent levels or measures are appropriate in view

[4] In reference to transboundary pollutants, including those covered under the Convention on Long-range Transboundary Air Pollution.
[5] As defined by local legislation or international conventions.
[6] Consistent with the objectives of the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes.
[7] Consistent with the objectives of the Stockholm Convention on Persistent Organic Pollutants and the Montreal Protocol on Substances that Deplete the Ozone Layer. Similar considerations will apply to certain World Health Organization (WHO) classes of pesticides.

of specific project circumstances, the client will provide full and detailed justification for any proposed alternatives. This justification will demonstrate that the choice for any alternate performance levels is consistent with the overall requirements of this Performance Standard.

Ambient Considerations

9. To address adverse project impacts on existing ambient conditions,[8] the client will: (i) consider a number of factors, including the finite assimilative capacity[9] of the environment, existing and future land use, existing ambient conditions, the project's proximity to ecologically sensitive or protected areas, and the potential for cumulative impacts with uncertain and irreversible consequences; and (ii) promote strategies that avoid or, where avoidance is not feasible, minimize or reduce the release of pollutants, including strategies that contribute to the improvement of ambient conditions when the project has the potential to constitute a significant source of emissions in an already degraded area. These strategies include, but are not limited to, evaluation of project location alternatives and emissions offsets.

Greenhouse Gas Emissions

10. The client will promote the reduction of project-related greenhouse gas (GHG) emissions in a manner appropriate to the nature and scale of project operations and impacts.

11. During the development or operation of projects that are expected to or currently produce significant quantities of GHGs,[10] the client will quantify direct emissions from the facilities owned or controlled within the physical project boundary and indirect emissions associated with the off-site production of power used by the project. Quantification and monitoring of GHG emissions will be conducted annually in accordance with internationally recognized methodologies.[11] In addition, the client will evaluate technically and financially feasible and cost-effective options to reduce or offset project-related GHG emissions during the design and operation of the project. These options may include, but are not limited to, carbon financing, energy efficiency improvement, the use of renewable energy sources, alterations of project design, emissions offsets, and the adoption of other mitigation measures such as the reduction of fugitive emissions and the reduction of gas flaring.

Pesticide Use and Management

12. The client will formulate and implement an integrated pest management (IPM) and/or integrated vector management (IVM) approach for pest management activities. The client's IPM and IVM program will entail coordinated use of pest and environmental information along with available pest control methods, including cultural practices, biological, genetic and, as a last resort, chemical means to prevent unacceptable levels of pest damage.

[8] Such as air, surface and groundwater, and soils.
[9] The capacity of the environment for absorbing an incremental load of pollutants while remaining below a threshold of unacceptable risk to human health and the environment.
[10] The significance of a project's contribution to GHG emissions varies between industry sectors. The threshold for this Performance Standard is 100,000 tons CO_2 equivalent per year for the aggregate emissions of direct sources and indirect sources associated with purchased electricity for own consumption. This or similar thresholds will apply to such industry sectors or activities as energy, transport, heavy industry, agriculture, forestry, and waste management in order to help promote awareness and reduction of emissions.
[11] Estimation methodologies are provided by the Intergovernmental Panel on Climate Change (IPCC), various international organizations, and relevant host country agencies.

13. When pest management activities include the use of pesticides, the client will select pesticides that are low in human toxicity, known to be effective against the target species, and have minimal effects on non-target species and the environment. When the client selects pesticides, the selection will be based on whether the pesticides are packaged in safe containers, are clearly labeled for safe and proper use, and have been manufactured by an entity currently licensed by relevant regulatory agencies.

14. The client will design its pesticide application regime to minimize damage to natural enemies and prevent the development of resistance in pests. In addition, pesticides will be handled, stored, applied, and disposed of in accordance with the Food and Agriculture Organization's International Code of Conduct on the Distribution and Use of Pesticides or other good international industry practice.

15. The client will not use products that fall in World Health Organization Recommended Classification of Pesticides by Hazard Classes Ia (extremely hazardous) and Ib (highly hazardous); or Class II (moderately hazardous), if the project host country lacks restrictions on distribution and use of these chemicals, or if they are likely to be accessible to personnel without proper training, equipment, and facilities to handle, store, apply, and dispose of these products properly.

Performance Standard 4
Community Health, Safety and Security

April 30, 2006

Introduction

1. Performance Standard 4 recognizes that project activities, equipment, and infrastructure often bring benefits to communities including employment, services, and opportunities for economic development. However, projects can also increase the potential for community exposure to risks and impacts arising from equipment accidents, structural failures, and releases of hazardous materials. Communities may also be affected by impacts on their natural resources, exposure to diseases, and the use of security personnel. While acknowledging the public authorities' role in promoting the health, safety and security of the public, this Performance Standard addresses the client's responsibility to avoid or minimize the risks and impacts to community health, safety and security that may arise from project activities. The level of risks and impacts described in this Performance Standard may be greater in projects located in conflict and post-conflict areas.

Objectives

- To avoid or minimize risks to and impacts on the health and safety of the local community during the project life cycle from both routine and non-routine circumstances
- To ensure that the safeguarding of personnel and property is carried out in a legitimate manner that avoids or minimizes risks to the community's safety and security

Scope of Application

2. The applicability of this Performance Standard is established during the Social and Environmental Assessment process, while implementation of the actions necessary to meet the requirements of this Performance Standard is managed through the client's Social and Environmental Management System. The assessment and management system requirements are outlined in Performance Standard 1.

3. This Performance Standard addresses potential risks and impacts to the affected community from project activities. Occupational health and safety standards are found in paragraph 16 of Performance Standard 2, and environmental standards to prevent impacts on human health and the environment due to pollution are found in Performance Standard 3.

Requirements

Community Health and Safety Requirements

General Requirements

4. The client will evaluate the risks and impacts to the health and safety of the affected community during the design, construction, operation, and decommissioning of the project and will establish preventive measures to address them in a manner commensurate with the identified risks and impacts. These measures will favor the prevention or avoidance of risks and impacts over minimization and reduction.

5. Where the project poses risks to or adverse impacts on the health and safety of affected communities, the client will disclose the Action Plan and any other relevant project-related information to enable the affected communities and relevant government agencies to understand

these risks and impacts, and will engage the affected communities and agencies on an ongoing basis consistent with the requirements of Performance Standard 1.

Infrastructure and Equipment Safety

6. The client will design, construct, and operate and decommission the structural elements or components of the project in accordance with good international industry practice,[1] and will give particular consideration to potential exposure to natural hazards, especially where the structural elements are accessible to members of the affected community or where their failure could result in injury to the community. Structural elements will be designed and constructed by qualified and experienced professionals, and certified or approved by competent authorities or professionals. When structural elements or components, such as dams, tailings dams, or ash ponds, are situated in high-risk locations, and their failure or malfunction may threaten the safety of communities, the client will engage one or more qualified experts with relevant and recognized experience in similar projects, separate from those responsible for the design and construction, to conduct a review as early as possible in project development and throughout the stages of project design, construction, and commissioning. For projects that operate moving equipment on public roads and other forms of infrastructure, the client will seek to prevent the occurrence of incidents and accidents associated with the operation of such equipment.

Hazardous Materials Safety

7. The client will prevent or minimize the potential for community exposure to hazardous materials that may be released by the project. Where there is a potential for the community (including workers and their families) to be exposed to hazards, particularly those that may be life-threatening, the client will exercise special care to avoid or minimize their exposure by modifying, substituting or eliminating the condition or substance causing the hazards. Where hazardous materials are part of existing project infrastructure or components, the client will exercise special care when conducting decommissioning activities in order to prevent exposure to the community. In addition, the client will exercise commercially reasonable efforts to control the safety of deliveries of raw materials and of transportation and disposal of wastes, and will implement measures to avoid or control community exposure to pesticides in accordance with the requirements outlined in paragraphs 6 and 12 through 15 of Performance Standard 3.

Environmental and Natural Resource Issues

8. The client will avoid or minimize the exacerbation of impacts caused by natural hazards, such as landslides or floods that could arise from land use changes due to project activities.

9. The client will also avoid or minimize adverse impacts due to project activities on soil, water, and other natural resources in use by the affected communities.

Community Exposure to Disease

10. The client will prevent or minimize the potential for community exposure to water-borne, water-based, water-related, vector-borne disease, and other communicable diseases that could result from project activities. Where specific diseases are endemic in communities in the project area of influence, the dient is encouraged to explore opportunities during the project life cycle to improve environmental conditions that could help reduce their incidence.

[1] Defined as the exercise of that degree of skill, diligence, prudence and foresight that would reasonably and ordinarily be expected from skilled and experienced professionals engaged in the same type of undertaking under the same or similar circumstances globally.

11. The client will prevent or minimize transmission of communicable diseases that may be associated with the influx of temporary or permanent project labor.

Emergency Preparedness and Response

12. The client will assess the potential risks and impacts from project activities and inform affected communities of significant potential hazards in a culturally appropriate manner. The client will also assist and collaborate with the community and the local government agencies in their preparations to respond effectively to emergency situations, especially when their participation and collaboration are necessary to respond to such emergency situations. If local government agencies have little or no capacity to respond effectively, the client will play an active role in preparing for and responding to emergencies associated with the project. The client will document its emergency preparedness and response activities, resources, and responsibilities, and will disclose appropriate information in the Action Plan or other relevant document to affected communities and relevant government agencies.

Security Personnel Requirements

13. When the client directly retains employees or contractors to provide security to safeguard its personnel and property, it will assess risks to those within and outside the project site posed by its security arrangements. In making such arrangements, the client will be guided by the principles of proportionality, good international practices in terms of hiring, rules of conduct, training, equipping and monitoring of such personnel, and applicable law. The client will make reasonable inquiries to satisfy itself that those providing security are not implicated in past abuses, will train them adequately in the use of force (and where applicable, firearms) and appropriate conduct toward workers and the local community, and require them to act within the applicable law. The client will not sanction any use of force except when used for preventive and defensive purposes in proportion to the nature and extent of the threat. A grievance mechanism should allow the affected community to express concerns about the security arrangements and acts of security personnel.

14. If government security personnel are deployed to provide security services for the client, the client will assess risks arising from such use, communicate its intent that the security personnel act in a manner consistent with paragraph 13 above, and encourage the relevant public authorities to disclose the security arrangements for the client's facilities to the public, subject to overriding security concerns.

15. The client will investigate any credible allegations of unlawful or abusive acts of security personnel, take action (or urge appropriate parties to take action) to prevent recurrence, and report unlawful and abusive acts to public authorities when appropriate.

Performance Standard 5
Land Acquisition and Involuntary Resettlement

April 30, 2006

Introduction

1. Involuntary resettlement refers both to physical displacement (relocation or loss of shelter) and to economic displacement (loss of assets or access to assets that leads to loss of income sources or means of livelihood) as a result of project-related land acquisition.[1] Resettlement is considered involuntary when affected individuals or communities do not have the right to refuse land acquisition that results in displacement. This occurs in cases of: (i) lawful expropriation or restrictions on land use based on eminent domain;[2] and ii) negotiated settlements in which the buyer can resort to expropriation or impose legal restrictions on land use if negotiations with the seller fail.

2. Unless properly managed, involuntary resettlement may result in long-term hardship and impoverishment for affected persons and communities, as well as environmental damage and social stress in areas to which they have been displaced. For these reasons, involuntary resettlement should be avoided or at least minimized. However, where it is unavoidable, appropriate measures to mitigate adverse impacts on displaced persons and host communities[3] should be carefully planned and implemented. Experience demonstrates that the direct involvement of the client in resettlement activities can result in cost-effective, efficient, and timely implementation of those activities, as well as innovative approaches to improving the livelihoods of those affected by resettlement.

3. Negotiated settlements help avoid expropriation and eliminate the need to use governmental authority to remove people forcibly. Negotiated settlements can usually be achieved by providing fair and appropriate compensation and other incentives or benefits to affected persons or communities, and by mitigating the risks of asymmetry of information and bargaining power. Clients are encouraged to acquire land rights through negotiated settlements wherever possible, even if they have the legal means to gain access to the land without the seller's consent.

Objectives

- To avoid or at least minimize involuntary resettlement wherever feasible by exploring alternative project designs
- To mitigate adverse social and economic impacts from land acquisition or restrictions on affected persons' use of land by: (i) providing compensation for loss of assets at replacement cost; and (ii) ensuring that resettlement activities are implemented with appropriate disclosure of information, consultation, and the informed participation of those affected
- To improve or at least restore the livelihoods and standards of living of displaced persons
- To improve living conditions among displaced persons through provision of adequate housing with security of tenure[4] at resettlement sites

Scope of Application

4. The applicability of this Performance Standard is established during the Social and Environmental Assessment process, while implementation of the actions necessary to meet the

[1] Land acquisition includes both outright purchases of property and purchases of access rights, such as rights-of-way.
[2] Such restriction may include restrictions of access to legally designated nature conservation areas.
[3] A host community is any community receiving displaced persons.
[4] A resettlement site offers security of tenure if it protects the resettled persons from forced evictions.

requirements of this Performance Standard is managed through the client's Social and Environmental Management System. The assessment and management system requirements are outlined in Performance Standard 1.

5. This Performance Standard applies to physical or economic displacement resulting from the following types of land transactions:

- Type I: Land rights for a private sector project acquired through expropriation or other compulsory procedures
- Type II: Land rights for a private sector project acquired through negotiated settlements with property owners or those with legal rights to land, including customary or traditional rights recognized or recognizable under the laws of the country, if expropriation or other compulsory process would have resulted upon the failure of negotiation[5]

Paragraph 18 and part of paragraph 20 below apply to displaced persons with no recognizable legal right or claim to the land they occupy.

6. This Performance Standard does not apply to resettlement resulting from voluntary land transactions (i.e., market transactions in which the seller is not obliged to sell and the buyer cannot resort to expropriation or other compulsory procedures if negotiations fail). In the event of adverse economic, social, or environmental impacts from project activities other than land acquisition (e.g., loss of access to assets or resources or restrictions on land use), such impacts will be avoided, minimized, mitigated or compensated for through the process of Social and Environmental Assessment under Performance Standard 1. If these impacts become significantly adverse at any stage of the project, the client should consider applying the requirements of Performance Standard 5, even where no initial land acquisition was involved.

Requirements

General Requirements

Project Design

7. The client will consider feasible alternative project designs to avoid or at least minimize physical or economic displacement, while balancing environmental, social, and financial costs and benefits.

Compensation and Benefits for Displaced Persons

8. When displacement cannot be avoided, the client will offer displaced persons and communities compensation for loss of assets at full replacement cost and other assistance[6] to help them improve or at least restore their standards of living or livelihoods, as provided in this Performance Standard. Standards for compensation will be transparent and consistent within the project. Where livelihoods of displaced persons are land-based, or where land is collectively owned, the client will offer land-based compensation, where feasible.[7] The client will provide opportunities to displaced persons and communities to derive appropriate development benefits from the project.

[5] These negotiations can be carried out by the private sector company acquiring the land or by an agent of the company. In the case of private sector projects in which land rights are acquired by the government, the negotiations may be carried out by the government or by the private company as an agent of the government.
[6] As described in paragraphs 18 and 20.
[7] See also footnote 9.

Consultation

9. Following disclosure of all relevant information, the client will consult with and facilitate the informed participation of affected persons and communities, including host communities, in decision-making processes related to resettlement. Consultation will continue during the implementation, monitoring, and evaluation of compensation payment and resettlement to achieve outcomes that are consistent with the objectives of this Performance Standard.

Grievance Mechanism

10. The client will establish a grievance mechanism consistent with Performance Standard 1 to receive and address specific concerns about compensation and relocation that are raised by displaced persons or members of host communities, including a recourse mechanism designed to resolve disputes in an impartial manner.

Resettlement Planning and Implementation

11. Where involuntary resettlement is unavoidable, the client will carry out a census with appropriate socio-economic baseline data to identify the persons who will be displaced by the project, to determine who will be eligible for compensation and assistance, and to discourage inflow of people who are ineligible for these benefits. In the absence of host government procedures, the client will establish a cut-off date for eligibility. Information regarding the cut-off date will be well documented and disseminated throughout the project area.

12. In the case of Type I transactions (acquisition of land rights through the exercise of eminent domain) or Type II transactions (negotiated settlements) that involve the physical displacement of people, the client will develop a resettlement action plan or a resettlement framework based on a Social and Environmental Assessment that covers, at a minimum, the applicable requirements of this Performance Standard regardless of the number of people affected. The plan or framework will be designed to mitigate the negative impacts of displacement, identify development opportunities, and establish the entitlements of all categories of affected persons (including host communities), with particular attention paid to the needs of the poor and the vulnerable (see Performance Standard 1, paragraph 12). The client will document all transactions to acquire land rights, as well as compensation measures and relocation activities. The client will also establish procedures to monitor and evaluate the implementation of resettlement plans and take corrective action as necessary. A resettlement will be considered complete when the adverse impacts of resettlement have been addressed in a manner that is consistent with the objectives stated in the resettlement plan or framework as well as the objectives of this Performance Standard.

13. In the case of Type II transactions (negotiated settlements) involving economic (but not physical) displacement of people, the client will develop procedures to offer to the affected persons and communities compensation and other assistance that meet the objectives of this Performance Standard. The procedures will establish the entitlements of affected persons or communities and will ensure that these are provided in a transparent, consistent, and equitable manner. The implementation of the procedures will be considered complete when affected persons or communities have received compensation and other assistance according to the requirements of this Performance Standard. In cases where affected persons reject compensation offers that meet the requirements of this Performance Standard and, as a result, expropriation or other legal procedures are initiated, the client will explore opportunities to collaborate with the responsible government agency, and if permitted by the agency, play an active role in the resettlement planning, implementation, and monitoring.

Displacement

14. Displaced persons may be classified as persons: (i) who have formal legal rights to the land they occupy; (ii) who do not have formal legal rights to land, but have a claim to land that is recognized or recognizable under the national laws[8]; or (iii) who have no recognizable legal right or claim to the land they occupy.[9] The census will establish the status of the displaced persons.

15. Land acquisition for the project may result in the physical displacement of people as well as their economic displacement. As a result, requirements for both physical displacement and economic displacement may apply.

Physical Displacement

16. If people living in the project area must move to another location, the client will: (i) offer displaced persons choices among feasible resettlement options, including adequate replacement housing or cash compensation where appropriate; and (ii) provide relocation assistance suited to the needs of each group of displaced persons, with particular attention paid to the needs of the poor and the vulnerable. Alternative housing and/or cash compensation will be made available prior to relocation. New resettlement sites built for displaced persons will offer improved living conditions.

17. In the case of physically displaced persons under paragraph 14 (i) or (ii), the client will offer the choice of replacement property of equal or higher value, equivalent or better characteristics and advantages of location, or cash compensation at full replacement value where appropriate.[10]

18. In the case of physically displaced persons under paragraph 14 (iii), the client will offer them a choice of options for adequate housing with security of tenure so that they can resettle legally without having to face the risk of forced eviction. Where these displaced persons own and occupy structures, the client will compensate them for the loss of assets other than land, such as dwellings and other improvements to the land, at full replacement cost, provided that these people occupy the project area prior to the cut-off date for eligibility. Compensation in kind will be offered in lieu of cash compensation where feasible. Based on consultation with such displaced persons, the client will provide relocation assistance sufficient for them to restore their standards of living at an adequate alternative site.[11] The client is not required to compensate or assist those who encroach on the project area after the cut-off date.

19. Where communities of Indigenous Peoples are to be physically displaced from their communally held traditional or customary lands under use, the client will meet the applicable requirements of this Performance Standard, as well as those of Performance Standard 7 (in particular paragraph 14).

Economic Displacement

20. If land acquisition for the project causes loss of income or livelihood, regardless of whether or not the affected people are physically displaced, the client will meet the following requirements:

[8] Such claims could be derived from adverse possession or from customary or traditional law.
[9] Such as opportunistic squatters and recently arrived economic migrants who occupy land prior to the cut-off date.
[10] Payment of cash compensation for lost assets may be appropriate where: (a) livelihoods are not land-based; (b) livelihoods are land-based but the land taken for the project is a small fraction of the affected asset and the residual land is economically viable; or (c) active markets for land, housing, and labor exist, displaced persons use such markets, and there is sufficient supply of land and housing. Cash compensation levels should be sufficient to replace the lost land and other assets at full replacement cost in local markets.
[11] Relocation of informal settlers in urban areas often has trade-offs. For example, the relocated families may gain security of tenure, but they may lose advantages of location.

- Promptly compensate economically displaced persons for loss of assets or access to assets at full replacement cost
- In cases where land acquisition affects commercial structures, compensate the affected business owner for the cost of reestablishing commercial activities elsewhere, for lost net income during the period of transition, and for the costs of the transfer and reinstallation of the plant, machinery or other equipment
- Provide replacement property (e.g., agricultural or commercial sites) of equal or greater value, or cash compensation at full replacement cost where appropriate, to persons with legal rights or claims to land which are recognized or recognizable under the national laws (see paragraph 14 (i) and (ii))
- Compensate economically displaced persons who are without legally recognizable claims to land (see paragraph 14 (iii)) for lost assets (such as crops, irrigation infrastructure and other improvements made to the land) other than land, at full replacement cost. The client is not required to compensate or assist opportunistic settlers who encroach on the project area after the cut-off date
- Provide additional targeted assistance (e.g., credit facilities, training, or job opportunities) and opportunities to improve or at least restore their income-earning capacity, production levels, and standards of living to economically displaced persons whose livelihoods or income levels are adversely affected
- Provide transitional support to economically displaced persons, as necessary, based on a reasonable estimate of the time required to restore their income-earning capacity, production levels, and standards of living

21. Where communities of Indigenous Peoples are economically displaced (but not relocated) as a result of project-related land acquisition, the client will meet the applicable requirements of this Performance Standard, as well as those of Performance Standard 7 (in particular paragraphs 12 and 13).

Private Sector Responsibilities under Government-Managed Resettlement

22. Where land acquisition and resettlement are the responsibility of the host government, the client will collaborate with the responsible government agency, to the extent permitted by the agency, to achieve outcomes that are consistent with the objectives of this Performance Standard. In addition, where government capacity is limited, the client will play an active role during resettlement planning, implementation and monitoring, as described below in paragraphs 23 through 25.

23. In the case of Type I transactions (acquisition of land rights through expropriation or other legal procedures) involving physical or economic displacement, and Type II transactions (negotiated settlements) involving physical displacement, the client will prepare a plan (or a framework) that, together with the documents prepared by the responsible government agency, will address the relevant requirements of this Performance Standard (the General Requirements, except for paragraph 13, and requirements for Physical Displacement and Economic Displacement above). The client may need to include in its plan: (i) a description of the entitlements of displaced persons provided under applicable laws and regulations; (ii) the measures proposed to bridge any gaps between such entitlements and the requirements of this Performance Standard; and (iii) the financial and implementation responsibilities of the government agency and/or the client.

24. In the case of Type II transactions (negotiated settlements) involving economic (but not physical) displacement, the client will identify and describe the procedures that the responsible government

agency plans to use to compensate affected persons and communities. If these procedures do not meet the relevant requirements of this Performance Standard (the General Requirements, except for paragraph 12, and requirements for Economic Displacement above), the client will develop its own procedures to supplement government action.

25. If permitted by the responsible government agency, the client will, in collaboration with such agency: (i) implement its plan or procedures established in accordance with paragraph 23 or 24 above; and (ii) monitor resettlement activity that is undertaken by the government agency until such activity has been completed.

Performance Standard 6
Biodiversity Conservation and Sustainable Natural Resource Management

April 30, 2006

Introduction

1. Performance Standard 6 recognizes that protecting and conserving biodiversity—the variety of life in all its forms, including genetic, species and ecosystem diversity—and its ability to change and evolve, is fundamental to sustainable development. The components of biodiversity, as defined in the Convention on Biological Diversity, include ecosystems and habitats, species and communities, and genes and genomes, all of which have social, economic, cultural and scientific importance. This Performance Standard reflects the objectives of the Convention on Biological Diversity to conserve biological diversity and promote use of renewable natural resources in a sustainable manner. This Performance Standard addresses how clients can avoid or mitigate threats to biodiversity arising from their operations as well as sustainably manage renewable natural resources.

Objectives

- To protect and conserve biodiversity
- To promote the sustainable management and use of natural resources through the adoption of practices that integrate conservation needs and development priorities

Scope of Application

2. The applicability of this Performance Standard is established during the Social and Environmental Assessment process, while implementation of the actions necessary to meet the requirements of this Performance Standard is managed through the client's Social and Environmental Management System. The assessment and management system requirements are outlined in Performance Standard 1.

3. Based on the Assessment of risks and impacts and the vulnerability of the biodiversity and the natural resources present, the requirements of this Performance Standard are applied to projects in all habitats, whether or not those habitats have been previously disturbed and whether or not they are legally protected.

Requirements

Protection and Conservation of Biodiversity

4. In order to avoid or minimize adverse impacts to biodiversity in the project's area of influence (see Performance Standard 1, paragraph 5), the client will assess the significance of project impacts on all levels of biodiversity as an integral part of the Social and Environmental Assessment process. The Assessment will take into account the differing values attached to biodiversity by specific stakeholders, as well as identify impacts on ecosystem services. The Assessment will focus on the major threats to biodiversity, which include habitat destruction and invasive alien species. When requirements of paragraphs 9, 10, or 11 apply, the client will retain qualified and experienced external experts to assist in conducting the Assessment.

Habitat

5. Habitat destruction is recognized as the major threat to the maintenance of biodiversity. Habitats can be divided into natural habitats (which are land and water areas where the biological communities are formed largely by native plant and animal species, and where human activity has not essentially modified the area's primary ecological functions) and modified habitats (where there

has been apparent alteration of the natural habitat, often with the introduction of alien species of plants and animals, such as agricultural areas). Both types of habitat can support important biodiversity at all levels, including endemic or threatened species.

Modified Habitat

6. In areas of modified habitat, the client will exercise care to minimize any conversion or degradation of such habitat, and will, depending on the nature and scale of the project, identify opportunities to enhance habitat and protect and conserve biodiversity as part of their operations.

Natural Habitat

7. In areas of natural habitat, the client will not significantly convert or degrade[1] such habitat, unless the following conditions are met:

- There are no technically and financially feasible alternatives
- The overall benefits of the project outweigh the costs, including those to the environment and biodiversity
- Any conversion or degradation is appropriately mitigated

8. Mitigation measures will be designed to achieve no net loss of biodiversity where feasible, and may include a combination of actions, such as:

- Post-operation restoration of habitats
- Offset of losses through the creation of ecologically comparable area(s) that is managed for biodiversity[2]
- Compensation to direct users of biodiversity

Critical Habitat

9. Critical habitat is a subset of both natural and modified habitat that deserves particular attention. Critical habitat includes areas with high biodiversity value[3], including habitat required for the survival of critically endangered or endangered species;[4] areas having special significance for endemic or restricted-range species; sites that are critical for the survival of migratory species; areas supporting globally significant concentrations or numbers of individuals of congregatory species; areas with unique assemblages of species or which are associated with key evolutionary processes or provide key ecosystem services; and areas having biodiversity of significant social, economic or cultural importance to local communities.

10. In areas of critical habitat, the client will not implement any project activities unless the following requirements are met:

- There are no measurable adverse impacts on the ability of the critical habitat to support the established population of species described in paragraph 9 or the functions of the critical habitat described in paragraph 9

[1] Significant conversion or degradation is: (i) the elimination or severe diminution of the integrity of a habitat caused by a major, long-term change in land or water use; or (ii) modification of a habitat that substantially reduces the habitat's ability to maintain viable population of its native species.
[2] Clients will respect the ongoing usage of such biodiversity by Indigenous Peoples or traditional communities.
[3] Such as areas that meet the criteria of the World Conservation Union (IUCN) classification.
[4] As defined by the IUCN Red List of Threatened Species or as defined in any national legislation.

- There is no reduction in the population of any recognized critically endangered or endangered species[5]
- Any lesser impacts are mitigated in accordance with paragraph 8

Legally protected Areas

11. In circumstances where a proposed project is located within a legally protected area,[6] the client, in addition to the applicable requirements of paragraph 10 above, will meet the following requirements:

- Act in a manner consistent with defined protected area management plans
- Consult protected area sponsors and managers, local communities, and other key stakeholders on the proposed project
- Implement additional programs, as appropriate, to promote and enhance the conservation aims of the protected area

Invasive Alien Species

12. Intentional or accidental introduction of alien, or non-native, species of flora and fauna into areas where they are not normally found can be a significant threat to biodiversity, since some alien species can become invasive, spreading rapidly and out-competing native species.

13. The client will not intentionally introduce any new alien species (not currently established in the country or region of the project) unless this is carried out in accordance with the existing regulatory framework for such introduction, if such framework is present, or is subject to a risk assessment (as part of the client's Social and Environmental Assessment) to determine the potential for invasive behavior. The client will not deliberately introduce any alien species with a high risk of invasive behavior or any known invasive species, and will exercise diligence to prevent accidental or unintended introductions.

Management and Use of Renewable Natural Resources

14. The client will manage renewable natural resources in a sustainable manner.[7] Where possible, the client will demonstrate the sustainable management of the resources through an appropriate system of independent certification.[8]

15. In particular, forests and aquatic systems are principal providers of natural resources, and need to be managed as specified below.

[5] As defined by the IUCN Red List of Threatened Species or as defined in any national legislation.
[6] An area may be designated as legally protected for different purposes. This Performance Standard refers to areas legally designated for the protection or conservation of biodiversity, including areas proposed by governments for such designation.
[7] Sustainable resource management is the management of the use, development and protection of resources in a way, or at a rate, which enables people and communities, including Indigenous Peoples, to provide for their present social, economic and cultural well-being while also sustaining the potential of those resources to meet the reasonably foreseeable needs of future generations and safeguarding the life-supporting capacity of air, water and soil ecosystems.
[8] An appropriate certification system would be one which is independent, cost-effective, based on objective and measurable performance standards and developed through consultation with relevant stakeholders, such as local people and communities, indigenous peoples, civil society organizations representing consumer, producer, and conservation interests. Such a system has fair, transparent, independent decision-making procedures that avoid conflicts of interest.

Natural and Plantation Forests

16. Clients involved in natural forest harvesting or plantation development will not cause any conversion or degradation of critical habitat. Where feasible, the client will locate plantation projects on unforested land or land already converted (excluding land that is converted in anticipation of the project). In addition, the client will ensure that all natural forests and plantations over which they have management control are independently certified as meeting performance standards compatible with internationally accepted principles and criteria for sustainable forest management.[9] Where a pre-assessment determines that the operation does not yet meet the requirements of such an independent forest certification system, the client will develop and adhere to a time-bound, phased action plan for achieving such certification.

Freshwater and Marine Systems

17. Clients involved in the production and harvesting of fish populations or other aquatic species must demonstrate that their activities are being undertaken in a sustainable manner, through application of an internationally accepted system of independent certification, if available, or through appropriate studies carried out in conjunction with the Social and Environmental Assessment process.

[9] See footnote 7.

Performance Standard 7
Indigenous Peoples

April 30, 2006

Introduction

1. Performance Standard 7 recognizes that Indigenous Peoples, as social groups with identities that are distinct from dominant groups in national societies, are often among the most marginalized and vulnerable segments of the population. Their economic, social and legal status often limits their capacity to defend their interests in, and rights to, lands and natural and cultural resources, and may restrict their ability to participate in and benefit from development. They are particularly vulnerable if their lands and resources are transformed, encroached upon by outsiders, or significantly degraded. Their languages, cultures, religions, spiritual beliefs, and institutions may also be under threat. These characteristics expose Indigenous Peoples to different types of risks and severity of impacts, including loss of identity, culture, and natural resource-based livelihoods, as well as exposure to impoverishment and disease.

2. Private sector projects may create opportunities for Indigenous Peoples to participate in, and benefit from, project-related activities that may help them fulfill their aspiration for economic and social development. In addition, this Performance Standard recognizes that Indigenous Peoples may play a role in sustainable development by promoting and managing activities and enterprises as partners in development.

Objectives

- To ensure that the development process fosters full respect for the dignity, human rights, aspirations, cultures and natural resource-based livelihoods of Indigenous Peoples
- To avoid adverse impacts of projects on communities of Indigenous Peoples, or when avoidance is not feasible, to minimize, mitigate, or compensate for such impacts, and to provide opportunities for development benefits, in a culturally appropriate manner
- To establish and maintain an ongoing relationship with the Indigenous Peoples affected by a project throughout the life of the project
- To foster good faith negotiation with and informed participation of Indigenous Peoples when projects are to be located on traditional or customary lands under use by the Indigenous Peoples
- To respect and preserve the culture, knowledge and practices of Indigenous Peoples

Scope of Application

3. The applicability of this Performance Standard is established during the Social and Environmental Assessment process, while implementation of the actions necessary to meet the requirements of this Performance Standard is managed through the client's Social and Environmental Management System. The assessment and management system requirements are outlined in Performance Standard 1.

4. There is no universally accepted definition of "Indigenous Peoples". Indigenous Peoples may be referred to in different countries by such terms as "Indigenous ethnic minorities," "aboriginals," "hill tribes," "minority nationalities," "scheduled tribes," "first nations," or "tribal groups."

5. In this Performance Standard, the term "Indigenous Peoples" is used in a generic sense to refer to a distinct social and cultural group possessing the following characteristics in varying degrees:

- Self-identification as members of a distinct indigenous cultural group and recognition of this identity by others
- Collective attachment to geographically distinct habitats or ancestral territories in the project area and to the natural resources in these habitats and territories
- Customary cultural, economic, social, or political institutions that are separate from those of the dominant society or culture
- An indigenous language, often different from the official language of the country or region

6. Ascertaining whether a particular group is considered as Indigenous Peoples for the purpose of this Performance Standard may require technical judgment.

Requirements

General Requirements

Avoidance of Adverse Impacts

7. The client will identify through a process of Social and Environmental Assessment all communities of Indigenous Peoples who may be affected by the project within the project's area of influence, as well as the nature and degree of the expected social, cultural (including cultural heritage[1]), and environmental impacts on them, and avoid adverse impacts whenever feasible.

8. When avoidance is not feasible, the client will minimize, mitigate or compensate for these impacts in a culturally appropriate manner. The client's proposed action will be developed with the informed participation of affected Indigenous Peoples and contained in a time-bound plan, such as an Indigenous Peoples Development Plan, or a broader community development plan with separate components for Indigenous Peoples consistent with the requirements of paragraph 9.[2]

Information Disclosure, Consultation and Informed Participation

9. The client will establish an ongoing relationship with the affected communities of Indigenous Peoples from as early as possible in the project planning and throughout the life of the project. In projects with adverse impacts on affected communities of Indigenous Peoples, the consultation process will ensure their free, prior, and informed consultation and facilitate their informed participation on matters that affect them directly, such as proposed mitigation measures, the sharing of development benefits and opportunities, and implementation issues. The process of community engagement will be culturally appropriate and commensurate with the risks and potential impacts to the Indigenous Peoples. In particular, the process will include the following steps:

- Involve Indigenous Peoples' representative bodies (for example, councils of elders or village councils, among others)
- Be inclusive of both women and men and of various age groups in a culturally appropriate manner

[1] Additional client requirements on protection of cultural heritage are set out in Performance Standard 8.
[2] The determination of the appropriate plan will require technical judgment. A community development plan may be appropriate when Indigenous Peoples are integrated into larger affected communities.

- Provide sufficient time for Indigenous Peoples' collective decision-making processes
- Facilitate the Indigenous Peoples' expression of their views, concerns, and proposals in the language of their choice, without external manipulation, interference, or coercion, and without intimidation
- Ensure that the grievance mechanism established for the project, as described in Performance Standard 1, paragraph 23, is culturally appropriate and accessible for Indigenous Peoples

Development Benefits

10. The client will seek to identify, through the process of free, prior, and informed consultation with and the informed participation of the affected communities of Indigenous Peoples, opportunities for culturally appropriate development benefits. Such opportunities should be commensurate with the degree of project impacts, with the aim of improving their standard of living and livelihoods in a culturally appropriate manner, and to fostering the long-term sustainability of the natural resource on which they depend. The client will document identified development benefits consistent with the requirements of paragraphs 8 and 9 above, and provide them in a timely and equitable manner.

Special Requirements

11. Because Indigenous Peoples may be particularly vulnerable to the project circumstances described below, the following requirements will also apply, in the circumstances indicated, in addition to the General Requirements above. When any of these Special Requirements apply, the client will retain qualified and experienced external experts to assist in conducting the Assessment.

Impacts on Traditional or Customary Lands under Use

12. Indigenous Peoples are often closely tied to their traditional or customary lands and natural resources on these lands. While these lands may not be under legal ownership pursuant to national law, use of these lands, including seasonal or cyclical use, by communities of Indigenous Peoples for their livelihoods, or cultural, ceremonial, or spiritual purposes that define their identity and community, can often be substantiated and documented. Paragraphs 13 and 14 below specify the requirements that the client will follow when traditional or customary lands are under use in a manner described in this paragraph.

13. If the client proposes to locate the project on, or commercially develop natural resources located within, traditional or customary lands under use, and adverse impacts[3] can be expected on the livelihoods, or cultural, ceremonial, or spiritual use that define the identity and community of the Indigenous Peoples, the client will respect their use by taking the following steps:

- The client will document its efforts to avoid or at least minimize the size of land proposed for the project

[3] Such adverse impacts may include impacts from loss of access to assets or resources, or restrictions on land use, resulting from project activities.

- The Indigenous Peoples' land use will be documented by experts in collaboration with the affected communities of Indigenous Peoples without prejudicing any Indigenous Peoples' land claim[4]
- The affected communities of Indigenous People will be informed of their rights with respect to these lands under national laws, including any national law recognizing customary rights or use
- The client will offer affected communities of Indigenous Peoples at least compensation and due process available to those with full legal title to land in the case of commercial development of their land under national laws, together with culturally appropriate development opportunities; land-based compensation or compensation-in-kind will be offered in lieu of cash compensation where feasible
- The client will enter into good faith negotiation with the affected communities of Indigenous Peoples, and document their informed participation and the successful outcome of the negotiation

Relocation of Indigenous Peoples from Traditional or Customary Lands

14. The client will consider feasible alternative project designs to avoid the relocation of Indigenous Peoples from their communally held[5] traditional or customary lands under use. If such relocation is unavoidable, the client will not proceed with the project unless it enters into a good faith negotiation with the affected communities of Indigenous Peoples, and documents their informed participation and the successful outcome of the negotiation. Any relocation of Indigenous Peoples will be consistent with the Resettlement Planning and Implementation requirements of Performance Standard 5. Where feasible, the relocated Indigenous Peoples should be able to return to their traditional or customary lands, should the reason for their relocation cease to exist.

Cultural Resources

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

[4] While this Performance Standard requires substantiation and documentation of the use of such land, clients should also be aware that the land may already be under alternative use, as designated by the host government.
[5] Where members of the affected communities of Indigenous Peoples individually hold legal title, or where the relevant national law recognizes customary rights for individuals, the requirements of Performance Standard 5 will apply, rather than the requirements under this heading.

Performance Standard 8
Cultural Heritage

April 30, 2006

Introduction

1. Performance Standard 8 recognizes the importance of cultural heritage for current and future generations. Consistent with the Convention Concerning the Protection of the World Cultural and Natural Heritage, this Performance Standard aims to protect irreplaceable cultural heritage and to guide clients on protecting cultural heritage in the course of their business operations. In addition, the requirements of this Performance Standard on a project's use of cultural heritage are based in part on standards set by the Convention on Biological Diversity.

Objectives

- To protect cultural heritage from the adverse impacts of project activities and support its preservation
- To promote the equitable sharing of benefits from the use of cultural heritage in business activities

Scope of Application

2. The applicability of this Performance Standard is established during the Social and Environmental Assessment process, while implementation of the actions necessary to meet the requirements of this Performance Standard is managed through the client's Social and Environmental Management System. The assessment and management system requirements are outlined in Performance Standard 1.

3. For the purposes of this Performance Standard, cultural heritage refers to tangible forms of cultural heritage, such as tangible property and sites having archaeological (prehistoric), paleontological, historical, cultural, artistic, and religious values, as well as unique natural environmental features that embody cultural values, such as sacred groves. However, for the purpose of paragraph 11 below, intangible forms of culture, such as cultural knowledge, innovations and practices of communities embodying traditional lifestyles, are also included. The requirements of this Performance Standard apply to cultural heritage regardless of whether or not it has been legally protected or previously disturbed.

Requirements

Protection of Cultural Heritage in Project Design and Execution

Internationally Recognized Practices

4. In addition to complying with relevant national law on the protection of cultural heritage, including national law implementing the host country's obligations under the Convention Concerning the Protection of the World Cultural and Natural Heritage and other relevant international law, the client will protect and support cultural heritage by undertaking internationally recognized practices for the protection, field-based study, and documentation of cultural heritage. If the requirements of paragraphs 7, 8, 9, 10 or 11 apply, the client will retain qualified and experienced experts to assist in the Assessment.

Chance Find Procedures

5. The client is responsible for siting and designing a project to avoid significant damage to cultural heritage. When the proposed location of a project is in areas where cultural heritage is expected to

be found, either during construction or operations, the client will implement chance find procedures established through the Social and Environmental Assessment. The client will not disturb any chance finds further until an Assessment by a competent specialist is made and actions consistent with the requirements of this Performance Standard are identified.

Consultation

6. Where a project may affect cultural heritage, the client will consult with affected communities within the host country who use, or have used within living memory, the cultural heritage for long-standing cultural purposes to identify cultural heritage of importance, and to incorporate into the client's decision-making process the views of the affected communities on such cultural heritage. Consultation will also involve the relevant national or local regulatory agencies that are entrusted with the protection of cultural heritage.

Removal of Cultural Heritage

7. Most cultural heritage is best protected by preservation in its place, since removal is likely to result in irreparable damage or destruction of the cultural heritage. The client will not remove any cultural heritage, unless the following conditions are met:

- There are no technically or financially feasible alternatives to removal
- The overall benefits of the project outweigh the anticipated cultural heritage loss from removal
- Any removal of cultural heritage is conducted by the best available technique

Critical Cultural Heritage

8. Critical cultural heritage consists of (i) the internationally recognized heritage of communities who use, or have used within living memory the cultural heritage for long-standing cultural purposes; and (ii) legally protected cultural heritage areas, including those proposed by host governments for such designation.

9. The client will not significantly alter, damage, or remove any critical cultural heritage. In exceptional circumstances, where a project may significantly damage critical cultural heritage, and its damage or loss may endanger the cultural or economic survival of communities within the host country who use the cultural heritage for long-standing cultural purposes, the client will: (i) meet the requirements of Paragraph 6 above; and (ii) conduct a good faith negotiation with and document the informed participation of the affected communities and the successful outcome of the negotiation. In addition, any other impacts on critical cultural heritage must be appropriately mitigated with the informed participation of the affected communities.

10. Legally protected cultural heritage areas are important for the protection and conservation of cultural heritage, and additional measures are needed for any projects that would be permitted under the applicable national laws in these areas. In circumstances where a proposed project is located within a legally protected area or a legally defined buffer zone, the client, in addition to the requirements for critical cultural heritage cited above in Paragraph 9, will meet the following requirements:

- Comply with defined national or local cultural heritage regulations or the protected area management plans
- Consult the protected area sponsors and managers, local communities and other key stakeholders on the proposed project

- Implement additional programs, as appropriate, to promote and enhance the conservation aims of the protected area

Project's Use of Cultural Heritage

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

Environmental, Health, and Safety General Guidelines

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 assessment[2] in which site-specific variables, such as host country context, assimilative capacity of the environment, and other project factors, are taken into account. The applicability of specific technical recommendations should be based on the professional opinion of qualified and experienced persons. When host country regulations differ from the levels and measures presented in 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.

The **General EHS Guidelines** are organized as follows:

[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.

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

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

- Identifying EHS project hazards[3] and associated risks[4] 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

Applicability and Approach

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

Emissions of air pollutants can occur from a wide variety of activities during the construction, operation, and decommissioning phases of a project. These activities can be categorized based on the spatial characteristic of the source including point sources, fugitive sources, and mobile sources and, further, by process, such as combustion, materials storage, or other industry sector-specific processes.

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

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

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

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

Ambient Air Quality

General Approach

Projects with significant[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 standards[9] by applying national legislated standards, or in their absence, the current WHO Air Quality Guidelines[10] (see Table 1.1.1), or other internationally recognized sources[11];
- 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, nearby[13] 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 µg/m³
Sulfur dioxide (SO_2)	24-hour 10 minute	125 (Interim target-1) 50 (Interim target-2) 20 (guideline) 500 (guideline)
Nitrogen dioxide (NO_2)	1-year 1-hour	40 (guideline) 200 (guideline)
Particulate Matter PM_{10}	1-year 24-hour	70 (Interim target-1) 50 (Interim target-2) 30 (Interim target-3) 20 (guideline) 150 (Interim target-1) 100 (Interim target-2) 75 (Interim target-3) 50 (guideline)
Particulate Matter $PM_{2.5}$	1-year 24-hour	35 (Interim target-1) 25 (Interim target-2) 15 (Interim target-3) 10 (guideline) 75 (Interim target-1) 50 (Interim target-2) 37.5 (Interim target-3) 25 (guideline)
Ozone	8-hour daily maximum	160 (Interim target-1) 100 (guideline)

[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); NOx: 500 tpy; SO2: 500 tpy; or as established through national legislation; and combustion sources with an equivalent heat input of 50 MWth or greater. The significance of emissions of inorganic and organic pollutants should be established on a project-specific basis taking into account toxic and other properties of the pollutant.

[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 geo-morphology of the project site (e.g. mountainous terrain, urban or rural area).

Projects Located in Degraded Airsheds or Ecologically Sensitive Areas

Facilities or projects located within poor quality airsheds[14], 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 (SO_2), carbon monoxide (CO), and particulate matter (PM), as well as other air pollutants including certain volatile organic compounds (VOCs) and metals that may also be associated with a wide range of industrial activities.

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

Stack Height

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

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 fuel[17]. 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/Nm^3 or as indicated)				
Combustion Technology / Fuel	**Particulate Matter (PM)**	**Sulfur Dioxide (SO_2)**	**Nitrogen Oxides (NOx)**	**Dry Gas, Excess O_2 Content (%)**
Engine				
Gas	N/A	N/A	200 (Spark Ignition) 400 (Dual Fuel) 1,600 (Compression Ignition)	15
Liquid	50 or up to 100 if justified by project specific considerations (e.g. Economic feasibility of using lower ash content fuel, or adding secondary treatment to meet 50, and available environmental capacity of the site)	1.5 percent Sulfur or up to 3.0 percent Sulfur if justified by project specific considerations (e.g. Economic feasibility of using lower S content fuel, or adding secondary treatment to meet levels of using 1.5 percent Sulfur, and available environmental capacity of the site)	If bore size diameter [mm] < 400: 1460 (or up to 1,600 if justified to maintain high energy efficiency.) If bore size diameter [mm] > 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; Nm^3 is at one atmosphere pressure, 0°C.; MWth category is to apply to the entire facility consisting of multiple units that are reasonably considered to be emitted from a common stack except for NOx and PM limits for turbines and boilers. 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, SO_2 and CO) are mainly associated with combustion processes, as described above. Projects with potentially significant fugitive sources of emissions should establish the need for ambient quality assessment and monitoring practices.

Open burning of solid wastes, whether hazardous or 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 700º C to 1,300º C
  - Enclosed Oxidizing Flares: Used to convert VOCs into CO_2 and H_2O by way of direct combustion
- Use of floating roofs on storage tanks to reduce the opportunity for volatilization by eliminating the headspace present in conventional storage tanks.

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.ldar.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, SO_2, PM and VOCs. Emissions from on-road and off-road vehicles should comply with national or regional programs. In the absence of these, the following approach should be considered:

- Regardless of the size or type of vehicle, fleet owners / operators should implement the manufacturer recommended engine maintenance programs;
- Drivers should be instructed on the benefits of driving practices that reduce both the risk of accidents and fuel consumption, including measured acceleration and driving within safe speed limits;
- Operators with fleets of 120 or more units of heavy duty vehicles (buses and trucks), or 540 or more light duty vehicles[21] (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

[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/

[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 (CO_2); methane (CH_4); nitrous oxide (N_2O); hydrofluorocarbons (HFCs); perfluorocarbons (PFCs); and sulfur hexafluoride (SF_6).

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 consists of off-site or fence line monitoring either by the project sponsor, the competent government agency, or by collaboration between both. The location of ambient air

[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 CO_2 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 CO_2 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: SO_2, NO_x and PM. For gaseous fuel-fired boilers, only NO_x. SO_2 can be calculated based on fuel quality certification if no SO_2 control equipment is used.
  - 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: SO_2, NO_x and PM. For gaseous fuel-fired boilers, only NO_x. SO_2 can be calculated based on fuel quality certification (if no SO_2 control equipment is used)
  - Emission Monitoring: SO_2. Plants with SO_2 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 SO_2 (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.SO_2: Continuous monitoring if SO_2 control equipment is used.

- Additional recommended monitoring approaches for **engines**:
  - Annual Stack Emission Testing: NO_x ,SO_2 and PM (NO_x only for gaseous fuel-fired diesel engines).

[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 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. SO_2: Continuous monitoring if SO_2 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/Nm3
Sulfur Dioxide (SO_2)					
Mainly produced by the combustion of fuels such as oil and coal and as a by-product from some chemical production or wastewater treatment processes.	Control system selection is heavily dependent on the inlet concentration. For SO2 concentrations in excess of 10%, the stream is passed through an acid plant not only to lower the SO2 emissions but also to generate high grade sulfur for sale. Levels below 10% are not rich enough for this process and should therefore utilize absorption or 'scrubbing,' where SO2 molecules are captured into a liquid phase or adsorption, where SO2 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 (NOx)		Percent Reduction by Fuel Type			Comments
Associated with combustion of fuel. May occur in several forms of nitrogen oxide; namely nitric oxide (NO), nitrogen dioxide (NO_2) and nitrous oxide (N_2O), which is also a greenhouse gas. The term NOx serves as a composite between NO and NO_2 and emissions are usually reported as NOx. Here the NO is multiplied by the ratio of molecular weights of NO_2 to NO and added to the NO_2 emissions. Means of reducing NOx emissions are based on the modification of operating conditions such as minimizing the resident time at peak temperatures, reducing the peak temperatures by increasing heat transfer rates or minimizing the availability of oxygen.	**Combustion modification** (Illustrative of boilers)	**Coal**	**Oil**	**Gas**	These modifications are capable of reducing NOx emissions by 50 to 95%. The method of combustion control used depends on the type of boiler and the method of firing fuel.
	Low-excess-air firing	10–30	10–30	10–30	
	Staged Combustion	20–50	20–50	20–50	
	Flue Gas Recirculation	N/A	20–50	20–50	
	Water/Steam Injection	N/A	10–50	N/A.	
	Low-NOx Burners	30–40	30–40	30–40	
	Flue Gas Treatment	**Coal**	**Oil**	**Gas**	Flue gas treatment is more effective in reducing NOx emissions than are combustion controls. Techniques can be classified as SCR, SNCR, and adsorption. SCR involves the injection of ammonia as a reducing agent to convert NOx to nitrogen in the presence of a catalyst in a converter upstream of the air heater. Generally, some ammonia slips through and is part of the emissions. SNCR also involves the injection of ammonia or urea based products without the presence of a catalyst.
	Selective Catalytic Reduction (SCR)	60–90	60–90	60–90	
	Selective Non-Catalytic Reduction (SNCR)	N/A	30–70	30–70	

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

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

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

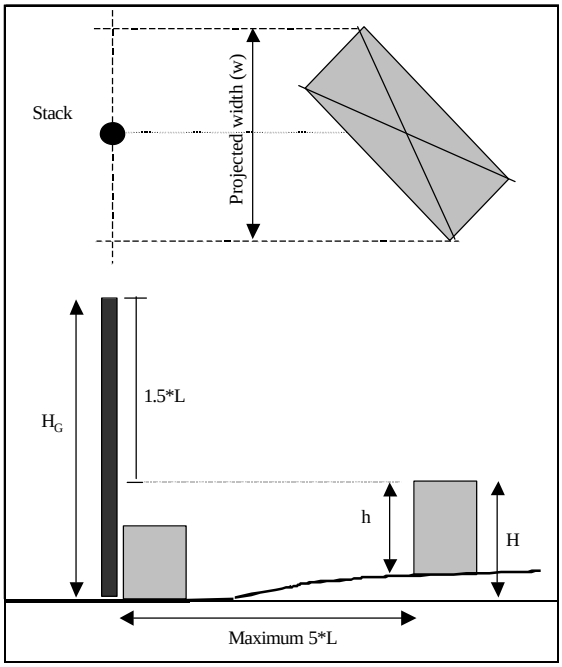
$H_G = H + 1.5L$; where

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

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 forming[33].

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 electrodialysis feed water treatment to minimize the requirement for boiler blowdown
- Adopt automatic (continuous) boiler blowdown
- Recover heat from blowdown systems through flash steam recovery or feed-water preheat
- Do not supply excessive quantities of steam to the 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 systems[34]

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_strategies_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

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 use[36] and assimilative capacity[37], taking other sources of discharges to the receiving water into consideration, should also influence the acceptable pollution loadings and effluent discharge quality. Additional considerations that should be included in the setting of project-specific performance levels for wastewater effluents include:

- Process wastewater treatment standards consistent with applicable Industry Sector EHS Guidelines. Projects for which there are no industry-specific guidelines should reference the effluent quality guidelines of an industry sector with suitably analogous processes and effluents;
- Compliance with national or local standards for sanitary wastewater discharges or, in their absence, the indicative guideline values applicable to sanitary wastewater discharges shown in Table 1.3.1 below;
- Temperature of wastewater prior to discharge does not result in an increase greater than 3°C of ambient temperature at the edge of a scientifically established mixing zone which takes into account ambient water quality, receiving water use and assimilative capacity among other considerations.

Discharge to Sanitary Sewer Systems

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

- Meet the pretreatment and monitoring requirements of the sewer treatment system into which it discharges.
- Not interfere, directly or indirectly, with the operation and maintenance of the collection and treatment systems, or pose a risk to worker health and safety, or adversely impact

[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 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

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 sensored 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

Applicability and Approach

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

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

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

This section is divided into two main subsections:

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

Management of Major Hazards: Additional guidance for projects or facilities that store or handle hazardous materials at, or above, threshold quantities[39], 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 equivalent[40] 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 standards[41]
- 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=STANDARDS&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 Sheets[42] (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

[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.

Preventive Measures

Hazardous Materials Transfer

Uncontrolled releases of hazardous materials may result from small cumulative events, or from more significant equipment failure associated with events such as manual or mechanical transfer between storage systems or process equipment. Recommended practices to prevent hazardous material releases from processes include:

- Use of dedicated fittings, pipes, and hoses specific to materials in tanks (e.g., all acids use one type of connection, all caustics use another), and maintaining procedures to prevent addition of hazardous materials to incorrect tanks
- Use of transfer equipment that is compatible and suitable for the characteristics of the materials transferred and designed to ensure safe transfer
- Regular inspection, maintenance and repair of fittings, pipes and hoses
- Provision of secondary containment, drip trays or other overflow and drip containment measures, for hazardous materials containers at connection points or other possible overflow points.

Overfill Protection

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

- Prepare written procedures for transfer operations that includes a checklist of measures to follow during filling operations and the use of filling operators trained in these procedures
- Installation of gauges on tanks to measure volume inside
- Use of dripless hose connections for vehicle tank and fixed connections with storage tanks

- Provision of automatic fill shutoff valves on storage tanks to prevent overfilling
- Use of a catch basin around the fill pipe to collect spills
- Use of piping connections with automatic overfill protection (float valve)
- Pumping less volume than available capacity into the tank or vessel by ordering less material than its available capacity
- Provision of overfill or over pressure vents that allow controlled release to a capture point

Reaction, Fire, and Explosion Prevention

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

- Storage of incompatible materials (acids, bases, flammables, oxidizers, reactive chemicals) in separate areas, and with containment facilities separating material storage areas
- Provision of material-specific storage for extremely hazardous or reactive materials
- Use of flame arresting devices on vents from flammable storage containers
- Provision of grounding and lightning protection for tank farms, transfer stations, and other equipment that handles flammable materials
- Selection of materials of construction compatible with products stored for all parts of storage and delivery systems, and avoiding reuse of tanks for different products without checking material compatibility
- Storage of hazardous materials in an area of the facility separated from the main production works. Where proximity is unavoidable, physical separation should be provided using structures designed to prevent fire, explosion, spill, and other emergency situations from affecting facility operations
- Prohibition of all sources of ignition from areas near flammable storage tanks

Control Measures

Secondary Containment (Liquids)

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

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

- Transfer of hazardous materials from vehicle tanks to storage in areas with surfaces sufficiently impervious to avoid loss to the environment and sloped to a collection or a containment structure not connected to municipal wastewater/stormwater collection system
- Where it is not practical to provide permanent, dedicated containment structures for transfer operations, one or more alternative forms of spill containment should be provided, such as portable drain covers (which can be deployed for the duration of the operations), automatic shut-off valves on storm water basins, or shut off valves in drainage or sewer facilities, combined with oil-water separators

- Storage of drummed hazardous materials with a total volume equal or greater than 1,000 liters in areas with impervious surfaces that are sloped or bermed to contain a minimum of 25 percent of the total storage volume
- Provision of secondary containment for components (tanks, pipes) of the hazardous material storage system, to the extent feasible
- Conducting periodic (e.g. daily or weekly) reconciliation of tank contents, and inspection of visible portions of tanks and piping for leaks;
- Use of double-walled, composite, or specially coated storage and piping systems particularly in the use of underground storage tanks (USTs) and underground piping. If double-walled systems are used, they should provide a means of detecting leaks between the two walls.

Storage Tank and Piping Leak Detection

Leak detection may be used in conjunction with secondary containment, particularly in high-risk locations[43]. 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 SCADA[44] 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 hazard materials management procedures that meet the requirements of the hazardous materials management plan. Their procedures should be consistent with those of the contracting company and the contractor workforce should undergo the same training. Additionally, procedures should require that contractors are:
  - 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

Applicability and Approach

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

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

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

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

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

Facilities that generate and store wastes should practice the following:

- Establishing waste management priorities at the outset of activities based on an understanding of potential Environmental, Health, and Safety (EHS) risks and impacts and considering waste generation and its consequences
- Establishing a waste management hierarchy that considers prevention, reduction, reuse, recovery, recycling, removal and finally disposal of wastes.
- Avoiding or minimizing the generation waste materials, as far as practicable
- Where waste generation cannot be avoided but has been minimized, recovering and reusing waste

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

General Waste Management

The following guidance applies to the management of 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
- Definition of procedures and operational controls for on-site storage
- Definition of options / procedures / operational controls for treatment and final disposal

Waste Prevention

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

- Substituting raw materials or inputs with less hazardous or toxic materials, or with those where processing generates lower waste volumes
- Applying manufacturing process that convert materials efficiently, providing higher product output yields, including modification of design of the production process, operating conditions, and process controls[50]
- 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 regulations[51]

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 in provided in Section 3 of this document)
- Avoiding underground storage tanks and underground piping of hazardous waste

Transportation

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

Treatment and Disposal

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

Commercial or Government Waste Contractors

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

- Have the technical capability to manage the waste in a manner that reduces immediate and future impact to the environment
- Have all required permits, certifications, and approvals, of applicable government authorities

- Have been secured through the use of formal procurement agreements

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

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

Small Quantities of Hazardous Waste

Hazardous waste materials are frequently generated in small quantities by many projects through a variety of activities such as equipment and building maintenance activities. Examples of these types of wastes include: spent solvents and oily rags, empty paint cans, chemical containers; used lubricating oil; used batteries (such as nickel-cadmium or lead acid); and lighting equipment, such as lamps or lamp ballasts. These wastes should be managed following the guidance provided in the above sections.

Monitoring

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

- Regular visual inspection of all waste storage collection and storage areas for evidence of accidental releases and to verify that wastes are properly labeled and stored. When significant quantities of hazardous wastes are generated and stored on site, monitoring activities should include:
  - 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/m^2 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 Guidelines[54]		
	One Hour L_{Aeq} (dBA)	
Receptor	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 monitoring[56] 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

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

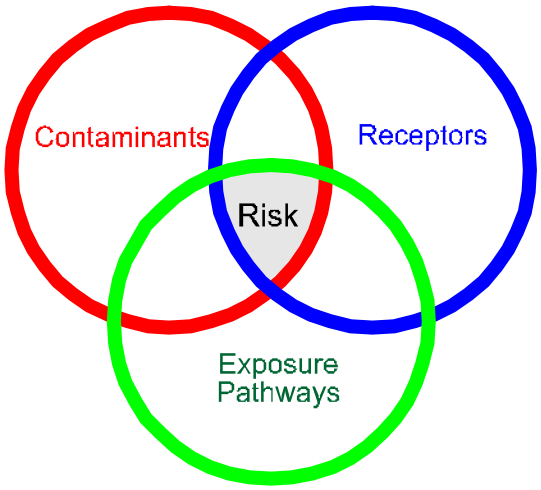


FIGURE 1.8.1: Inter-Relationship of Contaminant Risk Factors

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 (RBCs[60]) 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]

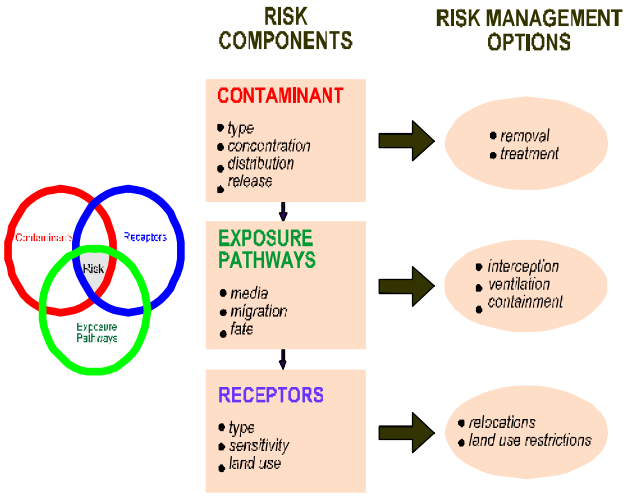


FIGURE 1.8.2: Inter-Relationship of Risk Factors and Management Options

[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=STANDARDS&p_id=9765

2.0 Occupational Health and Safety

Applicability and Approach

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

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

- *Eliminating the hazard* by removing the activity from the work process. Examples include substitution with less hazardous chemicals, using different manufacturing processes, etc;
- *Controlling the hazard* at its source through use of engineering controls. Examples include local exhaust ventilation, isolation rooms, machine guarding, acoustic insulating, etc;
- *Minimizing the hazard* through design of safe work systems and administrative or institutional control measures. Examples include job rotation, training safe work procedures, lock-out and tag-out, workplace monitoring, limiting exposure or work duration, etc.
- *Providing appropriate personal protective equipment (PPE)* in conjunction with training, use, and maintenance of the PPE.

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

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

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

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.

Workspace and Exit

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

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

Fire Precautions

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

- Equipping facilities with fire detectors, alarm systems, and fire-fighting equipment. The equipment should be maintained in good working order and be readily accessible. It should be adequate for the dimensions and use of the premises, equipment installed, physical and chemical properties of substances present, and the maximum number of people present.
- Provision of manual firefighting equipment that is easily accessible and simple to use
- Fire and emergency alarm systems that are both audible and visible

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

Lavatories and Showers

- Adequate lavatory facilities (toilets and washing areas) should be provided for the number of people expected to work in the facility and allowances made for segregated facilities, or for indicating whether the toilet facility is "In Use" or "Vacant". Toilet facilities should also be provided with adequate supplies of hot and cold running water, soap, and hand drying devices.
- Where workers may be exposed to substances poisonous by ingestion and skin contamination may occur, facilities for showering and changing into and out of street and work clothes should be provided.

Potable Water Supply

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

Clean Eating Area

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

Lighting

- Workplaces should, to the degree feasible, receive natural light and be supplemented with sufficient artificial illumination to promote workers' safety and health, and enable safe equipment operation. Supplemental 'task lighting' may be required where specific visual acuity requirements should be met.
- Emergency lighting of adequate intensity should be installed and automatically activated upon failure of the principal artificial light source to ensure safe shut-down, evacuation, etc.

Safe Access

- Passageways for pedestrians and vehicles within and outside buildings should be segregated and provide for easy, safe, and appropriate access
- Equipment and installations requiring servicing, inspection, and/or cleaning should have unobstructed, unrestricted, and ready access
- Hand, knee and foot railings should be installed on stairs, fixed ladders, platforms, permanent and interim floor openings, loading bays, ramps, etc.

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

First Aid

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

Air Supply

- Sufficient fresh air should be supplied for indoor and confined work spaces. Factors to be considered in ventilation design include physical activity, substances in use, and process-related emissions. Air distribution systems should be designed so as not to expose workers to draughts
- Mechanical ventilation systems should be maintained in good working order. Point-source exhaust systems required for maintaining a safe ambient environment should have local indicators of correct functioning.
- Re-circulation of contaminated air is not acceptable. Air inlet filters should be kept clean and free of dust and microorganisms. Heating, ventilation and air conditioning (HVAC) and industrial evaporative cooling systems should be equipped, maintained and operated so as to prevent growth and spreading of disease agents (e.g. *Legionnella pneumophilia*) or breeding of vectors (e.g. mosquitoes and flies) of public health concern.

Work Environment Temperature

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

2.2 Communication and Training

OHS Training

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

Visitor Orientation

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

New Task Employee and Contractor Training

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

understand work hazards and to protect their health from hazardous ambient factors that may be present.
The training should adequately cover:

- 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 ACGIH[66]. Exposure levels should be checked on the basis of daily exposure time and data provided by equipment manufacturers.

Electrical

Exposed or faulty electrical devices, such as circuit breakers, panels, cables, cords and hand tools, can pose a serious risk to workers. Overhead wires can be struck by metal devices, such as poles or ladders, and by vehicles with metal booms. Vehicles or grounded metal objects brought into close proximity with overhead wires can result in arcing between the wires and the object, without actual contact. Recommended actions include:

Table 2.3.1. Noise Limits for Various Working Environments

Location /activity	Equivalent level LA_{eq},8h	Maximum LA_{max},fast
Heavy Industry (no demand for oral communication)	85 dB(A)	110 dB(A)
Light industry (decreasing demand for oral communication)	50-65 dB(A)	110 dB(A)
Open offices, control rooms, service counters or similar	45-50 dB(A)	-
Individual offices (no disturbing noise)	40-45 dB(A)	-
Classrooms, lecture halls	35-40 dB(A)	-
Hospitals	30-35 dB(A)	40 dB(A)

- 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 injur a worker's eyesight. In extreme cases, blindness may result. Additionally, welding may produce noxious fumes to which prolonged exposure can cause serious chronic diseases. Recommended measures include:

- Provision of proper eye protection such as welder goggles and/or a full-face eye shield for all personnel involved in, or assisting, welding operations. Additional methods may include the use of welding barrier screens around the specific work station (a solid piece of light metal, canvas, or plywood designed to block welding light from others). Devices to extract and remove noxious fumes at the source may also be required.
- Special hot work and fire prevention precautions and Standard Operating Procedures (SOPs) should be implemented if welding or hot cutting is undertaken outside established welding work stations, including 'Hot Work Permits, stand-by fire extinguishers, stand-by fire watch, and maintaining the fire watch for up to one hour after welding or hot cutting has terminated. Special procedures are required for 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 ACGIH[67], 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 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.

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

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 ACGIH[68] 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 ACGIH[69]
- Where work shifts extend beyond eight (8) hours, calculating adjusted workplace exposure criteria recommended by the ACGIH[70]

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 personnel[71] 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 groups[73]:

- ***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 limits[75].

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

- 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

[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).

- 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 organizations[76].

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.

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.

[76] Examples include the American National Standards Institute (ANSI), http://www.ansi.org/; National Institute for Occupational Safety and Health[76] (NIOSH), http://www.cdc.gov/niosh/homepage.html; Canadian Standards Association[76] (CSA), http://www.csa.ca/Default.asp?language=english; Mine Safety and Health Administration[76] (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

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 codes[80] 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 Code[82], 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 standards[83] 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 standards[86]. Such nationally referenced material constitutes the acceptable fire life safety code.

3.4 Traffic Safety

Traffic accidents have become one of the most significant causes of injuries and fatalities among members of the public worldwide. Traffic safety should be promoted by all project personnel during displacement to and from the workplace, and during operation of project equipment on private or public roads. Prevention and control of traffic related injuries and fatalities should include the adoption of safety measures that are protective of project workers and of road users, including those who are most vulnerable to road traffic accidents[87]. 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
- 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 requirements[89] for air transport
  - IMDG Code[90] sea transport
  - UN Model Regulations[91] 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

[88] Additional 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

[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

- Ensuring that the volume, nature, integrity and protection of packaging and containers used for transport are appropriate for the type and quantity of hazardous material and modes of transport involved
- Ensuring adequate transport vehicle specifications
- Training employees involved in the transportation of hazardous materials regarding proper shipping procedures and emergency procedures
- Using labeling and placarding (external signs on transport vehicles), as required
- Providing the necessary means for emergency response on call 24 hours/day

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 below[93].

Hazard Assessment

The hazard assessment should identify the potential hazard involved in the transportation of hazardous materials by reviewing:

- The hazard characteristics of the substances identified during the screening stage
- The history of accidents, both by the company and its contractors, involving hazardous materials transportation
- The existing criteria for the safe transportation of hazardous materials, including environmental management systems used by the company and its contractors

This review should cover the management actions, preventive measures and emergency response procedures described below. The hazard assessment helps to determine what additional measures may be required to complete the plan.

Management Actions

- *Management of Change:* These procedures should address:
  - 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

[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.

- 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 include[94]:

- 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

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{ TC "4.1 Environment" \f C \l "2" }

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{ TC "4.2 Occupational Health and Safety" \f C \l "2" }

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 hazard[95]:

- 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 dusk 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 mercury[96]
- 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{ TC "4.3 Community Health and Safety" \f C \l "2" }

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).

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