Environmental Management Plan

CONTENTS

1 ENVIRONMENTAL MANAGEMENT PLAN

1.1 INTRODUCTION

1.1.1 Purpose of the EMP

In the course of the EPS EIA, project design decisions have been made taking account of the need to avoid, minimise and reduce negative environmental and socio-economic impacts, and the opportunity to enhance positive impacts. These are reflected in the EMP as a set of mitigation measures ('actions').

To ensure that the actions are managed fully and that unforeseen or unidentified impacts of the Project are detected and resolved, an integral part of the EIA is the development of the EMP. The Contractor will be provided with a copy of the EMP.

The EMP is required in order to:

- assist in ensuring continuing compliance with Ugandan legislation and Tullow policy;
- provide a mechanism for ensuring that measures identified in the EPS EIA to mitigate potentially adverse impacts, are implemented;
- provide a framework for mitigating impacts that may be unforeseen or unidentified until construction is underway;
- provide assurance to regulators and stakeholders that their requirements with respect to environmental and socio-economic performance will be met; and
- provide a framework for Tullow's compliance auditing and inspection programs.

It is also worth noting the EMP also has the longer term objectives of:

- ensuring environmental and socio-economic issues continue to be fully integrated into business decisions;
- rationalising and streamlining environmental and socio-economic activities throughout the lifetime of the Project to add value and efficiency;
- encouraging and achieving the highest environmental and socio-economic performance and response from all employees and contractors;
- providing the standards for overall planning, operation, audit and review;

- enabling management to establish environmental and socio-economic priorities.

1.1.2 Structure of the EMP

Mitigation and management measures are contained throughout this EIA. A key activity is to distil them into a single concise framework. The EMP sets out the following in tabular format:

- a comprehensive listing of the mitigation measures (actions) that the Project will implement;
- suggested designation of responsibility for ensuring full implementation of that action;
- the parameters that will be monitored to track how effectively actions and mitigation are implemented; and
- the timing for implementation of the action to ensure that the objectives of mitigation are fully met.

1.2 TULLOW POLICY

The Early Production System (EPS) Project has adopted Tullow's Environmental, Health and Safety Policy to manage the environmental and socio-economic impacts of the Project. The development of the Environmental Management Plan (EMP) will be guided by Tullow's Objective and Values on Corporate Social Responsibility as outlined in *Box 1.1*.

Box 1.1 Tullow's Objectives and Values

'Our objective is to minimise our impact on the environment and to foster and support longer-term development and self-sustaining enterprise in local communities.

- *To respect the countries in which we operate;*
- *To contribute and support communities where we work;*
- *To look after and care for the environment;*
- *To empower and support individual responsibility;*
- *To value and foster long-term relationships; and*
- *To be transparent in our activities and reporting.'*

Source: http://www.tullowoil.com/tlw/cr/

Tullow will achieve these core values through the Environmental, Health and Safety Policy (EHS) shown in *Box 1.2* and Corporate Social Responsibility (CSR) Policy as shown in *Box 1.3*. In the context of the EPS EIA, the main vehicle for converting these policies into action will be the Environmental Management Plan (EMP). The structure and content of the Project's EMP and its relationship with the EPS EIA are discussed in the following sections:

- *Section 1.3* provides an overview of the roles and responsibilities of Tullow and its contractors;

- *Section 1.4* provides an overview of the standards and subsidiary plans;

- *Section 1.5* outlines plans for ongoing stakeholder engagement including the management of community grievances and concerns;

- *Section 1.6* introduces key components for implementation of the EMP including training, monitoring, audit and inspection and reporting;

- *Section 1.7* explains the system for the management of change during implementation of the Project; and

- *Section 1.8* presents the mitigation measures (actions) and monitoring measures tabular format.

Box 1.2 Tullow's Environmental Health and Safety Policy

Source: http://www.tullowoil.com/tlw/siteware/pdf/ehs_policy.pdf

Box 1.3 *Tullow's Corporate Social Responsibility Policy*

Corporate Social Responsibility Policy

Tullow is committed to continuous improvement in all its standards and practices.

Tullow Oil's policy is to conduct all our business operations to best industry standards and to behave in a socially responsible manner.

Our goal is to behave ethically and with integrity in the communities where we work, and to respect cultural, national and religious diversity.

Directors, company personnel and contractors are responsible for ensuring compliance with this policy, and specifically to:

- Respect the rights of all employees, treating them fairly and without discrimination
- Commit to providing opportunities for staff development
- Provide equal employment opportunities
- Recognise individual and team contributions
- Ensure compliance with Tullow's EHS policy by all personnel involved in our activities
- Provide clear direction on key CSR initiatives, policies, performance data and targets
- Actively engage with communities in areas where we operate
- Support selected social and community development projects
- Maintain high ethical standards and support transparency in our activities
- Encourage our partners and stakeholders to observe similar standards wherever possible

Tullow is committed to continuous improvement in all its standards and practices.

Aidan J Heavey, Chief Executive Officer, Tullow Oil plc
March 2007

TO-CSR-POL-001-Rev 4

Source: http://www.tullowoil.com/tlw/siteware/pdf/csr_policy.pdf

1.3 ROLES AND RESPONSIBILITIES

1.3.1 Tullow's Role

Although the contractors will have the primary roles in delivering on the measures set out in the EMP, as the Project proponent Tullow will have the ultimate responsibility for ensuring the measures are delivered. In this respect Tullow will review and approve contractor plans for delivery of the actions contained in the EMP and subsequently during project operation, will review contractor performance through monitoring, audits and inspection (see also below, *Section 1.6)*). Where the measures set out in the EMP do not result in the achievement of objectives, Tullow will work with lead contractors as relevant to refine the measures.

During construction of the Project an Environmental Control Officer (ECO) will be responsible for ensuring the overall objectives of the environmental and social mitigation measures are met, while a Community Relations (CR) Manager will be responsible for overall achievement of socio-economic objectives and engagement with local stakeholders.

Specialists such as ecologists or air quality modellers will be utilised as required. The ECO and CR managers will ensure that environmental and socio-economic actions are achieved. This will be done by monitoring the implementation of these actions and also by monitoring their success.

The Tullow CR manager will take the lead in engaging with the local community and other stakeholders. Part of this engagement process will be focused on encouraging feedback from local residents on the performance of the Project in order to quickly identify and resolve community grievances.

When working on site, the Tullow ECO and CRs will report to the Construction Manager on site who has the power to stop the work (1) at any time should the actions established in the EMP or otherwise required not be adhered to.

1.3.2 The Contractor's Role

During site preparation and construction, the contractor (2) will be responsible for ensuring compliance with all relevant legislation as well as adherence to all environmental and socio-economic mitigation measures specified in the EMP. The contractor is also responsible under the contract for managing the potential environmental, socio-economic, safety and health impacts of all contract activities whether these are undertaken by themselves or by their subcontractors. There is therefore no intention to differentiate between the responsibilities of contractors and subcontractors; all contractors must meet all requirements.

(1) Stop work issues include, but are not limited to: oil spills, the identification of rare or protected species or cultural sites; extreme weather (e.g. extended hot periods).
(2) In this context, the term 'contractor' refers to all main contractors, i.e. the EPC and other main contractors and their subcontractors.

The contractor will need to demonstrate to Tullow's satisfaction how compliance with the requirements of the EMP will be ensured. The contractor will also be expected to demonstrate commitment to the EMP at all levels in the contractor's management structure. The contractor will be required to identify individuals responsible for overall environment, socio-economic (including community relations), safety and health management.

The contractor's community liaison team will be required to work with Tullow's CR Manager to implement the stakeholder engagement plan. The contractor will be required to participate in community meetings that will be held in affected communities prior to, during and upon completion of construction.

The contractor will be required to undertake regular environmental and socio-economic inspections and provide reports to Tullow to monitor and evaluate performance against the measures and objectives established in the EMP. In this regard, the contractor's performance in complying with the EMP will be monitored and audited by Tullow's ECO and CR Manager.

1.4 STANDARDS AND SUBSIDIARY PLANS

1.4.1 Standards

Environmental and socio-economic management issues at various stages in the life of the Project from detailed design through decommissioning, are governed or guided by a number of 'standards', including:

- those contained in Ugandan legislation;
- those established by industry codes of practice;
- those required by Tullow policy, or Functional Specifications;
- those within relevant international standards (e.g. World Bank environmental guidelines, IFC Performance Standards, World Health Organisation, International Labour Organisation); and
- commitments made in the EIA and elsewhere.

Primary contractors will be required to compile a management plan to cover the issues identified in this EMP, for approval by the Project. This plan will be compliant with the legal and Project Standards as described above, as well as the mitigation actions made in the EIA.

Mitigation and management measures are contained throughout the EIA. A key activity is to distil them into a single concise framework. The commitment register sets out the following in tabular format:

1.4.2 Subsidiary Plans

As detailed design proceeds and as construction contractors are appointed, the EMP requires specific plans be developed for the management of issues such as those summarised in *Box 1.4*.

Box 1.4 Summary of Subsidiary Plans, Policies and Programmes for the EMP

Plans identified in the EIA

- Ambient Air Quality and Emissions Monitoring Plan
- Ambient Meteorological Monitoring Plan
- Water and Sediment Quality Monitoring Programme
- Construction Site Management Plan
- Flora and Fauna Management Plan
- Conservation Management Plan
- Spill Prevention Control, Containment and Emergency Response Plan
- Operational Discharge Management Plan
- Integrated Waste Management Plan
- Vehicle and Traffic Management Plan
- Integrated Conservation Management Plan
- Employee and Subcontractor Training Plans
- Community Social Investment (CSI) Programme
- Community Engagement Plan (CEP)
- Recruitment Policy
- Local Procurement Policy

1.5 STAKEHOLDER ENGAGEMENT

1.5.1 Introduction

Tullow should continue to engage with stakeholders throughout Project construction and operation. Communication with local communities and other local stakeholders will be a key part of this engagement process and is one where Tullow and the contractor will need to work closely together during the construction period. Development of a Community Engagement Plan (CEP) is important to facilitate this communication.

The objectives of communication and liaison with local communities are the following.

- To provide residents in the vicinity of the Project (e.g. Sebagoro Village) and along the pipeline route and access roads, and other interested stakeholders, with regular information on the progress of work and its implications.

- To monitor implementation of mitigation measures and the impact of construction on communities via direct monitoring and feedback from those affected in order to ensure that mitigation measures are implemented and the mitigation objectives achieved.

- To manage any disputes between Tullow, the contractors and local people.

1.5.2 Grievance Procedure

Tullow should develop a grievance procedure to ensure fair and prompt resolution of problems arising from the Project. The grievance procedure should be underpinned by the following principles and commitments:

- Implement a transparent grievance procedure, and disseminate key information to directly impacted stakeholders.
- Seek to resolve all grievances within a stipulated time period unless the grievance is referred to the national legal processes within Uganda.
- Maintain full written records of each grievance case and the associated process of resolution and outcome for transparent, external reporting.

The responsibility for resolution of grievances will lie with Tullow and its contractors.

1.6 IMPLEMENTATION OF THE EMP

1.6.1 Overview

Responsibility for proper performance during construction and operation will be with the Tullow construction and facility operational managers. These managers, supported by Project ECO and CR Managers and logistics staff, will be accountable for delivering the actions contained in the EMP as summarised in *Section 1.8*.

1.6.2 Training

Tullow 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 implementation of the actions made in this EMP. Training will include:

- induction training for all staff including modules on: environmental awareness, accommodation rules, worker code of conduct and cultural awareness;
- toolbox training for specific tasks; and
- specialist training as required, for example for the environmental inspectors.

1.6.3 Monitoring

Monitoring will be undertaken by the Project and its contractors during the construction phase and by Tullow during operation. The key objectives of monitoring are:

- assurance that the EMP is implemented;
- assessment of the efficiency of mitigation actions for all stages of Project implementation;
- verification of predictions presented in the EIA based on computation and modelling;
- provision of information to permitting authorities; and
- provision of information on environmental and socio-economic performance as required by the Project.

In order to achieve these objectives, it is necessary to:

- develop a Monitoring and Reporting Program, including the definition of targets for Key Performance Indicators (KPIs) aimed at driving continuous improvements in performance; and
- introduce and manage this Monitoring Program through collection, storage and review of data.

A monitoring and measurement plan will be developed by Tullow as additional details on the design of specific Project components and the work execution plans become available.

1.6.4 Audit and Inspection

Regular environmental audits and random spot checks will be undertaken by Tullow throughout the Project. The audit and inspection frequencies will be established by Tullow, and may be increased or decreased according to the findings and degree of confidence arising from the ongoing audit program. The audits will be based on appropriate protocols (according to the type/phase of operation) prepared by Tullow's ECO and CR Managers. In addition to assessing operational aspects and monitoring, audits will also assess compliance with agreed objectives and targets, and the effectiveness of the EMP and its implementation. The EMP will therefore be subject to ongoing review and development to ensure that it remains appropriate for all aspects of the Project.

All audit findings will be reviewed by the ECO and CR Managers and where corrective actions are deemed necessary, specific plans (with designated

responsibility and timing) will be developed aimed at achieving continuous improvement in performance.

1.6.5 Reporting

The Project will develop a system of internal reporting that provides robust internal communication on the full range of environmental and socio-economic issues. Tullow Management will receive periodic assessments of the effectiveness of the management program, based on systematic data collection and analysis.

The Project will publicly report on the implementation of its Corporate Social Responsibility policy and on a range of issues of interest or concern to local communities.

1.7 UNCERTAINTY AND CHANGE MANAGEMENT

Uncertainty in the development of the EPS Project derives from a number of factors including:

- evolving EPS design, including detailed construction techniques;
- uncertainty in certain aspects of the baseline; and
- unforeseen events and the results of monitoring.

A key element of ongoing environmental and socio-economic management is to address uncertainty through collecting information, additional assessment and, where necessary, the development of further mitigation and management measures.

The EPS EIA as a process does not stop with submission of the reports to the authorities, or indeed with Government approval, the EMP will require a mechanism to manage change. Sometimes these changes may be material ones that could influence the original findings of the EIA, and hence the basis for its approval.

Tullow will therefore implement a Change Management System. This is to ensure that changes to the scope of the Project, or any new information are subjected to a robust assessment process. Any changes will be evaluated by the Project for their degree of significance, and incorporated into the appropriate Project documentation as follows:

- Minor changes will be reflected in updates to the EMP.

- Substantive changes that might potentially alter the EIA findings (i.e. result in changes to the predicted significance of environmental and socio-economic impacts) will be subject to re-assessment, including further stakeholder consultation, supplementary reporting and revision of the Project's EMP. To this end, there will be a reporting system between the

Project, the Ugandan government and communities within the Kaiso-Tonya Valley.

1.8 MITIGATION AND MONITORING MEASURES

This section presents the mitigation and monitoring measures in tabular format for the following impacts:

- Air Quality (*Table 1*)
- Surface and Groundwater (*Table 2*)
- Soil (*Table 3*)
- Habitat, Biodiversity, Flora and Fauna (*Table 4*)
- Non-routine Events (*Table 5*)
- Economic (*Table 6*)
- Social and Visual (*Table 7*)
- Archaeology (*Table 8*)
- Noise (*Table 9*)

Each of the tables provides an impact, impact objective; impact mitigation measure, timing of the mitigation measure; monitoring measure for the impact, timing of the monitoring measure; responsibility; reference with the EPS EIA; and any additional Tullow documentation that must be prepared.

1 - Air Quality Management Plan

ID	Mitigation Objective	Mitigation Measure/ Action	Timing			Monitoring Measure	Timing	Responsibility	EIA Reference	Additional Tullow Documentation
			Planning	Construction	Operation					
Impacts on Air Quality Relating to SO_2, NO_2, PM10 During Construction										
1.1	Reduce dust (when necessary) and vehicle emissions generated by construction activities	Traffic management measures for vehicles on the construction site to enforce speed limits (i.e. signage and training)		✔		Visual inspection	Daily	Tullow	Section 7.2.1	
1.2		A wetting programme for unpaved surfaces, when necessary		✔	✔	Visual inspection	Daily	Tullow	Section 7.2.1	
1.3		Paving of high usage roads	✔	✔		-	-	Tullow	Section 7.2.1	
1.4		Limit removal of vegetation and a rehabilitation programme on site and associated infrastructure following construction		✔	✔	Visual inspection	Daily	Tullow	Section 7.2.1	*Table 4* – Habitat, Biodiversity, Flora and Fauna
1.5		Regular maintenance of all construction vehicles on site according to manufacturer specifications.		✔		Maintenance Records	Monthly	Tullow	Section 7.2.1	

Impacts on Air Quality Relating to SO_2, NO_2 and PM_{10} During Operation										
1.6	Reduce the extent of the area where ambient SO_2, NO_2 (1) and PM_{10} concentrations are predicted to be highest and reduce the duration of occurrence or the intensity of the impact	Assess alternative stack parameterisation - different stack and emission configurations. Configurations of stack height, exit temperature and exit velocity should be evaluated with dispersion modelling before finalising EPS design to ensure World Bank emissions standards and WHO ambient air quality guidelines are not exceeded.	✓			Final EPS design and modelling results	On completion of final EPS design	Tullow	Sections 7.2.2 7.2.3 7.2.4	WHO Guidelines (2) (3) and World Bank Emissions Standards (4)
1.7		Ensure that management and maintenance programmes are developed and adhered to so that the implemented technology is operated according to specification and World Bank emission standards are maintained			✓	Final EPS design and modelling results	On completion of final EPS design	Tullow	Sections 7.2.2 7.2.3 7.2.4	
1.8		Improve local meteorological data-sets to assist with on-going dispersion modelling to increase degree of confidence of assessed impacts	✓	✓	✓	See Annex A	See Annex A	Tullow	Sections 7.2.2 7.2.3 7.2.4	
1.9		Undertake on-going emissions monitoring and ambient air quality monitoring to monitor assessed impact	✓	✓	✓	See Annex A	See Annex A	Tullow	Sections 7.2.2 7.2.3 7.2.4	Ambient Air Quality Monitoring Plan Meteorological Data Monitoring

(1) Annual concentration of NO2 and maximum 24-hour concentrations of NO2 are predicted to be very low while exceedances of the 1-hour WHO ambient air quality guideline for NO2 are predicted.

(2) WHO, (1997): World Health Organization's Environmental Health Criteria 188. Nitrogen Oxides. Second Edition.

(3) WHO, (2006): WHO Air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulphur dioxide, Global update 2005, Summary of risk assessment, WHO/SDE/PHE/OEH/06.02.

(4)World Bank, (1998): Pollution Prevention and Abatement Handbook: Towards Cleaner Production, with the UN Environment Programme and the UN Industrial Development Organization, at http://www.ifc.org/ifcext/enviro.nsf/Content/PPA, visited 20 February 2008

2 – *Surface and Groundwater Management Plan*

ID	Mitigation Objective	Mitigation Measure/ Action	Timing			Monitoring Measure	Timing	Responsibility	EIA Reference	Additional Tullow Documentation
			Planning	Construction	Operation					
Impact on Groundwater and Surface Water Quality as a Result of Sewage, Waste and Effluent Pollution										
2.1	To reduce the volumes of solid and liquid waste generation	Solid waste should be recycled, re-used and utilised in an environmentally acceptable manner	✓	✓	✓	Final EPS design and visual inspection	On completion of final EPS design	Tullow	Section 7.3.1	
2.2		Solid waste should be analysed prior to disposal for compatibility with treatment and disposal methods		✓	✓	Maintenance Records, Laboratory results	Daily	Tullow	Section 7.3.1	
2.3	To prevent soil and groundwater contamination from solid waste disposal	Hazardous waste will have to be isolated and contained in a separate hazardous waste cell/disposal area	✓		✓	Final EPS design and visual inspection	On completion of final EPS design	Tullow	Section 7.3.1	
2.4		Solid waste is to be removed from site to an approved landfill		✓	✓			Tullow	Section 7.3.1	
2.5		A Waste Management Plan to be developed to handle temporary storage, transport and disposal of hazardous waste	✓			Final EPS design	On completion of final EPS design	Tullow	Section 7.3.1	
2.6	To prevent pollution of surface- and groundwater from effluent streams	Effluent and contaminated stormwater run-off during construction phase should be discharged far away from watercourses (streams, rivers, lagoon, and Lake Albert)	✓	✓		Final EPS design Visual inspection	On completion of final EPS design Weekly	Tullow	Section 7.3.1	
2.7		The design of sedimentation ponds, i.e. for hydrotest water must follow World Bank Group EHS guidelines, such as integrity of the pond by using liners at bottom and sides of the pit. Pond shall be 5 m above seasonal high water table	✓	✓		Final EPS design, Integrity testing	On completion of final EPS design After completion of surface pits	Tullow	Section 7.3.1	IFC Standards[1]

2.8		Chemicals and hydrocarbons capable of causing water pollution should be appropriately transported, stored and disposed off. This includes the use of bunded area, suitable containers, and designated areas for disposal	✓	✓	✓	Final EPS design and visual inspections	On completion of final EPS design	Tullow	Section 7.3.1	
2.9		A spill prevention control, containment and emergency plan should be implemented	✓	✓	✓	Final EPS design and completion and implementation of a spill prevention control, containment and emergency plan	On completion of final EPS design	Tullow	Section 7.3.1	
2.10		Surface run-off from process areas or potential sources of contamination should be prevented	✓		✓	Final EPS design and visual inspections	On completion of final EPS design	Tullow	Section 7.3.1	
2.11		Run-off from process and storage areas should be segregated from potentially less contaminated run-off	✓		✓	Final EPS design and visual inspection	On completion of EPS design	Tullow	Section 7.3.1	
2.12		Run-off from areas without potential sources of contamination should be minimised (e.g. by minimising the area of impermeable surfaces) and the peak discharge rate should be reduced	✓		✓	Final EPS design	On completion of final EPS design	Tullow	Section 7.3.1	
Impacts on Groundwater Quality as a Result of Re-Injection of Produced Water into Injection Well										
2.13	Minimisation of the potential for groundwater and surface water contamination	Careful selection of fluid additives taking into account technical requirements, chemical additive concentration, toxicity, bioavailability and bioaccumulation potential	✓		✓	Daily analysis records, material reconciliation list	Daily	Tullow	Section 7.3.2	
2.14		On-site produced water treatment plant that ensures re-injection of clean, treated and filtered water only	✓		✓	Final EPS design Water quality	On completion of final EPS design Daily monitoring	Tullow	Section 7.3.2	Ugandan Standards[3], WHO[4]
2.15		Site selection of water injection wells as far as possible away from surface water streams	✓			Final EPS design	On completion of final EPS design	Tullow	Section 7.3.2	

2.16		Adequate construction of injection wells, to ensure that shallow aquifers are cased off, i.e. casing of the entire depth of water injection and extraction wells in order to prevent losses of produced water into aquifer system	✓	✓	✓	Final EPS design Drilling supervision	On completion of final EPS design On-going drilling supervision during well construction	Tullow	Section 7.3.2	
2.17		Design of EPS system to route all produced water streams to ensure a closed system with zero discharge into ground and surface water resources	✓			Final EPS design	On completion of final EPS design	Tullow	Section 7.3.2	
2.18		To prevent environmental impacts as a result of leaks and spill associated with oil production, adequate leakage detection systems and spill control measures should be in place to immediately detect leaks and spills during production	✓		✓	Final EPS design and visual inspections	On completion of final EPS design	Tullow	Section 7.3.2	
2.19		Implementation of a groundwater and surface water monitoring system in close proximity of the injection and extraction wells in order to detect any adverse water quality impacts in time, with further mitigation options, should contamination occurs	✓		✓	Final EPS design Water quality sampling	On completion of final EPS design Bi-annually	Tullow	Section 7.3.2	
Impact on Surface and Groundwater as a Result of Spillages and Leakages (e.g. Refuelling, Leaks from Storage Tanks, Leaks from Pipes etc)										
2.20	To ensure minimal impacts to soil and surface water	Good house keeping and industry best management practices should be maintained to prevent spillages and leakages	✓		✓	Visual inspection, record of spills and leakages	Monthly	Tullow	Section 7.3.3	
2.21		Crossing of pipelines over surface water courses should be avoided if possible	✓			Final EPS design	On completion of final EPS design	Tullow	Section 7.3.3	
2.22		Ensure adequate transportation, storage and disposal of chemicals and hydrocarbons. This includes the use of bunded area, suitable containers, and designated areas for disposal	✓	✓	✓	Final EPS design and visual inspection	On completion of final EPS design, daily visual inspections	Tullow	Section 7.3.3	

2.23		A spill prevention control, containment and emergency plan should be implemented. All spills should be cleaned up immediately to prevent soil, surface and groundwater contamination	✓	✓	✓	Final EPS design Visual inspection	On completion of final EPS design Daily visual inspections	Tullow	Section 7.3.3	
2.24	To monitor effectiveness of pollution control measures	An appropriate surface and groundwater monitoring plan should be implemented	✓	✓	✓	Final EPS design Water quality sampling	On completion of final EPS design Bi-annually water sampling and testing	Tullow	Section 7.3.3	
Impacts on Surface and Ground Water Quantity as a Result of Groundwater Abstraction										
2.25	To ensure that the projects water requirements will be met in a sustainable manner by the proposed wellfield during the entire life of the project.	A comprehensive intrusive investigation programme should be undertaken, including the installation of abstraction and monitoring wells and the conduction of long-term aquifer tests in order to confirm the feasibility of sustainable groundwater abstraction	✓			Results of intrusive investigation programme	After completion of intrusive investigation programme	Tullow	Section 7.3.4	
2.26		Numerical groundwater flow modelling should be undertaken to reassess the feasibility of groundwater abstraction, to optimise the location of abstraction wells, to estimate maximum drawdown and the extent of the drawdown cone, and to simulate recovery rates of groundwater levels	✓			Results of numerical groundwater flow modelling	After completion of intrusive investigation programme and modelling exercise	Tullow	Section 7.3.4	
2.27		The water management strategy as well as proposed mitigation measures will be updated based on the results of the detailed intrusive investigation and groundwater modelling	✓			Results of intrusive investigation programme and numerical groundwater flow modelling results	After completion of intrusive investigation programme and modelling exercise	Tullow	Section 7.3.4	
2.28		Minimise the amount of fresh water used for EPS activities by preventing water losses by spills and by re-using water where possible	✓		✓	EPS design and visual inspections	On completion of final EPS design	Tullow	Section 7.3.4	

2.29		Spill and leakage control systems will be implemented in order to identify major leaks	✓	✓	✓	EPS design Records	On completion of final EPS design Daily inspection	Tullow	Section 7.3.4	
2.30		Implementation of a groundwater and surface water monitoring plan to monitor impacts on groundwater levels. The monitoring programme should include the community well located to the south of the proposed wellfield on the foothill of the escarpment as well as newly drilled shallow and deep observation boreholes in the vicinity of the proposed wellfield area	✓	✓	✓	Hydrocensus (measuring of groundwater levels, discharge measurements at Hohwa River and water sampling)	Monthly	Tullow	Section 7.3.4	Surface and groundwater Monitoring Plan

(1) Environmental Health and Safety (EHS) Guidelines. General EHS Guidelines: Environmental, Environmental, Health, and Safety Guidelines for Onshore Oil and Gas Development, World Bank Group, http://www.ifc.org/ifcext/enviro.nsf/Content/EnvironmentalGuidelines

(2) The National Environment (Standards for Discharge of Effluent into Water or on Land) Regulations, 999, Under Section 27 and 108 of the National Environment Statute, 1995.

(3) Ugandan National Bureau of Standards, 1994, Specification for Drinking (Potable Water).

(4) World Health Organisation, 2004. Guidelines for Drinking Water Quality, 3rd edition.

ID	Mitigation Objective	Mitigation Measure/ Action	Timing			Monitoring Measure	Timing	Responsibility	EIA Reference	Additional Tullow Documentation
			Planning	Construction	Operation					
Impact: Loss of Topsoil										
3.1	Conserve excavated topsoil through the maintenance of its soil structure and ecological capacity and to minimise the erosion of soils	To maintain topsoil structure: i) Where possible, remove and place soils when dry, and not when wet ii) Minimise the amount of soils handling iii) Avoid compaction of the soil, in situ, during handling, during storage and during placement iv) Topsoil and rootstock to be removed (less than 30cm) and stockpiled. Restrict the height of topsoil stockpiles to maintain the soils ecological capacity. Topsoil stockpiles shall be extensive and low, rather than high; an ideal stockpiling arrangement would be to stockpile topsoil as a layer 1 metre in height, spread over the required area		✓	✓	Method of handling and stockpiling of topsoil – extensive and low – height less than 1m	On-going	Tullow	Section 7.4.1	
3.2		Vegetate stockpile after formation, to reduce risk of soil loss due to erosion, prevent weed growth and to reinstitute the ecological processes within the soil		✓	✓	Vegetation of stockpiles where practicable	On-going	Tullow	Section 7.4.1	Construction Site Management Plan Flora and Fauna Management Plan
3.3		Maintain removal and disturbance of vegetation and soils to those absolutely essential for the development		✓	✓	Footprint of site and control measures (i.e. clear demarcation of area to be excavated)	On-going	Tullow	Section 7.4.1	Construction Site Management Plan Flora and Fauna Management Plan

3.4	To prevent soil erosion around the EPS and associated infrastructure	Incorporate proper drainage controls such as culverts and flow cut-off ditches, design for storm conditions and ensure that offsite natural runoff does not wash over the site and cause erosion	✓	✓		Drainage system in place and visible erosion	On-going	Tullow	Section 7.4.1	Construction Site Management Plan Spill Prevention Control, Containment and Emergency Plan
3.5		Re-vegetate or stabilise any disturbed areas as soon as possible. Re-vegetated areas should be visually inspected on a weekly basis to ensure growth and adequate cover. Areas with poor cover need to be attended to by re-seeding and possibly fertilising soils		✓	✓	Recovery of vegetation cover	Weekly	Tullow	Section 7.4.1	Construction Site Management Plan Flora and Fauna Management Plan
Impact: Soil Compaction										
3.6	Conserve soils (in particular topsoils) through the maintenance of its soil structure and ecological capacity	Maintain removal and disturbance of vegetation and soils to those absolutely essential for the development		✓	✓	Footprint of site and control measures (i.e. clear demarcation of area to be excavated)	On-going	Tullow	Section 7.4.2	
3.7		Restrict human, vehicle and machinery access to defined areas through fencing or demarcation		✓	✓	Demarcated EPS site and temporary and permanent accommodation facilities, roads, pipeline routes, well	On-going	Tullow	Section 7.4.2	
3.8		Ripping of the soils surface where compaction of soils has occurred. Ripping should be done using long grader ripper tines to a depth of about 50 centimetres following leveling. Ripping must be done on contour, so as to avoid the formation of erosion channels, even where the landform is thought to be level.		✓	✓	All compacted areas ripped	On-going	Tullow	Section 7.4.2	

ID	Mitigation Objective	Mitigation Measure/ Action	Timing			Monitoring Measure	Timing	Responsibility	EIA Reference	Additional Tullow Documentation
			Planning	Construction	Operation					
Impact: Impact on Biodiversity, Local Flora and Fauna										
4.1	To minimise biodiversity and habitat fragmentation or destruction	Minimise footprint and need to remove vegetation for all infrastructure	✓			Final EPS design	On completion of final EPS design	Tullow	Section 7.5.1 7.6.1	
4.2	To maximise connectivity to surrounding untransformed areas To minimise impacts on vegetation and to maximise rehabilitation and re-vegetation of disturbed areas	Locate and align infrastructure routing, particularly the flowlines, water supply pipeline and access roads to avoid sensitive habitats including wetlands, woodlands and forest patches	✓			Sensitive habitats avoided	On completion of final EPS design	Tullow	Section 7.5.1 7.6.1 7.6.2	
4.3		Pipeline trenches and road width to be kept to a minimum to meet operational and health and safety requirements	✓	✓		-	-	Tullow	Section 7.5.1 7.6.1	
4.4		Identify and relocate red data plants on site and at least 100m from infrastructure (to prevent impacts due to dust, soil and water contamination and general construction activity) prior to vegetation clearing	✓	✓		Inspection of relocated red data plants	Prior to vegetation clearing	Tullow and vegetation specialist	Section 7.6.1	
4.5		All pipeline routes and disturbed areas around the EPS and associated infrastructure to be restored to pre-construction habitat type		✓		Visual inspection of rehabilitation	After rehabilitation until vegetation is well established	Tullow	Section 7.5.1 7.6.1	
4.6		Impose a 'No Fires' rule on all employees. Fires for cooking only in designated areas		✓		Visual inspection	On-going	Tullow	Section 7.5.1 7.6.1	
4.7	To minimise impacts on wildlife within the Kabwoya Wildlife Reserve	Construction equipment will be correctly maintained to minimise noise disturbance of wildlife		✓	✓	Equipment maintenance records	On-going	Tullow	Section 7.5.1	

4.8		Use minimum lighting possible, and prevent light spill using down lighting limited to the proposed EPS and associated infrastructure, do not use spot lights that light up beyond the areas that require lighting		✓	✓	Visual inspection	On-going until minimal impact achieved	Tullow	Section 7.5.1 7.6.2	
4. 9		Trenches to be covered as soon as practically possible to avoid extended periods of time where trenches are exposed and thus a threat to animals		✓	✓	Visual inspection	On-going	Tullow	Section 7.6.2	
4.10		Daily inspection of trenches to 'rescue' any wildlife that may have fallen in the trenches		✓	✓	Visual inspection	Daily	Tullow	Section 7.6.2	
4.11		Impose a 'No Hunting' rule on all employees.		✓	✓	Visual observation and community complaints	On-going	Tullow	Section 7.5.1	
4.12	Minimise the impacts on both vegetation and wildlife	Development of a robust work execution plan to ensure short duration of construction phase (≤4 months)	✓			Construction schedule	Weekly	Tullow	Section 7.5.1	
4.13		Restrict all construction activities to designated working areas with all work areas and access areas clearly demarcated and signposted		✓		Visual inspection	On-going	Tullow	Section 7.5.1 7.6.1	
4.14		Raise awareness and educate site staff and visitors about flora and fauna, particularly Red Data or endangered species and about rules and regulations regarding speed limits, illegal dumping of waste, collecting wood for fires and general behaviour on the property		✓	✓	Attendance registers and course material	On-going	Tullow	Section 7.5.1 7.6.1	
4.15		Implement appropriate effluent treatment and waste management to meet the Project's Functional Specifications			✓	Functional Specification	On-going	Tullow	Section 7.5.1	Operational Discharge Management Plan Integrated Waste Management Plan

4.16		Correct waste and effluent management procedures should reduce risk of contamination of water, thus reducing indirect impacts on flora and fauna		✓	✓	Water quality and sediment quality monitoring in Hohwa River – See Annex A	Seasonal	Tullow	Section 7.6.1 7.6.2	Water and Sediment Quality Monitoring programme
4.17		Minimise soil contamination as it directly and indirectly impacts on flora and fauna in the area. Contaminated soil to be minimised and remediated as soon as possible in order to reduce impacts on vegetation and wildlife		✓	✓	Remediation according to Spill Prevention Control, Containment and Emergency Response Plan		Tullow	Section 7.6.1 7.6.2	Spill Prevention Control, Containment and Emergency Response Plan Integrated Waste Management Plan
4.18		On-going long-term monitoring and mapping programmes all flora and fauna types in the Kaiso-Tonya Valley will be essential to improve the understanding of the conservation worthiness of the area and to guide future development. Tullow should work in collaboration with UWA and local research institutions in gathering this data		✓	✓	Commencement of monitoring and mapping programmes	On-going	Tullow	Section 7.6.1 7.6.2	Monitoring and mapping programmes
4.19		Tullow to work in close cooperation with Ugandan Wildlife Authority (UWA) and existing concessionaires in terms of ensuring that the conservation worthiness of the Kabwoya Wildlife Reserve is maintained through the development of an Integrated Conservation Management Plan	✓	✓	✓	Liaise with UWA and existing Kabwoya Wildlife Reserve concessionaires	On-going	Tullow	Section 7.6.2	Integrated Conservation Management Plan

ID	Mitigation Objective	Mitigation Measure/ Action	Timing			Monitoring Measure	Timing	Responsibility	EIA Reference	Additional Tullow Documentation
			Planning	Construction	Operation					
Impact on Terrestrial and Aquatic Habitats as a Result Oil Spills										
5.1	To control any oil release that may arise from a fault in the operation of the pipeline and associated EPS facilities	Designing the CPF and associated pipelines to ensure that the risks of incidents during operation are minimised	✓			-	-	Tullow	Section 7.7.1	Oil Spill Containment and Emergency Response Plan Integrated Waste Management Plan
5.2		Ensuring the CPF and associated pipelines are operated and maintained in a manner that minimises the risk of incidents			✓	-	-	Tullow	Section 7.7.1	Oil Spill Containment and Emergency Response Plan
5.3		Compile an Oil Spill Containment and Emergency Response Plan including the following: i) Rapid implementation of primary containment and recovery activities aimed at minimising the release volume, physically protecting highly sensitive receptors, containing the spill within as small an area as possible and recovering available free phase oil		✓	✓	Oil Spill Containment and Emergency Response Plan prepared and training undertaken	Before construction commences – for construction –related spills, before operation for operation-related spills	Tullow	Section 7.7.1	Oil Spill Containment and Emergency Response Plan

5.4		ii) The rapid deployment of expert personnel to the spill site to carry out site specific appraisals of the spill, to develop site specific clean up/remediation plans and to direct clean up activities		✓	✓	Oil Spill Containment and Emergency Response Plan prepared and training undertaken	Before construction commences	Tullow	Section 7.7.1	Oil Spill Containment and Emergency Response Plan
5.5		iii) The implementation of the recommendations of the expert personnel (e.g. site characterisation, risk assessment, remediation of residual contamination)		✓	✓	Oil Spill Containment and Emergency Response Plan prepared and training undertaken	Before construction commences	Tullow	Section 7.7.1	Oil Spill Containment and Emergency Response Plan
5.6		iv) Ongoing monitoring and review of clean up activities		✓	✓	Oil Spill Containment and Emergency Response Plan prepared and training undertaken	Before construction commences	Tullow	Section 7.7.1	Oil Spill Containment and Emergency Response Plan
5.7		v) Ensuring appropriate emergency response resources are in place		✓	✓	Oil Spill Containment and Emergency Response Plan prepared and training undertaken	Before construction commences	Tullow	Section 7.7.1	Oil Spill Containment and Emergency Response Plan
5.8		vi) Ensuring appropriate training is undertaken		✓	✓	Oil Spill Containment and Emergency Response Plan prepared and training undertaken	Before construction commences	Tullow	Section 7.7.1	Oil Spill Containment and Emergency Response Plan
5.9		vii) Ensure appropriate waste management procedures are in place		✓	✓	Oil Spill Containment and Emergency Response Plan prepared and training undertaken	Before construction commences	Tullow	Section 7.7.1	Oil Spill Containment and Emergency Response Plan Integrated Waste Management Plan

ID	Mitigation Objective	Mitigation Measure/ Action	Timing			Monitoring Measure	Timing	Responsibility	EIA Reference	Additional Tullow Documentation
			Planning	Construction	Operation					
Impact: Employment – Direct, Indirect and Induced										
6.1	Optimise opportunities for employment of people from Uganda where possible, particularly those from Hoima District and the Kaiso-Tonya Valley.	Establish and implement a recruitment policy which prioritises the employment of Ugandan Nationals and local residents (1) (as recognised by the LC1 Chairmen) over foreigners during the recruitment process[2]. Wherever possible, residents of the Valley will be prioritised for employment; in this context, in terms of unskilled labour, these opportunities will be as evenly distributed within the nine villages in the Valley as is realistically feasible.	✓	✓	✓	Review of employment records to check compliance with targets, as set by Tullow.	Monthly	Tullow	Section 8.2.1	Recruitment Policy
6.2		Set targets for percentage of Ugandan nationals and local residents to be employed during construction and operation phases. In terms of unskilled labour, these targets will be set to reflect an even distribution of opportunities within the nine villages in the Valley.	✓	✓	✓	Review of employment records to check compliance with targets, as set by Tullow.	Monthly	Tullow	Section 8.2.1	Recruitment Policy

(1) The local residents are not limited to Ugandans but include foreigners who have lived in the area for many years.

(1) [2] Note: the job opportunities for locals in the Kaiso Tonya Valley will be limited initially to unskilled labour during construction as the remaining opportunities are limited in number and require a high degree of skills,. In, terms of the Production Sharing Agreement wherever possible local Ugandans are employed in the Kampala Office and all related operations; in this context Tullow actively builds capacity of Ugandan employees and is currently involved in ongoing discussions with the Ugandan Government in this regard..

6.3		Clearly advertise employment criteria (e.g. skills and experience needed) for available jobs through appropriate local and national channels, including through the LC1 Chairman. Ensure that employment opportunities are well advertised in the local area	✓	✓	✓	Review of adverts sent out, with a focus on clarity of information provided, and grass-roots accessibility of information provided.	Prior to adverts being sent out.	Tullow	Section 8.2.1	Recruitment Policy
6.4		Work with the government (Department of Education, or equivalent) to assist in the development of appropriate training programmes for the local residents in the Valley, such that they have improved opportunities to benefit from the direct and indirect employment opportunities associated with the EPS. • Tullow to meet with Department of Education (or equivalent) as soon as the EPS development is approved (planning). • Training programme to be developed as soon as agreement has been reached with Government on how to implement this measure (planning). • Training to be ongoing through the construction and operation phase as appropriate.	✓	✓	✓	• Review records of consultations and meetings between Tullow and relevant local government. • Review of training programme. • Review of training records and graduation/ qualification records for number of people trained.	• N/A • Prior to the commencement of training • Annually once training has commenced	Tullow	Section 8.2.1	
6.5		Provide skills requirements to educational institutions in order for them to better understand the requirements of the oil industry and adjust the curricula accordingly.	✓			Review records of skills requirements as sent to educational institutions.	N/A	Tullow	Section 8.2.1	
6.6		Provide bursaries to potential Ugandan candidates for specific positions during operation and set specific targets.			✓	Check numbers of candidates given bursaries against set targets.	Annually	Tullow	Section 8.2.1	
Impact: Procurement of Local Goods and Services										

6.7	Maximise the procurement of goods and services from the Kaiso-Tonya Valley, Hoima District and Uganda where possible, appropriate and economically viable.	Tullow will conduct an assessment of capacity within Uganda to supply goods and services over the lifetime of the project.	✓		✓	• Review of terms of reference for the assessment. • Review of assessment after its completion.	• Prior to assessment being carried out. • Once the assessment has been undertaken.	Tullow	Section 8.2.2	Local Procurement Policy
6.8		Procurement targets, focussing on Ugandan suppliers, will be incorporated into the key performance indicators of the EPS team[1].	✓		✓	• Review procurement from Uganda and % growth over time. • Review local procurement targets to ensure that key performance indicators have been achieved.	• Twice during construction. • 6-monthly during operation.	Tullow	Section 8.2.2	Local Procurement Policy
6.9		Encourage contractors to use Ugandan suppliers where appropriate and cost effective.	✓	✓	✓	Review procurement from Uganda and % growth over time.	• Twice during construction. • 6-monthly during operation.	Tullow	Section 8.2.2	Local Procurement Policy

[1] Note: Because of the specialised nature of this project and associated equipment and installation only major international companies will be bidding. Consequently, procurement targets would be limited to locally available equipment being acquired by Tullow independently and to encouraging contractors to use Ugandan suppliers where non specialised equipment is required.

6.10		Ensure that the local project contractors and suppliers have accesses to Health, Safety, Environmental and Quality training as required by the project.		✓	✓	• Review record of training received by contractors and suppliers. • Review register of those who have successfully completed training and review this register. • Review evaluation forms to assess perceived value of the training. • Spot check of certificates received by those who have successfully completed training.	• Once during construction. • 6-monthly during operation.	Tullow	Section 8.2.2	Health and Safety Plan Subcontractor Training Plan

Impact: Enhancement/Upgrade of Skills and Experience and Increased Income Stability										
6.11	Maximise and enhance the skills and experience of those employed by Tullow and its main contractors, with a specific focus on Ugandan nationals.	All employees and contractors will receive Health, Safety, Environmental and Quality training together with specific job related training.		✓	✓	• Review record of training received by contractors and suppliers. • Review register of those who have successfully completed training. • Review evaluation forms to assess perceived value of the training. • Spot check of certificates received by those who have successfully completed training.	• Once during construction. • 6-monthly during operation.	Tullow	Section 8.2.3	Health and Safety Plan Employee and Subcontractor Training Plans
6.12		As above in 6.4.	✓	✓	✓	As above in 6.4.	As above in 6.4.	Tullow	Section 8.2.3	

Impact: Increased Economic Development and Diversification										
6.13	Strive to optimise the potential benefits of the project for the local, regional and national economy, such that the economies can develop sustainably and can withstand the potentially negative impacts associated with decommissioning and closure.	Community Social Investment programme to focus on sustainable livelihood development in addition to existing activities. Including working with government assist in the development of appropriate training programmes for local communities so that they have improved opportunities to benefit from the direct and indirect employment opportunities associated with the EPS. Programme policy and objectives to be defined prior to construction and developed and implemented within 6 months of operation.	✓		✓	• Review policy to determine whether objectives have been set • Review minutes of meetings with government. • Review strategy, programme and indicators. • Determine performance indicators for success of programme and monitor	• Once-off at start of construction. • Once-off at start of construction • Prior to operation. • As soon as strategy and programme is finalised and track 6-monthly.	Tullow and Community Relations (CR) Manager	8.2.4	Community Social Investment (CSI) Programme
Impact: Increased Government Revenue										
6.14	Ensure that the agreed payments to government are made in a timely and transparent manner.	Ensure that sound financial management systems are put in place within Tullow for the EPS.	✓		✓	Audit trails of all financial transactions within the country, including those to Government.	Annually	Tullow	Section 8.2.5	
6.15		Consider signing up to the Extractive Industries Transparency Initiative (EITI) in partnership with government, if appropriate.	✓			-	-	Tullow	Section 8.2.5	
Impact: Unmet Expectations										
6.16	Attempt to ensure that expectations around economic opportunities associated with the EPS are realistic in the context of the local skills base and capacity to meet the needs of the project.	Clearly advertise criteria for skills and experience needed for available jobs through local and national media within a reasonable amount of time to give locals the opportunity to apply and until all positions are filled.	✓	✓	✓	Review of adverts sent out, with a focus on clarity of information provided, and grass-roots accessibility of information provided.	Prior to adverts being sent out.	Tullow	Section 8.2.6	Recruitment Policy

6.17		Clearly advertise experience, quality and volume requirements for the EPS supply chain needs within a reasonable amount of time to give local business the opportunity to meet quality standards and the time to apply.	✓	✓	✓	Review of adverts sent out.	Prior to adverts being sent out.	Tullow	Section 8.2.6	Local Procurement Policy
Impact: Exacerbation of Economic Vulnerability										
6.18	Attempt to ensure that economic vulnerability as a result of the project is avoided or minimised.	The recruitment and skills development of employees will incorporate the economically vulnerable where possible.	✓	✓	✓	Develop indicators for number of potentially vulnerable trained and/or employed and track these.	• Monthly during construction. • 6-monthly during operation.	Tullow	Section 8.2.7	Recruitment Policy Employee Training Plan
6.19		Social investment activities undertaken by Tullow will be focussed on economically vulnerable groups.		✓	✓	Review number of vulnerable people who receive benefits from social investment activities.	• Once during construction • 6-monthly during operation.	Tullow and CR Manager	Section 8.2.7	Community Social Investment Programme.

ID	Mitigation Objective	Mitigation Measure/ Action	Timing			Monitoring Measure	Timing	Responsibility	EIA Reference	Additional Tullow Documentation
			Planning	Construction	Operation					
Impact: Increased Pressure on Social Infrastructure and Service Delivery										
7.1	• To encourage and support government in improving the levels of infrastructure and services provided to all villages in the Kaiso-Tonya Valley. • To use the EPS and associated Tullow projects as a catalyst to initiate land use development and spatial structuring that will promote growth, improve sustainability and inclusive delivery of services. • To ensure that the EPS does not place any direct pressure on the already strained local infrastructure and services.	Establish a community engagement plan (CEP) during planning and implement during operation to ensure on-going identification and management of stakeholder issues and concerns. This plan will target residents from all nine villages in the Valley. A community liaison officer to be appointed to interact with the local residents	✓	✓	✓	Carry out spot checks at Community Engagement Forum to assess whether: • Appropriate information is being provided to stakeholders; • Sufficient information is being collected to ensure effective mitigation; • Issues raised are being forwarded to correct Tullow department for resolution. CEP to be reviewed and updated if required.	• Once during planning • Twice during construction • 6-monthly during operation • Annually	Tullow	Section 8.3.1	Community Engagement Plan (CEP)

7.2		Tullow will meet all practical needs of its non-local employees for access to services and infrastructure (such as medical aid, health facilities, piped water, electricity) so that no additional pressure is placed on existing capacity.		✓	✓	• Check that all services and infrastructure required by employees are to be provided by Tullow and are ready for utilisation. • Spot checks to be carried out to check that all required infrastructure/ services are not being drawn from local capacity. • Ensure pressure on services is reported and addressed as far as possible (use CEP).	• Once during pre-construction. • Once during construction. • Quarterly during operation. • On-going	Tullow	Section 8.3.1	Community Engagement Plan (CEP)

7.3		• Tullow to initiate and support a working group with government to monitor the extent and impact of the on-going in-migration into the area as related to the broader oil-related activities. Implement regular surveys (quantitative or qualitative) that measure the changes in population numbers, demographic structure, access to and pressure on resources and services, etc. Make use of findings to assess the changes enabling Tullow and government to proactively plan for and manage the impacts.	✓	✓	✓	• Keep records of working group meetings. Minutes to be spot-checked by senior Tullow representative. • Report showing findings of the survey and an assessment of the adequacy of infrastructure and resources based on the findings. Describe the methodology used and the people interviewed. • Document changes to activities planned for delivering infrastructure and services.	• Once during planning • Once during construction • Twice yearly during operation • Annually • Annually	Tullow	Section 8.3.1	
7.4		In order to address the lack of infrastructure and resources in the Valley, Tullow will need to focus on forming partnerships with the relevant authorities to address these needs. By working together, more of the needs can be addressed and the likelihood of the infrastructure being maintained and the services being continued will be increased. Tullow will undertake the following:				Refer to bullets below	Refer to bullets below			

		• initiate discussions with the Ministries of Education and Health in order to plan for anticipated increased demands on local education and health facilities, respectively, from the influx of migrants;	✓	✓	✓	• Keep records of meetings held with potential external partners. Minutes to be spot-checked by senior Tullow representative. • Assist with monitoring the impact of newcomers on the local schools and clinics through on-going consultation with local authorities, teachers and clinic staff. • Informally monitor extent of actions taken by Ministries of Education and health.	• Once during planning • Once during construction • Twice yearly during operation • Monthly as part of the Community Engagement Plan • As required	Tullow	Section 8.3.1	Community Engagement Plan
		• Partner with the relevant authorities to assess the types and quantities of waste generated from the villages. Work together to identify and implement mechanisms for managing waste. This will alleviate the additional indirect pressure of increased waste generation;	✓	✓	✓	• Keep records of meetings held with potential external partners. Minutes to be spot-checked by senior Tullow representative. • Records of management plans and progress reports outlining delivery of outputs.	• Once during planning • Once during construction • Twice yearly during operation • Continue to record and manage annually	Tullow	Section 8.3.1	Community Engagement Plan

		• provide higher quality drinking water to communities; and	✓	✓	✓	• Keep records of meetings held with potential external partners. Minutes to be spot-checked by senior Tullow representative.	• Once during planning • Once during construction • Twice yearly during operation	Tullow	Section 8.3.1	Community Engagement Plan
		• support local policing activities.	✓	✓	✓	• Keep records of meetings held with potential external partners. Minutes to be spot-checked by senior Tullow representative.	• Once during planning • Once during construction • Twice yearly during operation	Tullow	Section 8.3.1	Community Engagement Plan
7.5		Upgrade and maintain transport routes in the area that are used by project vehicles. EPS vehicles to use specified routes so as to limit impacts to local roads, which will be surfaced and managed by Tullow.	✓	✓	✓	• Monitor the condition of the roads, and provide written assurance to local government that roads are being maintained to agreed standards. • Spot checks to be carried out to ensure that drivers are only using specified routes.	• Monthly • Spot check on weekly basis during planning and construction and monthly during operation	Tullow	Section 8.3.1	

7.6		Tullow will plan early and continually for closure. It will communicate these plans and the timings to relevant authorities. Tullow will place emphasis on identifying CSI projects that meet the needs of the local communities and boost potential for the area to survive and thrive post-closure.		✓	✓	• Records of planning meetings to be available, specifically noting key decisions. • Closure Plan to be drafted	• From beginning of operation and ongoing throughout operation • After first year of operation	Tullow	Sections 8.3.1 and 9.6	Closure Plan

Impact: Changes to Social and Cultural Make-up of Local Communities										
7.7	To limit, where possible, negative impacts on community and individual social and cultural norms resulting from indirect project-related activities, and to do this in such a way that does not infringe on the human rights of local residents, EPS contractors and employees.	Develop and implement induction programmes, including a Code of Conduct (CoC), for all newcomers directly related to the project. Code to include the following: • Respect for local residents and customs. • Zero tolerance of bribery or requesting gifts from villages. • No hunting, fishing or unauthorised gathering of products. • Zero tolerance of illegal activities by construction personnel including: unlicensed prostitution; illegal sale or purchase of alcohol; sale, purchase or consumption of drugs; illegal gambling or fighting. • No use of camp vehicle for non-work business. • No access to camps by non-authorised personnel. • No purchase of goods or services at camp gate. • No alcohol and drugs policy (in and out of work hours). • Description of disciplinary measures for infringement of the Code and camp rules. • Road speed limits (10% lower than legally required). Code of Conduct to be developed in the form of posters and distribute to all villages.	✓	✓	✓	• Provide local government (LC1) with the opportunity to input into and/or review cultural sensitivity component of induction programme, as well as CoC. • A senior staff member to carry out spot check attendance at induction programme to assess whether appropriate information is being provided to recruits. • Consult on the effectiveness of their CoC, as part of their Community Engagement Plan. • Review and update as required.	• Prior to arrival of recruits and annually during operation to discuss and make required changes • Spot checks carried out randomly but at no less than 50% of induction programmes during construction and 30% during operation • Twice during construction and quarterly as part of CEP during operation. • Annually	Tullow	Section 8.3.2	Code of Conduct (CoC)

7.8		Establish and implement a grievance procedure that is easily accessible to local villagers, through whom complaints related to contractors or employee behaviour can be lodged and responded to. Response must be in a serious manner. Key steps include: • Circulation of contact details or other key contact within local villages • Awareness raising among local villages regarding the procedure and how it works. • Establishment of a grievance register	✓	✓	✓	• Spot check on distribution of contact details of 'grievance officer' or other key contact, notification of grievance of procedure to local residents, and levels of understanding among local residents of how the procedure works. • Spot check follow-up of grievances recorded, to assess whether complaints have been adequately addressed and within the agreed timeframe.	• Once during planning • Once during construction • 6-monthly during operation	Tullow	Section 8.3.2	Grievance procedure
7.9		As above in 7.1	✓	✓	✓	As above in 7.1	As above in 7.1	Tullow	Section 8.3.1 and 8.3.2	Community Engagement Plan

Impact: Increase in Social Ills										
7.10	To limit, where possible the social pathologies brought about by the rapid pace of change in the project area, as brought about by the development of the EPS.	As above in 7.7	✓	✓	✓	As above in 7.7	As above in 7.7	Tullow	Section 8.3.3	Code of Conduct
7.11		Develop and implement an HIV/AIDS programme, in association with local health providers, addressing factual health issues as well as behaviour change issues around the transmission and infection of HIV/AIDS as well as other communicable diseases. This programme will be implemented amongst contractors, employees and local residents, and will include making condoms available to employees, contractors and local communities.	✓	✓	✓	• Appoint a specialist to confirm the suitability and accuracy of the HIV/AIDS awareness programme prior to its roll-out. • Carry out spot check attendance at an HIV/AIDS awareness activity to assess whether: 1. the programme is reaching the required target group; and 2. appropriate information is being provided to stakeholders. • Solicit feedback on the suitability of the HIV/AIDS programme as part of the CEP.	• Prior to construction phase • Twice during construction and 6-monthly during operation • On-going	Tullow	Section 8.3.3	HIV/AIDS programme
7.12		Seek to initiate, prior to construction, and maintain relationships with local health providers such that they can monitor changes in levels of community health and wellbeing. If necessary, Tullow seek to support local social welfare/social worker positions to assist people affected by HIV/AIDS.	✓	✓	✓	Minutes of all meetings held with local health care providers to be submitted to relevant management for assessment	Minutes to be reviewed and responded to when submitted	Tullow	Section 8.3.3	

7.13		As above in 7.8	✓	✓	✓	As above in 7.8	As above in 7.8	Tullow	Section 8.3.2 and 8.3.3	Grievance Procedure
7.14		As above in 7.1	✓	✓	✓	As above in 7.1	As above in 7.1	Tullow	Section 8.3.1 and 8.3.3	Community Engagement Plan
Impact: Potential Tension and Conflict Between Villages										
7.15	To limit possible tension and conflict between affected villages that may arise as a result of competition for Tullow resources or perceived unequal and unfair distribution of benefits.	Ensure that, wherever possible, the affected stakeholders will receive access to opportunities in terms of local recruitment, training, procurement and community outreach programmes. This will be achieved through Tullow's: • Recruitment policy (to be developed during planning) – see Table 6.1; • Local procurement policy (to be developed during planning) – see Table 6.7; • Commitments to enhancement/upgrade of skills through training programmes – see Table 6.11; and • CSI Programme (policy and objectives to be defined during planning and reviewed annually).	✓	✓	✓	Review of employment records, local suppliers, list of trainees, and beneficiaries of CSI Programmes to ensure that there is an even distribution of unskilled labour from the nine villages wherever possible.	Monthly	Tullow	Section 8.2.1; 8.2.2; 8.2.3 and 8.3.4	Recruitment Policy Local Procurement Policy Community Social Investment Programme

7.16		Wherever possible, benefits will be evenly spread throughout all nine villages in the Kaiso-Tonya Valley. This policy will be clearly communicated to the LC1 community leaders for each of the villages.	✓	✓	✓	• Review of labour records to assess spread of labour sourced from the different villages within the Valley. • Assess LC1 community leader and local residents understanding of Tullow's policy to provide equal opportunity to all nine villages in the Valley. To be done as part of the CEP.	• Monthly during construction • Quarterly during operation • Twice during construction	Tullow	Section 8.3.4	
7.17		As above in 7.8	✓	✓	✓	As above in 7.8	As above in 7.8	Tullow	Section 8.3.2 and 8.3.4	Grievance Procedure
7.18		As above in 7.1	✓	✓	✓	As above in 7.1	As above in 7.1	Tullow	Section 8.3.1 and 8.3.4	Community Engagement Plan
Impact: Restricted Movement										
7.19	To minimise the level of disruption to people's movements during the course of construction of the EPS and associated infrastructure (most specifically the pipelines)	Ensure that reasonable alternatives are provided where disruption is unavoidable, particularly across roads.	✓	✓		Carry out spot checks of measures put in place to ensure that traffic and movement is not unduly interrupted	Weekly during construction	Tullow	Section 8.3.5	
7.20		As above in 7.8	✓	✓	✓	As above in 7.8	• Once during planning • Once during construction	Tullow	Section 8.3.2 and 8.3.5	Grievance Procedure
7.21		As above in 7.1	✓	✓	✓	As above in 7.1	• Once during planning • Once during construction	Tullow	Section 8.3.1 and 8.3.5	Community Engagement Plan

Impact: Broadened Knowledge Base and World View										
7.22	To participate in enhancing the knowledge base of the area, such that the capacity of the local residents is strengthened	Implement skills development and training programmes, as part of CSI Initiatives, for residents within the Kaiso-Tonya Valley. To be done in association with relevant government departments Maximise local employment opportunities for the local residents through CSI initiatives	✓	✓	✓	• Determine whether programme policy and objectives have been set • Review meeting minutes of consultations with government • Review strategy, programme and indicators • CSI initiatives to be assessed against the CSI policy objectives	• Once-off at start of construction • Once-off at start of construction • Prior to operation • 6 monthly during operation	Tullow	Section 8.3.6	Community Social Investment Programme
Impact: Increase in Traffic and Associated Hazards										
7.23	To manage EPS traffic in such a way that negative impacts on public roads, and health and safety risks to local residents, contractors, employees and animals is reduced	Upgrade and surface any main routes used by EPS vehicles in the project area	✓		✓	• Carry out inspections and sign-off all roads identified for upgrade or surfacing • Check that quality of roads is maintained during construction and operation phases.	• Once during planning • When required during operation • Monthly during construction • Ongoing during operation	Tullow	Section 8.3.7	

7.24		Develop and implement a traffic management plan including strict controls over driver training, vehicle maintenance, speed restrictions, appropriate road safety signage, and vehicle loading and maintenance measures.	✓	✓	✓	• Review of traffic management plan to ensure it addresses traffic and associated hazards, and is fit for purpose • Review traffic management programmes and reports to ensure identified risks are addressed	• Once prior to construction • Six-monthly during operation	Tullow	Section 8.3.7	Traffic and Vehicle Management Plan
7.25		Ensure that reasonable alternatives are provided where disruption to traffic is unavoidable. This will assist in reducing inconvenience and risks to public road users.		✓	✓	Carry out spot checks of measures put in place to ensure that traffic and movement is not unduly interrupted	• Weekly during construction • As required during operation	Tullow	Section 8.3.7	
7.26		As above in 7.1	✓	✓	✓	As above in 7.1	As above in 7.1	Tullow	Section 8.3.1 and 8.3.7	Community Engagement Plan

Impact: Increase in HIV/AIDS and Sexually Transmitted Diseases (STDs) Prevalence										
7.27	• To assist in minimising the transmission and spread of HIV/AIDS and STDs amongst the local residents specifically, as well as amongst Tullow employees and contractors. • Partner with relevant government departments to deliver an HIV/AIDS programme that is supported by government and therefore has an increased chance of success.	Continue to implement, evaluate and adapt Tullow's HIV/AIDS programme ensuring that it remains relevant, proactive and meets the needs of the target audience.	✓	✓	✓	• Evaluate programme implementation to determine whether programme objectives are being met and still relevant to the needs of the target audience. • Adapt programme to realign with objectives and target audience needs	• Annually • As required following evaluation	Tullow	Section 8.3.8	HIV/AIDS and STDs Policy Statement
7.28		Tullow to establish partnerships between itself, government and relevant local and national organisations to address the requirements for proactive community health programmes, particularly focusing on HIV/AIDS, as a result of the in-migration to the Kaiso-Tonya Valley. The roles and responsibilities (financial and other) of the respective partners must be clearly defined.	✓	✓	✓	Keep records of meetings held with potential external partners. Minutes to be spot-checked by senior Tullow representative.	• Once during planning • Once during construction • Twice yearly during operation	Tullow	Section 8.3.8	

7.29		Tullow will finalise and implement an HIV/AIDS awareness programme amongst employees and contractors.	✓	✓	✓	• Appoint a specialist to confirm the suitability and accuracy of the HIV/AIDS awareness programme prior to its roll-out. • Carry out spot check attendance at an HIV/AIDS awareness activity to assess whether: - the programme is reaching the required target group; and - appropriate information is being provided to stakeholders. • Solicit feedback on suitability of the HIV/AIDS programme as part of the CEP.	• Prior to construction • Twice during construction • 6-monthly during operation • Ongoing during construction • Annually during operation	Tullow	Section 8.3.8	Internal HIV/AIDs Programme

7.30		All initiatives should address the symptoms as well as behaviour change issues around the transmission and infection of HIV/AIDS as well as other sexually transmitted diseases. Tullow should compare their current initiatives to best practice measures and make appropriate changes in order to strength their existing programme. The programmes will need to be developed and carried out in partnership with national, district and local health services, and will not be the sole responsibility of Tullow.	✓			• Compare Tullow's existing internal HIV/AIDS programme to best practice programmes and update Tullow's programme accordingly • Work together with identified partners to evaluate and update community HIV/AIDS programme	• During the planning phase • During the planning phase	Tullow	Section 8.3.8	
7.31		Given the lack of existing recreational activities, and the resultant impact on the spread of HIV/AIDS, Tullow will consult with the local communities to identify recreational activities for the residents. Tullow will implement the identified activities in the villages.				• Keep records of meetings with local communities. Minutes to be spot-checked by senior Tullow representative. • Documented plan for addressing this need. • Records of outputs delivered	• Ongoing	Tullow	Section 8.3.8	
7.32		As above in 7.1	✓	✓	✓	As above in 7.1	As above in 7.1	Tullow	Section 8.3.1 and 8.3.8	Community Engagement Plan

Impact: Increased Risk of Malaria Transmission										
7.33	To reduce the impact of the disease on the health of the employees/ contractors and affected communities to the lowest possible level	Ensure that the construction and operation conditions minimises the creation of mosquito breeding areas and that appropriate chemical control measures are utilised, where required		✓	✓	Regular checks of construction sites and completed facilities to ensure possible mosquito breeding areas are not created	• Weekly during construction • Monthly during operation	Tullow	Section 8.3.9	
7.34		Ensure that the employee accommodation is suitably fitted with control measures (e.g. screened windows and doors) to minimise mosquito/ human contact.	✓	✓	✓	Spot checks during construction and operation, and sign-off and payment for construction of accommodation only if structures are fitted with suitable control measures.	• During construction and once accommodation has been completed • Monthly during operation	Tullow	Section 8.3.9	
7.35		Ensure that all employees have access to mosquito repellent/malaria medication		✓	✓	Checks to be carried out on availability of and distribution of malaria medication	Monthly	Tullow	Section 8.3.9	
7.36		Make available early, accurate diagnosis and effective treatment		✓	✓	Checks to be carried out on availability and use of early, accurate diagnosis and effective treatment	Monthly	Tullow	Section 8.3.9	
7.37		Partnering and collaboration in community programs with key external stakeholders to ensure community co-operation and correct implementation of Malaria control measures		✓	✓	Solicit feedback on levels of awareness and implementation of malaria protection by local residents, as part of the CEP.	On-going as part of community engagement activities	Tullow	Section 8.3.9	Community Engagement Plan

Impact: Increased Security Risks and Associated Fears Relating to Oil Activity										
7.38	To minimise (where possible) the safety and security risk posed by the EPS and associated activities on the local villages.	Play a role in ensuring that village residents are proactively informed of any safety or security risks that may arise relating to the EPS and associated activities. This will be done as part of the CEP – see 7.1 above.	✓	✓	✓	As above in 7.1	As above in 7.1	Tullow	Section 8.3.1 and 8.3.10	Community Engagement Plan
7.39		Encourage government to give due consideration to the implications of any security measures that may be imposed (e.g. the implications related to the ban on night fishing)	✓	✓	✓			Tullow	Section 8.3.10	
Impact: Change in Character from Natural to Disturbed Landscape and Changed 'Sense of Place'										
7.40	To minimise the visual impact during the construction and operation phases Wherever possible, to limit any negative changes in sense of place, whilst enhancing the positive impacts of such a change.	Limit the footprint(s) of the proposed development areas to the minimum possible	✓			Checks of compliance against agreed footprint area	On-going during construction	Tullow	Section 8.6.1	
7.41		Ensure siting of facilities is related to environmental resilience and visual screening capabilities of the landscape	✓			Final EPS design	Once final EPS design complete	Tullow	Section 8.6.1	
7.42		Ensure that landform features, particular skylines, view sites and site lines are preserved	✓			Final EPS design	Once final EPS design is completed	Tullow	Section 8.6.1	
7.43		Ensure that the built form and screening of the development takes into account views from the surrounding areas	✓	✓		• Final EPS design • Visual inspection	• Once final EPS design is completed • After construction is complete	Tullow	Section 8.6.1	
7.44		Building materials used should be compatible with the prevalent materials in terms of colour, texture and scale	✓			Final EPS design	Once final design is complete	Tullow	Section 8.6.1	

7.45		Fence or clearly demarcate the areas that construction activity may disturb (to be agreed with the Environmental Control Officer (ECO) or person responsible) so that the limitation is visible to all working on the site(s)	✓			• Check of all construction areas for required fencing (sign-off required). • Ongoing spot checks throughout construction.	• Prior to construction • Every 2 weeks	Tullow	Section 8.6.1	
7.46		Limit clearing of vegetation only to what is necessary. Discussions to be held with contractors in this regard, with written agreements regarding extent of clearance allowed	✓	✓		On-going checks of vegetation clearance, to ensure compliance with agreed extent of clearance	Spots checks every 2 weeks.	Tullow	Section 8.6.1	
7.47		Ensure that existing established vegetation patterns that contribute to the character of the site are maintained. Any new planting should be compatible with the character of the area	✓	✓	✓	Ad hoc checks that vegetation patterns are being maintained and new planting is consistent	On-going (when new planting is required)	Tullow	Section 8.6.1	
7.48		Electrical substations, metre boxes and telephone lines should be as unobtrusive as possible	✓	✓		• Final EPS design • Visual inspection	• Once final design is complete • After construction	Tullow	Section 8.6.1	
7.49		Locate satellite dishes and television aerials without detracting from important features of the site	✓	✓		• Final design • Visual inspection	• Once final design is complete • After installation	Tullow	Section 8.6.1	
7.50		Outbuildings and parking areas should be designed to conform as closely as possible to existing patterns. Materials used should be compatible with those of the buildings and architectural style should be appropriate	✓			• Final design • Visual inspection	• Once final design is complete • Once construction completed	Tullow	Section 8.6.1	

7.51		Plan layout EPS and associated infrastructure such that most, if not all, of the trees in the disturbed area are retained – high priority and vulnerable trees i.e. near construction activities to be protected by clear identification signage or markings and where necessary putting fencing around them. In some cases valuable trees may need to be physically relocated.	✓			• Check that all trees identified for fencing have been suitably fenced off (sign-off required) • Spot checks throughout construction to ensure that trees are being protected	• Once prior to construction • Monthly during construction	Tullow	Section 8.6.1	
7.52		Limit dust when necessary by regular watering of disturbed surfaces or implementing surfactants such as 'Dustex' which reduces dust on roads		✓	✓	Spot check for watering of disturbed surfaces	Weekly	Tullow	Section 8.6.1	
7.53		As above in 7.1 and 7.15	✓	✓	✓	As above in 7.1 and 7.15	As above in 7.1 and 7.15	Tullow	Section 8.6.2	
7.54	Reduce the visibility of the power plant stacks, topping unit and other built components so that visual intrusion on the scenic resources, the Kabwoya Wildlife Reserve, the tourists and local residents are reduced	Use minimum lighting, and prevent light spill using down lighting limited to the proposed EPS and associated infrastructure, and do not use spot lights that light up beyond the areas that actually require lighting		✓	✓	Ad hoc checks that agreed nature of the lighting is being maintained	On-going	Tullow	Section 8.6.1	
7.55		As above in 7.49			✓	As above in 7.49	As above in 7.49	Tullow	Section 8.6.1	
Impact: Impact on Tourism and Tourism Potential in the Valley										
7.56	To minimise the impact on tourism activities in the Valley as directly related to the visual impact of the proposed EPS and associated infrastructure.	Negotiate a common way forward for the management of the tourism/ecotourism operations within the Kabwoya Wildlife Reserve with the Uganda Wildlife Authority and existing concessionaires	✓			Discussions with UWA and existing concessionaires of the Kabwoya Wildlife Reserve	Prior to construction	Tullow	Section 8.6.3	Conservation Management Plan
7.57		As above in 7.40, 7.41, 7.42, 7.43, 7.44, 7.45, 7.46, 7.47, 7.48, 7.49, 7.50, 7.51, 7.52, 7.1 and 7.15	As above			As above in 7.40, 7.41, 7.42, 7.43, 7.44, 7.45, 7.46, 7.47, 7.48, 7.49, 7.50, 7.51, 7.52, 7.1 and 7.15	As above in 7.40, 7.41, 7.42, 7.43, 7.44, 7.45, 7.46, 7.47, 7.48, 7.49, 7.50, 7.51, 7.52, 7.1 and 7.15	Tullow	Section 8.6.1 and 8.6.3	

ID	Mitigation Objective	Mitigation Measure/ Action	Timing			Monitoring Measure	Timing	Responsibility	EIA Reference	Additional Tullow Documentation
			Planning	Construction	Operation					
Impact: Long-Term Effects on Fossiliferous Sites During Construction Phase										
8.1	To minimise the damage to fossiliferous sites To record and preserve all of the fossils and artefacts on the site of the proposed EPS and associated infrastructure	Appoint suitably qualified /experienced person/ archaeologist to be present on site during site clearance of EPS and associated infrastructure and should any potential fossiliferous sites be identified the Archaeologist should make recommendations on the way forward		✓		Suitably qualified archaeologist present on site	Ongoing	Tullow	Section 8.4.1	
8.2		If chance finds occur of fossiliferous and/or archaeological artefacts, stop work and inform Commissioner of Antiquities and follow legislated or best management procedure as required		✓	✓	Archaeologist's site records	Ongoing	Tullow	Section 8.4.1	
8.3		Arrange for archaeologists, in collaboration with the Uganda Museum, to salvage identifiable material and detail the finds recorded by: i) recording stratigraphy (excavated section); ii) recording inter-site spatial distribution (by means of a reasonable number of test pits); and iii) investigating dating possibilities		✓	✓	Records of finds	Ongoing	Tullow	Section 8.4.1	

ID	Mitigation Objective	Mitigation Measure/ Action	Timing			Monitoring Measure	Timing	Responsibility	EIA Reference	Additional Tullow Documentation
			Planning	Construction	Operation					
Impact: Noise Impact During the Day and Night										
9.1	Noise emissions must not cause the ambient noise level to rise by more than 3 dBA at the nearest habitation	All designs must include from the start the objective to minimise the noise emissions from a particular process of piece of equipment	✓			Final EPS design	On completion of final EPS design	Tullow	Sections 8.5.1 8.5.2	Ugandan Statutory Instruments (1) South African National Standards (2) WHO Guidelines (3)
9.2		All diesel-powered equipment is to be of high quality and well maintained		✓	✓	Community response	On-going	Tullow	Sections 8.5.1	See above
9.3		Regular maintenance schedules shall include the checking of noise levels and the inspection and replacement if necessary of intake and exhaust silencers		✓	✓	Community response	On-going	Tullow	8.5.2	See above
9.4		A change in the noise emission characteristics of a piece of equipment shall serve as an indication for withdrawing it for inspection and maintenance purposes		✓	✓	Community response	On-going	Tullow	Sections 8.5.1	See above

(1) Statutory Instruments 2003 No. 30, The National Environment (Noise Standards Control), 2003, Statutory Instruments Supplement No. 15 to the Uganda Gazette No. 27, Volume XCVI of 13th June 2003.
(2) South African National Standards SANS 1013:2004 'The measurement and rating of environmental noise with respect to land use, health, annoyance and to speech communication', Edition 5.1.
(3) Guidelines for Community Noise, World Health Organisation (WHO), Geneva, 1999.

Annex A

Monitoring

A1 MONITORING

A1.1 AIR QUALITY

A1.1.1 Emissions Monitoring

It is recommended that an emissions monitoring program is included in the Environmental Management Plan (EMP) for the proposed EPS to support air quality management and to improve future modelling exercises. Such a program should include the following:

- The development of a comprehensive emissions inventory including:
  - Detailed characterisations of all point and fugitive sources;
  - Emission rates from all pollutants from hydrocarbon processing and power generation. These should include, but not be limited to the following:
    - Sulphur dioxide (SO_2);
    - Oxides of nitrogen (NO and NO_2);
    - Particulate matter;
    - BTEX (benzene, toluene, ethylbenzene and xylene);
    - Carbon monoxide (CO); and
    - Carbon dioxide (CO_2)
  - The information requirements of the emissions inventory which are detailed in *Table 1.1* and *Table 1.2*.
- The establishment of an emissions measurement programme, either by the installation of on-line monitoring equipment, routine measurement using recognised methodologies, e.g. in-stack sampling, or through recognised engineering principles such as mass-balance calculations. These measurements should be conducted at least annually and be used to maintain a representative emissions inventory.

A1.1.2 Meteorological Monitoring

Meteorological monitoring is currently undertaken at the Kyehoro Seismic Camp and at the National Lake Rescue Institute. Rainfall, temperature, humidity and atmospheric pressure are measured. On-going meteorological monitoring is recommended, the following needs to be taken into account in respect to this monitoring:

- The monitoring program is maintained for life of the proposed EPS;
- The current capabilities are expanded to include the measurement of solar radiation and the standard deviation of wind direction. Both these parameters may be used as proxy for atmospheric stability and provide valuable input in the absence of upper air meteorology;
- A routine maintenance program is introduced to prevent or minimise the extent of periods of data loss;
- To ensure a higher level of confidence in the data, the following should occur:

- Sensors are calibrated annually; and
- A data quality control program is introduced.

A1.2 AMBIENT AIR QUALITY MONITORING

It is necessary to improve on the current understanding of ambient air quality in the Kaiso-Tonya Valley and to measure the impact of emissions of the proposed EPS on ambient air quality. It is therefore recommended that an ambient air quality monitoring programme is instituted and the following are considered:

- The monitoring program is instituted as soon as possible in order to develop a reasonable record of air quality in the Kaiso-Tonya Valley before the EPS is operational;
- Monitoring is conducted for sulphur dioxide (SO_2), oxides of nitrogen (NOx), particulate matter with a diameter les than 10 μm (PM_{10}) and the four VOC compounds that are most commonly associated with hydrocarbon production, i.e. benzene, toluene, ethylbenzene and xylene;
- A network of monitoring sites is established that includes monitoring stations in the following areas identified by the dispersion modelling:
  - Two sites within 2 km of Site 1C, one to the west and the second to the south;
  - Two sites on the escarpment, approximately 10 km from Site 1C with the first to the northeast and the second to the southeast;
  - Two monitoring sites located to provide information on the background air quality with one beyond the escarpment ridge in the vicinity of TAPM station 3604 (See Figure 6.5 in the main report for location of this station) and the second to the north at the Lake Rescue Institute at Kaiso; and
- It is recommended that passive sampling is conducted initially at all of the sites proposed above. It is recommended that real time gas and particulate analysers are used at the two near-field sites once the proposed EPS becomes operational.

Table 1.1 Point Source Characteristics of the Proposed EPS

TAG No.	Description	Stack height (m)	Stack diameter (m)	Stack base-height elevation (m)[2]	Emission temp (K)	Emission exit velocity (m/s)	Gas flow rate (Nm^3/h)
200-H-3211	Train 1 - Column Inlet Heater	20	0.5	752	650	21.22	15,000
200-H-3221	Train 2 - Column Inlet Heater	20	0.5	752	650	21.22	15,000
200-H-5602	Heating Medium Suppl. Fired Heater	20	0.8	752	500	55.26	100,000
200-A-8001-A	Main Power Generator 1 (Dual Fuel Capability)	22	1.4	753.5	413[1]	16.24	90,000
200-A-8001-B	Main Power Generator 2 (Dual Fuel Capability)	22	1.4	753.5	413[1]	16.24	90,000
200-A-8001-C	Main Power Generator 3	22	1.4	753.5	413[1]	16.24	90,000
200-A-8001-D	Main Power Generator 4	22	1.4	753.5	613	16.24	90,000
200-A-8001-E	Main Power Generator 5	22	1.4	753.5	613	16.24	90,000
200-A-8001-F	Main Power Generator 6	22	1.4	753.5	613	16.24	90,000
200-A-8001-G	Main Power Generator 7	22	1.4	753.5	613	16.24	90,000
200-A-8001-H	Main Power Generator 8	22	1.4	753.5	613	16.24	90,000

NOTE 1: 3 generators are assumed to operate with waste heart recovery units which reduces the exhaust temperature
NOTE 2: The construction platform is assumed to be 748 m amsl.

Table 1.2 Emission Rates for a Range of Pollutants in g/s for the Point Sources of the proposed EPS

Description	Fuel	Fuel Requirement (kg/h)	Emission Rates (g/s)					
			NO_x[1]	CO	SO_2[1]	CH_4	PM (Total)[1,2]	CO_2
Train 1 - Column Inlet Heater	Gas	114.04	0.03	0.05	0.00	0.00	0.00	56
Train 2 - Column Inlet Heater	Gas	114.04	0.03	0.05		0.00	0.00	56
Heating Medium Suppl. Fired Heater	WHRUs On Line	0.00	0.00	0.00	0.00	0.00	0.00	0
Main Power Generator 1 (Dual Fuel Capability)	Dual Fuel	1256.53	18.65	8.03	0.02	5.31	0.08	800
Main Power Generator 2 (Dual Fuel Capability)	Dual Fuel	0.00	0.00	0.00	0.00	0.00	0.00	0
Main Power Generator 3	Heavy Fuel Oil	1431.50	14.52	6.50	0.95	0.69	0.76	1,261
Main Power Generator 4	Heavy Fuel Oil	1431.50	14.52	6.50	0.95	0.69	0.76	1,261
Main Power Generator 5	Heavy Fuel Oil	1431.50	14.52	6.50	0.95	0.69	0.76	1,261
Main Power Generator 6	Heavy Fuel Oil	1431.50	14.52	6.50	0.95	0.69	0.76	1,261
Main Power Generator 7	Heavy Fuel Oil	1431.50	14.52	6.50	0.95	0.69	0.76	1,261
Main Power Generator 8	Heavy Fuel Oil	1431.50	14.52	6.50	0.95	0.69	0.76	1,261

A1.3 SURFACE AND GROUNDWATER

The following recommendations are made with respect to further baseline monitoring:

- Installation of monitoring wells up gradient and down gradient of leachate producing facilities in order to assess the baseline conditions close to EPS facilities at locations where contamination could occur, i.e. discharge points, storage and handling of chemicals, waste and hydrocarbons;
- Shallow and deep boreholes close to the lake, to determine and characterise the interaction between the shallow and deeper aquifer systems;
- Monitoring of groundwater levels in all monitoring and abstraction wells before groundwater abstraction commences in order to obtain baseline groundwater levels;
- Monitoring of water quality and discharge in Hohwa River at locations upstream and downstream of the site; and

A1.3.1 Development of a Groundwater Monitoring Network

The following recommendations are made with respect to performance monitoring during construction and operations:

- A groundwater monitoring program should be developed in order to detect any adverse water quality and quantity impacts quickly. Monitoring boreholes should be installed in close proximity of hydrocarbon abstraction and water re-injection wells, discharge locations and storage and chemical handling areas. Furthermore monitoring wells should be installed close to abstraction wells and further apart in order to monitor the extent of the groundwater drawdown cone as a result of groundwater abstraction. Monitoring should take place bi-annually, once during wetter and once during drier season.
- A surface water monitoring program should be developed in order to detect any adverse water quality and quantity impacts in time. Discharge measurements should take place in Hohwa River at locations upstream and downstream of the site.
- A post construction audit of the site, prior to the operational stage should be conducted in order to identify construction phase impacts on soil due to hydrocarbon spills and / or potential runoff of spilled material; and impacts on ground- and surface water due to sewage and waste disposal. Soil sampling of impacted areas for volatile, metal, phenols and Diesel Range Organics (DRO) components should be undertaken. Groundwater and surface water monitoring of the surrounding area should take place to monitor water quality and levels to identify whether groundwater and/or surface water has been impacted during the construction phase.
- A wastewater and water quality monitoring program should be developed that considers monitoring parameters that should be indicative of the pollutants of concern. Furthermore monitoring type, frequency, location and data quality should be considered in the monitoring program.

Monitoring location should be selected at discharge points, waste management facilities, as well as at strategic upstream locations;

- Monitoring programs should apply internationally approved methods for sample collection, preservation and analyses. Sampling and analyses quality assurance and quality control (QA/QC) plans should be implemented and QA/QC documentation should be included in the reports.

A1.3.2 Sampling Protocols and Quality Control

Quality Control

A rigorous programme of field quality assurance and quality control (QA/QC) has to be implemented, including sample labelling, duplicate samples and chain of custody documentation. Following sample labelling in the field, all samples must be transferred to insulated coolers containing frozen ice packs. These samples then need to be dispatched to the laboratory by courier. Analysis for inorganics and metals need to be carried out by an accredited laboratory in South Africa, i.e. M&L Inspectorate and all organic samplie analysis, i.e. VOC, DRO by an accredited laboratory, eg *TES Bretby* located in the United Kingdom.

As part of the overall sampling, QA/QC package chain of custody travel documents need to be completed for each sample. This will allow tracking of the samples from acquisition through to analysis. These forms are enclosed in the sample coolers shipped to the laboratory.

Water Level Measurement

Monthly water level measurements need to be collected at each monitoring location.

The following method is to be applied when taking a manual water level reading:
At each borehole it is necessary to take a manual reading of the static water level before any downloading is carried out. This is done using a dip meter.

- Switch the dip meter on with the switch / button at the side of the device.
- Lower the probe into the borehole and allow the tape to unwind slowly.
- A loud continuous beep is heard when the probe makes contact with the water.
- Draw the probe up by winding in the tape.
- Take the measurement as the noise (continuous beep) stops (i.e. the surface of the water).
- The measurement must be recorded from the top of the borehole casing.

Always wind up the dip meter carefully so the wire running through the tape does not get twisted and damaged.

General Sampling and Decontamination Procedures

Prior to the collection of the groundwater samples, the standing water from each of the monitoring wells need to be removed to ensure that the sample collected was representative of the groundwater. The pre-existing monitoring wells would have been developed following their installation and consequently only three well volumes need to be purged from each location to ensure that all stagnant water from the installation had been replaced with fresh aquifer water. The groundwater dip data and well volume information will be calculated for each of the monitoring borehole.

The purging and collection of samples from the monitoring wells will be facilitated using a new disposable hand bailer, or a whale or Grundfos MP20 pump with disposable tubing, at every location to prevent the cross contamination of samples.

Samples for inorganic analysis are collected in 1 litre bottles, without preservation. Samples for metal analyses are filtered in the field using a membrane filter system fitted with 0.45 μm aperture filters to remove all suspended materials. Water samples are collected in clean bottles obtained from the laboratory and kept cool before they were transferred to the laboratory. These samples are then transferred to bottles that were preserved with nitric acid (HNO_3) for transport to an accredited laboratory.

The sample jars will be filled to minimise aeration of the groundwater in the case of VOC and DRO samples, after which samples will be transferred immediately to cooler boxes containing pre-frozen ice bricks.

During sampling and decontamination activities, disposable nitrile gloves will be worn to minimise transfer of contaminants. Any disposable equipment, such as nitrile gloves and single used bailers will be dedicated to a sampling location and disposed of after use.

Constituents to be analysed for

The analytical schedule for inorganic and metal analyses should include the following constituents:

- Aluminium as Al;
- Boron as B;
- Cadmium as Cd;
- Calcium as Ca;
- Total Chromium as Cr;
- Magnesium as Mg;
- Manganese as Mn;
- Sodium as Na;
- Potassium as K;
- Iron as Fe;
- Copper as Cu;

- Zinc as Zn;
- Lead as Pb;
- Nickel as Ni;
- Silicon as Si;
- Ammonia as $NH_{4;}$
- Fluoride as F;
- Chloride as Cl;
- Nitrate as $NO_{3;}$
- Sulphate as $SO_{4;}$
- Phosphate as $PO_{4;}$
- Arsenic as As;
- Selenium as Se;
- Strontium as Sr;
- Barium as Ba;
- Total Mercury as Hg; and
- Uranium as U.

For PAH and DRO, full scans needs to be requested at detection limits low enough to satisfy WHO drinking water quality guideline levels.

Data Collation and reporting

All monitoring data needs to be collated into an Access data base on a monthly basis. The data will be forwarded to Ugandan Water Affairs once a year with an annual monitoring report.

The annual report will address the following:

- Water level changes across the EPS;
- Groundwater quality changes across the EPS; and
- Recommendations for improved management options.

Annex B

Waste Management Options at the EPS

B1 WASTE MANAGEMENT OPTIONS AT THE EPS

B1.1 AVOIDANCE

B1.1.1 Cleaner Production and Cleaner Technology

The planning phase provides an important opportunity for the introduction of clean production and the use of cleaner technologies both during the construction and operation of the facility.

Cleaner Production is defined as the *continuous application* of an *integrated preventative* environmental strategy to processes, products and services to reduce the risks to humans and the environment. For production processes, Cleaner Production includes *conserving* raw materials and energy, *eliminating* toxic raw materials, and *reducing* the quantity and toxicity of all emissions and wastes *before* they leave a process. Cleaner Production, for operating plants, is the application of the principles of waste minimisation to production process and would form a major part of a company's Environmental Management System.

A cleaner technology can be defined as:
"*A technological process that produces less waste and fewer polluting by-products*"
or
"*Production processes or equipment with a low rate of waste production and/or high levels of resource efficiency*"

For new plants, the choice of a cleaner technology begins with the design of process, i.e. eliminate problems rather than fix them later:

- Better control of chemistry;
- Eliminate waste at source;
- Less and cleaner fuels;
- Minimise waste and off-spec products;
- Avoid abnormal situations;
- Extremes of operating conditions and their control must be well understood;
- Internal treatment: capture, concentrate, recover;
- End of pipe treatment: treat effluents and wastes in dedicated facilities;
- Storage of input materials, intermediates, products and wastes; and
- Study total impact including emergency situations, e.g. high rainfall conditions, spills, accidents (including transport of materials).

It is important to recognise that it is better to identify the key pollution impacts while the plant is being designed and to put in place the technologies and systems to control and/or prevent them, as retrofitting will almost certainly result in significant additional costs.

A number of standards are used for the selection of an appropriate technology [Barnard, 1999]:

- BAT: Best Available Technology
- BDAT: Best Demonstrated Available Technology
- BATNEEC: Best (proven) Available Technology Not Entailing Excessive Cost
- BPEO: Best Practicable Environmental Option (See definition and discussion below)
- BPM: Best Practicable Means

BPEO, which has been adopted by South Africa and many other countries, is defined as:
'*The outcome of a systematic consultative decision making procedure that emphasises the protection of the environment across land, air and water: it establishes, for a given set of objectives, the option that provides the most benefit or least damage to the environment as a whole and at acceptable cost both in the long term as well as the short term*'.

Note that BPEO takes a holistic view of the environment in that introduction of a technology to minimise the effect on one resource should not lead to an unacceptable impact on another. An example is the introduction of gas cleaning equipment to reduce air pollution, which results in the formation of liquid and/or solid products, which usually have to be disposed as waste. The disposal of these gas cleaning residues should not have a high impact on water and land resources, such that this negates the advantages obtained by reducing air emissions. Note that pollutants emitted into the air tend to be dispersed over a large area, whereas disposal of a liquid and/or solid waste tends to have a more localised impact. The quantification of these different environmental impacts and, therefore, making a choice of the most appropriate technology can be difficult. In addition, the BPEO approach requires the technology to be at acceptable cost not only to the company but to society as a whole.

B1.1.2 Waste Minimisation

The most important approach used internationally for the management of chemicals and hazardous and general waste is the prevention or minimisation of its generation. This approach was adopted internationally at the Rio Summit (UN, 1992) in which one of the overall targets is '*the prevention or minimisation of the generation of hazardous wastes, as part of an overall integrated cleaner production approach*'.

Waste Minimisation is the key component of an Integrated Waste Management Programme applied to a production facility and includes conformance to the waste hierarchy given in *Figure 1.1* in which lists in order of preference the approach that must be taken to the management of the waste.

Figure 1.1 Waste Hierarchy

According to the USA Environmental Protection Agency, waste minimisation is:

'Any action that reduces the volume or toxicity of a waste'

Waste minimisation, thus, includes waste avoidance or prevention; waste recycling, re-use and utilisation; plus many treatment technologies that can be applied to decrease the volume and the toxicity of a waste. These can include technologies such as incineration, solidification and stabilisation, and neutralisation and precipitation.

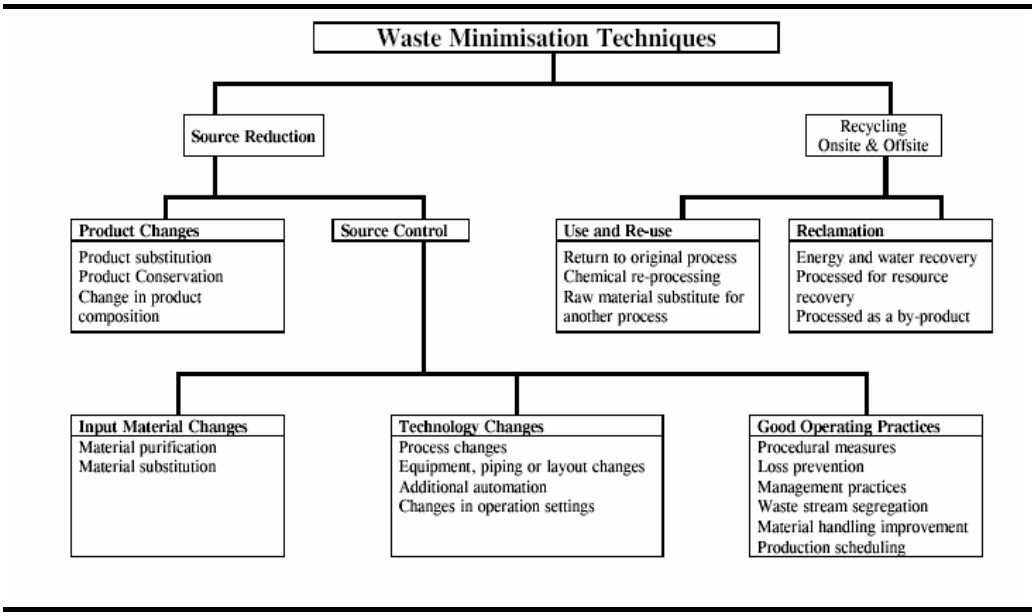
Waste Minimisation is the major strategy that a company can implement to control the environmental impact of chemicals and waste materials and the costs associated with waste management.

The UN is promoting the 3R Concept and Waste Prevention (UNEP, 2004). The concept of 3R refers to reduce, reuse and recycle and calls for an increase in the ratio of recyclable materials, further reusing of raw materials and manufacturing wastes and an overall reduction in resources and energy used. These ideas are applied to the entire lifecycle of products and services, from design and extraction of raw materials, to transport, manufacture, use, dismantling/reuse and disposal. Projects include waste minimisation in areas as diverse as dismantling of ships, e-waste, and the use of hexavalent chromium among others.

The best approach is to undertake a Waste Minimisation Audit during the development of the plant, where each point in the facility that can give rise to the generation of waste and possible environmental risks is identified and a plan put into place for the minimisation of waste generation. This audit can form part of the development of an Environmental Management System (EMS), such as ISO 14001, and can be included as part of an EMS audit. Various waste minimisation techniques are presented in *Figure 1.2*. Note that a key component of waste minimisation is avoidance and in any chemical processing plant, such as a refinery operation, good house keeping can decrease the amounts of waste significantly, i.e. don't spill a chemical or

product , ensure leaking valves or pipes are repaired or replaced; and separate non-hazardous and hazardous wastes.

Figure 1.2 Waste Minimisation Techniques



B1.1.3 Green Procurement

In this section, the approach to green procurement is briefly discussed. Green Procurement, which is '*the selection in the procurement (purchasing) process of environmentally less hazardous materials and services, which generate less waste during and after use*', is an important aspect of managing the Health Safety and Environmental (HSE) risks at any facility. This could involve:

- Procuring and requesting products and services that have less environmental impact,
- Taking account of the entire life-cycle of goods and services, design and engineering, purchasing and materials management, production, marketing and distribution and waste management within the company,
- Applying the principles of eco-efficiency through the sustainable use of resources, examples are:
  - Reduce the use of materials
  - Reduce energy use
  - Maximise sustainable use of renewable resources
  - Reduce the impact of potentially toxic materials and waste

Green procurement should for instance include purchasing of non-chlorinated degreasing solvents, mercury free thermometers for the clinic, and PVC-free plastic products or the substitution of plastic products that contain heavy metal dies or colouring, particularly for any wastes that may be incinerated. The process need not be restricted to hazardous materials, since one can select products with only the minimum packaging required, since this would result in less waste being generated. New initiatives clearly have to be balanced in relation to the functionality and cost effectiveness of the alternative products

and whether such products are readily available within Uganda.

For each hazardous substance, which is purchased and used at EPS, the following should be undertaken:

- The toxicity of the product must be determined and assessed and should this prove problematic then alternative, less hazardous / toxic products should, where feasible, be chosen.
- The disposal requirements should be ascertained and should these prove to be onerous and very costly, again other products, if available, should be sourced and used. Please note that one cannot take the suppliers information at face value and disposal requirements should be verified or confirmed with the disposal company or a waste management consultant.
- A sufficiently detailed MSDS (material safety data sheet) should be supplied with each product and kept on file. Material safety data sheets should be available for all hazardous materials used on the site. Often an MSDS supplied by a manufacturer will be written for USA or European requirements and not for Ugandan requirements, and may not properly describe the environmental impact of the material or give an adequate description of the disposal procedures required. For example, a statement such as "*Dispose according to Federal or State Regulations*" is clearly meaningless in Uganda. The MSDS for each material should be augmented with the additional and appropriate information, and should be in an ISO format.
- Personnel must be aware of the possibility of product and packaging deterioration over time and must manage this accordingly, e.g. the usage system should be FIFO (first in first out), or the volumes held in stock should be reduced, because demand is lower than may have been originally anticipated.
- Hazardous materials must be stored correctly with flammable wastes kept separately.
- Some hazardous materials cannot be replaced and an option is to require the supplier to take back any redundant product, used material or waste. Clearly, the supplier must be environmentally responsible and the waste material must be recycled, re-used, utilised or, at least, disposed of in an environmentally responsible manner.

A *preferred supplier of services* to the facility should be selected on the basis that they conform to acceptable environmental principles, particularly in terms of their hazardous materials management and waste management. Too often contractors leave their waste materials on site, which could then become the problem of the EPS, or utilise chemicals in a manner that is not acceptable. A service supplier should, if possible, be ISO 14001 rated or, at least, be implementing an acceptable environmental management system. This is particularly important for any waste management company that is selected.

B1.2 MINIMISATION OF OILY WASTES

Possible recycling, re-use and utilisation options for most wastes have been identified in Annex F of the EPS EIA. However, the major issue at the EPS will be the management of the oily wastes that are generated. Some may be disposed to landfill (see *Section B1.6*), although the most environmentally acceptable option is to recover as much as possible for recycling, re-use or utilisation.

B1.2.1 Oily Production Wastes

According to the US EPA (1995), there are a number of points in the refinery process, where solid and liquid waste can be avoided or minimised: some of these are mentioned below:

- **Regenerate or eliminate filtration clay** - Clay from refinery filters must periodically be replaced. Spent clay often contains significant amounts of entrained hydrocarbons and, therefore, must be designated as hazardous waste. Options for recovery of the clay include: back washing spent clay with water or steam can reduce the hydrocarbon content to levels so that it can be reused or handled as a non-hazardous waste; regenerate the clay by washing with naphtha, dry it by steam heating and then feed it to a burning kiln for regeneration; or by direct thermal treatment.
- **Reduce the generation of tank bottoms** -Tank bottoms from crude oil storage tanks constitute a large percentage of refinery solid waste and pose a particularly difficult disposal problem due to the presence of heavy metals. Tank bottoms are comprised of heavy hydrocarbons, solids, water, rust and scale. Minimisation of tank bottoms is carried out most cost effectively through careful separation of the oil and water remaining in the tank bottom. Filters and centrifuges can also be used to recover the oil for recycling.
- **Minimise solids leaving the desalter** -Solids entering the crude distillation unit are likely to eventually attract more oil and produce additional emulsions and sludges. The amount of solids removed from the desalting unit should, therefore, be maximized. A number of techniques can be used such as: using low shear mixing devices to mix desalter wash water and crude oil; using lower pressure water in the desalter to avoid turbulence; and replacing the water jets used in some refineries with mud rakes, which add less turbulence, when removing settled solids.
- **Minimise cooling tower blow-down** -The dissolved solids concentration in the re-circulating cooling water is controlled by purging or blowing down a portion of the cooling water stream to the wastewater treatment system. Solids in the blow-down eventually create additional sludge in the wastewater treatment plant. However, the amount of cooling tower blow-down can be lowered by minimising the dissolved solids content of the cooling water. A significant portion of the total dissolved solids in the cooling water can originate in the cooling water makeup stream in the form of naturally occurring calcium carbonates. Such solids can be controlled either by selecting a source of cooling tower makeup water with less dissolved solids or by removing the dissolved solids from the makeup

water stream. Common treatment methods include: cold lime softening, reverse osmosis, or electrodialysis.

- **Control of surfactants in wastewater** - Surfactants entering the refinery wastewater streams will increase the amount of emulsions and sludges generated. Surfactants can enter the system from a number of sources including: washing unit pads with detergents; cleaning tank truck tank interiors; and using soaps and cleaners for miscellaneous tasks. In addition, the overuse and mixing of the organic polymers used to separate oil, water and solids in the wastewater treatment plant can actually stabilise emulsions. The use of surfactants should be minimised by educating operators and by using dry cleaning, high pressure water or steam to clean oil surfaces of oil and dirt.
- **Thermal treatment of applicable sludge's** - The toxicity and volume of some de-oiled and dewatered sludge's can be further reduced through thermal treatment: see *Section B1.3.2*. Thermal sludge treatment units use heat to vaporize the water and volatile components in the feed and leave behind a dry solid residue. The vapours are condensed for separation into the hydrocarbon and water components.

B1.2.2 Used Oily Wastes from Mechanical Workshops

Any used oil recovered during vehicle maintenance can be drained and stored prior to sending for recycling or utilisation. Although this oil will have a different composition to oil recovered during the production operations due to the presence of additives, such as Zn or B, and will contain other heavy metals from the wear and corrosion of metal parts, the amounts will be small compared to the amounts handle during the production process. The option of managing this oil by simply adding it at some place during the production process should be considered. It will be important to ensure that the oil does not become contaminated with chlorinated hydrocarbons due to the use of certain types of degreasing solvent.

B1.3 TREATMENT OPTIONS FOR OILY WASTES

B1.3.1 General

The management of the problem oily wastes such as emulsions, oily sludges and solids, oily rags, filters, etc. can be undertaken at specific an oil waste management facility: see *Figure 1.3* Oily Waste Management Facility, which shows a facility at a large mining operation in South Africa. Note the skips are used to temporarily store the waste and the concreted and bunded areas are set aside for different waste streams.

Figure 1.3 Oily Waste Management Facility

In such a facility, the oil can be recovered using various techniques. One recent innovation is the thermal treatment of oily waste such as sludges, contaminated soil, oil filtration wastes, oily rags, etc.

B1.3.2 Thermal Treatment

A thermal de-sorption system is depicted in *Figure 1.4*, which removes organic contaminants from soil and wastes. The volatile oil components are volatilised and non-volatile components, including polycyclic hydrocarbons, are cracked to give more volatile species that are driven off and collected by condensation or, alternatively, converted to carbon dioxide by the presence of free or bound oxygen in the material. Oily rags and paper are carbonised and soil, sand and other items left completely free of organic contaminants. These mobile batch units can handle up to 12 tons of material over a period of 24 hours and are ideal for small operations such as the EPS that will include oily wastes that can have a high PAH content and which is located in a potentially environmentally sensitive area. These systems have proven highly successful in the Alaskan oil fields, where bio-treatment technologies are not effective, because of the low temperatures and when persistent pollutants such as the PAHs must be managed. In addition, the facility can be used for wastes such as paint sludges, solvents and possibly even destruction of health care risk waste.

Figure 1.4 Thermal Treatment Unit for Oily Wastes

Note that the solids recovered from such a thermal treatment facility can be disposed to general waste landfill and, some recovered materials such as soil, which is totally sterile, can be simply used as fill or on agricultural land.

B1.3.3 Biological Treatment

The relatively high temperatures in Uganda make it ideal for the use of biodegradation techniques, including composting. Rapid biodegradation requires a reasonable temperature, air (oxygen), a moisture content of ~60% and nutrients, i.e. nitrogen, phosphorus and potassium, which can be provided by the addition of a normal NPK fertiliser. Naturally occurring bacteria that will metabolise petroleum hydrocarbons will be present in the soil near any facility handling petroleum hydrocarbons and can be encouraged to form viable and active microbial communities providing the conditions are optimised. For example, a soil contaminated with petroleum hydrocarbons can be cleaned to acceptable levels, say 1000mg/kg or less, by rotovating the soil or excavating it and forming windrows; adding an appropriate amount of water; some NPK fertiliser; and aerating it, either by drawing air through the pile or simply by turning the pile over using a front end loader. The waste should not contain extremely high concentrations of oil, as biodegradation is compromised, as many bacteria require a solid inorganic surface to be viable. The heavy rains that are experienced in Uganda means that such an activity may, at times, have to be protected from too much water by processing it under cover – a tarpaulin would be acceptable.
If a composting operation is available for green wastes, then moderate amounts of hydrocarbon contaminated soil can also be added half way through the composting process and the hydrocarbons will be degraded. Care must be taken to ensure that the oily waste does not contain too high concentrations of heavy metals that may compromise the quality of the compost.

B1.4 STORAGE OF HAZARDOUS CHEMICALS AND WASTE

Hazardous chemicals and wastes must be stored so that they will not pose a risk the human health and the environment. Note that chemicals will have to be stored during construction activities at the EPS and the Power Plant. They must have an effective drainage system and a spillage collection facility. The area must be contained and bunded, clearly demarcated and any unauthorised access must be prohibited. The storage requirements are as follows:

- The storage area must be bunded to contain any spillages and the floor must have a firm waterproof base, e.g. concrete.
- Preferably the storage area should be undercover to protect the materials from the sun and prevent any ingress of stormwater.
- The area must be secure and no unauthorised access must be allowed.
- The containers such as drums must be in a good condition and well labelled, detailing contents, origin, destination, etc.
- Spills and leaking containers should be handled as quickly as possible.
- An inventory must be kept of all chemicals and hazardous waste stored on site. This should include information such as: the generator (division), the date received, the volumes and contents, the destination, etc.
- Hazardous chemicals and wastes should be compatible, e.g. acids and alkaline materials should be stored separately. Flammable materials should, also, be stored separately so that a fire will not compromise non-flammable products.
- The containers must be inspected regularly (for leaks, condition, etc). These inspections must be recorded.
- An emergency response procedure must be in place, e.g. provision of appropriate absorbents, for the clean up of any accidental spills.

B1.5 TRANSPORT OF HAZARDOUS CHEMICALS AND WASTES

The transport of hazardous chemicals and wastes must be carried out in terms of international guidelines in order to reduce the associated risks. Emergency plans for handling any accidental spills must be in-place.

Hazardous waste must be classified, packaged and transported in accordance with appropriate legislative requirements and, in the apparent absence of any Ugandan legislation; it is recommended that the appropriate South African National Standards are adopted. These include SANS 10228, Identification and Classification of Dangerous Goods for Transport; SANS 10229, Packaging of dangerous goods for road and rail transportation; and SANS 10233, IBC's for dangerous substances. SANS 10228 is based on the International Maritime Dangerous Goods Code. The labelling of hazardous waste storage containers must include an accurate description of the waste stored. The labelling requirements are dictated by the following legislation, as set out in SANS 10265: Labelling of dangerous preparations.

Note that SANS 10228 is gradually being replaced by SANS 10234:2005, Globally Harmonised System for the Classification and Labelling of Chemicals (GHS), which was recently published in South Africa. The GHS is to be adopted by all members of the UN; South Africa being one of the first countries to attempt to implement the requirements.

B1.6 WASTE DISPOSAL TO LANDFILL

B1.6.1 Introduction

At all operations there will be the need to dispose of any waste that cannot be avoided or recycled, re-used or utilised in an environmentally acceptable manner. The waste may have to be treated prior to disposal to minimise its impact on the landfill environment and, hence, potentially on health and safety of persons residing in the area and the general environment.
The following discussion has been adapted from the South African Department of Environment Affairs and Tourism's 'Minimum Requirements for Waste Disposal by Landfill', draft 3rd edition (SADWAF, 2005). The general objective of environmentally acceptable landfilling is, therefore, to avoid both short and long term impacts and any degradation of the environment in which the landfill is located.

More specific objectives are to, proactively:

- Prevent pollution of the surface and ground water;
- Ensure public acceptance by ensuring environmental acceptability.

The short term impacts of landfilling include problems such as noise, flies, odour, air pollution, unsightliness and windblown litter. Such nuisances are generally associated with a waste disposal operation and should cease with the closure of the landfill.

The long term impacts include problems such as pollution of the water regime, landfill gas generation and devaluation of adjacent land holdings. Such problems are generally associated with incorrect landfill site selection, design, preparation or operation, or inadequate buffer zones and may persist long after the landfill site has been closed. However with careful site selection, good engineering design, operation and closure, a landfill can be an acceptable solution to the management of selected wastes.

B1.6.2 Waste Types Requiring Disposal

The site required for the waste generated during the construction, operation and closure of the EPS will have to cater for the following wastes:

a) General household, canteen and office waste, which because of its composition and characteristics, does not pose a significant threat to public health or the environment, if properly managed. During construction the number of persons working on site will be approximately 170 and during the operational phase approximately 70, i.e. assuming an average of 4

persons per family and 1.2 kg/day/person, the amount of non-hazardous general waste would be 816kg/day during construction and 336kg/day during the operational phase.

b) Construction wastes include excavated soil, packaging, off-cuts, wood waste, etc. This is difficult to quantify, but the amounts of soil may be too large at times to transport to the landfill site and may be used at the EPS for landscaping. Some clean soil can be stockpiled for future use at the landfill as cover material.
c) Processing and other potentially 'hazardous wastes' could either be co-disposed, where appropriate with the general waste, or, where it would pose a significant threat to the environment it would have to be isolated and contained in a separate hazardous waste cell/disposal area.

The site would, therefore, be required to accept both general and hazardous waste but because of the relatively small size of the operation would be classified as small landfill.

B1.6.3 Site Selection

A number of candidate sites should be identified and compared on the basis of a number of fatal flaws which are presented below. Initially a coarse screening should be done and any sites that have one or more fatal flaws can be eliminated from consideration.

The following situations may represent Fatal Flaws in that they may prohibit the development of an environmentally or publicly acceptable waste disposal facility except at excessive cost (SADWAF 19988b):

- *Areas below a 1 in 100 year or 1 in 50 flood line*. This eliminates wetlands, pans and flood plains, where water pollution would result from waste disposal.
- *Areas in close proximity to significant surface water bodies*, e.g., water courses, lakes or dams.
- *Unstable areas*. These could include fault zones, seismic zones and dolomitic areas where sinkholes and subsidence are likely.
- *Sensitive ecological and/or historical areas*: these include nature reserves and areas of ecological and cultural or historical significance.
- *Areas characterised by flat gradients, shallow or emergent ground water*, e.g., wetlands, pans and springs, where a sufficient unsaturated zone separating the waste body and the ground water would not be possible.
- *Areas characterised by steep gradients, where stability of slopes could be problematic*.
- *Areas of ground water recharges on account of topography and/or highly permeable soils.*
- *Areas overlying or adjacent to important or potentially important aquifers.*
- *Areas characterised by shallow bedrock with little soil cover:* these areas are frequently also associated with steep slopes, which may be unsuitable.
- *Areas in close proximity to land-uses, which are incompatible with landfilling*: these could include residential areas, nature reserves and cemeteries.

- *Areas immediately upwind of a residential area in the prevailing wind direction(s).*
- *Areas that, because of title deeds and other constraints, can never be rezoned to permit a waste disposal facility.*
- *Areas over which servitudes are held that would prevent the establishment of a waste disposal facility.*
- *Any area characterised by any factor that would prohibit the development of a landfill except at prohibitive cost.*

The following economic criteria relate to the cost of obtaining, developing and operating the EPS site should be considered:

- The possible incorporation of the site into a regional waste disposal system or expansion to cater for a bigger operation, either immediately or in the future. This tends to make a site economically more attractive.
- The distance of the site from the waste generation areas: this is directly proportional to transport costs.
- Access to the landfill site: this has cost convenience and environmental implications, especially if roads have to be constructed. Current land use in the vicinity of the site will have a direct bearing on accessibility. For example, an access route through a residential suburb may result in unacceptable impacts, such as increased traffic or the risk of spillage.
- The availability of on-site soil to provide low cost cover material. Importation of cover increases operating costs. Furthermore, cover shortage may reduce site life.
- The quality of the on-site soil. Low permeability clayey soils on site will reduce the cost of constructing containment liners and leachate control systems.
- Exposed or highly visible sites: high visibility may result in additional costs being incurred for screening.
- Land availability and/or acquisition costs: these are often dependent on present or future competitive land-uses, such as agriculture, residential or mining.
- Other miscellaneous economic or socio-economic issues, e.g. the chosen site should not result in the displacement of local inhabitants, as this will usually arouse public resistance.

Environmental criteria relate to the potential threat to the biotic and abiotic environment, particularly to water resources:

- The distance to ground water or surface water bodies, e.g. the lake, a river or stream: the greater this distance, the more suitable the site is in terms of lower potential for water pollution. The minimum distance allowed in South Africa for ground water is two metres between the maximum height of the ground water and the base of the landfill.
- The importance of ground or surface water as water resources. The greater the resource value of the water, the more sensitive the establishment of a landfill on account of the potential for water pollution.

- The depth of soil on the site and the greater the availability of soil, the more cost-effective it will be for the landfill to meet the Minimum Requirements for operation. The landfill will thus be more acceptable in terms of cover material and, therefore, control of nuisances.
- The quality of on-site soil: low permeability soils reduce pollutant migration and are therefore favoured.
- Valleys where temperature inversion could occur should be avoided, as far as possible. This could promote the migration of landfill gas and odours into populated areas.

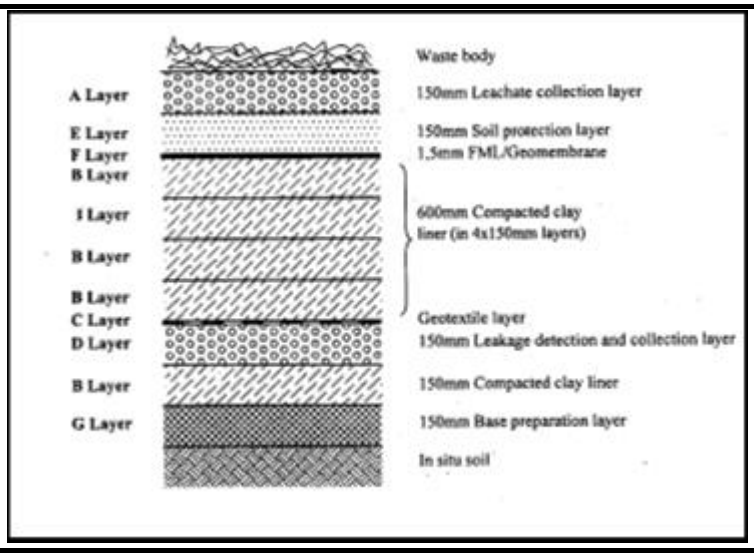
B1.6.4 Landfill Design and Operations

The location of the EPS is characterised by *high rainfall* conditions and *relatively high humidity*, i.e. potentially low evaporation rates. The area would be characterised as a water excess area, where rainfall will contribute significant moisture to the waste, and leachate will be generated. Some of the important issues concerning the landfill and its requirements are discussed below.

Liner Design

As the site will be accepting hazardous waste, it should be constructed with a double liner system to minimise the risk of contamination of ground water. A typical liner construction system for moderate to low hazardous waste is detailed in *Figure 1.5* below (SADWAF 1998b). Note that it consists of a number of different layers and includes a leachate collection layer consisting of gravel a liner protection layer, and then an High Density Polyethylene (HDPE) liner, below which four separate 150mm clay layers are present.

Figure 1.5 A Typical Landfill Liner Design for a Landfill Accepting Low to Moderate Hazardous Waste



The liner design in *Figure 1.5* is merely an example, the designed required for use at the EPS should be determined after a complete geological / hydrogeological assessment and site selection process. An accepted international practice is to ensure that the groundwater is at all times at least

two metres below the bottom layer of the site or, alternatively, a drainage system should be installed to minimise any pressure that may drive water vertically into the landfill.

Site Design

As indicated above, two different areas/cells would be envisaged for the landfill:

- Disposal of general waste that will include both putrescible waste, e.g. food waste, and non-hazardous waste, e.g. rubble.
- Disposal/containment of hazardous waste.

The amount of waste that requires disposal is expected to be small (see above) and, therefore, adjoining lined areas of 0,5ha each should be more than sufficient. Provision for future expansion of the EPS and power plant should be allowed for.

Because the site will be located in a relatively high rainfall area, where there is likely to be poor evaporation rates, the landfill will have to have a leachate management system and some landfill gas would be generated from the general waste area, where biodegradable and putrescible waste is disposed: See below - *Gas and Leachate Management*.

Consideration should be given to various aspects when designing the landfill, these can include, the liner design; soil slopes and management of sole erosion; vehicle access; security (fencing, etc.), and location of offices and of any treatment facilities.

Site Operations

The following issues should be considered:

- Signs in the appropriate official languages must be erected in the vicinity of the landfill, indicating the route and distance to the landfill site from the nearest main roads.
- Particularly as the site accepts hazardous waste, access to the site must be strictly controlled, i.e. it must be fenced, have a single gated entrance that is manned during hours of operation and have security, after operating hours.
- An Operating Plan, which is a site specific document that will be required as part of the Landfill Permit that describes the way in which the landfill is to be operated, commencing at the level and detail of daily cell construction and continuing through to the projected development of the landfill with time. The Operating Plan would include, *inter alia*, the phasing, the excavation sequence, provision of wet weather cells, site access and drainage. It would also include all operation monitoring and a plan for mitigatory actions in response to problems detected by monitoring.
- The facilities at a landfill site normally vary in accordance with the size of

the operation. In the case of the EPS landfill, a small office and ablutions, a covered area for storing of vehicles and, if necessary, drummed waste.

- A laboratory is normally required for a landfill that accepts hazardous waste but since the landfill will be only used by the EPS, the plant laboratory could analyse waste, when required.
- The obtaining and use of daily, intermediate and final cover material.
- Hazardous waste should, preferably, be treated to minimise the risks to staff, the landfill and the general environment prior to arriving at the landfill for disposal. However, treatment could be undertaken at a dedicated facility located at the landfill, which could incorporate oily waste management facilities, such as those described in *Section B1.2.*

Gas and Leachate Management

The only area of the site that should generate landfill gas is that accepting general and putrescible waste. The amount of gas generated can be expected to be low because of the low volumes and passive gas management is most likely all that will be required. This may include the construction of impervious migration barriers adjacent to the landfill and passive venting from boreholes and perforated pipes within the landfill. The resultant gas may be flared or passed through filters to remove odour, if this is considered necessary.

Leachate collection is usually achieved using a graded underliner and drains, which lead to a collection point or sump: see *Figure 1.5*. The leachate collection system is a system of drains, bunds or trenches covered by the leachate collection layer. It should be equipped with suitable drains or collection pipes that direct the gravity flow of leachate or leakage to defined collection points or sumps, from which it can be collected for treatment. Collected leachate must be treated to a quality standard that complies with the relevant legislation. Leachate from a general waste cell may usually be treated in a normal sewerage treatment plant provided the quality. This is clearly a cost effective way of handling leachate as a sewage plant will have to be constructed at the plant anyway and one can avoid the need to construct a separate treatment plant. Clearly, it will be most important that any hazardous waste is managed in such a way that it will not contaminate the leachate with hazardous pollutants that cannot be readily treated at a sewage plant, e.g. PCBs, pesticides, etc. It is, therefore, recommended that most of the hazardous waste is disposed to the hazardous waste area in drums that are covered with soil to prevent a hazardous leachate being generated.

Site Water Quality Monitoring

The general objective of landfill operation monitoring is to verify that the landfill conforms to the required standards and the site permit conditions.

More specific objectives are:

- To ensure that the accepted site design is properly implemented.

- To function as a control measure to ensure that the operation conforms to the required standards.
- To quantify any effect that the operation has on the environment, and, in particular, any effect on the water regime.
- To serve as an early warning system, so that any problems that arise can be *timeously* identified and rectified.

During the site investigation, surface water quality in any associated drainage feature is monitored both upstream and downstream of the proposed landfill. Sampling points must be selected at representative, easily identified sites. While a single upstream sampling point may suffice, normally, at least two downstream boreholes are required, although the number required will be determined by the size and complexity of the site. The sampling points upstream of the proposed landfill provide ambient background values, while the sampling points downstream of the proposed landfill ultimately indicate any pollution resulting from the site. Monitoring of the leachate quality will identify those potential pollutants that could contaminate surface and underground water and these parameters must be included in the monitoring programme. The number of boreholes required, the location of surface water monitoring points, including monitoring of leachate quality and the monitoring frequency are all normally included in the permit issued by the relevant authorities

Site Auditing

There are a number of ways in which waste disposal sites may be monitored or audited:

- Authority audits and inspections.
- External audits by independent consultants.
- Internal inspections or audits by EPS and/or the landfill operator: these can be regular monthly checks to ensure that all permit and company requirements are being adhered to and/or annual audits.
- A Landfill Monitoring Committee, which includes I&APs may be formed to assist in monitoring landfill operations, to identify problems and to keep the public informed of activities/developments on the landfill.

Normally, the landfill permit will specify the types of audits and the frequency required.

Site Closure

The engineering plans for the landfill should include a complete operation plan plus a site closure plan. The site closure plan should include the final height and slopes of the facility, details of the capping layer that will be used, the site maintenance and monitoring programme, issues of fencing of the site and long term security and, if appropriate, the final use, e.g. as sports fields.