Appendix F: Project Environmental Standards

February 2020

CONTENTS

TABLES

GLOSSARY AND ACRONYMS

Symbols	
µ	micro – one millionth, or 10^{-6}
A	
AQ	air quality
B	
BOD	biological oxygen demand – the amount of dissolved oxygen needed by aerobic biological organisms to break down organic material present in a given water sample. Effectively a water pollutant parameter
C	
CO	carbon monoxide
COD	chemical oxygen demand – the amount of oxidisable pollutants found in surface water
D	
dB, dB(A)	decibel – in an environmental context, a unit of sound pressure. Suffixed by (A), it is A-weighted. A-weighting is applied to instrument-measured sound levels in an effort to account for the relative loudness perceived by the human ear, as the ear is less sensitive to low audio frequencies.
DDT	dichlorodiphenyltrichloroethane – a chemical used as an insecticide
dscm	dry standard cubic metre
E	
EAC	East African Community – regional intergovernmental organisation of six states including both Tanzania and Uganda. Publishes standards to be applied across its member states
EACOP	East African Crude Oil Pipeline
EC	electrical conductivity (of soil) – a parameter that correlates with soil properties that affect crop productivity, including soil texture, drainage conditions, organic matter level, salinity and subsoil characteristics. Can also be European Community, but only in references to directives
EHS	environment, health and safety
EMDC	Environmental Management Divisional Standards Committee – Tanzanian body responsible for environmental standards
EPA	See US EPA
ESP	exchangeable sodium percentage – a parameter used to classify saline and alkali soils or to determine if a sodium hazard exists
EU	European Union
F	
G	

H	
HC	hydrocarbon
I	
IED	Industrial Emissions Directive – a directive (ref 2010/75/EU) of the European Union concerning industrial pollution prevention and control
IFC	International Finance Corporation – part of World Bank Group, provider of finance to private sector projects and publisher of widely used international standards and guidelines on environmental, health, safety and social performance
J	
K	
K	kelvin – International System of Units (SI) unit of temperature
kPa	kilopascal – a unit of pressure
L	
L	limit level
L_{eq}, L_{max}	define averaging periods for noise measurements. L_{eq} is equivalent continuous noise level and is the usual preferred method to characterise noise levels that vary over time. L_{max} is the maximum instantaneous level. If a number is included, it refers to a percentile of the time. If 'A' is included, it means A-weighted – see dB(A).
M	
mg, mg/Nm^3 also µg, µg/Nm^3	milligram (or µg=microgram), per normal cubic metre – a unit of concentration of air pollutants. The reference temperature and pressure conditions that represent 'normal' do not have a universal standard definition and should be clearly defined.
mmhos/cm	milli mhos per centimetre - the basic (archaic) unit of measure of electrical conductivity in soil. A mho is equivalent to a siemens, which is the modern, SI-derived unit.
MPN	most probable number (of organisms in a water sample)
MW, MWth	megawatt (thermal) – one million watts. Thermal power distinguishes from electrical or mechanical power. In environmental regulatory context, it usually refers to the energy input capacity of a process, i.e., the energy content of the fuel use at maximum rate
N	
NEMA	National Environmental Management Authority – semi-autonomous institution coordinating, monitoring, regulating and supervising all matters on environment in Uganda
ng	nanogram – one billionth (10^{-9}) of a gram
NO, NO_2	See NOx
NOx	oxides of nitrogen – a generic term for the nitrogen oxides that are most relevant for air pollution, namely nitric oxide (NO) and nitrogen dioxide (NO_2)
NTU	nephelometric turbidity unit – a unit for turbidity from a calibrated nephelometer
O	

P	
PEC	predicted environmental concentration – usually used in relation to air pollutants
PM, PM_{10}, $PM_{2.5}$	particulate matter – also known as dust. Numerical suffixes refer to a size fraction and are in micrometers, e.g. PM_{10} is particulate matter with diameter of less than 10 µm. These small fractions present higher health risk as they penetrate further into the respiratory system.
ppm, ppmv	parts per million, parts per million by volume
Q	
R	
S	
SI	International System of Units. From the French *Système international*
SO_2	sulphur dioxide
T	
TBS	Tanzanian Bureau of Standards
TEQ	toxic equivalents. A weighted factor allowing mixtures of toxic compounds to be reported as a single number.
TSS	total suspended solids (mass in a water sample)
TZ	Tanzania
TZS	Tanzanian standard (prefix used for naming standards)
U	
UG	Uganda
US EPA	United States Environmental Protection Agency
V	
VOC	volatile organic compound.
W	
WHO	World Health Organization – a specialised agency of the United Nations that is concerned with international public health
WID	waste incineration directive – a directive (ref 2000/76/EC) of the European Community
X	
Y	
Z	

1 INTRODUCTION

1.1 General Project Information

Total E&P Uganda (TEPU), Tullow Uganda Operations Pty Ltd (TUOP) and CNOOC Uganda Limited (CUL) (Upstream Partners) hold interests in petroleum resource licences in the Lake Albert Development Area. The licences include the following Exploration Areas (EA): Buliisa-Nwoya (EA 1 and northern portion of EA 2), Kaiso Tonya (EA 2), located on the central part of the east shoreline of Lake Albert and Kingfisher (EA 3A), located on the southeast shoreline of Lake Albert. The Upstream Partners and the Government of Uganda have made a number of commercial crude oil discoveries in the Exploration Areas and propose upstream projects for the Buliisa-Nwoya EA called the Tilenga Project and for the Kingfisher EA called the Kingfisher Discovery Area, and to construct two crude oil feeder pipelines and an export pipeline to transport the crude oil produced to international markets, net of supply commitments to a planned refinery development in the Kabaale area that will produce refined products to service regional market needs.

The crude oil produced by the Tilenga Project will be transported from the Tilenga Central Processing Facility near Buliisa via the Tilenga feeder pipeline to a hub at Kabaale. From Kabaale crude oil will be delivered to a government planned refinery and to an export pipeline, the East African Crude Oil Pipeline (EACOP) Project, and delivered to the East African coast at Tanga in Tanzania for marine export.

The Republic of Uganda, the National Oil Company of Uganda (the Potential State Participants), as well as the international oil company parties partaking in the development of the Lake Albert Development area, and their affiliates (the "Potential International Participants") will participate in the implementation of the Tilenga Project, including the Tilenga feeder pipeline. The Republic of Uganda, the National Oil Company of Uganda, the United Republic of Tanzania and/or Tanzania Petroleum Development Corporation (the Potential State Participants), as well as the international oil company parties partaking in the development of the Lake Albert Development area, and their affiliates (the "Potential International Participants"), will participate in the implementation of the EACOP.

The Potential State Participants and the Potential International Participants, collectively "Potential Pipeline Participants" may create one or more special purpose companies (Pipe Co) to develop, construct, operate and maintain the EACOP project on behalf of the development partners. Prior to the establishment of Pipe Co, the ESIA for the projects will be managed by the Pipeline Project Team (PPT) responsible for undertaking all activities relating to the ESIA of the EACOP project. Currently the corporate proponent of the EACOP project is Total East Africa Midstream BV.

Subject to the regulatory requirements of Uganda and Tanzania and requirements of international lending institutions, environmental and social impact assessments are being planned and stakeholder engagement will be implemented for the two pipeline projects:

- 24” diameter feeder pipeline of approximately 95 km from Buliisa to the Kabaale hub
- 24” export pipeline of an estimated length of 1443 km, 296 km in Uganda and 1147 km in Tanzania, from the hub in Kabaale Uganda to north of Tanga, Tanzania. The crude oil flows in the pipeline where it commences at the hub, traverses southward along the western side of Lake Victoria, crosses the border into Tanzania, continues to the south end of Lake Victoria, turns east continuing across the Rift Valley at the Tanzanian Divergence, continuing east and terminates at Marine Storage Terminal (MST) located at north of the port of Tanga on the Chongoleani peninsula for storage and further export.

The marine storage terminal (MST) is connected by a jetty to a load-out facility (LOF) located approximately 1.5 km offshore.

1.2 Project Standards Introduction

This document details Ugandan, Tanzanian and international emission and ambient standards for air, water and environmental noise and identifies project-preferred standards. The proposed project preferred standards are generally the national standards except where more stringent international standards apply, national standards are not available or, in rare cases, where concerns are identified with the implementation of the national standard. There are also a small number of instances where the national standards have not been listed as the project standard to minimise duplication as other standards identified for adoption already provide adequate control. There is an associated parallel document that provides more information where needed.

The intent is to incorporate the content of this document into the project Environmental Optimum Requirements document.

2 AIR EMISSIONS AND AIR QUALITY

2.1 Stationary Source Emissions Standards

2.1.1 Ugandan Standards

There are two sources of standards for air quality in Uganda, neither of which is adopted into statute:

- the National Environmental Management Authority (NEMA) public notice, a public notice of standards for public consultation that has been in circulation since 2006 but has not been formally issued as a regulation
- the National Environment (Air Quality) Regulations, 2013, draft regulations detailing air emission standards for emissions from various point sources and standards for ambient air quality. These standards have been issued for public review before they are issued as regulations.

2.1.2 Tanzanian and East African Community Standards

Established under the Environmental Management Act (Cap. 191) (2004), the Environmental Management (Air Quality Standards) Regulations, 2007 contain provisions for the regulation of air quality. This includes establishing minimum air quality standards (source emissions and ambient air), emission permits, measures for compliance and enforcement, offences and penalties and reporting measures.

The Tanzanian standards TZS 845:2005 Air Quality – Specification and EMDC[1] 2 (1758): Air Quality – Vehicular Exhaust Emissions Limits are two of the nine compulsory environmental standards developed by the Tanzanian Bureau of Standards (TBS) and collated in the National Environmental Standards Compendium (part 1 of the compendium contains the compulsory standards and is the only part discussed in this document). In general, the air quality standards contain the same tables of limit or guideline values as the regulations, though there are some differences between the vehicle emissions limits in EMDC 2 (1758) and the regulations.

Applicable schedules are as follows:

- first schedule: permissible weight concentration of emission limits from the atmosphere to a receptor and respective test methods (these are ambient air quality standards, covered in Section 2.2)
- second schedule: highest permissible quantity (emission) and test methods
- (third schedule: for cement factories, i.e., kilns, which will not be under the project's control)
- fourth schedule: emission limits for motor vehicles (discussed in Section 2.3).

The East African Community air quality specification duplicates the Tanzanian standards.

[1] EMDC is the Environmental Management Divisional Standards Committee, but only the abbreviation is used in the name of the standard.

2.1.3 International Standards

Table 1.1.2 of the International Finance Corporation (IFC) EHS General Guidelines 2007 details emission limits for combustion plant with a total rated heat input of 3 to 50 MWth.

The emissions guidelines are applicable to small combustion process installations operating more than 500 hours per year, and those with an annual capacity use of more than 30%.

The emissions guidelines also specify some monitoring requirements and general management and optimisation principles.

The sector-specific guidelines, including the EHS Guidelines for Onshore Oil and Gas Development (IFC, 2007 and draft 2017 versions), principally refer to these general emissions guidelines. A notable exception is the waste management facilities guideline, which contains additional standards for waste incineration plant. These are covered in Section 2.1.5.

2.1.4 General Source Emissions Standards Comparison

Table 2.1-1 compares general source emissions standards. The project column includes the project-preferred standards.

Table 2.1-1 Source Emissions Standards

Stationary Emission Source Type	Fuel	Pollutant	Exhaust Gas Concentration (mg/Nm^3, dry gas, 15% O_2 for engines, 3% O_2 for boilers)			
			UG	TZ/EAC[9]	IFC	Project Preferred Standard
Boiler/heater	Liquid	NOx	300[2]	-	460	300
Engine	Liquid	NOx	300[2]	-	1460/1600/1850[1]	1460[2]
Boiler/heater	Liquid	CO	[4]	175[3]	-	175[3]
Engine	Liquid	CO	[4]	-	-	-
Boiler/heater	Liquid	PM	50[8]	250[7]	50[5]	50
Engine	Liquid	PM	50[8]	250[7]	50[6]	50
All	All	HC/VOC	20[7]	20[6]	-	20

NOTES:

[1] Bore size diameter less than 400 mm: 1460 or 1600 for smaller engines if justified to maintain high energy efficiency. Bore size diameter greater than 400 mm: 1850. Concept engineering documents indicate bore size likely to be less than 400 mm

[2] Reference conditions, equipment types not specified. Propose to adopt 3% O_2 for boiler standard, in accordance with EU Medium Combustion Plant Directive. The associated document explains why the project intends to adopt the less stringent IFC engine standard rather than the draft Ugandan standard

[3] Standard applies above 5 MW heat output

[4] Standards in point source emission column of schedule 2 of draft air quality regulations 2013 are incongruous There are no point source standards for CO in the 2006 draft standards

[5] Or up to 150 if justified by environmental assessment

[6] Or up to 100 if justified by project specific considerations, e.g., economic feasibility of using lower ash content fuel, or adding secondary treatment to meet 50, and available environmental capacity of the site

[7] 24-hour mean (for PM). As (unlike for other pollutants) there are no qualifiers regarding equipment, capacities or fuels, this standard is assumed to apply to all. In Tanzanian regulations, "as total organic carbon" is specified for the hydrocarbon standard

[8] 2006 draft standards only. Standards in point source emission column of schedule 2 of draft air quality regulations 2013 require clarification

[9] The Tanzanian standards are duplicated in the East African Community standards

The following standards are not included in the above comparison table:

- turbine standards. It is assumed that there will not be any turbines.
- standards that apply to installations greater than 50 MWth. Concept-phase engineering documents indicate that no project facility will approach this threshold, even when aggregation rules are taken into account. According to the IFC guidelines, the capacities of individual plant that might reasonably emit through a common stack should be aggregated.
- sulphur dioxide source emissions standards. Some standards are set in terms of the sulphur content of the fuels, others as exhaust gas concentration limits. Concept-phase engineering documents show that the sulphur content of the crude is low enough to meet all sulphur dioxide standards. Sulphur dioxide ambient air standards are, however, included (see Section 2.2).

2.1.5 Waste Incineration Standards

Section 2 of the IFC's EHS guideline for waste management facilities documents performance indicators and industry benchmarks, and includes applicable standards on air emissions for waste incineration. It compares standards from the EU Waste Incineration Directive (WID), 2000/76/EC and US EPA legislative standards. Since the guideline dates from 2007 it does not refer to the EU Industrial Emissions Directive (IED), which supersedes the WID. The IED is therefore considered the more up-to-date source of European waste incineration standards for use as a reference of the IFC guidelines and is the directive quoted in Table 2.1-2.

The US EPA standards are different for hazardous and non-hazardous waste incinerators.

There are no specific standards for incineration in either Uganda or Tanzania.

All the standards are presented in Table 2.1-2.

The values in the US standard have been converted to the same units as the EU standard for ease of comparison. The proposed project preferred standards are the EU standards because they are more recent, more stringent in most cases for nonhazardous wastes, which it is assumed will make up by far the greater proportion of waste for incineration and include a wider range of substances.

Table 2.1-2 Waste Incineration Emission Standards

Pollutant	EU Standard (mg/Nm^3, 11% O_2) (Proposed Project Standard)			US Standard (mg/dscm, Except Where Stated, 7% O_2)		US Standard, Converted (mg/Nm^3, 11% O_2) [5]	
	Daily Mean	Half-hour Mean A[1]	Half-hour Mean B[1]	Hazardous Waste	Non-haz Waste	Hazardous Waste	Non-haz Waste
Particulate matter, PM	10	30	10	1.5	70	1.2	54.6
VOC/HC as total organic carbon	10	20	10	10 ppmv	-	4.2	-
Hydrogen chloride, HCl	10	60	10	21 ppmv [3]	62 ppmv	26.7	78.7
Hydrogen fluoride, HF	1	4	2	-	-	-	-
Sulphur dioxide, SO_2	50	200	50	-	20 ppmv	-	44.5
Oxides of nitrogen, NOx (as NO_2)	200	400	200	-	388 ppmv	-	621
Carbon monoxide, CO	50	100	-	100 ppmv	157 ppmv		153
Dioxins and furans (as TEQ)	$1x10^{-7}$ [2]	-	-	$1.1x10^{-7}$ [4]	$4.1x10^{-7}$	$8.6x10^{-8}$	$3.2x10^{-7}$
Mercury, Hg	0.05 [2]		-	0.008	0.47	0.006	0.37
Thallium, Th	0.05 [2]		-	-	-	-	-
Cadmium, Cd				0.01	0.004	0.008	0.003
Lead, Pb	0.5 [2]		-		0.04		0.031
Arsenic, As				0.023	-	0.018	-
Beryllium, Be					-		-
Chromium, Cr					-		-
Cobalt, Co				-	-	-	-
Copper, Cu				-	-	-	-
Manganese, Mn				-	-	-	-
Nickel, Ni				-	-	-	-

Table 2.1-2 Waste Incineration Emission Standards

Pollutant	EU Standard (mg/Nm^3, 11% O_2) (Proposed Project Standard)			US Standard (mg/dscm, Except Where Stated, 7% O_2)		US Standard, Converted (mg/Nm^3, 11% O_2) [5]	
	Daily Mean	Half-hour Mean A[1]	Half-hour Mean B[1]	Hazardous Waste	Non-haz Waste	Hazardous Waste	Non-haz Waste
Antimony, Sb				-	-	-	-
Vanadium, V				-	-	-	-

NOTES:
Where cells are merged across numerous pollutants, the standard for is the total of the concentrations of these substances
[1] The two columns of limit values (A and B) are different limits that have to be met by 100% of the half-hourly average values and 97% of the half hourly average values over a year respectively. Compliance with the EU directive is on an either/or basis for each pollutant, i.e. as long as one or the other is met, compliance is deemed
[2] EU dioxins and furans averaging period is 6 to 8 hours; for metals it is 30 minutes to 8 hours
[3] Total chlorine (HCl, Cl_2)
[4] With 'air pollution control device'. Without, the standard is 2.0 x 10^{-7} mg/dscm
[5] In these columns, the standard as published in the IFC guideline has been converted to the same units and reference conditions as the EU standards, for ease of comparison. This entails an oxygen correction of (21-11)/(21-7) to convert from 7% to 11% O_2, a temperature correction of 298/273 to convert from the US EPA 'standard' temperature of 25°C to the EU 'normal' temperature of 0°C and, where the standard is quoted in ppm, converted to mass units by multiplying by the species molecular weight and dividing by the molar volume at normal conditions, 22.414 l/mol. For total chlorine (HCl and Cl_2), a molecular weight of 36.5 was used.

2.2 Ambient Air Quality Standards

2.2.1 Ugandan Standards

The two sources referred to in Section 2.1.1 include both ambient air quality and source emission standards.

2.2.2 Tanzanian Standards

The first schedule of the Environmental Management (Air Quality Standards) Regulations 2007, duplicated in the Tanzanian standard TZS 845: 2005 Air Quality – Specification, sets ambient air quality standards.

The standard gives two types of standards, "guidelines" and "limit levels", and explains them as follows:

> "The limit levels are binding and are to be used for regulatory purposes. Limit levels are usually measurable in shorter averaging periods. The guidelines are based on studies that indicate safe levels

> averaged over relatively longer periods and mostly, they are derived from WHO[2] Guidelines."

The regulations reproduce both the guidelines and limits and do not repeat the explanation.

The standard specifies various test methods to be applied.

2.2.3 East African Community Standards

The East African Community (EAC) specification contains standards applicable at the property boundary as well as three columns of standards that are dependent on a classification of the area into "industrial", "residential, rural and other" and "controlled". These classifications are not defined further in the specification.

2.2.4 International Standards

The following sections contain the standards, limits and values applicable to ambient air quality contained within the IFC General EHS Guidelines and WHO standards.EU standards are similar to the WHO standards so are not described separately.

2.2.4.1 IFC EHS General Guidelines

Regarding ambient air quality, the IFC EHS General Guidelines require that

> "emissions do not result in pollutant concentrations that reach or exceed relevant ambient quality guidelines and standards by applying national legislated standards, or in their absence the current WHO Air Quality Guidelines or other internationally recognised sources".

The guidelines also require that

> "emissions do not contribute a significant portion to the attainment of relevant ambient air quality guidelines or standards. As a general rule, this Guideline suggests 25 percent of the applicable air quality standards to allow additional, future sustainable development in the same airshed."

Therefore, the guidelines focus on both absolute pollutant concentrations (also known as PECs, predicted environmental concentrations, which include background levels) and process contributions (the change caused by the project components).

However, the IFC's guidance notes (specifically GN36) on performance standard 3 in addition requires that the background concentration of the pollutant is taken into account:

[2] World Health Organization

"the project should not normally consume more than 25 percent of the assimilative capacity[3] between the pre-project case and the relevant ambient quality guideline standards."

This is proposed as the project preferred standard.

2.2.4.2 WHO Standards

The WHO air quality guidelines have been designed for worldwide use with the key objective of protecting human health. They originate from two publications: the Air Quality Guidelines for Europe (2nd Edition), 2000 and the Global Update (2005). The 2005 update did not review all pollutants and some guidelines from the earlier publication remain current.

2.2.5 Standards Comparison

Table 2.2-1 compares the ambient air quality standards. The project column contains the project-preferred standard.

Where standards are set only by the draft Ugandan regulations or the EAC specification (NOx, nonmethane hydrocarbons, total VOC, ozone 1-hour average, total suspended particulate matter), these are not preferred as project standards. This is because these are not criteria pollutants or averaging periods covered by, for example, the internationally widely accepted WHO guidelines, and risk mitigation is achieved through coverage of other pollutants or averaging periods.[4] Further information is also given in the associated parallel document.

Table 2.2-1 Ambient Air Quality Standards

Pollutant	Averaging Period	Air Quality Standard - Ambient Air Concentration, µg/m^3					
		UG	TZ Guideline[11]	TZ Limit [11]	EAC [12]	WHO[3]	Project Preferred Standard
Nitrogen dioxide, NO_2	Annual	40	100[1]	-	150/100/-	40	40
	1 month	-	-	-	-/160/-	-	-
	24 hr	-	-	150 [2]	100/200/-	-	150
	8 hr	-	-	120 [2]	-	-	120
	1 hr	200	-	-	-/400/-	200	200
	10 mins	-	-	-	-/1,000/-	-	-
Oxides of nitrogen, NOx (as NO_2)	Annual	-	-	-	80/60/15	-	-
	1 month	-	-	-		-	-
	24 hr	200	-	-	150/80/30	-	-

[3] Defined in a footnote within the performance standard itself as "the capacity of the environment for absorbing an incremental load of pollutants while remaining below a threshold of unacceptable risk to human health and the environment"

[4] For example, particulate matter risks can be appropriately covered by consideration of the finer fractions (which are where the health risks lie), NOx is covered by the NO_2 standards.

Table 2.2-1 Ambient Air Quality Standards

Pollutant	Averaging Period	Air Quality Standard - Ambient Air Concentration, µg/m^3					
		UG	TZ Guideline[11]	TZ Limit [11]	EAC [12]	WHO[3]	Project Preferred Standard
	1 hr	-	-	-		-	-
	10 mins	-	-	-		-	-
Sulphur dioxide, SO_2	Annual	-	40–60	-	80/60 or 50/15	50 [9]	50
	24 hr	400 [10]	100	100 [6]	125/80 or 125/30	20 [9]	20
	10 min	500	-	500	-/500/-	500	500
Carbon monoxide, CO	8 hr	10 or 11x10^3	-	10,000	5/2/1 x10^3	10,000	10,000
	1 hr	-	-	30,000	10/4/2 x 10^3	30,000	30,000
	30 min	-	-	60,000	-	60,000	60,000
	15 min	-	-	100,000	-	100,000	100,000
Suspended particulate matter	Annual	-	-	-	3.6/1.4 or 1/.7 x10^2	-	-
	24 hr	500 ('soot')	-	-	5/2 or 1.8/1 x10^2	-	-
Fine particulate matter, PM_{10}	Annual	60	-	-	70/50/50	20 [5]	20
	24 hr	100	60–90 [7]	100 [8]	150/100/ 75	50 [5]	50
	1 hr	-	-	200 [8]	-	-	200
Fine particulate matter, $PM_{2.5}$	Annual	40	-	-	35/-/-	10 [5]	10
	24 hour	60	-	-	75/-/-	25 [5]	25
Ozone, O_3	Annual	-	10–100	-	-	-	-
	8 hr [4]	120	-	120	120/[10]/-	100	100
	1 hr	-	-	-	200/ 260[10]/-	-	-
Nonmethane hydrocarbons	10 mins	-	-	-	700 ppb	-	-
Total volatile organic carbon (VOC)	24 hr	6,000	-	-	6,000	-	6,000

NOTES:

[1] The Tanzanian Environmental Management (Air Quality Standards) Regulations 2007 state 0.1 µg/m^3. This is assumed to be a typographical error and the intention is probably 0.1 mg/m^3

[2] It is contrary to expectations that the longer averaging period should have the higher limit value associated with it. This is perhaps a clerical error in the Environmental Management (Air Quality Standards) Regulations 2007
[3] WHO standards are listed as analogous to IFC standards. The IFC EHS General Guidelines require that "emissions do not result in pollutant concentrations that reach or exceed relevant ambient quality guidelines and standards by applying national legislated standards, or in their absence the current WHO Air Quality Guidelines or other internationally recognised sources."
[4] Maximum daily 8-hour mean, permitted exceedances 25 days averaged over 3 years
[5] In addition to the guideline values included here, the 2005 update guidelines provide interim targets aimed at promoting a gradual shift from high to lower concentrations
[6] The Environmental Management (Air Quality Standards) Regulations 2007 states that daily average of hourly values will not exceed 0.1 mg/kg. Assumed typographical error and 0.1 mg/m^3 is intended. Differs from guideline value in that the guideline value states only 24-hour average
[7] Averaging period not stated
[8] Written as 0.10 and 0.20 µg/m^3 in the Environmental Management (Air Quality Standards) Regulations 2007. Assumed a typographical error and milligrams rather than micrograms is intended
[9] The apparent anomaly whereby the WHO guideline of 20 µg/m^3 24-hour mean contradicts its annual mean guideline of 50 µg/m^3 is because the former is from the 2005 global update, whereas the latter is from the 2000 guidelines for Europe and no updated value for this averaging period was included in the 2005 update. The 2005 update found that health effects were now known to be associated with much lower levels of SO_2 than previously believed and adopted the precautionary principle in setting a guideline value that it acknowledges will be very tough for many areas to meet
[10] Converted from 0.15 ppm as written in the draft regulations, for consistency of units and ease of comparison. 20°C reference temperature is assumed in this conversion
[11] TZ GL = Tanzanian guideline, TZ L = Tanzanian limit. Ambient air quality standards are set by the first schedule of The Environmental Management (Air Quality Standards) Regulations 2007, duplicated in the Tanzanian standard TZS 845: 2005 Air Quality – Specification. The standard gives two types of standards, "guidelines" and "limit levels", and explains them as follows: "The limit levels are binding and are to be used for regulatory purposes. Limit levels are usually measurable in shorter averaging periods. The guidelines are based on studies that indicate safe levels averaged over relatively longer periods and mostly, they are derived from WHO Guidelines." The regulations reproduce both the guidelines and limits and do not repeat the explanation The standard specifies various test methods to be applied, as does the EAC standard
[12] EAC standards apply to "industrial", "residential, rural and other" and "controlled' areas"

The IFC performance standard guidance that projects should not normally contribute more than 25% of the difference between the background level of a pollutant, and the applicable ambient air quality standard should also be considered as an overarching ambient air quality standard.

2.3 Vehicle Emission Standards

The Tanzanian regulation 12 states that

> "a person owning, driving or controlling motor vehicles shall ensure that the vehicle comply [sic] with permissible limits of substances found in exhaust emissions . . . prescribed in the Fourth Schedule . . ."

The Ugandan draft regulation is worded differently, regulation 22 stating

> "Every motor vehicle (other than a motor cycle or scooter) to be imported or registered . . . shall conform to the standard of exhaust emission specified in the Fourth Schedule to these Regulations."

There is no specification of responsibility.

Normally the onus would be on manufacturers, importers and vendors to show emissions compliance of vehicles, according to a standard set of laboratory tests. For this reason, this document does not include the vehicle emissions standards.

3 WATER

3.1 Industrial Effluent and Sewage Discharge Standards

3.1.1 Ugandan Standards

Ugandan standards are part of the National Environment (Standards for Discharge of Effluent into Water or on Land) Regulations, SI No 5/1999 and there is also a 2014 draft update of these regulations. They apply to discharges to surface water, groundwater and land.

3.1.2 Tanzanian Standards

The Tanzanian standard TZS 860:2005, Municipal and Industrial Wastewaters – General Tolerance Limits for Municipal and Industrial Wastewaters, is one of the nine compulsory environmental standards developed by the TBS. It is applicable to effluents discharged from all establishments, setting out permissible municipal and industrial wastewater limits that have been incorporated into the Environmental Management (Water Quality Standards) Regulations, 2007. They apply to discharges into surface water and groundwater.

3.1.3 East African Community Standards

The East African Community Gazette of 8 January 2016 included legal notice EAC/4/2016, the East African Industrial and Municipal Effluents Standards. The notice states that “these standards are hereby set to be the standards applicable in the East African Community”. It makes no reference to the existing legislation in the member states.

The standards for discharges to public sewer are not included in this document as there will be no such discharges from the project.

3.1.4 International Standards

The IFC EHS Guidelines for Onshore Oil and Gas Development, 2007 include standards specific to hydrotest discharges to surface water or land. There are also standards in these guidelines applicable to cooling water (temperature only) and stormwater (oil and grease only), which are also included in the comparison. For sewage discharges, the onshore oil and gas guidelines refer to the relevant standards in the General EHS Guidelines. These are presented in the comparison, which makes clear where they differ from the effluent standards or are only applicable to certain types of discharge. The sewage discharge standards are not applicable to discharges to centralised, municipal, wastewater treatment systems.

The IFC EHS Guidelines for Onshore Oil and Gas Development 2007 also include several descriptive standards on hydrotest water sourcing, use, discharge and storage. The impending revision of the onshore oil and gas guidelines does not include any changes to the effluent standards, according to the second draft for consultation (April 2017, available on the IFC website).

3.1.5 Comparison of Standards

Table 3.1-1 compares industrial effluent and sewage discharge standards. The rightmost column includes the project-preferred standard.

The most notable of these are the draft Ugandan and EAC standards of 5 mg/l for oil and grease, which are lower than the equivalent limits in the other sources.

Table 3.1-1 Industrial Effluent and Sewage Discharge Standards

Parameter	Ugandan Standards Limit		TZ Limit	EAC Limit	IFC Guideline Value	Project Preferred Standard
	1999	Draft 2014				
	mg/l unless stated					
Physical Components						
BOD	50	30	30	30	25 (effluent), 30 (sewage)	25 (effluent), 30 (sewage)
COD	100	60	60	60	125	60
Colour	300 TCU	50 TCU	300 TCU	50 TCU	-	50 TCU
pH range	6–8	6–9	6.5-8.5	6–9	6–9	6–8
Temperature range	20–35°C	-	20–35°C	±3°C[7]	A limit for cooling water only is set (maximum increase of 3°C in mixing zone)	20–35°C
Total coliform organisms	10,000 count / 100 ml	400 count / 100 ml	10,000 count / 100 ml	400 count / 100 ml[8]	400 MPN[E] / 100 ml (sewage only)	400 MPN[E] / 100 ml (sewage only)
Total dissolved solids (TDS)	1200	1200	-	1200	-	1200
Total suspended solids (TSS)	100	100	100	100	35 (effluent), 50 (sewage)	35 (effluent), 50 (sewage)
Turbidity	300 NTU	30 NTU	300 NTU	30 NTU	-	30 NTU
Inorganic Components						
Aluminium (Al)	0.5	-	2.0	2.0	-	0.5
Ammonia nitrogen	10	5	-	5	-	5
Arsenic (As)	0.2	0.01	0.2	0.01	Part of total metals	0.01
Barium (Ba)	10	10	1.5		-	1.5
Boron (B)	5		-		-	5

Table 3.1-1 Industrial Effluent and Sewage Discharge Standards

Parameter	Ugandan Standards Limit		TZ Limit	EAC Limit	IFC Guideline Value	Project Preferred Standard
	1999	Draft 2014				
	mg/l unless stated					
Cadmium (Cd)	0.1	0.01	0.1	0.01	Part of total metals	0.01
Calcium	100		-		-	100
Chlorides (Cl-)	500	250	200		600 (average) 1200 (maximum)	200
Chlorine	1	0.2	-	0.2[6]	-	0.2
Chromium (total)	1.0	1.0	1.0	1.0	Part of total metals	1.0
Chromium VI	0.05	-	0.1	0.05	Part of total metals	0.05
Chlorides (Cl-)	500	250	200		600 (average) 1200 (maximum)	200
Cobalt (Co)	? [1]	-	1.0		-	1.0
Copper (Cu)	1.0	0.5	2.0	0.5	Part of total metals	0.5
Cyanide	0.1		-	0.05	-	0.05
Fluorides (F-)	-	-	8	2	-	2
Iron (Fe)	10	-	5.0		-	5
Lead (Pb)	0.1	0.01	0.1	0.01	Part of total metals	0.01
Magnesium	100		-		-	100
Manganese (Mn)	1.0	-	5.0		-	1.0
Mercury (Hg)	0.01	0.001	0.005	0.001	Part of total metals	0.001
Nickel (Ni)	1.0	1.0	0.5	0.5	Part of total metals	0.5
Nitrates (NO_3^-)	? [2]	5	20	5	-	5
Nitrites	2		-	1	-	1
Phosphate (soluble)	5		-		-	5
Phosphorus total (as P)[3]	10	5	6	5	2 (sewage only)	5 (effluent), 2 (sewage)
Selenium (Se)	1.0	-	1.0	0.02	-	0.02

Table 3.1-1 Industrial Effluent and Sewage Discharge Standards

Parameter	Ugandan Standards Limit		TZ Limit	EAC Limit	IFC Guideline Value	Project Preferred Standard
	1999	Draft 2014				
	mg/l unless stated					
Silver (Ag)	0.5	0.1	0.1	0.1	Part of total metals	0.1
Sulphate (SO_4^{-2})	500	-	500	50	-	50
Sulphides (S-)	1.0	1.0	1	1	1	1
Tin (Sn)	5	-	2.0		-	2
Total heavy metals (As, Cd, Cr, Cu, Pb, Hg, Ni, Ag, V and Zn)	-	-	-		5	5
Total (Kjeldahl)[D] nitrogen (as N)	10	-	15	10	10 (sewage only)	10
Vanadium (V)	-	-	1.0		Part of total metals	1
Zinc (Zn)	5	5	5.0	5	Part of total metals	5
Organic Components						
1,1,2-trichloroethane	0.2	-	0.06		-	0.06
1,1,1-trichloroethane	3	-	3.0		-	3
1,2-dichloroethylene	0.2	-	0.2		-	0.2
1,2-dichloroethane	0.04	-	0.04		-	0.04
1,3-dichloropropene	0.2	-	0.2		-	0.2
Alkyl benzene sulfonate (ABS)	-	-	0.5		-	0.5
Aromatic nitrogen containing compounds (e.g. aromatic amines)	-	-	0.001		-	0.001
Benzene	0.2	Nil	-	0	-	Nil
Cis-1,2-dichloroethylene	? [1]	-	0.4		-	0.4
Detergents	10		-		-	10
Dichloromethane	0.2	-	0.2		-	0.2

Table 3.1-1 Industrial Effluent and Sewage Discharge Standards

Parameter	Ugandan Standards Limit		TZ Limit	EAC Limit	IFC Guideline Value	Project Preferred Standard
	1999	Draft 2014				
	mg/l unless stated					
Oil and grease (fatty matters and hydrocarbons)	10	5	10	5	10 (stormwater and sewage only)	5
Organochlorine pesticides (Cl)	-	-	0.0005	0	-	0
Other aromatic or aliphatic hydrocarbons not used as pesticides	-	-	0.05		-	0.05
Total hydrocarbon content	-	-	-		10 (effluent only)	10 (effluent only)
Pesticides other than organochlorines	-	-	0.01		-	0.01
Phenols	0.2	0.02	0.002	0.002	0.5	0.002
Polychlorinated biphenyls	-	-	-	0.003	-	0.003
Tetrachloroethylene	0.1	-	0.1		-	0.1
Tetrachloromethane	0.02	-	0.02		-	0.02
Trichloroethylene	0.3	-	0.3		-	0.3

NOTES:

[1] There are line entries (no.19 for cis-1,2-dichloroethylene, no.20 for cobalt) in the regulations, but no figures defining a limit.

[2] There are duplicate entries for “nitrite – N” in the Ugandan regulations: line 34, 20 mg/l; line 35, 2.0 mg/l. It is assumed that the former of these is intended to be nitrates.

[3] Ugandan regulations and IFC guidelines state “phosphates”, Tanzanian regulations “phosphorus as P”, EAC “total phosphorous”.

[4] “Kjeldahl” specified in Tanzanian regulations only and defined therein as meaning “the concentration of organic nitrogen and ammoniacal nitrogen in an effluent sample, determined after mineralisation. It does not include nitrate and nitrite nitrogen, and does not necessarily include all organically bound nitrogen”

[5] Most probable number

[6] Total residual chlorine

[7] Parameter expressed as ‘temperature change’ – it is unclear if this is a temperature difference of effluent to receiving body or a temperature change of the receiving body e.g. at the edge of a mixing zone, as per IFC.

[8] Faecal coliform

3.2 Receiving and Irrigation Water Standards for Tanzania

On 27 April 2017, the Tanzanian Bureau of Standards' Chemical Standards Section released two draft standards for public consultation. These are:

- CDC 6 (5017) P3 – Receiving Waters – Specification
- CDC 6 (5016) P3 – Water for Irrigation – Specification

Both operate in a similar way, classifying waterbodies according to levels of various parameters and defining their suitability in the receiving waters specification for broad usage groups and the irrigation waters specification for irrigation.

The receiving waters specification defines receiving waters as "water bodies into which any effluent or runoff are being or can be discharged". It states that the standard is being prepared "to guide authorities for processing various uses of receiving waters".

There are no similar standards in Uganda or in the IFC guidelines.

3.2.1 Receiving Waters Specification

Table 3.2-1 details the receiving water standards. The usage categories, "fields of application", are defined as follows:

- **Category 1:** Water that can be processed for drinking water supplies, swimming pools, food and beverage manufacturing industries, pharmaceuticals manufacturing industries or industries requiring a water source of similar quality.
- **Category 2:** Water that can be processed for use in feeding domestic animals; in fisheries, shellfish cultures, recreation and water contact sports.
- **Category 3:** Water that can be processed for irrigation and other industrial activities requiring water of standards lower than those of water in categories 1 and 2.

Table 3.2-1 Receiving Water Standards

Parameter	Permissible Level (mg/l Unless Specified Otherwise)		
	Category 1	Category 2	Category 3
pH	6.5–8.5	6.5–8.5	6.5–9.0
Total dissolved solids	2000	2000	-
Aluminium (Al)	0.3	0.3	0.3
Arsenic (As)	0.05	0.1	0.1
Barium (Ba)	1.0	1.0	1.5
Boron (B)	1.15	1.5	1.5
Cadmium (Cd)	0.03	0.1	0.2
Chromium III (Cr^{3+})	0.1	0.3	0.5
Chromium VI (Cr^{6+})	0.05	0.1	0.1
Cobalt (Co)	0.1	0.1	0.5

Table 3.2-1 Receiving Water Standards

Parameter	Permissible Level (mg/l Unless Specified Otherwise)		
	Category 1	Category 2	Category 3
Copper (Cu)	3.0	3.0	4.0
Iron (Fe)	1.0	1.2	1.5
Lead (Pb)	0.1	0.1	0.2
Manganese (Mn)	0.5	0.8	0.8
Mercury (Hg)	0.001	0.001	0.005
Nickel (Ni)	0.05	0.05	0.1
Selenium (Se)	0.05	0.05	0.5
Silver (Ag)	0.05	0.05	0.05
Tin (Sn)	0.5	0.5	0.1
Vanadium (V)	0.005	0.005	0.01
Zinc (Zn)	0.2	0.2	1.0
Ammonia + Ammonium ($NH_3 + NH_4^+$)	0.5	0.5	2.0
Chlorides (Cl^-)	200	200	400
Fluorides (F^-)	8.0	8.0	8.0
Cyanides (Cn)	0.05	0.05	0.1
Nitrates (NO_3^-)	50	50	100
Dissolved oxygen, min	6	5	3
Oxygen saturation, min	80%	60%	40%
Sulphates (SO_4^{2-})	600	600	600
Sulphides (S^{2-})	0.01	0.01	0.1
Organic and Microbiological Substances or Parameters			
Alkyl benzene sulphonates (ABS)	0.5	1.0	1.0
Aromatic and aliphatic hydrocarbons	0.05	0.05	1.0
Aromatic nitrogen containing compounds (e.g. aromatic amines)	0.01	0.01	0.1
Chloroform extract	0.5	0.5	1.0
Formaldehyde	0.2	0.2	0.5
Grease and oils (petroleum ether extract)	0.5	1.0	5.0
Non-volatile chlorinated compounds	0.005	0.005	0.10
Volatile chlorinated hydrocarbons (as Cl^-)	0.005	0.005	0.01
Organochlorine pesticides (as Cl^-)	0.0005	0.0005	0.001
Other pesticides	0.001	0.001	0.005
Phenols	0.002	0.002	0.1

Table 3.2-1 Receiving Water Standards

Parameter	Permissible Level (mg/l Unless Specified Otherwise)		
	Category 1	Category 2	Category 3
Resins or tar	0.1	0.1	0.5
BOD-5 days, 20°C	5	5	10
BOD-5 days, 25°C	6	6	12
BOD-5 days, 30°C	6	6	12
BOD-5 days, 35°C	7	7	13
Permanganate value	20	20	30
Total coliform organisms (count per 100 ml)	5000	25,000	100,000

Additional specifications are:

(1) The receiving water shall have a concentration of nitrates as low as required to prevent eutrophication or excessive weed growth if nitrogen is a limiting nutrient.

(2) The receiving water shall have a concentration of phosphates as low as required to prevent eutrophication or excessive weed growth if phosphorous is a limiting nutrient.

It is recommended that, as this is a very recent proposed draft, the project should monitor its progress towards adoption. The recommended approach to compliance would be to identify the potential use category of any waterbodies into which effluent may be discharged and to ensure that project discharges do not lead to a change in the use category.

3.2.2 Water for Irrigation Specification

The irrigation specification states:

> "This Draft Tanzania Standard is being prepared in order to control the quality of water used for irrigation purposes. Within the growing agriculture industry in Tanzania, it is accepted that good quality water is needed for maintaining viable production. This draft standard has been prepared in order to maintain the quality of required water for use by relevant stakeholders in the irrigation purposes."

The specification contains two tables. The first classifies water into "degrees of restriction" for irrigation according to levels of major parameters. The precise implications of the degrees of restriction are not detailed. The specification states, "For guidance on use of these tables refer to specialists in irrigation". The second table contains maximum levels of trace elements for long- and short-term irrigation use. These tables are reproduced as Table 3.2-2 and Table 3.2-3 respectively.

Table 3.2-2 Degree of Restriction of Irrigation Water According to Major Parameters

Parameter	Degree of Restriction		
	No Problem	Increasing Problem	Severe Problem
Salinity (affects crop water availability)			
Electrical conductivity (mmhos/cm)	<0.75	0.75–3.0	>3.0
Total dissolved solids (mg/l)	<450	450–2000	>2000
Permeability/filtration (affects infiltration rate into soil) electrical conductivity (mmhos/cm)	>0.5	0.2–0.5	<0.2
Specific Ion Toxicity (affects sensitive crops)			
Sodium adsorption rate [1]	<3	3–9	>9
Chloride (Cl) (mg/l)	<142	142–355	>355
Boron (B) (mg/l)	<0.75	0.75–2.0	>2.0
NO3-N or NH4-N (mg/l) [2]	<5	5–30	>30
HCO3 (mg/l) (overhead sprinkling)	<91.5	91.5–518.5	>518.5
pH	<6.5	6.5–8.4	>8.4

NOTES:

[1] Sodium adsorption ratio – ratio between soluble sodium and soluble divalent cations (calcium and magnesium) in water or soil extracts that can be used to predict the relative activity of sodium ions in exchange reactions with soil

[2] NO_3-N means nitrate nitrogen reported in terms of elemental nitrogen (NH_4-N and Organic-N should be included when wastewater is being tested)

Table 3.2-3 Maximum Concentrations of Trace Elements in Water for Irrigation

Substance	Maximum Concentration (mg/l)	
	Long-Term Use	Short-Term Use
Aluminium (Al)	5.0	20
Arsenic (As)	0.10	2.0
Beryllium (Be)	0.10	0.5
Cadmium (Cd)	0.01	0.05
Chromium (Cr)	0.1	1.0
Cobalt (Co)	0.05	5.0
Copper (Cu)	0.2	5.0
Fluoride (F–)	1.0	15.0
Iron (Fe)	5.0	20.0
Lead (Pb)	5.0	10.0

Table 3.2-3 Maximum Concentrations of Trace Elements in Water for Irrigation

Substance	Maximum Concentration (mg/l)	
	Long-Term Use	Short-Term Use
Lithium (Li)	2.5	2.5
Manganese (Mg)	0.2	10.0
Molybdenum (Mo)	0.01	0.05
Nickel (Ni)	0.2	2.0
Selenium (Se)	0.02	0.02
Vanadium (V)	0.1	1.0
Zinc (Zn)	2.0	10.0

NOTE:
The maximum concentration is based on a water application rate that is consistent with good irrigation practices (10,000 m_3 per hectare per year). If the water application rate greatly exceeds this, the maximum concentrations should be adjusted downward accordingly. No adjustment should be made for application rates less than 10,000 m_3 per hectare per year. The values given are for water used on a continuous basis at one site.

It is recommended that, as this is a very recent proposed draft, the project should monitor its progress towards adoption. The recommended approach to compliance would be to identify the potential classification, for irrigation purposes, of any water bodies into which effluent may be discharged and to aim to ensure that project discharges do not lead to a change in the classification or contain levels of trace elements that would restrict the use of water for irrigation.

3.3 Drinking Water Standards

3.3.1 Ugandan Standards

The Uganda Standard, US EAS 12: 2014, Potable water — Specification, is identical to and has been reproduced from an East African Standard, EAS 12: 2014. US EAS 12: 2014 cancels and replaces the previous Ugandan standard US 201:2008.

In addition, the Ugandan Design Guidelines for Water Supply Infrastructure state that water supplied for potable uses should meet the WHO water quality standards for parameters that are not included in the national drinking water quality standards.

3.3.2 Tanzanian Standards

The TBS Tanzanian Standard TZS 789:2003 Drinking (Potable) Water – Specification contains quality requirements applicable to drinking water other than packaged drinking water and natural mineral water. Requirements for quality are divided into three categories:

- microbiological quality requirements
- physical and chemical requirements

- standards of sanitary protection of water intake and surrounding land.

The limits established for the above components have been incorporated into the Environmental Management (Water Quality Standards) Regulations, 2007, which also include various descriptive requirements. In some cases, both lower and upper limits are stated; these are expressed as a range in the comparison table.

3.3.3 International Standards

The IFC General EHS Guidelines for Community Health and Safety state that drinking water sources, whether public or private, should at all times be protected so that they meet or exceed applicable national acceptability standards or, in their absence, the current edition of WHO's *Guidelines for Drinking-water Quality*.

WHO's *Guidelines for Drinking-water Quality* (fourth edition, WHO 2011) is recognised as the UN system's official position on drinking water quality. The guidelines are used as the scientific departure point for many regulatory regimes such as the EU's directives.

The International Association of Oil and Gas Producers (IOGP) and the International Petroleum Industry Environmental Conservation Association (IPIECA) both reference the WHO guidelines as a reference source for determining drinking water quality guidelines.

3.3.4 Comparison of Standards

Table 3.3-1 compares drinking water standards. The rightmost column includes the proposed project-preferred standard.

Table 3.3-1 Drinking Water Standards

Parameter	Ugandan Standard Limit Level		Tanzanian Standards Limit Levels	WHO Water Quality Guidelines Limit Levels	Project Preferred Standard
	Treated	Natural			
	(mg/l unless otherwise stated)				
Coliform	Absent	Absent	0 count per 100 ml at 37°C (excellent) 1–3 count per 100 ml at 37°C (satisfactory**)	Must not be detectable in any 100 ml sample (*E. Coli* or thermotolerant coliform bacteria)	Absent
E. Coli (faecal coliform)	Absent	Absent	0 count per 100 ml at 44°C	Must not be detectable in any 100 ml sample (*E. Coli* or thermotolerant coliform bacteria)	Absent
Enterococci	-	-	0 number/100 ml	-	0 number/100 ml
Acrylamide	-	-	-	0.5 µg/l	0.5 µg/l

Table 3.3-1 Drinking Water Standards

Parameter	Ugandan Standard Limit Level		Tanzanian Standards Limit Levels	WHO Water Quality Guidelines Limit Levels	Project Preferred Standard
	Treated	Natural			
	(mg/l unless otherwise stated)				
Antimony	-	-	-	20 µg/l	20 µg/l
Arsenic	0.01	0.01	0.05	10 µg/l	10 µg/l
Barium	0.7	0.7	1	-	0.7 mg/l
Benzene	0.01	0.01	-	10 µg/l	10 µg/l
Benzo(a)pyrene	0.7 µg/l [3]	0.7 µg/l [3]	-	0.7 µg/l	0.7 µg/l
Boron	2.4	2.4	-	2.4 mg/l	2.4 mg/l
Bromate	0.01	0.01	-	10 µg/l	10 µg/l
Cadmium	0.003	0.003	0.05	3 µg/l	3 µg/l
Chromium [D]	0.05	0.05	0.05	50 µg/l	50 µg/l
Copper	1	1	1–3	2 mg/l	1 mg/l
Cyanide	0.01	0.01	0.2	-	0.01 mg/l
Epichlorohydrin	-	-	-	0.4 µg/l	0.4 µg/l
Fluoride	1.5	1.5	1.5–4	1.5 mg/l	1.5 mg/l
Lead	0.01	0.01	0.1	10 µg/l	10 µg/l
Mercury	0.001	0.001	0.001	6 µg/l	0.001 mg/l
Nickel	0.02	0.02	-	70 µg/l	0.02 mg/l
Nitrate	45	45	10–75	50 mg/l[5]	45 mg/l
Nitrite	0.003	0.003	-	3 mg/l (short-term exposure)[5] 0.2 mg/l (long-term exposure)	3 mg/l (short-term exposure)[5] 0.2 mg/l (long-term exposure)
Total nitrogen (excluding NO_3)	-	-	1	-	1 mg/l
Zinc	5	5	5–15	-	5 mg/l
Aldrin + Dieldrin	0.03 µg/l	0.03 µg/l	-	0.03 µg/l	0.03 µg/l
Selenium	0.01	0.01	0.05	40 µg/l	0.01 mg/l
Trichloroethene	-	-	-	40 µg/l	40 µg/l

Table 3.3-1 Drinking Water Standards

Parameter	Ugandan Standard Limit Level		Tanzanian Standards Limit Levels	WHO Water Quality Guidelines Limit Levels	Project Preferred Standard
	Treated	Natural			
	(mg/l unless otherwise stated)				
Trihalomethanes total	30 µg/l chloroform	30 µg/l chloroform	-	The sum of the ratio of the concentration of each to its respective guideline value should not exceed 1 300 µg/l chloroform 100 µg/l bromoform 100 µg/l dibromochloromethane 60 µg/l bromodichloromethane	Comply with both the Ugandan outright chloroform standard and the WHO composite standard
Vinyl chloride	-	-	-	0.3 µg/l	0.3 µg/l
Colour	15 TCU	50 TCU	15–50 TCU	-	15 TCU
Iron	0.3	0.3	0.3–1.0	-	0.3 mg/l
Manganese	0.1	0.1	0.1–0.5	400 µg/l	0.1 mg/l
Odour	Odourless	Odourless	Not objectionable	-	Odourless
Taste	Not obj.	Not obj.	Not objectionable	-	Not objectionable
Turbidity	5	25	5–25 NTU	-	5 NTU
pH	6.5–8.5	5.5–9.5	6.5–9.2	-	6.5–8.5
Total filterable residue	-	-	200–2000	-	200–2000 mg/l
Total hardness	300 [1]	600 [1]	500–600	-	300 mg/l [1]
$CaCO_3$	-	-	75–300	-	300 mg/l
Calcium	150	150	50–100	-	100 mg/l
Magnesium	100	100	500–1000	-	100 mg/l
Magnesium and sodium	200 (Na)	200 (Na)	200–600	-	200 mg/l (Na)
Sulphate	400	400	200–800	-	400 mg/l
BOD (5 days at 30°C)	-	-	6	-	6 mg/l
PV (oxygen as $KMNO_4$)	-	-	10–20	-	10 mg/l
Ammonia or ammonium	0.5 (NH_3)	0.5 (NH_3)	2 (NH_3+NH_4^+)	-	2 mg/l (NH_3+NH_4^+), 0.5 mg/l (NH_3)

Table 3.3-1 Drinking Water Standards

Parameter	Ugandan Standard Limit Level		Tanzanian Standards Limit Levels	WHO Water Quality Guidelines Limit Levels	Project Preferred Standard
	Treated	Natural			
	(mg/l unless otherwise stated)				
Surfactants (alkyl benzyl sulphonates)	0.2 [2]	0.2 [2]	1 – 2	-	0.2 mg/l [2]
Organic matter (as carbon in chloroform extract)	-	-	0.5	-	0.5
Phenolic substances (as phenol)	0.002	0.002	0.002	-	0.002 mg/l
Radioactive materials: gross alpha activity	0.5	0.5	0.1 Bq/l	-	0.1 Bq/l
Gross beta activity	1	1	0.1 Bq/l	-	0.1 Bq/l

NOTES:

[1]As $CaCO_3$

[2]Reacting with methylene blue

[3]Unspecified polynuclear aromatic hydrocarbon

[4]Specified as “Chromium (6+)” for Tanzanian Standards limit level

[5]WHO standards are as ions.

The Ugandan standard sets limits for the following substances or parameters, for which there are no comparable limits in Tanzanian or WHO standards. Units are mg/l. Where there is an oblique, this separates different standards for treated and natural water sources. These are proposed as project standards.

Physical: Conductivity 1500/2500 µS/cm, suspended matter not detectable

Chemical: total dissolved solids 700/1500, aluminium as Al^{3+} 0.2, chloride as Cl^{-} 250

Inorganic: molybdenum 0.07, phosphates as PO_4^{3-} 2.2, residual free chlorine 0.2–0.5/absent

Organic: toluene 0.7, xylene 0.5, carbon tetrachloride 0.002, 1,2-dichloroethane 0.03, 1,1-dichloroethylene 0.0003, tetrachloroethene 0.04, 2,4,6-trichlorophenol 0.2, organic matter 0.003, mineral oil 0.00001

Pesticides: chlordane (total) 0.0003, 2,4-dichlorophenoxyacetic acid 0.03, DDT (total) 0.001, heptachlor and heptachlor epoxide 0.00003, hexachlorobenzene 0.001, lindane BHC 0.002, methoxychlor 0.02

Microbiological: total viable counts at 22 and 37°C respectively: 100 and 50; plus a number of specified micro-organisms such as shigella and salmonella that must be absent

4 NOISE

4.1 Environmental Noise

4.1.1 Ugandan and Tanzanian Standards

The noise control standards defined by Ugandan and Tanzanian legislation are the same. They are respectively from the National Environment (Noise Standards and Control) Regulations, 2003 and the Environmental Management (Standards for the Control of Noise and Vibration Pollution) Regulations, 2011.

In April 2017, the Tanzanian Bureau of Standards (TBS) published a new draft standard - EMDC 5(4145) P3, “Acoustic- General Tolerance Limits for Environmental and Occupational Noise” for stakeholder comment. This draft proposes less stringent standards applicable to the two most sensitive noise receptor classes, aligning them with the IFC standards. These are shown in parentheses in Table 4.1-1. The standards for the other receptor classes remain unchanged.

4.1.2 International Standards

The IFC General EHS Guidelines include some guidelines for noise levels.

4.1.3 Comparison of Standards

Table 4.1-1 compares national and international standards for noise. The project-preferred standards are the same as the in-force national standards.

Table 4.1-1 Operational or General Environmental Noise Standards

Surrounding Environment[1]	**Ugandan, Tanzanian and Project Preferred Standards(dB(A) L_{Aeq}) Draft Tanzanian Standards in (s)[2]**		**IFC Guidelines (dB(A) one-hour L_{Aeq})**	
	Day (0600 to 2200)	**Night (2200 to 0600)**	**Day (0700 to 2200)**	**Night (2200 to 0700)**
Any building used as hospital, convalescence home, home for the aged, sanatorium and institutes of higher learning, conference rooms, public library, and environmental or recreational sites	45 (52)	35 (42)	55	45
Residential buildings	50 (55)	35 (45)		

Table 4.1-1 Operational or General Environmental Noise Standards

Surrounding Environment[1]	Ugandan, Tanzanian and Project Preferred Standards(dB(A) L_{Aeq}) Draft Tanzanian Standards in (s)[2]		IFC Guidelines (dB(A) one-hour L_{Aeq})	
	Day (0600 to 2200)	Night (2200 to 0600)	Day (0700 to 2200)	Night (2200 to 0700)
Mixed residential, with some commercial and entertainment	55	45	70	70
Residential + industry or small-scale production + commerce	60	50		
Industrial	70	60		

NOTES:

[1]The receptor categories are from the national legislation. The categories in the IFC guidelines are "residential, institutional and educational" (for which the lower guideline levels apply) and "industrial and commercial" (higher levels)

[2] The draft revised limits are not project preferred limits at present

The IFC guidelines state that, in addition, to meeting the IFC standards:

> "noise prevention and mitigation measures should be applied where predicted or measured noise impacts from a project facility or operations exceed the applicable noise level guideline at the most sensitive point of reception. . . . Noise impacts should not exceed the levels [presented in Table 4.1-1]] or result in a maximum increase in background levels of 3 dB at the nearest receptor location off-site."

4.2 Construction Noise

The Tanzanian and Ugandan regulations detailed in Section 4.1.1 both contain limits applicable to construction and they differ between the two countries; see Table 5.1-1. The TBS draft standard does not include standards specific to construction noise.

Table 4.2-1 Construction Site Noise Standards

Facility (TZ) or Noise Control Zone (UZ)	Ugandan Standards (dB(A) LAeq)		Tanzanian Standards (dB(A) LAeq)		Project Preferred Standard (dB(A) LAeq)	
	Day (0600 to 2200)	Night (2200 to 0600)	Day (0600 to 2200)	Night (2200 to 0600)	Day (0600 to 2200)	Night (2200 to 0600)
Residential	60	40	75[1]	65[1]	60	40
Commercial	75	50			75	50
Industrial	85	65			75	65
"Hospital, schools, institutions of higher learning, homes for the disabled"	-	-	60	50	60	50

NOTES: [1]These standards apply to any building other than those for which the more stringent standard is prescribed (such as hospitals).

The IFC does not provide any numerical limits specifically related to noise generated from construction. It does, however, outline several mitigation measures to control noise for consideration.

The relevant Ugandan and Tanzanian regulations and the draft Tanzanian standard set the same standards for impact or impulsive noise and intermittent or continuous noise from a factory or workshop. Although they do not specify limitations on the receptors that they intend to protect, they are clearly primarily occupational noise standards and are therefore not included in this document.

Both sets of national regulations also prescribe (the same) limits for vehicles (specified as 'accelerating' vehicles in the Ugandan regulations). Similar comments apply as in Section 2.3 regarding the responsibilities of vehicle owners and operators compared to manufacturers, importers or retailers and therefore the standards are not included in this document.

5 SOIL

5.1 Ugandan Standards

Section 3.1 includes standards for the discharge of effluent to groundwater or land.

The National Environment (Minimum Standards for Management of Soil Quality) Regulations, 2001 set Ugandan soil quality standards. These regulations:

- establish and prescribe minimum soil quality standards for maintaining, restoring and enhancing the inherent productivity of the soil in the long term
- establish minimum standards for managing the quality of soil for specified agricultural practices
- establish criteria and procedures for measuring and determining soil quality
- issue measures and guidelines for managing soil.

The classifications for soil quality for rain-fed and irrigated agriculture (with the minimum required quality indicated) are presented respectively in Table 5.1-1 and Table 5.1-2. There are no regulations or standards limiting the levels of contaminants in soils, as there are in Tanzania.

Table 5.1-1 Ugandan Soil Quality Classifications for Rain-fed Agriculture

Soil Quality Parameter	Class I Prime	Class II Good	Class III Medium (Minimum Standard)	Class IV Marginal	Class V Unsuitable
Bulk density – upper limit (g/cm^3)	1.25	1.3	1.5	1.65 or 1.25 (wetlands)	High
Porosity (volume %)	53	51	43	38 or 53 (wetlands)	Low
Water holding capacity (mm H_2O/m soil)	>150	130–150	100–130	<100	Low
Infiltration rate (mm/hr)	60–100	40–60	10–40	<10	Low
Permeability (mm/hr)	50–80	40–50	10–40	<10	Low
Slope (%)	0–3	3–8	8–13	13–20	>20
Stoniness (volume %)	<0.1 (>30 m apart)	0.1 (10–30 m apart)	<1 (10–30 m apart)	1–3 (10–30 m apart)	>15% of the surface covered
Soil depth (cm)	>100	75–100	20–75	<20	Very shallow
Flooding and duration (monthly or year)	NL	NL	Slight to moderate >1–2	Moderate to severe 2–4	Very severe >4
Depth to water table (cm)	>150	100–150	50–100	25–50	0–25

Table 5.1-2 Ugandan Soil Quality Classifications for Irrigated Agriculture

Soil Quality Parameter	Class I Suitable	Class II Moderately Suitable	Class III Marginally Suitable (Minimum Standard)	Class IV Potentially Suitable	Class V Unsuitable
Slope (%)	0–3	3–8	8–13	13–20	>20
Wetness Flooding Internal drainage Natural drainage	 NF Moderate Good	 Slight or less Moderate - rapid Good	 - Slow-very rapid Mod.	 - Slow-very rapid Imperfect	 - Very slow Very poor
Physical Topsoil texture, 0–25 cm Subsoil texture, 25–100 cm Surface stoniness (volume %) Subsurface coarse fragments (volume %)	 SL-CL SL-CL <0.01 0-5	 LS-C LS-C 0.01-0.1 5-15	 S-C LS-C 0.1-3.0 15-20	 S-C S-C 3-15 20-25	 CM-S CM-S >15 >25
Salinity and alkalinity (75–100 cm) EC (mmhos/cm) ESP, 0–100 cm	 <1 <4	 1-4 4-10	 4-8 10-20	 8-15 20-25	 >15 >25

NOTES:
C= clay, CM = massive clay, S= sand, SL = sandy loam, CL = clay loam, LS = loamy sand
NL = not limiting.
ESP = Exchangeable sodium percentage (meq/100g soil) x 100.
EC = electrical conductivity
mmhos/cm = milli mhos per centimetre - the basic (archaic) unit of measure of electrical conductivity in soil. A mho is equivalent to a siemens, which is the modern, SI-derived unit

Further tables within the first schedule of the regulations similarly define classifications for wetland rice systems. Table 5.1-3 presents the classification thresholds. The table includes the classifications for both naturally flooded and irrigated systems. The regulations give the following guidance on these definitions:

> "The natural flooding or waterlogged system represents the small-scale rice products in periodically flooded alluvial plains and valleys. These systems depend on flooding from rain events. The irrigated system represents the large-scale systems where irrigation waters

are ‘fairly’ well regulated. These rice production systems are adapted to specific hydrologic conditions and specific soil qualities.

The first category is very widespread in eastern Uganda and it is the main cultivation pattern in wetlands.”

Table 5.1-3 Ugandan Soil Quality Classifications for Wetland Rice Systems

Soil Quality Parameter	Class I Suitable	Class II Moderately Suitable	Class III Marginally Suitable (Minimum Standard)	Class IV Potentially Suitable	Class V Unsuitable
Slope (%)	NL / <1	<2 / <2	<4 / <3	<6 / <4	<8 / <5
Wetness Flooding Drainage	3–4 mon / NL Poor / mod to IP	3–4 mon / NL Poor to imperfect / Good to poor	<2 mon / 3–4 mon VP to mod / good to VP	<1 mon / 3–4 mon VP to mod / -	Too short / too short or too long VP / -
Physical Surface texture and structure Subsurface texture and structure	CM to SIC CM to LSF	CM to SCL CM to SC	CM to SF -	CM to SF -	CM to SC -
Salinity and alkalinity EC (mmhos/cm) ESP, %	<1 / <2 <4 / <5	<4 / <4 <10 / <10	<6 / <6 <20 / <20	<6 / <6 <25 / <35	<6 / <6 <25 / <35

NOTES:
Data before the oblique (/) are threshold limits for naturally flooded systems, those after the oblique are for irrigated systems. Data for the physical parameters are the same for both types
CM = massive clay, SF= fine sand, SC = coarse sand, SIC = silty clay blocky, SCL = sandy clay loam, LSF = loamy fine sand
NL = not limiting, mod = moderate, VP = very poor, IP = impermeable, mon = month(s)
ESP = Exchangeable sodium percentage (meq/100 g soil) x 100.
EC = electrical conductivity
mmhos/cm = milli mhos per centimetre - the basic (archaic) unit of measure of electrical conductivity in soil. A mho is equivalent to a siemens, which is the modern, SI-derived unit

Subsequent relevant schedules of the regulations include further guidance on the definitions and methods for determination of the soil quality parameters (third schedule) and measures and guidelines for soil conservation (fourth schedule).

The project-preferred procedure is that where the project affects agricultural land, the project will define and classify the soil quality before any major groundwork takes place. On reinstatement of the land, the process will be repeated and the soil quality should be at least returned to the same class as prior to groundwork.

5.2 Tanzanian Standards

Section 3.1 covers standards for the discharge of effluents to surface water and groundwater.

The Environmental Management (Soil Quality Standards) Regulations 2007 establish the role of the National Environmental Standards Committee for soil quality, and contain provisions establishing pollution prohibitions and minimum soil quality standards, arrangements for soil pollutant discharge permits, compliance and enforcement, and offences and penalties. One of the committee's responsibilities is to set minimum standards for soil quality. Empirical limits for a variety of polluting substances are set out in several schedules. These are summarised in the table below. All are adopted as project-preferred standards. There are no standards or regulations classifying requirements for agricultural land as there are in Uganda.

Table 5.2-1 Tanzanian Soil Contaminant Limits

Parameter	Upper Limit (mg/kg)	Parameter	Upper Limit (mg/kg)
Organic compounds		Metals	
Benzene	5	Arsenic	1
Carbon tetrachloride	5	Cadmium	1
1, 2-dichloroethane	5	Hexavalent chromium	100
1, 1-dichloroethylene	0.5	Lead	200
Cis-1,2-dichloroethylene	40	Manganese	1800
Trans-1,2-dichloroethylene	60	Mercury	2
Dichloromethane	90	Nickel	100
Ethylbenzene	200	Selenium	20
Styrene	1000	Copper	200
Tetrachloroethylene	50	Zinc	150
Toluene	500	Molybdenum	5
Trichloroethylene	30	Other chemicals	
1,1,1-trichloroethane	600	Benzo(a)pyrene	1.0
1,1,2-trichloroethane	10	Cyanide	10
Total xylenes	200	Polychlorinated biphenyls (PCBs)	1.0
		Vinyl chloride	1.0
		Polychlorinated dibenzo dioxins	100 ng toxic equivalents (TEQ)/kg

Table 5.2-1 Tanzanian Soil Contaminant Limits

Parameter	Upper Limit (mg/kg)	Parameter	Upper Limit (mg/kg)
Pesticides		Pesticides	
Atrazine	50	Paraquat	300
2,4-dichlorophenox acetic acid (2,4-D)	700	Diquat	150
2,4-dichlorophenox acetic acid amine (2,4-D amine)	700	Chlordane[1]	0.6
Lindane	2	DDT[1]	3
Pentachlorophenol	20	Dieldrin[1]	0.05
Sulphur	500	Heptachlor[1]	0.2
Endosulfan	60	Toxaphene[2]	0.6
Glyphosate	700	Aldrin[1]	0.05
Acetochlor	500	Hexachlorobenzene[1]	500
Carbofuran	200		

NOTES:

[1]Restricted by Stockholm Convention on persistent organic pollutants, to which Tanzania is a party

[2]Banned by Stockholm Convention on persistent organic pollutants

5.3 International Standards

International best practice has adopted a risk-based approach for contaminated land and associated groundwater management. With this approach, the required soil quality is defined by the use of the land, pathways to potential receptors, and types of receptors rather than the rigid standards as set by Ugandan and Tanzanian legislation. The approach is described in Section 1.8 of the IFC's General EHS Guidelines.

The project-preferred standard will use this risk-based approach to go beyond compliance with the national standards where necessary. In exceptional circumstances, the risk-based approach could be used to justify a noncompliance with a national standard.

The IFC EHS Guidelines for Onshore Oil and Gas Development include guideline values for hydrotest discharges to land; see Section 3.1.3.

5.4 Summary of Project Preferred Standards

Controls on soil and groundwater impact differ considerably between Ugandan law, Tanzanian law and international standards. The project should apply a composite of these regimes in managing its effects on soils and groundwater. The project preferred approach is to:

- for affected agricultural land, at least maintain and preferably improve the soil quality classification, as defined by the Ugandan regulations, that was in place before the project's activity when it is returned to agricultural use
- comply with the Tanzanian limits on contaminant levels

  apply the risk-based approach as outlined in the IFC EHS General Guidelines to determine when it will be necessary to go beyond compliance in managing land contamination.