UPSTREAM EFFLUENT MANAGEMENT (UEM) POLICY

MINISTRY OF ENERGY AND ENERGY INDUSTRIES

(MEEI)

February 2018

FOREWORD

The Government of the Republic of Trinidad and Tobago (GoRTT) is committed to ensuring that there is a sustainable balance between the development of the oil and gas sector and the protection, conservation and wise use of the environment. As such, it is the responsibility of the GoRTT to support more sustainable Upstream Effluent Management (UEM) practices, whilst it continues to benefit from hydrocarbon production.

In light of the existing state of the upstream oil and gas industry, the GoRTT has established an UEM Committee, tasked with establishing this UEM Policy. This Policy focuses on effluents created as a result of oil and gas operations including Produced Water (PW), Drilling Fluids (DF), Workover Fluids (WF), Completion Fluids (CF), and Hydrotest Water (HTW). Due to its inextricable association to DF, in a supplementary section, a Drill Cuttings (DC) Policy is also outlined.

The overarching principle of the UEM policy includes the minimization and ultimate elimination of treated and untreated upstream effluent discharge by utilization of an integrated management approach to ensure Zero Harmful Discharge (ZHD) to the environment.

This UEM Policy outlines the objectives that the Government will embark upon in order to achieve good petroleum industry practices, aligned with the country's National Development Strategy 2016-2030 (Vision 2030) and National Environmental Policy (NEP). These objectives are intended to impact UEM practices, legislation, regulation, research and development, as well as, beneficial production practices. The strategies detailed under the specific objectives are also intended to prioritize the actions required by the various stakeholders and their roles and responsibilities for implementation of this Policy.

LIST OF ACRONYMNS

API	Advanced Plate Interceptor
AUOTT	Association of Upstream Operators of Trinidad and Tobago
BAT	Best Available Technology
BOD	Biological Oxygen Demand
BPEO	Best Practicable Environmental Options
BTEX	Benzene, Toluene, Ethyl benzene, Xylene
CEC	Certificate of Environmental Clearance
CF	Completion Fluids
CHARM	Chemical Hazard Assessment and Risk Management
COD	Chemical Oxygen Demand
DC	Drill Cuttings
DF	Drilling Fluids
DGWS	Downhole Gas/Water Separator
DOWS	Downhole Oil/Water Separator
EC	Electrical Conductivity
EIA	Environmental Impact Assessment
EIF	Environmental Impact Factor
EM Act	Environmental Management Act
EMA	Environmental Management Authority
ERA	Ecological Risk Assessment
E&P	Exploration and Production
GoRTT	Government of the Republic of Trinidad and Tobago
HTW	Hydrotest Water
IMA	Institute of Marine Affairs
MEEI	Ministry of Energy and Energy Industries
OSPAR	Oslo/Paris convention (for the Protection of the Marine Environment of the North-East Atlantic)
PAH	Polyaromatic hydrocarbon
PAMMD	Petroleum Asset Monitoring and Measurement Division
PW	Produced Water
ROC	Retention on Cuttings
TO&G	Total Oil and Grease
TPH	Total Petroleum Hydrocarbons
TTBS	Trinidad and Tobago Bureau of Standards
US EPA	United States Environmental Protection Agency
UTT	University of Trinidad and Tobago
UWI	University of the West Indies
WET	Whole Effluent Toxicity
WF	Workover Fluids
WPR	Water Pollution Rules
SPE	Society of Petroleum Engineers

GLOSSARY

BAT	The latest stage of development (state of the art) of processes, of facilities or of methods of operation, which indicate the practical suitability of a particular measure for limiting discharges, emissions and waste. This is the technology approved for limiting pollutant discharges with regard to an abatement strategy.
BPEO	For a given set of objectives, it is the option that provides the most benefits or the least damage to the environment, as a whole, at acceptable cost, in the long term as well as the short term. Moreover, it is the outcome of a systematic consultative and decision-making procedure which emphasises the protection and conservation of the environment across land, air and water.
Completion	The hardware used to optimize the production of hydrocarbons from the well. This may range from nothing but a packer on tubing above an open hole completion ("barefoot" completion), to a system of mechanical filtering elements outside of perforated pipe, to a fully automated measurement and control system that optimizes reservoir economics without human intervention (an "intelligent" completion) and; A generic term used to describe the assembly of downhole tubulars and equipment required to enable safe and efficient production from an oil or gas well. The point at which the completion process begins may depend on the type and design of well. However, there are many options applied or actions performed during the construction phase of a well that have significant impact on the productivity of the well.
Completion Fluids	A solids-free liquid placed in the well to facilitate final operations prior to initiation of production, such as, setting screens, production liners, packers, downhole valves or shooting perforations into the producing zone.
Drilling Fluids	Any of a number of liquid and gaseous fluids and mixtures of fluids and solids (as solid suspensions, mixtures and/or emulsions of liquids, gases and solids) used in operations to drill boreholes into the earth.
Drill Cuttings	Soil, rock fragments, and pulverized material, which are, removed from a borehole and which may include a minimal amount of fluid that resulting from a drilling process.
ERA	The process for evaluating the risk of harm to the living species in a receiving environment as a result of exposure to one or more environmental stressors such as chemicals and land change.
Effluent	Wastewater, treated or untreated, which flows out of a treatment plant or industrial point source, such as a pipe. Generally refers to wastes discharged into surface waters.

Environmental Impact Factor	A management tool that helps to identify the potentially most harmful substances in the discharges of produced water and to quantify the environmental benefit of different mitigating measures. The EIF method can be based on a Predicted Environmental Concentration (PEC)/ Predicted No Effect Concentration (PNEC) approach. The ratio PEC/PNEC is related to the risk of damage to a marine recipient. That is, the concentration PEC for some compound discharged into the recipient is compared to some concentration threshold limit PNEC for that compound. When PEC is larger than the threshold PNEC, there may be a risk for damage. When the PEC is lower than the PNEC threshold, the risk for damage is considered to be "acceptable".
Formation Water	Water that occurs naturally within the pores of rock. Water from fluids introduced to a formation through drilling or other interference, such as mud and seawater, does not constitute formation water. Formation water, or interstitial water, might not have been the water present when the rock originally formed. In contrast, connate water is the water trapped in the pores of a rock during its formation and may be called fossil water.
Hydrotest Water	Water and chemicals which will be placed in pipelines, tanks, etc. (new/unused or used) and raised to greater than atmospheric pressure in order to check for leaks and/or the structural integrity of these facilities.
Hydrostatic testing	The use of water for pressure testing a pipeline to determine its integrity.
Produced Water	Water (brine) brought up from the hydrocarbon-bearing strata during the extraction of oil and gas. It can include formation water, condensation water, injection water, water for de-salting and any chemicals added downhole or during the oil/water separation process.
Slugging	Accumulation of a water, oil or condensate in a gas pipeline. These fluids need to be removed using a pig.
Waste	This includes any material discarded or intended to be discarded which constitutes garbage, refuse, sludge, or other solid, liquid, semisolid or gaseous material, resulting from any residential, community, commercial, industrial, manufacturing, mining, petroleum or natural gas exploration, extraction or processing, agricultural, healthcare, or scientific research activities.
Workover Fluids	A well-control fluid, typically a brine that is used during workover operations.
Zero harmful discharges	Discharges where by risk-based, case by-case evaluation must show that the discharges will not cause any harm to the receiving environment.

TABLE OF CONTENTS

CHAPTER 1: Introduction

1.1 Background

Over the years, the Energy Sector has proven to be an integral part of the nation's overall development. As a result, the Government of the Republic of Trinidad and Tobago (GoRTT) has recognized its responsibility in supporting a more sustainable oil and gas industry. The economic fortunes of Trinidad and Tobago can be attributed to the exploration and production (E&P) of oil and gas. Inextricably linked to the exploitation of these resources, are the various effluents generated, which, if not managed in an environmentally sound manner, can have significant negative consequences.

These effluents created as a result of oil and gas operations are Produced Water (PW), Drilling Fluids (DF), Workover Fluids (WF), Completion Fluids (CF), and Hydrotest Water (HTW), which are addressed within this Upstream Effluent Management (UEM) Policy. The UEM Committee also addressed the management of Drill Cuttings (DC) due to its close association with the aforementioned effluents, namely DF. This waste stream, not meeting the criteria to be deemed an *effluent*, is dealt with as a supplementary document. In keeping with the main objectives of the UEM Policy, the GORTT's strategies to improve DC management are highlighted (Refer to S1).

Due to its negative impacts on the environment, upstream effluent regulations in some parts of the world have become stricter with a goal of reducing and/or eliminating such impacts, especially those of the more toxic components (e.g. phenols, BTEX, PAHs, etc.). In order to comply with local environmental standards for example Water Pollution Rules (WPR) 2001 (as amended), Certificate of Environment Clearance (CEC) Rules, and the requirements of international conventions, it is envisaged that operators should incorporate best environmental practices, thereby minimizing negative environmental impacts.

1.2 Need for Policy

This UEM Policy serves as a guide, where necessary, for the amendment of existing regulations, for new regulations and for use of BAT and best management practices. A UEM Policy is a regulatory tool that provides all stakeholders involved, with a clear statement of the government's intention to address upstream effluents and expectations for all relevant stakeholders.

There have been challenges in the Energy Sector, in particular, with the application of the Certificate of Environmental Clearance (CEC) Rules and the WPR 2001 (as amended). Some of the main challenges faced within the Sector include:

1. inability to meet some of the permissible discharge standards in the Second Schedule of the WPR, 2001 (as amended), in particular, Ammoniacal Nitrogen, Phenols and Chemical Oxygen Demand (COD);
2. limited Best Practicable Environmental Options (BPEO) treatment technologies to meet end-of-pipe standards
3. lack of Ambient Water Quality Standards for Trinidad and Tobago to support designated uses and for assessing environmental impacts;
4. lack of adequate information on the toxicity of raw formation water versus PW which has chemical additives;
5. lack of knowledge on the cumulative impacts of upstream effluents (raw and treated) on the receiving environments; and
6. limited number of local laboratories capacity including accreditation for testing certain constituents in upstream effluents.

1.3 Purpose of Policy

This Policy seeks to outline the direction for a more sustainable Upstream Energy Sector, capable of meeting local regulations and interdependent/related Government Policies. As such, this policy addresses the gaps and deficiencies in national enforcement mechanisms as well as the regulatory and legislative mechanisms. In addition, the policy treats with the lack of reasonably practicable options that may exist in Trinidad and Tobago and the various management options available to allow the development of a more sustainable industry.

1.3.1 Policy Objectives

The objectives of this policy are to:

1. identify the specific areas for legislative reform;
2. promote and encourage greater use of environmental best practices including BAT which focus on Zero Harmful Discharge (ZHD) to the environment;
3. facilitate effective regulation of upstream effluents through consistent application of the Rules to all Upstream Operators, regularized monitoring based on scientific datasets, range of

differing environmental and climatic conditions, etc. and enforcement actions which are specific to exceedances and proven related damage;

4. encourage the development of human resource and technical capacity and provide a framework for the increased application of science and technology within UEM; and
5. achieve and maintain a level of sustainability that is required for the oil and gas industry and in effect the GoRTT that is in keeping with the United Nations Sustainable Development Goals.

1.3.2 Policy Instruments

The GoRTT should utilize or amend regulatory instruments such as standards, regulations and legislation, as well as, economic instruments, such as, taxes, fees, penalties, subsidies, incentives and tax credits to accomplish the desired effects proposed by this policy.

1.3.3 Policy Administration

a) Role of the State in UEM Management

The two major state bodies that are the lead regulators of UEM are the Ministry of Energy and Energy Industries (MEEI) and the Environmental Management Authority (EMA). In addition, the Trinidad and Tobago Bureau of Standards (TTBS) develops Standards for UEM Management.

i. **Role of the MEEI**

The MEEI is responsible for the overall management including the monitoring, controlling and regulating of the oil and gas sector of Trinidad and Tobago. The MEEI is mandated to ensure that licensees are in compliance with the Petroleum Act 62:01 and its subsidiary Regulations (specifically Regulation 42) and any other legislation having jurisdiction.

ii. **Role of EMA**

The Environmental Management Authority (EMA) manages effluents from the oil and gas sector through the Certificate of Environmental Clearance Rules (CEC) and the Water Pollution Rules (WPR). In both instances, the generator of upstream effluent is required to meet the end-of-pipe standards as stipulated in Schedule II of WPR 2001 (as amended). This means that Pollutants of Concern (POC) in the effluent must be treated to attain levels below the discharge limits of the WPR 2001 (as amended) before release into the environment. Permit holders must demonstrate by submission of discharge monitoring reports that standards are being met. In

cases of non-compliance, the EMA has the option to take enforcement action on the offending party for corrective action. In circumstances where an activity, existing prior to the implementation of the CEC Rules and has not expanded or modified after this period, has discharges that do not meet Schedule II of the WPR 2001, the EMA would invite the proponent to apply for a Water Pollution Permit.

iii. **Role of TTBS**

The Trinidad and Tobago Bureau of Standards (TTBS) is empowered by the Standards Act No. 18 of 1997 to establish standards for the protection of the environment. These standards would be the National Standards of Trinidad and Tobago, which can then be referenced in legislation or policy. The National Standard is developed by a specifications committee that is comprised stakeholders involved in UEM management.

Additionally, the Standards Act also mandates the TTBS to administer an accreditation scheme for laboratories. Accreditation determines the technical competence and integrity of organizations offering conformity assessment services such as laboratory testing. This is essential to ensure the results obtained by laboratories testing all effluents are reliable.

b) Role of Operators in UEM Management

Operators are responsible for minimizing the impact of upstream effluents on the environment and maintaining compliance with legislation. They are required to provide information on technologies used and tested, submit influent and effluent data and environmental monitoring data to the applicable authorities at an established frequency. In addition, they should make financial contributions to environmental studies within the licensed areas and areas potentially impacted by their operations.

Inter-Agency Collaboration - Upstream Effluent Management (UEM) Working Group

In order to facilitate the progression of this policy it is proposed that a Cabinet-appointed Working Group be established.

Suggested members for the Working Group include:

i. Ministry of Energy and Energy Industries (MEEI);
ii. Ministry of Planning and Development (MPD);

iii. Environmental Management Authority (EMA);

iv. Trinidad and Tobago Bureau of Standards (TTBS);

v. Institute of Marine Affairs (IMA);

vi. The University of the West Indies (UWI);

vii. The University of Trinidad and Tobago (UTT);

viii. The Tobago House of Assembly (THA);

ix. The Association of Upstream Operators of Trinidad and Tobago (AUOTT);

x. The Society of Petroleum Engineers Trinidad and Tobago Section (SPETT);

xi. Energy Chamber of Trinidad and Tobago;

xii. Council of Presidents for the Environment (COPE).

CHAPTER 2: Strategies for Management of Upstream Effluent Associated with Trinidad and Tobago's Oil and Gas Industry

This Chapter aims to highlight each effluent and the respective strategies intended to be used by the GORTT, as it pertains to achieving the aforementioned Policy objectives.

Effluent 1: Produced Water

Produced Water (PW) is essentially a by-product of the upstream Energy Sector. The United States Environmental Protection Agency (US EPA) refers to PW as brine brought up from the hydrocarbon-bearing strata during the extraction of oil and gas, and can include formation water, injection water, including any chemicals added downhole or during the oil/water separation process. At surface, this water is separated from hydrocarbons, then discharged after treatment into the environment, at land or sea or re-injected into a well, with or without further treatment.

PW is generally viewed as an undesirable by-product with significant associated treatment costs. Treatment options may be influenced by factors such as the characteristics of the PW, the availability of space on offshore structures, Best Available Technology (BAT), economies of scale and regulatory requirements. Traditionally, in Trinidad and Tobago, it has been the practice to attempt to meet selected parameters, such as but not limited to, required limits of Total Oil and Grease (TO&G), Chemical Oxygen Demand (COD), and Total Petroleum Hydrocarbons (TPH). In light of this, a challenge faced by operators, is its treatment to meet current regulatory limits.

The objectives and associated strategies outlined below serve to promote improved management of PW in Trinidad and Tobago, and in turn, protection of the surrounding environment.

<u>Objective 1: Legislative Reform</u>

The GoRTT will:

i. in alignment with the ZHD policy utilized in other parts of the world, amend the Specification for the Effluent from Industrial Processes Discharged into the Environment (TTS 547:1998) and the WPR 2001 (as amended) to add toxic components (based on Environmental Impact Factor (EIF), Whole Effluent Toxicity (WET) testing, PW Characterization etc.) such as BTEX and PAH, with their applicable limits; and

ii. amend the WPR 2001 (as amended) to refer to the updated TTS 547 Standard in order to facilitate implementation of industry specific requirements instead of listing Schedule II in the WPR.

iii. include reporting requirements for type and volume of chemical waste produced and disposal methods utilized, inclusive of onsite treatment and disposal in the proposed Waste Management Rules currently being drafted.

Objective 2: Sustainable PW Management Practices

For existing facilities, the GoRTT will:

i. promote the use of BPEO treatment technologies that are capable of meeting end of pipe limits for the more environmentally harmful components like BTEX, Phenols and PAHs;

ii. maximize, where reasonably practicable, the use of water minimization techniques such as water shut-off systems or downhole separation technologies like Downhole Oil/Water Separation (DOWS), Downhole Gas/Water Separation (DGWS) or Downhole Water Sinks (Dual-Completion Well);

iii. encourage the reuse of PW as an alternative to treatment and disposal, such as injection for Enhanced Oil Recovery; and

iv. encourage treatment at source for offshore installations as far as reasonably practicable.

For new facilities, the GoRTT will:

v. require the use of practices to achieve ZHD in the following order:
    a) reduction by utilizing practices including but not limited to zonal shut-off, downhole separation, seabed separation and optimization of use of chemicals;
    b) re-use by implementing practices including, but not limited to, PW reinjection for reservoir pressure support and the re-use of chemicals;
    c) confined disposal by utilizing practices including, but not limited to, injection of PW into another reservoir; and
    d) treatment and discharge by utilizing practices including, but not limited to, improved primary treatment such as improved separation, extraction and flotation technology; secondary treatment such as biological technology; tertiary treatment such as reverse

osmosis, as well as, new and available technologies or any combination of the aforementioned techniques.

For all facilities, the GoRTT will:

vi. ensure standardization of the evaluation and assessment criteria in order to trigger measures which would improve the comparability and harmonization of procedures, for example, standardization of the ERA methodology required by operators;

vii. encourage PW treatment at source, as much as practicably possible, so as to minimize threat to human health and the environment; and

viii. consider mixing zones only for the offshore environment when it has been demonstrated by documentary evidence that PW has undergone treatment to reduce toxic components to the lowest levels possible before discharge.

Objective 3: Monitoring and Evaluation

The GoRTT will:

i. require operators to provide information on PW treatment technologies used and tested, as well as, submit the influent and effluent PW data to the relevant authorities at an established frequency;

ii. require that operators provide an assessment of potential chronic and acute effects and risks to aquatic environment (biotic and abiotic) of their long-term PW discharge (annually until the end of life of the well) to the relevant authorities (Field / laboratory toxicity tests on appropriate species should be used together with fate and effects modelling to support the risk assessments.);

iii. require additional environmental monitoring be conducted, as required;

iv. conduct audits of PW treatment systems as part of regulatory inspections;

v. conduct audits of PW discharge quality in order to reconcile data submitted by operators;

vi. require vendors seeking chemical approval to conduct LC50 testing at the relevant usage concentration;

vii. ensure that approval is not granted for use of chemicals with individual and/or cumulative toxicities above EMA recommended levels unless there is an acceptable means of disposal/treatment prior to any discharge;

viii. require that operators utilize laboratories accredited to conduct required effluent tests.

Objective 4: Research and Development

This objective seeks to address the research needed for effective PW management and to identify the associated human resource capacity required.

As such, the GoRTT will:

i. compile and analyze local PW chemical properties, which can assist in their characterization them according to their location, type and degree of toxicity of hydrocarbon production (oil versus gas);
ii. encourage the identification and use of appropriate indicator species for toxicity testing.
iii. conduct ERA studies, similar to what is to be done for the Gulf of Paria (Point –a – Pierre), on the East Coast and other areas as necessary in order to assess the effects of PW on the marine ecosystem to inform future PW Management practices and requirements;
iv. collaborate with research institutions to compare toxicity levels of raw formation water with chemically - treated formation water and to assess cumulative toxic impact of various chemical additives to PW;
v. encourage local institutions to pursue research and development relating to alternative PW management options such as re-use and beneficial uses; and
vi. facilitate the introduction of programs, specifically geared towards the industry to constantly improve the competencies of government officials to effectively regulate, maintain compliance to licenses and all sector-related legislation along with being equipped to adequately enforce the provisions of the Petroleum Act and related Regulations;
vii. develop and implement educational and training programs to provide the required pool of skilled personnel for effluent treatment or management to be facilitated through reputable, local educational institutions in collaboration with international institutions as necessary;
viii. integrate into the MEEI process for chemical approvals, a review step for evaluating and monitoring the human health and environmental risks of chemicals imported and utilized in Trinidad and Tobago, modeled after the CHARM (Chemical Hazard Assessment and Risk Management) or similar systems for evaluating chemical risks:

a) prescribing maximum limits of toxicity and minimum limits of biodegradability;
b) specifying minimum reporting criteria for importers and users for quantities utilized treatment and disposal methods;
c) adopting the chemical evaluation listings utilized by OSPAR signatories for guidance in ranking the risks of locally used substances;

ix. develop a national database of industry chemicals, classified by chemical constituents and relevant eco-toxicological and human health risks;

x. encourage the transition to more environmentally friendly chemicals, by increasing or decreasing the validity period of approvals granted for less or more hazardous chemicals respectively; and

xi. support the Ministry responsible for the environment and relevant research institutions on the development of National Ambient Water Quality Standards;

Objective 5: Sustainable production practices

This objective seeks to address the need to ensure that consumption and production patterns within the Petroleum Sector in Trinidad and Tobago are sustainable. This sector, while intended to bring a better quality of life to the citizens of the country through its contribution to the National Economy, should not jeopardize the needs of future generations. Petroleum operators, as far as reasonably practicable, should minimize/eliminate use of toxic materials as well as minimize the release of untreated and treated PW.

The GoRTT will:

i. encourage the full participation of all stakeholders in thoroughly exploring all options available to ensure that operations in the Petroleum Sector are conducted in a sustainable manner;

ii. promote the use of more waste minimization strategies, among them, modified technologies, chemical alternatives and substitutions to less harmful;

iii. implement more recycle/reuse approaches to PW handling; and

iv. ensure that operational liabilities, including but not limited to, incidents, injuries, occupational illnesses, pollution and damage to assets, are also at the core of PW

management endeavors, especially in the event of introducing new technology where proper training of personnel will be required.

Effluent 2: Hydrotest Water

Hydrotest water (HTW) refers to water placed in pipelines, tanks, etc. (new/unused or used) and raised to greater than atmospheric pressure in order to check for leaks and /or the structural integrity of these facilities. HTW also includes water used to fill tanks and pipelines to test for leaks without raising pressure to above atmospheric pressure. Discharges of HTW are usually from these new/unused or used facilities, which aid the transportation or storage of natural gas, crude oil, or liquid or gaseous petroleum hydrocarbons.

Typical pollutants usually present in HTW discharge are total suspended solids (TSS), total recoverable iron, total residual chlorine, benzene, toluene, ethylbenzene, xylene and floating oil & grease. Parameters, such as pH and dissolved oxygen, which influence effluent chemistry, are also regulated. Additives and their degradation by–products are another source of contaminants in HTW. Two main additive groups, commonly added to water as it is introduced into the pipeline, are oxygen scavengers and biocides.

WCF and HTW may comprise similar contaminants, including chemical additives such as corrosion inhibitors, oxygen scavengers, along with BTEX and oil & grease. Although similar in constituents, while HTW is used for hydrostatic pressure testing of the above-mentioned structures, CF are used to facilitate final operations prior to production of an oil and gas well and WF are used during remedial operations at the wellsite.

The objectives and associated strategies outlined below serve to promote proper management of HTW in Trinidad and Tobago and, in turn, protection of the surrounding environment.

<u>Objective 1: Legislative Reform</u>

The GoRTT will:

i. in alignment with the ZHD policy utilized in other parts of the world, amend the Specification for the Effluent from Industrial Processes Discharged into the Environment (TTS 547:1998) and the WPR 2001 (as amended) to add toxic components, for example BTEX and their applicable limits;
ii. amend the WPR 2001 (as amended) to refer to the updated TTS 547:1 Standard in order to facilitate implementation of industry specific requirements; and

iii. include reporting requirements for type and volume of chemical waste produced and disposal methods utilized, inclusive of onsite treatment and disposal, in the proposed Waste Management Rules (Hazardous Waste) Rules, 2014 currently being drafted.

Objective 2: Sustainable HTW Management Practices

The GoRTT will:

i. promote the use of Best Available Techniques (BAT) and Best Environmental Practices (BEP) for disposal of HTW;
ii. prohibit the disposal of HTW into shallow coastal waters and sensitive ecosystems;
iii. encourage the recycling of HTW from one test section to the next to minimize the amount of water abstracted from the source and to reduce the amount of chemical additives;
iv. encourage the testing of new equipment at an onshore site, prior to its being loaded onto the offshore facilities, in order to minimize the volume of HTW offshore and to reduce the need for chemicals by minimizing the time that test water remains in the equipment or pipeline;
v. encourage the careful selection of chemical additives, including oxygen scavengers and biocides, by taking into consideration their dose concentration, toxicity, biodegradability, bioavailability, and bioaccumulation potential;
vi. encourage Best Management Practices (BMP's) prior to Hydrostatic Testing, including appropriate pre-treatment options (such as pigging, pre-cleaning, inlet filters), which will reduce the contaminant levels in the source water and/or in the inside of the structure and lead to a concomitant reduction of contaminants in the outlet stream; and
vii. promote the use of BAT and BEP for treatment of HTW prior to discharge to inland, coastal nearshore, marine offshore and environmentally sensitive waters, with the complexity of the selected treatment process contingent on the characteristics of the disposal water.

Objective 3: Monitoring and Evaluation

The GoRTT will:

i. establish and enforce standards and criteria for disposal of HTW into the onshore and offshore environments. The test results for waste water shall be made available to the EMA and MEEI within an established timeframe. There should be maximum limits on several

compounds, including those stated under the Second Schedule of the WPR, 2001 (as amended 2006), as well as, but not restricted to benzene, total BTEX and specific chemical additives;

ii. encourage the development of an HTW Management Plan by Operators in accordance with the MEEI's *"Requirements for Pipeline Hydrotest Discharge Permit"*.

iii. require monitoring during a specified sample period, when HTW is discharged, to ensure compliance with relevant effluent limitations;

iv. conduct regular assessments of HTW treatment technologies;

v. monitor and evaluate chemicals approved by the MEEI via integration of a process which ensures individual chemical constituents to be rated according to international chemical hazard rankings and risk evaluations;

vi. require vendors seeking chemical approval to conduct LC50 testing at the relevant usage concentration; and

vii. ensure that approval is not granted for use of chemicals with individual and/or cumulative toxicities above EMA recommended levels unless there is an acceptable means of disposal/treatment prior to any discharge.

Objective 4: Research and Development

The GoRTT will:

i. collaborate with research institutions to conduct research into toxic components of HTW and the cumulative toxic impact of various chemical additives;

ii. encourage the identification and use of appropriate indicator species for toxicity testing;

iii. encourage local institutions to pursue research and development relating to the most effective option/s for treating HTW for (1) inhibition of oxygen corrosion, (2) inhibition of microbiologically influenced corrosion (MIC), and (3) safe discharge of water;

iv. encourage local institutions to pursue research and development relating to alternative HTW management options;

v. facilitate the research into the effects of discharge of HTW on the environment;

vi. facilitate the introduction of industry specific training programs for government personnel to improve regulation of the sector, in keeping with all relevant policies and legislation;

vii. incorporate relevant waste management training into existing tertiary education environmental management programmes to provide the required pool of skilled personnel in this area;

viii. encourage feasibility studies for utilizing more onshore hydrotesting so that waste waters can be treated onshore to meet concentration levels for relevant parameters suitable for discharge;

ix. integrate into the MEEI process for chemical approvals, a review step for evaluating and monitoring the human health and environmental risks of chemicals imported and utilized in Trinidad and Tobago, modeled after the CHARM (Chemical Hazard Assessment and Risk Management) or similar systems for evaluating chemical risks:

   a. prescribing maximum limits of toxicity and minimum limits of biodegradability;
   b. specifying minimum reporting criteria for importers and users for quantities utilized treatment and disposal methods;
   c. adopting the chemical evaluation listings utilized by OSPAR signatories for guidance in ranking the risks of locally used substances;

x. develop a national database of industry chemicals, classified by chemical constituents and relevant eco-toxicological and human health risks;

xi. encourage the transition to more environmentally friendly chemicals, by increasing or decreasing the validity period of approvals granted for less or more hazardous chemicals respectively; and

xii. support the Ministry responsible for the environment and relevant research institutions on the development of National Ambient Water Quality Standards.

Objective 5: Sustainable Production Practices

This objective seeks to address the need to ensure that consumption and production patterns within the Petroleum Sector in Trinidad and Tobago are sustainable. This sector, while intended to bring a better quality of life to the citizens of the country through its contribution to the National Economy, should not jeopardize the needs of future generations. Petroleum operators, as far as reasonably practicable, should minimize/eliminate use of toxic materials as well as minimize the release of HTW.

The GoRTT will:

v. encourage the full participation of all stakeholders in exploring the options available that enable rather than constrain sustainable production choices;

vi. promote the use of more waste minimization strategies (environmentally friendly chemical additive substitutions or etc.);

vii. implement more recycle/reuse approaches to HTW handling; and

viii. ensure that operational liabilities, including but not limited to, incidents, injuries, occupational illnesses, pollution and damage to assets, are also at the core of HTW management endeavors, especially in the event of introducing new technology where proper training of personnel will be required.

Effluent 3: Drilling Fluids

Drilling Fluids (DF), also referred to as Drilling Muds, are fluids used during the drilling of subterranean wells. The two main types of DF include water based fluids (WBF) and non-aqueous drilling fluids (NADF): oil-based (OBM) and synthetic-based (SBM). DF function to control subsurface pressures and provide primary well control. These fluids also remove the DC from beneath the drill bit, and circulate them back up the annulus to the surface, thereby removing the cuttings from the wellbore.

There are several environmental issues, however, associated with the discharge of DF, including toxicity to marine biota; fate, persistence and biodegradability; bioaccumulation or bio concentration by marine biota; and leaching of NADF into the water column. As such, these fluids should be properly applied, controlled, monitored, treated and disposed of in order to minimize hazards in the environment.

The objectives and associated strategies outlined below serve to promote proper management of DF in Trinidad and Tobago, and in turn, protection of the surrounding environment.

Objective 1: Legislative Reform

The GoRTT will:

i. in alignment with the ZHD policy utilized in other parts of the world, amend the Specification for the Effluent from Industrial Processes Discharged into the Environment (TTS 547:1998) and the WPR 2001 (as amended) to add toxic components, for example BTEX and PAH and their applicable limits;
ii. amend the WPR 2001 (as amended) to refer to the updated TTS 547 Standard in order to facilitate implementation of industry specific requirements; and
iii. include reporting requirements for type and volume of chemical waste produced and disposal methods utilized, inclusive of onsite treatment and disposal, in the proposed Waste Management Rules (Hazardous Waste) Rules currently being drafted.

Objective 2: Sustainable DF Management Practices

The GoRTT will:

i. encourage the use of more environmentally friendly types of DF for drilling operations;
ii. promote the use of DF treatment practices which are able to meet amended pollution limits, with attention being paid to environmentally harmful components, which include BTEX and PAHs;
iii. encourage the recovery of used DF on the drilling rig for reuse to the maximum extent that is reasonably practicable, following separation from DC;
iv. encourage the offshore treatment and disposal option for whole Water-based Muds (WBM), when their properties have become degraded;
v. prohibit the discharge of whole synthetic-based muds (SBM) and oil-based muds (OBM) into the marine environment. Instead, the recovery and recycling of SBM and OBM shall be encouraged for re-use by operators, when possible;
vi. require testing of DF, prior to and after use, to ensure compliance with approved toxicity limits;
vii. develop and implement a Code of Practice detailing the various storage, treatment, disposal and re-use alternatives for DF.

Objective 3: Monitoring and Evaluation

The GoRTT will:

i. establish and enforce standards and criteria for disposal of DF into the offshore environment, the results of which shall be made available to the EMA and MEEI within an established timeframe. There should be limits on:
    - WET;
    - heavy metals;
    - BTEX and PAH;
    - percent of muds retained on cuttings (well average ROC) based on BAT;
ii. require the conduct of post-disposal monitoring upon closure of an onshore site, to ensure that waste constituents are not present at levels that can be a threat to human health and the

environment. This shall be conducted following disposal, and results of the monitoring shall be recorded and issued to the relevant authorities within an established timeframe;

iii. conduct regular assessments of DF treatment technologies;

iv. conduct audits of DF discharge quality in order to reconcile data submitted by operators.

v. monitor and evaluate chemicals approved by the MEEI via integration of a process which ensures individual chemical constituents to be rated according to international chemical hazard rankings and risk evaluations;

vi. require vendors seeking chemical approval to conduct LC50 testing at the relevant usage concentration; and

vii. ensure that approval is not granted for use of chemicals with toxicities individual and/or cumulative above EMA recommended levels unless there is an acceptable means of disposal/treatment prior to any discharge.

Objective 4: Research and Development

This objective seeks to address the research needed for effective DF management and to identify the associated human resource capacity required.

The GoRTT will:

i. collaborate with research institutions to conduct research into toxic components of DF and cumulative toxic impact of various chemical additives;

ii. collaborate with research institutions to conduct research into cumulative toxic impact of various chemical additives to DF;

iii. facilitate the research into the effects of discharge of DF on the environment;

iv. encourage the identification and use of appropriate indicator species for toxicity testing;

v. facilitate the introduction of industry specific training programs, for government personnel for improved regulation of the sector, in keeping with all relevant policies and legislation;

vi. incorporate relevant waste management training into existing tertiary education environmental management programmes to provide the required pool of skilled personnel;

vii. encourage local institutions to pursue research and development relating to alternative DF management options;

viii. develop a formal process for evaluating and monitoring the human health and environmental risks of chemicals imported and utilized in Trinidad and Tobago modeled after the CHARM (Chemical Hazard Assessment and Risk Management) or similar systems for evaluating chemical risks:
    a. prescribing maximum limits of toxicity and minimum limits biodegradability;
    b. specifying minimum reporting criteria for importers and users for quantities utilized treatment and disposal methods;
    c. adopting the chemical evaluation listings utilized by OSPAR signatories for guidance in ranking the risks of locally used substances;
ix. develop a national database of industry chemicals, classified by chemical constituents and relevant eco-toxicological and human health risks;
x. support the Ministry responsible for the environment and relevant research institutions on the development of National Ambient Water Quality Standards;
xi. conduct a review of chemical effluent treatment and reconditioning capabilities among service providers and waste management contractors;
xii. encourage the transition to more environmentally friendly chemicals, by increasing or decreasing the validity period of approvals granted for less or more hazardous chemicals respectively; and
xiii. promote incentive programs to encourage DF reconditioning and recycling technologies.

Objective 5: Sustainable production practices

This objective seeks to address the need to ensure that consumption and production patterns within the Petroleum Sector in Trinidad and Tobago are sustainable. This sector, while intended to bring a better quality of life to the citizens of the country through its contribution to the National Economy, should not jeopardize the needs of future generations. Petroleum operators, as far as reasonably practicable, should minimize/eliminate use of toxic materials as well as minimize the release of untreated and treated DF.

The GoRTT will:

i. encourage the full participation of all stakeholders in exploring the options available that enable rather than constrain sustainable production choices;

ii. promote the use of more waste minimization strategies (modified technologies, chemical additive substitutions etc.);

iii. implement more recycle/reuse approaches to DF handling;

iv. ensure that operational liabilities, including but not limited to, incidents, injuries, occupational illnesses, pollution and damage to assets, are also at the core of DF management endeavors, especially in the event of introducing new technology where proper training of personnel will be required.

Effluent 4: Workover and Completion Fluids

Workover Fluids (WF) are well-control or well treatment fluids, typically a brine such as chlorides, bromides and formates or another fluid of the appropriate density and properties, which is used during workover operations.

WFs are known to have several functions as follows:

- transportation of wanted and unwanted materials into and out of the well;
- pressure control;
- suspension of wanted and unwanted materials when circulation has stopped;
- heat removal and lubrication;
- delivery of hydraulic energy;
- provision of a suitable medium for wireline, logging, and perforating tools;
- permitting downhole equipment to be run safely in a reasonable amount of time; and
- avoiding damage to downhole and surface equipment, producible formations, personnel and the environment.
- Treatments to formations e.g. acid stimulations.

Completion Fluids (CF) are usually a solids-free liquid placed in the well to facilitate final operations prior to initiation of production, such as, setting screens, production liners, packers, downhole valves or shooting perforations into the producing zone.

Completion fluids are utilized for various tasks required to prepare the well for production such as:

- cleaning of the well annulus (casing, pipes, valves) of drilling fluids etc., surface lines and equipment;
- protection of the production riser from the corrosive action of other drilling fluids and naturally occurring corrosives in the formation;
- displacement of well fluids; and
- perforation and temporary well closure.

Acknowledging the differences in the applications of these fluids, due to their similar compositions, their management requirements are seen to be quite comparable. As such, for the purpose of this policy the management of both fluids will be addressed simultaneously, represented by the term WCF (Workover and Completions Fluids).

If WCF are improperly managed, there can potentially be damage to the producing formation, the equipment, personnel or the environment. For instance, accidental spillage of these fluids may result in pollution of the adjacent environment (terrestrial or local aquatic environments where present). As such, they should be properly applied, controlled, monitored, treated and disposed of in order to minimize damage to the environment.

The objectives and associated strategies outlined below serve to promote proper management of WCF in Trinidad and Tobago, and in turn protection of the surrounding environment.

Objective 1: Legislative Reform

The GoRTT will:

i. in alignment with the ZHD policy utilized in other parts of the world, amend the Specification for the Effluent from Industrial Processes Discharged into the Environment (TTS 547:1998) and the WPR 2001 (as amended) to add toxic components for example BTEX and PAH and their applicable limits;
ii. amend the WPR 2001 (as amended) to refer to the updated TTS 547 Standard in order to facilitate implementation of industry specific requirements;
iii. include reporting requirements for type and volume of chemical waste produced and disposal methods utilized, inclusive of onsite treatment and disposal, in the proposed Waste Management Rules currently being drafted.

Objective 2: Sustainable WCF Management Practices

The GoRTT will:

i. promote the transition to more sustainable alternatives of WCF on a continuous basis;
ii. promote the use of Best Available Techniques and Best Environmental Practices for treatment and disposal of WCF;
iii. promote the reconditioning and reuse of WCF brines;
iv. discourage the comingling of produced water with WCF which may compromise the process of hydrocarbon separation and the ability to comply with, Total Oil and Grease (TO&G) and Total Petroleum Hydrocarbon (TPH) and any other relevant effluent limits;

v. prohibit comingling and dilution of toxic effluent as a means to achieve compliance with regulatory standards;
vi. encourage the offshore treatment and disposal option for WCF to meet regulatory standards, for the following minimum parameters:
    - oil and grease testing of WCF for each job, to ensure compliance with approved oil & grease limits;
    - compliance test for the "no discharge of free oil" requirement for discharges of WCF;
    - spent acid neutralization prior to disposal into the marine environment;
vii. prohibit the use of zinc bromide brine;
viii. encourage the transition to formate brines where they are functionally feasible;
ix. promote the reconditioning and reuse of completion brines;
x. prohibit the discharge of "free oil" into the marine area;
xi. prohibit the discharge of oil-based WCF into the marine area; and
xii. develop and implement a Code of Practice detailing the various storage, treatment, disposal and re-use alternatives for WCF.

Objective 3: Monitoring and Evaluation

The GoRTT will:

i. Establish and enforce standards and criteria for disposal of WCF into the offshore environment, the results of which shall be made available to the EMA and MEEI within an established timeframe. There should be limits on:
    - oil and grease content;
    - pH;
    - BTEX and PAH concentrations;
ii. require the conduct of post-disposal monitoring upon closure of an onshore site, to ensure that waste constituents are not present at levels that can be a threat to human health and the environment. This shall be conducted following disposal, and results of the monitoring shall be recorded and issued to the relevant authorities within an established timeframe;

iii. monitor the treatment, disposal and/or recovery capabilities and practices of waste management contractors and completion/workover operators and/or service providers to ensure utilization of best practice technologies and techniques;
iv. conduct regular assessments of WCF treatment technologies;
v. conduct audits of WF discharge quality in order to reconcile data submitted by operators;
vi. monitor and evaluate chemicals approved by the MEEI via integration of a process which ensures individual chemical constituents to be rated according to international chemical hazard rankings and risk evaluations;
vii. require vendors seeking chemical approval to conduct LC50 testing at the relevant usage concentration;
viii. ensure that approval is not granted for use of chemicals with individual and/or cumulative toxicities above EMA recommended levels unless there is an acceptable means of disposal/treatment prior to any discharge;
ix. revise the existing process of chemical approvals to include the identification of less toxic and less hazardous chemicals for phased substitution and eventual discontinuation; and
x. require declaration of chemical volumes utilized on well completions and treatments including methods of effluent treatment and disposal offshore and/or onshore.

Objective 4: Research and Development

This objective seeks to address the research needed for effective WCF management and to identify the associated human resource capacity required.

The GoRTT will:

i. collaborate with research institutions to conduct research into toxic components of WCF and cumulative toxic impact of various chemical additives;
ii. encourage the identification and use of appropriate indicator species for toxicity testing;
iii. facilitate the introduction of industry specific training programs, for government personnel for improved regulation of the sector, in keeping with all relevant policies and legislation;
iv. partner with tertiary level educational institutions to integrate sustainable chemical and waste management principles in the oil and gas industry into existing programs;

v. encourage local institutions to pursue research and development relating to alternative Workover Fluid management options;
vi. facilitate the research into the effects of discharge of WCF on the environment;
vii. develop a formal process for evaluating and monitoring the human health and environmental risks of chemicals imported and utilized in Trinidad and Tobago modeled after the CHARM (Chemical Hazard Assessment and Risk Management) or similar systems for evaluating chemical risks:
    a. prescribing maximum limits of toxicity and minimum limits biodegradability;
    b. specifying minimum reporting criteria for importers and users for quantities utilized treatment and disposal methods;
    c. adopting the chemical evaluation listings utilized by OSPAR signatories for guidance in ranking the risks of locally used substances;
viii. develop a national database of industry chemicals, classified by chemical constituents and relevant eco-toxicological and human health risks;
ix. support the Ministry responsible for the environment and relevant research institutions on the development of National Ambient Water Quality Standards;
x. conduct a review of chemical effluent treatment and reconditioning capabilities among service providers and waste management contractors;
xi. encourage the transition to more environmentally friendly chemicals, by increasing or decreasing the validity period of approvals granted for less or more hazardous chemicals respectively; and
xii. promote incentive programs to encourage WCF reconditioning and recycling technologies.

Objective 5: Sustainable production practices

This objective seeks to address the need to ensure that consumption and production patterns within the Petroleum Sector in Trinidad and Tobago are sustainable. This sector, while intended to bring a better quality of life to the citizens of the country through its contribution to the National Economy, should not jeopardize the needs of future generations. Petroleum operators, as far as reasonably practicable, should minimize/eliminate use of toxic materials as well as minimize the release of untreated and treated WCF.

The GoRTT will:

i. encourage the full participation of all stakeholders in thoroughly exploring all options available to ensure that operations in the Petroleum Sector are conducted in a sustainable manner;

ii. promote the use of more waste minimization strategies, among them, modified technologies, chemical alternatives and substitutions to less harmful;

iii. implement more recycle/reuse approaches to WCF handling; and

iv. ensure that operational liabilities, including but not limited to, incidents, injuries, occupational illnesses, pollution and damage to assets, are also at the core of WCF management endeavors, especially in the event of introducing new technology where proper training of personnel will be required.

CHAPTER 3: Implementing and Achieving Policy Actions

3.1 Critical Stress Factors

The GoRTT realizes that there have been several challenges hindering sustainable UEM in the past and as a result undertakes to surmount these barriers. Thus, the GoRTT commits to:

- *Creating mechanisms for compliance with the UEM Policy and existing environmental legislation*

In order to achieve compliance with legislation pertaining to the management of upstream effluents, the GoRTT shall:

a) encourage regulators and government agencies to undertake programmes geared towards proactive outreach for compliance with the UEM policy and existing environmental legislation; and
b) enhance the capacity of government organisations to operationalize this UEM Policy and undertake works related to the Action Plan.

- *Strengthening institutional arrangements and collaboration amongst stakeholders*

There are many stakeholders that play a role in effective UEM and sustainable development. Implementation of the UEM Policy requires the cooperation of all agencies and interest groups. Hence, the GoRTT will:

a) enhance the existing inter-agency collaboration framework with the establishment of an Upstream Effluent Management (UEM) Working Group;
b) enhance the existing communication and coordination amongst regulatory agencies to ensure optimum environmental compliance and ensure that any social and or environmental impacts are minimized; and
c) encourage government organisations to engage in effective collaboration with non-governmental organisations including operators, towards sustainability.

- *Improving national environmental data / information management*

Timely access to accurate environmental information is a necessity to effective management and overall decision-making, which is critical to the implementation of this UEM Policy. The GoRTT shall therefore:

a) establish a suite of baseline environmental indicators, aligned with the best petroleum industry UEM practices, to be monitored;
b) introduce protocol/process for the collection and assessment of these baseline environmental indicators; and
c) integrate baseline environmental information collected, into the National Information Management System to be established under the NEP.

- *Participating in cross-boundary strategies and global partnerships*

In encouraging sustainability, the GoRTT shall commit to contributing to the collective effort addressing upstream effluent issues. Thus, the GoRTT will:

a) subscribe to and encourage relevant sustainable, regional and international UEM practices; and
b) contribute to the development of future UEM programmes that promote environmental sustainability.

3.2 Implementation and Mainstreaming Framework

3.2.1 Implementation

It is envisioned that the implementation of the UEM Policy will be achieved through efforts by all relevant regulatory organisations. To this end, a UEM Action Plan will be developed by the UEM Working Group. This Action Plan will give effect to the objectives contained within the UEM Policy and will identify timeframes, the lead and supporting agencies, monitoring indicators and targets. The Action Plan will serve as an avenue to a fully sustainable UEM system for Trinidad and Tobago.

The UEM Working Group will provide a platform for relevant government and non-government bodies to have ongoing oversight, with advisory functions to the Action Plan. It is envisioned however, that the UEM Working Group will address all effluents relevant to the upstream oil and gas industry of Trinidad and Tobago.

3.2.2 Mainstreaming & Coordination

The Ministry responsible for the Environment is entrusted with the responsibility for coordinating the mainstreaming of the UEM Policy for all upstream operations with support from the MEEI. The Ministry responsible for the Environment will have the responsibility of:

i. coordinating and supporting the mainstreaming of the UEM Policy into the work plans of relevant government agencies, as well as, into the wastewater management systems of all upstream operators; and
ii. Providing technical and other support to agencies with assigned responsibilities under the Action Plan.

CHAPTER 4: Monitoring and Evaluation

4.1 Monitoring and Evaluation of the UEM Policy and Action Plan

The Action Plan will provide performance indicators for the short, medium and long-term action items necessary to achieve the objectives contained within the UEM Policy. It will also identify the lead and supporting agencies responsible for tracking and reporting performance metrics.

To ensure that continuous progress is being made towards environmental sustainability, the UEM Policy and the associated Action Plan will be monitored and evaluated by the UEM Working Group. Annual reporting of the overall progress made shall be reported to the Minister responsible for the Environment.

4.2 Revision of the UEM Policy and Action Plan

To maintain relevance and cohesion with the available national and international management practices, this UEM Policy shall be reviewed every five (5) years. By assessing the barriers, constraints and degree of progress made towards achieving the Policy objectives, the strategies and actions can be modified to suit evolving needs and conditions.

The UEM Working Group shall review the Action Plan at a frequency determined as necessary, but not exceeding two years. Revision of the document will be made to ensure that action items are aligned with national obligations and the socio-economic context of the time. This can include but shall not be limited to, the review of any new effluent treatment technologies as they become available and how they can be considered in the revision of the requirements of the Policy.

Supplementary Document

S1. Drill Cuttings

In keeping with the main UEM Policy, addressing the management of Drill Cuttings (DC) is significant due to its simultaneous existence with DF. DC can also be described as the soil, rock fragments, and crushed material that are removed from a borehole which include trace amounts of DF on the cuttings.

They are generated from the geological formation of the rocks and become entrained within the DF. DC do not have an economical value in Trinidad and Tobago, and as such, oil and gas companies typically consider it a liability since the solid cuttings requires storage space and must be treated to ensure that they are safe for disposal or transportation.

Ultimately, DC require capital investments and operating expenditures that do not bring any financial return to the local operators. Adherence of fluids and other material can negatively affect the environment as heavy metals and materials can leach and contaminate soils. As such, there is a need to address the issues and shortcomings related to the management of solid DC and provide internationally accepted best practices/guidelines.

In alignment with the UEM Policy's main objectives highlighted in Section 1.3.1, the following strategies were developed:

<u>Objective 1: Legislative Reform</u>

The GoRTT will:

i. develop formal standardized practices for safe disposal of DC in the marine environment;
ii. establish minimum standards for quality of input waste material sent to treatment and disposal sites; and
iii. establish standards and practices for onshore treatment and disposal sites with respect to acceptable ranges for the following parameters and recommend a timeframe for remediation:

- electrical conductivity (EC)
- major ions sodium, calcium, magnesium, potassium and sulphate
- Sodium Adsorption Ratio (SAR)

Objective 2: Sustainable DC Management Practices

The GoRTT will encourage the prevention and reduction of waste through best management practices of DC. Operators should ensure that the best method of disposal is chosen for both offshore and onshore. The method chosen should depend on environmental and operational factors. The following are the best management practices that should be considered at a minimum in accordance with the waste management hierarchy. GORTT will:

i. prohibit the discharge of Oil Based Muds (OBM) associated with cuttings in an offshore environment;
ii. ensure that storage of DC on offshore installations are managed in a way that prohibits leakage to the marine environment;
iii. ensure toxicity testing of DC and compliance to ROC standards before discharge into the marine environment;
iv. ensure operators carry out field assessments of proposed disposal sites before employing methods. Records should be presented on past and present land use, soil samples of native soils and land capability for chosen disposal method;
v. regulate the use of OBM on cuttings in the offshore environment and encourage the use of more environmentally friendly muds thus ensuring DC are less harmful to the marine and onshore environments;
vi. encourage the re-use of DC as an alternative to discharging offshore;
vii. ensure that toxicity testing is undertaken before disposal onshore and the levels of metal, pH, EC and SAR regulated on land after disposal;
viii. develop and implement a Code of Practice detailing the various storage, treatment, transport, disposal and re-use alternatives for DC.
ix. develop guidelines for the treatment of SBM and OBM retained on solid DC using onshore methods including pit burial, mix-bury cover, landfilling and bioremediation;

Objective 3: Monitoring and Evaluation

The GoRTT will:

i. ensure that pre- and post- drilling environmental surveys are undertaken before disposal of solid DC offshore;
ii. promote the use of benthic, ecology and sediment surveys to assess the effects of offshore discharge. These studies should be carried out within a stipulated period after the drilling operations;
iii. ensure that monitoring of onshore disposal sites involved in land application treatment be undertaken prior to, during and following treatment and disposal. This should assess possible soil contamination from potential run-off and leaching. This will also help to ensure that remediation of sites is carried out;
iv. regulate toxicity of DC before disposal to ensure that levels are in compliance with required standards;
v. mandate that operators maintain up-to-date DC records which should be made available upon request; and
vi. encourage offshore discharge of DC according to sea depth.

Objective 4: Research and Development

This objective seeks to address the research needed for effective DC management and to identify the associated human resource capacity required.

The GoRTT will:

i. collaborate with research institutions to conduct research into toxic components of DC, cumulative toxic impact of various chemical additives and measures that can be undertaken to reduce toxicity to DC;
ii. facilitate the introduction of industry specific training programs, for government personnel for improved regulation of the sector, in keeping with all relevant policies and legislation;
iii. incorporate relevant waste management training into existing tertiary education environmental management programmes to provide the required pool of skilled personnel;

iv. encourage local institutions to pursue research and development relating to alternative DC management options such as re-use and beneficial uses; and
v. facilitate the research into the effects of discharge of DC on the environment.

Objective 5: Sustainable production practices

This objective seeks to address the need to ensure that consumption and production patterns within the Petroleum Sector in Trinidad and Tobago are sustainable. This sector, while intended to bring a better quality of life to the citizens of the country through its contribution to the National Economy, should not jeopardize the needs of future generations. Petroleum operators, as far as reasonably practicable, should minimize/eliminate use of toxic materials as well as minimize the release of untreated and treated DC.

The GoRTT will:

i. encourage the full participation of all stakeholders in exploring the options available that enable rather than constrain sustainable production choices;
ii. promote the use of more waste minimization strategies (modified technologies, chemical additive substitutions etc.);
iii. implement more recycle/reuse approaches to DC handling; and
iv. ensure that operational liabilities, including but not limited to, incidents, injuries, occupational illnesses, pollution and damage to assets, are also at the core of DC management endeavors, especially in the event of introducing new technology where proper training of personnel will be required.

It should be noted that all implementation, mainstreaming, monitoring and evaluation practices should be in alignment with those outlined in the above-mentioned UEM Policy.