AUGUST 2022

OIL & GAS DEVELOPMENT COMPANY LIMITED

INTEGRATED WASTE MANAGEMENT

HANDBOOK

This handbook is principally based on the applicable guidelines and best practices followed by oil & gas exploration and production companies worldwide. Ask your Location HSE Representative/ Coordinator for more specific information. This handbook corresponds to the procedures available in the latest revision of OGDCL's Integrated HSE System Manual.

Occupational Health, Safety, Environment & QA/ QC Department

Oil & Gas Development Company Limited

Occupational Health, Safety and Environment

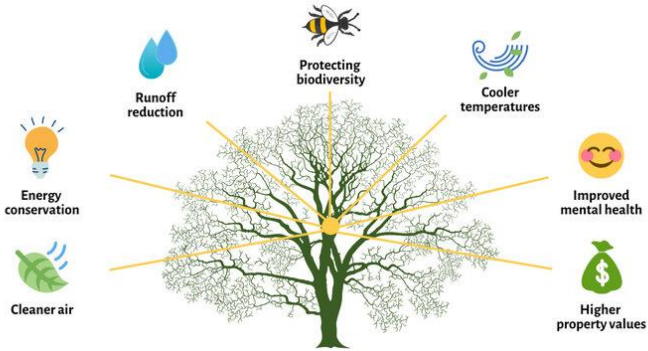
Policy Statement and Commitment

As a responsible Oil and Gas E&P company, we are committed to embrace Health, Safety and Environment (HSE) in all our activities. The emphasis on HSE management is crucial to our operational requirement and to maintain market repute. In carrying out our multidimensional activities, we also ensure welfare of indigenous communities, protection of ecosystems and environment. As we continue to avail exploration and production opportunities on a sound foundation of technical and financial prudence, we intend to:

- Exhibit visible leadership at each level and ensure necessary resources, trainings and infrastructure are in place for aiming HSE excellence.
- Identify hazards and ensure effective controls to manage operational risks.
- Ensure that our entities meet or exceed applicable HSE laws, regulations, standards and other requirements.
- Set objectives and targets to safeguard humans & assets, protect environment and conserve energy & natural resources.
- Ensure that Contingency Plans are in place for business continuity.
- Provide employees with self-assured methods & practices, authority to stop unsafe work & motivation through rewards and recognition.
- Employ contractors and service companies who aspire to the high HSE standards at all times, and recognize that HSE is everyone's responsibility.
- Improve HSE system by continually focusing on Leading Indicators and disseminating lessons learned from Lagging Indicators.
- Assess HSE KPIs regularly & share performance accordingly.

Through observance of this policy, we aim to assist in protecting the environment and the overall wellbeing of our stakeholders, specifically our employees, clients, shareholders, partners, contractors, subcontractors, service companies and communities.

Managing Director/ CEO


Protecting biodiversity
Runoff reduction
Cooler temperatures
Energy conservation
Improved mental health
Cleaner air
Higher property values

Distribution List

- **Board of Directors (BOD)**
  - **Company Secretary/ GM (Legal Services)**
  - **Chief Internal Auditor**
  - **Managing Director (MD) / Chief Executive Officer (CEO)**
    - **GM (Corporate Affairs)**
    - **GM (HSEQ)**
    - **ED (HR/Admin)**
      - *GM (HR)*
      - *GM (Admin)*
      - *InCharge (OGTI)*
    - **Chief Operating Officer (COO)**
      - ***ED Exploration***
        - GM (Prospect Generation)
        - GM (Geological Services)
        - GM (Geophysical Services)
      - ***ED Petroserv***
        - GM (Drilling Operations)
        - GM (Drilling Services)
        - GM (C&ESS)
      - ***ED Production***
        - GM (Production)
        - GM (P & P)
        - GM (Projects)
        - GM (PE&FD)
        - GM (Commercial)
      - ***ED Reservoir Management***
        - GM (Reservoir Management)
        - GM (Geology & Geophysical)
      - ***ED JV/ BD***
        - GM (JV)
        - GM (BD)
    - **Chief Financial Officer (CFO)**
      - *Chief Information Officer (CIO)*
      - *GM (CSR)*
      - ***ED Finance***
        - GM (Finance)
        - GM (Accounts)
        - GM (Treasury)
      - ***ED Services***
        - GM (SCM)
        - GM (Material Management)
        - GM (Security)

Contents

1. Objective
2. Scope
3. Legal & Other Requirements/ References
4. Responsibilities
5. Definitions
6. Sources of Wastes
6.1 Engineering & Construction Specified
6.2 Seismic Specified
6.3 Drilling Specified
6.4 Production Specified
6.5 Camps Specified
6.6 Maintenance Activities Specified
7. Waste Management Methods
7.1 Source Reduction Methods
7.2 Reuse
7.3 Recycling/Recovery
7.4 Treatment
7.5 Responsible Disposal
8. Specific Wastes Information
8.1 Atmospheric Emissions
8.2 Chemical Wastes
8.3 Contaminated Soil from Oil/ Fuel Spills
8.4 Drilling Pit Wastes
8.5 Drums/Containers
8.6 Garbage–Inert Solid Wastes
8.7 Pit, Tank and Vessel Bottom Wastes
8.8 Process Drainage Wastes System
8.9 Produced Water
8.10 Rainwater Drainage
8.11 Sanitary Wastes
8.12 Clinical Wastes
8.13 Electronic Wastes (E-waste)
9. Standardized Operating Procedure: Handling, Segregation And Disposal Of Solid Wastes
10. Standardized Operating Procedure: Framework For Site Restoration

Annexures

Annexure A	Template for On-Site Waste Management Plan
Annexure B	Guidelines for Produced and Process Water Management
Annexure C	Guidelines for Drilling & Production Waste Management
Annexure D	Guidelines for Camp Site Waste Management and Disposal
Annexure E	Guidelines for Oil Spills/Soil Contaminated by Oil Leakages
Annexure F	Guidelines for Guidelines For Emissions From Controls, Gas Flaring And Venting
Annexure G	National Environmental Quality Standards (NEQS) (Self Monitoring And Reporting By Industry) Rules 2001, SRO 528(1)/2001
Annexure H	Louisiana Statewide Order (LSO) No. 29-B Permissible Limits For The Restored (Treated) Soil
Annexure I	Guidelines for Open Auction
Annexure J	Guidelines For Hazardous Materials Storage And Handling
Annexure K	Bioremediation Process
Annexure L	Floating Treatment Wetlands (FTW)
Annexure M	Undertaking
Annexure N	QC Checklist for Treatment/ Restoration of Pit
Annexure O	Coverall Specifications
Annexure P	How GHG Emissions get Quantified?

CHAPTER 01

OBJECTIVE

Effective and responsible wastes handling and disposal are key elements of OGDCL's environmental management system. Our "generated-waste" is any material that is either solid, liquid or mixture that is surplus to the requirements. Not only, there is concern from the federal/ provincial EPAs but also from the Company's management that all generated wastes be properly managed in order to minimize their potential to cause harm to health or the environment. Moreover, OGDCL believes that efficient management of generated wastes can reduce operating costs and potential liabilities.

This handbook is designed as an information source as well. It is intended to provide roles and methods to ensure adequate and effective handling and disposal of generated wastes as required within local regulatory requirements.

The fundamental objectives of this handbook are given below:

- To meet legal requirements of the national and local statutory laws & regulations.
- To prevent or minimize emissions, effluents, spills, dumping, composting etc. into air, water and soils for protecting of the echo system (air quality, landscapes, surface water & ground water, flora, organisms & wild life) – its restoration and wellbeing.
- To incite and stimulate behavioral change among our workforce as well as among the surrounding community to initiate individual contribution towards managing the generated wastes.

CHAPTER 02
SCOPE

This handbook covers the management of wastes generating from Company's current and planned activities at its operational (field) locations, which are:

- Projects activities
- *(engineering & construction)*
- Exploration and Development activities
- *(drilling, geological field survey and seismic*
- *operations)*
- Production and Plant operations

Sections of the handbook provide:

- Description of OGDCL's waste management principles
- Identification of OGDCL's activities and associated wastes, and
- OGDCL's options for wastes reduction, recycling, treatment and responsible disposal.

OGDCL has formulated this document to proclaim a Waste Management Program that is appropriate to its activities and to the ecological sensitivity of the operating locations. The specific requirements mentioned in this handbook are in agreement or above the required standards issued by the local authorities, either at district, provincial or country level.

CHAPTER 03

LEGAL & OTHER REQUIREMENTS/ REFERENCES

- Federal & Provincial Environmental Protection Acts
- DGPC Guidelines For Operational Safety, Health, & Environmental (SHE) Management (Petroleum Exploration & Production Sector)
- Rules 55 and 56 of the 1986 Exploration and Production Rules
- Safety Regulations-1974 of Mines Act 1923
- National Environmental Quality Standards
  - SRO.742 (I)/93 & SRO.1023 (I)/95 National Environmental Quality Standards for Municipal and Liquid Industrial Effluents (mg/L, unless otherwise defined).
  - SRO.1062 (I)/2010, SRO.1063 (I)/2010 & SRO.1064 (I)/2010 National Environmental Quality Standards for Ambient Air, Industrial Gaseous Emissions and Noise).
  - SRO.72 (KE)/2009 National Environmental Quality Standards for Motor Vehicle Exhaust & Noise.
- Oil & Gas UK Guidelines for the Suspension and Abandonment of Wells Issue 4 , July 2012
- Louisiana Statewide Order (LSO) No. 29-B, June 2010, Pollution Control—Onsite Storage, Treatment and Disposal of Exploration and Production Waste (E&P Waste) Generated from the Drilling and Production of Oil and Gas Wells (Oilfield Pit Regulations), Title 43 Natural Resources Part XIX. Office of Conservation — General Operations of Louisiana Administrative Code
- World Bank Guidelines (Environmental Assessment Sourcebook. Volume III, 1991)

CHAPTER 04

RESPONSIBILITIES

- Heads of Technical (Exploration/ Petroserv/ Production) Department shall ensure that waste is managed in line with requirements of this handbook.
- Head of HSEQ Department shall ensure that all requirements outlined in the OGDCL's Integrated Waste Management Plan are timely updated and communicated to relevant functions/ interfaces.
- Line/ field management and particularly all sectional heads are responsible to ensure that the personnel and contractors/ subcontractors performing under their administrative control take responsible, effective and applicable measures when dealing with wastes generated in the course of their activities i.e. maintenance, repair, modification, erection, construction, fabrication, commissioning, etc.

Following Waste Management Practices shall be carried out at field locations:

- Material Safety Data Sheets for each arriving material shall be maintained, reviewed and less toxic alternatives selected when possible.
- Wastes generated from each specific area shall be properly collected, segregated, analyzed (where required), labeled, and safely disposed. Wastes materials stored at facilities shall be minimized.
- Samples of emissions and effluents shall be frequently collected to check compliance against NEQS.
- Routine inspections of materials and wastes storage areas shall be performed to locate damaged or leaking drums and containers.
- Personnel shall be trained to use sensible waste management practices.

CHAPTER 05

DEFINITIONS

i. **ACIDISING – The treatment of a well by injection with a solution of acid (hydrochloric, hydrofluoric, acetic, formic, citric) to maintain or increase permeability of a rock stratum by dissolving pore blockage due to fine particles from the reservoir stratum, precipitated materials or corrosion products, so improving productivity or injectivity (see 'injection') of a well.**

ii. **AQUIFERS - Rock strata which contain, and are permeable to, water. The water may be fresh or saline, and either potable or non-potable.**

iii. **ASPHYXIANT - A vapor or gas which can cause unconsciousness or death by suffocation (lack of oxygen).**

iv. **BTEX - Benzene, Toluene, Ethylbenzene and ortho-, meta-and para-Xylene.**

v. **BIOLOGICALLY AVAILABLE - Also bio-available. Substances which are present in a form which can be taken up by plants or animals and which may be incorporated into their tissues.**

vi. **BIOCIDES - Materials which can be added to muds or reinjected produced water for the purpose of prevention or limitation of growth of bacteria in the mud or in the oil reservoir rock.**

vii. **BIODEGRADABLE - Susceptible to breakdown, into simpler—often soluble and/or gaseous—compounds, by microorganisms in the soil, water and atmosphere. Biodegradation often converts toxic organic compounds into non- or less-toxic substances.**

viii. **Bioremediation – This treatment option naturally degrades chemicals in soil and groundwater using biological processes that involve the conversion of chemicals into water and harmless gases by microbes. The right conditions (e.g., temperature, nutrients, amount of oxygen) must be present or created in order for bioremediation to be successful.**

ix. **BOD (BIOCHEMICAL OXYGEN DEMAND) - Measure of the quantity of dissolved oxygen (expressed in parts per million)**

used in the decomposition of organic matter by biochemical action.

x. **BRINE** – Salt water. May be produced water or mixed solutions most commonly containing sodium, potassium, or calcium chloride salts. When added to drilling muds, brine has three functions: 1. minimize reaction between mud and soluble salts in the strata being drilled; 2. increase mud weight; 3. increase mud viscosity.

xi. **CARCINOGEN** - A substance or agent capable of causing cancer or having the potential to cause cancer. Carcinogen (H) Known to cause cancer in humans. Carcinogen (A) Known to cause cancer in animals. Carcinogen (S) Suspected to cause cancer.

xii. **CFC** - Chlorofluorocarbon.

xiii. **CNS DEPRESSANT** - A chemical that may cause loss of functioning and possible damage to Central Nervous System (CNS). Central Nervous System depressants may include a majority of hydrocarbons in the refinery. Symptoms from overexposure are headache, dizziness, nausea, unconsciousness and possibly, death.

xiv. **COMPLETION FLUID** – Chemical mixture present in the well during the placement of production tubing and perforation of the well (may be a drilling fluid, or specialized brine).

xv. **COMPOSTING** – Composting is the controlled biological decomposition of organic material in the presence of air to form a humus-like material. Controlled methods of composting include mechanical mixing and aerating, ventilating the materials by dropping them through a vertical series of aerated chambers, or placing the compost in piles out in the open air and mixing it or turning it periodically.

xvi. **CONSOLIDATION MATERIALS** - Chemical mixture pumped down a well to stabilize the formation structure or minimize water production.

xvii. **CORROSIVE** - A chemical that causes visible destruction of, or irreversible alterations in, living tissue.

xviii. **CUTTINGS – The fragments of rock dislodged by the drilling bit and brought to the surface in the drilling mud.**

xix. **DRILLING CHEMICALS - Chemicals used in the formulation and maintenance of drilling muds.**

xx. **DRILLING FLUIDS - Specialized fluid made up of a mixture of clays, water (and sometimes oil) and chemicals, which is pumped down a well during drilling operations to cool and lubricate the system, remove cuttings and control pressure.**

xxi. **DESCALERS – Substances added to prevent build-up of, and to a lesser extent remove, solids such as calcium carbonates and sulphates deposited on the drill pipe and casing. Pitting corrosion of metal can occur under scale deposits.**

xxii. **ENVIRONMENTAL IMPACT ASSESSMENT - A formal, written, technical evaluation of potential effects on the environment (atmosphere, water, land, plants and animals) of a particular event or activity**

xxiii. **EFFLUENTS - Liquid wastes materials discharged from operations.**

xxiv. **ENCAPSULATION - The enclosure of wastes by a non-permeable substance. Wastes constituents are not chemically altered, but their transport will be impeded by the encapsulating matrix.**

xxv. **FRACTURING FLUID – Heavy, viscous fluid pumped down a well under high pressure to fracture the target formation in order to enhance fluid flow.**

xxvi. **FLARING - Controlled disposal of surplus combustible vapours by igniting them in the atmosphere.**

xxvii. **HIGHLY TOXIC - Chemicals that have a high potential for causing death or serious injury if inhaled, ingested or absorbed through the skin.**

xxviii. **INCINERATION - This treatment option burns wastes under controlled conditions. Different incinerators are permitted for different kinds of wastes. Hazardous wastes must be brought to an incinerator permitted to accept hazardous wastes.**

xxix. **INJECTION WELL - A well used to inject gas or water into an oil/gas reservoir rock to maintain reservoir pressure during the secondary recovery process. Also a well used to inject treated wastes into selected formations for disposal.**

xxx. **IRRITANT - A chemical that causes reddening, swelling and pain short of actual tissue damage. Irritants are not corrosive. Their inflammatory effect is reversible.**

xxxi. **LANDFILL DISPOSAL - This is a disposal option involving carefully designed structures built into or on top of the ground in which wastes is isolated from the surrounding environment. There are different types of landfills, each designed to handle particular wastes streams.**

xxxii. **MSDS/SDS – Material Safety Data Sheet used by chemical suppliers to summarise properties of products, including health, safety and environmental aspects.**

xxxiii. **NORM - Naturally Occurring Radioactive Materials. Low Specific Activity (LSA) scale is one example of a NORM wastes.**

xxxiv. **ONSITE BURIAL – This disposal option refers to the placing of the wastes within the ground at the site of the incident. This option should only be used when site characteristics allow it (e.g., depth to water table) and proper environmental controls to protect groundwater, surface water, and soil are put into place.**

xxxv. **OPEN BURNING – This disposal option refers to the deliberate outdoor burning of wastes. It can be done in open drums, in fields, and in large open pits or trenches. The use of this option is highly restrictive**

xxxvi. **PRODUCED WATER - Water originating from the natural oil reservoir, that is separated from the oil and gas in the production facility.**

xxxvii. **PRODUCTION TREATING CHEMICALS – Chemicals used to enhance or assist the production process or protect equipment.**

xxxviii. **RECLAMATION – The activities undertaken to restore a site to a predetermined land-use.**

xxxix. **SCRUBBING - Purifying gas by treatment with a water or chemical wash.**

xl. **SENSITIZER - A chemical that causes a substantial proportion of exposed people or animals to develop an allergic reaction in normal tissue after repeated exposure to the chemical.**

xli. **SOLIDIFICATION – The addition of materials (sawdust, adsorbent polymers, etc.) to a wastes to change its physical state and improve handling and weight-bearing characteristics.**

xlii. **STABILIZATION - The chemical conversion or encapsulation of wastes to create a composite matrix that resists leaching.**

xliii. **STIMULATION FLUIDS – Chemical mixture pumped down a well to stimulate or enhance the production of hydrocarbons from that well.**

xliv. **VENT GASES – Those gases which are released, unburnt to the atmosphere. Venting may be deliberate (for operational reasons) or accidental.**

xlv. **REPRODUCTIVE HAZARDS - Chemicals that affect the reproductive capabilities of males, females and a developing fetus.**

a. **Reproductive (M) - for males**
b. **Reproductive (F) - for females**
c. **Reproductive (D) - developmental hazard for fetus**
d. **Reproductive (S) - suspect, effects seen at levels not expected in industry**

xlvi. **SKIN ABSORBER - A chemical that penetrates the intact skin, leading to uptake and distribution throughout the body.**

xlvii. **TARGET ORGAN EFFECTS (SKIN, LIVER, KIDNEY, LUNGS, EYES) - Chemicals that cause effects at organ locations other than at the point of entry into the body.**

CHAPTER 06

SOURCES OF WASTE

6.1 Engineering & Construction Specified

Construction of infrastructure and facilities is required to support activities to seismic, drilling and production. Construction of facilities such as roads, camps, pits/ ponds and pipelines may be required both before and during the development and production process. The construction process uses a wide variety of materials, equipment and methods. The facilities required for a specific activity depends on the activity and its geographic location.

Specific Wastes: The primary wastes from construction activities include excess construction materials, sand, cement, bricks, reinforcement steel bars, paints, used lubricating oils, solvents, sewage and domestic wastes. Demolition wastes like concrete, bricks, and other building material is also included.

Decommissioning and Reclamation:
Decommissioning generally involves permanently plugging and abandoning wells, and may include removal of buildings and equipment, transfer of buildings and roads to local communities, implementation of measures to encourage site re-vegetation and site monitoring.

Specific Wastes: The primary wastes from decommissioning and reclamation include construction materials, insulating materials, plant equipment, sludges and contaminated soil.

6.2 Seismic Specified

Since seismic activities are highly mobile, therefore the base camps are temporary in nature. In order to protect surface water bodies, sanitary pits and biodegradable garbage pits are built at least 100 meters from the water, if possible. Non-biodegradable, flammable wastes may be burned and the ashes buried with the non-flammable wastes. This burial is at least one meter deep. If the area water table is high, then the burial criteria is reconsidered.

Specific Wastes: The primary wastes from the seismic operations include domestic wastes, sewage, explosive wastes, lines, cables and vehicle maintenance wastes.

6.3 Drilling Specified

Once drilling commences, drilling fluid or mud is continuously circulated down the drill pipe and back to the surface equipment to balance underground hydrostatic pressure, cool and lubricate the bit and flush out rock cuttings. The risk of uncontrolled flow from the reservoir to the surface is further reduced by using blowout preventers, a series of hydraulically actuated steel rams that can close around the drill string or casing to quickly seal off a well. Steel casing is run into completed sections of the borehole and cemented into place. The casing and cement provide structural support to maintain the integrity of the borehole, isolate underground formations, and protect usable underground sources of water. Where a hydrocarbon formation is found, initial well tests are conducted to establish flow rates, formation pressure, and the physical and chemical characteristics of the oil and gas.

Specific Wastes: The primary wastes from exploratory drilling operations include drilling muds and cuttings; cementing wastes (like cement classes G/H/J and

cement additives); well completion, workover and stimulation fluids; and production testing wastes. Other wastes include excess drilling chemicals and containers (including jumbo bags of barite), construction materials (pallets, wood, etc.), process water, fuel storage containers, power unit and transport maintenance wastes, scrap metal and domestic/ sewage wastes.

6.4 Production Specified

Routine operations on a producing well include monitoring, safety and security inspections and periodic downhole servicing using a wire line unit or a workover rig. In some areas, a self-contained base camp may be established to support routine operations. The base camp provides workforce accommodation, communications, vehicle maintenance and parking, fuel handling and storage, and provision for collection, treatment and disposal of wastes.

If there is a processing facility (dehydration, H2S/ CO2/ Nitrogen/ Mercury removal, etc.), then specific plant based wastes may include various chemicals/ additives, corrosion inhibitors, amine leftovers, glycol leftovers, alumina silicate, activated carbon, gas elements, etc.

Specific Wastes: The main wastes from development and production operations include discharged produced water, flare and vent gas, production chemicals, workover wastes (e.g. brines) and sludge (tank or pit bottoms).

6.5 Camps Specified:

In addition to the specified wastes for each operation, there is a wastes category that is primarily related to Camps and which includes; fused tube lights, redundant electrical appliances, paper, air fresheners, disposable

razors, tooth paste tubes, brushes, combs, shopping bags, insecticides spray cans, edible oil cans, old newspapers, miscellaneous un-serviceable plastic utensils, food wastes etc.

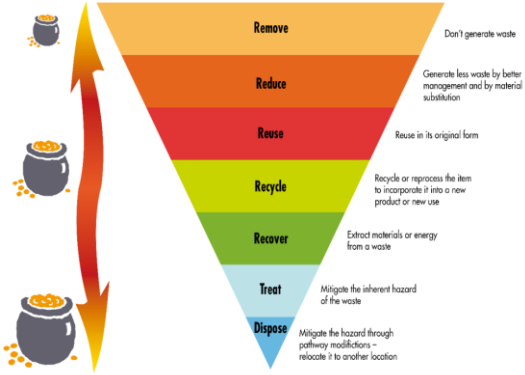
6.6 Maintenance Activities Specified:

The primary wastes associated with the maintenance activities include wooden packing boxes, rubber tubes, batteries, used lubricants, filters, hoses, tyres, paints, solvents, bulbs, tube lights, energy savers, grass, cotton rags, plastic and glass bottles, metal wastes, oil tins, insecticide spray can, glass material, packing cartons, miscellaneous bottles, plastic material, electrical cables, e-waste, grass, papers, contaminated soil, coolant and antifreeze chemicals, used parts, scrap metals, air/ fuel/ particle/ dust filters, pigging (oily) sludge, tank sludge, etc.

CHAPTER 07

WASTE MANAGEMENT METHODS

OGDCL understands the capabilities and limitations of different Waste Management Options for the various types of wastes generated in order to make cost-effective Waste Management Decisions that are protective of human health and the environment. As a general matter, OGDCL has a Waste Management Hierarchy (as recommended by EPA), with a preference for reuse and recycling options.



Source Reduction Methods: Source reduction means eliminating or decreasing, to the extent practical, the volume or relative toxicity of wastes generated by using alternate materials, processes or procedures. Since the opportunities to achieve significant wastes volume reductions for some wastes are limited as their volumes are primarily a function of activity level and age or state of reservoir depletion. For example, the proportion of

discharged produced water typically increases as the reservoir is depleted. Also, the volume of drilling mud generated is generally a function of the number of wells drilled and their depth. Nevertheless, OGDCL makes use of opportunities for source reduction and efforts are made to exploit them. For example, use of proper solids control equipment reduces the volume of mud discharged.

i. OGDCL also believes in process modification which is possible through more effective use of mechanical components, such as more effective drill bits, rather than chemical additions. Gravel packs and screens significantly reduce the volume of formation solids/ sludge produced. Improved controls aid OGDCL to minimize mud changes, engine oil changes and solvent usage.
ii. Substitution of products that result in the generation of less toxic wastes is preferred. For example, biocides, corrosion inhibitors, coagulants, cleaners, solvents, dispersants, emulsion breakers, scale inhibitors, viscosifiers and weighting agents are selected with potential environmental impacts and disposal needs in mind. Some examples are the selection of mud and additives that do not contain significant levels of biologically available heavy metals or toxic compounds, and the use of mineral oils in place of diesel oil for stuck drill pipe.
iii. Other efforts include efficient planning so that all commercial chemical products are used on the site or returned unused to the vendors; consideration of bulk chemical purchases to eliminate drums; and use of drains and sumps to collect and segregate spills.

Reuse: After all wastes reduction options have been considered, the next step is to evaluate reuse of the wastes material. The reuse may be in the same, alternative, or downgraded service, or the return of unused materials for reissue or reuse in other industries.

i. Examples include use of drill cutting wastes for brick manufacture and roadbed material, use of vent gas for fuel, use of produced water or process water as wash water, and return of oil based drilling mud to the vendor for reprocessing and re-issue.
ii. Wastes such as tank bottoms, emulsions, heavy hydrocarbons, and hydrocarbon bearing soil is used for road oil, road mix, or asphalt. These wastes are analyzed to ensure they are not flammable and have a mixed density and metals content consistent with road oils or mixes. Application of hydrocarbon wastes to roads is kept at loading rates that minimize the possibility of surface run-off.

Recycling/Recovery: After all wastes reduction and reuse options have been considered, the next step is to evaluate recycling and recovery of the wastes material either in-process, on-site, or with outside contractors. When available, the recycling of drilling mud in mud plants is considered.

i. There are potential benefits in the sale of recovered hydrocarbons. All hydrocarbon wastes are returned to the production stream where possible. Recovery of hydrocarbons from tank bottoms, pipeline and separator sludge via centrifuging or filtering is accomplished at on-site production facilities or off-site commercial facilities.
ii. When recycling scrap metal, monitoring is considered to ensure that metal with NORM (LSA) scale is not sent to the recycling facility along with uncontaminated materials.

Treatment: After source reduction, reuse, recycling and recovery opportunities have been examined, potential treatment steps to minimize wastes volumes or toxicity is considered.

i. Treatment methods include: biological methods (e.g. land spreading, composting, tank based reactors),

thermal methods (e.g. thermal desorption and detoxification), chemical methods (e.g. precipitation, extraction, neutralization) and physical methods (e.g. gravity separation, filtration, centrifugation).

ii. Examples of treatment methods include biodegradation of oily wastes in a pit by tillage and addition of nutrients (fertilizer); and stabilization of mud pit wastes by adjusting the pH to chemically stabilize and reduce potential toxicity and mobility of inorganic compounds.

Responsible Disposal: Finally, after all practical source reduction, reuse, recycling, recovery and treatment options have been considered and incorporated, responsible disposal options for the residue is determined. The following criteria is examined when evaluating wastes disposal options. This information helps in determining the long-term fate of wastes and their constituents and is applied to both on-site and off-site disposal facilities.

CHAPTER 08

SPECIFIC WASTE INFORMATION

The following pages contain descriptions of some selected wastes streams and discussion of possible Waste Management Options for these wastes. These descriptions are not intended to be all-inclusive but give examples of potential options.

8.1 Atmospheric Emissions

This covers all exhausts, flares, vents and gas leaks in the drilling and oil and gas processing activities. This can include SOx, NOx, H2S, hydrocarbons, VOCs, particulates and PAHs.

Waste Management Options

Reduce:	▸ Design and operate oil and gas exploration and production activities and process equipment with controls and policies to minimize atmospheric emissions. ▸ Maintain and run all plants under optimal fuel efficient conditions, when possible.
Reuse:	▸ Where possible flare gas is used as a fuel. Natural gas may also be injected for reservoir maintenance, enhanced recovery or used in artificial lift.
Recycle/ Recover:	▸ Wastes heat recovery opportunities are exploited where practically possible.
Treatment/ Disposal:	▸ Excess produced gas may be injected or flared under controlled system. ▸ Catalytic chambers, scrubbers or strippers can be installed on exhaust stacks. ▸ Water injection into fuel combustion chambers may reduce NOx emissions.

8.2 Chemical Wastes

This includes any surplus or contaminated chemicals used at all stages of exploration and production activities. It includes specific items such as batteries, transformers and other items containing or contaminated with chemical products. The concerns depend on the composition and

the associated safety and adverse environmental considerations. These wastes may require specific segregation and disposal techniques.

Waste Management Options

Reduce:	▸ Wherever possible, planning and good housekeeping practices should be employed to minimize surplus and contamination e.g. re-bagging of damaged packing during transportation & stacking at site; storage of costly chemicals in containers or covered with tarpaulins. ▸ Substitution with longer life products and those with lower impacts should be considered.
Reuse:	▸ Surplus chemicals may be usable in other locations or returned to vendors, if possible. ▸ Materials such as cement, bentonite, lime, may have alternate use in wastes treatment, road construction, landfill site construction, etc.
Recycle/ Recover:	▸ Items such as lead acid batteries, wet nickel/ cadmium batteries are sent to the recycling facilities if available. ▸ Certain chemical wastes may contain metals such as silver or mercury which could be recovered. ▸ Chemical solvents may be economically recovered or used in a fuel blending programme.
Treatment/ Disposal:	▸ Encapsulation/solidification by mixing with cement, lime or other binder may be appropriate prior to disposal. ▸ Special landfill sites may be available which can accept certain kinds of chemical wastes. The possibility of leachate problems need to be identified. ▸ For some organic chemical wastes, incineration may be the preferred treatment option. For chemicals like PCBs, high temperature incineration is required to destroy the compounds.

8.3 Contaminated Soil from Oil/ Fuel Spills

This may include soil, and other materials arising from the leakage or spill of hydrocarbons or fuels. The impact depends on the type of hydrocarbon and the location of the spill or leak.

Waste Management Options

Reduce:	▸ Avoid spills and leakage by improved housekeeping, maintenance and transport procedures (like use of secondary containment and proper decanting system for petrol/diesel from damaged drums or vessels.)
Reuse:	▸ N/A
Recycle/ Recover:	▸ Depending on the extent of the contamination, recovery of free liquids may be possible.
Treatment/ Disposal:	▸ Bioremediation. ▸ Land-farming, land-spreading and composting may be applicable if conditions for biological degradation are favorable. ▸ Enhancement techniques could be considered. ▸ Incineration, landfill and burial options may be limited by availability and the quantity/nature of the contaminated soil. ▸ Stabilization techniques may be applicable prior to disposal.

8.4 Drilling Pit Wastes

Drilling pit wastes usually contain both solid and liquid components. Constituents of environmental concern include salt, hydrocarbons, pH, drilling chemicals and biologically available heavy metals. These constituents have the possibility of impacting soil and water quality.

Waste Management Options

Reduce:	▸ The volume of drilling/ workover pit wastes may be reduced by judicious use of rig wash water, by releasing water that does not contain hydrocarbons or high salinity from the pit, by avoiding the collection of rainwater run-off in the pit or by reusing the

	water in the drilling fluid. ▸ All pits to be lined with an impermeable lining such as a synthetic plastic PVC liner (high density polyethylene geomembrane of 2.0 mm thickness but not less than 1.0 mm in any case) to ensure that no horizontal or vertical leakage occurs. ▸ The boundaries/ banks of pits be raised at least one foot above the ground surface to restrict the entry of surface runoff into the wastewater pits. ▸ High pressure pneumatic valve be used for water conservation during rig wash. ▸ Drilling wastes volume may be minimized by the use of a closed loop mud system. Dumping volumes of mud be reduced by effective utilization of solid control system for mechanical separation of solids including shale shaker screen panels.
Reuse:	▸ Solids are applied for the lining or capping of landfill sites, or as a road construction material.
Recycle/ Recover:	▸ Recovered weighting materials and drilling fluids may be recycled into the drilling fluid of the same or different well. ▸ Commercial mud plants may take used drilling fluids for recycle.
Treatment/ Disposal:	▸ Coagulation/ flocculation may be preferred to separate the suspended solids portion from the water; Gypsum/ alum may be applied on wastewater to address excess sodium; Pits solids may be adjusted to pH 6-9 with agricultural limestone to maintain metals in a fixed state. Pits may be left for drying for 7 days till solidification completed. ▸ Leftover materials like sludge and water based mud drill cuttings may be air-dried prior to burial whereas the oil based drill mud cuttings/ material with HC dried with an oil-sorbent; Spread & tilled-in bio-ingredients on the dried cuttings / slurry. Bioremediation may also be a viable option. ▸ Then the pits may be backfilled with clean soil cover, buried 02 ft below grade; Mulch

	may be spread and compressed followed by little vegetative cover spread to prevent erosion. ▸ Liquids which cannot be treated to a standard suitable for surface discharge may be incinerated.

8.5 Drums/Containers

Metal and plastic containers are used for a wide range of lubricants and chemicals used throughout the oil and gas industry. The accumulation and disposal of these can be problematic. Drums and containers inevitably contain variable quantities of residues. The impact arises from both the volume and presence of residues.

Waste Management Options

Reduce:	▸ Bulk transport and storage is considered for high volume consumption items.
Reuse:	▸ Certain containers can be refilled from the bulk storage and reused. Where possible, non-refillable containers are returned to the vendor for reuse, or to a company specializing in container refurbishment. ▸ Drums and containers are used for the transportation of suitable wastes provided safety considerations are not compromised.
Recycle/ Recover:	▸ Both metal and certain plastic drums and containers are recycled if outlets are available. However, this may require that they be cleaned of any residues beforehand.
Treatment/ Disposal:	▸ Drums are crushed prior to landfill. The nature of any residues may restrict this option or require pre-cleaning. Incineration is applicable to plastic containers, but incinerators need to be equipped with air pollution control devices.

8.6 Garbage–Inert Solid Wastes

This includes wood, plastics, paper, food wastes, general garbage and inert construction and maintenance materials. The environmental impact may arise from the

encouragement of vermin by food wastes, production of gases by biodegradable materials and leachates where other site materials such as chemical residues have been mixed in with the wastes.

Waste Management Options

Reduce:	▸ Packaging wastes such as paper and plastic is reduced by the use of bulk handling systems or 'big bags'. ▸ Segregation of components such as wood, plastic and paper, for recycling or reuse will reduce the quantity for disposal.
Reuse:	▸ Where the inert waste consists totally of construction material, it is usable as infill.
Recycle/ Recover:	▸ Materials such as wood, paper and metals is segregated for recycling. ▸ General garbage is frequently incinerated and some incinerators are fitted with heat recovery.
Treatment/ Disposal:	▸ Landfill is the most common disposal method employed. Local conditions may limit this option. Burial of these wastes may be an option when a suitable landfill is not available. ▸ Incineration using fixed or mobile facilities greatly reduces the wastes volume for landfill. Techniques such as composting are used to reduce the volume of domestic wastes through biodegradation.

8.7 Pit, Tank and Vessel Bottom Wastes

This waste consists of water, accumulated hydrocarbons, solids, sand and emulsions which collect in the lower sections of slop oil tanks, crude oil stock tanks, closed water drain tanks, open water drain tanks and other storage and separation vessels as well as in produced water storage or emergency pits. Constituents of these wastes that may impact selection of Waste Management and Disposal Methods include hydrocarbons, salts, metals, production chemicals and occasionally NORM. Possible environmental impacts will depend on the concentrations of these constituents and the Waste

Management Option(s) chosen.

Waste Management Options

Reduce:	▸Improved housekeeping procedures reduce the volume of solids collected in drainage water storage tanks. The wastes volume is reduced through evaporation or dewatering.
Reuse:	▸Suitable wastes is mixed with absorbent material (e.g. lime) and applied as road surfacing material, or mixed with aggregate in an asphalt batch process.
Recycle/ Recover:	▸Sludges containing significant oil is reclaimed either onsite or offsite for the removal and recovery of hydrocarbons.
Treatment/ Disposal:	▸These sludges may be land-filled, if dry. ▸These sludges are landspread or landfarmed. Consideration is made of the biodegradability of the organics, availability of land, loading rates, and possibility of ground or surface water contamination. ▸These sludges are incinerated, with proper pollution control devices in place.

8.8 Process Drainage Wastes System

The process facility drainage system wastes include washdown water, boiler and cooling water blow downs, leaks and spills. The hazards depend on the nature of the sources. As with surface water drainage, physical effects such as erosion and temperature may be considerations.

Waste Management Options

Reduce:	▸A leak minimization strategy forms an integral part of facility design and maintenance procedures. All fuel, hydrocarbon and hazardous chemical storage areas are sufficiently bunded. Drip pans are used where needed. ▸Spill clean-up procedures are developed.
Reuse:	▸Process water is reused for activities requiring lower water quality (e.g. rig washing or flare suppression).
Recycle/ Recover:	▸N/A

Treatment/ Disposal:	▸ *See rainwater drainage.*

8.9 Produced Water

Originating from oil and gas production/processing, produced water may contain variable quantities of mineral salts, solids, suspended and dissolved hydrocarbons, and other organic and inorganic components, and may be at high temperature. The composition may change with time. It may require pre-treatment prior to disposal. The environmental impacts are highly dependent on the quantities involved, the components, the receiving environment and dispersion characteristics. Before significant or long-term discharge of produced water to the environment is carried out, an environmental impact study is carried out.

Waste Management Options

Reduce:	▸ Water shut off treatments, re-perforation.
Reuse:	▸ Re-injection for reservoir pressure maintenance or secondary recovery of oil. ▸ Quality may allow use for agricultural purposes or reuse as wash water.
Recycle/ Recover:	▸ Heat content. ▸ De-salination.
Treatment/ Disposal:	▸ Surface discharge into the environment may be possible depending on the water quality, volume and flow. Primary treatment such as de-oiling will often be required. Bio-treatment may be practical for low volumes. ▸ Downhole injection to suitable formations other than the producing formation may be possible. However, the possibility of contaminating usable water aquifers must be taken into account. ▸ Evaporation and subsequent disposal of salts may be possible.

8.10 Rainwater Drainage

This comes from all areas of the site/facilities. Surface drainage will be susceptible to contamination from spills, leakage and leaching. The environmental impact

depends on such contamination along with physical considerations such as erosion.

Waste Management Options

Reduce:	▸ Contamination of the surface drainage water is avoided as this is considerably easier than any subsequent treatment. Thought is given to the segregation of drainage from liquid storage, loading/unloading facilities, and operations areas from unimpacted areas of the site.
Reuse:	▸ Collected rainwater is reused for agricultural purposes if quality permits or could be used for activities requiring lower water quality such as washing or flare suppression.
Recycle/ Recover:	▸ N/A
Treatment/ Disposal:	▸ Surface disposal is governed by contamination. The provision of a site drainage system with an oil/solids interceptor is considered. Any surface disposal option should be capable of taking the drainage volumes without causing damage by erosion or flooding, which would not otherwise occur. ▸ Drainage water with a high organic content may be treated in biological water treatment systems to remove organics prior to discharge.

8.11 Sanitary Wastes

This covers all sewage and foul drainage. The impact is associated with the BOD, Coliform bacteria and treatment chemicals.

Waste Management Options

Reduce:	▸ Low flow/ low water use toilets may be used.
Reuse:	▸ N/A
Recycle/ Recover:	▸ Digested sewage sludge may be used for agricultural/land improvement purposes.
Treatment/ Disposal:	▸ Full treatment septic systems to process all sewage should be installed for all construction, drilling and production facilities, and camps on land. Proper

	sewage treatment systems to be considered at major plants. ▸If chlorination is carried out, this should be strictly controlled and oxygenation may be required to prevent damage to aquatic life.

8.12 Clinical Wastes

This covers all medical/ clinical refuse. The impact is associated with the microorganisms spreading diseases, unhygienic/ used syringes, etc.

Waste Management Options

Reduce:	▸Use of sterilized gadgets/ equipment. ▸Safe return of the expired medicines, injections, etc. back to the dealer.
Reuse:	▸N/A
Recycle/ Recover:	▸N/A
Treatment/ Disposal:	▸All medical/ clinical wastes to be properly packed/ sealed in a carton. ▸Incineration, landfill and burial options to be preferred.

8.13 Electronic Wastes (e-waste)

This covers all electronic gadgets like computers, laptops, electronic modules, tablets, cellular phones, control room modules, etc. Certain health and environmental hazards are caused by e-waste. Reduce new purchases, reuse, repair, and recycle unused electronic gadgets and equipment. E-waste does not need to be wasted.

Waste Management Options

Reduce:	▸Reduce purchases of new electronic devices and electrical equipment. ▸Think twice before buying a new electronic gadget when an upgrade or new device becomes available. ▸Instead focus on continuously upgrading and improving the software.
Reuse:	▸Redeploy existing items to new owners. Pre-owned electronic devices can be put to good use by other people. ▸Introduce buy-back options for computers/

	laptops/ mobiles. ▸ Donate to a school, community center, or charitable organization. ▸ When electronic devices and electrical equipment breakdown, they should be repaired and then reused.
Recycle/ Recover:	▸ Disposing off electronic equipment responsibly by identifying and working with Certified Recyclers who meet stringent standards for handling e-waste in an environmentally sound manner while ensuring workers safety. ▸ E-waste contains valuable materials as well as potentially toxic substances and can be safely recycled to recover metals and other materials for reuse and dispose of toxins appropriately.
Treatment/ Disposal:	▸ Incineration the e-waste at high temperature in specially designed incinerators. Emissions of the harmful gases like mercury and cadmium be strictly monitored.

CHAPTER 09

STANDARDIZED OPERATING PROCEDURE:

HANDLING, SEGREGATION AND DISPOSAL OF SOLID WASTES

9.1 Waste is classified as Hazardous and Nonhazardous by identifying the physical, chemical and toxicological properties. This information may be found via Material Safety Data Sheets (MSDS), manufacturer's information, process knowledge, historic information or lab analysis. A system to categorize wastes streams according to their health and environmental vulnerabilities is then be developed.

9.2 Location HSE Section shall develop an On-Site Waste Management Plan based on this procedure.

9.3 To properly address each segregated wastes, the most suitable Disposal Method; Frequency of Disposal; and Disposal Responsibility shall be determined by documenting where the acceptability of each disposal option for the different ecological domains shall be determined by virtue of evaluation which shall include: environmental considerations; location; engineering limitations; regulatory restrictions; operating feasibility; economics; potential long-term liability; etc.

9.4 Designated drums, containers, bins, etc. with specific labels shall be placed as Collection Method for the Waste Generating Areas.

9.5 Color coding of drums, containers, bins, etc. for various types of wastes is to be as follows:

Wastes Type	Bin Color
Hazardous	Red
Food/ Paper/ Wood (Organic)	Green
Plastic	Yellow

9.6 Responsibility shall be defined to collect and drop every segregated wastes in the Designated Scrap Yard and to further dispose as per the below steps:

Activities	Responsible Person	Related Document
Proper placement of generated wastes in a designated place / (wastes drum / bin).	Actual Waste Generating Section	Recording of wastes into the Section's Waste Register
Inform to Camp Maintenance Section / Housekeeping Supervisor in case of Common Scrap Item	Actual Waste Generating Section	Recording of wastes into the Section's Waste Register
Inform to Material Management Section in case of Valued / Hazardous Salvage Waste.		
Segregation and shifting of Valued / Hazardous Salvage Waste into the Designated Salvage Waste Yard.	Actual Waste Generating Section	Waste Consignment Note
Weighing of wastes / note down its quantity and other necessary information.	Housekeeping Supervisor (for Common Scrap Waste)	Common Scrap Waste Disposal Log (by Housekeeping Supervisor)
	Material Management Section (for Valued / Hazardous Salvage Waste)	Waste Consignment Note
Placement of Valued / Hazardous Waste into the designated section of Salvage Waste Yard.	Material Management Section	Approved Waste Segregation / Placement Plan (developed by Material Management Section)

Disposal of Common Scrap Waste as per the Onsite Waste Management Plan.	Local Waste Picker through Field Level Committee	Common Scrap Waste Disposal Log (by Housekeeping Supervisor)
Disposal of Valued / Hazardous Salvage Waste as per the Onsite Waste Management Plan.	Auction → Material Management Approved 3rd party contractor → HSE	Salvage Waste Disposal Log (by Material Management Section / HSE)
Checking compliance.	HSE Audit Team	HSE Inspection Report / Audit Report/ Disposal Certificates

9.7 Transfer waste from Designated Scrap Yard to Contractor's Waste Yard should be using preferably Contractor's own vehicle (or approved subcontracted vehicles), licensed for this purpose. Modes of transport and routes from the waste generation site to the Contractor Waste Yard should be selected to reduce risks of release.

9.8 All waste consignments leaving the Contractor Waste Yard to licensed and approved Waste Treatment & Disposal Facility shall be tracked using Waste Treatment Certificates. The treatment certificates should contain the following information: *Waste type(s) and sources; Consignment reference number; Form (e.g. solid, liquid, sludge); Treatment / disposal method; Quantities and units collected; Date and time of collection and disposal; Flue gas / ash analysis where applicable*

9.9 Waste Management Contractors shall provide Waste Treatment/ Disposal Certificates to the respective sites.

9.10 Waste disposal record (evidence like Lab. Reports and Waste Treatment/ Disposal Certificates) shall be maintained by Location Material Management (original) and HSE Department/ Section (copy).

CHAPTER 10

STANDARDIZED OPERATING PROCEDURE:

FRAMEWORK FOR SITE RESTORATION

10.1 General

Upon completion of drilling/ testing/ workover/ plugging and abandonment of a well/ abandonment of a production site, and where management, DGPC, local authorities and landowner agrees the facilities have no future use, custodians of the generated-waste shall restore the site to its previous condition as defined in this procedure.

Note-1: An abandoned well may be used as a disposal well to dispose off the produced water/ wastewater/ mud in the well by selecting a suitable formation below the aquifer in consultation with Reservoir Department.

10.2 Primary Responsibility

- Treatment and restoration of *drilling pits* shall be the primary responsibility of **Drilling Services Deptt.** as custodian of the generated-waste.
- Treatment and restoration of *produced water pits* shall be the primary responsibility of **Production Deptt.** as custodian of the generated-waste.
- Treatment and restoration of *pits associated with a Gas Processing and LPG Recovery Plant* shall be the primary responsibility of **P&P Deptt.** as custodian of the generated-waste.

Note-2: After successful completion of a well/ workover, each well(site) shall be handed over to Production Deptt. once all requisite HSE aspects, especially related to wastes including pits, have been duly addressed as mentioned in the Well(lsite) Handing Over Taking Over Checklist.

10.3 Assessment/ Categorization

- A pit wastes usually contains both solid and liquid components. Constituents and characteristics of environmental concern may include salts, hydrocarbons, pH value, chemicals and biologically available heavy metals.

- The constituents have the possibility of impacting soil and water quality, therefore all pits which have no operational requirement shall be restored.
- HSEQ Department shall take the lead to carry out laboratory analysis of each pit in the light of EPA regulatory requirements through concerned Department and based upon results, categorize a pit as nonhazardous or hazardous.
- However, hazardous pits with substantial hydrocarbon content and/ or oily sludge may be auctioned as per company rules and subsequently the pit shall be restored accordingly as defined in this procedure.

10.4 Restoration Process

10.4.1 Nonhazardous Pits

- Restoration requisition shall be initiated by Drilling Services/ Production/ P&P Deptt. as the case may be and forwarded to C&ESS Deptt.
- Restoration shall be carried out by C&ESS Deptt. either employing its own resources or outsourcing the job to waste management contractor.
- In case of outsourcing, TORs/ Invitation-to-Bid (ITB) document shall be prepared by C&ESS Deptt. having inputs from the concerned Departments and perform technical evaluation of the bids accordingly.

10.4.2 Hazardous Pits

- Drilling Services/ Production/ P&P Deptt. may outsource the treatment job to waste management contractor as per requirement.
- The restoration part may either be referred to C&ESS Deptt. or Drilling Services/ Production/ P&P Deptt. may outsource it directly to the waste management contractor along with the treatment part.
- TORs/ Invitation-to-Bid (ITB) document shall be prepared by Drilling Services/ Production/ P&P Deptt. having inputs from HSEQ Deptt. in the light of EPA regulatory requirements for the treatment job

and technical evaluation of the bids shall be carried out accordingly.

10.4.3 Execution and Quality Control

- Drilling Services/ Production/ P&P Dept. shall ensure that the restoration is executed as per TORs in consultation with HSEQ Deptt..
- Laboratory results of the treated water/ cuttings/ soil samples shall be benchmarked against the permissible limits defined by regulatory body(ies) or best industrial practice(s) and may be compared with surrounding undisturbed soil, where required.
- QC Checklist presenting overview of restoration of hazardous pits shall be developed by HSEQ Deptt.; and the same shall be filled&signed by HSEQ and Drilling Services/ Production/ P&P Reps.

10.4.4 Budget Allocation and Invoicing

- Budget allocation, verification and processing of invoices shall be the responsibility of Drilling Services, Production, P&P and C&ESS Department.

RACI Chart

Task/ Deliverable	C&ESS	Drilling Services	Production/ P&P	HSEQ	CSR
Initiation/ Custodianship	I	R&A	R&A	C	I
Budget Allocation/ A.F.E.	R&A	R&A	R&A	I	I
Assessment/ Categorization	I	I	I	R&A	I
T.O.R./ I.T.B.	R&A	R&A	R&A	C	I
Technical Evaluation	R&A	R&A	R&A	C	I
Job Execution/ Coordination	R&A	R&A	R&A	C	I
QC/Lab. Analysis/Progress Reporting	R&A	R&A	R&A	C	I
Conflict Resolution	R&A	I	I	I	R&A
Invoice Verification	R&A	R&A	R&A		
N.O.C. from Landowner(s)	I	I	I	I	R&A
*Endorsement Certificate from RB**	I	R&A	R&A	C	I

*RB = Regulatory Body

In case of Nonhazardous Pits
In case of Hazardous Pits
In case of Both Pits

Note:

R = Responsible: *Doing The Decision*; This Departmental role is responsible for getting the decision and starting the task or deliverable.
A = Accountable: *Owning The Task*; This Departmental role is responsible to ensure execution and completion of the task or deliverable.
C = Consulted: *Assisting, as subject matter expert*; This Departmental role is responsible to provide information useful to completing the task or deliverable.
I = Informed: *Keeping Aware*; This Departmental role is just kept up-to-date on the task or deliverable (as it can be affected by the outcome).

10.5 Restoration of Wellsite after Plugging & Abandoning (P&A)

10.5.1 Restoration of Soil

- Area shall be jointly visited by Representatives of a) Drilling/ Production/ P&P, b) Land Management/ CSR, c) C&ESS and d) HSEQ Deptt. and any contaminated soil within and around the wellsite fence boundary shall be marked.
- Laboratory analysis of the soil shall be the responsibility of concerned Departments.
- C&ESS Deptt. shall remove the contaminated soil (if any) and where required handover it to waste management contractor/ bioremediation facility for treatment and backfill the area with clean/ treated soil.

10.5.2 Surface Facilities Removal

- Following surface facilities from the wellsite shall be removed by Production/ PE&FD;
  - Oil, gas and water supply lines
  - Solar arrays & batteries for solar panels
  - Wellhead control panels
  - Skid mounted separator
  - Surface piping/ pipe racks/ pig launcher
  - Cables/ cable trays
  - Chemical injection tank
  - Every sort of instrumentation
  - Any other

10.5.3 Cellar Area

- Civil construction in the cellar may be dismantled and cellar backfilled with soil with the consultation of Drilling/ Production Deptt.

10.5.4. Septic Tank and Soak Pit

- Septic tank shall be broken and after neutralizing the material, the septic tank/ soak pit shall be leveled with clean soil having an extra 1 meter layer.

10.5.5 Flow Line

- All the surface and underground flow lines and other facilities shall be removed entirely from end to end by Production/ PE&FD Deptt.

10.5.6 Fence and Civil Construction

- Fence including main gate, mesh/ barbed/ razor/ concertina wire and anti-snake sheet around the well-site shall be removed by C&ESS Deptt..
- Civil construction like accommodation facilities, barracks, secondary containment for diesel/ chemicals and foundations may be removed by C&ESS Deptt.
- All concrete structures e.g. pads/ flow line supports, etc. at wellsite shall be removed by C&ESS Deptt.

10.5.7 Water Source/ Tubewell

- Decision on the dismantling or usage/ handing over of water sources like tubewell(s) may be made by RC/ CSR Officer/ Land Management Section in consultation with landowner(s)/ local administration.

Note:-3 After successful plugging & abandonment (P&A) of a production site/ well(site), the site shall be handed over to the landowner/ custodian once all the requisite aspects have been duly addressed as mentioned in the Production site/ Well(site) Plugging and Abandonment (P&A) Checklist.

10.6 Conflict Resolution

- Handling of locals' related complaints arising from the waste management services as well as their redressal shall be the responsibility of CSR Deptt.
- Hiring of legal counsel in case litigation arises from the waste related matters shall be the responsibility of Legal Services Deptt.
- NOC from landowner(s) shall be acquired by RC/ CSR Officer/ Land Management Section.
- Endorsement of restoration of hazardous pit from regulatory authority(ies) shall be acquired as per regulatory requirements.

ANNEXURE A
TEMPLATE FOR ON-SITE WASTE MANAGEMENT PLAN

Part-I: Hazardous Wastes

Nature of Wastes	Segregation	Collection Method for the Wastes Generating Section	Responsibility to Collect and Drop in the Designated Scrap Yard	Designated Scrap Yard	Disposal Method	Frequency of Disposal	Disposal Responsibility

Part-II: Non-Hazardous Wastes

Nature of Wastes	Segregation	Collection Method for the Wastes Generating Section	Responsibility to Collect and Drop in the Designated Scrap Yard	Designated Scrap Yard	Disposal Method	Frequency of Disposal	Disposal Responsibility

Prepared by Field HSE InCharge	Reviewed by HSE Field Management Review Committee (MRC)	Approved by Location InCharge

ANNEXURE B
GUIDELINES FOR PRODUCED AND PROCESS WATER MANAGEMENT

General Guidelines

a. The Concessionaire should identity (narrative description, illustrations, maps, or other means) and should protect aquifers, which are underground source of drinking water, or other aquifers, which may be used by the community for drinking or agricultural use.
b. The Concessionaire should not release produced water into the environment (through percolation, land application, and discharge to surface water) if such release may adversely affect soils, surface water, groundwater, organisms or wildlife.
c. The Concessionaire should, to the best of this ability and consistent with best management practices, effectively isolate oil and gas producing zones to minimize the volume of associated production water.

Produced Water Pits

Pits permitted for storage or disposal of produced saltwater, with the exception of emergency saltwater pits are required to be lined - except where the Concessionaire has conclusively demonstrated through an EIA or IEE that the pit cannot cause pollution of surrounding agricultural land nor pollution of surface or subsurface water. Evaporation ponds used for disposal of production water should be constructed to prevent vertical and horizontal seepage. The Federal Agency can require a Concessionaire to drill one up- gradient well and two down-gradient wells to monitor the quality of the underlying aquifer.

Underground Injection Well Disposal

The Concessionaire may decide to inject produced water underground for either disposal or enhanced oil recovery. In both cases, the Concessionaire should

comply with the following listed installation, operation, monitoring and reporting guidelines.

Installation guidelines

a. **Well Casing installation and testing** should be consistent with Chapter XX Sections 161-166 of the Oil and Gas (Safety in Drilling and Production) Regulations. 1974.
b. **Surface Casing -** should be set at least 200 feet below lowermost underground source of drinking water and cemented back to the surface.
c. **Casing and cementing** – the Concessionaire should case and cement the well to prevent movement of fluids into or between underground sources of drinking water or agricultural sources of freshwater.
d. **Injection wells** should be equipped with tubing set on a mechanical packer, no higher than 150 feet above the top of the disposal zone.

Operating guidelines

a. The Concessionaire should first confirm that the target zone of injection has no current or potential future use as a reservoir for drinking water or agricultural use.
b. Injection between the outermost casing protecting the aquifers and the well bore is prohibited.
c. The Concessionaire should not exceed a maximum injection pressure at the wellhead which should be calculated so as to assure that the pressure during injection does not initiate new fractures or propagate existing fractures in the confining zone adjacent to the aquifers which must be protected.
d. The Concessionaire should not inject at a pressure, which will cause the movement of injection or formation fluids into an underground source of drinking water.
e. The Concessionaire should plug and abandon the injection well in accordance with Section 11.3 of DGPC guidelines.

Monitoring guidelines

The Concessionaire should monitor the nature of the injected fluids with sufficient frequency to yield data representative of their characteristics. This frequency should be at least once within the first year of authorization and thereafter when changes are made to the fluid.

The Concessionaire should observe the injection pressure, flow rate and cumulative volume at reasonable intervals no greater than thirty days:

a. Weekly for produced fluid operations;
b. Monthly for enhanced recovery operations; and
c. Daily for injection of liquid hydrocarbons and injection for withdrawal of stored hydrocarbons.

Discharge to Surface Water

The Federal Agency will allow discharge of produced waters to other waters under very few and specific conditions.

a. The Concessionaire must demonstrate that the receiving water has adequate assimilation capacity.
b. The produced water must be tested and must be below 500 ppm chlorides and 10 ppm oil and grease content to allow discharge.
c. The Concessionaire will be prohibited from discharging produced water, where a sensitive resource is defined as: a coral community, mangrove, fish farm or intensive commercial fishing area, tourism recreation area, national park or area which is a known habitat for endangered, threatened or rare species.
d. Quarterly reports of discharge volumes and quality of the discharge must be sent to the Federal Agency and other interested provincial government agencies on a quarterly basis.

ANNEXURE C
GUIDELINES FOR DRILLING & PRODUCTION WASTE MANAGEMENT AND DISPOSAL

Hazardous Materials

- Pursuant to the Section 33(2)(k) of the Environmental Protection Ordinance to "provide procedures for handling hazardous materials", the Federal Agency may require the Concessionaire to prepare an annual inventory of all potential and identified hazardous wastes materials and to provide the inventory report, if requested, to local emergency response authorities.
- The Concessionaire will substitute where practical and feasible non-hazardous chemicals to replace hazardous chemical use.
- Drilling mud additives should be restricted to non-hazardous materials to ensure that the resulting pit wastes can be easily disposed with minimal environmental impact.

Pit Design

i. The Concessionaire should design and maintain all pits to minimize adverse impact to the environment.
ii. No Concessionaire or person should use any pit for storage of oil or oil products.
iii. All pits, except for the following exceptions, should be lined with an impermeable lining such as a synthetic plastic PVC liner to ensure that no horizontal or vertical leakage occurs. Exceptions include:
    a. Emergency saltwater storage pits;
    b. Drilling pits associated with wells less than 5000 feet where only freshwater drilling muds were used and have tested less for low chlorides (> 500 ppm) and have prohibited all hazardous mud additives and oil based drilling muds.
    c. The Concessionaire should use synthetic liners for high chloride (chloride > 5000 ppm) or oil based muds.

d. Liquid level of the pits should not be permitted to rise within two feet of the top of the pit dikes.
e. Liquid level of the pits should not be permitted to rise within two feet of the top of the pit dikes. Pit dikes or walls should be maintained at all times to prevent deterioration, subsequent overfill, and leakage of contents.
f. If required, observation wells should be installed in sensitive areas to determine potential impact on the upper aquifer.

Production Wastes

i. The Concessionaire should segregate hazardous wastes from non-hazardous wastes.
ii. Non-hazardous wastes may be treated and/or disposed onsite, as pit contents, if such treatment and disposal will not adversely affect humans, animals, or the environmental resources.

Non-Hazardous Wastes

The Concessionaire should avoid disposing of unused commercial products and should try to return them to the vendor or use them at another location. All non-hazardous wastes should be segregated from hazardous wastes. The Concessionaire should dispose of any mixture of non-hazardous and hazardous wastes as hazardous wastes, and must comply with existing hazardous materials storage, use and disposal requirements.

Hazardous Wastes

Hazardous wastes must be stored, managed and disposed in a safe manner which will not cause harm to humans, animals, or environmental resources. The Concessionaire should comply with existing hazardous materials storage, use and disposal requirements.

ANNEXURE D
GUIDELINES FOR CAMP SITE WASTE MANAGEMENT AND DISPOSAL

The Concessionaire should collect and treat camp site wastes water and sewage to satisfy Federal and local effluent requirements.

Sanitary Wastes

The Concessionaire may use septic systems, packaged wastes water treatment units, or portable commercial containers for disposal of wastes water and sewage at a drilling or production camp site.

Refuse Disposal

The Concessionaire should comply with all local refuse disposal regulations. If no local regulations exist, the Concessionaire must comply with best management practices which may include incineration of combustible refuse, segregation of recyclable materials, or burial of biodegradable wastes onsite, depending upon local wastes regulations.

Other Environmental Guidelines for Campsites

- Latrines should be located at a suitable distance from a water body.
- Sewage should be handled to prevent surface and groundwater contamination.
- No litter (i.e., food wastes, packaging, etc.) should be left onsite.

ANNEXURE E
GUIDELINES FOR OIL SPILLS/ SOIL CONTAMINATED BY OIL LEAKAGES OR SPILLS

Spill Prevention, Containment and Clean-up (SPCC) Plans

i. The Concessionaire with facilities storing large quantities of oil should develop and implement SPCC Plans at all production worksites. These plans should he submitted to DGPC as part of the Development Plan and to the Federal Agency in the EIA/ IEE.
ii. The SPCC plan seeks to minimize the risk of oil spills and is applicable to facilities located in an area where there is a potential for discharge of oil to navigable waters and storing the following:
    a. More than 1320 gallons of oil above ground;
    b. Oil in a single aboveground container with a capacity greater than 660 gallons: or
    c. More than 42,000 gallons of oil below ground.

Product Transfer Operations

The Concessionaire should routinely conduct visual inspections of pipeline easements and daily visual checks for spillage around tanks, transfer areas, pipelines and transfer plants. Onshore pipelines easements should be inspected every month, or other period as may be appropriate for the risk involved. In addition to the aerial survey, a buried pipeline easement should be "walked" once per year.

Completion, Testing and Workover

The Concessionaire should take additional measures to ensure that minimal or no hazardous materials are used during the well completion and that procedures are in place to prevent spillage of completion fluids (often acids) during the completion operation.

ANNEXURE F
GUIDELINES FOR EMISSIONS FROM CONTROLS, GAS FLARING AND VENTING

I. Air Quality Standards

The Concessionaire should ensure that emissions from exploration and production operations, do not exceed the National Environmental Quality Standards (NEQS). As authorized by Sections 6(1)(e) and (g)(1) of The Environmental Protection Ordinance and consistent with World Bank onshore emission criteria (Environmental Guidelines 1988) the Concessionaire should not exceed the following emission criteria:

a. Unpolluted area (annual average SO_2 ambient concentration is less than 50 micrograms per cubic meter): 50 t/day.
b. Very polluted area - (annual average SO_2 ambient concentration of greater than 100 micrograms per cubic meter): 100t/day maximum emission.

II. Air Monitoring

Consistent with World Bank Environmental Guidelines, monitors for Hydrogen Sulfide (H_2S) should be installed wherever there is a risk for this gas accumulating in amount greater than 10 parts per million time weighted average

Air Monitoring Procedures

→ Air monitoring should be conducted continuously for both H_2S, SO_2 and methane during drilling, circulation of drilling muds, completion, workover and plug/ abandonment

→ Consistent with Section 6.2 of DGPC guidelines, monitors should be located on the drilling or production site and located to provide for maximum exposure.

H_2S Monitoring

→ Monitors should be set to activate warning signals

when detected levels are not more than one-half the permissible exposure limit (PEL)or 5.0 parls per million (ppm) (0.0005% percent by volume).

→ It is recommended that these detectors be set for 2 - 3 ppm to ensure timely warning.

→ Monitors should be placed for maximum exposure, for example in topographic low areas such as ditches where H_2S accumulates as a heavy gas

III. Gaseous Waste

→ Consistent with Rule 56 (2) of the 1986 Exploration and Production Rules and Article XXIX (29.3) of the Concession Agreement, the Concessionaire should not flare associated gas "but to use it commercially for recycling" where economically and technically feasible.

→ Consistent with Rule 56(2) of the 1986 Exploration and Production Rules, if no delivery of gas can he arranged, the Concessionaire should request permission to flare the gas until such time that delivery of gas can be arranged. Where sale, re-injection, processing or other use of associated gas is not economically feasible, DGPC in consultation with the Federal Agency, may issue allowable permits to flare gas under controlled conditions. Plans for waste gas should be addressed in the EIA/IEE.

IV. Reporting

Operators should prepare an annual inventory of gaseous wastes providing an estimate of total annual output of contaminants.

ANNEXURE G

NATIONAL ENVIRONMENTAL QUALITY STANDARDS (NEQS) (SELF MONITORING AND REPORTING BY INDUSTRY) RULES 2001, SRO 528(1)/2001

1. Quarterly basis, monitoring of Effluents for the given parameters and reporting to provincial EPA:

(i) Flow
(ii) pH = 6 – 9
(iii) Temperature Increase = < 3 C
(iv) BOD5 = 80 mg/l
(v) COD = 150 mg/l
(vi) TSS = 200 mg/l
(vii) TDS = 3500 mg/l
(viii) Oil/Grease = 10 mg/l
(ix) Phenol = 0.1 mg/l
(x) Chloride = 1000 mg/l

2. Quarterly basis, monitoring of Emissions for the given parameters and reporting to provincial EPA:

(i) CO = 800 mg/Nm3
(ii) Hydrogen Sulphide = 10 mg/Nm3
(iii) PM10 = 300 mg/Nm3
(iv) SOx = 400 mg/Nm3
(Based on one percent sulphur content in fuel oil.)
(v) NOx = 130 nanogram per joule of heat input

3. Annual basis, monitoring of Diesel Vehicle Exhausts:

(i) CO = 4.0 g/kWh [ECE R-49] for Trucks and Buses + Large good vehicles + Older Vehicles
(ii) HC = 1.1 g/kWh [ECE R-49] for Trucks and Buses
(iii) HC = 7.0 g/kWh [ECE R-49] for Large good vehicles and Older Vehicles
(iv) NOx = 7.0 g/kWh [ECE R-49 for Trucks and Buses
(v) NOx = 1.1 g/kWh [ECE R-49] for Large good vehicles and Older Vehicles
(vi) PM = 0.15 g/kWh [ECE R-49] for Trucks and Buses + Large good vehicles + Older Vehicles

4. Annual basis, monitoring ambient air quality (due to flare/ vent):

Sulphur Dioxide (SO_2)	Annual Average* = 80 ug/m^3	Ultraviolet Fluorescence method
	24 hours** = 120 ug/m^3	
Oxides of Nitrogen as (NO)	Annual Average* = 40 ug/m^3	Gas Phase Chemiluminescence
	24 hours** = 40 ug/m^3	
Oxides of Nitrogen as (NO_2)	Annual Average* = 40 ug/m^3	Gas Phase Chemiluminescence
	24 hours** = 80 ug/m^3	
O_3	1 hour = 180 ug/m^3	Non dispersive UV absorption method
Suspended Particulate Matter (SPM)	Annual Average* = 400ug/m^3	High Volume Sampling, (Average flow rate not less than 1.1 m^3/minute)
	24 hours** = 550ug/m^3	
Respirable Particulate Matter.PM_{10}	Annual Average* = 200ug/m^3	B Ray absorption method
	24 hours** = 250ug/m^3	
Respirable Particulate Matter. $PM_{2.5}$	Annual Average* = 25 ug/m^3	B Ray absorption Method
	24 hours** = 40 ug/m^3	
Lead (Pb)	Annual Average* = 1.5 ug/m^3	ASS Method after sampling using EPM 2000 or equivalent Filter Paper
	24 hours** = 2 ug/m^3	
Carbon Monoxide (CO)	8hours** = 5 mg/m^3	Non Dispersive Infra Red (NDIR) method
	1 hour** = 10 mg/m^3	

* Annual arithmetic mean of minimum 104 measurements in a year taken twice a week 24 hourly at uniform interval.
** 24 hourly /8 hourly values should be met 98% of the time in a year. 2% of the time, it may exceed but not on two consecutive days.

5. Quarterly basis, monitoring noise levels:

Noise –dB(A) Leq* 55 (Day Time); 45 (Night Time)	Residential Camp Area
Noise –dB(A) Leq* 75 (Day Time); 65 (Night Time)	Engine Hall, Plant Premises

1. Day time hours: 6.00 a.m to 10.00 p.m.
2. Night time hours: 10.00 p.m. to 6.00 a.m.
3. Silence zone: Zone which are declared as such by the competent authority. An area comprising not less than 100 meters around hospitals, educational institutions and courts.
4. Mixed categories of areas may be declared as one of the four above-mentioned categories by the competent authority.

*dB(A) Leq: Time weighted average of the level of sound in decibels on scale A which is relatable to human hearing.

6. National Standards for Drinking Water Quality

#	Properties/ Parameters	Standard Values
Bacterial		
1.	All water intended for drinking (E.Coli or Thermotolerant Coliform bacteria)	Must not be detectable in any 100 ml sample
2.	Treated water entering the distribution system (E.Coli or thermotolerant coliform and total coliform bacteria)	Must not be detectable in any 100 ml sample
3.	Treated water in the distribution system (E.coli or thermotolerant coliform and total coliform baceria)	Must not be detectable in any 100 ml sample. In case of large supplies, where sufficient samples are examined, must not be present in 95% of the samples taken throughout any 12-month period.

Physical		
4.	Colour	≤ 15 TCU
5.	Taste	Non objectionable/ Acceptable
6.	Odour	Non objectionable/ Acceptable
7.	Turbidity	< 5 NTU
8.	Total Hardness as $CaCO_3$	< 500 mg/l
9.	TDS	< 1000
10.	pH	6.5-8.5
Radioactive		
11.	Alpha Emitters bq/L or pCi	0.1
12.	Beta emitters	1
Chemical		
	Essential Inorganics	*mg/Litre*
13.	Aluminum (Al) mg/l	≤0.2
14.	Antimony (Sb)	≤0.005
15.	Arsenic (As)	≤0.05
16.	Barium (Ba)	0.7
17.	Boron (B)	0.3
18.	Cadmium (Cd)	0.01
19.	Chloride (Cl)	<250
20.	Chromium (Cr)	≤0.05
21.	Copper (Cu)	2
Toxic		
	Toxic Inorganics	*mg/Litre*
22.	Cyanide (CN)	≤0.05
23.	Fluoride (F)*	≤1.5
24.	Lead (Pb)	≤0.05
25.	Manganese (Mn)	≤0.5
26.	Mercury (Hg)	≤0.001
27.	Nickel (Ni)	≤0.02
28.	Nitrate (NO3)*	≤50
29.	Nitrite (NO2)*	≤3
30.	Selenium (Se)	0.01
31.	Residual chlorine	0.2 – 0.5 at consumer end 0.5-1.5 at source
32.	Zinc (Zn)	5.0

7. Light Intensity

To assess whether lighting is sufficient in workplace, following light intensity ranges are used. Employees should understand the effects of lighting on their health and safety. In particular, they need to understand visual fatigue: its causes, prevention, symptoms, and recovery techniques.

Task/ Area	Range of Luminance (Lux)
Emergency lighting (at floor or tread levels) in exits, exit routes, stairs, and underground walkways	At least 10 (on average)
Simple visual tasks e.g. lobby area; washrooms; loading into trucks	30 – 100
Medium visual tasks e.g. bookkeeping; filing; material receiving and packing areas	300 – 1000
More visually demanding tasks e.g. QC/ inspection; proofreading; workshops/ machine work	3000 – 10000

ANNEXURE H
LOUISIANA STATEWIDE ORDER (LSO) NO. 29-B
PERMISSIBLE LIMITS FOR THE RESTORED (TREATED) SOIL

For Land Treatment

Pits containing waste may be closed onsite by mixing wastes with soil from pit levees or walls and adjacent areas provided waste/soil mixtures at completion of closure operations do not exceed the following criteria, as applicable, unless the operator can show that higher limits for EC, SAR, and ESP can be justified for future land use or that background analyses indicate that native soil conditions exceed the criteria.

1. range of pH: 6-9 for land treatment and burial and trenching, 6-12 for onsite land development;
2. total metals content (ppm):

Parameter	Limitation
Arsenic	10
Barium	
Submerged Wetland Areas	20,000
Elevated Wetland Areas	20,000
Upland Area	40,000
Cadmium	10
Chromium	500
Lead	500
Mercury	10
Selenium	10
Silver	200
Zinc	500

3. In addition to the pH and metals criteria listed as above, land treatment of waste in submerged wetland, elevated wetland, and upland areas is permitted if the oil and grease content of the waste/soil mixture after closure is < 1 percent (dry weight).
4. Additional parameters for land treatment waste in elevated, freshwater wetland areas where the disposal site is not normally inundated:
   a. electrical conductivity (EC-solution phase): < 8 mmhos/cm;
   b. sodium adsorption ratio (SAR-solution phase): < 14;
   c. exchangeable sodium percentage (ESP-solid phase): 25 percent.

5. Additional parameters for land treatment of waste in upland areas:
   a. electrical conductivity (EC-solution phase): < 4 mmhos/cm;
   b. sodium adsorption ratio (SAR-solution phase): < 12;
   c. exchangeable sodium percentage (ESP-solid phase): < 15 percent.

For Burial/ Trenching

Pits containing waste may be closed by mixing the waste with soil and burying the mixture onsite, provided the material to be buried meets the following criteria:

1. range of pH: 6-9 for land treatment and burial and trenching, 6-12 for onsite land development;
2. total metals content same as mentioned above in case of land treatment.
3. moisture content: < 50 percent by weight;
4. electrical conductivity (EC): < 12 mmhos/cm;
5. oil and grease content: < 3 percent by weight;
6. top of buried mixture must be at least 5 feet below ground level and then covered with 5 feet of native soil;
7. bottom of burial cell must be at least 5 feet above the seasonal high water table.

For Solidification and Burial

Pits containing waste may be closed by solidifying wastes and burying it onsite provided the material to be buried meets the following criteria:

1. pH range: 6 - 12;
2. Leachate testing for oil and grease: < 10.0 mg/1 and chlorides < 500.0 mg/1
3. Leachate testing for the following metals:
   a. arsenic < 0.5 mg/1;
   b. barium < 10.0 mg/l;
   c. cadmium < 0.1 mg/1;
   d. chromium < 0.5 mg/1;
   e. lead < 0.5 mg/1;
   f. mercury < 0.02 mg/1;
   g. selenium < 0.1 mg/1;
   h. silver < 0.5 mg/1;
   i. zinc < 5.0 mg/1;
4. top of buried mixture must be at least 5 feet below ground level, covered with 5 feet of native soil;

5. bottom of burial cell must be at least 5 feet above the seasonal high water table;
6. solidified material must meet the following criteria:
   a. unconfined compressive strength (Qu): > 20 lbs/in2 (psi);
   b. permeability: <1 x 10-6 cm/sec;
   c. wet/dry durability: > 10 cycles to failure.

ANNEXURE I
GUIDELINES FOR OPEN AUCTION

While opting for an Open Action of critical items, Press Tender would be advertised as per Company policy based on the a) the justification explicitly showing ineffectuality of the items and b) proper value determination of the items by a Committee. This would be mandatory for the following category of items:

i. Operational: Weary assemblies and spares of engines, pumps, generators, pipes of different sizes, welding plants, rig mast structures, production tubing and other valued electrical and mechanical assets.
ii. Support: Unserviceable support vehicles including Ambulance, Dozers, Trailers, Bouzers, Fork Lifters, and Cranes.
iii. Product related: Used Chemicals/ Oil and Sludge collected from the separators/ pipelines/ tanks.

ANNEXURE J
GUIDELINES FOR HAZARDOUS MATERIALS STORAGE AND HANDLING

Section 359 of the 1974 Safety Regulations relating to precautions when handling "hazardous chemicals, liquids, powders or vapors."

I. General

The Concessionaire should ensure that employees are trained in the proper use and storage, and in the prevention of risks from exposure to hazardous materials, including explosives, fuels, solvents, and flammables. Following guidelines should be followed to reduce exposure to hazardous materials:

a. Toxic chemicals should be accompanied by the manufacturer's material safety data sheet (MSDS)
b. The Manager of the Well should ensure that all hazardous materials are properly stored and labeled.
c. Use of asbestos should be avoided for insulation in project construction.
d. Gasoline, diesel fuel, liquefied petroleum gas (LPG), and compressed gas (propane, acetylene), and solvents are all highly flammable. They should be plainly labeled as hazardous, and stored in well ventilated buildings away from ignition sources.

II. Radiation

In addition to the Section 386 of the 1974 Safety Regulations, the instructions contained in the following sections may be observed.

Naturally Occurring Radioactive Material (NORM)

Following instructions should be followed while working with materials contaminated by NORM:

a. Employees and contractors should be advised of the presence and potential hazards of NORM and of procedures to minimize exposures,

b. Exposures of personnel working with equipment which is NORM-contaminated should be evaluated to determine whether they may be in danger of exceeding exposure limits, using personal dosimeters.
c. In all cases, workers should wear protective gloves, boots and coveralls to minimize contact. They should avoid eating, smoking or applying skin balms during such work, and should wash hands and faces thoroughly before eating.
d. Openings on NORM-contaminated equipment should be wrapped, capped, or sealed to avoid generation of dust. Sales and sludge should be wetted to minimize dust generation during handling. Where dust is generated, workers should wear respiratory protection.
e. Prior to entry to NORM-contaminated vessels the vessel should be ventilated to dissipate radon buildup and hydrocarbon vapors. Workers should wear respiratory protection, latex or neoprene gloves, and rubber or paper suits.
f. Decontamination work should be restricted to a designated area. Wash water discarded for unrestricted use should not exceed 30 picocuries/liter for each radium isotope.
g. All hazardous materials should be stored in appropriate containers and disposed of in hazardous waste landfill sites.

III. Exposure Restrictions

Exposure During Routine Operations

a. During routine operations the employees should not be exposed to radiation in excess of 1,250 millirem per calendar quarter.
b. Where personnel are likely to receive greater than 312.5 millirem per calendar quarter or 600 microrem/hour for a 40 hour workweek, personal dosimeters should be used. Thermoluminescent

dosimeters or film badges may be used where it is possible to return the badges for analysis by the supplier. An alternative is the use of a shielded energy compensated Geiger Muller (GM) probe or ion chamber survey meter capable of producing a millirem/hour readout to determine the area levels of radiation.

Exposure to Airborne Radioactive Materials

Maintenance and dismantling of equipment and piping contaminated with NORM presents airborne radiation exposure risks. The airborne concentrations for a 40 hour workweek should be limited to 5×10^{-11} microcuries per milliliter for insoluble radium- 226, and 2×10^{-10} microcuries per milliliter for lead-210. Measurements can be made by filtering a high-volume air sample and the filter analyzed by a radiometric laboratory.

ANNEXURE K
BIOREMEDIATION PROCESS

Traditional methods for the disposal of Oil-Based Mud (OBM) drill cuttings have included pit burial or leaving the untreated cuttings scattered in-situ. Increasingly stringent regulations and increased environmental awareness have required new and improved disposal techniques. The process in practice is called Drill Cuttings Bioremediation. The concept is that some micro-organisms have the ability to digest organic compounds using specialist protein molecules, known as enzymes. Enzymes are what are referred to as biological catalysts. Some micro-organisms produce enzymes capable of accelerating the biodegradation process of organic pollutants into harmless carbon dioxide, water and clean solids.

This natural process is exploited and used in the oil industry to treat drill cuttings waste. Drill cuttings are placed into the cells of the bunded areas, along with measured quantities of sawdust, sand, nutrients and naturally occurring microbes. The mixture can be tilled by either manpower or machine depending on the size of the project and location. Properly organized regular mixing and passage of time allows the pollutants in the drill cuttings to be digested and consumed by the microbes. This process causes the percentage of oil in the drill cuttings to drop to a pre-agreed level as being environmentally acceptable.

This way in many cases the end product, containing harmless nutrients, can be used as a growing medium. The balance of micro-organisms and chemicals required is very much dependent on the composition of the drill cuttings or other waste material.

ANNEXURE L
FLOATING TREATMENT WETLANDS (FTW)

Conventional wastewater treatment technologies based on coagulation, flocculation, filtration, electrochemical and membrane separation are not just expensive due to requirement of engineering skills, labor administration, and operational management, but are also environmentally invasive in nature. A newly emerged technology called Floating Treatment Island/ Wetland (FTW) has been introduced which is a cost-effective, efficient and aesthetically pleasing `green` wastewater treatment technology by which FTW is established as a soil-less planting technology by integrating agronomy and ecological engineering, whereby regionally-suitable vegetation is trapped in self-buoyant mats to construct artificial floating wetlands.

FTW are man-made ecosystems that mimic natural wetlands. FTWs are created using floating mats (rafts) that support plants grown hydroponically. The mats float on a wet pond water surface and can be used to improve water quality by filtering, consuming, or breaking down pollutants (e.g., nutrients, sediment, and metals) from the water. Following are the basic treatment steps:

Phase-1: Floating mats (rafts) are manufactured on order from an indigenous manufacturer.

Phase-2: Numerous acclimatized saplings are planted e.g. in Potohar region Typha domingensis, Leptochloa fusca, Brachiaria mutica, Cyperus leavigatus, Phragmites australis, and Canna indica. Plants directly uptakes pollutants, especially nutrients, from the water (using a process known as biological uptake).

Phase-3: Bacterial consortium is cultured in the laboratory for the specific contaminated oil; for example oil of

Potohar reservoirs is applied bacterial consortium which consists of the strains, Bacillus pumilus RT1, Shigella sonnei RT5, Pseudomonas aeruginosa R21, Acinetobacter spp LCRH81, Acinetobacter spp BRSI56, Acinetobacter junii T4RH 47, Acinetobacter spp T4RH21, and Klebsiella spp LCR187). Microorganisms growing on the floating mats (rafts) and plant root systems breaks down and consumes organic matter in the water through microbial decomposition; and root systems filters out sediment and associated pollutants.

The overall results start to appear favorable downward trend meeting permissible limits after three to four months; other benefits of FTW are mentioned below:

- Design flexibility; FTWs are sized to fit into almost any pond or pit.
- Enhances the pollutant removal effectiveness of the produced water ponds or pits.
- Provides a "sustainable" pollutant-removal system (and wildlife habitat).
- Offers resiliency. FTWs tolerates storm-event driven water-level fluctuations as long as they are anchored to the bottom or tethered to the brinks so they are not damaged or lost by flowing through the outlet structure of the pond or pit.
- Improves aesthetics. FTWs are also used to enhance the visual appeal of surface water features.

ANNEXURE M
UNDERTAKING

Date: _____

1. I _____ S/o _____ CNIC#_____ resident of _____ solemnly undertake that any metallic/nonmetallic empties (containers, drums, tins, bottles, etc.) purchased or collected, as a result of Open Public Option organized by M/S OGDCL (the company) on _____, shall not be disposed off or re-sold to any retailer(s) leading to use for carrying or storing any edible items i.e. milk, oil, water, etc.
2. However these empties are allowed to be further supplied to recycling units or plants where these can be processed or fabricated for safe use.
3. It is hereby preemptively comprehended as a legal and moral responsibility of the company that the product once used to be stored in these empties were classified as dangerous in accordance with the Preparations Directive 1999/45/EC and hence the residual may still pose such risk.
4. I understand that if carried or stored any edible items i.e. milk, oil, water, etc. in these empties, this secondary storage may behave "as flammable, cause burns, irritating to respiratory system, toxic to aquatic organisms, long term adverse effects in the aquatic environment, lung damage if swallowed and vapor may cause drowsiness and dizziness."
5. Therefore, I take this responsibility to abide by the information provided by the company in this regard and I hereby fully agree to conform to the local environmental, health and safety laws and regulations with respect to collection, transportation, storage, etc. of these empties. Any violation may provoke the company to take any legal action or blacklisting from the company's business.

Signature

Witness: #1	Witness: #2
Name----------	Name----------
NIC #----------	NIC #----------
Address:	Address:
Signature	Signature

INCHARGE MATERIALS MANAGEMENT
_____ Field OGDCL

ANNEXURE N

QC Checklist for Treatment/ Restoration of Pit

Oil Gas Development Company Limited
Location:_____

OGC/-HSE-33B(01)

HSEQ Department

QC Checklist for Treatment/ Restoration of Pit

Frequency: _____

Nomenclature of Pit: _____ Date: _____

#	DESCRIPTION	Y	N	REMARKS
01	Are the equipment/ materials/ chemicals available at site adequate and appropriate to carry out treatment/ safe disposal of wastewater and site restoration?			
02	Are the contractor's workforce available at site adequate and competent to perform the assigned tasks as per TORs or scope of work?			
03	Are the "treatment" methodologies conform/ meet TORs & scope of work for treatment/ safe disposal of wastewater?			
04	Are the "restoration" methodologies conform/ meet TORs & scope of work for rehabilitation/ restoration of hazardous pits?			
05	Is Joint Sampling carried out during the pretreatment/ pre-restoration phase by environmental monitoring laboratory to conduct tests for parameters as mentioned in scope of work? Are the desired lab reports kept in record?			
06	Is Joint Sampling carried out during post-treatment/ post-restoration phase by environmental monitoring laboratory to conduct tests against the regulatory requirements/ best industrial practices? Are the desired lab reports kept in record?			
07	Are photographs taken "before" treatment of wastewater/ restoration of pits for record and reference?			
08	Are photographs taken during and upon completion of the wastewater treatment/ pit restoration preferably on daily basis for submission of progress reports to H.O. and also for record?			
09	Is progress like visual/ physical inspection on wastewater treatment/ pit restoration process found satisfactory?			
10	Has RC/ CSR Officer/ Land Management Section acquired NOC(s) from the landowner(s)?			
11	Has the regulatory body(ies) (where required) endorsed the treatment process in a formal manner?			

Field HSE Rep.
Prepared & Initiated by:

Drilling Services/ Production/ P&P Rep.
Checked &Verified by:

OM/ PM/ FM
Endorsed by

ANNEXURE O
Coverall Specifications

Specifications of Coverall

Material: 100% Pre-shrunk Pure Cotton Drill Cloth or Flame Retardant Treatment (FRT) Cotton Drill Cloth (as per actual requirement)

Feature: Anti-Static

Weight: 180 – 200 gm/ m^2

Stitches per Inch: 14

Color: Grayish Blue

Formation:
- Upper half with concealed two-way black high-density polyester coil zip with press brass stud closure from top to bottom with neck open
- Straight cuffs of sleeves and trousers (coverall's lower half) with concealed press brass studs on cuffs and ankle openings
- One piece top stitched shirt collar
- Stretchable elasticized waistband/ elastic waist (left & right sides)
- Officer's name tag embroidered on right side above chest pocket

Pockets:
- Left sleeve pocket with pen pocket divider, small flap with hook-and-loop fastener (velcro quality)
- Two 5" x 6-½" chest pockets with concealed zip closure
- Tool pocket on right leg/ knee (back side)
- ID card holder loop on chest right side above right front chest pocket
- Two radio loops
- Two back/ hip pockets
- Two side pockets with exterior-to-interior access

Reflector: 2" (50mm) wide white reflective FR striping around arms, legs and over the shoulders ANSI/ ISEA 107-1999 Class 2 standard or equivalent

Logo: OGDCL logo embroidered above left side chest pocket and on back (white thread)

Special (where required):
- The wearing of Flame Resistant Clothing is required for all employees, contractors and visitors involved in a) production, plant & process operations and maintenance, b) drilling operations, services and maintenance, c) work-over jobs/ live well servicing, d) well testing, e) handling of energized equipment, f) high voltage switching operations & maintenance, g) erection/ modification of project facilities (that are located at a production facility) and h) activities assessed as hazardous during risk assessment.
- Flame Resistant Clothing materials must comply with EN ISO 11612 or equivalent.
- Flame Resistant Clothing is NOT required for workforce members working in field/ site offices (performing desk jobs), seismic operations, routine civil works & support services, logistics, material stores and project facilities (that are not located at a production facility)..

Sample

ANNEXURE P
How GHG Emissions Get Quantified?

Methodology to Determine Carbon Footprint & Intensity

Carbon footprint shall be determined using the net carbon footprint methodology based on fuel analysis & mass balance approach and real-time emissions monitoring.

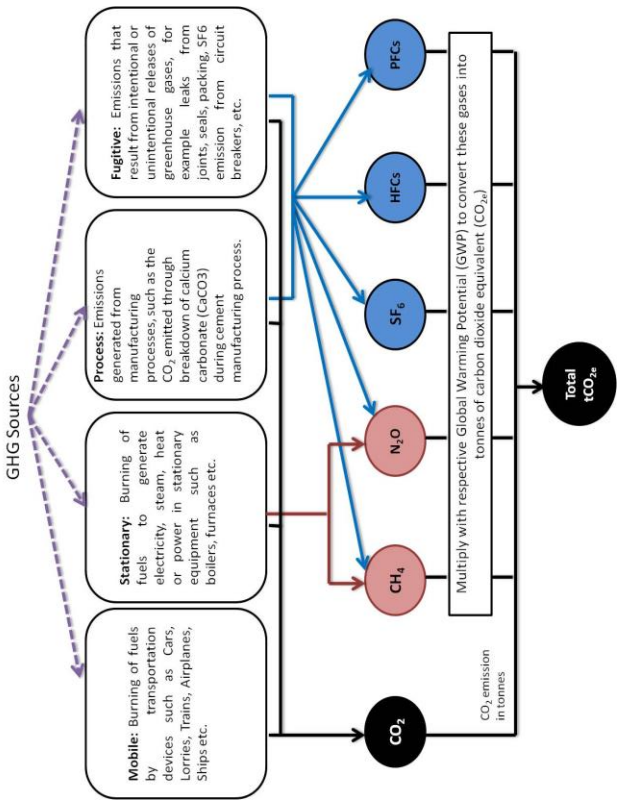
The intensity shall be calculated by estimating the individual emissions for each component of the process scheme applied; this shall be achieved using process flow diagrams identifying all possible emission sources associated with the engineering, exploration, production, workover and processing activities in a D&PL.

American Petroleum Institute's (API) Compendium of Greenhouse Gas Emissions Estimation Methodologies for the Oil and Natural Gas Industry shall be used as a standardized tool for the estimation of GHG emissions.

The calculated emissions shall be converted into carbon dioxide equivalents (CO_2e) and carbon equivalents (Ce) based on their Global Warming Potentials (GWPs) to determine the annual carbon footprint of each strategic business unit quantifying the collective effect in the end.

Subsequently, a GHG emissions inventory will be developed and maintained on annual basis.

Net carbon intensity shall be expressed as tons/year and tons/employee.


GHG Sources
Mobile: Burning of fuels by transportation devices such as Cars, Lorries, Trains, Airplanes, Ships etc.
Stationary: Burning of fuels to generate electricity, steam, heat or power in stationary equipment such as boilers, furnaces etc.
Process: Emissions generated from manufacturing processes, such as the CO_2 emitted through breakdown of calcium carbonate (CaCO3) during cement manufacturing process.
Fugitive: Emissions that result from intentional or unintentional releases of greenhouse gases, for example leaks from joints, seals, packing, SF6 emission from circuit breakers, etc.
CO_2
CH_4
N_2O
SF_6
HFCs
PFCs
CO_2 emission in tonnes
Multiply with respective Global Warming Potential (GWP) to convert these gases into tonnes of carbon dioxide equivalent (CO_{2e})
Total tCO_{2e}

IMPORTANT CONTACT NUMBERS

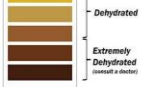
#	Designation	Contact #s		
		Office	Residence	Cell

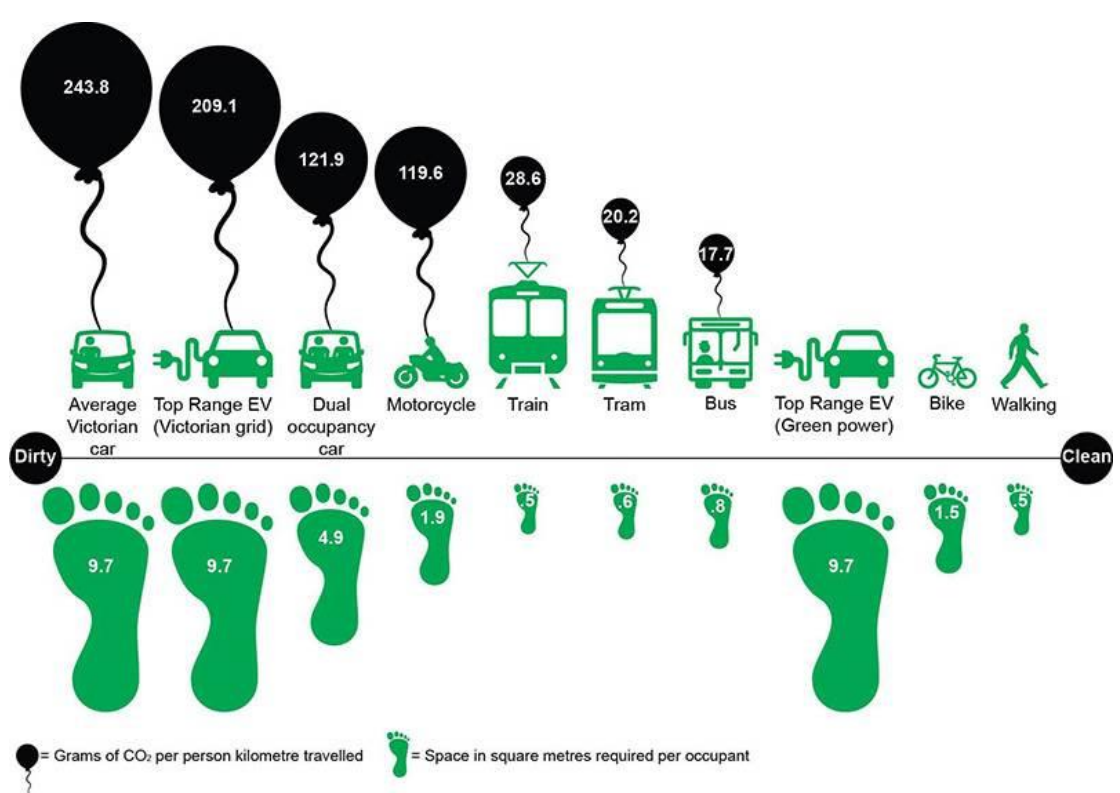
Oil & Gas Development Company Ltd.

HSE INDUCTION FOR FIELD VISITORS

[to be placed or posted in every guest room]

1. Please note that the major hazards of this field/ location are of physical, chemical, and biological nature.
2. Therefore, visitors are expected to comply with all SAFETY/ ENVIRONMENT/ EMERGENCY signs and use of PPE where required.
3. In case of any emergency, inform Duty Officer by dialing 'xxx'.
4. Actions in the event of Fire or Fire Alarm:
   - If fire is detected, inform Duty officer.
   - If fire alarm sounds; Switch off any electrical/ gas appliance in use; Close doors/ windows.
   - Evacuate through the nearest Fire Exit and proceed to Muster Point.
   - Do not attempt to gather your personal belongings.
   - Do not go to the places other than the Muster Point.
   - Return to the office/ plant/ camp when allowed by Security Administrator.
5. Only use the designated areas for smoking.
6. Visitor's responsibilities towards Environment:
   - Do not litter; Use the designated waste bins.
   - Switch off the lights, fan, air conditioner, and heater when not needed.
   - Report any spark in the switch boards and water leakage in the toilets.
   - Do not use tap water for drinking.
7. Please avoid wearing open shoes or sandals while going out of the camp/ field area, since presence of snakes or poisonous insects cannot be ruled out. In case of snake/ insect bite, please call medical emergency at xxx. Necessary medicines are available at field.
8. Illegal drugs, weapons and explosives are prohibited within office/ plant/ camp premises.
9. While using toilets, you may consult the following Dehydration Chart to check your dehydration levels through urine color:




243.8
209.1
121.9
119.6
28.6
20.2
17.7
Average Victorian car
Top Range EV (Victorian grid)
Dual occupancy car
Motorcycle
Train
Tram
Bus
Top Range EV (Green power)
Bike
Walking
Dirty
Clean
9.7
9.7
4.9
1.9
.5
.6
.8
9.7
1.5
.5
= Grams of CO_2 per person kilometre travelled
= Space in square metres required per occupant

For further information contact
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