شركه المنصورين للإنشاءات
والخدمات النفطية

AMANSORIN CONSTRUCTION CO.
and oil services
ACCO

Waste Management Services

TECHNICAL PROPOSAL FOR DOMESTIC, INDUSTRIAL AND DRILLING WASTES MANAGEMENT AND DISPOSAL

A. TECHNICAL PROPOSAL FOR DOMESTIC AND INDUSTRIAL WASTE MANAGEMENT AND DISPOSAL

A1. EQUIPMENT AND PERSONNEL SUGGESTED FOR WASTE COLLECTING AND MANAGEMENT ON SITE

- 10 suitable sealing skips of $5m_3$, clearly identified with dedicated panel information, for storage of domestic wastes and industrial wastes, as indicated in the scope of work (see appendix 2 : photo of containers 5m3);
- 4 suitable containers for storage of empty drums 25 drums / container;
- 1 Hydraulic/electric waste compactor unit suitable for compacting 10:1 of domestic and industrial wastes volumes (see appendix 1);
- 1 Metallic (steel) cleaner and drum crusher ;
- 1 Plastic drums shredders (Option);
- 5 Suitable container of 4m3 for storage of sand contaminated by oil (see photo);
- 1 Waste Manager Coordinator in charge to ensure day to day wastes management, control, logbook holding of each quantity of waste generated onsite and sent to authorized disposal site, compilation of authorized disposal site receipt and certificate, and preparation of reports required by Environmental Authorities and Client;
- 2 qualified helpers to operate the waste compactors and to ensure waste bags handling and storage of compacted wastes on reserved container;

A2. DOMESTIC, CHEMICAL AND HAZARDOUS WASTES MANAGEMENT PROCEDURES

A2.1. INTRODUCTION

Effective and responsible waste handling and disposal are the key elements in ACCO environmental management system. It is the goal of ACCO to ascertain and minimise the environmental impact of its operations. ACCO pledges to apply all practicable measures to responsibly manage the generation of wastes and to handle them in a legal and environmentally friendly manner.
All wastes shall be handled in conformity with Libyan and recognised international environmental regulation and standards and with application of the following process:

- Waste Source Elimination/ Reduction/ Re-use/ Recycling/ Recovery as per suitable procedures;
- Collecting on appropriate containers ;
- Disposal (Discharge) controlled.

Inevitable wastes generated by drilling operations will be disposed of, treated or recycled according to procedures approved by competent authorities.

A2.2. LEGISLATION

Applicable Libyan and recognised International regulation and standards.

A2.3. SCOPE

A2.3.1. Field of application

This procedure is applicable for all petroleum activities sites where ACCO is contracted to ensure waste management, treatment and disposal activities.

A2.3.2. Custodian

The custodian of this procedure is the ACCO Operation Manager and ACCO supervisor on working sites.

A2.4. WASTE MANAGEMENT OBJECTIVES

The objectives of the waste management program are to:

- Comply with Libyan and recognised International regulation and standards requirements;
- Satisfy client environmental protection and waste disposal policy and strategy;
- Quantify and record the types and quantities of waste generated ;
- Use industry best practice to collect, store, segregate, transport, treat and dispose of wastes in an environmentally sound way, taking into account the cost and available local resources.
- Involve employees/ contractors in developing new initiatives and suggestions, which improve performance.

A2.5. ORGANISATION AND RESPONSIBILITIES

A2.5.1. Principals for the organisation structure

For the organisation of ACCO waste stream management system, tasks at different levels, can be discerned as follow:

- Managing;
- Executing;
- Logistic;
- Administrative (Registration / Reporting);
- Controlling.

a. Managing tasks (Operation Manager / logistics /supervisor)

Managing tasks are:

- Setting up and maintaining a waste control system;
- Introduction of requirements by changing rules of the authorities;
- Finding solutions for special problems;
- Selection of waste contractors;
- Taking care of coordination between all involved parties.

b. Executing tasks (Supervisor/logistics)

These tasks cover the route from origin of the waste to the proper transfer to the wastes contractor and comprise:

- Collecting, storage, packing and labelling;
- Description of the waste and waste composition both for the transportation and processing as for the registration system;
- Supply of information to the downstream contractor ;
- Supply of information for the registration system.

The tasks of the originator of the waste are limited to the storage in appropriate containers.

c. Logistic tasks

These tasks cover the route from receipt of the waste from the waste originator to delivery to an authorised waste disposal site or to an authorised recycler and comprise:

- Receipt of the waste containers from the site ;
- Informs the waste disposal site or recycler ;
- Ensure loading and transportation of waste containers to disposal site or recycler ;
- Receive certification of waste disposal;
- Supply of information for the registration system.

d. Registration / Reporting tasks

The registration will be carried out base on the supplied information by the responsible for the managing, executing and logistic tasks. The person charged with the registration shall also check and monitor received certificate and the quality of the supplied information. After a check on the data provided by the originator of the waste, the internal reporting and the external reporting will be carried out by the person charged with the registration.

f. Controlling tasks

Controlling tasks are:

- Daily control;
- Periodic checking of the data on waste streams as inserted in the registration system, in order to release the data for in- or external reporting. This task will be carried out by the Operation Manager, Client representative and HSE Advisor, if any;
- Checking of documentation, packing, storage containers, etc... of waste streams, at receipt by the logistics from the waste originator. This task will be carried out by the person charged with the logistic tasks;
- Checking of the functioning of the waste control system. This task will be carried out by the responsible of managing tasks.

A2.6. WASTE CLASSIFICATION

Waste is classified as:

- Domestic waste
- Inert industrial waste
- Special hazardous industrial waste.
- Drilling solid (mud/cutting) and liquid wastes

A2.7. WASTE MANAGEMENT AND DISPOSAL STRATEGIES (RECAPITULATIVE TABLES)

A2.7.1. Class 1: Domestic waste

Type of waste	Source(s)	Storage on board	Management	Transportation	Disposal method
Paper	Drilling unit offices Living quarter	Sealed bags placed in steel containers with cover provided by ACCO	Reduce by up 10:1 volume of wastes with suitable wastes compactor	Covered steel container transported by ACCO truck	Delivered by ACCO to recycling company
Plastic	Water bottles Plastic cups Yogurt cups				Transported to recycling company
Food waste	Drilling unit restaurant				• Cooking oil is recuperated • Other domestic waste will be incinerated or Disposed of by ACCO at domestic wastes authorized disposal site.

A2.7.2. Inert industrial waste

The inert industrial waste is either disposed of through scrap handlers or the authorized municipal landfill disposal site.

Type of waste	Sources(s)	Storage on board	Transportation	Disposal method
Scrap wood	Drilling unit	Steel container Skips of 5m3	Covered steel container transported by ACCO truck	Segregated by ACCO and delivered to scrap handlers or disposed at authorized disposal site
Scrap metal	Drilling unit			
Scrap plastic	Drilling unit			
Electrical cable	Drilling unit			
Paper and package	Drilling services company	Steel containers 5m3	Reduce by up 10:1 the volume of waste with suitable waste compactor	Delivered to recycling company
Plastic package	Drilling services company			

A2.7.3. Special /hazardous /industrial/ waste

Special industrial waste is received, then segregated by ACCO, delivered to recycler, or specialized waste treatment company, or cleaned by ACCO and delivered to recycler or scrap handler.

INDUSTRIAL/HASARDOUS WASTES MANAGEMENT AND DISPOSAL TABLE (COLLECTION, TRANSPORTATION, TREATMENT AND DISPOSAL)

Type of waste	Collecting	Transportation	Treatment	Disposal
• Used filters	Certified sealed and covered skips	Transportation by delivery truck	Application of ACCO procedure .	- Separated metallic part will be delivered to metal recycling company - Plastic/ paper part will be recycling company
• Contaminated sand / soil	Certified sealed and covered skips 4m3	Transportation of full skips by trolley trucks	Application of ACCO procedure .	- Treated sand (having analysis results in compliance with the required Standard will be disposed at authorized disposal site
• Wax / Sludge	Certified sealed and covered skips 4m3	Transportation of full skips by trolley trucks	Application of ACCO procedure .	- Transportation by vacuum truck and delivery of treated and fuel diluted wax/sludge to crude oil terminal / storage site, against a receipt document.
• Hydrocarbon (HC)	Certified sealed tanks	Vacuum truck	Application of ACCO procedure .	- Transportation by vacuum truck and delivery of purified HC to crude oil terminal / storage site, against a receipt document.
• Contaminated water	Certified sealed tanks	Vacuum truck	Application of ACCO procedure .	Treated water (having analysis results in compliance with the required Standard) will be disposed as follow : - At network, if fresh water - At sea, if salty water
• Oily rags	Certified sealed and covered skips	Transportation by delivery truck	Application of ACCO procedure .	- Cleaned rags will be incinerated or delivered to a specialized recycling company
• Empty metallic drums and cans	Certified appropriate and safe containers	Transportation by ACCO trolley truck	Application of ACCO procedure .	- Cleaned and crushed plastic and metallic drums and cans will be delivered to authorized recyclers.
• Chemical/ oil empty drums plastic		Certified appropriate and safe containers	Transportation by ACCO trolley truck	Application of ACCO procedure .
• Batteries, lead acid	Steel container	Transportation by ACCO trolley truck	Application of ACCO procedure .	- Delivered by ACCO to agreed /authorised recycler
• Batteries, dry cell	Suitable sealed container	Transportation by ACCO trolley truck	Application of ACCO procedure .	
• Used lube oils	Appropriate sealed and securely closed metallic container	Transportation by ACCO trolley truck	Application of ACCO procedure .	- Delivered by ACCO to used oil authorised recycling company
• Surplus chemicals (paints)	Suitable sealed container	Transportation by ACCO trolley truck	Application of ACCO procedure .	- Paint containers will be delivered by ACCO to paint authorized recycling company

A2.7.4. Drilling wastes: solid (Mud/Cutting) and liquid (see details Chapter B)

Type of waste	Source	Collecting	Transportation (if necessary)	Treatment and disposal method
• Solid Water Base Mud Cutting • Solid oil bas Mud Cutting	Drilling operation	Screw conveyor, appropriate container of 40m3 or skips of 4m3	Covered full skips 4m3 or Covered dump truck	• Treatment according to MAL procedure (see chapter B) • Disposal of treated and controlled solid and liquid on site if agreed by authority or at authorized disposal site
• Water base Mud Fluid • Cleaning Water • Wastewater	Drilling operation	Appropriate tanks or pits	- Offshore : Supply boat tank - Onshore : Vacuum truck	
Contaminated soil	Oil or chemical spill	Skips of 4m3 or 5m3	Covered full skips 4m3 or Covered dump truck	

A2.8. WASTES MANAGEMENT PROCEDURE

A2.8.1. Wastes segregation

An important aspect of the waste management is the segregation of the waste materials based on their general physical and toxic characteristics.
It is the responsibility of the personnel working on the drilling site to identify all wastes generated. An initial waste characterisation will help to determine those waste streams that may be combined to simplify storage, recycling and/or disposal, and which streams are to remain segregated.

A2.8.2. Domestic wastes management

- Domestic waste generated by daily living activities, such as paper, wood, plastics, aluminium cans, glass, cloth, galley wastes, etc… shall be stored in sealed bags, placed on tight dedicated and labelled container equipped with cover ;
- The full sealed bags should be stored on suitable dedicated containers of 5m3 ;
- Full bags will be compacted with suitable hydraulic /electric compactor unit to reduce volume 10:1 and stored on suitable dedicated container of 5m3 ;
- Compacted bags container will be transported by ACCO and disposed of on an authorised disposal site ;
- Organic wastes may be incinerated onsite with appropriate incinerators (option).

A2.8.3. Inert industrial wastes management

- Dedicated and labelled containers of 5m3, equipped with covers, should be allocated respectively for paper, plastic, metallic cans, oily rags, scrap metals, scrap plastic, electrical cables and wood ;
- Full inert industrial wastes containers should be transported by ACCO and delivered to a scrap handler or authorized recycler.

A2.8.4. Industrial /hazardous wastes management

- Industrial/ hazardous waste should be stored so that it does not pose any threat to personnel, e.g. no obstructions, correct stacking, away from heat sources;
- Industrial/ hazardous waste should be segregated to facilitate its handling and prevent contamination or chemical reactions ;
- When waste has the potential to contaminate soil or water or sea water, it should be stored on tight containers.
- Industrial/ hazardous wastes containers will be managed by ACCO, as described on A2.7.3. (Industrial, hazardous wastes management and disposal table)
- Appropriate “HAZARDOUS PRODUCT” signs will be posted on transportation trucks.

A2.8.5. Drilling wastes mud/cutting/ contaminated water management

Drilling wastes (mud/cutting/contaminated water) are managed by ACCO as follow :

- Online recovery and clarification for reuse of drilling valuable fluids (OBM, WBM) from cuttings during drilling operation, thus, reducing the total volume of drilling wastes.
- Online or offline collecting, removal, transportation, treatment and disposal of contaminated wastes (water, cuttings, mud, solids…) generated by petroleum drilling and production activities.
- Deoiling, treatment and disposal of oily water;
- Sites cleaning up, remediation and reclamation;

A2.8.6. Chemical wastes

- Surplus chemicals, paints and solvents that cannot be used up and have to be disposed of onshore shall be stored separately in suitable sealed containers, labelled with the point of origin, product name, nature of hazards, and transported for proper disposal by a waste management contractor. Waste chemicals of different types shall not be mixed with other waste materials (oil/ lubricants, paints, solvents or any other materials).
- Metal and plastic drums or containers contain various quantities of residues. Each of the empty drums or containers should be securely closed, labelled with the name and the hazards (MSDS) of the original product before shipping to shore.

Those containers should be well stowed during their transport offshore and onshore to avoid loss of drum overboard and should be delivered to specialized companies for such type of waste treatment.

A2.8.7. Waste Oil

Oily and greasy refuse should be sealed in tanks or containers, sent to shore and delivered to an official authorized Specialized Company for treatment or recycling.

A2.9. RECORD KEEPING

Records relating to waste management will be maintained.
Records of shipment, transportation and disposal of waste will include the following information :

- Date of dispatch;
- Origin of waste;
- Description;
- Quantity;
- Container type;
- Designated disposal site and method;
- Means of transportation;
- Confirmation of actual disposal.

A2.10. TREATMENT PROCESSES

A2.10.1. Contaminated solid / sand / soil treatment process

The consolidation of the recovered sand (solids) consists to transform them from an environmentally unacceptable waste to a stable, inert, solid waste which is easily handled by mechanical plant and can be disposed of in a normal landfill.

The consolidation plant is divided into three sections:

- Recovered sand discharge tanks;
- Sand transfer system from discharge tanks to the dynamic mixing units;
- Dynamic mixing unit where the sand is blended with solidification additives;
- Storage/ Fixing tanks.

Solid consolidation process description:

Sand is transferred from the discharge tanks by screw conveyor or backhoe to the dynamic mixing, where the sand is blended with controlled quantity of cement and chemical additives and, if necessary, lime, so that all of the free water is absorbed, the cuttings are then passed onto the storage/fixing half cylindrical tanks where the cement is given sufficient time to harden to a predetermined consistency.

After this process the inert “fixed and stabilized” sand is transported for disposal to an agreed/ authorized disposal site.

A2.10.2. Wax / sludge treatment process

- Separation of water from wax/ sludge by centrifuge
- Mixing and dilution of wax/sludge by gasoil, in order to have an acceptable viscosity.
- Storage of obtained oil in tanks of 60 m3
- Analysis of diluted sludge (content in sulphur, % of water);
- Transportation by vacuum truck and delivery of diluted wax/sludge to crude oil terminal / storage site, against a receipt document.

A2.10.3. Oil treatment process

Oil will be purified on our treatment site by centrifuge, which ensure separation of water and sediments/sand from oil.
Separated water and sediments/sand will be treated as indicated respectively in A2.10.1. and A2.10.4.
Purified oil will be transported by vacuum truck and delivered to crude oil terminal / storage site, against a receipt document.

A2.10.4. Contaminated water treatment process

- Contaminated water contains hydrocarbons, solid particles and a variety of different ions / heavy metals, these are usually present in sufficient quantity to exceed statutory or other imposed quality standards for discharge will be treated as flow :
- The water treatment process, consists to remove oil by centrifuge, oil separator or hydro-cyclone and to add flocculating and coagulating chemicals to the water to ensure the precipitation of suspended solids when the water is transferred to the settling tank.
- The settling phase allows the suspended solids and heavy metals present in the water to precipitate out and accumulate at the base of the settling tank, this creates a sludge which can then be pumped to the start of the dewatering process to be treated.
- After settling, the water is passed on to a series filtration process with silica and cartridge or activated charcoal filters to reduce the organic content of the water.
- At this stage the pH of the water entering the filtration cells is continuously monitored and carefully adjusted by additions of acidic or basic chemicals to maintain a neutral value.
- After filtration the water quality is checked for compliance with regulatory / required standards before either passing on to storage tank to be reused for treatment of solid or disposed at purifying network, if fresh water or at the sea, if salty water or on an activated evaporation pond.
- The residues and precipitates are stabilised with an appropriate chemical product (sodium silicate) and solidified in homogeneous manner by cement mortar, to ensure a total impermeability and reliability against any climatic and / or physical aggression.

A2.10.5. Oily rags treatment process

Oily rags will be incinerated on an appropriate incinerator or washed as follow :

- Washing and drying by washing and drying machine.
- Separation of grease and oil from washing water.
- Purification of washing water and disposal at purifying Network.
- Delivery of cleaned rags to specialized recycling company.

A2.10.6. Used filters treatment process

- Suction of residual oil on the filter with mini vacuum ;
- Dismantling of filter plug ;
- Segregation of the filter to metallic part, paper part or plastic part ;
- Storage of each part on separate sealed containers.
- Delivery of each part to specialised recycling company.

A2.10.7. Empty plastic and metallic drums and cans

- We provide appropriate and safe containers to collect plastic and metallic drums ;
- Plastic and metallic drums will be cleaned with specific high pressure washing machine ;
- Cleaning water will be treated as described in chapter A2.10.4 ;
- Cleaned metallic drums will be crushed with a crushing unit and delivered to authorized recyclers ;
- Cleaned plastic drums will be crushed with shredder and compacted and delivered to authorized recycler.

APPENDIX A1 : HYDRAULIC/ELECTRIC WASTE COMPACTOR UNIT SPECIFICATIONS

General specifications :

In-bag-compactor, is the perfect tool for compacting a mix of waste in plastic bags. The bag is slipped over a stainless steel drum to protect the sack during the compaction process. It does not take up much space and it is an efficient and general machine, which for example deals with cartons, alu cans, metal cans and mixed combustible waste (semi-wet or dry waste from the kitchen or from waste paper baskets).

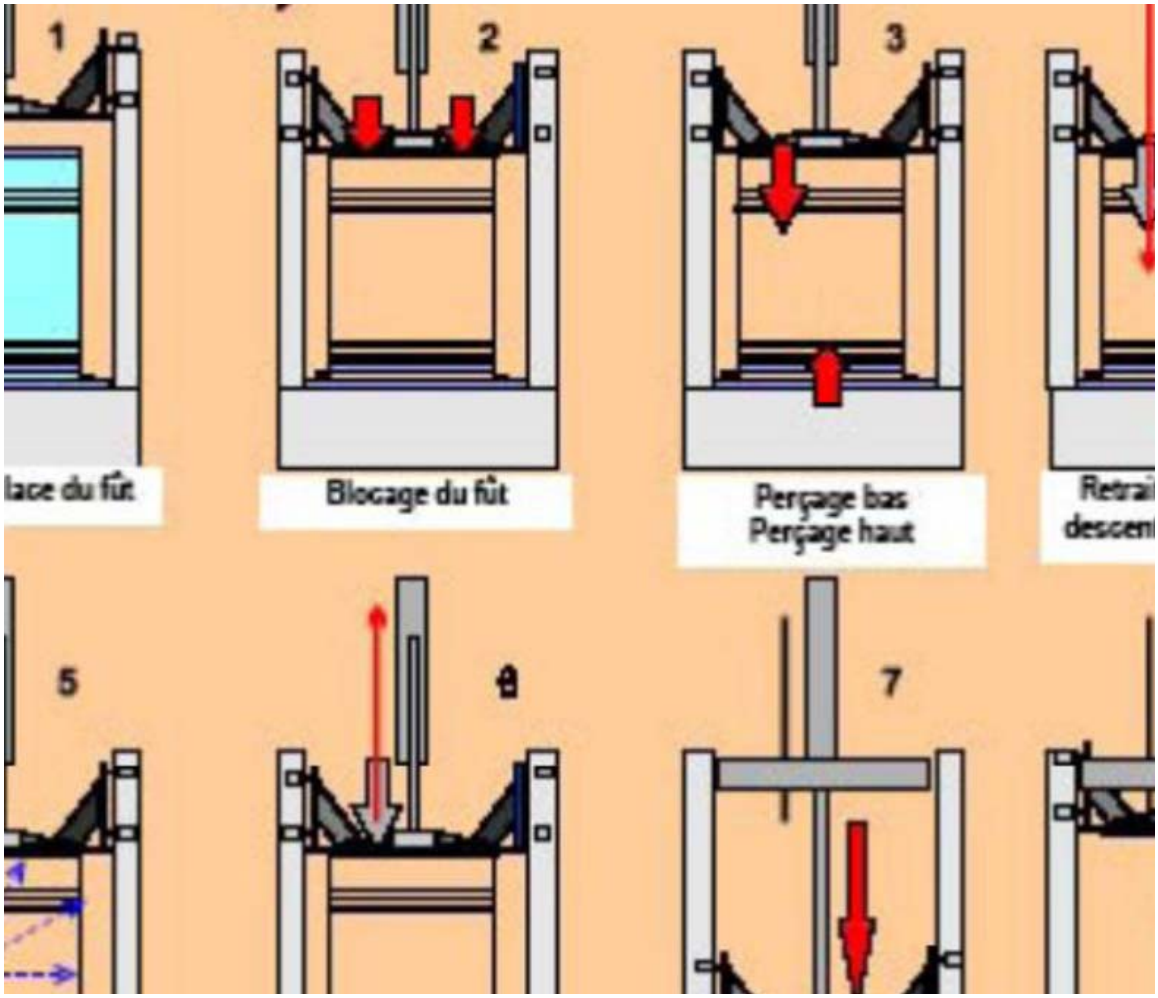
Big reduction in volume

In 30 seconds your waste is reduced by up to 10:1. That means better hygiene and a better working environment, more free space and better safety at work.

APPENDIX A2 : DRUMS CLEANER AND CRUSHER

Cleaning and crushing unit technical characteristics

Pressing power in tonnes	17
Pressing time with return stroke	40
For light sheet barrels	200-220 liters
Standard hopper opening in mm	750
Barrel maximum dim. (Ø height in mm)	630x980
Capacity/hour	40 to 50 barrels /h
Residual collector – tank	80 liters
Driving power (motor / operating volt./frequency)	4KW/400V/50Hz
Overall dimensions (weight/depth/maxi height)	1300 x 920 x 2520
Loading height in mm	250



Photos of cleaning and crushing unit

APPENDIX A3 : SHREDDER

APPENDIX A4 : PHOTO OF DOMESTIC AND INUSTRIAL WASTES SKIP 5M3

APPENDIX A5 : PHOTO OF CONTAMINATED SAND STORAGE SKIP 4M3

APPENDIX A6 : PHOTO OF LABELLED TRASH SKIP 200 LITERS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TECHNICAL PROPOSAL FOR ONLINE ONSHORE DRILLING WASTES COLLECTING, HANDLING, TREATMENT AND DISPOSAL AND VALUABLE FLUID RECOVERY

B. TECHNICAL PROPOSAL FOR ONLINE ONSHORE DRILLING WASTES COLLECTING, HANDLING, TREATMENT AND DISPOSAL AND VALUABLE FLUID RECOVERY

B1. INTRODUCTION / SUMMARY

In drilling operation, it is important to note that:

- Typical solid control equipment discards 1 to 4 barrels of liquid (WBM, OBM) for each barrel of solid removed;
- Water content of typical Water Base Mud (WBM) is around 75% to 90%;
- Use of Oil Based Mud (OBM) requires special consideration due to the environmental /legal requirements and the important cost of lost OBM.

Taking these factors into consideration and in order to help operators to reduce drilling project cost and to meet environmental objectives, ACCO has improved its wastes management and treatment processes, based on the principle of recovery of valuable base fluids for reuse and reducing of the total volume of the wastes as a first stage in the global treatment.
This process can be briefly summarised as follow:

- Recovery online of drilling wastes (WBM cutting, WBM fluid, OBM cutting…) from the Rig solid control equipment by screw conveyor;
- Separation by dryer of valuable base fluid liquid (WBM, OBM) from solid;
- Clarification by centrifuge of valuable base fluid to be reused;
- Solidification and stabilisation of dry cutting and solid for disposal;
- Dewatering of exhaust WBM by dewatering system and centrifuge and purification of water to be reused and solidification and stabilisation of the discarded low volume of WBM solid to be disposed.

This improved process provides main significant advantages, notably:

<u>Economic benefit:</u>

- Significant reduction in the volume of solid to be treated 40 to 50 % of total volume of drilling wastes habitually treated.
- Recovery of valuable mud base fluids (OBM, WBM) and water for reuse; thus reducing new fluids requirement and save money.

<u>Ecologic benefit:</u>

- Minimise environmental impact of drilling operations;
- Reduce oil contamination of cutting by removing oil base mud;
- Reduce amount of drilling waste volume to be treated and disposed;
- Ensure clean working area.

B2. ONSHORE ONLINE PROCESS FOR DRILLING VALUABLE FLUID RECOVERY AND WASTES COLLECTING, HANDLING, TREATMENT AND DISPOSAL

B2.1. Online Water Base Mud (WBM) oil base mud (OBM)/Cuttings Collecting, Handling, Treatment and disposal Process (See Figure N°1)

B2.1.1. Introduction

This process allows separating of base fluid (WBM/OBM) from drilled cutting. Recovered fluid can be returned to the active mud system to reduce new fluid (WBM/OBM) requirements and save money.

B2.1.2. Process description

Drilling Water Base Mud (WBM/OBM) cuttings from the rig solids control equipment **(1)**, specifically shale shakers and mud conditioners, are routed to the **Vortex Dryer** via *screw conveyors* **(2)**.

WBM/OBM cutting enter the Vortex Dryer (3) through the top feed inlet and are separated inside the Dryer.

The recovered liquid (WBM/OBM) exits the Dryer through the effluent ports and is routed, via pumping system, to a liquid WBM/OBM collection tank **(4)**. The recovered liquid [valuable base fluid] (WBM/OBM) is processed through a *decanting centrifuge* **(5)** for final clarification, then returned to the mud active system for reuse **(6)**.
Dried WBM/OBM Cuttings issued from the Dryer and solids output from the centrifuge are transferred to the consolidation system (9), via screw conveyors, where they are mixed and blended with a controlled quantity of cement and treatment additives, the treated cuttings and solids are then passed on to the disposal pit(s) **(10)**.

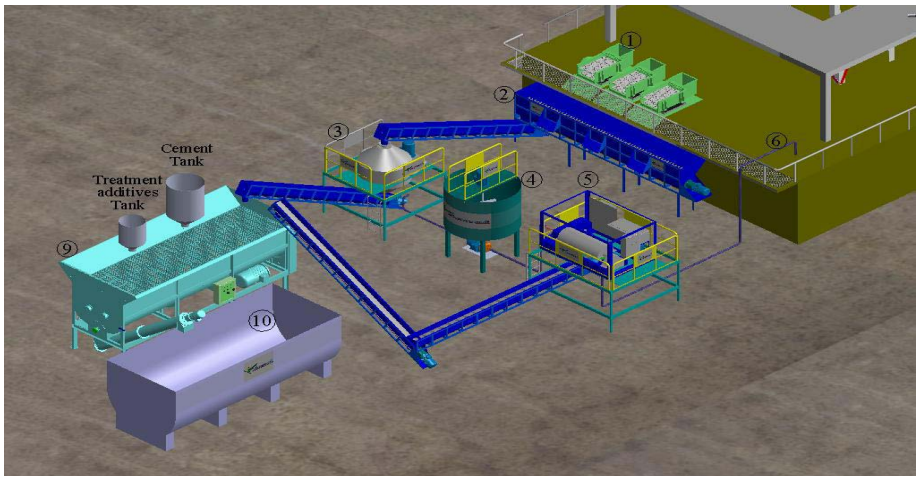


Figure N°1 : Online Water Base Mud/Cuttings Collecting, Handling and Treatment Process

B2.1.3. Option

If required by the operator, dried WBM/OBM cuttings and solids could also be collected, via screw conveyors, in cuttings boxes of 4m3 or half cylindrical tanks of 75m3 **(7)** or disposed into the mud/cuttings storage sealed pit **(8)** to be treated offline when the Rig is removed.

B2.2. Exhausted Water Base Mud (WBM) Dewatering and Treatment Process (See Plan 090/2008)

B2.2.1. Introduction

Water content of typical WBM is around 70% to 90%. The process allows to separate the majority of the solids from the water phase and purify water for reuse in drilling operations.

B2.2.2. Process description

Water base mud which has been taken out of the active circulating system, is dewatered as follow:

From the WBM fluid storage tanks or pit, the exhausted mud is transferred via an aspiration pump to the input of the dynamic mixer, where chemical additives (coagulants and flocculating agents) and diluting water are added to the mud.

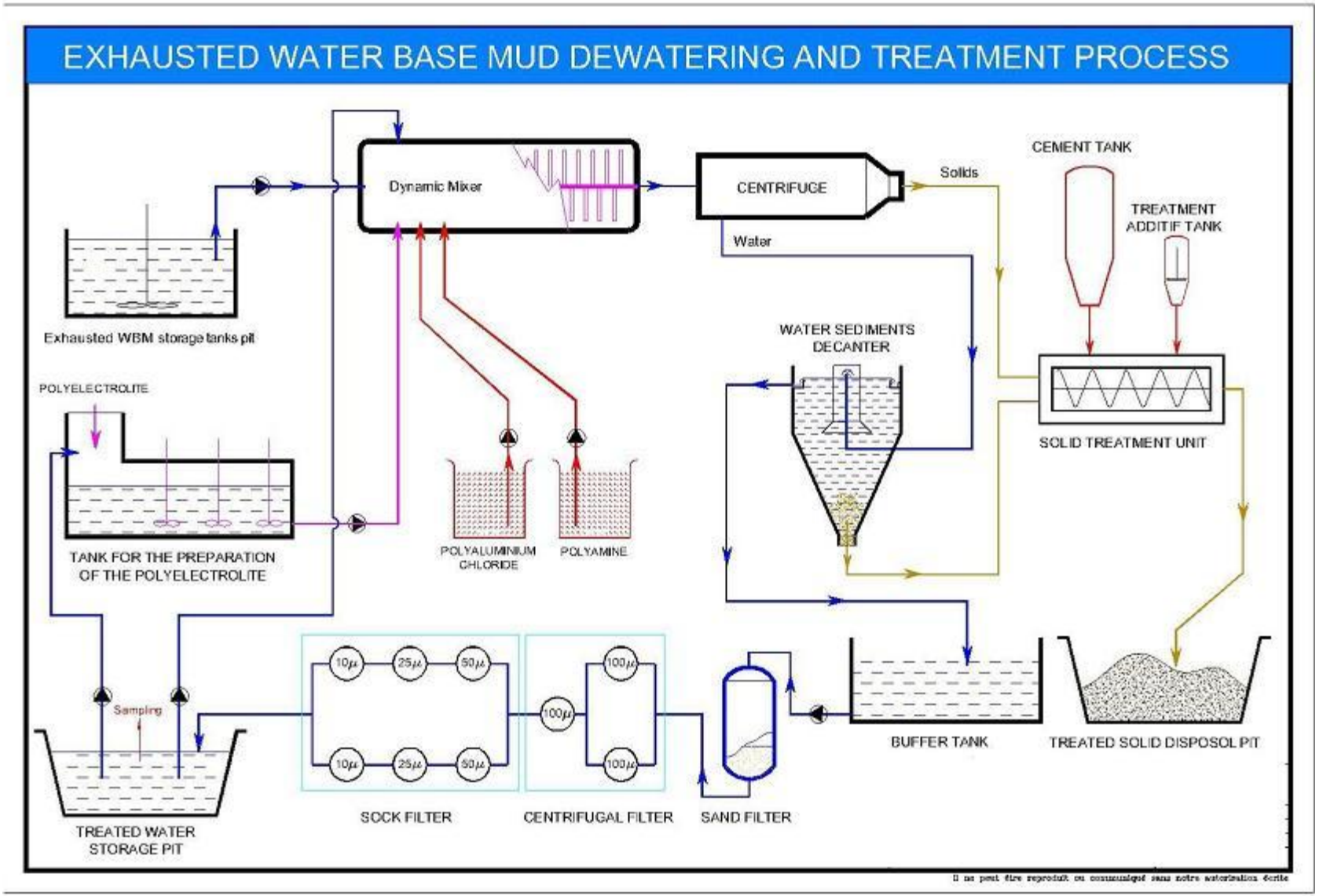
The addition of coagulants and flocculating agents improves the efficiency of the centrifuge in separating the solids from the water.

Dilution is made with water, when necessary, to maintain a fluid feed density of 1.20 sg (±10.2 ppg) to the centrifuge, which is the optimum density to process the mud.

From the dynamic mixer, the flocculated mud is pumped to the decanting centrifuge where the majority of the solids are separated from the water phase.
At the end of this process, there are two products

- Clarified water;
- Solids (40% at total WBM volume).

The clarified water output from the centrifuge is pumped to the purification and filtration process.
The purified water is finally stored in the drilling site water pit for reuse.
The solids recovered from WBM are transferred to the consolidation plant, via screw conveyors, and blended with a controlled quantity of cement and treatment additives in the mixing unit. The treated solids are then passed on to the disposal pit(s) where the cement is given sufficient time to harden to a predetermined consistency.


EXHAUSTED WATER BASE MUD DEWATERING AND TREATMENT PROCESS
Dynamic Mixer
CENTRIFUGE
Solids
Water
CEMENT TANK
TREATMENT ADDITIF TANK
Exhausted WBM storage tanks pit
WATER SEDIMENTS DECANTER
SOLID TREATMENT UNIT
POLYELECTROLITE
TANK FOR THE PREPARATION OF THE POLYELECTROLITE
POLYALUMINIUM CHLORIDE
POLYAMINE
Sampling
10µ
25µ
50µ
100µ
BUFFER TANK
TREATED SOLID DISPOSOL PIT
TREATED WATER STORAGE PIT
SOCK FILTER
CENTRIFUGAL FILTER
SAND FILTER

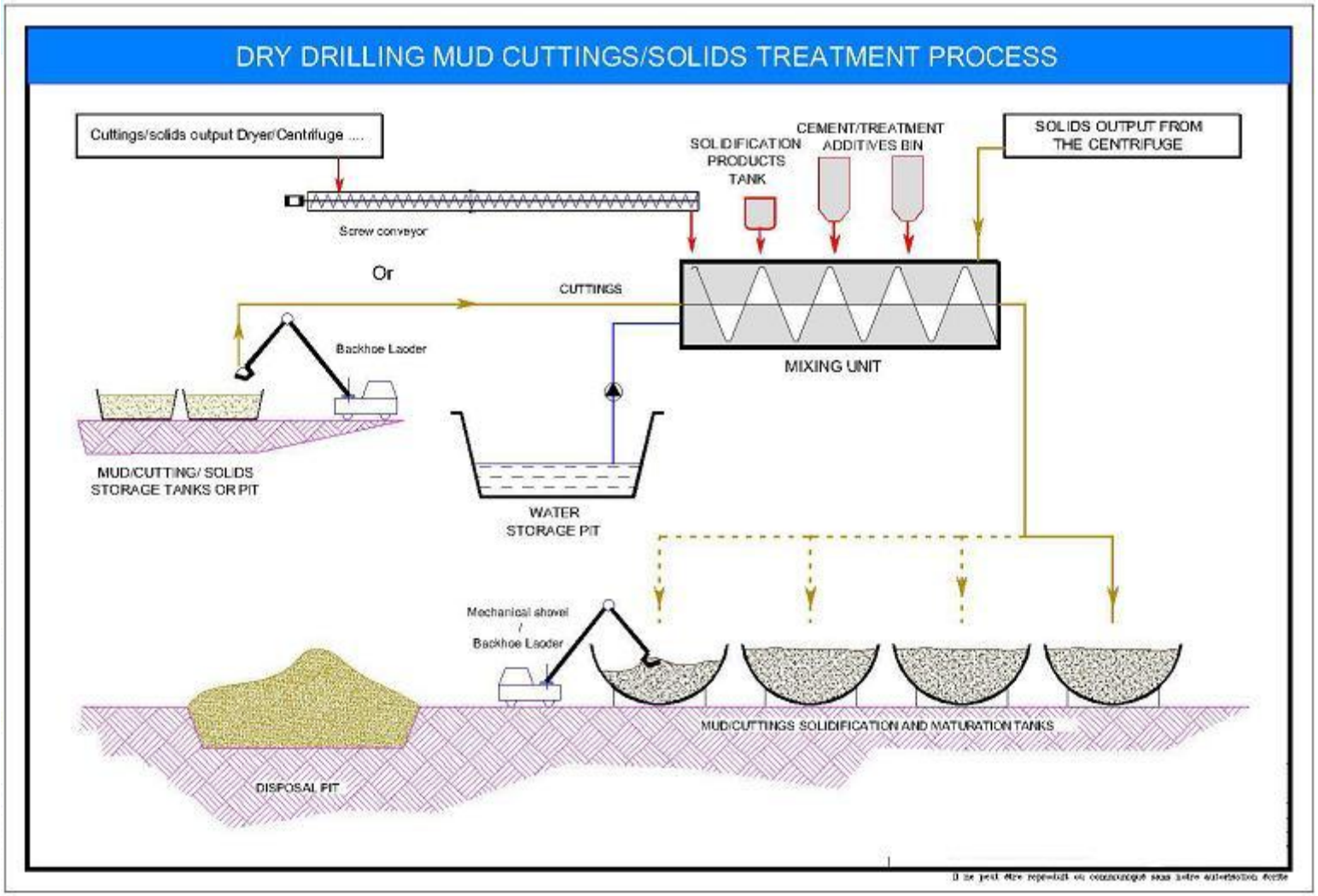
B2.4. Cuttings / solids treatment and consolidation process (see plan 93/2008)

The consolidation of the drilled cuttings and solids consists to transform them from an environmentally unacceptable waste to a stable, inert, solid waste which is easily handled by mechanical plant and can be disposed of in a normal landfill.

The consolidation plant is divided into three sections:

1. Cuttings solids transportation from discharge points of the solids control equipment to the mixing units by a screw conveyor system;
2. Mixing unit where the cuttings are blended with cement and solidification additives;
3. Storage/Fixing pit.

The cuttings / solids are transported from the various discharge points of the solids control system by screw conveyor to the mixing unit. In the mixing unit the cuttings are blended with controlled quantity of cement so that all of the free water is absorbed, the cuttings are then passed onto the storage/fixing half cylindrical tanks where the cement is given sufficient time to harden to a predetermined consistency.
After this process the inert “fixed and stabilized” cutting/solid are transferred by mechanical shovel /backhoe loader for disposal at disposal pit arranged on the drilling site.


DRY DRILLING MUD CUTTINGS/SOLIDS TREATMENT PROCESS
Cuttings/solids output Dryer/Centrifuge ....
Screw conveyor
Or
SOLIDIFICATION PRODUCTS TANK
CEMENT/TREATMENT ADDITIVES BIN
SOLIDS OUTPUT FROM THE CENTRIFUGE
CUTTINGS
Backhoe Laoder
MIXING UNIT
MUD/CUTTING/ SOLIDS STORAGE TANKS OR PIT
WATER STORAGE PIT
Mechanical shovel / Backhoe Laoder
MUD/CUTTINGS SOLIDIFICATION AND MATURATION TANKS
DISPOSAL PIT

B2.5. Equipment required for online drilling valuable fluid recovery and waste collecting, treatment and disposal

Collecting and recovery of valuable fluid	**Number**
Screw conveyor	1 x 12m 3 x 3m
Vortex dryer	1
Collection tank 20m3 with agitator	1
Centrifuge pump	1
Centrifuge	1
Skips 4m3	10
Cylindrical tanks 50 m3	2
Solid treatment	
Mixing Unit	1
Cement	1
Lime bin	1
Additives	
Exhaust WBM dewatering	
Fluid storage tanks 70m3	2
Fluid pumps	Number TBA (according to needs)
Dynamic mixer to mix WBM with additives	1
Additives preparation tanks	3
Additives proportioning pumps	2
Dilution pumps	2
Centrifuge	1

B2.6. Personnel

Collecting and recovery of valuable fluid

- 2 operator
- 2 Qualified workers

Treatment

In addition to the personnel, here above :

- 3 Qualified Worker
- 3 Drivers.

B2.7. Economical and ecological benefits of online drilling wastes management and treatment onshore process

The ACCO improved process constitutes an effective cost tool to eliminate the environmental problem created by discarded/ waste mud, drilling cutting and other effluent produced by drilling operations. The main advantages of this improved process are:

- Recovery of valuable drilling fluid (OBM, WBM) for reuse (for argument ; recovered OBM from OBM cutting represent about 50 to 60% of total amount of exhaust OBM cutting). Thus reducing new drilling fluid requirement and save money (the cost of valuable volume of OBM which may be recovered is estimated to about 200 000 to 250 000 US$);

- Significant reduction of OBM cutting oil contamination (in lixiviate : from 250mg/l to 6mg/l) as result minimise environmental drilling impact and reduce treatment cost (the treatment cost of $1m_3$ of dry cutting with low contamination by oil (OBM) is 20% less then the treatment cost of $1m_3$ of non dried OBM cutting. The unit cost applicable is the same of WBM cutting;

- Significant reduction (40 to 50%) in the volume of drilling solid waste to be treated, limited only to dry cutting, as result; minimise impact on the environment by the reduction in the volume of wastes to be disposed and save money in reducing treatment cost;

- Recovery water from discarded WBM (water content of WBM is around 75%), there is a significant reduction in the volume of mud to be disposed of, limited only to the volume of the solids;

As the treated water phase can be recycled, then this provides a reduced demand for drill water which is a significant factor if water is scarce or is trucked into the location.

- As these solids (dry cuttings, WBM solid phase,…) have been rendered inert then ordinary land fill disposal method are used,

- As the treatment process proceeds online with drilling the well then no large scale treatment at the end of drilling is required. This provides a significant saving in cost and time.

B3. OFFLINE ONSHORE DRILLING WASTES TREATMENT AND DISPOSAL

B3.1. INTRODUCTION

This option consists to ensure drilling wastes (mud cutting, waste water…) treatment and disposal after the end of drilling operations.

The main operations performed on drilling site are:

- Drilling platform and drains cleaning ;
- Fluid pumping and treatment by separation oil from water and solid from liquid;
- Solid recovery from storage pit and treatment.
- Treated and stabilised solid analysis and disposal.

B3.2. OIL RECOVERY

In case of presence of oil on the drilling waste storage pit, the oil will be recovered from contaminated fluid with a deoiling system.

B3.3. FLUID DEWATERING PROCESS

The dewatering of fluid recovered from the pit will be processed as described on the chapter A2.2.

B3.4. SOLID TREATMENT AND CONSOLIDATION PROCESS (SEE PLAN N°93/2008)

From the contaminated disposal pit, the mud and cutting are removed with backhoe and sent to input of dynamic mixer in which the solid (mud/cutting) are mixed with cement, chemicals and water, until to have good consistency.
The treated solid is removed from treatment unit with screw conveyor and disposed into a proper storage tank.
Solids treated are transferred from the first storage tank to a second tank to improve drying and solidification.
From drying and solidification tank, the treated solid with be transported by dump truck and used to fill up pits excavated on drilling site.

B3.5. EQUIPMENT

- Pumping system
- Deoiling system
- Fluid treatment and dewatering unit
- Mud /cutting storage tank
- Dipper dredge
- Backhoe
- Treatment unit supplying system (cogger screw) of cuttings/ mud
- Cement bins
- Lime bin
- Chemical additive product bin
- Oxidizing product tank
- Mixing system
- Mixer disposal tank
- Tuff mixing and dryer tank
- Trucks for transportation of treated solid to final disposal pit.

B3.6. PERSONNEL

- 1 Supervisor
- 3 Drivers (backhoe, trucks, tractor shovel,…)
- 4 Qualified workers.

B4. SAMPLING AND ANALYSIS

B4.1. ONSHORE SITE ANALYSIS

In order to provide an express and continuous control on some mud and cuttings parameters, the site laboratory cabin will be equipped with:

- Laboratory centrifuge
- Laboratory drying Oven (220°C)
- Laboratory electric Oven (1100°C)
- Pocket-sized pH meter
- Magnetic Agitators
- Laboratory glassware
- Weighing machine
- Salinity measurement instrument
- Sampling equipments: Polyethylene/Glass bottles, 2 iceboxes, Mini-refrigerator, sampling probes.

B4.2. SAMPLING

B4.2.1. Sampling of contaminated liquid and sold (mud/cutting) wastes

Before treatment, representative samples will be taken from the drilling contaminated wastes. These samples will express the level of contamination of the drilling wastes.

B4.2.2. Sampling of treated liquid and solid (mud/cutting) wastes

Representative samples of 2 dm_3 each will be taken from the daily treated liquid or solid quantity.
Weekly representative samples will be taken from the mixture of the daily samples of the treated solids and treated liquids, for chemical analysis.
All precautions will be taken in order to preserve the chemical quality of the samples.
The samples taken from the treated solid and liquid wastes will be put in appropriate bottles.
The samples will be put in a cool box at a temperature < 4°C before being given to the analysis' laboratories.

B4.2.3. Chemical analysis

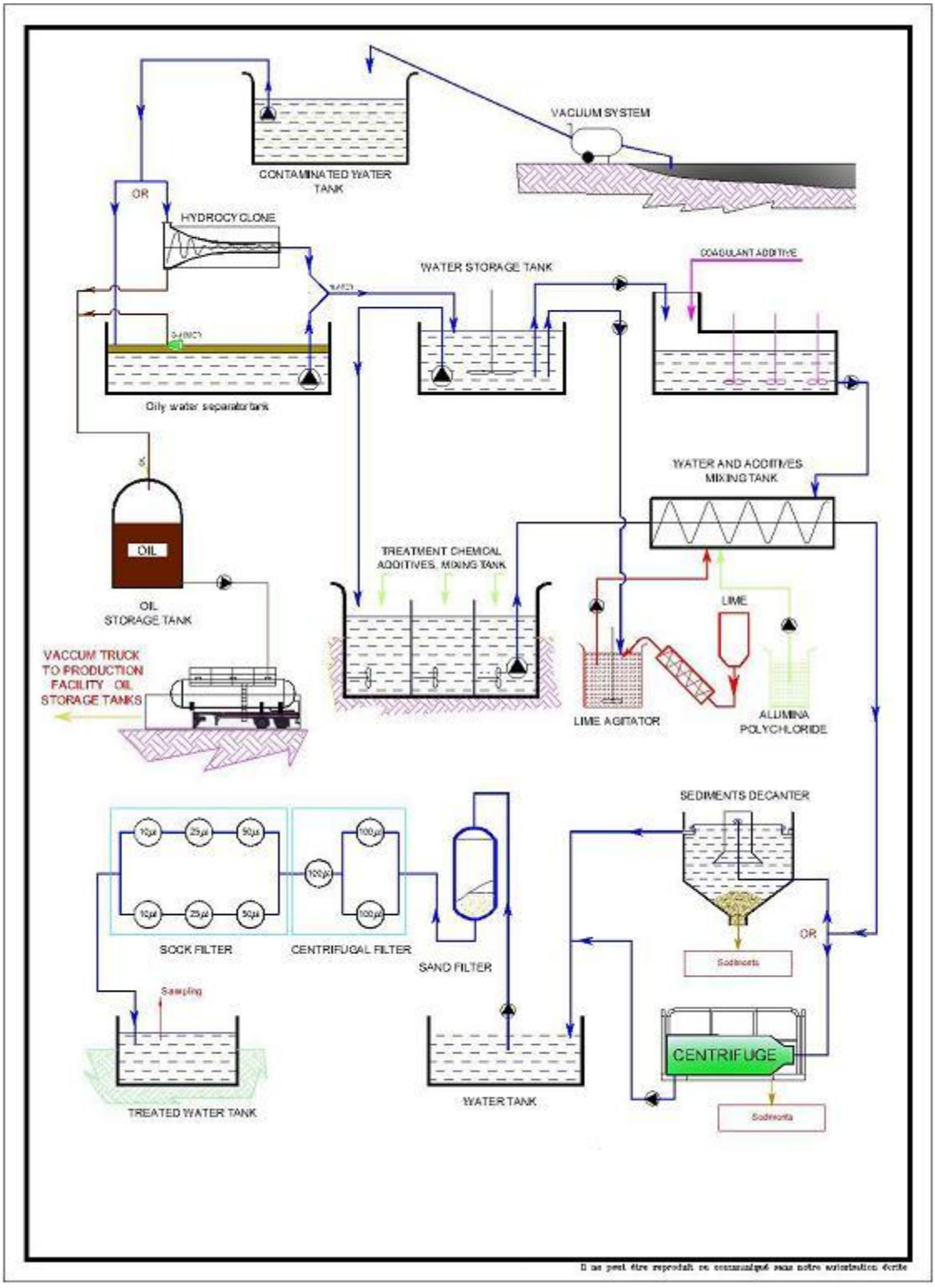
Samples will be analysed by a recognised laboratory such to determine the following elements:

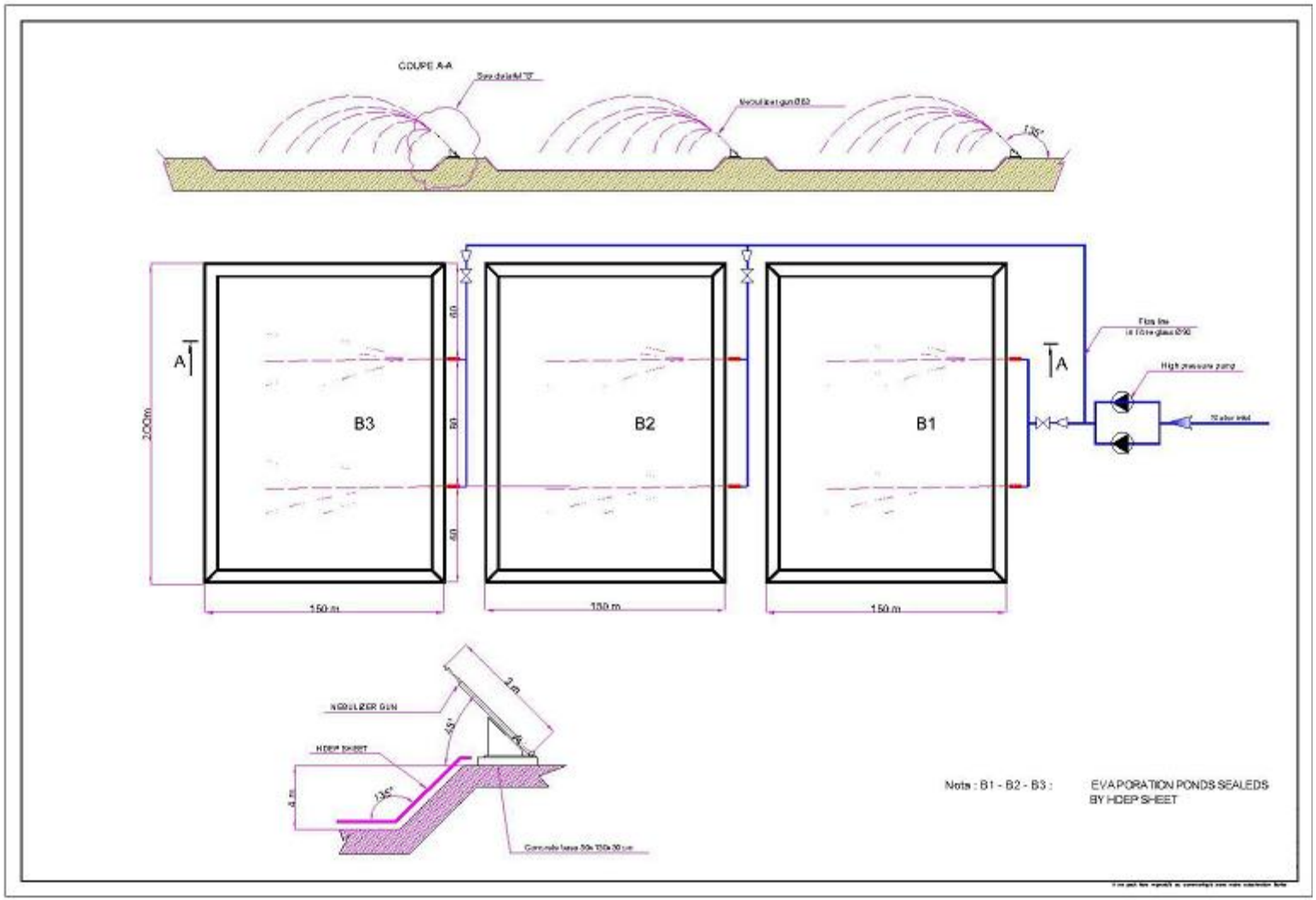
- Ph
- Total Hydrocarbons (TPH)
- Heavy metals (Al, Ag, As, Ba, Cd, Co, Cr, Cu, Fe, Mn, Ni, Pb, Zn, Hg and Sn)
- DBO_5 and DCO for water samples.

B5. CONTAMINATED PRODUCED WATER TREATMENT

B5.1. INTRODUCTION

The process consists to ensure deoiling and purification of contaminated water online from water disposal pit.
Free oil is removed from contaminated water with oil /water separator or hydrocyclone.
The deoiled water is passed through a treatment plant after adjusting the pH, it is subject to flocculation process to remove any heavy metals present, after which it passes through filtration plant.
At the end of this process, the water is chemically pure and complies with legal standards
The treated water having low salinity may be used for irrigation of plants (palmers, trees, herbs, plants for biocarburant...)
The treated water having high salinity will be atomised with a high pressure pump and spraying system to activate its evaporation over an evaporation pond arranged on the site and covered with a resistant plastic sheets.


VACUUM SYSTEM
CONTAMINATED WATER TANK
OR
HYDROCY CLONE
WATER STORAGE TANK
COAGULANT ADDITIVE
Oily water separator tank
OIL
OIL STORAGE TANK
WATER AND ADDITIVES MIXING TANK
TREATMENT CHEMICAL ADDITIVES, MIXING TANK
LIME
LIME AGITATOR
ALUMINA POLYCHLORIDE
VACCUM TRUCK TO PRODUCTION FACILITY OIL STORAGE TANKS
SEDIMENTS DECANTER
SOCK FILTER
CENTRIFUGAL FILTER
SAND FILTER
OR
Sediments
Sampling
CENTRIFUGE
TREATED WATER TANK
WATER TANK
Sediments


COUPE A-A
B3
B2
B1
A
A
200m
150 m
150 m
150 m
NEBULIZER GUN
HDEP SHEET
45°
135°
4 m
2 m
Nota : B1 - B2 - B3 :
EVAPORATION PONDS SEALEDS
BY HDEP SHEET

APPENDIX B : SOME PHOTOS OF ACCO DRILLING WASTE HANDLING, RECOVERY, TREATMENT AND TRANSPORTATION EQUIPMENT

Water activated evaporation pond

Centrifuge units

Vortex Dryer

Drilling waste (mud /cutting) treatment unit

Vacuum truck

Plate truck transporting skips