



Exploration & Production

GENERAL SPECIFICATION

ENVIRONMENT

GS EP ENV 011

Environmental specification for onshore pipeline construction

02	10/05	Addition of EP root to document identification
01	10/03	Change of Group name and logo
00	04/01	Old TotalFina SP ENV 530 (06/98)
Rev.	Date	Notes

Contents

1. Scope	3
2. Reference documents.....	3
3. Terminology and Abbreviations	4
4. Environment management requirements.....	4
4.1 Environment Management Plan	4
4.2 CONTRACTOR Environment Representative	8
4.3 Meetings, visits	8
4.4 Inspections.....	9
4.5 Catering/Housekeeping/Accommodation	9
4.6 Dealing with local communities.....	9
4.7 Site refurbishment.....	9
5. Environment protection requirements	9
5.1 Atmospheric emissions, dust, noise	9
5.2 Minimisation of temporary construction campsites impacts.....	10
5.3 Land protection and restoration	10
5.4 Soils and waters protection.....	13
5.5 Polluted soils remediation.....	13
5.6 Waste management.....	14
5.7 Fauna, flora protection.....	17
5.8 Providing equipment for fighting pollution.....	17
5.9 Respect of socio-cultural traditions.....	17
6. Environment incentives and penalties	18
6.1 Incentives.....	18
6.2 Penalties	18

1. Scope

This general specification concerns the Environment Protection items related to the onshore pipeline construction activity, and describes the requirements of the COMPANY that have to be fulfilled by the construction CONTRACTOR.

For each pipeline particular specifications will specify the complementary requirements of the COMPANY as a function of the project.

The CONTRACTOR is asked to take all necessary measures in order to protect the environment, an Environment Management Plan will be elaborated for that purpose.

This specification covers the following subjects:

- Environment Management Plan requirements (policies, impacts identification, personal competency, audits and inspection, drills, documentation)
- Waste Management Plan
- Environment Protection concerns: air, noise, soils, surface and ground waters, land erosion prevention, drainage, reinstatement.

Safety aspects related to pipe construction are not covered by the present document.

2. Reference documents

The reference documents listed below form an integral part of this General Specification. Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and supplements, is the latest revision published at the EFFECTIVE DATE of the CONTRACT.

Standards

Reference	Title
Not applicable	

Professional Documents

Reference	Title
Not applicable	

Regulations

Reference	Title
Not applicable	

Codes

Reference	Title
Not applicable	

Other documents

Reference	Title
Not applicable	

Total General Specifications

This specification recalls other subjects like environmental baseline study and impact assessment, drainage, waste handling and works in particular environment contexts.

Reference	Title
GS EP ENV 121	Environmental Impact Assessment onshore activities
GS EP ENV 111	Baseline Study-Environmental status of an onshore site
GS EP ENV 210	Liquid effluents drainage systems (under rev.) ref GS EP SAF 228
GS EP ENV 421	Landfill design and operation for E&P sites
GS EP ENV 001	Environmental requirements for oil and gas projects designs

3. Terminology and Abbreviations

This specification covers onshore pipelines construction, and is addressed to the following associated items:

- The gas or liquid pipeline itself (oil, condensates, etc.)
- Pipeline landfall site if any (coastal area)
- The pipeline RoW
- Associated tracks and access roads, and all other related facilities
- Associated equipment (control and counting stations, block valves, manifolds, pig traps, pig launchers, etc.)
- Construction camps for manpower accommodation.

The two following phases will be considered:

- Pipeline construction period, and
- Commissioning phase (hydrotesting, etc.).

4. Environment management requirements

4.1 Environment Management Plan

CONTRACTOR shall submit an Environment Management Plan for COMPANY approval.

COMPANY reserves the right to audit the implementation of the approved EMP during the execution of the services and to request drills and exercises to be carried out with or without notice in order to ascertain that CONTRACTOR's procedures are satisfactory and well understood.



In addition COMPANY reserves the right to perform Environment Audits of the site at any time. This Plan shall cover in detail a description of the subjects as follows.

4.1.1 Environment Policies

CONTRACTOR shall adhere to local regulation and international standards and define its objectives, management organisation, and responsibilities.

4.1.2 Identification of Major Impacts to the Environment

The major impacts of the construction works to the Environment have to be clearly identified: the conclusions of the Environment Impact Assessment study can be used for that purpose.

The means by which these impacts will be minimised have to be described.

4.1.3 Waste Management Plan

Construction works are likely to generate several kinds of waste: inert, domestic and hazardous waste, that have to be handled according to COMPANY standards.

A Waste Management Plan (WMP) has to be developed and implemented; it shall include the following aspects:

- Waste classification (categories, quantities expected, etc.)
- Measures taken to minimise waste quantities
- Measures taken to reuse and recycle waste
- Waste to be eliminated: treatment routes (incineration, disposal into landfill, etc.)
- Procedures for inert material stockpiling
- Procedures for incineration
- Procedures for landfill operation and decommissioning.

4.1.4 Meetings, inspection

CONTRACTOR shall fully participate in any HSE Meetings as may be requested by COMPANY.

If requested by COMPANY, CONTRACTOR shall conduct an initial inspection of all areas where CONTRACTOR'S personnel are to carry out work prior to the commencement of work and at such intervals as COMPANY may require.

Following each inspection, CONTRACTOR shall submit to COMPANY Contract Representative an inspection report highlighting any areas of concern noted and the corrective actions taken or to be taken by CONTRACTOR.

Alternatively the COMPANY has the right to conduct an initial inspection at any time and shall issue a report to the CONTRACTOR highlighting areas of concern and the corrective actions to be taken.

4.1.5 Competency of personnel

All persons who hold Environment critical positions shall be fully competent.

4.1.6 Incident/anomaly reporting and investigation

Where work is required on a COMPANY Site for the provision of Services, the following specific conditions shall apply.

CONTRACTOR shall ensure that all anomalies and all incidents identified or occurring during the performance of Services are reported in writing on CONTRACTOR's report forms within 12 hours to a COMPANY Supervisor.

In the case of any accident, CONTRACTOR shall participate, as requested by COMPANY, in the investigating team established by COMPANY, if any.

CONTRACTOR shall provide, within seven days of an accident, COMPANY Contract Representative with copies of all reports related thereof including, but not limited to: medical reports, CONTRACTOR investigation reports, statutory and regulatory reports, and claims and reports made to CONTRACTOR's insurer(s).

4.1.7 Documentation - Reporting

Emergency response procedures covering communications and actions in case of pollution incident will be issued.

CONTRACTOR shall provide Monthly Environmental Inspection Report that summarises the works performed and the findings of last Audit. The structure will be the following:

- Summary of recent works
- Programme of forthcoming works (over next month)
- Last Audit: summary of Corrective Actions Undertaken and Status
- Audit Findings:
 - Atmospheric emissions, noise
 - Protection of water courses and ground waters
 - Waste Management
 - Land, soils (erosion, drainage, re-vegetation, reforestation, etc.)
 - Reinstatement
 - General
 - Documentation.

4.1.8 Emergency drills and exercises

CONTRACTOR should ensure that all his sites, vessels undertake suitable emergency drills and exercises. In addition CONTRACTOR shall ensure that suitable emergency drills and exercises take place as well as the testing and inspection of emergency equipment such as fire-fighting pumps, life rafts, rescue craft, etc.

4.1.9 Inspections, reviews and audits

CONTRACTOR shall implement periodical self audits (see EMP). The Environment Items to be covered by self audits are presented in the checklist below (non exhaustive):

4.1.9.1 Dust monitoring

- Unsurface roads dampened down and kept clean
- Sheeting of spoil lorries
- Speed limit enforced on site
- Material stockpiles stored
- Dusty materials dampened down during dry water
- Earthworks sealed or re-vegetated
- Mixing of concrete carried out in enclosed areas
- Minimum drop height enforced for spoil conveyors and site protection provided
- Special provisions in place to protect sensitive land use.

4.1.9.2 Noise survey report

4.1.9.3 Atmospheric emissions

- Mechanical plant status
- Vehicles
- Stockpiles materials
- Concrete mixing conditions
- Roads dampened down
- Speed limits.

4.1.9.4 Protection of water courses

- Works located immediately next to or in the vicinity of streams, surface or groundwater abstraction areas
- Measures incorporated at bridges crossings to reduce sediment release
- Measures to prevent blockage of culverts
- Fuel storage tanks status
- Waste water discharge status
- Waste water effluent treatment status
- Evidence of surface water pollution
- Indications of groundwater contamination.

4.1.9.5 Waste Management Plan

- Waste containers suitably stored, labelled and separated
- Hazardous waste substances including oil drums properly recorded, stored and banded
- Appropriate storage of hazardous substances
- Incinerator operation progress

- Landfill:
 - Construction progress (earthworks, liners, berms, fence, etc.)
 - Operation progress (quantities of domestic, hazardous waste disposed)
 - Water Monitoring status (samples, analysis).

4.1.9.6 Land use

- Cleared surfaces adequately protected from erosive actions
- Worksites adequately drained
- Vehicle movements restricted to sites and access roads
- Irrigation channels and drains suitably protected (rice paddies).

4.1.9.7 Reinstatement

- Re-vegetation/reforestation status
- Soil erosion control methods put in place
- Adequate drainage structures put in place and in good conditions
- Natural and agricultural contours restored
- Physical infrastructures, equipment removed
- Landfill decommissioning status.

4.1.9.8 General

- Compliance with regulation
- Good sites Housekeeping
- Chemical and toxic products: Material Safety Data Sheets available for all personal.

4.1.9.9 Documentation

- Is adequate Environment Plan in place (at beginning of works)
- Environment briefings to personal
- Reports and documentation status
- Environment monthly Reports completed
- Environment Incident reporting and debriefing.

4.2 CONTRACTOR Environment Representative

The CONTRACTOR shall define his organisation. It is required that the CONTRACTOR employs on site on a full-time basis an experienced Environment Expert who's CV shall be submitted in advance to the COMPANY for approval.

4.3 Meetings, visits

CONTRACTOR shall fully participate in any Environment Meetings as may be requested by COMPANY. COMPANY and CONTRACTOR shall carry out a joint visit to the various

construction areas in order to evaluate the proper implementation of the EMP, on a frequency that have to be defined (weekly for instance).

4.4 Inspections

If requested by COMPANY, CONTRACTOR shall conduct an initial inspection of all areas where CONTRACTOR's personnel are to carry out work prior to the commencement of work and at such intervals as COMPANY may require.

Following each inspection, CONTRACTOR shall submit to COMPANY Contract Representative an inspection report highlighting any areas of concern noted and the corrective actions taken or to be taken by CONTRACTOR.

Alternatively the COMPANY has the right to conduct an initial inspection at any time and shall issue a report to the CONTRACTOR highlighting areas of concern and the corrective actions to be taken.

4.5 Catering/Housekeeping/Accommodation

The CONTRACTOR is in charge of catering and accommodation, etc. He shall ensure:

- That sufficient bottled drinking water is available.
- Food storage, preparation and eating areas are of a good and hygienic standard.
- Suitable toilets, washing and shower facilities are available and cleaned on a daily basis.
- The CONTRACTOR will not accommodate more people in his accommodation quarters than they are rated for or can be reasonably lodge.

4.6 Dealing with local communities

The CONTRACTOR shall ensure sufficient liaison is ongoing with the local communities, in particular to disseminate the necessary environment information and knowledge.

4.7 Site refurbishment

The CONTRACTOR shall ensure that at the end of the Contract the Site is restored to in particular:

- All camps are removed and the areas revegetated.
- The RoW is returned to COMPANY's requirements.
- All waste is removed.

5. Environment protection requirements

CONTRACTOR shall conduct the provision of Services in a manner that will prevent any pollution or damage to the Environment.

Requirements regarding atmospheric emissions, dust, noise, campsites status, land protection and restoration, soil and water protection, and Waste Management are presented here after.

5.1 Atmospheric emissions, dust, noise

CONTRACTOR shall ensure that plant and machinery are well maintained and fitted with MANUFACTURER's noise and emission abatement equipment.

Dust emission from stockpiles, roads or other fugitive sources will be avoided by bowsters water aspersion. In that respect vehicle speed shall be restricted.

Operating hours to be flexible to avoid sensitive receptors during particular periods (ceremonies, festivals, etc.).

5.2 Minimisation of temporary construction campsites impacts

CONTRACTOR shall define precisely the number and location of workers campsites, and the number of people accommodated.

Campsites will be **correctly managed** in order to prevent any damage to the Environment.

Land take for campsites setting will be minimised.

Water intake for camp consumption will be sized and designed in order to avoid any detrimental effect on the local resource, and any conflict for freshwater demands. CONTRACTOR shall provide its own drinking/freshwater supplies.

Black and sewage waters will be properly drained by a dedicated network and collected by septic tanks for treatment before being discharged into the Environment, with respect to the Country and Internationally acceptable standards. The system will be correctly sized according to the number of workers. The discharge (out of any flooding area) shall be located to prevent contamination of downstream water supplies.

Storm waters shall be diverted around the campsite, settlement ponds and erosion protection measures shall be adopted to minimise run-off with high loads of suspended solids.

Domestic waste will be managed according to the Waste Management requirements (see 5.6) and collected into appropriate bins before elimination. Waste resulting from campsites clean up will be disposed properly in the dedicated landfill (see 5.6).

Site refurbishment: the CONTRACTOR shall ensure that at the end of the CONTRACT the Campsites are correctly cleaned up, all waste is removed, and sites are restored to their previous status.

5.3 Land protection and restoration

5.3.1 General pipeline RoW environmental features

For information, the main Environmental Features of the crossed areas have to be highlighted (see conclusions of the EBS and EIA studies).

The results have to be presented on appropriate maps, figures and synthetic charts.

5.3.2 General requirements

The general requirements concerning the RoW construction are as follows:

- Specify the RoW width
- Prior to commencement CONTRACTOR is recommended to take special note of conditions in the area (topography, soils compaction) perhaps with photography
- Restrict vehicle access to designated routes and within pipeline corridor
- Minimise demand for backfill and use approved sources

- Specify the RoW final use: natural vegetation and crops will be replanted within the RoW limits, with the exception of large trees, etc.
- Loss of large trees will be minimised; due care and attention need to be paid to the method used for vegetation clearance, burning is strictly prohibited
- On the RoW stumps will be removed during construction; cleared vegetation to be composted, buried or burned as indicated by appropriate safety requirements. If appropriate providing locals with firewood will be preferred
- All other tracks constructed for access or other purposes, excluding the RoW, will be re-vegetated and reforested to their previous status
- No re-vegetation and reforestation will normally occur on the RoW, apart from steep slope zones in order to ensure stability
- Slopes stability will be ensured, adequate means will be taken to minimise erosion, and drainage systems will be set up for collecting run off waters.

5.3.3 Protection of cultivated zones

COMPANY will define the final destination of land after work completion: restoration, land turned back to their previous original status (cultivation, etc.), reserved land, etc.

Prior to construction, CONTRACTOR will conduct a detailed survey and permitting of the cultivated zones in order to identify potential damages and compensation problems (irrigation systems, dikes, dams deterioration, etc.).

5.3.4 Stability - Prevention of erosion - Drainage

5.3.4.1 Problems identification

COMPANY will identify all the potential problems and risks related to soil stability, prevention of erosion, drainage, etc.

Particular attention shall be paid to steep slopes and run off water collection in case of areas affected by heavy rainfalls events.

5.3.4.2 CONTRACTOR's obligations

CONTRACTOR will undertake a preliminary survey to examine slopes and drainage patterns, and establish erosion risk.

In steep relied areas, CONTRACTOR shall ensure pipe stability by installing appropriate means in line with established pipeline engineering practice and in association with bioengineering techniques (gabions, risberms, rip rap, anchored walls, etc.).

Appropriate longitudinal roads profiles will be used to assist run-off distribution, such as stepped cut and fill.

Construction activities should be located away from watercourses to minimise sediment input. Where this is unavoidable, a buffer zone of natural vegetation should be maintained between the construction and the watercourse.

In steep zones, drainage systems correctly sized (culverts, fascines, pipes, gutters, etc.) will be installed as far as necessary by CONTRACTOR in order to drain the run-off water during rainfall events, and prevent from erosion and soil instabilities due to excessive interstitial pressure **(keep the flow where it would naturally flow)**.

Run off water shall be diverted outside the RoW.

5.3.5 Re-vegetation - Reforestation

5.3.5.1 Application

- Re-vegetation and reforestation will not normally occur on the RoW
The bulk of the pipeline will probably re-vegetate naturally and, by default, the first aim above will probably be realised in all the slash and bamboo areas.
- In very steep areas, compacted sites, and areas with subsoil and rock exposed, natural regeneration will be poor or non-existent in all habitats, except possibly bamboo brakes
On every steep zones (slope > 45°) re-vegetation will be carried out by CONTRACTOR.
- Other temporary access tracks, normally not use in future for pipe inspection, will be re-vegetated and reforested.
- COMPANY will specify the tracks to be kept for future use.
- In some cases specified by the COMPANY, seasonal crops will be cultivated on the RoW; in all cases no trees will be planted.
- COMPANY's approval shall be needed prior re-vegetation and reforestation works.

5.3.5.2 Methods

Re-vegetation works will be carried out by CONTRACTOR by appropriate means. The need of artificial re-vegetation will depend on the aim of re-vegetation, the habitat, and the nature of the substrate that is left after construction works and demobilisation are complete.

Bio-engineering options will be considered. Hydroseeding will be applied on stabilised slopes. On very steep slopes, stabilisation will be enhanced by application of natting or geomatrix technique for soil anchoring, prior to revegetation works.

CONTRACTOR will preserve as far as practicable top soils excavated during construction for future use (spreading and compacting for RoW reinstatement). Top soil must be retained and stored separately (top soils are fragile and will contain seeds and cuttings which will be important factors in natural re-vegetation).

The number of trees cut during construction works will be correctly follow up by the CONTRACTOR.

CONTRACTOR will have to carry out tree plantation in areas where deforestation occurred. CONTRACTOR will have to install and design a tree nursery correctly designed and sized according to the extend of reforestation works.

5.3.6 Borrow pits - Spoil tips

CONTRACTOR will set an adequate materials management and planning in order to minimise the number of borrow pits and spoil tips.

Stockpiles need management, treatment and stabilisation subject to location, duration of storage, prevailing seasonable conditions during storage period.

Reinstatement of excavations will be completed after construction works completion.

5.4 Soils and waters protection

5.4.1 Protection of water resources

- **Water intake** will be sized and designed in order to avoid any detrimental effect on the local resource, and any conflict for freshwater demands.
- **Water discharge** shall be located to prevent contamination of downstream water supplies.

5.4.2 Storage tanks

In order to protect soils and ground waters, any diesel, fuel or chemical product tank will be installed by CONTRACTOR with a retention system in order to contain any liquid leakage. The retention capacity will be (see **GS EP ENV 210**):

- For one tank: 100% of the total volume
- For several tanks: 110% of the largest tank volume, or 50% of the total tanks capacity.

The retention system will be composed either of:

- A metallic skid base plate
- A retention bounded by a dam, with a tight liner at bottom.

The retention will be equipped with suitable drain valves. Draining procedure will be set, checked and instructions given to the operators.

CONTRACTOR will provide the operators with collection device (drip pan, bucket, sorbent pads or pillows) to face eventual leakage that may occur during refuelling or tank emptying operations.

5.4.3 Effluents discharge

- **Black waters and sanitary effluents** from campsites will be collected and treated in septic tanks before being discharged into Environment (see 5.2).
- **Pipe commissioning operation:** water used for the pipes hydrotesting may contain a significant amount of dissolved iron and pollutants such as bactericide, corrosion inhibitors, oxygen scavenger.

Only seawater will be used. Low toxicity and bio-degradable products will be first preferred by CONTRACTOR. Products Material Safety Data Sheet shall be provided by CONTRACTOR, and available on Worksite.

CONTRACTOR will carry out hydro-tests in such a way to avoid any discharge in the rivers (hydrotests conducted by sections from land to sea if possible).

The waters will be finally discharged into the sea near the landfall location, at a sufficient minimum distance from the shore in order to avoid any pollution of the coast line. The **minimum required distance is 100 m** offshore from the tie-in point to the sea, the discharge shall occur during high tide to enhance water dispersion.

5.5 Polluted soils remediation

CONTRACTOR shall immediately clean up any and all pollutants, which are discharged accidentally.

If an incident were to impact the soil quality, the polluted soils will be removed, transferred and disposed into the hazardous landfill facility for lime stabilisation.

If an existing pollution were to be found during excavation, polluted soils shall be stabilised and disposed in the hazardous landfill facility.

- Any soils polluted by hydrocarbons will have to be stabilised by mechanical mixing with lime, prior being disposed into the hazardous landfill, the **lime proportion requirement being 15% in weight**.

5.6 Waste management

CONTRACTOR shall ensure that all waste products, including wreckage and debris resulting from or in connection with the provision of Services, are disposed of in a healthy, safe and environmentally responsible manner.

CONTRACTOR shall ensure that suitable arrangement are in place for the handling and disposal of all types of waste. In particular this shall include proper segregation and treatment means.

5.6.1 Waste segregation

CONTRACTOR shall minimise the waste production quantities as far as practicable.

Waste will be collected, and segregated according to the following categories:

- **Inert waste:** excavated material, topsoil, wood debris, etc.
- **Recyclable and reusable waste** (wood debris, iron and steel scraps, etc.)
- **Domestic Waste** must be segregated into:
 - Burnable (paper, cartoons, wood, etc.): can be burnt on site but must in a safe and controlled manner.
 - Non Burnable: to be disposed of in a proper and controlled manner. Dumping in the sea/river is prohibited.
 - Degradable i.e. food, can be disposed of locally.
- **Hazardous and Toxic Waste:** Batteries, Maintenance Waste (painting packaging, etc.), lubricating oil, etc.

All the above wastes are to be segregated and treated of in a proper and controlled manner, described here after.

5.6.2 Recycling - Reusing

First of all CONTRACTOR will recycle, reuse waste as much as possible, depending on local available conditions. This will apply for instance for wood, iron and steel scraps debris, batteries, empty drums, etc.

Recyclable waste will be collected and stored in appropriate bins and containers.

Empty drums will be completely drained and cleaned before being compacted and scrapped.

5.6.3 Waste treatment

Temporary stockpiles can be implemented for inert material disposal.

Two treatment process will be supplied by the CONTRACTOR for waste elimination: **a burning/incineration device, and one licensed landfill facility**. Under no circumstances is dumping locally or in an uncontrolled manner allowed.

5.6.3.1 Inert waste (material) temporary stockpiles

Excavated materials shall be temporarily stockpiled if required for backfill or construction purposes and disposed in approved locations. Stockpile erosion shall be prevented by use of drainage control, vegetation and/or geotextile.

Topsoil shall be stockpiled to less than 2 m high to reduce risk of damage to soil structure fertility.

5.6.3.2 Incineration, burning device

A field simple **incinerator or burning device** will be provided by the CONTRACTOR, after COMPANY's approval. This process, able to burn liquid and solids in a safe and controlled manner will apply to:

- Engine lubricating oil in priority
- Burnable non toxic chemical waste
- Burnable Domestic Waste.

Waste able to generate toxic smokes during combustion will not be allowed in the incinerator. No chlorinated solvents base waste will be allowed.

The resulting ultimate ash will be disposed in the landfill (see here after).

5.6.3.3 Landfill facility

(refer to **GS EP ENV 421**)

The COMPANY requires the installation of **one secure dedicated licensed Landfill Facility**, able to accept Inert and Domestic Waste, and Hazardous Waste (see figure ...).

Only one landfill site will be constructed for the disposal of all the waste generated by the pipe construction, no other landfill site will be allowed.

5.6.3.3.1 Waste admitted

The landfill will be divided into two distinct compartments:

- Domestic and Inert Waste compartment: Domestic waste, food waste, paper, cartoons, ash residues from burning, inert waste, glass, biodegradable waste, non spoiled packaging, etc.
- Hazardous Waste compartment: Maintenance waste, painting and chemicals packaging, spoiled stabilised soils and residues, batteries, etc.

No hazardous liquid waste will be allowed.

No other waste than those concerned by the Services will be allowed.

5.6.3.3.2 Location

The landfill location requirements are as follows:

- Non inhabited area (minimum 500 m from the nearest habitations)
- Preferably set on a hill cut
- Site installed above the groundwater table
- Non flooded area
- No ground waters catchment area
- Absence of surface stream, even intermittent.

The landfill will be designed in order to minimise the visual impacts. A fence will be installed to prevent from undesirable intrusion.

The site final location shall be submitted in advance to the COMPANY for approval before any construction works.

5.6.3.3.3 Capacity

The total maximum capacity of the two compartments will be determined according to the expected waste quantities.

Top soil excavated during the construction earthworks will be carefully preserved and reuse for the final cover of the landfill.

5.6.3.3.4 Design

- Basement - Tightness
 - The basement of the Domestic Waste compartment will be composed of a 0.50 m thick compacted clay layer, a geotextile sheet, and a thin layer (0.20 m) of bulk material (Fig. ...).
 - The basement of the Hazardous Waste compartment will be composed from bottom to top (Fig. ...):
 - . 0.50 m of a compacted clay layer, permeability = $1E-09$ m/s
 - . A 2 mm thick HDPE liner
 - . A 0.20 m thick sand/gravel layer
 - . A geotextile sheet.

- Cover

After operation, the landfill will be entirely covered by a 0.20 m layer of clay material, then by 0.20 m of top soil. A slope will be shaped in order to divert waters at the periphery of the landfill.

The cover will be re-vegetated by common grass.

- Drainage

Construction works being performed during the dry season, no leachate production should be expected in the landfill. However, if any leachate were produced punctually (heavy rain

episode), polluted effluent shall be recycled into the landfill to avoid any dispersion into the Environment, and dams installed to prevent from leaks.

A peripheral ditch will be installed around the landfill in order to collect and derive the run off waters towards the general surface network.

- Operation

Waste will be checked on a dedicated area for control and dispatching into the corresponding compartment.

Operation will be conducted by successive overlaying layers.

5.6.3.3.5 Water quality monitoring

Water samples will be collected in downstream surface waters (two sampling points being approved by COMPANY) for laboratory analysis. The frequency will be:

- One sample before landfill construction (baseline condition)
- Operation phase: two times a year (dry season and rainy season)
- One after landfill decommissioning.

The parameters to be determined are: pH, Eh, temperature, conductivity, Total Organic Carbon, DBO(5), Total Hydrocarbons, N total, ammonium, P total, metals (Pb Zn Cu Ni Cr Fe As Co Hg).

Analytical methods will be derived from International Standards (US EPA, ISO, French NFT, etc.) and submitted for COMPANY's approval.

The results shall be transmitted to COMPANY.

5.6.3.3.6 Decommissioning

After landfill operation CONTRACTOR shall entirely cover the two compartments, ensure that the landfill site is correctly cleaned up, no waste is remaining, and control that the permanent run off drainage system is operational. The site will be closed with the existing fence.

The landfill final location map with appropriate co-ordinates will be provided by CONTRACTOR to COMPANY.

5.7 Fauna, flora protection

CONTRACTOR shall minimise disturbance to flora and fauna.

Hunting and fishing by CONTRACTOR's workforce will be prohibited.

5.8 Providing equipment for fighting pollution

In case of emergency, CONTRACTOR will provide adequate procedure and equipment to tackle any pollution that may occur for instance during refuelling or maintenance operation: drip pan, bucket, sorbent pads and pillows, etc.

Spoiled soils that may result from incident will be treated according to the requirements mentioned in 5.4.

5.9 Respect of socio-cultural traditions

CONTRACTOR shall avoid any disturbance related to socio-cultural sites and activities: archeological sites, cultural events, religious practices, religious sites, sanctuaries, etc.

6. Environment incentives and penalties

6.1 Incentives

Prior to work starting on site the CONTRACTOR and COMPANY shall agree on an Environment Incentive scheme. A series of objectives shall be agreed upon and a marking/scoring system defined. If by the end of the Work these objectives have been met then COMPANY will pay an agreed amount to each of the CONTRACTOR's and SUB-CONTRACTORS work force.

6.2 Penalties

The COMPANY wishes to ensure that no fatalities occur during this contract on site and therefore will impose a penalty on the CONTRACTOR should there be one or more fatalities. If, as a direct consequence of a work-related accident, there is a single fatality the CONTRACTOR shall pay to COMPANY an agreed lump sum, which shall be equivalent to a percentage of the Total Value of the Contract. For each subsequent fatality he shall pay an additional percentage of the Total value of the Contract. The CONTRACTOR's maximum liability shall be a percentage of the Contract Value.

To clarify this matter there must not be a fatality to either:

- A CONTRACTOR's employee, agent or servant
- A SUB-CONTRACTORS employee, agent or servant
- A Member of the General Public (caused directly by either the CONTRACTOR or SUB-CONTRACTOR's).

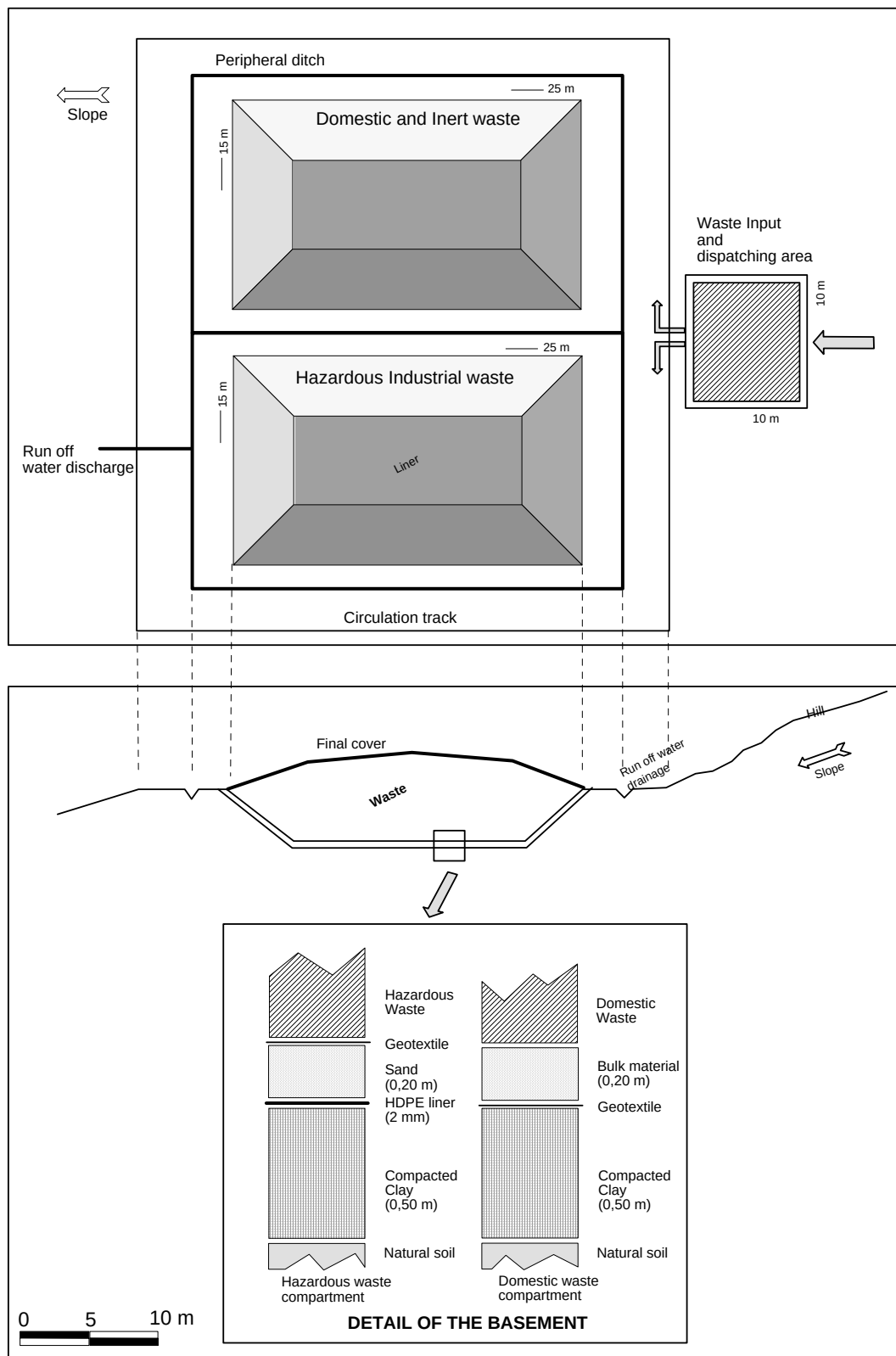


Figure 4 - Landfill facility - General layout