



Exploration & Production

GENERAL SPECIFICATION

ENVIRONMENT

GS EP ENV 111

Environmental Baseline and Monitoring Studies: Onshore Sites

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1. Scope

The purpose of the present General Specification is to define the technical instructions for compiling a detailed Scope of Work in order to establish the reference environmental status or to carry out environmental monitoring of an onshore site.

This General Specification is the minimum standard required by Company. It should be adapted to each project in order to define a particular specification or Scope of Work.

Additional requirements from the local authorities shall be taken into account.

This General Specification defines the content of the study and its organization, progress, content of the different phases and deliverables.

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
Rio Convention	Convention on Biological Diversity (United Nations, 1992)

Codes

Reference	Title
Not applicable	

Other documents

Reference	Title
Not applicable	



Total General Specifications

Reference	Title
GS EP ENV 001	Environmental requirements for projects design and E&P activities
GS EP ENV 011	Environmental specifications for onshore pipeline construction
GS EP ENV 112	Environmental Baseline and Monitoring Studies: Offshore and Nearshore sites
GS EP ENV 120	Environmental Impact Assessment of E&P activities
GS EP ENV 501	GIS deliverables for HSE
GS EP SDV 101	Social Baseline Study

3. Terms and definitions

For the purpose of this document, the following definitions apply:

Coastal area refers to a distance of a few hundred meters inland starting from the lowest low-tide point.

Nearshore or coastal water: in the absence of more stringent local regulations, nearshore or coastal water starts from the lowest low-tide point and extends up to 3 nautical miles towards the sea.

Onshore or terrestrial means on land.

Offshore means situated at sea some distance from the shore and beyond the 3 nautical mile coastal water limit.

The **sensitivity** is the degree to which a **system** may be affected, directly or indirectly, by a perturbation (i.e. potential consequences based on its intrinsic physical, biological and socio-economic characteristics).

System includes areas with ecological or economical importance, such as protected areas or sensitive ecosystems such as mangroves, peat bogs, fishing areas, areas of tourist interest, etc.

The **vulnerability** is the degree to which a **system** (ecologic, socio-economic) is susceptible to, or unable to cope with a perturbation. The vulnerability relies on the sensitivity of the **system**, on the nature, extent, rate of the perturbation, and on the capacity of the **system** to recover from the effects of the perturbation (also known as resilience).

For other definitions or acronyms, refer to Appendix 1 and **GS EP ENV 001**.

4. Objectives of environmental baseline and monitoring studies

The objective of the Environmental Baseline Study (EBS) or reference status of an onshore site is to describe, before starting any new E&P project, the physic-chemical, biological and general socio-economical characteristics of the site and highlight its main sensitivities. Any existing pollution shall be identified and clearly assessed, in particular that which is related to oil industry activities. The EBS shall also provide an evaluation of the capacity of the disturbed environment for natural self-restoration.

The EBS includes both a bibliographic study and a field survey.

The EBS shall provide all the factual elements and parameters to support completion of an Environmental Impact Assessment (EIA) of the project to satisfy the **GS EP ENV 120** requirements.

The mapping of the sensitive areas should be used as the basis to develop an accidental spill prevention and intervention plan.

The objective of the Environmental Monitoring Study (EMoS) is to assess the site conditions at regular intervals during the operation phases or after the end of activities and to compare to the original reference status.

5. Responsibilities

The appointed Company Representative shall be approved by Company Headquarter EP/HSE/ENV.

The Company Representative is responsible for coordination between the parties involved:

- Company headquarter departments (HSE/ENV, HSE/SUR, EP/OPS/LSO)
- The entity responsible for the Project.
- The affiliate HSE, Environment, Security, Logistics departments, and site RSES.
- The Contractor selected to carry out the study.
- Local Authorities and any International Organizations involved.
- Local community(ies) and associations.

The Company Representative is also responsible for:

- Adapting, if necessary, the scope of work or particular specification to the local conditions and to the characteristics of the project,
- Providing all in-house available information,
- Defining a tentative schedule and approving the final schedule of the study,
- Approving the choice of the logistics means, survey team and laboratory(ies) in charge of the analyses,
- Supervision of the field survey,
- Deciding on the final choice of survey routes, areas to be investigated and sampling locations,
- Approving methods and equipment for sampling, in situ analyses, storage, packaging and shipment to Laboratories,

- Deciding to analyze part or all of the samples recovered and approving methods for analysis,
- The validation of the Contractor's deliverables.

The Contractor is responsible for:

- Proposing a schedule for the study,
- Carrying out the bibliographic study,
- Proposing a preliminary sampling plan,
- Obtaining all the necessary authorizations from the Local Authorities,
- Ensuring at his own cost the health, safety and welfare of all personnel involved in the work ,
- Providing all the necessary equipment for the sampling campaign, and the certificates of conformity/calibration of the equipment,
- Providing the positioning equipment and ensuring it is in good working order during the entire survey duration,
- Carrying out the field survey,
- Selection of the accredited laboratory(ies),
- Performing the in situ and laboratory analyses, equipment calibration, and quality control,
- Ensuring full quality control for sample recovery, storage,
- Ensuring the correct packaging and shipment of samples and that samples are received in good condition by the selected laboratory(ies),
- The interpretation of the results,
- The deliverables and results integration in a GIS (Geographic Information System).

Excessive out-sourcing should be avoided but the Contractor may use dedicated external consultancies or scientists from institutes and specialist laboratories for detailed or special analyses with the agreement of Company.

Integration and participation of local personnel in the field team should be considered (Local Authorities representatives, scientists, experts, etc.) and the choice of participants shall be approved by Company.

6. Organization of the study

6.1 General content of the study

The study consists of:

- **A bibliographic study** of all available documents (previous studies, maps, remote sensing studies,...) in order to identify the specific concerns of the type of environment,
- **A field survey** ("ground truthing") in order to acquire the environmental and general socio-economic data necessary for the study, including in-situ analysis, taking pictures,

collecting samples of the different representative media (soil, air, water) as well as the flora and fauna, ...

- **Laboratory analyses,**
- **An interpretation** of the results, field observations, in-situ and laboratory analyses, data from the bibliographic study...
- **Deliverables preparation** (production of a stand-alone document or in some cases limited to a section in the contents of the EIA).

6.2 Schedule

Company defines a tentative schedule including:

- The date of the contract award,
- The estimated date for start-up the study,
- The time required for the acquisition of bibliographic data,
- The time necessary for personal and equipment mobilization/demobilization,
- The estimated duration of the field survey and the administrative authorization,
- The dates for deliverables issues.

The survey duration is adapted to the specificity of the study. In some cases the field survey may need to be split in to several phases in order to take into consideration particular local situations (regulations, site access, climate, seasons, logistics, etc.).

The final schedule of the study is approved by the Company Representative before starting any work. Any change in the work to be done or schedule shall also be approved by the Company Representative.

6.3 Field survey organization

The following minimum information (as an information, a model form is provided in Appendix 2) shall be submitted by Contractor to the Company for approval, before the field survey mobilization, to help for the selection of the sampling locations and survey routes:

- A short description of the main characteristics of the concerned area (geography, meteorology, water resources, archaeology, protected areas, sensitivities,...),
- Valid maps, directly usable for the field survey,
- A proposal for the site study perimeter, route and sampling locations,
- A list of bibliographical references and local contacts.

During the field survey, the route and the investigated areas shall be plotted on maps on a daily basis and, if possible, in real time.

6.3.1 Field survey team

The personnel should include:

- From Company:
 - A Company Representative or mandatory expert,

- One or several other project representatives (Optional).
- From Contractor (indicative list to be adapted according to the project and the specific characteristics of the site):
 - One senior Project manager,
 - Biologist(s), specialized in the type of environment concerned (desert, arctic region, tropical forests, etc.),
 - One hydrologist or hydro-geologist,
 - One archaeologist (in some countries the archaeologist should be registered/approved by the local Authorities).

Local experts (archaeologists, scientists, socio-economic, etc.), representatives from local Authorities or project partners may be integrated in the survey team on Company request or local authorities' requirements.

The role of the various participants shall be clearly defined, particularly for:

- Sampling decisions and procedures,
- Samples treatment, preservation and transportation,
- In situ analysis.

6.3.2 Logistics

Logistics strongly depend on the environmental context and local conditions.

Logistics, safety and security arrangements shall be submitted to Company for approval.

In areas of political instability or local conflict, team security arrangements shall be considered and approved by Company.

Any logistics used for personnel local transportation (helicopter, vehicles, planes...) shall be in accordance with Company safety requirements.

A short duration **helicopter (or small plane) survey** can be proposed for a preliminary survey of zones with particularly difficult access, with approved landing points for observation.

Logistics (accommodation, food) should be entrusted to approved local agencies (Tour Operator, oil logistics support Company) with a good knowledge of the area. Existing or temporary base camps can be used for accommodation.

In difficult access zones, surveys may be carried out by foot by competent person. Rock climbing or speleological survey details shall be submitted to Company for approval.

All access routes shall be selected in such a way as to preserve the environment (no land clearance, no use of mechanical bulldozers) and ensure employees' safety.

6.3.3 Equipment

Only equipment which has been properly calibrated and is in perfect working order shall be supplied by the Contractor. Its correct functioning shall be demonstrated in the presence of the Company Representative before the survey starts.

Any equipment modification shall be justified to and approved by the Company.



As an information, an indicative list of equipment is provided in Appendix 3. Spares shall be provided.

6.3.4 Samples collection, storage and transport

A record of each sample collected shall be established by the Contractor, with all useful details and information (number, date, time, sampling location, nature, description, measurements, etc.). It is checked and validated by the Company Representative (as information a typical record format is provided in Appendix 4).

On a case-by-case basis, it may be required to duplicate the samples to provide against any loss during transport or for Quality Control. Any duplicate samples shall be carefully identified.

The samples shall be conditioned (packaging shall be adapted to the type of analysis), kept in a cool box during the survey, clearly identified, and stored properly to avoid any disturbance or alteration during transport to the laboratory.

6.4 Laboratory(ies) selection

The Contractor shall provide all data concerning:

- References and certifications of the laboratory,
- Methods and norms used by the laboratory for analyses,
- Laboratory QA/QC procedures,
- Available laboratory equipment,
- Laboratory Personnel list with qualifications, specifically for detailed analyses such as benthic taxonomy...

Company reserves the right to audit the laboratory for validation.

All the samples collected shall be kept for at least three months by the Contractor after delivery of the final report and shall not be disposed of without Company formal approval.

6.5 Deliverables

Any information shall be provided in the geodetic system specified by Company in the particular specification.

The following deliverables shall be provided:

- **Daily report sheets,**
- **A Field Survey Report,** on completion of the field work before the demobilization of personnel and equipment,
- **Draft and Final EBS or EMoS reports** after completion of the survey and final analysis,
- **A Photo catalogue database,**
- **GIS Data and Project.**

The schedule and number of copies of the Reports shall be defined in the particular specification by Company.



In addition to classical paper print-out, reports, illustrations, maps, photos, analytical results, etc., shall be delivered in electronic format in :

- Word® for texts.
- Excel® for analyses results, tables and charts.
- ArcGIS® (compatible with ArcGis 9.2 version from ESRI) for maps and layouts.
- Photo catalogue database compatible with ArcGIS.

Electronic models provided by the Company shall be used.

6.5.1 Field reports

Daily report sheets (as an information a model is provided in Appendix 5) shall be prepared by the Contractor and based on the factual elements collected during the field survey (routes, access, noteworthy events, samples locations, observations, interviews, incidents, photos, videos, etc.) then checked and validated by the Company Representative.

Any particular event which could have an impact on the site status shall be duly recorded and taken into account (e.g. human activities, field exploration work such as seismic surveys, drilling operations, etc.).

After completion of the field survey the Contractor shall present the preliminary result to Company for comments.

The Field Survey Report shall include at least:

- The schedule and list of participants,
- A full description of equipment and methods used for sampling and observations,
- A synoptic chart of the samples taken (number, date, coordinates, description, etc.),
- A positioning map of the sampling stations and routes,
- A compilation of the daily report sheets, samples records, in-situ analytical results and interview recordings (attached in the appendix of the Field survey report),
- A preliminary interpretation of the survey.

6.5.2 EBS and EMoS reports

The typical report contents are detailed in Appendix 6.

The report shall give a synopsis of the different phases of the study, including the bibliographical study and field survey works description and also present the analyses results and their interpretation.

The report shall include an executive summary-conclusion. It shall be written in a clear concise style which is easily usable, with maps, charts, diagrams, graphics and significant photos.

The report shall include all the documentary elements, field survey and laboratory results.

The interpretation methods shall be clearly specified (statistical analysis, diagrams, graphics, etc.).

The various ecosystems shall be identified and located on maps.

Any soil or water contamination by pollutants shall be indicated, as well as the possible source of pollution.

Clear synoptic charts and thematic maps shall be provided (water resources, vegetation, archaeology, agriculture, local constraints, human and socio-economic aspects, etc.).

A global synoptic map shall detail the **sensitive** and **vulnerable** zones to pollution on which the impact study will focus.

All analyses results shall be provided using the Excel model provided by Company.

Recommendations, on the following points, shall be highlighted in the final report:

- Possible further investigations,
- Points to be examined in detail in the EIA,
- For a monitoring program with relevant biological indicators to be taken into consideration for future site bio-monitoring during operations.

A draft of the final report shall be submitted to the Company for comments and approval. After receipt of the comments of the Company, the Contractor shall revise the draft report accordingly.

6.5.3 Photo catalogue database

Photos shall be taken with equipment which ensures a good quality output for future publication.

The photo catalogue database, or as a minimum an Excel file, should include the following:

- Name of the photo and site location, GPS coordinates, azimuth, owner of the photo, date, short description and key words.

6.5.4 GIS deliverables

All maps and georeferenced data (sampling locations, results, observations,...) and interpretations (thematic maps, sensitivity maps,...) shall be provided under GIS format (according to the **GS EP ENV 501** requirements).

7. Bibliographic study content

The bibliographic study shall be based on the available documentation relating to the various disciplines involved and to the remote sensing studies.

The aim of this study is to provide information on site sensitivities, which shall be verified by the field survey (ground truthing).

It shall focus on the following key aspects:

- **Historical study of site activity:** pre-existing installations (including underground or adjacent), identification of any existing contamination of the site related to past or present industrial, or urban activity (mainly hydrocarbons and heavy metals),
- **Sensitive zones and protected areas:** any particularly sensitive zones shall be identified and located, and their vulnerability to pollutants shall be documented,
- **Climatology:** temperature, rainfall, frost and snow cover periods, winds,

- **Physical and geographical context, access:** landscapes, topography, roads, access to sensitive areas,...
- **Geology, pedology, geomorphology:** soil and rock types, structural context, neotectonic indices, mineral resources,
- **Hydrology, Hydrogeology:** hydrographic network, surface water (flow rates, river quality and objectives, existing contamination,...), catchment areas, water resources and vulnerability, water use (food, agriculture, washing, etc.),
- **Natural hazards:** seismicity, lack of ground stability, erosion, flooding, etc.,
- **Biological environment:** ecosystems, fauna, flora, biodiversity,
- **Socio economical general context:** population, density, economical activities, soil occupation, etc.,
- **Archeological general context.**

The results of this bibliographic study shall be synthesized and compared to the field survey results in the final report.

8. Field survey works

8.1 General

The geographical boundaries and coordinates of the area to be studied (block limits, provisional pipeline route, plant facility map and possible extension, etc.) is approved by the Company Representative.

The collection of baseline and monitoring field survey data shall be adapted to the characteristics of the onshore local environment (refer Appendix 7) :

- The type of ecosystem shall be characterized.
- Biological characterization is essential in the case of virgin sites.
- In the case of urban sites or sites with economic activities, the study focus on any existing oil industry origin pollution (hydrocarbons identification and fingerprinting).
- In the context of a protected area (for example a tropical forest classified by IUCN), the baseline study shall focus on characterizing the main ecosystems, their functioning and vulnerability and shall identify the authorized activities in the site perimeter. Endangered species should be identified as well as the richness of the natural environment.

Monitoring survey samples should be collected at the same locations as for the baseline survey or at selected representative locations to allow comparison and to assess the impact of the E&P activities by following specific indicators (e.g. Ba, PAH, ...).

Appendix 8 and Appendix 9 provide as information indicative lists of the data to be collected and typical concerns and recommendations.

8.2 Preliminary survey - Overflight

For linear facilities (pipeline, Right Of Way, tracks) a preliminary overflight of the zone may be necessary. It can be performed with a helicopter or a small plane to provide a basis for setting up the field survey.



Survey routes shall be plotted on maps to facilitate flight monitoring.

Flight survey photos shall be taken and coordinates marked accurately; a video film can also be taken.

8.3 Positioning – Geographic coordinates system

Sampling locations, route coordinates and altitudes shall be measured, with an accuracy of approximately 15m, using, as a minimum, a portable GPS. Coordinates shall be expressed in WGS 84 system even if the Company official coordinate system for engineering is different in the area of interest. Before measuring the geographic coordinates (longitude, latitude), GPS receiver parameters shall be checked by the Contractor and approved by Company.

Contractor shall ensure that the positioning equipment is in good working order during the entire survey duration.

8.4 Soils and sediments sampling

8.4.1 Sampling locations

The soil sampling pattern may be random, or regularly plotted (square grid or transects) according to the project features. It shall be established, before starting the field survey, considering the following requirements:

- In the case of an oil or gas plant project, the sampling stations shall be positioned as follows: a reference sample shall be taken in a virgin area where no industrial facilities are present (background level). This position shall be located up stream and up wind of the planned site. It shall act as a reference monitoring point for scheduled operations.
- Sampling points shall be located on future, or close to existing, vulnerable points, such as storage tanks, water treatment stations, oil water separator, water or effluent basin, discharge zone, unloading area etc.
- Alluvial sediments shall be sampled in streams and rivers if any, upstream and downstream of the planned site.
- In case of a pipeline route (or other linear structure) the sampling points shall be located regularly (e.g. every 20 km, depending on the total length), and in zones representative of each type of landscape (valley, river crossing, foothill, plateau, plain, mountain, agricultural areas). All geotechnical information and reports shall be also considered.
- In other cases, the sampling pattern may be random, or regularly plotted (regular square grid, or transects) according to the project features.

In case of heterogeneous sites, it is recommended to distribute the number of sampling points in proportion to the surface area of the each zone type.

To improve geostatistical treatment for comparison in the future, sampling should be as exhaustive and regular as possible for consistency, validity and representativeness (case of an existing industrially contaminated site).

8.4.2 Sampling methods

Soil samples shall be taken from the surface, after quick stripping of the top soil. Indicative sampling depth is around **10 to 20 cm**. Each sample shall be made by **homogenization of 3 to 4 samples** taken in an area of several square meters.

River bed **sediments** can be sampled by various means, depending on water depth (from small boats if necessary, with plastic tubes, or sediment cores, or simple manual scoops).

In case of deeper sampling (one meter), a manual auger or manual corer should be used. A geological log should be recorded (lithology, texture, organoleptic indices, etc.).

Depending on the context (pollution characterization horizontal and vertical extension), a mechanical excavator or core-drilling equipment can be used to investigate greater depths (down to 4 meters). Particular care shall be taken not to impact underground facilities. Excavations shall be carefully refilled after investigation. This method shall not generate visual impact in the environment and landscape. At least one sample per 1 meter depth should be taken (to be adapted in case of lithological changes).

Light **drilling methods** can be scheduled by Company in some particular cases (mechanical auger, core drilling). One sample per 1 meter depth shall be taken and adapted in case of lithology changes.

8.4.3 In situ analysis and observations

In case of soil with mixed granulometry, the fine fraction shall be sampled (big blocks being avoided). Full samples shall be taken for further granulometric determination.

Each sample shall be labelled and numbered. A photo shall be taken for each sample.

The following minimum information shall be gathered and recorded: sample coordinates, sampling depth, sampling technique, general aspect, lithology, texture, calcification, hardness, Redox potential, packing, photo.

The use of analytical field kits, as portable photoionisation detector (PID), shall be submitted to Company for approval. They can be used for preliminary screening or as complementary means, and their results shall be checked by approved laboratory analysis (methodology to be specified).

In specific cases, ambient radioactivity level shall be measured.

8.5 Water sampling

Water sampling program shall be carried out for the following categories:

- Surface water (springs, water courses, ponds, pools, dams, etc.),
- Surface water table (groundwater),
- Deeper aquifers.

8.5.1 Sampling locations

Samples shall be taken upstream and downstream of the site.

Waterholes in the vicinity of the site shall be identified from maps, field observation or interviews.

Samples shall be taken from the surface water and the surface water table, if it can be easily reached. Any existing boreholes or piezometer networks (for example, from a previous geological or geotechnical exploration campaign) can be used.

Existing water wells in the vicinity (within a radius of some five km) shall be identified, characterized and sampled. Drilling of monitoring wells may be necessary to assess the quality of the groundwater.

In the case of a pipeline, any water wells located within a radius of about one km of the pipeline route shall be identified and the most relevant shall be sampled.

8.5.2 Sampling methods

Surface water: a sampling bottle shall be immersed in the water. The type of water shall be recorded (temporary, stagnant, permanent, spring, reservoirs made for water collection, dam).

In an urban context, waste water (drainage, industrial discharge) shall also be sampled for analysis.

Shallow wells: sampling with a one litre capacity plastic bailer (single use) run in with a clean rope. Data shall be acquired regarding water well use, depth, static level.

Deep water wells: sampling if possible using existing pumping means (submersible or surface pump). A preliminary pumping operation shall be performed to purge the borehole and measure the flow. Information concerning water use should be collected in addition to the borehole characteristics (age, depth, static level, diameter, completion, filters position, cementing, tubing, available flow rate, water use, etc.).

Water samples shall be packed immediately in suitable containers, adapted to the parameters to be analyzed in the laboratory, numbered and stored.

One photo shall be taken for each sample.

The following basic information shall be gathered and recorded: sample coordinates, sampling depth, sampling method, precipitates, odour, bacterial aggregates, algae, gas bubbles, packing, photos.

8.5.3 In situ physic-chemical measurements

As a minimum, the followings (non exclusive list) shall be measured in-situ and recorded:

- Temperature,
- pH, Eh,
- Salinity,
- Conductivity,
- Dissolved oxygen,
- Turbidity,
- Observations: smell, gas bubbles, algae, iridescence, bacterial aggregates, precipitates.

8.6 Air measurements

The air quality of the site shall be evaluated with passive air captors (duration depends on captor type but usually for approximately one week) in order to determine the background level or as per local environmental regulation. The following parameters (indicative list) shall be measured and the equipment specified: NO_x, O₃, SO₂, COV, H₂S, CO, etc.

The solid particles content can also be determined on request.



Three measurement stations shall be placed in a line oriented according to the most dominant prevailing winds: up wind, on site, downwind, the indicative height of the captors is from 1 to 5 meters above ground level.

All information during the measurement phase shall be recorded: sample coordinates, sampling elevation, vehicle traffic, human activity, engines running, etc.

The measurement should be taken during a representative period of activity.

8.7 Noise measurements

When necessary, measurements of background noise level (daytime and night) shall be performed on the surveyed site, and recorded, during a representative period of activity, according to the method required by **GS EP ENV 001**.

8.8 Biodiversity

Biological analyses shall be statistically interpreted in order to give a global image of the studied ecosystems: abundance, specific resources, diversity and equitability indices.

The adopted methods shall be indicated and the results presented graphically.

It may be necessary to repeat the survey at different period of the year in order to assess the global biodiversity of the areas, at least during seasons.

The sensitivity of the different species (e.g. Endangered,...) shall be assessed. Endangered species should be identified as well as the richness of the natural environment.

8.8.1 Vegetation

The various plant species shall be characterized in terms of diversity. Special attention shall be paid to identifying any endemic, rare or endangered species, particularly those sensitive to changes in environmental conditions. Interviews with local inhabitants, etc., may be carried out for this purpose.

Plant species distribution and their association with each kind of environment shall be determined (valleys, slopes, foothills, mountains, plateaus, humid zones, high altitudes).

Bioindicators (e.g. lichens) shall be identified for future monitoring surveys.

A reference herbarium can be constructed, for future identification by national experts of the considered zone, and be archived in the country, in accordance with the **Rio Convention**, and with Company approval. Any export of herbarium shall strictly satisfy the regulations in force.

Photos shall be taken and sketches drawn of the different identified species. A photographic herbarium can be an alternative.

8.8.2 Zoology

Identification shall focus on rare or endangered animal species, which could be affected by the project in terms of habitat and breeding conditions.

Vertebrates shall be identified in priority (mammals, reptiles, birds, etc.) by direct or indirect visual observations and interviews with local inhabitants.

Migration corridors for birds, nesting areas and periods for birds, reptiles, amphibians, etc. should be detailed and plotted. Nocturnal animals like bats for example should be also identified.



Bioindicators (e.g. beetles, butterflies...) should be identified during the baseline study and controlled during monitoring surveys.

8.9 Archeological and cultural context

When necessary, the investigation perimeter shall be submitted to Company approval before starting the field survey.

As a minimum, the area situated within a radius of one km of the pipelines or seismic routes likely to have archeological and cultural remains identified during the bibliographic study, shall be controlled on the field.

Photos and field observations shall be performed (standing stones, sketches of tombs or human dwelling remains, search for pottery or tools, cave drawings, etc.) and geographical coordinates recorded.

Any collection of sample shall be submitted to preliminary Authorities approval.

8.10 Socio-economic aspects

According to the local context, Company may define a specific Social Baseline Study Scope of Work in accordance with **GS EP SDV 101**.

As a minimum, presence of human communities in the vicinity of the project, which could be affected, shall be clearly identified and located, as well as their way of life (means of subsistence, displacements, agricultural activity, and religious practices).

9. Laboratory analysis and methodology

Normalized methods currently in force, and/or according to applicable regulation, shall be used and indicated in the report. Company reserves the right to specify particular analytical procedures.

The number and types of analysis to be carried out shall be defined according to the site sensitivity and characteristics, in particular regarding heavy metals, nitrates, phosphates, hydrocarbons and BTEX. The **analytical target precision** shall be submitted to Company for approval, in particular for groundwater (comparison with potable water standards).

9.1.1 Soil analysis

In addition to in-situ measurements, as a minimum, the following analyses shall be carried out on selected samples with Company approval (indicative list or according to applicable regulation):

Chemical analysis	Method (indicative)
Total Organic Matter (TOM)	H ₂ O ₂ or fire loss (550°C)
Total Organic Carbon (TOC)	Sulfonic Oxydation or combustion after carbonates elimination
Total nitrogen	Spectrophotometry (630 nm)
Total phosphorus	Spectrophotometry (720 ou 880 nm)
Water content	Drying up
Heavy metals : - Ba, Cd, Cu, Pb, Zn, Fe, Co, Ni, V, Cr, Sr, Al* - Hg	On the fine fraction < 63 µm and control on totality: - Spectro with AA - Hg: Atomic fluorescence
Total Petroleum Hydrocarbons (TPH)	Spectrophotometry Infra Red
Mono Aromatic Hydrocarbons (BTEX) (if TPH > detection limit)	Gas chromatography
Polycyclic Aromatic Hydrocarbon (PAH) (if TPH > detection limit)	Chromatography Gas phase and Mass Spectrometry (GC-MS)
Aliphatic hydrocarbons (if TPH > detection limit)	Gas chromatography

* Company may modify the list of heavy metals according to the local context.

The extraction method of the pollutant from the soil shall be specified.

If necessary and at the request of the Company, leaching tests can be performed in compliance with existing standards.

9.1.2 Water analysis

In addition to in-situ measurements, as a minimum the following analyses shall be carried out on selected samples with Company approval (indicative list or according to applicable regulation):

Analysis	Method (indicative)
Total Petroleum Hydrocarbons (TPH)	Infra Red Spectrometry
Polycyclic Aromatic Hydrocarbon (PAH) (if TPH detection limit)	Gas chromatography
Mono Aromatic Hydrocarbons (BTEX) (if TPH > detection limit)	Gas chromatography
Polycyclic Aromatic Hydrocarbon (PAH) (if TPH > detection limit)	Gas chromatography
Suspended matters	Filtering then weighing Centrifugation
Nitrates, nitrites, ortho-phosphates	Ionic chromatography
Heavy metals (if relevant) - Ba, Cd, Cu, Pb, Zn, Co, Ni, Cr, Sn* - Hg	Extraction, then - Inductively coupled plasma atomic emission spectrometer, or - Spectrometry
Bacteriological analysis (coliforms, fecal streptococcus)	To be adapted
TOC, BOD5, COD : if relevant	Approved method
Hydrocarbons fingerprinting : if relevant	Chromatography

* Company may modify the list of heavy metals according to the local context.

In order to measure low concentrations of pollutants, the use of passive samplers may be used.

9.1.3 Ecotoxicity tests

According to analytical results, Company may require a dedicated ecotoxicological test program.

9.1.4 Analysis results interpretation

Analysis results shall undergo statistical interpretation and be presented on clear synoptic charts and using Company electronic file format.

Existing contamination by pollutants shall be clearly identified as well as the possible origin, by comparing the concentrations measured with available norms, regulations and standards (drinking water, WHO values, existing reference values for contaminated soil, etc.).



Bibliography

IMO/IPIECA	Guide for Oil Spill Sensitivity Mapping and its Integration into Preparedness and Response Systems in the West and Central Africa Region – GIWACAF (2008)
IMO/MARPOL 73/78	International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto (MARPOL) and subsequent amendments (2008)
IPIECA	Volume 1: Sensitivity Mapping for Oil Spill Response (1994)
NOAA	Environmental Sensitivity Index (ESI) Guidelines, NOAA , version 3.0, 2002, updated 2009
WCMC/UNEP	World Database on Protected Areas (WDPA) (permanent update)



Appendix 1 Acronyms

BOD	Biological Oxygen Demand
BTEX	Benzene, Toluene, Ethylbenzene, Xylenes
COD	Chemical Oxygen Demand
EBS	Environmental Baseline Study
EIA	Environmental Impact Assessment
EMoS	Environmental Monitoring Study
GIS	Geographic Information System
IUCN	The World Conservation Union
NORM	Naturally Occurring Radioactive Material
OSCP	Oil Spill Contingency Plan
PAH	Polycyclic Aromatic Hydrocarbon
PID	Portable Photoionisation Detector
PCB	Polychlorinated Biphenyls
TOC	Total Organic Content
TPH	Total Petroleum Hydrocarbon
TSS	Total Suspended Solids
UV	Ultraviolet
VOC	Volatile Organic Compounds
WHO	World Health Organisation



Appendix 2 Documentary sheet

Project	Environmental baseline survey Documentary file			Page: /
Client	< Client Identification >			Date:
Internal documents forwarded by Company	Identification (reports, maps, layouts, software files, etc.)			Reference
External documentation	Source			Author
People contacted	Speciality	Organization	Date of contact	
Maps (topography, geological, hydrogeological, etc.)				
Satellite images Aerial photos				
Others				
Meteorological data				
Lack of site data				
Prepared by:	Name:			Date:
	Visa:			

Appendix 3 Equipment list for the survey

In case of any failure and to avoid delaying the survey, Contractor certain items are duplicated.

1. Sampling and measurement equipment

- **Soil**

- Small pick, shovel or metallic scoop (manual)
- Manual auger (indicative diameter 80 mm), depths around 1 m, or manual corer
- Geologist's hammer for hard rock
- Visual charts (texture, grain size, etc.)
- Plastic bags of different sizes (for grain-size determination, archaeological findings)
- Metallic box with cover
- PID field apparatus for VOC soil measurements

- **Water**

- Rubber Gloves (e.g. medical use)
- Single use plastic bailers
- Plastic and glass flasks
- pH, Eh measurement apparatus
- pH paper
- Conductivitymeter
- Oxymeter
- Thermometer
- Ammonia measurement kit
- Others field kits (metals, COD, etc.)
- In situ analyzer (pH, Temperature, DO, Conductivity, Turbidity)

- **Packing**

- Cool box for sample preservation.

- **Air**

- Passive captors, Dräger tubes
- PID field apparatus for VOC measurement in air
- Explosimeter
- Gas detector

- **Noise**

- Suitable apparatus

- **Radioactivity**

- Radioactivity measurement apparatus



- **Biology**

- Small net for collecting aquatic organisms
- Small glass tubes for water sampling and observation of organisms
- Paper sheet and wood press for herbarium

2. Positioning and communication equipment

- Portable GPS (duplicated)
- Mirror
- Maps, aerial photos
- Walkies-talkies
- Radio between vehicles
- Satellite phone

3. Miscellaneous

- Passport, visas
- Field notebook, knife, water resistant pencils, etc.
- Binoculars, geologist magnifying glass
- Photo apparatus, video
- Camping equipment, or bivouac

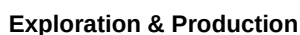
4. Protection/health

- Health and hygiene protection for personnel
- Suitable vaccinations
- First Aid equipment
- Suitable clothing (for cold or hot climates, etc.)
- Individual protection (gloves, sun glasses, shoes, etc.)
- Distress rocket (in desert/sparsely populated region)
- Fire extinguisher (one per vehicle)



Appendix 4 Sample record sheet

Project	Environmental field survey			Page /
Client	< Client identification >		Ech. No.	
Sample	Type:	Soil	Date	
		Sediment	Time	
		Surface water	Weather	
		Groundwater	Temperature	
Coordinates	System	Wind		
	KP	Access		
	Longitude: <+/- XXX.XXXXXX°>			
	Latitude: <+/- XX.XXXXXX>			
	Hauteur GPS: <XXm>			
Sample positioning description			Sampling technique	
			Tools	
			Penetration	
			Container	
			Packing	
In-situ measurements				
Soil	General description			
	Calcification degree			
	Texture			
Water	pH			
	Eh			
	Temperature			
	Dissolved oxygen			
	Conductivity			
	Iridescence			
	Algae			
	Bacterial aggregates			
	Gas bubbles			
	Metallic precipitates			
Other remarks				
Observations				
Photos	Film no.	No. photo		
	Description:			
Sampled by	Name:	Visa:	Date	Time
Approved	Name:	Visa:	Date	Time



General Specification

Date : 01/2012

GS EP ENV 111

Rev : 04

Appendix 5

Appendix 5 EBS Daily report sheet (model)

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Appendix 6 Typical contents of the Final Report

1. Detailed contents

2. Executive summary-conclusions giving all program, site characteristics and sensitivities, and the main conclusions

3. General presentation of the study

- Survey Description
- Bibliographic study synthesis

4. A chapter “Equipment and Methods” will present

- Observation and sampling methods
- Method of treatment and in situ sample analysis
- Laboratory analysis (method descriptions will be appended)

Different sections will address:

- Geographical and geological contexts
- Soils and sediments
- Water resources (surface and groundwater)
- Botanical and zoological identification
- Identification of sites of archaeological and cultural/religious significance
- Socio-economic aspects
- Any constraints

5. A chapter “Results and Interpretation”

The detailed results are presented in appendix.

Interpretation method is described:

- Biological indices
- Statistical analysis
- Correlation studies
- Comparison with analytical national or international standards (for drinking water, discharge standards and soil quality)
- Interest regarding archaeological findings in the considered country,...

The different sections will address:

- Physical and geological environment
- Soils and sediments
- Surface water and local water resources for human consumption
- Terrestrial ecosystem (fauna, flora)
- Archaeological context



- Socio-economical context of the site, comparison with national context

Results are compared with the bibliographic and remote sensing study, and presented on maps showing sensitive zones for each context or aspect (water, fauna, flora, socio-economics, etc.).

6. Proposal for future monitoring studies

Appendix

- Charts of numerical analytical results for each sample (soil, water)
- Analytical method details
- Maps of sensitive areas
- Bibliographical references
- Relevant photos

Appendix 7 General characteristics of typical onshore environment

Environment	Environmental characteristics
Arctic and sub arctic regions: • Polar desert • Tundra with or without forest • Taiga: conifer forest • Boreal forest/tundra	Climate: arctic or alpine. Winters: 8 to 9 months sunny period. Precipitation (~500 mm with 50% snow) Geomorphology: Permafrost (dry or wet). Complex drainage system, thermokarsts, various landscapes Hydrology: Numerous lakes, shallow ponds (permafrost thaw). Shallow frozen water lenses, wet zones Soil type: thin, cold, nutrient shortage, badly drained. Activity located in the surface layers above permafrost (< 40 cm) Vegetation: • Tundra with small or large shrubs • Clumps of grass and flowering herbs • Dwarf shrubs • Tundra with shrubs and heather • Tundra with lichens and sedges • Tundra with moss/rushes/grasses/meadows Growing season: ~60 days. Fauna: • Mammals: deer, moose, ermine, fox, weasel, mink, otter, wolf, bear, lynx, etc. • Birds: goose, owl, wood owl, herons, crane, warblers, aquatic birds, etc. Socio-eco: native population. The Boreal forest is of major economic importance Sensitivity: the air is pure (lichens are very sensitive to pollution), water quality is good (a slight change in chemistry may entail permafrost thaw); vegetation is delicate (very low growth, and difficult regeneration)

Environment	Environmental characteristics
Humid zones : (ponds, lagoons swamps, marshlands, mangroves)	Location: Common between latitudes 45° to 75°N and the equatorial region. Mangroves are located at the transition between salt and fresh water (delta zone) Definition: Transition between aquatic and terrestrial environments. Delta zone, or sufficiently water saturated to allow aquatic processes Catchment zone regulation (reducing storm and massive water influx effects). Littoral protection by reducing the erosion process Ecosystem (mangrove): rich in nutrients carried by rivers, but vulnerable. Very rich and diversified aquatic fauna. Plant zonation of the littoral (pneumatophores, Avicennia, palm trees, etc.) Socio-economy: fishing and aquaculture (shrimps, large shellfish, etc.) sustaining many villages
Tropical Forests:	Location: between 10° latitude S et N from equator Climate: High temperatures: minimum 18°C, high pluviometry (> 1600-2000 mm/yr), ETP < 1. Frequent and heavy showers. Relative humidity: > 60% (hyper-humid, humid or sub-humid types) Classification: Altitude forests (mountains, cloud forests), edaphic formation (ponds, unstable slopes), quasi mono specific Soils: Highly altered bedrocks. Low mineral reserve. Acid (pH 5 to 6). Poor in major nutrients. Porous, aerated structure. Upper horizons rich in organic matter. Protected from erosion process by the vegetation. Sensitive to leaching: deforestation considerably increases erosion process related to rain, deterioration and humus loss Hydrography: unstable slopes, landslides, active rivers with high sedimentary load Fauna: diversified wild fauna, e.g.: bird species may disappear with a change from primary to secondary forest, or deforestation. Fauna very sensitive to the alteration of forest cover (habitat, breeding, etc.) Flora: High flora biodiversity. Complex regeneration. Deforestation may result in endemic species disappearing. Growing period: 7 to 12 months Socio-eco: Ethnic communities dependent on forest ecosystem. In case of deforestation: compensating area, regulation, mechanized deforestation, destruction of larger trees, extensive deforestation, forest strip refuges, protection. Ecotourism Remark: tropical forest are endangered (fragmentation, etc.)

Environment	Environmental characteristics
Arid environments : (desert region, tropical savannas)	Location: Africa, Middle east, South America, Australia. Climate: • Savanna: Pluviometry < 1500 mm, long dry season • Desert region: Pluviometry < 250 mm, high daytime temperatures, cold at night. Extreme seasonal temperature variations • Strong winds Landscapes: Sand and dune deserts (erg), rocky flat areas (reg), alluvial valleys with terrace systems. High plateaux, mountains. Significant wind erosion Hydrology: temporary hydrographic network (oueds, wadis) often dry, with sudden deep floods (especially in mountainous regions). Water table: poor water resource renewal Vegetation: • Savanna: extensive grassy areas with sparse trees and groves • Desert region: annual plants, succulents, bushes, shrubs Fauna: insects, reptiles, birds, small mammals. Domestic animals (dromedaries, camels, goats, sheep, etc.) Socio-eco: nomadic dwellings (itinerant stock breeding), and sedentary dwellings in valleys, agriculture, market gardening Archeology: cave drawings, tools, pottery, tombs and burial sites, standing stones, remains of dwellings, etc.
Agricultural zones:	Location: • In temperate zones with deciduous forests • Temperate zones with meadows • Savanna or semi-desertic zone Socio-eco: essentially agricultural development Soil productivity: high sensitivity regarding wind or water erosion, salinity and soil compaction
Urban zones:	Soil use: residential, leisure, industrial or commercial Special cases.



Environment	Environmental characteristics
Industrial polluted sites:	Context: site of historical interest, natural context, etc. Type of industry: hydrocarbon storage, production wells, flow station, gas plant, flare, petrochemical plant, refinery, etc. Pay attention to: water treatment plant, air and water discharges, tanks, pipes, buried networks, waste storage, mud pit, etc. Wastes: landfills, drums, barrels, etc. Soils: pollutants identification, levels of pollution, extent of existing pollution (surface area and depth) Water: surface water, shallow water table and deep aquifers (existing wells and boreholes, dedicated piezometers to be installed). Concentration, pollution extent Quality of air Level of risk: for man (migration in air, soil, water), risk of explosion, toxicity

Appendix 8 Data to be collected

Theme	Detailed data
Regulation:	Local regulations: prescribed environmental national obligations, (laws, etc.)
Climatology:	Meteorology, temperatures (seasons, variations), rainfall (quantity, annual distribution), winds
Physical, geological, morphological environments:	Types of landscape, relief, topography Visual approach, by plots Pedology (soils types and evolution) Lithology, structural, neo-tectonics, seismicity Geotechnical aspects (instability, hardness, etc.) Existing soil and water pollution, radioactivity
Hydrology, hydrogeology:	Hydrology: Catchment basin, surface flow, surface water quality criteria, natural outlets. Humid zones (ponds, lakes, swamp, peat bog) Hydrogeology: Aquifer types, depth, permeability, hydraulic gradient, velocity and direction OF flow, renewal, outlets Water resources: use (drinking water, industrial water, irrigation), vulnerability and protection, means implemented (surface water, canals, wells, drains, boreholes). Shallow water table zones, poor protection Water catchment zones, protection areas. Norms of potability Existing water pollution
Fauna/flora:	Flora: rich diversification, quantity, habitats, ecosystems, rare species, endangered, listed. Protected forests zones Fauna: diversity, quantity, habitats, protected species, distribution, reproduction areas, migration tracks, hunting reserves Protected areas, with vulnerable equilibrium. Natural regional or national park, Unesco protection
Air:	Natural background level Pre-existing source of air pollution
Noise:	Background level Existing noise sources
Archaeology/ Cultural sites:	Remains: dwellings, ruins, pottery, cave drawings, objects,...



Theme	Detailed data
Socio economic general aspects:	Human geography: kind of habitation, villages, density of population, demography, nomadic and sedentary populations Infrastructures : health and education services, potable water and electricity Natural resources: mines (ores, salt), oil resources, quarries, etc. Agriculture: horticulture, fruit farming, breeding livestock, fish farming, fishing Industrial activity: factories, types of industry, projects Others: tourist and hotel trade projects (leisure centers, sports fields, etc.) Communications: roads, highways, tracks, rivers, canals. Railways, airport, helipad Constraints: military bases, administrative constraints. Pipelines, electric lines, buried water pipes, etc., Urbanism constraints Waste treatment facilities: industrial and domestic authorized landfills, un-authorized landfills Domestic and industrial water treatment plants, tanks/pits, industrial lagoons

Appendix 9 Field survey: typical concerns and recommendations

1. Arid and desert regions

- Pipeline
 - Identify the homogeneous geological units
 - River bed and valley crossings (oueds-wadis) sensitivity
 - Access to relief (fallen rocks, etc.): visual impact evaluation
 - Slope stability (geohazards observation, natural fracturing)
 - Water holes interaction: springs, catchment fields, etc.
 - Characterization of temporary agricultural zones: oueds-wadis beds are frequently used as soil preparation for future cultivation (terraces, small dams for rain water)
 - Archaeological resources potential richness
- Site
 - Take advantage of any existing logistics provided at the time of a geological drilling campaign, for example
 - Local water resources (origin, use, present quality, etc.)
 - Economic resources
 - Archeological remains
- **Importance of good logistics:** experienced local drivers with good field knowledge, suitable vehicles, duplicate equipment, accommodation in local oil camps, or bivouacs.
- **Main risks :** security, access conditions, dangerous animals, logistics

2. Arctic environment

- Snow cover in winter, frozen soil, permafrost. Survey to be carried out in summer season (for flora observation, access problems, etc.): $T > 20^{\circ}\text{C}$ from May to September. Field conditions are difficult during the thaw
- **Soils:** manual sampling with shovel (1 meter depth) down to permafrost, soil type description, drainage conditions
- **Hydrology:** surface water samples (lakes, rivers, etc.)
- **Hydrogeology:** maximum and minimum permafrost depth to be determined, surface water table, drained by the hydrographic network, deep aquifers identification
- **Vegetation:** flora characterization (sensitivity, weak growth and reproduction). Remote sensing, field survey. Vegetation types communities (in particular lichens) to be identified
- **Fauna:** reindeer, moose, ermine, fox, weasel, mink, otter, wolf, lynx, etc.
- Geese, owl, herons, cranes, warbler, aquatic birds, etc.
- **Economy:** fishing areas to be identified, trapping, hunting zones, reindeer grazing zones, breeding livestock, crop farming



3. Tropical forest

- Preliminary helicopter survey, then a field survey on foot with team conveyed to site by helicopter access
- Topography, slopes and stability, land slide and erosion risks, flooding
- **Hydrology**: river crossing, sedimentation areas
- Existing forest types identification and quality evaluation: primary forest with canopy intact, degraded discontinuous canopy, very degraded secondary forest, bare ground with isolated trees and bamboo, etc.
- Evaluate the valuable trees in case of deforestation
- Determine the key plant species and indicators, aquatic riverside ecosystems, risks of degradation
- Characterize the existing tracks for human access, farming areas, burnt zones, deforested areas, any industrial zones, and vegetation loss, impact of fires and storms
- **Socio-economy**: type of dwelling and fragmentation
- **Ethnic groups**: number, origins, structure and social cohesion, geographical position, hierarchy and decision making process within the group
- Land use and territorial rights (legal aspects, customs, traditions)
- Farming, hunting, fishing, gathering, traditional sites
- NGOs: identification, evaluation, action, interlocutors

4. Sensitive humid environment (mangroves, etc.)

- Survey with transects: physic-chemical parameters (pH, T, salinity, conductivity, dissolved oxygen, turbidity, suspended matter)
- Phytoplankton, zooplankton (annelides, mollusks, shellfish), benthos
- Ligneous plants, birds (waders)
- Characterization of ecosystem, economy/socio-economy related to ecosystems

5. Urban environments

- Existing industries, type of premises, ground plan
- Potential harmful impacts:
 - Noise
 - Air quality
 - Surface and groundwater quality, resources
 - Urban methods of cleansing, waste water collecting network, water treatment plant, discharge points and standards
 - Industrial discharge
 - Domestic and industrial waste management
- Existing pollution notification: air, soil and water



6. Particular case of industrial polluted sites

A pollution diagnosis:

- Determination of pollution type of soils and water (pollutant types, levels of pollution) according to existing referential and local regulatory context
- Quantify the polluted soil volumes to be treated
- Risk assessment for environment (man, fauna, flora)
- Recommend the most suitable treatments for site remediation and give costs estimates

In the case of **acquisition or cessation of activity**, the following general methodology is adopted:

- **Historical and documentary desk study**, natural site context
- **Soil survey** with samplings (manual or mechanical auger, coring, drilling), radioactivity
- **Hydrogeological survey**: surface water and groundwater: water sampling, piezometers (one upstream, two downstream and at point of pollution sources), springs and list of existing wells
- **Physico-chemical analysis** with field kits and in the laboratory (in compliance with current standards for soil and water quality)
- **Results interpretation**, evaluation of polluted soil volumes, and extent of any water pollution
- **Risk assessment** for man and the environment (toxicity, pollutant migration in soils and water)
- **Identification of best cost treatment methods**, to reach the quality objectives according to local context and official requirements.