Acknowledgements

This Environmental and Socio-economic Impact Assessment (ESIA) for the Azeri Chirag and Deep Water Gunashli Full Field Development Phase 3 Project (ACG Phase 3) was carried out by URS on behalf of the AIOC partners (operated by BP).

URS acknowledges the collective and individual contributions from all those involved in the preparation of this ESIA report. URS is grateful for the willing assistance of these individuals and their contributions to a rigorous and comprehensive ESIA report.

URS acknowledges with thanks the following:

Applied Science Associates
BP Research & Monitoring Group (RMG)
ERT Caspian Environmental Laboratory
K-UNI

ACG Phase 3 Project
Environmental & Socio-Economic Impact Assessment

Executive Summary

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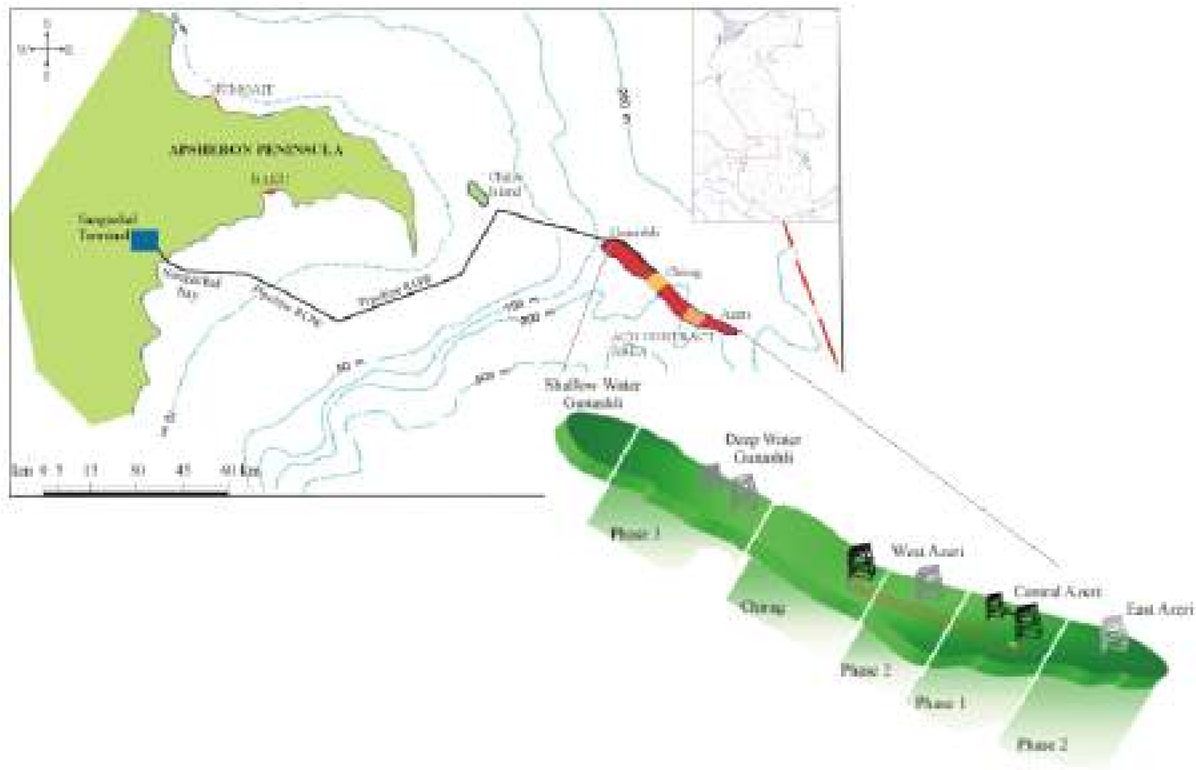
ES1 Introduction

This Environment and Social Statement (ES) has been prepared following a detailed Environmental and Socio-economic Impact Assessment (ESIA) of the proposed ACG Phase 3 project. The ES has been prepared for submission to the Azerbaijan Ministry of Ecology and Natural Resources (MENR) to gain approval for the project and as such, has been conducted in accordance with the legal requirements and policies of Azerbaijan and in line with International Finance Institutions (IFIs) requirements established during ACG Phase 1 and 2. The ESIA process has also been undertaken in the context of BP's Health, Safety and Environment (HSE) Policy and the HSE policies of the AIOC partners.

ES2 ACG Project Background

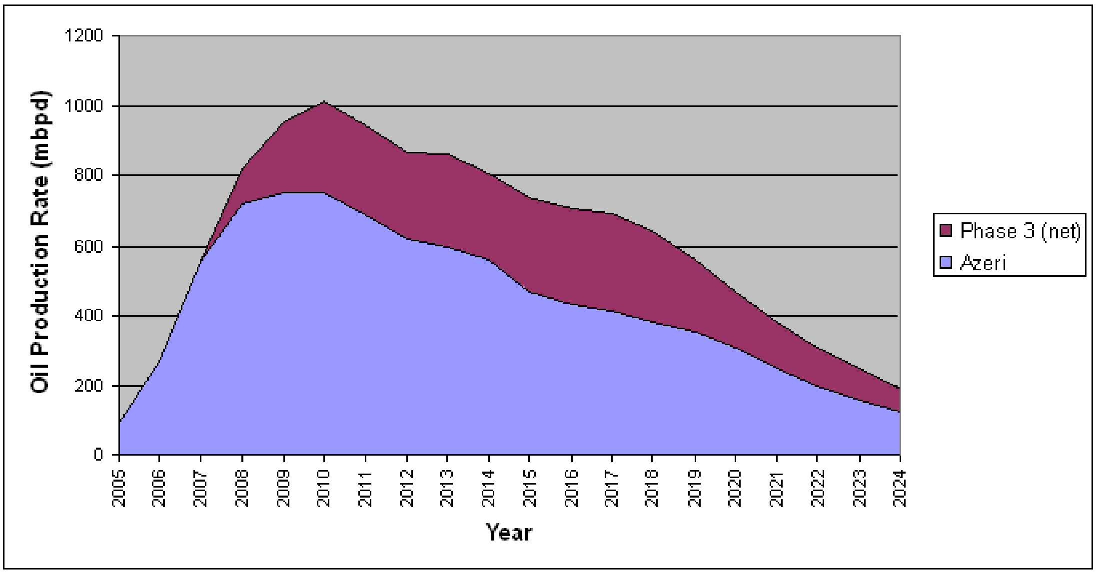
The Azerbaijan International Operating Company (AIOC), operated by BP is planning to begin development of Phase 3 of the Azeri Chirag and Deep Water Gunashli (ACG) Full Field Development (FFD) Project. The ACG Contract Area has estimated oil reserves of 5.2 billion barrels of oil representing roughly half of the proven oil reserves in Azerbaijan's offshore fields. It lies in the Azerbaijan sector of the Caspian Sea approximately 120 km south east of Baku (Figure ES.1).

Figure ES.1 ACG Contract Area Location and Phased Field Development



Overall, FFD is expected to cost $10 billion over the phased life of the project representing about 10% of the investment required to extract the Caspian region's anticipated reserves. The primary objective of the ACG FFD Phase 3 project is to produce the recoverable reserves in the deep water Gunashli part of the field (DWG). Peak Phase 3 design production is anticipated to be 316 Mbpd of oil and 350 MMscfd of gas. The predicted oil production profile for Phase 3 is presented in context with each of the preceding phases of ACG FFD development in Figure ES.2.

Figure ES.2 Predicted oil production profile from ACG FFD



ES2.1 Benefits of ACG FFD

The ACG Phase 3 project is part of the ACG FFD development and will deliver major economic benefits to Azerbaijan. The project, together with the linked investments including the Early Oil Project (EOP), Phases 1 and 2 of the ACG FFD, and the BTC project are collectively by far the largest investments ever committed in Azerbaijan. They will have a major positive effect on the national economy of Azerbaijan.

With prudent revenue management, the projects can lead to positive social and environmental change within Azerbaijan. The economic assessment for the three proposed phases of ACG FFD development so far indicates that revenues from oil and gas production and transit would be very significant especially within the term of the Production Sharing Agreement (PSA) to 2024. Over the peak period between 2007 and 2017 these revenues are predicted to exceed all other sources of public revenue.

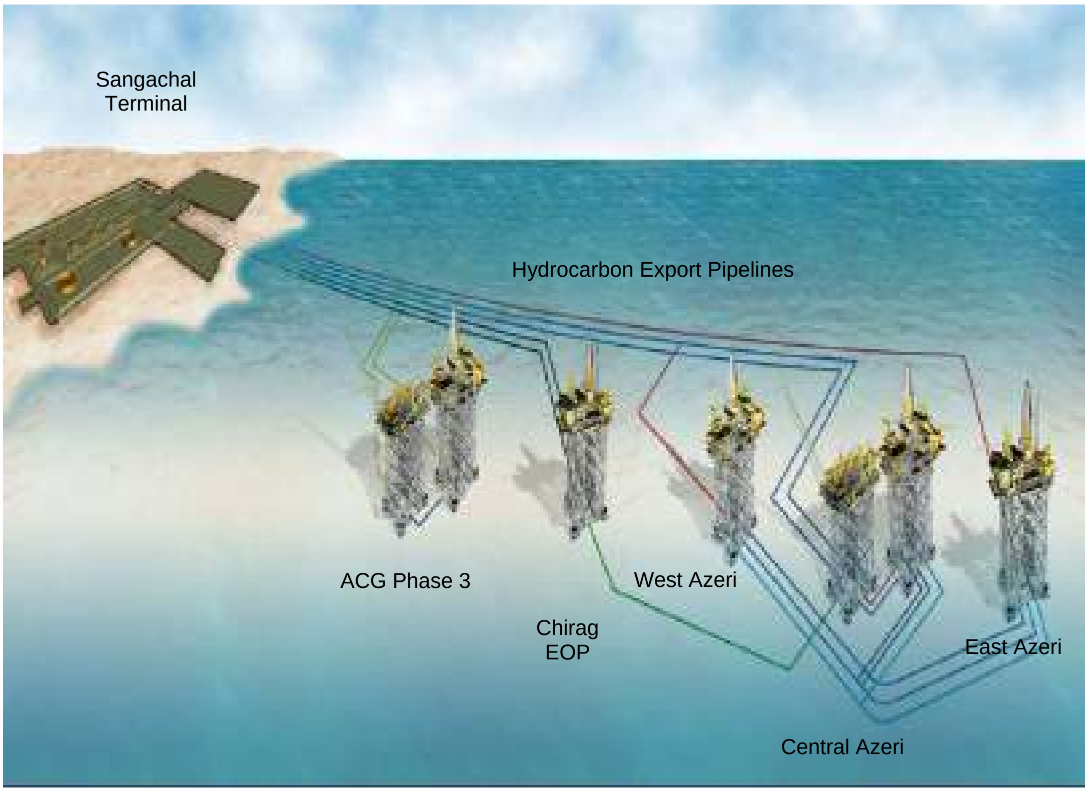
With respect to ACG Phase 3 specifically, the project has the potential to either result in, or create the climate for, the following positive impacts:

- A yield of revenues can be used for investment in the non-oil sector;
- Contribution to poverty alleviation, sustainable development and increased standards of living via the revenues generated;
- Creation of both direct and indirect employment opportunities;
- Continuing development of a national resource and income generation to Azerbaijan.

ES2.2 ACG Phase 3 Project Overview

The ACG Phase 3 Project presently represents the last phase of development of the ACG FFD Project and will target the Deep Water Gunashli (DWG) part of the Contract Area. Estimated recoverable oil-in-place in the DWG field range between 1,000 and 1,200 MMstb. Oil and gas export from the Phase 3 offshore platforms to the onshore Sangachal Terminal will be via tie-in lines to the existing Azeri Project (ACG Phase 1 and Phase 2) pipeline infrastructure (Figure ES3). The project will require offshore drilling and production facilities, a means of transferring the produced hydrocarbons to the ACG Phases 1 and 2 hydrocarbon export pipelines and a hydrocarbon reception and processing facility onshore for storage and onward delivery of the export product. In addition, as the DWG field reservoir is pressure depleted, then the project requires subsea water injection facilities that will provide immediate water injection support to the field. These subsea facilities will be tied back to the main offshore production platforms.

Figure ES.3 Location of ACG Phase 3 Offshore Facilities and Flowlines in Relation to all Developments in the ACG Contract Area



ES3 Policy, Legal and Administrative Framework

ES3.1 Production Sharing Agreement (PSA)

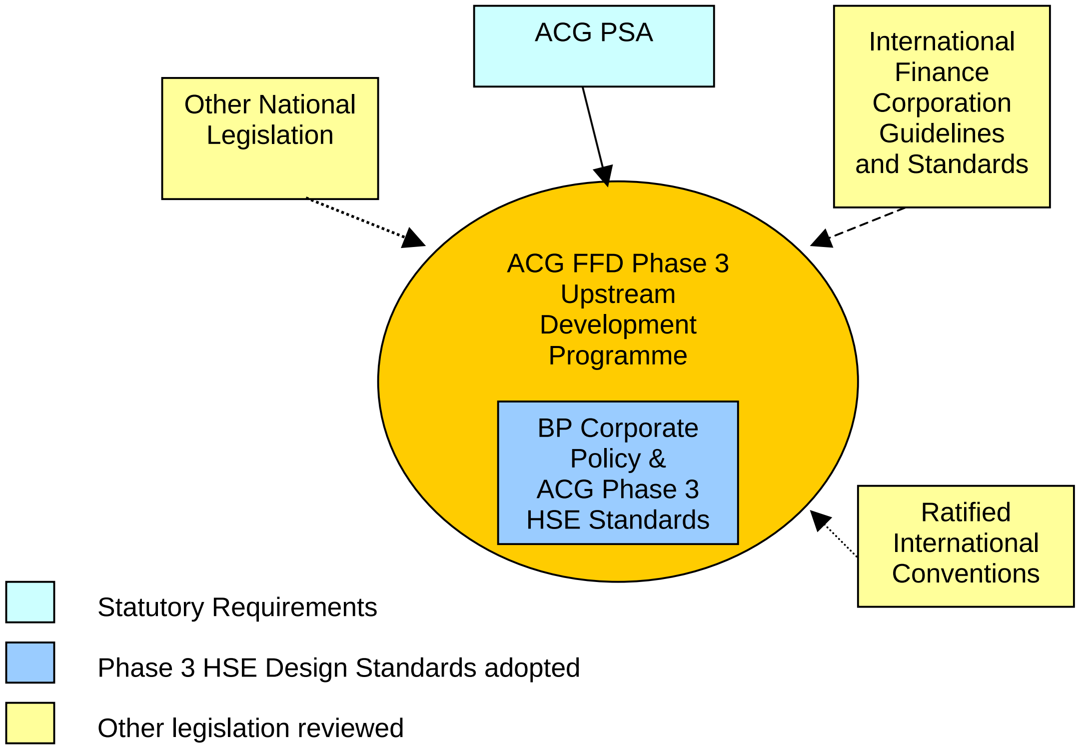
The ACG PSA is the legally binding agreement for the joint development and production sharing of the Azeri and Chirag fields and the deep water portion of the Gunashli Field. This agreement, between the State Oil Company of Azerbaijan Republic (SOCAR) and AIOC shareholder parties (Contractor Parties) was made on the 20th September 1994 and was enacted into Azerbaijan law on 2nd December 1994. Under the terms of the PSA, AIOC, acting on behalf of Contractor Parties, has the right, until 2024, to develop and produce hydrocarbons from the ACG offshore fields. The PSA states that the conduct of operations should be undertaken with respect to the general environment, other natural resources and property, with the order of priority being the protection of life, environment and property.

According to Article 26.3 of the PSA, AIOC shall comply with the present and future Azerbaijani laws or regulations of general applicability with respect to public health, safety and protection and restoration of the environment to the extent that such laws and regulations are no more stringent than current international petroleum standards and practices at the execution date of the PSA.

Beyond the framework of the PSA, the project will also be undertaken with due regard to AIOC HSE design standards, Corporate Policy, international conventions as ratified by the Azerbaijan government and national legislation (Figure ES.4). Applicable national and international guidelines and standards, including the requirements of the International Finance

Institutions (IFIs), have also been reviewed as part of this ESIA in order to ensure that the development is undertaken in a manner that is compliant with these guidelines and standards.

Figure ES.4 Legislative framework of ACG Phase 3 project



ES3.2 BP HSE Policy and ACG Phase 3 Health, Safety & Environment (HSE) Design Standards

ES3.2.1 BP HSE Policy

BP as operator of AIOC is committed to ensuring that the principles and expectations contained within the BP document "What We Stand For" are applied to all aspects and phases of all business operations. The principles focus on five key areas:

- Ethical conduct;
- Employees;
- Relationships;
- HSE performance; and
- Control and finance.

These principles seek to encourage safer and more secure employment, increase efficiency, improve job satisfaction and provide a better-trained workforce within all business operations. The HSE principle reflects BP's commitment to health, safety and environmental performance *"no accidents, no harm to people and no damage to the environment"* as endorsed by the Chief Executive Officer.

HSE expectations to be adopted by all BP managers and the boundaries within which all BP managers must operate are further described in the document "Getting HSE Right", which provides a broad-based set of expectations collated into a series of thirteen elements of accountability, and which forms the central part of the BP HSE Management System Framework.

The HSE Management System Framework links into BP's commitment to HSE whilst at the same time driving the processes, procedures and management systems implemented by individual Business Units. Auditing and monitoring programmes are used to confirm that systems and processes are in place and working effectively.

ES3.2.2 ACG Phase 3 HSE Design Standards

In 2003, the AIOC partners' Contracts Management Committee (CMC) approved a set of HSE standards for the design of the ACG FFD Phase 3 Project. These standards built upon the standards set out in the PSA, Phase 1 & 2 HSE design standards, and took into consideration international standards and local environmental conditions. The Phase 3 HSE Design Standards serve as the standards that AIOC has self-imposed for Phase 3 engineering design. Therefore, while the PSA forms the legal basis for conducting operations, these standards seek to supplement, enhance and further define the standards set forth in the PSA.

ES3.3 International Finance Institutions Guidelines and Standards

The Phase 3 Project shall be undertaken in accordance with applicable IFI environmental and social policies and guidelines, including:

- World Bank Operational Policy Note 11.03 "Management of Cultural Property" (September 1986);
- World Bank Operational Directive 4.30 "Involuntary Resettlement" (June 1990);
- World Bank Group Guidelines for Oil and Gas Development (Onshore) (July 1998);
- World Bank Guidelines: Thermal Power (July 1998);
- World Bank General Environmental Guidelines (July 1998);
- International Finance Corporation (IFC) Guidelines for Oil and Gas Development (Offshore) (December 2000);
- IFC Operational Policy 4.04 "Natural Habitats "(November 1998) ("IFC OP 4.04");
- IFC Policy Statement on Forced Labour and Harmful Child Labour (March 1998);
- IFC Hazardous Materials Management Guidelines (December 2001);
- IFC General Health and Safety Guidelines (July 1998); and
- IFC Waste Management Facilities Guidelines (July 1998).

Phase 3 will integrate into the Azeri project Environmental and Social Action Plan (ESAP). This illustrates AIOC's adherence to the requirements of these IFC environmental and social policies and guidelines. The ESAP considers all stages of the development including construction, commissioning, operation, and decommissioning.

ES3.4 Ratified International Conventions

The Azerbaijan Republic has entered into and ratified a number of international conventions, many within the last year. AIOC will endeavour to provide information necessary to allow the government to meet their obligations with respect to these conventions.

ES3.5 National ESIA Legislation and Regulatory Bodies

In Azerbaijan, major private and public developments require the preparation of an ESIA. The objective of the ESIA process is to provide a means whereby adverse impacts can be identified and either avoided or minimised to acceptable levels.

The fundamental principle of the ESIA is applied by the Azerbaijan Ministry of Ecology and Natural Resources (MENR), the main environmental regulatory body, using the Law of the Azerbaijan Republic on Environmental Protection, August 1999 and the Handbook for the Environmental Impact Assessment Process published in 1996, with the assistance of the United Nations Development Programme (UNDP). The handbook includes requirements for scientific expertise and public consultation. Following its submission to the Ministry, the document is reviewed for up to three months by an expert panel.

The main environmental regulatory body is the Ministry of Ecology and Natural Resources (MENR). This body is responsible for the following:

- Development of draft environmental legislation for submission to the Parliament (Milli Mejlis);
- Implementation of environmental policy;
- Enforcement of standards and requirements for environmental protection;
- Suspension or termination of activities not meeting set standards;
- Advising on environmental issues; and
- Expert review and approval of environmental documentation including ESIAs.

In addition, the MENR has responsibility for the implementation of the requirements set out in international environmental conventions ratified by the Azerbaijan Republic.

ES4 Environmental and Socio-Economic Impact Assessment

The ESIA process incorporates a number of steps. A key element is the interaction with the engineering design team with the objective of removing, or at a minimum reducing, as many of the potentially significant impacts as practicable, while enhancing positive benefits of the project wherever possible. This has been achieved t as follows:

- Assessing a wide range of design options against numerous criteria including environmental and social impact, safety, technical feasibility, cost, ability to meet project needs, and stakeholder concerns.
- Environmental and Socio-economic Issues Identification (ENVIID) workshops held between the Phase 3 project team and the ESIA Consultants to identify the project environmental and socio-economic aspects associated with all proposed activities from construction through installation and operation, including planned routine activities (activities occurring during normal operating conditions), planned but non-routine activities (activities that are planned to occur outwith desired normal operations but within operational design parameters) and unplanned (accidental) events. Proposed project activities and potential events were considered in terms of their potential to:
  - Interact with the natural environment including its physical and biological elements;
  - Breach the Production Sharing Agreement, relevant international, national, industry and operator and partner standards and operator/partner policy; and
  - Interact with the existing socio-economic environment.

- Mitigation workshops that were held in London and Baku with the relevant project design teams following the impact assessment of the proposed Phase 3 project. These workshops were designed to:
  - Confirm the level and accuracy of project design defined in the Project Description and used for impact assessment;
  - Discuss and confirm mitigation measures incorporated into the project to ensure that the impact assessment was informed and accurate;
  - Communicate the results of the impact assessment and identify any areas where additional mitigation may be required; and
  - Facilitate the development of mitigation and monitoring to be committed to in the ESIA, in order to reduce significant or residual impacts.

A critical element of the ESIA process has been the public consultation and disclosure programme. The objectives of this process were to inform stakeholders about the project, allow stakeholders to raise key issues and concerns associated with the project, source accurate information, identify potential impacts and offer the opportunity for alternatives or objections to be raised by the potentially affected parties, non-governmental organisations, members of the public and other stakeholders.

The concluding step of the ESIA process is the public disclosure of a draft ES for which comment is sought from the public and regulatory authorities. After the disclosure period of 60 days, the draft ES is revised and a final ES is submitted to the MENR, approval typically forthcoming 30 days after submission.

ES5 Options

ES5.1 Introduction

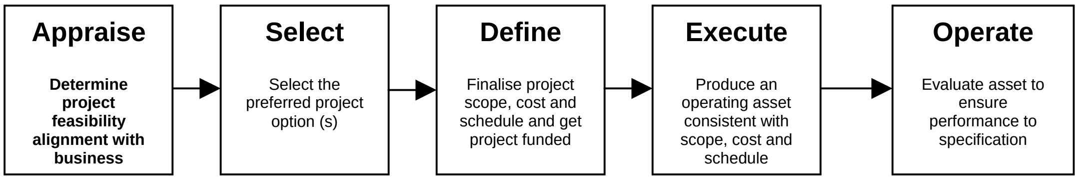
A number of alternative engineering design options were considered for the development including the “no development option” (Section ES5.2). As the Phase 3 project follows previous phases of ACG development there is existing infrastructure, such as the marine pipelines and the terminal facilities at Sangachal, therefore no option selection process for these parts of the development was undertaken. The option selection process therefore centred on the offshore facilities to develop DWG, with further consideration of reserves that Chirag is unable to recover and secondary reserves. As part of this, locating facilities in West Chirag (between Chirag and DWG) as well as DWG were considered. Project design options for the offshore facilities were identified and evaluated using a number of screening criteria. Non-viable options were rejected at an early stage in the process and potentially viable options were taken forward for further consideration. The screening criteria used during the option evaluation process are as follows:

- Safety;
- Technical feasibility;
- Logistical feasibility;
- Environmental and socio-economic implications;
- Capital expenditure (CAPEX);
- Schedule and ability to execute the project;
- Operating expenditure (OPEX);
- Availability;
- Operability;
- Partner and government agreement; and
- Reputation.

BP's Capital Value Process (CVP) was used to check key project development decisions and provide assurance that the project definition is sound. The CVP is synergistic with standard engineering design phases and consists of a number of stages (Figure ES.5) with 'gates' between stages that all project development decisions must pass through.

Project concept design options are considered in terms of their feasibility during the Appraise Stage. Recommended design options are then passed into the Select Stage during which the preferred option for development is selected. At the time of the ESIA, the Phase 3 project was in the Define stage of the CVP.

Figure ES.5 BP Capital Value Process



ES5.2 No Development Option

In addition to the possible design alternatives for the development, a decision not to proceed with Phase 3 of ACG FFD was also recognised as an option. This was not considered viable following sanction of the Phase 1 and Phase 2 developments, as the programme of ACG FFD has been designed to achieve sufficient recovery of reserves that will make the investment in the region economically attractive. Without Phase 3 this would be difficult to achieve.

The "no development" option would mean that the potentially significant benefits described in Section ES-2.1 (Benefits of ACG FFD) would not be realised as there would be a significant reduction in revenues to the Azerbaijan government from oil export earnings that would in turn reduce the broader benefits to the Azerbaijan economy that such revenues can deliver. The Phase 3 project will also provide additional benefits including a continued source of employment for national citizens and continued use of in-country facilities and infrastructure as well as local suppliers.

ES5.3 Selection of Offshore Facilities

A number of concepts for offshore facilities were considered from the appraise stage through to define as follows;

- A DWG standalone concept that is analogous to the Phase 1 offshore platform facilities, with additional subsea water injection wells tied back to the offshore platforms;
- Two variants to the DWG standalone – 1. a Phase 1 analogue with twin drilling facilities and 2. a single combined platform, the latter with subsea water injection wells; and
- Two options for extending the development to the West Chirag area – 1.a single platform on both DWG and West Chirag and 2. a Phase 1 analogue at DWG with a subsea production development at Chirag. Both these options included the requirement for additional subsea water injection wells.

Within these concepts, a number of variations for the selection of offshore facilities and technology were considered based on the screening criteria in Section ES.5.1. The result of the assessment recommended that Phase 3 proceed into the Define Stage with the DWG standalone concept, as listed first above which is analogous to the Phase 1 offshore development. The commonality of design was considered valuable in terms of using the lessons learned from construction of the Phase 1 facilities as well as the potential ability to use available and previously upgraded fabrication yards and infrastructure and the trained in-country workforce. This would reduce costs and schedule risks and presents a high degree of confidence in project deliverability. This concept is also inherently safe and allows the HSE strategies developed for Phase 1 and Phase 2 to be transferred to the Phase 3 design, construction and operational programme.

The chosen concept does not however allow access to the secondary reservoirs in West Chirag or provide opportunities to support production from the existing Chirag field. Pre-investment requirements for a potential future development in West Chirag are being included in the design of the offshore facilities. This mainly consists of definition of space and jacket riser location requirements.

ES6 ACG Phase 3 Project Description

ES6.1 Phase 3 Facilities and Programme Design

The Phase 3 Project will include the construction, installation, commissioning and operations of two bridge-linked offshore platform facilities (a Drilling, Utilities and Quarters (DUQ) platform, bridge-linked to a Production, Compression, Water Injection and Utilities (PCWU) platform), three inter-field pipelines (two oil and one gas) that will tie-in to the existing Azeri Project export pipelines, two subsea water injection developments tied back to the offshore platforms, and expansion of the existing onshore terminal facilities at Sangachal.

Many of the offshore facilities will be constructed within Azerbaijan, with the remaining facilities assembled in-country from specialised components transported from the international market. Once assembled/constructed these facilities will be transported and installed at the offshore development location. The schematic layout of the ACG Phase 3 facilities and the proposed schedule for project activities are provided in Figure ES.6 and ES.7 respectively.

Figure ES.6 Schematic of the Phase 3 Project

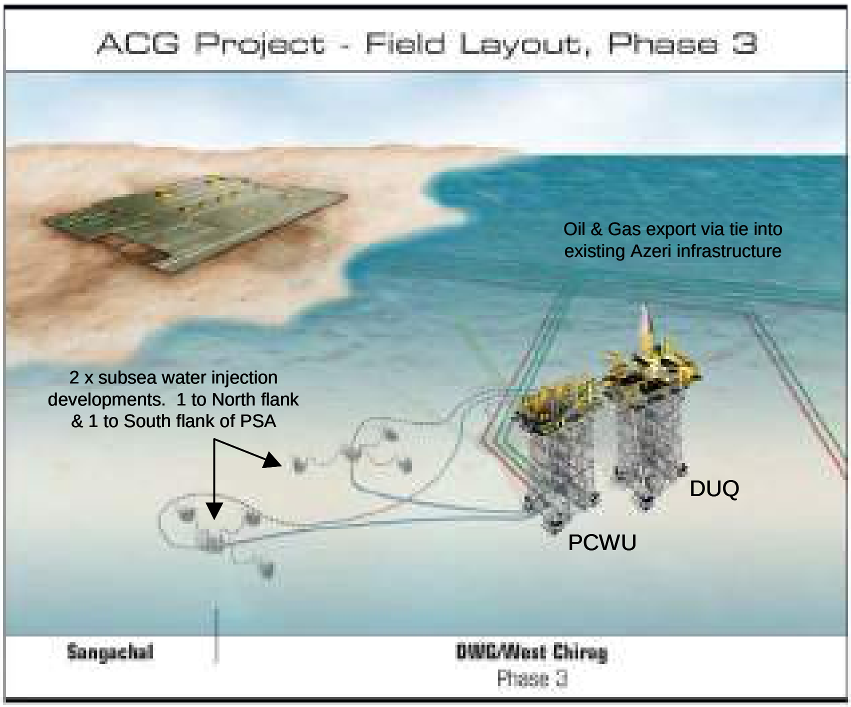
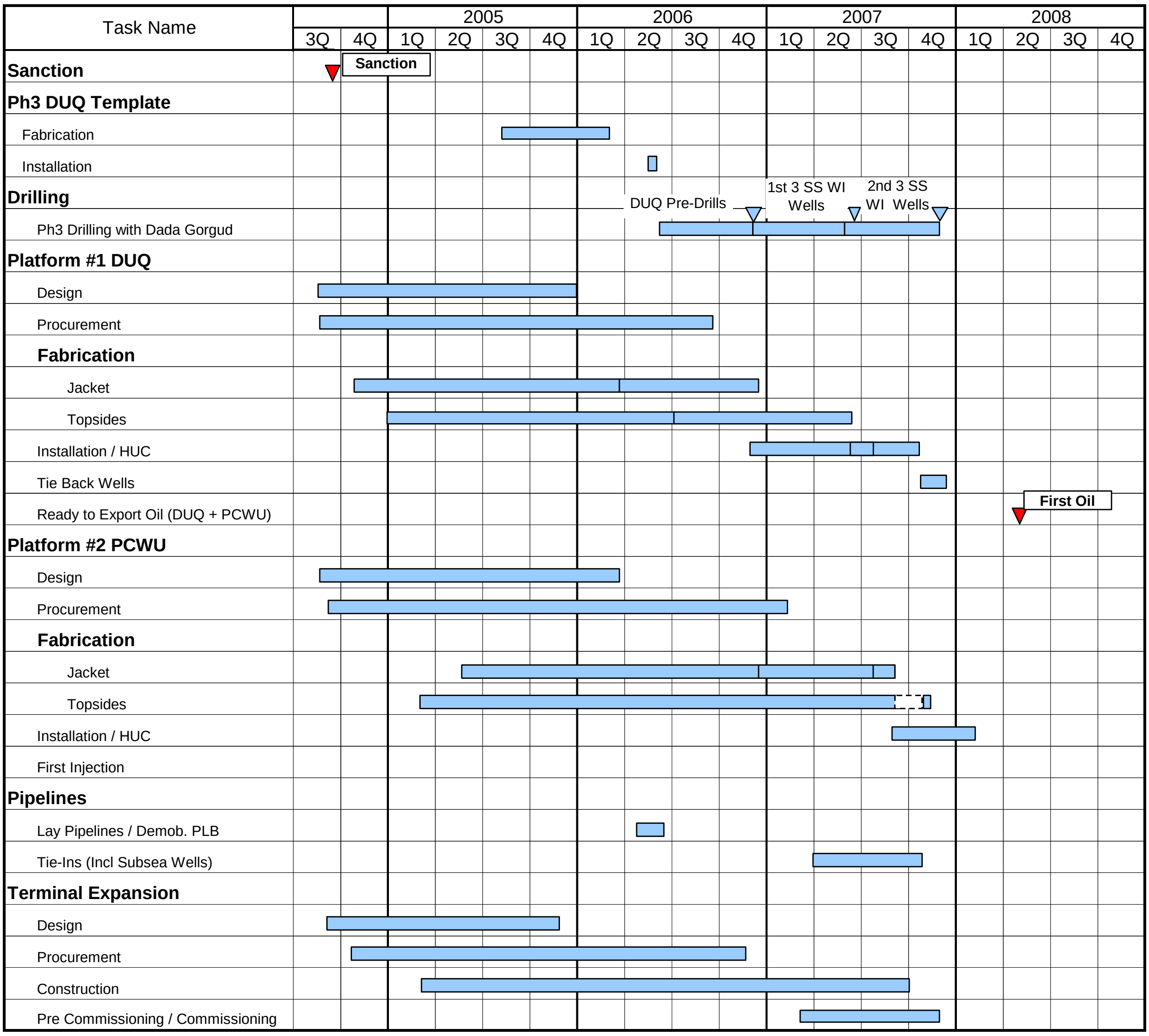


Figure ES.7 Estimated Schedule for Phase 3 Development



The Phase 3 project drilling activities will include a 10 well pre-drilling programme to be conducted at the DWG site from the semi submersible Mobile Offshore Drilling Unit (MODU), nominally the “Dada Gorgud” prior to installation of the DUQ platform. Subsequently a 38 well platform-drilling programme will be completed from the DUQ platform. The MODU will also drill six to eight water injection wells at the two subsea sites and these will be tied-back to the PCWU platform, with their subsea controls tied back to the DUQ platform.

As discussed in Section ES5.3, the Phase 3 offshore platform facilities, less the subsea developments, is effectively a clone of the Phase 1 offshore facilities and therefore, has benefited during the design stage from much of the development work performed for Phase 1. Similarly, lessons learnt from Phase 2 have been exploited. The design precedence from Phase 1 / Phase 2 for FFD operability in part restricted some opportunities for incremental improvements; for instance, use of waste heat recovery and flare gas recovery offshore. Nevertheless, the Project design represents a state of the art development and considerable effort has been expended to ensure that potential environmental and socio-economic impacts are mitigated through appropriate design measures.

ES6.1.1 ACG Phase 3 Fabrication and Construction

Phase 3 offshore facilities will be provided by a combination of in-country and out-of-country fabrication and construction. Where in-country fabrication and construction is required, it is predicted that local yards developed as part of ACG Phases 1 and 2 will be used. The principal in-country yards under consideration are the Shelfprojectsroi (SPS) yard and the Amec-Tekfen-Azfen (ATA) yard located to the south of Baku. At the time of writing, fabrication/construction contracts had not been awarded and therefore a final selection of yard or yards has not been made. Where possible, selected materials and components required for construction will also be sourced within Azerbaijan, where the specification and quality of materials can be assured from a local supplier.

Phase 3 components and modules fabricated outside of Azerbaijan will be imported into Azerbaijan by road, rail and sea using the transportation routes established for the previous Azeri Project construction programmes. The main proven routes are the Russian Federation canal system and road and rail networks through Turkey/Georgia and Iran depending on the point of origin of each component.

In summary, the fabrication and construction of Phase 3 facilities and components will be as follows;

- In Azerbaijan: DUQ and PCWU Jackets, drilling template, steel deck frames required for the DUQ and PCWU topsides, bridge-link between the PDQ and PCWU and flare boom;
- Out of Azerbaijan: PDQ and PCWU utility, drilling module and process equipment, the majority of subsea components (including subsea manifolds and distribution units, trees and control and hydraulic system components) and flowline pipe sections.

All facilities will be assembled at the onshore fabrication yards and subject to a process of pre-commissioning and testing prior to load out and installation offshore.

ES6.1.2 Offshore Installation, Hook-Up and Commissioning

Once constructed, the following offshore facilities will be installed at the Phase 3 offshore locations:

- 12 slot drilling template;
- DUQ and PCWU jackets;
- DUQ and PCWU topsides;
- The platforms bridge-link; and
- Two subsea manifolds and associated facilities.

The installation of each offshore facility will be carried out separately as shown in the Phase 3 development schedule (Figure ES.7). Transportation of the facilities from the construction yard to the offshore location will be conducted using the Derrick Barge Azerbaijan (DBA) for transportation of the drilling template, and the STB-1 barge for the jacket structures and topsides. Support vessels will be located on site to aid the installation and hook-up and commissioning (HUC) activities. Further vessels will supply equipment and materials, travelling between the shore and the offshore location.

ES6.1.3 Drilling Programme

Phase 3 development will require the drilling of the following wells:

- 33 platform producer wells;
- 13 platform water injection wells;

- 2 platform cuttings re-injection (CRI) wells; and
- 6 to 8 subsea water injector wells.

Additional reservoir penetrations will be achieved in the future by sidetracking the 54 primary wells described above. The delivery of the projected production profile for Phase 3 (shown in Figure ES.2) requires drilling operations to be carried out in three key stages as follows:

- Template drilling or "pre-drilling":

  A number of wells will be pre-drilled at the offshore platform site from a Mobile Offshore Drilling Unit (MODU), prior to the installation of the DUQ and PCWU platforms. This will enable rapid completion and tie back of these wells and thus early production from these wells once the platforms are in place. A 12-slot drilling template will be installed at the DUQ offshore location to enable this.

- Subsea water injection wells:

  A number of water injection wells will be drilled using the MODU prior to the installation of the offshore platform facilities. These wells will be drilled in two locations to the north-west and south-west of the central platform location in readiness to be completed as subsea tie-backs to the platform facilities.

- Platform Drilling:

  Once the offshore platforms are installed at the DUQ location, subsequent wells will be drilled from the DUQ platform to utilise the 48 available well-slots.

During the drilling programme, surface and top-hole section drill cuttings will be drilled with Water Based Mud (WBM) and the cuttings will be discharged either directly at the seabed (MODU surface-hole section), or via a cuttings caisson (MODU and platform top-hole sections). The platform surface-hole section will be driven with a closed-end casing so no cuttings will be generated. Discharged WBM cuttings will form cuttings piles on the seabed and drill cuttings dispersion modelling has been conducted to predict the maximum deposition depth and area of seabed coverage from the discharged cuttings.

All lower-hole sections will be drilled with Non Water Based Mud (NWBM). The NWBM cuttings generated from wells drilled on the platform will be re-injected in dedicated Cuttings Re-Injection wells (CRI). If the re-injection facility is unavailable (e.g. due to equipment trips or failures), then the NWBM cuttings will be containerised and shipped-to-shore for treatment and disposal in accordance with the Azerbaijan Business Unit (AzBU) Waste Management Plan. All NWBM cuttings generated during MODU drilling programme will be containerised and shipped-to-shore for treatment and disposal. .

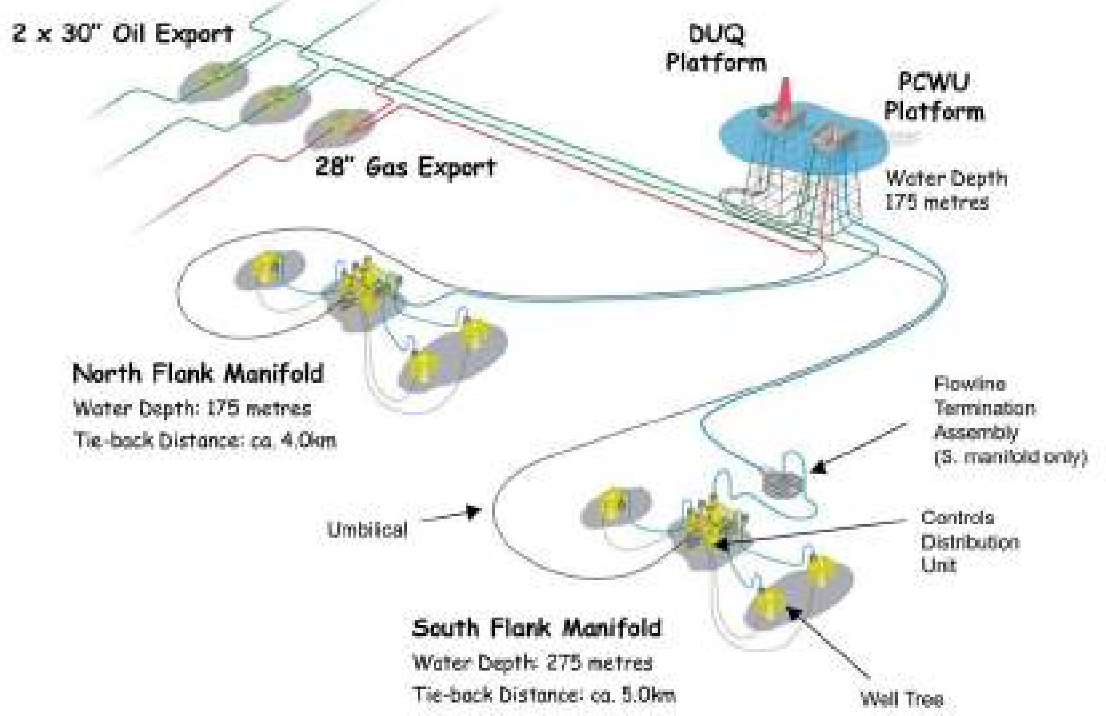
ES6.1.4 Subsea Development

To provide water injection for reservoir re-pressurisation and pressure maintenance, the Phase 3 Project will include the installation and operation of two subsea water injection developments, as introduced in Section ES1.2.1.1. Following the pre-drilling of the water injection wells, the subsea facilities will be fixed on the seabed approximately 4 km to the northwest and 5 km southwest of the DUQ and PCWU platforms. The facilities will be operated and controlled remotely from the DUQ platform, and the supply of water for injection will be from the PCWU platform. The facilities to the northwest will be installed in approximately 175 m of water and those to the southwest will be in approximately 275 m of water. Each subsea development will consist of the following:

- A subsea manifold with distribution unit;
- Cables and piping between the manifolds and 3 well trees
- Control/command cables (umbilicals) between the DUQ and manifolds; and
- A 12" water injection flowline or 10" flexible flowline tied-back to the PCWU platform.

The generic layout of a Phase 3 subsea development is illustrated in Figure ES.8 below.

Figure ES.8 Phase 3 Subsea Development Layout



The subsea equipment will be designed to allow remote operation and maintenance by Remotely Operated Vehicles (ROVs). They will also be designed for ease of retrieval to minimise and simplify well intervention procedures without affecting non-associated equipment and systems.

ES6.1.5 Offshore Hydrocarbon Production and Export

The ACG Phase 3 project plans to produce hydrocarbons from the DWG field by 2008. Offshore production consists of a number of operations that allow the safe and efficient production of hydrocarbons from the flowing wells. Flowed hydrocarbons from DWG will be partially separated and stabilised on the DUQ platform. Oil will then be transferred to the inter-field pipelines that feed into the Phase 1 and Phase 2 export pipelines.

Unlike the Azeri project, associated gas from Phase 3 will not be re-injected into the reservoir for disposal or pressure support purposes. A portion of treated gas will be used as fuel gas on the platforms and for gas lift in producing wells, with the remaining gas sent for export. During Phase 3 production, this gas will be cleaned, dried and compressed on the PCWU platform and then transferred to inter-field gas pipeline for onwards export to the onshore terminal with the Azeri Project gas.

As the DWG oil field is depleted water injection for pressure maintenance will be required from the start of production. Seawater will be lifted to meet the water injection demand. Produced water and cooling water (lifted seawater) will also be re-injected thus negating the need to routinely discharge these wastewater streams to sea.

A range of chemicals will be required to aid the production process, inhibit corrosion of equipment, prevent the build up of scale, and to assist hydrocarbon export. AIOC has a policy to limit chemical use and where use is essential, only selected chemicals of known low toxicity (i.e. OCNS Category E or D or those approved under the Project's HSE Design Standards) will, as far as practicable, be used. No production chemicals used will be discharged from the platforms to the marine environment under normal operating conditions.

Any water-soluble chemicals used in the produced water system will normally be re-injected into the reservoir with the produced water. If all water injection lines become unavailable simultaneously (a very low probability event) then produced water will be discharged to sea.

Hydrocarbon export from the Phase 3 offshore facilities will be via the existing Azeri Project marine export pipeline infrastructure running to the onshore terminal at Sangachal. The existing pipeline infrastructure established for the Azeri Project includes:

- A 30" diameter oil pipeline running from the Central Azeri field to shore installed as part of the Phase 1 project;
- A 28" diameter gas pipeline running from the Central Azeri field to shore installed as part of the Phase 1 project; and
- A 30" diameter oil pipeline running from the Central Azeri field to shore to be installed as part of the Phase 2 project.

There is also an existing 24" oil line from the EOP Chirag-1 platform to shore but this facility will not be used as part of the Phase 3 development.

- Three (3) infield export pipelines will be installed between the Phase 3 PCWU platform and the above Azeri Project pipelines. These pipelines will be connected to the existing pipelines at connections (wye pieces) pre-installed on the Azeri Project pipelines.

The Phase 3 export pipeline materials and design will be consistent with that used for the Azeri Project including all design features to ensure integrity and corrosion prevention. . The pipelines will be constructed of carbon steel and will be designed to ensure that they are suitable for the environmental conditions in the development area including seawater properties and geo-hazards. All the pipelines will be fitted with non-return "check valves" near base of the PCWU platform.

The pipelines shall also have external corrosion protection that will consist of a three-layer polypropylene/polyethylene coating. Additional external corrosion protection will be provided through cathodic protection by means of conventional aluminium-zinc-indium sacrificial anodes attached to the pipelines at regular intervals. The pipelines will also be externally coated with concrete or steel to provide the weight required to ensure stability on the seabed as well as mechanical protection against impact.

Installation of the Phase 3 connecting pipelines will be from the pipe-lay barge Israfil Guseinov, with support from 2-3 anchor handling vessels and 2-3 pipe-haul barges and tugs. The pipe-laying operation is continuous with the barge moving progressively forward as sections of the pipe are welded, inspected, coated on board, and then deployed to the seabed. Once in place, the line will be flooded with inhibited seawater in preparation for commissioning and then tied-in to the wyes and spools at the platform.

ES6.1.6 Onshore Terminal Expansion

Expansion of the onshore terminal at Sangachal to accommodate the increased production from Phase 3 will include the installation of two additional hydrocarbon process trains with a nominal capacity of 175 bpd per train for crude oil separation and stabilisation. The construction activities required for the Phase 3 terminal expansion are minor in comparison to those required for Phase 1 and 2, but will involve a number of common activities. The majority of the Phase 3 steel, process vessels, pipework and equipment will be manufactured outside of Azerbaijan and will be imported by rail or via rivership through the Russian canal system. Construction materials will be sourced from local Azerbaijani suppliers wherever possible.

The construction programme will involve the establishment of underground services such as drains and the firewater systems; earthworks to establish foundations, plus surface pipework, tank and facility construction and tie-in. Construction methods will be based on those already established for previous phases. It may be necessary to carry out 'hot work' at times adjacent to producing plant as the terminal will be in operational mode during the Phase 3 construction phase.

Production operations for Phase 3 terminal facilities will be consistent with and will operate in parallel with those for all Phases of the ACG development and essentially consist of oil reception, separation and stabilisation. Together these facilities will supply stabilised oil to three available 800 Mbbl storage tanks prior to metering and export. The third crude oil storage tank is required to meet the storage requirement of the Phase 3 project and is currently being installed as part of the Phase 1 scope to ensure availability and flexibility at the start-up of the Phase 1 project and the Baku-Tbilisi-Ceyhan (BTC) project. Gas processing will be minimal and will consist of reception and gas dewpointing.

The treated oil will be exported via the BTC pipeline and the gas (less a portion used for fuel gas at the terminal) will be exported to SOCAR for distribution in the Azerbaijan national grid. Produced water will be treated and disposed of with the produced water from Phases 1 and 2. The final disposal solution for produced water when determined will be considered in a dedicated and separate ESIA.

ES7 Existing Natural Environment

ES7.1 Overview

The ACG Phase 3 project will take place in the Caspian Sea, an enclosed body of water occupying 386,400 km^2 and with a shoreline of 5,360 km. The Caspian is approximately 1,200 km long and averages 310 km in width. Caspian sea levels have fluctuated significantly over time and it is currently 27 to 28 m below the world ocean level. The sea level dropped by 2.9 m in the period between 1929 and 1977 and rose by 2.4 m between 1977 and 1997. The recent sea level rises have resulted in the flooding of coastal land and damage to settlements, industrial enterprises and irrigated land.

The Caspian exhibits a multitude of environmental stresses. Most are the result of the many years of pollution from a vast array of land-based sources that reach the Caspian via the 130 rivers that drain its watershed. The largest of these is the Volga. This river receives domestic waste from over half the population of Russia, along with a significant percentage of the country's heavy industry. It is estimated that the Volga contributes 80% of the pollution load entering the Caspian. The combined effect of these and other factors is illustrated by the current poor state of the Caspian fishing industry. The effects have been particularly noticeable for the sturgeon fishery, where the Azerbaijan quota has been reduced in recent years.

ES7.2 Offshore Environment

The ACG Contract Area is approximately 40km in length, 11.5 km wide, and lies in the Middle Caspian. The area is characterised by an uneven topography, natural gas seeps, gas charged sediments, and subsea mudflows. The Contract Area contains large mud volcanoes.

The climatic conditions in the project area are mild (above sea air temperatures up 0 – 25°C) with most of the rainfall occurring in the Spring and Autumn months. The wind regime is very variable and unpredictable with the strongest winds from a northerly direction.

The Phase 3 project will be located in an area of water depth between 170m and 200m. The sea temperature in the contract area varies between a winter mean of 5 °C and summer mean of 25 °C. Currents in the area are weak, but storm surges, caused by episodes of very strong winds, occur frequently, with waves over 2m occurring most often during the July/August/September period. The Caspian has lower salinity than the world's oceans, and uniquely, seasonal and spatial variations in salinity. The water is oceanic in origin but has been diluted by the inflowing rivers, which have also increased the concentration of certain minerals. During the winter months the upper layers of water become highly oxygenated and in summer the water column becomes stratified. Hydrocarbons have been detected in the seawater in the contract area, some of which is thought to originate from the natural venting of hydrocarbons from mud volcanoes.

The sediments in the Contract Area are mostly medium to coarse sand with considerable spatial variation in the most abundant particle size. The sediments contain hydrocarbons but it is not possible to determine whether they are of natural or anthropogenic origin. Heavy metal content and radioactivity levels have been measured at typical background levels.

The benthic communities in the Contract Area are of high importance to Caspian Sea fish stocks, with crustacean-dominated communities in the northwest of the Area and annelid-dominated communities in the southeast. The Caspian sea contains a unique assemblage of fauna. About 75% of the species of the Caspian are endemic, 6% are from the Mediterranean and 3% are from the Arctic. The remaining 16% are freshwater immigrants that have adapted themselves to the salinity of the Caspian. Because of the special nature of the Caspian ecology the species introduction is a significant concern in the region and already several species of introduced zooplankton and fish have become established.

ES7.3 Onshore Environment

The onshore environment for the Phase 3 project is that surrounding the Sangachal Terminal. In addition, the ATA and SPS yards are being considered for use in onshore construction and fabrication of offshore facilities. No additional land take will be required for Phase 3, as all project activities will be contained within the boundaries of existing facilities.

The Sangachal terminal is located in a semi-desert area, in a low-lying basin on the margin of the Caspian Sea, approximately 10 to 12 m above the local sea level. The ATA Yard is located on the shores of the Caspian around 8km to the south of Baku on a sited bounded by the Caspian on the east and to the west by undeveloped land with a residential development 1km beyond. The Bibiheybat Oil Field is located to the north. The SPS Yard is located approximately 20km southwest of Baku, also on the Caspian coastline, in an area of shallow lagoons and small undulations of up to 2m. All three sites have a warm semi-arid steppe climate giving a mean temperature in summer of 26°C and 0°C in winter and a little rainfall occurring between October and March. A locally thermally driven wind system is based on onshore/offshore pressure differences and can result in very strong winds occurring with little forewarning.

Soils at the Sangachal Terminal have a low humus content, short soil profile and low agricultural productivity. The ATA Yard comprises made ground, and the SPS Yard has been used as an industrial facility for some years.

No aquifers supplying potable water are found in the vicinity of the Sangachal, ATA or SPS facilities. No significant ground water has been identified at Sangachal. At ATA ground water occurs at shallow depths and hydrocarbons are present: it is thought as a result of nearby historical oil field activities. A similar situation is thought to be present at the SPS Yard.

Air quality around the Sangachal and ATA facilities have been found to be within World Bank Environmental Guidelines with the exception of particulate measurements.

ES7.3.1 Flora and Fauna

The potential for the project to interact with onshore flora and fauna receptors is restricted given that all activities, except for transportation, will take place within the boundaries of existing sites. The ATA and SPS Yard in particular are industrial sites and virtually devoid of flora and fauna. However the Sangachal terminal has several items of ecological interest and environmental sensitivity in the vicinity of the site, and SPS is located next to a proposed Ramsar site[1]. These items are briefly described below.

1 A Ramsar site takes its name from Ramsar in Iran where the Ramsar Convention (Convention of Wetlands of International Importance Especially as Waterfowl Habitat) was drawn up in 1971. Azerbaijan is party to the Ramsar Convention.

Seeds of Sharp-edged Darling Iris (*Iris acutiloba*) listed in the 1989 Red Book of Azerbaijan and in the 1997 International Union for the Conservation of Nature (IUCN) Red List of Threatened Plants were found close to the terminal.

The Spur-thighed tortoise (*Testudo graeca iberia*) a species listed in the 1989 Red Data Book of the Azerbaijan Republic and in 1994 IUCN Red List of Threatened Animals as “vulnerable”, has been previously observed throughout the terminal area and it was encountered during surveys carried out in May/June 2001 in the coastal area close to the interface with the inland areas.

The Sangachal Terminal is situated on a bird migratory route between the breeding grounds as far north as the Arctic and wintering areas in South Asia and Africa. The wetlands close to the terminal in particular host an abundance of migrating wildfowl and passerines. The following Red Data species have been recorded near the terminal:

- Black-bellied Sandgrouse (*Pterocles orientalis*): ARB and 2000 IUCN Red List
- Dalmatian pelican (*Pelecanus crispus*): ARB and 2000 IUCN Red List
- Lesser kestrel (*Falco naumanni*): 2000 IUCN Red List and proposed for inclusion in ARB list
- Long-legged buzzard (*Buteo rufinus*): Proposed for inclusion in ARB.

The SPS Yard is located close to a pair of shallow lagoons known as the Shelf Factory Lagoons, separated from the Caspian by shingle banks and reeds. These are proposed as a Ramsar site due to the abundance of overwintering wildfowl and the presence of three ARB listed species and the IUCN Red Listed Pygmy cormorant (*Phalacrocorax pygmeus*).

Although the terminal has a limited potential to impact on local flora and fauna, the impacts of an accidental event in the offshore location, such as an oil spill, could have a much wider impact. Therefore the flora and fauna in the wider coastal region of the Caspian has been considered. The coastal zone of the Caspian, from Azerbaijan to Iran, is one of international ornithological importance. It supports both nationally and internationally significant numbers of migrating and overwintering birds, including species protected in Azerbaijan and Europe. Surveys at sensitive coastal sites have recorded four national Red Data species:

- Mute Swan (*Cygnus olor*);
- Greater Flamingo (*Phoenicopterus rubber*);
- White Tailed Eagle (*Haliaeetus albicilla*); and
- Dalmation Pelican (*Pelecanus crispus*).

To qualify as a Ramsar site, a wetland must support:- a). 20,000 or more waterfowl, OR b). substantial numbers of individuals from particular groups of waterfowl, indicative of wetland values, productivity or diversity OR c). 1% or more of the individuals in a population of one species or subspecies of waterfowl.

ES8 Existing Socio-Economic Environment

A considerable amount of socio-economic information for the national and local baseline relevant to the ACG Phase 3 project area has been compiled through the ACG Phase 1 and Phase 2 ESIAs. In terms of the data relevant to ACG Phase 3, regional and local baselines were revisited to gain the most recent data, where possible and to reflect any changes in socio-economic baseline as a result of these previous project phases.

ES8.1 Regional Baseline

ES8.1.1 Population

The terminal site at Sangachal is located in the Garadag District as part of the Baku Administrative Region extending from just south of Baku to Gobustan. The latest population figures indicate that approximately 98,555 people are resident in the District. In addition to the key settlements of the district, namely Lokbatan, Sahil (previously Primorsk), Gobustan, Elet, Gizildash, Mushfigabad, Sangachal, Buta, Cheyildag (previously Umbaki), Korgoz and Shangar, there are three small villages Umid, Shikhlar, and Kotel. The majority of this population is Muslim with only a small minority, (approximately 7.4%) being Christian.

ES8.1.2 Employment and Income

Employment in Garadag District is dominated by its proximity to the industrial and economic activities in Baku and Sahil. The oil and gas industries support large numbers of workers while activities in the agricultural sector are generally largely confined to grazing during the winter season. Fishing is limited and is concentrated around Elet, Sangachal and Lokbatan and appears to be undertaken for recreational and subsistence purposes.

The average monthly income in Garadag District for 2002 is estimated to be $100. For the first six months of 2001, the oil sector and its associated industries contributed approximately 50% of total GDP in Garadag District with the construction industry accounting for approximately 30%.

ES8.1.3 Infrastructure

The Baku-Alyaty highway routed along the Sangachal Bay coastline passes to the south of the terminal location. This section of road is a main highway in Azerbaijan being part of the main transportation route north from Baku to Boyuk and to Kesik at the Georgian border and south from Baku to Astara to the Iranian border. In addition, the Baku-Alyaty railway runs parallel to the highway through the Garadag District and is part of the main transportation route for Azerbaijan in terms of its capacity. A number of utility lines and pipelines are also routed along the coast parallel to the highway and railway line. These utility lines provide electricity, communications, oil, gas and water.

Health services in the area are provided through medical ambulance stations in the main settlements and also two hospitals. Health issues that have arisen include a typhus epidemic in 1989 and respiratory problems.

There are 24 secondary schools and 4 colleges in the Garadag District with a capacity for approximately 13,700 students at any one time. In total however, between 25,000 and 27,000 children are studying in these schools. These figures indicate problems of overcrowding. Although no figures are available on the percentage of graduates from the total school population, a rough estimate is that 6% of school age children graduate from secondary school. Of these, 37% are continuing their education in colleges and other higher schools.

The internally displaced persons (IDP) and refugees in Garadag District are primarily located in Lokbatan, Sahil, Gizildash and Sangachal settlements. Just over 20% of IDPs in the

District are from Armenia while the remaining 80% are IDP from occupied territories of Fizuli, Agdam, Zengilan, Gubadli, Kelbejer, Jebrayil, Lachin districts and Shusa, Khojavend, Khojali city and villages of the Nagarno Karabakh region.

ES8.2 Local Socio-Economic Receptor Profile

The socio-economic receptors[2] identified within the local area[3] around the proposed ACG Phase 3 Project developments included Sangachal town, some herding settlements, Umid IDP/cement workers camp, Sahil town and Bibiheybat oil field.

ES8.2.1 Sangachal Settlement

ES8.2.1.1 Population

There were approximately 3,595 residents in Sangachal Town in 2003. This figure includes more than 500 IDPs from the 10 different districts within Azerbaijan that are currently occupied by Armenia. Approximately 62.5% of the population is male and 37.5% female (AHFS, 2001). The majority of residents are within the 31-50 year age category. Some 97% of the residents are Muslim with the remaining 3% Christian and included 95.2% Azeri Turks, 2.9% Russian and 2.9% Slav.

Almost 13% (i.e. approximately 520) of Sangachal residents are classified as IDPs. Most IDPs arrived in Sangachal in 1992, although people continued to arrive throughout 1993 and 1994. IDPs within Sangachal do not live in permanent accommodation. They are housed in public buildings, abandoned homes or railway cars.

Based on discussions with the Garadag Executive Power, it appears that there are no major health problems in Sangachal town. However, health was discussed as part of the AHFS survey undertaken in Sangachal and in 2001 over 50% of the population assessed their health as poor, however no official figures were available to support this assertion. A public immunisation campaign has been undertaken within the town, and was administered by doctors from the United Hospital in Sahil (Garadag Executive Power; 22/10/03).

The distribution of diseases between Sangachal, Sahil and Umid follow similar patterns for Garadag District as a whole. However, there are differences in the total incidence of disease between the settlements. According to Garadag Executive Power (22/10/03) the most common health problems for adult males in Sangachal are respiratory or cardiologic in nature while adult females have more ailments of an oncological nature. There is also no form of maternity welfare support in the settlement and most women give birth at home.

ES8.2.1.2 Employment and Income

According to the Garadag Executive Power's representative for Sangachal the quality of life of residents in this settlement has risen since increased employment opportunities have become available for local residents. The main economic activities in Sangachal revolve around industry, oil and gas and trade sectors. The expansion of Sangachal Terminal and activities at ATA and SPS as part of ACG Phase 1 and 2 are viewed as key drivers of the economic development occurring in the area since 2001. The main increases in employment have been within the oil and gas industry, other industrial fields, and transport. For example, at the time of writing approximately 280 people from Sangachal are employed at Sangachal Terminal by one of the main contractors[4] (it should be noted these employment levels fluctuate depending on project requirements). According to the Garadag Executive Power, most IDPs living in Sangachal are employed, specifically providing labour to the oil and gas sector.

[2] A socio-economic receptor is defined as something that could be impacted upon by the proposed development that would affect the economic or social profile of the area

3 Local is classed as 2-5km around the various facilities, whilst regional is taken as the wider surrounding area and in this instance, the Garadag District.

[4] AIOC-BP-Tekfen Azfen, Azeri Project, Recruitment and Training Follow-Up Report, 14/3/04

ES8.2.1.3 Infrastructure

There are very few roads in and around Sangachal and most of these are gravelled. According to the Garadag Executive Power the quality of the road network has improved since 2001 and this has been linked to the construction works at the Sangachal terminal

There is no hospital or pharmacy within Sangachal. There is however, an ambulance station that provides basic first aid. From discussions with Garadag Executive Power it was ascertained that the station and ambulance are not in a good condition. Although Sahil United Hospital is not far away in terms of distance (about 15 minutes by bus), with few cars in Sangachal, and unreliable public transport, the United Hospital is not ideally positioned to serve the Sangachal community.

Although schools are present in Sangachal, several children travel to the school in Sahil in order to participate in extra curricular activities (e.g. sports and music) and attend the vocational training school. Such activities are not available in Sangachal (Garadag Executive Power; 5/7/01). Most of the children between the ages of 6 and 17 attend school although some do not to due to financial difficulties. The number of students going on to tertiary education is slowly increasing but the numbers who go on to higher education varies from year to year (Garadag Executive Power; 5/7/01) and has attendant difficulties. Some universities charge attendance fees and as public transport to Baku is not reliable (i.e. the service is irregular and seats can be limited), regular attendance at university can be difficult.

ES8.2.2 Herding Settlements – Central North and West Hills

The area surrounding the existing Sangachal Terminal has been used by an extended family of pastoralists as winter grazing pasture since 1961. The land acquisition prevented them from using some of the area for grazing and subsequently they requested to be moved. AIOC are currently (February 2004) in discussion with the various parties concerned on the exact nature of the re-location. The herders will be moved once agreement has been reached between all parties concerned. Full details of the process are contained within the ACG Phase 1 and Shah Deniz Stage 1 Resettlement Action Plan and the herders will not be affected as a result of the ACG Phase 3 development.

ES8.2.3 Umid Camp

Umid Camp is essentially two camps within one settlement; one camp houses IDPs and another camp is for workers from the Garadag Cement Plant at Sahil. The camp has been given permanent status and is now recognised as a formal settlement.

ES8.2.3.1 Population

In total there are 1,200 people currently living in Umid Camp, compared to 1,300 people in 2001, a 8% decrease between 2001 and 2003. Of the present 1,200 people, 67% are IDPs and the remaining 33% local residents. The major ethnic groups include Azeri, Tallish and Lezghin and the majority of residents are Muslim. It is estimated that 48.3% of the population is male and 51.7% female.

ES8.2.3.2 Employment and Income

Since the construction works undertaken at the terminal as part of ACG Phase 1 and Phase 2, the overall conditions for the inhabitants are considered to have improved, largely due to the increased employment. According to the Garadag Executive Power, unemployment within Umid settlement decreased from 78% in 2001, to 8% in 2003. It is believed that a significant proportion of those now employed are involved in construction activities at Sangachal Terminal and the ATA and SPS fabrication yards. At the time of writing, approximately 80 personnel were currently employed at Sangachal Terminal by one of the project's main contractors[5].

[5] AIOC-BP-Tekfen Azfen, Azeri Project, Recruitment and Training Follow-Up Report, 14/3/04

Despite the increased employment opportunities for local residents and resultant spending, no private businesses or small enterprises have developed. A few residents are involved in fishing and this is for subsistence purposes to supplement their diet. Such fishing is by rod from the shores nearest to the camp, including from the jetty built for the Early Oil Project (EOP).

Many of the IDP families have been affected by the war, influencing employment opportunities where injuries were sustained. Information given indicates that 10 households within the IDP population of the camp have war veterans as a member of the household and a further 14 households have officially injured war veterans as members of the household. The key concerns of war veterans in Umid Camp are the perceived lack of government support and the small amount of pension received (Head of Garadag Executive Power Representation, Umid Settlement; 05/07/01).

All of the children from the IDP Umid Camp are immunised by doctors from Sahil hospital. Whilst the medical facilities are free, there is a limited supply of medicine. There is however, a general belief held by Garadag Executive Power that the health services are getting better. Assistance from international organisations is on an infrequent and ad hoc basis and so does not form a reliable alternative to the public system (Head of Garadag Executive Power Representation, Umid Settlement; 05/07/01).

ES8.2.3.3 Infrastructure

There is a school, medical office, bakery and post office within Umid Camp. There is a rudimentary sewage system, however plans exist to upgrade this in the near future through the ACG Community Investment Program. There are telephones in every house in the IDP camp and all households have regular access to electricity and gas within their homes. Wood is not used for heating nor cooking purposes. Sufficient quantities of water are piped to households from the Kura River and the supply is regular. The water supply is cold water only, which is normal for the area.

Medical services within the camp are limited and the existing medical facility is a basic first aid post capable of providing only limited services. Most women give birth at a maternity home and for more serious health problems, residents must use the hospitals at either Sahil or Baku.

One school in the Camp provides secondary level education. At the time of writing, approximately 200 pupils attended the school, in comparison to 120 pupils in 2001 (Head of Garadag Executive Power Representation, Umid Settlement; 22/10/2003). There are only seven classrooms and overcrowding is a problem. As a result, a shift system has been applied whereby pupils attend either the morning or the afternoon sessions. Even though the technical and material basis of the school is not sufficient, the teaching is said to be of a good quality. Very few male students continue with higher education because of limited finances and compulsory military service. A limited number of female students continue with tertiary education.

ES8.2.4 Sahil

ES8.2.4.1 Population

Figures for 2003 indicate that there are approximately 20,900 people living within the Sahil boundaries. This is compared to 21,000 residents in 2001, illustrating a 0.5% population decrease between 2001 and 2003. The gender split of the current population is 48.8% male and 51.2% female, which is similar to Umid but different from Sangachal with 62.5% males. The major ethnic groups in the settlement are Azeri (93%), Russian (4.3%), Caucasian nations (1.8%) and other (0.6%) with Muslim and Christian being the most widely supported religions.

There are approximately 7,175 IDPs living in Sahil. The majority of IDPs in Sahil arrived in 1992, although people continued to arrive throughout 1993 and 1994. IDPs within Sahil are housed in public buildings or dormitories, private houses, or rented accommodation.

ES8.2.4.2 Employment and Income

The key areas of employment for Sahil residents during 2003 were the oil and gas sector, other industries, and public utilities. Employment within oil and gas and other industrial fields has increased significantly since 2001, with employment in public utilities, education and culture, domestic services, catering and trade increasing only slightly. Increases are primarily related to ACG project activities at the Sangachal Terminal Expansion Programme (STEP) and the SPS and ATA fabrication yards, however levels will fluctuate depending on project requirements.

According to the AHFS survey that was conducted in 2001 the unemployment rate was 63.2% in Sahil. Data received from Garadag Executive Power indicates that this figure has decreased to 52.3% in 2002 and 29.3% in 2003.

The AHFS survey gathered a range of data on Sahil residents' perception of family welfare and income levels in 2001. This showed that 52.3% of informants claim to be poor or very poor[6]. However, according to Garadag Executive Power (20/10/2003) the indications are that the general quality of life for the residents in Sahil has increased since 2001. This has largely been due to increased employment opportunities for both males and females of the settlement. In addition the funding of various development projects has benefited children in the area e.g. a new computer centre, day care centre for handicapped children and entertainment centre has likely added to the quality of life for children in the settlement.

ES8.2.4.3 Infrastructure

There are approximately 282 houses and 2,089 apartments in Sahil. According to official sources all residences in the town have electricity and gas, and supplies are regular, reliable and sufficient. Wood is generally not used for heating or cooking.

All of the apartments are privately owned, however the majority of the houses (90%) are owned by the government. During 2003 site visits, the survey team noted a lot of construction activities underway in the settlement and this may be aimed at solving any existing shortage of housing.

The majority of the houses within Sahil have telephones. According to the Garadag Executive Power the majority of people have access to televisions although exact figures are unavailable and it is unclear whether "access" means a television in the home or within a communal area. Sahil community receives most of its information from the television and the main newspapers and radio channels are readily accessible.

The roads in and around Sahil are mostly covered in asphalt and are viewed as satisfactory, despite the poor condition of the surfacing and lighting. According to the representatives of Garadag Executive Power based in Sahil, the quality of the road network has not changed in the past three years

A cold water supply is piped into the town from the Baku-Kura pipeline and is believed to occasionally be insufficient for the purposes of the settlement. There is no certified hot water supply to Sahil, although this is typical for the area. Bottled water is not used for drinking, washing or cooking (Garadag Executive Power; 20/10/03). The settlement also has both centralised sewage and garbage disposal systems in place. However, according to the Garadag Executive Power the sewage system needs to be repaired.

[6] Source: Azerbaijan-Holland Friendship Society, Sociological Survey, Baku 2001

According to Garadag Executive Power (20/10/03) the health of the residents of Sahil is good. However this does not correspond with the feedback from the Sahil population in 2001. Sahil Central Hospital #23 serves approximately 25,000 people. Although 65 beds are available, sheets, blankets and food are not provided. There are 47 doctors, 7 midwifes, 120 nurses and a further 46 assistants working at the hospital. The hospital is open 7 days a week, 24 hours a day, and provides the following services: immunisations, URI in children, treatment of diarrhoea in children, child growth monitoring, anti-natal care, delivery services, patronage, family planning services, laboratory analysis, health education, basic emergency care and treatment of minor injuries.

The local population believe the level of medical care received is satisfactory, and medical fees are levied. The facility is also conveniently located (i.e 1-3km from the town). Those interviewed in the AHFS survey estimated that they spent between 80,000 and 100,000 manat in 2000 on medical care.

There are 5 schools in Sahil including 3 secondary, 1 boarding school and one lyceum. Children from Sahil, Umid and Sangachal attend the schools in Sahil. A number of pupils from Sahil also attend specialised schools in Baku. The ACG Community Investment Programme has assisted in the rehabilitation of the refugee school in Sahil, which was in a very poor condition.

To overcome overcrowding, schools operate on a shift system with up to three shifts daily. At the Kasabasi school, the Human Development Forum is providing computer courses for 341 children.

ES8.2.5 SPS Yard

SPS is a potential location for fabrication/construction of ACG Phase 3 activities. There are a range of domestic and commercial buildings and associated activities within the vicinity of the SPS Yard. The socio-economic survey identified 3 groups of residential buildings, a range of commercial activities (e.g vehicle renting company, AzGas Plant, shop), signs of agricultural activities and a number of buildings at which the exact nature of the activities being undertaken was not confirmed. It appeared that some of the buildings exist due to the presence of the SPS Yard facility. While unconfirmed, it is considered that some of the residents may be employed at the facility or at least work in small commercial enterprises that support the Yard's operations.

ES8.2.6 Bibiheybat Oil Field[7]

Bibiheybat Oil field surrounds the ATA yard. Fabrication activities may occur at the yard as part of the Phase 3 construction programme. At the time of writing, 122 people live within 1.5km of the ATA Yard. Some 16% of the population is aged six or below, 24% is between the ages of seven and 16, 56% between 17 and 59 years of age and the remaining 4% being 60 years old or over. All of those households surveyed were Muslim. There are a number of companies and households situated within the oil field. The majority of the households in the area have been occupied since 1993 - 1997.

There are nine companies employing 2,945 people within 1.5 km of the ATA yard. The majority of companies are well established with some being based at their present site since the 1920s and 1930s. Most employees arrive at work by public service bus, primarily from Bayil district. Specific buses are provided for employees working at the ATA Yard.

All surveyed companies and households have access to electricity. Only 50% of businesses and 43% of households have access to gas. Only six households (i.e. 21% of the total) use wood for cooking and heating in the home.

[7] All of the information contained on the Bibiheybat Oil Field is sourced from ATA Yard : Socio-Economic Baseline Survey, Final Report, URS, November 2003.

All businesses obtain water from the main Baku supply and the supply was reported as being regular, although one business reported shortages during the summer months. Residents of surveyed households indicated that they either obtain water from the main Baku supply or from the shipyard's water pipeline.

Only one business and three households have a centralised sewage system. All businesses stated they have a centralised garbage collection and disposal system but only eight households (i.e. 29% of the total) have access to such a service.

The main sources of income for households in the survey area are industry, the service sector and government/humanitarian support. For the majority of households surveyed, these income sources have remained the same in recent years.

Nine of the surveyed households (i.e. 32% of the total) own livestock (mainly poultry). In all cases the livestock are kept for their eggs and meat and live in the area surrounding the house. Only one household (i.e. 4% of total) is involved in fishing.

Almost 65% of household residents surveyed stated that they had health problems. A broad range of health problems were cited, but the main health issues identified were liver and heart conditions, glandular fever and child birth trauma. Residents in the survey area indicated that they access a variety of different hospitals located in Baku, Bibiheybat, Bail and Shixor settlements.

Seven schools were identified as being accessed by residents in the survey area[8]. There are 2 schools in Bibiheybat, 4 in 20th settlement and 1 in Bailov. Of these seven schools, 3 are IDP schools. Almost 25% of residents in the area are currently pupils or students and almost 16% have achieved either secondary technical or university level education.

Access roads to households in the survey area are primarily earth or gravel, although some are asphalt. Almost 90% of surveyed residents indicated that they consider the roads to be of poor quality.

ES9 Environmental Impact Assessment

ES9.1 Introduction

The impact assessment was performed considering the project as occurring in a number of distinct stages:

- Offshore facilities – onshore construction and pre-commissioning;
- Offshore facilities – offshore installation, hook-up and commissioning;
- Mobile offshore drilling unit (MODU) drilling (template and subsea water injection sites);
- Offshore facilities – platform drilling, production and operations;
- Offshore interfield pipelines – installation and operations;
- Onshore facilities – construction and commissioning; and
- Onshore facilities – operations.

The following steps were undertaken in the assessment for each of the above stages:

- Routine and planned non-routine activities within each project phase were identified and the potential environmental and socio-economic aspects[9] associated with these activities

[8] Schools in Baku are often numbered rather than named.
[9] Environmental aspect defined as "An element of an organisation's activities, products or services that can interact with the environment", Environmental Management Standard ISO 14001.

were defined and discussed with project engineers through the ENVIID workshops (Section ES4).

- For each aspect, potential impacts[10] were considered and the effect of mitigation measures established through the design process/mitigation workshops were then taken into account. These measures comprise either specific design components or operational management procedures intended to eliminate or reduce the potential for impacts from the identified activities. In particular, lessons learned from the offshore facility and terminal expansion programmes for Phase 1 and Phase 2 of ACG FFD were taken into consideration, particularly the environmental and social management procedures that have been put in place. An assessment was made of their success in mitigating impacts related to Phase 1.
- Where issues remained and the potential for residual impacts was identified, these issues were assessed and their significance ranked using the methodology, probability of occurrence (likelihood) and consequence criteria. Where the residual impact was found to be of low significance, no further mitigation measures are considered necessary. Where potentially significant residual impacts were identified, these will require additional mitigation measures above and beyond those already in place for the project.

Phase 3 is the final phase of FFD, and the development has many activities in common with Phases 1 and 2. As a result many of the potential impacts are similar, and can be mitigated by a common set of measures. The ESIA for Phase 3, took into consideration the considerable amount of work carried out in developing mitigation and management measures for Phases 1 and 2. As part of the ESIA process advantage was taken of the fact that Phases 1 and 2 are under construction, and the effectiveness of some of those mitigation measures could be assessed. This ESIA found that the majority of impacts were of low residual significance due to the mitigation and management measures already in place.

ES9.2 Summary of the Impact Assessment Results

When considered in isolation, the majority of proposed Phase 3 activities have been predicted to result in an insignificant impact, either due to the small scale of the activity, the distance of the activity from receptors, or through the effective mitigation of impacts through careful design and procedural controls. Phase 3 will follow the EOP, Phase 1 and Phase 2 developments and as such needs to be considered within the context of FFD. The assessment of potential cumulative impacts considers those impacts that may result from the combined or incremental effects of past, present or future activities on environmental or socio-economic receptors. Phase 3 activities will contribute to an accumulation of activities, issues and impacts associated with FFD, such as noise, air emissions (including greenhouse gas emissions) and socio-economic issues.

The potential for accidental events to occur during the different stages of the Phase 3 project has also been assessed in terms of probability of occurrence and the resulting consequence of these accidents. In addition, Phase 3 activities may contribute to the challenge of meeting wider operational issues relating to FFD or other BP AzBU activities in the region.

The results of this assessment show that no impacts were identified with a high residual significance. Over the project, six impacts were identified as having a medium residual significance. 2 impacts are directly related to the ACG Phase 3 development as a single project (i.e. the project occurs on its own with no consideration of other projects in the region). The remainder arise as a result of either the project in a cumulative context with other AzBU activities such as ACG Phases 1 and 2 and Shah Deniz, or relate to wider issues associated with FFD or other AzBU activities in the region. As such, these require further mitigation and monitoring and are discussed in the following subsections.

[10] Environmental impact defined as “Any change to the biophysical environment, positive or negative, that wholly or partially results from a project activity or associated process”, Environmental Management Standard ISO 14001.

ES9.2.1 Residual Impacts from the ACG Phase 3 Project in Isolation

ES9.2.1.1 Discharge of WBM drill cuttings from surface hole sections

The length of time over which the drilling programme will run (10 years) and the total volume of water based mud cuttings that will be discharged to sea (14,706 m^3 from the MODU and 10,526 m^3) from platform drilling) will result in a physical impact to the seabed at and near to the drilling locations. Importantly, there will be no opportunity for the marine organisms to recolonise the impacted area until the drilling stops. It should also be noted that concerns over discharge of drill cuttings and the resultant disturbance of the benthic habitat was raised during consultation.

A BPEO study into drill cuttings management was performed for the Phase 1 ESIA. Several issues were highlighted with containing and shipping cuttings to shore:

- Containerising the volume of cuttings that would be generated during drilling of the surface and top-hole sections would be technically difficult as storing large volumes of cuttings on the topsides has inherent safety risks.
- The cuttings would be generated at a high rate thereby necessitating frequent vessel operations and quick off-loading of the cuttings from the topsides.
- Shipping to shore results in atmospheric emissions from vessel operations.

The study concluded that while not desirable, release of WBM drill cuttings to the seabed is, on balance, the best environmental option.

Deposition of the WBM cuttings may extend for up to 1.4 km from the platform and lead to a predicted biomass loss of 3,300kg.

The impact of the release of WBM drill cuttings will be mitigated via a number of measures:

- Selection of low toxicity WBM;
- Sampling and analysis of the cuttings to ensure chloride levels are kept within operating standards;
- Discharge from the platform will be from a caisson at –138m, well below the productive zone.

ES9.2.1.2 Oil Spills

The accidental events of greatest environmental significance are a well blow out or pipeline rupture, both of which would result in a large-scale oil spill. Both scenarios are extremely unlikely due to the incorporation of a variety of protective measures during project design, which include:

- Prior to production, drilling geophysical surveys will be conducted and shallow gas pilot holes drilled to enable potentially dangerous gas pockets to be avoided.
- Blow Out Preventors (BOP). BOPs will be utilised in all wells drilled and can be rapidly closed following an influx of formation fluids into the well bore. In an emergency situation, gas will be vented at the surface and any oil will be contained in the drilling rig's mud system.
- Mud logging to assess the characteristics of the formation being drilled and assist in identifying dangerous conditions potentially leading to a blow out.

- External protection of pipelines with concrete to provide the weight required to ensure stability on the seabed and mechanical protection against impact (mitigated as part of the ACG Phase 1 and Phase 2 projects).
- Pipeline route selection also minimises possible interference from anchoring boats and the risk of damage due to dropped objects. In the nearshore zone where the pipeline is potentially vulnerable to passing ships it will be buried under the seabed (mitigated as part of the ACG Phase 1 and Phase 2 projects).
- Regular pipeline inspection - side scan sonar and visual inspection surveys by ROV with onboard camera, internal intelligent pig surveys, and flow rate monitoring
- Pipeline corrosion protection measures (sacrificial anodes and protective coating) and corrosion monitoring

The environmental impacts of spilled oil are dependent upon the potential for oil to contact sensitive resources. Under a no-response modelled scenario, the potential distribution of a worst-case oil spill (a large-scale blow-out) could extend throughout the middle and south Caspian, with oil reaching the shorelines of Azerbaijan, Turkmenistan and Iran. In practice, AIOC has developed an ACG specific Oil Spill Contingency Plan (OSCP) and Phase 3 will integrate into this plan. The Caspian littoral states are also developing National Oil Spill Contingency Plans. Although Azerbaijan has yet to prepare a plan, AIOC is working with industry and government to support spill response preparedness.

ES9.2.2 Cumulative Residual Impacts from the ACG Phase 3 Project

ES9.2.2.1 Offshore and onshore atmospheric emissions

The ACG project partners are committed to assessing, and where practical, reducing the projects Green House Gas (GHG) emissions. The Phase 3 HSE Design Standards included the following relating to the control of GHGs:

- Evaluation of options to reduce flaring, combined with the development of operational flare policy, aligned with ACG FFD;
- Maximization of energy efficiency in line with BPEO;
- Challenge and justification of well testing requirements;
- Minimisation of combustion and fugitive emissions; and
- Prevention of hydrocarbon gas disposal by continuous venting.

As a result of these Design Standards the ACG FFD project (including Phase 3) has included a number of design measures to minimise GHG emissions:

- The cessation of routine flaring from the Chirag-1 platform (as part of EOP);
- Onshore flare gas recovery;
- Onshore inert purge gas;
- Centralised power offshore for the Azeri Field;
- No continuous flaring for production;
- Gas re-injection (as opposed to flaring) at the Azeri Field;
- External floating roof tanks at terminal;
- Use of Aero-derivative turbines;
- Electric motor driven export compression on Phase 3; and

- Gas management measures, including provision of associated gas to SOCAR for use in the national grid in Azerbaijan

Considerable annual savings in GHG emissions have been made through the implementation of these measures, peaking at a saving of 1.3 Million Tonnes CO_2 Eq in 2011 (for combined all FFD phases together). In addition to the measures outlined above the following further measures will be implemented in order to ensure the minimisation of GHG emissions from the Phase 3 project:

- Operational mechanisms, such as optimisation of energy efficiency, leak detection programmes, monitoring and maintenance programmes;
- Investigation of opportunities to integrate broader GHG reduction considerations into the projects' environmental and community investment programmes; and
- Monitoring of developments within the UNFCCC for ideas that could have applicability to Azerbaijan.

ES9.2.3 Wider Issues

ES9.2.3.1 Final disposal of wastes

The management of waste is an issue for all BP activities due to the lack of available facilities for the reception, treatment (where required) and disposal of wastes in Azerbaijan. This problem is compounded by the fact that some types of wastes have not been produced in Azerbaijan to the scale that will result from the ACG and other BP operated developments, and therefore there has not been a requirement to develop disposal routes for them. Work is ongoing by the AzBU to define disposal routes for these wastes and ACG Phase 3 will align with and integrate into final disposal solutions.

BP's waste production is predicted to peak around 2004, declining rapidly to around by the end of 2007 as projects move from construction to operation resulting in a decrease in the amount of waste generation. From 2008, waste production will become relatively constant until 2024. Current waste management practices are shown in Table ES.1.

Table ES.1 AzBU Identified Primary Waste Disposal Routes

Category	Description	Disposal Location
Hazardous waste	Storage under controlled conditions	Serenja Hazardous Waste Facility
Non-hazardous waste	Re-use/recycling and where not possible, landfill	Various recycling routes (steel, paper, wood) or Balakhany Municipal Landfill

AzBU is currently working in conjunction with local agencies and authorities and with individual BP project teams to identify compliant interim and long-term waste management solutions for hazardous storage, reuse/recycling options, landfill sites and operations.

ES9.2.3.2 Workforce Demobilisation

The demobilisation of the workforce that will occur at the completion of the construction programme remains of medium residual significance due to the number of people that will be directly affected and the consequent socio-economic impact. Whilst those employed in earlier projects have been able to move onto subsequent BP construction programmes, after the construction period of Phase 3 there will be no further major BP construction programmes to which the workforce can transfer.

The Phase 3 mitigations that will be implemented to minimise the impacts of construction workforce demobilisation are as follows:

- The verification of socio-economic management measures assumed to be in place during the impact assessment; specifically the implementation of appropriate recruitment, employment and training procedures; contractor alignment and coordination in workforce management across the project;
- The alignment and integration of ACG Phase 3 into the framework of the BP AzBU established social management system and social investment programme, which includes the following key components:
  - Transparency & Communication: Clear communication to all workers on terms and conditions of contracts at start of work, including notification process, so that workers are aware of the length of their employment.
  - Inter-Project Management: Focus on planning and collaboration between projects to maximise alternative employment opportunities, and the transfer of skilled and non-skilled workers between existing and any new projects that arise.
  - Contribution and communication within the established Industrial Forum (IF) mechanism between the projects main contractors on behalf of ACG Phase 3.
  - Provision of Training & Guidance: Training &/or Business Development Centres will be establishment to supplement existing training and diversify skills, such as business development, computer and life skills. These will be available to workers and other locals.
  - Social Development: Existing social investment (SI) programmes will be used as a platform to launch capacity building, sustainable income generation and micro-enterprise projects to enhance the opportunity for individuals, or groups close to BP-operated projects to generate their own income.
  - Linkages to External Activities: Engaging into and supporting where appropriate other NGO, IFI or Government strategies aimed at supporting economic development within the country and region.
- Development and proposal to AzBU of additional measures based on project experience to augment existing programmes.

ES9.2.3.3 Decommissioning

Local scientists raised the future decommissioning of ACG offshore facilities during stakeholder consultation (Section 8). The consideration of decommissioning, and more specifically the concern over the potential hazard to shipping posed by installations not completely removed from the seafloor, has therefore been considered in the ESIA process.

The ACG Phase 3 facilities have been designed so as to enable complete removal. According to the terms of the PSA, AIOC is required to produce a field abandonment plan for the ACG facilities one year prior to completion of 70% production of identified reserves. Whilst the PSA sates that ownership of these facilities will pass to SOCAR on completion of the term of the PSA, AIOC will develop a Field Abandonment Plan which will present recommendations for project decommissioning based on a best practicable environmental options (BPEO) study of all available options. The financial aspects of Phase 3 decommissioning will be addressed by the contribution of a proportionate share of the revenue raised from the project by each of the AIOC partners, as defined by the PSA.

ES10 Conclusions

The ACG FFD Phase 3 project, as the last major phase of full field development of the oil and gas reserves in the ACG Contract Area, has the potential to deliver major economic benefits to Azerbaijan. The ACG FFD project, together with the linked investments including ACG Phases 1 and 2, EOP, the BTC project are collectively the largest investments ever committed in Azerbaijan. They will have a major positive effect on the national economy of Azerbaijan.

There are a number of residual environmental impacts that have been assessed as being of medium residual significance, although only two of these; the discharge of drill cuttings and oil spills are directly a result of the ACG Phase 3 project when considered in isolation with other projects in the region. The impact of drill cuttings discharge includes repeated physical impacts to the offshore benthic habitat over a 10-year drilling period. It is this timescale, rather than the extent of the impact, that is the reason for a ranking as medium significance. The potential impact of a large oil spill incident would be significant and justifies a medium ranking, however the likelihood of such an event occurring is very small.

In addition, a number of residual cumulative impacts have been identified when considering ACG Phase 3 together with other projects (such as ACG Phase 1 and 2). These include the onshore and offshore cumulative GHG emissions. For Phase 3 a number of design measures have been adopted to reduce the GHG contribution from the project.

A range of other issues have been identified, not as specific for ACG Phase 3, but as wider issues that are being addressed by the AzBU. These comprise final disposal solutions for waste, demanning of the construction workforce at the end of the onshore contracts, and decommissioning. A number of initiatives are being pursued with respect to these wider issues and management and mitigation measures will be in place by the time ACG Phase 3 is initiated.

On consideration of the above, the ACG Phase 3 project, within the context of ACG FFD, has the potential to make a very significant contribution to sustainable development in Azerbaijan. Importantly, the project could indirectly add impetus to the energy sector reform within Azerbaijan. This in turn should improve the population’s access to energy (gas and electricity) and result in the wider use of cleaner fuels.

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Units and abbreviations

Units

barg	1 bar (gauge) = 14.5 psi
bbl	Barrel (6.2898 barrels = 1 m^3)
bcm	Billion cubic metres
bpd	Barrels per day
Bq	Becquerel
cm	Centimetre
dB	Decibel
dB (A)	A weighted unit of sound intensity weighted in favour of frequencies audible to the human ear.
^{0}C	Degrees centigrade
g	grammes
ha	Hectare
hr	Hour
h	Hour
K	One thousand (eg. 500K = 500,000)
keV	One thousand electron volts
kg	Kilogrammes
km	Kilometre
km^2	Square kilometre
kva	Kilovoltampere
kW	kilowatts
l	Litres
lb	Pounds (imperial)
m	Metres
M	Million
m^2	Square metres
m^3	Cubic metres
Mbbl	Thousand barrels
Mbpd	Thousand barrels per day
Mbwpd	Thousand barrels of water per day
mbgl	Meters below ground level
µm	Micrometers
µg	Micrograms
mg	Milligrams
ml	Millilitres
mm	Millimetres
MMBtu	Million British thermal units
MMscf	Million standard cubic feet
MMscfd	Million standard cubic feet per day
MMstb	Million standard barrels
MT	Metric tonnes
MW	Megawatt
ppb	Parts per billion
ppm	Parts per million
ppmv	Parts per million by volume
s	Second
scf	Standard cubic feet
Sm^3	Standard cubic metres
te	tonnes

yr	Year
“	Inches
%	Percent
‰	Parts per thousand
%ile	Percentile
$	United States Dollars
-	Minus
+	Plus
@	At
/	Per
~	Approximately
-ve	Negative
>	Greater than
E	Mulitiply by 10 to the power of… (eg 8.00E-03 = 8 multiplied by 10 to the power of minus 3)

Abbreviations

ACG	Azeri, Chirag and Deep Water Gunashli
AIDS	Acquired Immune Deficiency Syndrome
AIOC	Azerbaijan International Operating Company
AFFF	Aqueous Film Forming Foam
AHFS	Azerbaijan-Holland Friendship Society
AJSC	Caspian Basin Emergency Salvage
Am	Americum
API	American Petroleum Institute
AQS	Air Quality Standard
ARB	Azeri Red Book
ASTM	American Society for Testing and Materials
ATA	Amec-Tekfen-Azfen
AzBU	Azerbaijan Business Unit
AZM	Azerbaijan Manat
AZTV-1	Azeri Television Channel 1
AZTV-2	Azeri Television Channel 2
Ba	Barium
BACT	Best Available Control Technology
BAT	Best Available Technology
BOD	Biological Oxygen Demand
BOP	Blow Out Preventer
BP	British Petroleum
BPEO	Best Practicable Environmental Option
BTC	Baku-Tbilisi-Ceyhan
BTEX	Benzene, toluene, ethylbenzene, xylene
BU	Business Unit
C&WP	Compression and Water injection platform
C	Chirag
ca.	Circa (English word used with dates meaning about or approximately).
Ca	Calcium
CA	Central Azeri
CAPEX	Capital Expenditure
CCGT	Combined Cycle Gas Turbines
CCP	Contractor Control Plan
CCPG	Combined Cycle Power Generation
Cd	Cadmium
CD	Compact Disk
CFC	Chlorofluorocarbon
CH_4	Methane
CIP	Community Investment Programme
CIPP	Contractor Implementation Plans and Procedures
CITES	Convention on Trade In Endangered Species
CLEA	Contaminated Lands Exposure Assessment
CLO	Community Liason Officer
CMC	Contracts Management Committee
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CO_2 Eq	Equivalent
Cr	Chromium
CRA	Corrosion Resistant Alloy
CRI	Cuttings Reinjection
CRP	Community Relations Programme

Cs	Caesium
CSC	Caspian Shipping Company
Cu	Copper
CVP	Capital Value Process
CWAA	Central Waste Accumulation Area
DBA	Derrick Barge Azerbaijan
DES	Derrick Equipment Set
DETR	Department of the Environment, Transport and the Regions
DHFC	Down Hole Flow Control
DLE	Dry Low Emission
DPCU	Dew Point Control Unit
DRA	Drag Reducing Agent
DSM	Drilling Support Module
DST	Drill Stem Test
DSV	Dive Support Vessel
DUQ	Drilling, Utilities and Quarters
DWCM	Diamond Wire Cutting Machines
DWG	Deep Water Gunashli
E&P Forum	Exploration and Production Forum
EA	East Azeri
EBRD	European Bank for Reconstruction and Development
EC	Effective Concentration
EC	European Community
EC_{50}	The statistical estimate of the toxicant concentration that has an adverse effect on 50% of the test organisms after a specific exposure time.
ECWP	Early Civil Work Programme
EIA	Environmental Impact Assessment
EMS	Environmental Management System
ENVIID	Environmental Issues Identification
EOP	Early Oil Project
EQS	Environmental Quality Standard
ERD	Extended Reach
ERT	Environment & Resource Technology Ltd
ES	Environmental Statement
ES	Executive Summary
ESAP	Environmental & Social Action Plan
ESIA	Environmental and Socio-Economic Impact Assessment
ESD	Emergency Shut Down
ESMS	Environmental and Social Management System
FDI	Foreign Direct Investment
Fe	Iron
FFD	Full Field Development
FFFP	Film Forming Fluoro Protein
FOCs	Foreign Oil Companies
FPSO	Floating Production Storage and Offloading Vessel
GCA	Gunashli, Chirag, Azeri
FSU	Former Soviet Union
GDP	Gross Domestic Product
GHG	Greenhouse Gases
GHSER	Getting HSE Right
GT	Gas turbine
GWP	Global Warming Potential
H_2S	Hydrogen Sulphide
HADT	Hazardous Area Drainage Tank

HDC	Human Development Centre
HDF	Human Development Forum
HDI	Human Development Index
HFCs	Hydrofluorocarbons
Hg	Mercury
HIV	Human Immunodeficiency Virus
HOCNF	Harmonised Offshore Chemical Notification Format
HP	High-pressure
HRSG	Heat Recovery Steam Generators
HSE	Health, Safety & Environment
HVAC	Heating, Ventilation and Air-Conditioning
HUC	Hook-up and Commissioning
IDP	Internally Displaced Persons
IF	Industrial Forum
IFC	International Finance Corporation
IFIs	International Finance Institutions
IMF	International Monetary Fund
IMO	International Maritime Organisation
IMP	Integrated Monitoring Programme
ISO / iso	International Organisation for Standardisation
ITD	Indirect Thermal Desorption
IUCN	International Union for the Conservation of Nature
KASPAR	Caspian Basin State Ship Department
KO	Knock out
KPI	Key Performance Indicator
LAO	Linear Alpha Olefin
LC50	Lethal Concentration 50%
LCM	Lost Circulation Mud
LER	Local Equipment Room
LP	Low Pressure
LSR	Local Switch Room
MARPOL	International Convention for the Pollution of Prevention by Ships, 1973, as modified by the Protocol of 1978
MEG	Mono Ethylene Glycol
MENR	Ministry of Ecology and Natural Resources
MOD	Ministry of Defense
MODU	Mobile Offshore Drilling Unit
MOL	Main Oil Line
MP	Medium Pressure
MPC	Maximum Permissible Concentration
MPN	Most Probable Number
MSD	Marine Sanitation Device
MSDS	Material Safety Data Sheet
MSR	Main Switch Room
MW	Megawatt
N/A	Not applicable
N_2	Nitrogen gas
N_2O	Nitrous oxide
NDT	Non Destructive Testing
NER	Northern Export Route
NGO	Non-governmental Organisation
NIS	Newly Independent States
NMVOC	Non-methane Volatile Organic Compounds
NO	Nitrogen Oxide
NO_2	Nitrogen Dioxide

NO_x	Nitrogen Oxides
NORM	Naturally Occurring Radioactive Material
NPP	Napthalene and phenathrenes and dibenzothiophenes
NREP	Northern Route of Export Pipeline
NWBM	Non Water Based Mud
OBM	Oil Based Mud
OCNS	Offshore Chemical Notification Scheme
ODS	Oxygen Depleting Substances
OHGP	Open-hole Gravel Packs
OP	Operating procedures
OPEX	Operating expenditure
OSCP	Oil Spill Contingency Plan
OSIS	Oil Spill Information System
OSPAR	Oslo and Paris Convention for the Protection of the Marine Environment of the North East Atlantic
OSRP	Oil Spill Response Plan
PAH	Polycyclic aromatic hydrocarbons
Pb	Lead
PC	Process Contribution
PCDP	Public Consultation and Disclosure Plan
PCWU	Production, Compression Water Injection and Utilities
PDQ	Production, Drilling and Quarters platform
PDUQ	Production, Drilling, Utilities and Quarters platform
PEC	Predicted Environmental Concentration
pH	Acidity / akalinity
PFCs	Perfluorocarbons
PM	Particulate matter
POB	Persons on Board
PPM	Planned Preventative Maintenance
PRSP	State Programme on Poverty Reduction and Economic Growth
PSA	Production Sharing Agreement
PSA	Particle Size Analysis
PW	Produced water
Ra	Radium
RB211	Rolls Royce Duel Fuel Power Generator Turbine RB211
RBCA	Risk Based Closure Assessment Methodology
RDI	Regional Development Initiative
Rn	Noble Gas
RO	Reverse osmosis
ROV	Remotely operated vehicle
RSK	RSK Environment Ltd
SBM	Synthetic Based Mud
SCP	South Caucasus Pipeline
SCM	Subsea Control Module
SD	Shah Deniz
SDGP	Shah Deniz Gas Pipeline
SCS	Solids Circulation System
SF_6	Sulphur hexafluoride
SI	Social Investment
SIC	Sound Immission Contours
SIMOPS	Simultaneous operations
SLIP	Supplementary Lenders Information Package
SNIFFER	Scotland and Northern Ireland Forum for Environmental Research

SOx	Sulphur Oxides
SO_2	Sulphur dioxide
SOCAR	State Oil Company of the Azerbaijan Republic
SPAR	Type of offshore floating storage facility, eg the Brent Spar
SPS	Shelprojecstroy
SSCA	State Statistical Committee of Azerbaijan
St	Strontium
STB-01	Name of a transportation and installation barge
STEP	Sangachal Terminal Expansion Programme
SWG	Shallow Water Gunashli
TAE	Trans-Asia-Europe Fibre-Optic Line
TB	Tuberculosis
TCN	Third Country Nationals
TEG	Tri-ethylene Glycol
Th	Thorium
THC	Total Hydrocarbon Content
THPS	Tetrakishydroxymethylphosphonium sulphate
TOC	Total Organic Carbon
TPG	Technip Geoproduction
TPH	Total Petroleum Hydrocarbons
TSS	Total Suspended Solids
TV	Television
TVD BRT	True Vertical Depth Below Rotary Table
UCM	Unresolved complex mixture
UK	United Kingdom
UN	United Nations
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNFPA	United Nations Food Programme
UNICEF	United Nations Children's Fund
URI	Upper respiratory infection
URS	URS Corporation Ltd
USA	United States of America
US EPA	United States Environmental Protection Agency
USCG	United States Coast Guard
VOCs	Volatile Organic Compounds
WA	West Azeri
WI	Water Injection
WC	West Chirag
WB	World Bank
WBG	World Bank Group
WBM	Water Based Mud
WER	Western Export Route
WHO	World Health Organisation
WREP	Western Route Export Pipeline
Zn	Zinc

GLOSSARY

Abandonment
Final plugging of wells and/or permanent dismantling of a production platform or other installation.

Acute toxicity
The manifestation of a toxic effect over a short period relative to the lifespan of the organism.

Alien species / Introduced species
A species not native to the environment it inhabits.

American Petroleum Institute (API)
The world's foremost authority on oil industry standards and practices. API Gravity is a reference system for the density of crude oil and constituent hydrocarbons.

Amphipod
A small crustacean of the order Amphipoda having a laterally compressed body with no carapace.

Anadromous
Migrating up rivers from the sea to breed in fresh water.

Anodes
A positively charged electrode, as of an electrolytic cell, a storage battery, or an electron tube.

Annelid
Any of various worms or wormlike animals of the phylum Annelida, characterised by an elongated, cylindrical and segmented body.

Annulus
A term loosely used to describe the space between the drill string and the well wall, or casing strings or between casing and the production tubing.

Anti-foulant
Chemicals that are added to fluids, such as cuprous (copper) oxide or tributyltin (TBT) which inhibit fouling of plant or vessels by organisms.

Anthropogenic
Relating to humans.

Appraisal well
A well drilled to confirm the size or quality of an oil discovery. Before development, a discovery is likely to need at least two or three such wells.

Aquifer
An underground formation of rock saturated with water.

Aromatic hydrocarbons
The group of hydrocarbons which include Benzene, Toluene, Ethylene, Xylene etc.

Associated Gas
Natural gas found as part of or in conjunction with other constituents of crude oil as opposed to such gas found on its own.

ASTM
American Society for Testing and Materials publish authoratative standards such as calculation tables etc.

Ballast
Water taken aboard a vessel to maintain stability and to distribute load stresses.

Barite
A very heavy substances used as a main component of drilling mud to increase its density (mud weight and counter balance hydrostatic pressures).

Barrels
The traditional unit of measure of oil volume, equivalent to 159 litres (0.159 m^3) or approximately 35 imperial gallons (42 US gallons).

Beached Oil
The part of an oil spill that reaches the shore

Benthos
The collection of organisms attached to or resting on the bottom sediments and those which bore or burrow into the sediments.

Bentonite
A clay mineral

Best Practicable Environmental Option (BPEO)
Evaluation of the environmental implications of project options available along with safety and cost considerations.

Biocides
A chemical agent that can be added to fluids for the purpose of prevention or limitation of bacteria growth.

Biodegradable
Susceptible to breakdown into simpler compounds by microorganisms in the soil, water and atmosphere. Biodegradation often converts toxic organic compounds into non- or less toxic substances.

Biological Oxygen Demand (BOD)
The amount of oxygen required by aerobic microorganisms to decompose the organic matter in a sample of water, such as that polluted by sewage. It is used as a measure of the degree of water pollution.

Biomass
The total mass of living matter within a given unit of environmental area.

Biotope
An area that is uniform in environmental conditions and in its distribution of animal and plant life.

Bivalve
A marine or freshwater mollusk having a laterally compressed body and a shell consisting of two hinged valves.

Black Water
Sewage effluent.

Blowout
Uncontrolled or uncontrollable release of downhole pressure upward through the wellbore or casing.

Blowout Preventor (BOP)
Hydraulically operated device used to prevent uncontrolled releases of oil or gas from a well.

Borehole
The hole in the earth made by the drill; the uncased drill hole from the surface to the bottom of the well.

Bund
A wall or dyke around storage tanks to contain the contents in case of rupture or spillage.

Caisson
A steel cylindrical chamber extending from the drilling rig or platform that is completely submerged and may be used for the uptake of sea water or the discharge of effluent.

Casing
The steel pipes with which a well is lined for protection against collapse of the well borehole and unwanted leakage into or from the surrounding formation.

Cathodic Protection
A method of neutralising the corrosive static electric charges in a submerged steel structure.

Cement
Used to set casing in the well bore and seal off unproductive formations and apertures. It is also used as a coating to add weight to submarine pipelines.

Coliform
Of or relating to the rod-shaped bacteria that commonly inhabit the intestines of human beings and other vertebrates, especially the colon bacillus.

Commissioning
Preparatory work, servicing etc. usually on newly installed equipment and all testing prior to full production.

Completion
See well completion.

Completion Fluid
Chemical mixture present in the well during the placement of production tubing and perforation of the well.

Condensate (Gas Condensate)
Light hydrocarbon fractions produced with natural gas which condense into liquid at normal temperatures and pressures associated with surface production equipment.

Conductor Pipe
A relatively short string of large diameter pipe which is set to keep the top of the wellbore open and to provide means of conveying the upflowing drilling fluid from the wellbore to the surface drilling fluid system until surface casing string is set in the well. Conductor pipe may also be used in well control. Conductor pipe is usually cemented.

Consequence
The resultant effect (positive or negative) of an activity’s interaction with the legal, natural and/or socio-economic environments

Consortium
A joint venture enterprise used by the oil industry as a vehicle for joint operations where a distinct local legal entity and joint staffing are required.

Contract Area
Area of the sea that has been sub-divided and licensed/leased to a company or group of companies for exploration and production of hydrocarbons.

Copepod
Any member of a large family of the phylum Arthropoda, including many crustaceans, living in freshwater and marine water. Some copepods are parasitic and others are free living.

Corrosion
The eating away of metal by chemical or electrochemical action. The rusting and pitting of pipelines, steel tanks, and other metal structures is caused by a complex electrochemical action.

Corrosion inhibitors
Chemicals which delay the process of corrosion on metal.

Crude Oil
An unrefined mixture of naturally-occurring hydrocarbons with varying densities and properties.

Ctenophore
Any of various marine animals of the phylum Ctenophora, having transparent, gelatinous bodies bearing eight rows of comblike cilia used for swimming. Also known as comb jelly.

Cuttings
The fragments of rock dislodged by the bit and brought to the surface in the mud.

Cumulative Impact
Environmental and/or socio-economic aspects that may not on their own constitute a significant impact but when combined with impacts from past, present or reasonably foreseeable future activities associated with this and/or other projects, result in a larger and more significance impact(s).

Decibel (dB)
A unit used (one tenth of a bel) used in the comparison of two power levels relating to sound intensities.

Decommissioning
Shutdown of the pipeline with system cleaning and dismantling of any facilities.

De-gasser
A separator which removes entrained gas from the returned mud flow. Also any process which removes gases of various kinds from an oil flow.

Dehydration
Removing water from the gas stream.

Demulsifier
A chemical used to break down crude-oil water emulsions. The chemical reduces the surface tension of the film of oil surrounding the droplets of water. The water then settles to the bottom of the tank.

Derrick
A pylon-like steel tower which provides the vertical lifting capacity needed for drilling the well.

Descalers
Substances added to prevent build-up of, and to a lesser extent remove, solids such as calcium carbonates and sulphates deposited on the drill pipe and casing.

Detection Limit
The smallest concentration or amount of a substance that can be reported as present with a specified degree of certainty by a definite complete analytical procedure.

Development well
Any well drilled in the course of extraction of reservoir hydrocarbons, whether specifically a production well or injection well.

Diatom
Any of various microscopic one-celled or colonial algae of the class Bacillariophyceae, having cell walls of silica consisting of two interlocking symmetrical valves.

Diffusion
The transfer of particles by their random motion from one part of the medium to another.

Dispersant
Specially designed oil spill products that are composed of detergent-like surfactants in low toxicity solvents. Dispersants do not actually remove oil from the water but rather break the oil slick into small particles, which then disperse into the water where they are further broken down by natural processes.

Diurnal
Relating to a 24-hour period, daily.

Down Hole
Down a well.

Downtime
A period when any equipment is unserviceable or out of operation for maintenance.

Drill bit
A drilling tool used to cut through rock.

Drill Stem/Drill Stem Test (DST)
The assembled drill pipe in the well which serves to rotate the bit, to convey drilling mud or cement down the well and to flow to the surface the fluids in primary assessment of a discovery.

Drilling mud
A special clay, water and chemical additives, pumped downhole through the drill pipe (string) and drill bit. The mud cools the rapidly rotating bit, lubricates the drillpipe as it turns in the well bore, carries rock cuttings to the surface and serves as a plaster to prevent the wall of the borehole from collapsing. Also known as drilling fluids.

Drill string
Lengths of steel tubing roughly 10 m long screwed together to form a pipe connecting the drill bit to the drilling rig. It is rotated to drill the hole and delivers the drilling fluids to the cutting edge of the bit.

Dynamic positioning
Use of thrusters instead of anchors to maintain the position of a vessel.

Effluent
Waste products emitted by an operation or porcess.

Environmental and Socio-economic Impact Assessment
Systematic review of the environmental or socio-economic effects a proposed project may have on its surrounding environment.

Environmental Aspect
An element of an organisation's activities, products or services that can interact with the environment.

Environmental Impact
Any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organisation's activities, products or services.

Environmental Management System
System established to manage an organisation's processes and resultant environmental impacts.

Environmental receptors
Any of various organisms that are directly or indirectly affected by environmental impact.

Environmental Statement
Formal document presenting the findings of an ESIA process for a proposed project.

Exploration well
An exploration well is a well drilled to test a potential but unproven hydrocarbon reservoir.

Fault
A discontinuity in a rock formation caused by fracturing of the earth's crust.

Filter feeder
A variety of animals living mostly on detritus or on plankton, whose feeding mechanism comprises a filter and a means of creating a current carrying particles through the filter.

Finger pier
A jetty at a right-angle to the shoreline.

Flaring
Controlled disposal of surplus combustible vapours by igniting them in the atmosphere.

Flash Point
The lowest temperature at which vapours arising form the oil will ignite momentarily on application of a flame under specified conditions.

Float-out/Float-over
The launch or loading out of jackets or other structures for installation offshore on a flotation barge or other vessel.

Flowline
The pipe thorugh which oil travels from the well to the processing equipment or to storage.

Fluvial
Of or relating to rivers or streams or produced by the action of a river or stream.

Footprint
The impact/impression on the seabed or land from a facility.

Formation
A rock deposit or structure of homogenous origin and appearance.

Formation damage
Damage to the reservoir rock around a well due to e.g. plugging with mud, infiltration by water from the well or high flow rate.

Fugitive emissions
Very small chronic escape of gas and liquids from equipment and pipework.

Gas injection
Natural gas injected under high pressure into a production reservoir through an input of injection well as part of a pressure-maintenance, secondary recovery, or recycling operation.

Gas lift
Increasing the production flow of oil by injecting gas down a well to mingle with the oil, thus increasing pressure and flow rate.

Gastropod
Any of the various mollusks of the class Gastropoda such as the snail, characteristically having a single, usually coiled shell or no shell at all, a ventral muscular foot for locomotion, and eyes and feelers located on a distinct head.

Gravel Pack
A fill of fine gravel used to support the formation and keep the interior of the well clean when the producing formation of a well is crumbling or caving into the well bore and is plugging the perforations.

Habitat
An area where particular animal or plant species and assemblages are found, defined by environmental parameters.

Halophyte
An organism which prefers highly saline environments for growth.

Hazard
The potential to cause harm, including ill health or injury; damage to property, plant, products or the environment; production losses or increased liabilities.

Health, Safety and Environmental Management Plan
A description of the means of achieving health, safety and environmental objectives.

Health Safety and Environmental Management System
The company structure, responsibilities, practices, procedures, processes and resources for implementing health, safety and environmental management.

Hook-up
The activity following offshore development installation during which all connections and services are made operable for commissioning and 'start-up'.

Horizon
Layers within the soil or subsoil in a vertical cross section of land.

Hydrocarbon
Organic chemical compounds of hydrogen and carbon atoms. There are a vast number of these compounds and they form the basis of all petroleum products. They may exist as gases, liquids or solids, examples being methane, hexane and asphalt.

Hydrogen Sulfide
A pungent corrosive toxic gas occurring naturally in some oil and gas reservoirs (and elsewhere) generated by the metabolism of certain types of bacteria.

Hydrostatic pressure
The pressure exerted by a column of liquid at a given depth such as that exerted by drilling fluid in a well.

Hydrostatic Testing/Hydrotest
The checking of the integrity of a container (e.g. tank or pipe) by filling it with water under pressure and testing for any loss of pressure.

Inert Gas
Chemically unreactive gases used to flood compartments when there is fire or imminent danger of fire.

Injection well
A well used to introduce fluids into a reservoir, usually for enhanced recovery

Invertebrates
Any animal lacking a backbone, including all species not classified as vertebrates.

Jacket
The structure of an offshore steel, piled platform, which supports the topsides facilities.

Larvae
An immature free-living form of animal that develops into a different form through metamorphosis.

Lay Barge / Pipelay Barge
A vessel designed for welding together pipelines and laying them on the seabed.

LC_{50}
Standard test used to measure the toxicity of
chemicals based on time required to kill 50% of the test organisms over a specified time.

Lithology
The study of rocks and hence the description of different formations encountered by a well.

Littoral
The part of the shore that is under water at high tide and exposed when the tide is low. Also known as the intertidal zone.

Log/Logging
Various devices for taking measurements of formations, physical conditions and fluids encountered by a well, together with the records produced by them.

Manifold
Assembly of pipes, valves and fittings which allows fluids from more than one source to be directed to various alternative routes.

Mammal
A class of warm-blooded vertebrates, Mammalia, having mammary glands in the female.

Mat/Mattress
A structure to support and protect the lay down head and pig launcher/receiver during installation and pre-commissioning activities and also to provide any additional dropped object protection to the pipeline and tie-in spool arrangement.

Mitigation
Process that would make a negative consequence less severe.

Module
A separate section or box-like compartment of the top side of an offshore construction, as far as possible self-contained, designed to be lifted into place and connected to other modules offshore.

Naturally Ocurring Radioactive Material (NORM)
Low Specific Activity scale is an example of NORM.

Non-destructive Testing (NDT)
Methods of inspecting and testing the quality or integrity of vessels or equipment which do not involve the removal or testing to destruction of representative sections.

Non-Water Based Muds
Drilling fluids such as Oil Based Muds and Synthetic Based Muds, which are not based on suspension of solids using water.

Oligochaete
Any of various annelid worms of the class Oligochaeta, including the earthworms and a few small freshwater forms.

Operator
The company responsible for conducting operations on a concession on behalf of itself and any other concession-holders.

pH
A scale of alkalinity or acidity, running from 0 to 14 with 7 representing neutrality, 0 maximum acidity and 1 maximum alkalinity.

Phytoplankton
Microscopic planktonic plants, e.g. diatoms,
dinoflagellates.

Pig
A bullet shaped, cylindrical or spherical capsule which is inserted into a pipeline flow and travels along with the fluid in the pipeline. Its primary purpose is to scrape the pipeline clean from rust, wax or other deposits. More sophisticated pigs, called intelligent pigs, carry instrumentation used in pipeline inspection.

Piling
Tubular steel shafts driven into the seabed to secure a structure to the seabed. Piles are usually driven through external sleeves or skirts attached to legs.

Pipe Rack
Where stands of drill pipe are stacked verticaly in a derrick ready for use.

Plankton
Tiny plants and animals that drift in the surface waters of seas and lakes. Of great economic and ecological importance as they are a major component of marine food chains.

Platform
One of the various types of offshore structures.

Pollution
The introduction by man, directly or indirectly, of substances or energy to the marine environment resulting in deleterious effects such as harm to living resources; hazards to human health; hindrance of marine activities including fishing; and impairment of the quality for use of seawater and reduction of amenities.

Polychaete
Any of various annelid worms of the class Polychaeta, including mostly marine worms such as the lugworm, and characterized by fleshy paired appendages tipped with bristles on each body segment.

Polycyclic Aromatic Hydrocarbon (PAH)
Hydrocarbons whose carbon atoms form a ring or rings.

Polymer
Two or more molecules of the same kind, combined to form a compound with different physical properties.

Porosity
The volume of free space between the grains of a rock capable of holding fluid.

Practice
Accepted methods or means of accomplishing stated tasks.

Produced Water
Water that naturally accompanies produced oil. Also known as produced formation water.

Production
The full-scale extraction of hydrocarbon reserves.

Reduction
The generation of less waste through more efficient practices.

Recycling/Recovery
The conversion of wastes into usable materials and/or extraction of energy or materials from wastes.

Red List / Red Book
A list comprised of rare or threatened species of plants and animals. The book containing Red List species.

Reservoir
A porous, fractured or cavitied rock formation with a geological seal forming a trap for producible hydrocarbons.

Reservoir pressure
The pressure at reservoir depth in a shut-in well.

Residual Impacts
Residual impacts are impacts that remain after mitigation measures, including those incorporated into the project's base case design and those developed in addition to the base design, have been applied.

Reuse
The use of materials or products that are reusable in their original form.

Rig
A collective term to describe the permanent equipment needed for drilling a well.

Riser
A pipe through which fluids flow upwards.

Risk
The product of the chance that a specified undesired event will occur and the severity of the consequences of the event.

Salinity
Total amount of solid material dissolved in aqueous solution. Salinity is measured in parts per thousand.

Scrubbing
Purifying gas by treatment with a water or chemical wash.

Screen
A tubular "sieve" inserted in a well bore to hold back loose sand and rock while letting oil and gas enter the well.

Screen out
A term used to describe when a fluid that is loaded with solids has insufficient energy to carry its solids and as a consequence the fluid very quickly loses or deposits its solids in an uncontrolled way.

Semi-submersible drilling rig
A type of floating offshore drilling rig which has pontoons or buoyancy chambers located on short legs below the drilling platform.

Separator
A process vessel used to separate gases and liquids in a hydrocarbon stream.

Shale shaker
Screen for extracting rock cuttings from circulating drilling mud.

Significance
The significance of the impact is expressed as the product of the consequence and likelihood of occurrence of the activity.

Solidification
The addition of materials (sawdust, adsorbent polymers etc) to a waste to change its physical state and improve handling and weight-bearing characteristics.

Sour Oil/Gas
Oil or gas with a relatively high content of odorous, poisonous or corrosive sulfur compounds such as Hydrogen Sulfide (H_2S).

Stochastic oil spill modelling
A simulation of the distance and speed with which oil travels following a spill, based on range of possible input conditions, the product of which is an array of probable results.

Surfactant
A detergent or emulsifier.

Taxon
Plural -Taxa. A taxonomic category or group.

Template
The structural framework within which subsea wellheads are grouped. Also, the prepared foundation or "mattress" for soft or shifting seabeds on which a jackup rig can be stably installed.

Thermal desorption
A non-oxidising process using heat to desorp oil from oily wastes.

Thermocline
Temperature differential in the water.

Toxicity
Inherent potential or capacity of a test substance to cause adverse effects on living organisms.

Toxicity test
Procedure that measures the toxicity produced by exposure to a series of concentrations of a test substance. In an aquatic toxicity test, the effect is usually measured as either the proportion of organisms affected or the degree of effect shown by the organism.

Trajectory oil spill modelling
Estimated distance and speed with which oil travels following a spill, based on a single release scenario.

Tubing
Tubing installed within the casing through which wells are normally produced.

Unresolved Complex Mixture (UCM)
A mixture of hydrocarbons which produce a baseline rise in gas chromatograms of petroleum-derived hydrocarbons.

Venting
The release of gases to the atmosphere without burning.

Viscosity
The resistance of a fluid to flow due to the mutual adherence to its molecules.

Water Based Muds (WBM)
Drilling fluid based on suspension of solids in water.

Water injection
The injection of water into a reservoir.

Water separation
The removal of water from the production flow of oil or gas.

Wax
Paraffin wax is a constituent of crude oil that often requires special treatment to allow the oil to flow freely at surface conditions.

Weathering
Processes related to the chemical action of air, water and organisms. Weathering results in evaporative loss of light hydrocarbons and it is commonly accompanied by biodegradation and water washing.

Well clean-up
Ridding the borehole of spent fluid. This returns the well to an original state and drains back into the borehole where it is pumped or circulated out, leaving the hole clean.

Well completion
The work of preparing a newly drilled well for production, including Christmas tree deployment and erecting flow tanks.

Wellhead
A top of casing and the attached control and flow valves. The well head is where the control valves, testing equipment and take-off piping are located.

Well testing
Testing in an exploration or appraisal well is directed at estimating of reserves in communication with that well, in addition to well productivity. Testing in a production well also monitors the effects of cumulative production on the formation.

Wind Rose
A diagram with radiating lines showing the frequency and strength of winds from each direction affecting a specific place.

Zooplankton
Plankton that consist of animals such as .corals and jellyfish, usually small and often microscopic.

1 Introduction

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Figures

Tables

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1.1 Introduction

This Environmental and Socio-Economic Statement (ES) has been prepared following a detailed Environmental and Socio-economic Impact Assessment (ESIA) of the proposed Phase 3 development of the Azeri, Chirag and Deep Water Gunashli (ACG) oil fields in the Caspian Sea, Republic of Azerbaijan. The ES has been prepared for submission to the Azerbaijan Ministry of Ecology and Natural Resources (MENR) to gain approval for the project and, as such, has been conducted in accordance with the legal requirements and policies of Azerbaijan. In addition, the ESIA process has been undertaken in the context of BP's Health, Safety and Environment (HSE) Policy as described in Section 2.

The ACG Phase 3 project is the latest part of the ACG Full Field Development (FFD) and as such, will deliver major economic benefits to Azerbaijan. The project together with the linked investments including the Early Oil Project (EOP), Phases 1 and 2 of ACG FFD, and the BTC project are collectively by far the largest investments ever committed in Azerbaijan. They will have a major positive effect on the national economy of Azerbaijan. Considerable environmental and socio-economic studies have been carried out by AIOC in the region since 1994 as outlined in the following subsections. The ACG Phase 3 ESIA programme of work has built on these earlier studies where appropriate and has conducted additional studies to augment the existing knowledge base. This has enabled the assessment process to benefit from a comprehensive understanding of the environments in which the development is proposed.

1.2 Project background

1.2.1 ACG Production Sharing Agreement and Full Field Development

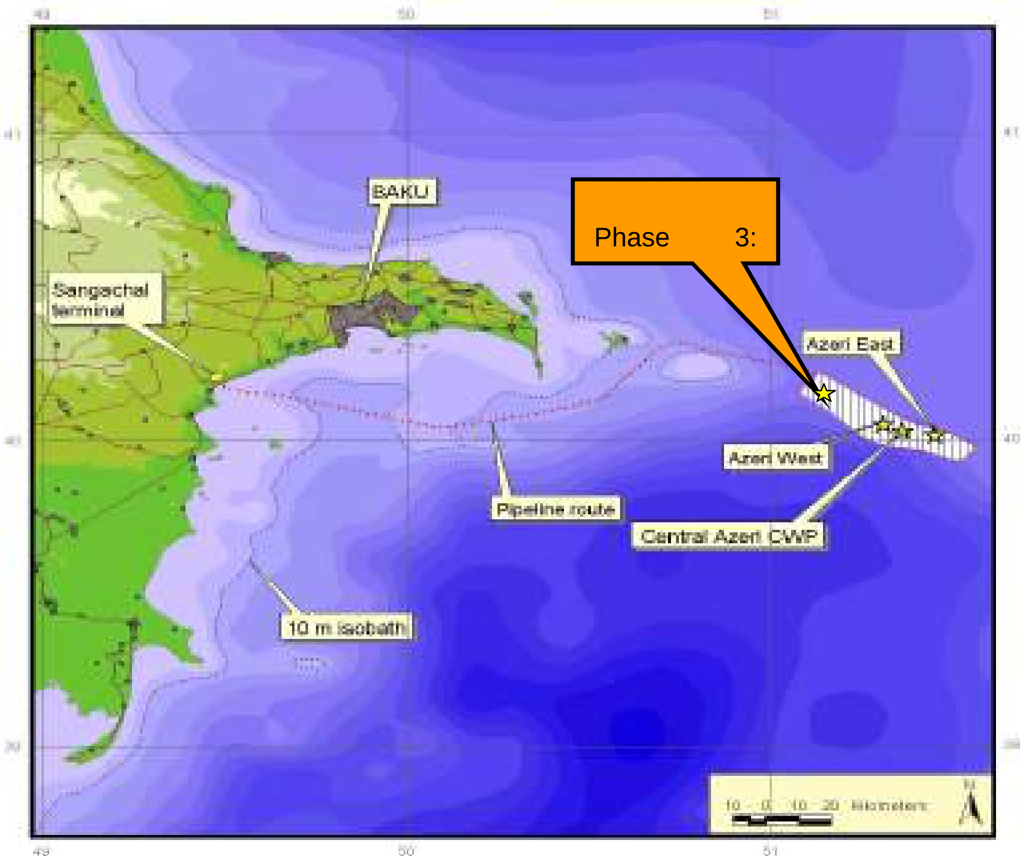
The first Production Sharing Agreement (PSA) in Azerbaijan was signed in September 1994 between the State Oil Company of the Azerbaijan Republic (SOCAR) and a consortium of foreign oil companies (FOCs). The PSA lasting for 30 years passed into Azerbaijan law in December 1994, and grants the consortium the rights to develop and manage the hydrocarbon reserves found in the ACG field defined as the "Contract Area". The FOCs established the Azerbaijan International Operating Company (AIOC) to conduct petroleum operations under the PSA on their behalf. In July 1999, BP was appointed the operator for the PSA on behalf of AIOC member companies. The participating interests of AIOC members and SOCAR are shown in Figure 1.1.

Figure 1.1 Participating interests of AIOC members and SOCAR for ACG Phase 3

1.2.2 BP Oil and Gas Caspian Developments

In addition to the ACG FFD, BP is involved in a number of other developments in Azerbaijan, consideration of which set the current project in context (Figure 1.2).

Figure 1.2 Location of BP developments Offshore Azerbaijan



These projects can lead to positive social and environmental change within Azerbaijan. The economic assessment for the three proposed phases of ACG FFD development so far indicates that revenues from oil and gas production and transit would be very significant especially within the term of the PSA (2024). Over the peak period between 2007 and 2017 these revenues are predicted to exceed all other sources of public revenue. Further detail on the predicted revenue from these projects is provided in the Economic, Social and Environmental Overview of the Southern Caspian Oil and Gas Projects, also referred to as the BP Regional Review (AIOC, 2003) and available on www:caspiandevelopmentandexport.com.

The relevant projects are therefore briefly described below.

1.2.2.1 Early Oil Project

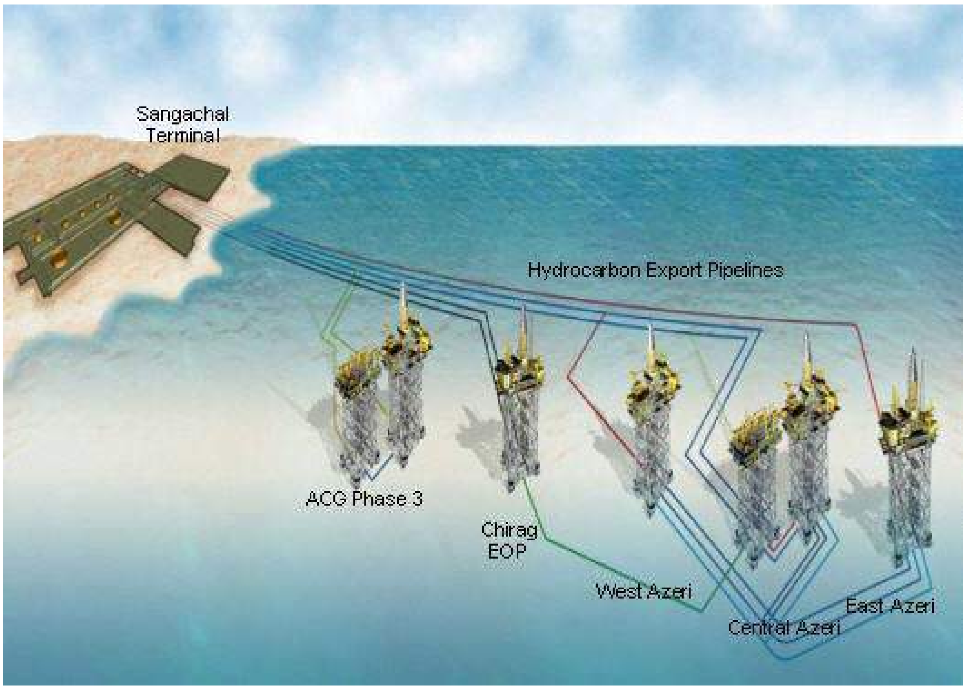
The Early Oil Project (EOP) comprises the Chirag-1 platform, located within the ACG Contract Area, and transfer of oil through a 24” sub-sea oil pipeline from Chirag-1 to an onshore oil reception terminal situated 38km south of Baku at Sangachal. Gas export from Chirag-1 is through a 16” sub-sea gas pipeline to SOCAR’s Oil Rocks facility to the north west of the Contract Area. Oil is exported to market from Sangachal by one of two pipeline routes to Black Sea ports: the Northern Export Route (NER) across Russia to Novorossiysk, and the Western Export Route (WER) to Supsa, Georgia. First oil from EOP was exported from Sangachal terminal in the fourth quarter of 1997. Current oil production rates from the EOP are approximately 125,000 bpd with gas export to the local market of around 100 million standard cubic feet per day (MMscfd).

1.2.2.2 ACG

The ACG Contract Area has estimated oil reserves in excess of 5.2 billion barrels of oil. It lies in the Azerbaijan sector of the Caspian Sea, approximately 120 km south east of Baku and covers an area of 432 square kilometres in water depths ranging from 100 m to 400 m. Primary oil bearing zones occur at depths of between 2,500 m and 3,000 m below the seabed.

In addition to the EOP, BP as the operator for AIOC has adopted a phased approach to the development of reserves from the ACG Contract Area. These are illustrated in Figure 1.3 and summarised below.

Figure 1.3 Location of ACG Phase 3 in Relation to all Developments in the ACG Contract Area



- Phase 1 Development

The Phase 1 development aims at the development of the central part of the Azeri reservoir, to the south east of Chirag-1 and will consist of: 1) a production, drilling and quarters platform (PDQ) bridge-linked to a compression and water injection platform (C&WP); 2) a new 30" sub-sea oil pipeline from the PDQ to shore; and, 3) a new 28" gas line to shore. In addition, the Chirag-1 platform will be integrated with the Phase 1 project by means of interfield oil and gas sub-sea pipelines. First oil production from Phase 1 is scheduled for early 2005. At the time of writing, the Sangachal Terminal was being expanded to receive the increased production and export requirements and the first jacket and drilling template have been constructed and installed at the offshore location. Construction continues for the ACG Phase 1 topside units and the second jacket. The development is described in the ACG Phase 1 ESIA (URS, 2001).

- Phase 2 Development

Phase 2 will develop the remaining part of the Azeri reservoir to the west and east of the Phase 1 development. It will consist of two fixed production and drilling facilities; a new 30" sub-sea oil pipeline; in-field sub-sea pipelines; and further expansion at the Sangachal

Terminal. First oil production from Phase 2 is planned for 2006. The development is described in the ACG Phase 2 ESIA (RSK, 2002).

- Phase 3 Development

The ACG Phase 3 Project presently represents the last phase of development of the ACG FFD Project. Phase 3 will develop the hydrocarbon reserves in the Deep Water Gunashli (DWG) sector of the ACG Contract Area approximately 120 km offshore from Baku, Azerbaijan. Estimated recoverable oil in-place in the DWG field range between 1,000 and 1,200 MMstb and facilities have been designed to process a peak oil production rate of 316 Mbpd and peak gas production rate of 350 MMscfd.

ACG Phase 3 will consist of a Drilling, Utilities and Quarters (DUQ) platform bridge linked to a Production, Compression Water Injection and Utilities (PCWU) platform. These offshore facilities will be tied into the existing ACG export pipeline infrastructure that extends to the Sangachal Terminal by interfield pipelines. In additon, the project will require the installation of a subsea water injection development (consisting of two subsea manifolds and associated facilties tied back to the offshore platform) to maintain reservoir pressure. All produced hydrocarbons from ACG Phase 3 will be received at the Sangachal Terminal. The increase in hydrocarbon inventory arriving ashore will necessitate the expansion of the existing onshore terminal to accommodate two additional processing trains, an additional dewpoint control unit and an additional oil storage tank. All expansion work will take place within the existing terminal boundary.

1.2.2.3 Baku-Tblisi-Ceyhan Main Export Pipeline

The Baku-Tblisi-Ceyhan (BTC) pipeline will transport oil from the Sangachal terminal through Azerbaijan, Georgia and Turkey to the Mediterranean Sea port at Ceyhan. The pipeline, currently under construction, will be over 1,750 km long and, with a proposed diameter of 42" – 46", will have a peak capacity of one million barrels of oil per day. It will be completed in early 2005: ready to carry the first oil from the ACG Phase 1 development in the second half of 2005, and later from Phases 2 and 3 of the project.

1.2.2.4 Shah Deniz Gas Export Project

The Shah Deniz gas/condensate field lies approximately 100 km south east of Baku in water depths ranging from 50 m to 500 m. Early appraisal well drilling indicated that Shah Deniz is a world-class gas condensate field, with potential recoverable reserves in excess of 400 billion cubic metres (bcm) of gas.

Full Field Development (FFD) of the Shah Deniz field will be undertaken in stages. The Stage 1 development will be located in the Eastern Flank of the field in approximately 100 m water depth. Stage 1 development will consist of a fixed platform with facilities for drilling and primary separation of gas and liquids. Gas and condensate will be delivered via two sub-sea pipelines to an onshore reception, gas-processing and condensate stabilisation terminal to be constructed adjacent to the existing ACG oil-receiving terminal at Sangachal. First gas delivery from the Shah Deniz field is anticipated in 2006. To maintain gas production rates from the field, further development is proposed several years after first delivery of gas. The sub-sea development, also in the Eastern Flank, will be installed in 350 m of water and produced fluids will be tied back to the Stage 1 platform via a marine pipeline for onward transport to the onshore terminal.

1.2.2.5 South Caucasus Pipeline (SCP) Project

Shah Deniz gas, conditioned for transportation and sales, will be transferred from the terminal to an export pipeline system, ultimately delivering the gas to the Turkish market. The gas will be exported via a new 690km pipeline (SCP) that will run parallel with the BTC crude oil pipeline from the Sangachal Terminal, through Azerbaijan and Georgia to the Turkish border, where it will be linked into the Turkish gas distribution network.

1.3 Environment and Socio-economic Impact Assessment

1.3.1 Objectives

The overall objective of the Environment and Socio-Economic Impact Assessment (ESIA) process for the ACG Phase 3 development is to ensure that any adverse environmental or socio-economic impacts arising from proposed project activities are identified and where possible, eliminated or minimised through early recognition of and response to the issues.

The purpose of the ESIA is to:

- ensure that environmental considerations are integrated into the project planning and design activities;
- ensure that a high standard of environmental performance is planned and achieved for the project;
- ensure that environmental and social aspects and impacts are identified, quantified where appropriate, and assessed and mitigation measures proposed;
- ensure that legal and company policy requirements and expectations are addressed;
- consult with all of the project stakeholders and address their concerns; and
- demonstrate that the project will be implemented with due regard to environmental and social considerations in mind.

Potential impacts of all stages of the project from construction of the offshore facilities and terminal expansion, through installation to operation are evaluated against applicable environmental standards, regulations and guidelines, the existing environmental conditions, and issues and concerns raised by all project stakeholders. Evaluation of the implementation, quality and effectiveness, of existing and planned environmental controls and monitoring and mitigation measures are also considered.

As Phase 3 is essentially based on a close copy of the Phase 1 & 2 Developments (with the exception of the subsea facilities), the ESIA process has been greatly enhanced by the fact that ACG Phase 1 is currently underway and details of the effectiveness of management measures implemented as part of the project, together with actual data with respect to manning levels, scheduling, waste emissions and discharges has been used in the assessment.

1.3.2 Structure of the Environmental Statement

This Environmental Statement has been compiled to report the findings of the detailed ESIA process. It is presented as summarised in Table 1.1.

Table 1.1 Structure and Content of the ES

Section	Content
Executive Summary	A summary of the Environment Statement report
Units and Abbreviations	A list of the units and abbreviations used in the ES
Glossary	A glossary of terms
1Introduction	A general introduction to the Phase 3 project in the context of other projects underway or proposed for the region, , the objectives of the assessment, and the report structure of the ES
2 Policy Legal and Administrative Framework	A summary of the composition and HSE policies of the project proponent, , the HSE requirements set out in the ACG PSA, relevant international and national environmental standards and guidelines.
3 ESIA Methodology	A description of the methods used to conduct the ESIA
4 Options Assessed	A description of the alternative concept options assessed for the Phase 3 Project.
5 Project Description	A detailed description of the Phase 3 Project
6 Environmental Baseline	A description of the environmental baseline conditions in the vicinity of the Phase 3 Project activities
7 Socio-Economic Baseline	A description of the socio-economic baseline conditions in the vicinity of the Phase 3 Project activities
8 Consultation	An overview of the consultation undertaken during the ESIA programme and the issues and concerns raised
9 Environmental and Socio-economic Impacts	An assessment of the potential environmental impacts associated with the Phase 3 development
10 Wider Issues	Discussion of issues relevant to Phase 3 that are related to wider BP Business Unit issues in Azerbaijan
11 Environmental and Socio-economic Mitigation and Monitoring	A description of environmental and social management systems and plans in place, further mitigation measures proposed, and monitoring measures.
12 Conclusions	Conclusions arising from the ESIA process
References	A list of all of the literature sources referred to in the ES
Appendices	Supporting technical information

2 Policy, Regulatory and Administrative Framework

Contents

Figures

Tables

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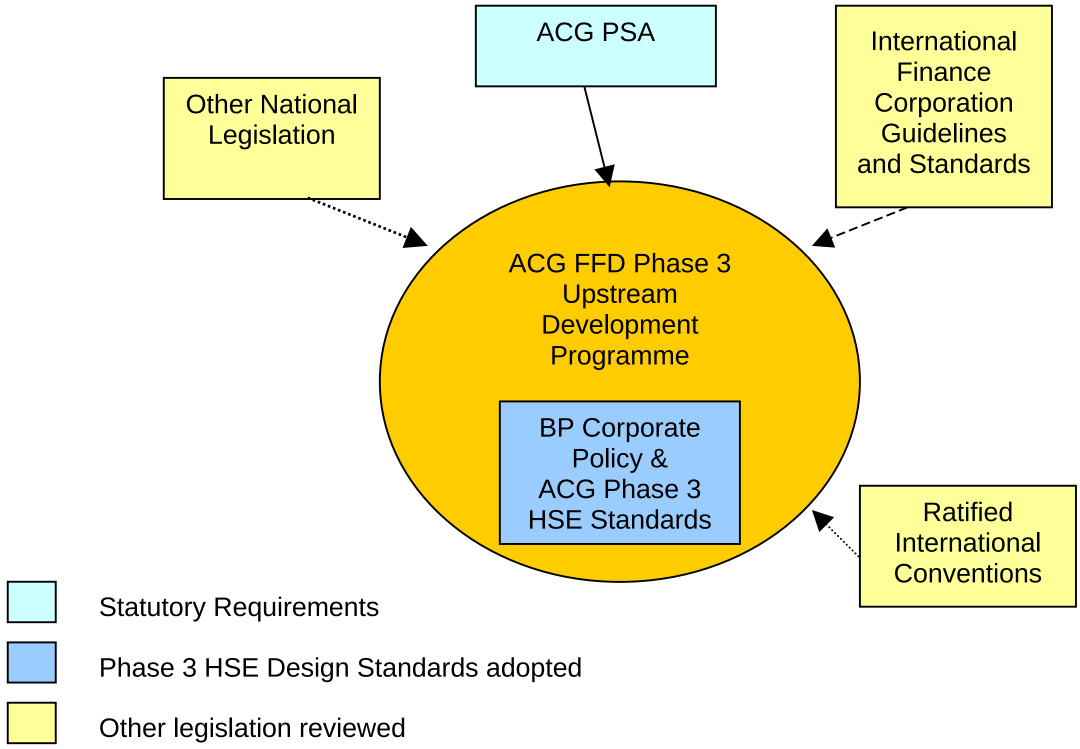
2.1 Introduction

The ACG Full Field Development (FFD) Phase 3 Programme is subject to the terms and conditions of the ACG Production Sharing Agreement (PSA), BP HSE Policy and the Phase 3 Health, Safety and Environment (HSE) Design Standards.

Beyond the framework of the PSA and the Phase 3 HSE standards, the project will also be undertaken with due regard to international conventions as ratified by the Azerbaijan government. In addition, although shareholder parties of AIOC do not currently intend to seek funding from International Finance Institutions (IFIs), the Phase 3 Project will also be undertaken in accordance with applicable World Bank and International Finance Corporation (IFC) environmental and social policies and guidelines (refer to Section 2.5) as part of the Phase 1 funding agreement.

Figure 2.1 provides a visual summary of legislative framework relevant to the ACG FFD Phase 3 project.

Figure 2.1 Legislative Framework of ACG Phase 3 Project



The following sections present an overview of each of these key elements of the legal and policy framework for the ACG FFD Phase 3 project.

2.2 The ACG Production Sharing Agreement

The ACG PSA is the legally binding agreement for the joint development and production sharing of the Azeri and Chirag fields and the deep-water portion of the Gunashli field in the Azerbaijan sector of the Caspian Sea. This agreement, between the State Oil Company of Azerbaijan Republic (SOCAR) and AIOC shareholder parties (Contractor Parties) was made on the 20th September 1994; it was enacted into Azerbaijan law on 2nd December 1994. Under the terms of the PSA, AIOC, acting on behalf of Contractor Parties, has the right, until 2024, to develop and produce hydrocarbons from the ACG offshore fields. The PSA states that the conduct of operations should be undertaken with respect to the general environment, other natural resources and property, with the order of priority being the protection of life, environment and property.

According to Article 26.3 of the PSA, AIOC shall:

'comply with the present and future Azerbaijani laws or regulations of general applicability with respect to public health, safety and protection and restoration of the environment to the extent that such laws and regulations are no more stringent than current international petroleum standards and practices' at the execution date of the PSA.

In addition, the environmental standards that must be met throughout the life of the contract are stipulated in Appendix IX of the PSA (Appendix 1).

The requirement to prepare environmental documentation, including an Environmental Impact Assessment of any new facilities and gain approval from the Azerbaijan Ministry for Ecology and Natural Resources (MENR) is also a condition of Appendix IX Section II B of the PSA. The ESS will be publicly disclosed in Azerbaijan in accordance with the PSA and Azerbaijan law, and internationally (by posting on a public internet site or similar means) for 60 days before being finalised.

The environmental standards and practices set out in the ACG PSA are provided in the Technical Appendix (Appendix 1). The general environmental requirements laid down in the ACG PSA will be applied to the ACG Phase 3 project. The following sub-sections list and summarise BP's HSE Policy, the Project HSE Design Standards applying to ACG Phase 3, applicable IFI Environmental and Social Policies and Guidelines, International Conventions and National legislation.

2.3 BP HSE Policy

BP as operator of AIOC is committed to the principles and expectations contained within the BP document "What We Stand For" are applied to business operations. The principles focus on five key areas:

- Ethical conduct;
- Employees;
- Relationships;
- HSE performance; and
- Control and finance.

These principles seek to encourage safer and more secure employment, increase efficiency, improve job satisfaction and provide a better-trained workforce within all business operations. The HSE principle reflects BP's commitment to health, safety and environmental performance *"no accidents, no harm to people and no damage to the environment"* as endorsed by the Chief Executive Officer.

HSE expectations to be adopted by all BP managers and the boundaries within which all BP managers must operate are further described in the document "Getting HSE Right", which provides a broad-based set of expectations collated into a series of thirteen elements of accountability, and which forms the central part of the BP HSE Management System Framework. The document covers:

- HSE risk management including personal security;
- Technical/operational integrity of facilities and equipment; and
- Product stewardship.

"Getting HSE Right" will be adhered to during the Phase 3 project.

The HSE Management System Framework is designed to assist managers in the delivery of continually improving HSE performance by focusing managers on critical HSE requirements, through the application of the thirteen elements of accountability as follows:

- Leadership and Accountability;
- People, Training and Behaviours;
- Working with Contractors and Others;
- Operations and Maintenance;
- Management of Change;
- Information and Documentation;
- Assessment, Assurance and Improvement.
- Risk Assessment and Management;
- Crisis and Emergency Management;
- Incident Analysis and Prevention;
- Community and Stakeholder Awareness;
- Facilities Design and Construction;
- Customers and Products;

This Framework links into BP's commitment to HSE whilst at the same time driving the processes, procedures and management systems implemented by individual Business Units. Staff at all levels of the organisation is responsible for health, safety, technical integrity and environmental goals and objectives. Best demonstrated practice, good operating procedures and information on new technology are shared between Business Units and through discussions to ensure that lessons learned are shared and adopted. Auditing and monitoring programmes are used to confirm that systems and processes are in place and working effectively.

2.4 ACG FFD Phase 3 Health, Safety & Environment (HSE) Design Standards

In 2003, the AIOC partners' Contracts Management Committee (CMC) approved a set of HSE standards for the design of the ACG FFD Phase 3 Project. These standards built upon the standards set out in the PSA, Phase 1 & 2 HSE design standards, and took into consideration international standards and local environmental conditions. The Phase 3 HSE Design Standards serve as the standards that AIOC has self-imposed for Phase 3 engineering design. Therefore, while the PSA forms the legal basis for conducting operations, these standards seek to supplement, enhance and further define the standards set forth in the PSA.

These standards are provided in Technical Appendix 2 and the categories are summarised below.

Table 2.1 Summary of the HS&E categories for the Phase 3 HSE Design Standards

Health	Safety	Environment
Medicals	Training	Monitoring and Measurement
Hygiene	Design Safety Reviews	Ozone Depleting Substances (ODS)
Noise	Hazard Management Plan	Other Halocarbons with Potential for Global Warming
Health Risk Management	Simultaneous Operations (SIMOPS)	Non-water-based Drill Fluids and Cuttings
	Manual Handling	Water Based Drill Fluids and Cuttings
	Hazardous Substances	Land-take at Sangachal
	Seismic Events	Nuisance at Sangachal
	Storm	Open Drains Off-shore
	Road Safety	Open Drains On-shore
		Venting Unburned Gas
		Chemicals
		Sewage
		Desalination Waste
		Pipeline Construction
		Sand
		Liquid and Solid Waste
		Cooling Water
		Seawater Abstraction for Operations
		Produced Water Offshore
		Decommissioning
		Fugitive Emissions
		Combustion Emissions
		Produced Water On-shore
		Routine Flaring – Onshore
		Routine Flaring – Offshore
		Well Testing
		Energy Efficiency

2.5 International Finance Institution Environmental and Social Policies and Guidelines

The Phase 3 Project shall be undertaken in accordance with applicable IFI environmental and social policies and guidelines, comprising:

- World Bank Operational Policy Note 11.03 "Management of Cultural Property" (September 1986);
- World Bank Operational Directive 4.30 "Involuntary Resettlement" (June 1990);
- World Bank Group Guidelines for Oil and Gas Development (Onshore) (July 1998);
- World Bank Guidelines: Thermal Power (July 1998);
- World Bank General Environmental Guidelines (July 1998);
- IFC Guidelines for Oil and Gas Development (Offshore) (December 2000);
- IFC Operational Policy 4.04 "Natural Habitats "(November 1998) ("IFC OP 4.04");
- IFC Policy Statement on Forced Labour and Harmful Child Labour (March 1998);
- IFC Hazardous Materials Management Guidelines (December 2001);
- IFC General Health and Safety Guidelines (July 1998); and
- IFC Waste Management Facilities Guidelines (July 1998).

2.6 International Conventions

The Azerbaijan Republic has entered into and ratified a number of international conventions and AIOC will endeavour to provide information necessary to allow the government to meet their obligations with respect to these conventions. The conventions relevant to the ACG FFD Phase 3 Project are:

- 1971 Convention on Wetlands (Ramsar Convention);
- 1972 Convention for the Protection of the World Cultural and National Heritage;
- 1972 Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (The London Dumping Convention);
- 1973 Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES);
- 1979 Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention);
- 1985 Vienna Convention for the Protection of the Ozone Layer and Montreal Protocol (1990) and Copenhagen amendments (1992);
- 1991 Convention on Environmental Impact Assessment in a Transboundary Context (Espoo Convention); and
- 1992 Convention on Biological Diversity;
- 1992 Convention on the Protection and Use of Transboundary Watercourses and International Lakes;
- 1992 United Nations Framework Convention on Climate Change (Climate Change Convention);
- 1994 Convention to Combat Desertification;
- 1998 Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters (Aarhus Convention).
- Applicable International Labour Organisation conventions;

The following conventions are of particular note to the ESIA process for the Phase 3 Project:

2.6.1 1998 Convention on Access to Information to Public Participation in Decision Making Process and the Administration of Justice concerning Environmental Matters (Aarhus Convention)

The objective of the Convention is to guarantee the rights of access to information, public participation in decision-making, and access to justice in environmental matters, in order to protect people's rights to a healthy environment. The convention sets out the following:

- Obliges public authorities to make sure that environmental information is available to the public upon request without discrimination and without having to state an interest. Although provisions are made for limitation of access to certain types of environmental information, this limitation is not strict and should take into account the public interest served by the disclosure. The Convention encourages public authorities to collect environmental information regularly and disseminate it in the form of computerised and publicly accessible database.
- Entitles the public to participate in the environmental decision-making concerning a wide range of economic activities, not only those covered by environmental impact assessment procedures. Government authorities should ensure that the public is involved at as early stage of the project planning as possible when various project options are open for discussion. Public participation should also take place in the preparation of environmental plans and programmes, and to a lesser degree, in the preparation of policies.
- Ensures that anyone who considers that his or her request for information has been inadequately dealt with has access to court for a review procedure.

2.6.2 1991 Convention on Environmental Impact Assessment in a Transboundary Context (Espoo Convention)

This Convention was signed in Espoo, Finland by governments of European Countries, the United States and the European Community in 1991. Azerbaijan acceded to the Convention in 1999. The main objective of the Convention is to promote environmentally sound and sustainable economic development, through the application of ESIA, especially as a preventive measure against transboundary environmental degradation.

Although the Convention does not specifically deal with public participation in environmental decision-making, it sets forth the requirement for a country in which a proposed activity is to be undertaken to provide an opportunity for involvement in the ESIA process to the public of those countries likely to be affected. Comments on the project are then fed back to the project country's relevant authorities for consideration. Therefore under the terms of this Convention, Azerbaijan is required to notify other contracting states if there is a potential impact upon their environment, resulting from a development on the territory of Azerbaijan including its waters. This notification can be done directly or through a third party coordinator.

AIOC has formally informed the Azerbaijan Government of the Phase 3 project ESIA via provision of the ESIA Scoping documentation for the project. Additionally, through the Caspian Environmental Programme initiative, AIOC has informally shared information on the Phase 3 project with the littoral states, bordering the Caspian Sea, to facilitate participation in the ESIA process where requested. At the time of writing, AIOC has not been made aware of any responses from littoral states indicating a desire to participate in the ESIA process.

2.6.3 1992 Convention on the Protection and Use of Transboundary Watercourses and International Lakes

The main objective of this Convention is to prevent, control or reduce any transboundary impact resulting from the pollution of transboundary waters caused by human activity. Transboundary waters are defined as those surface or ground waters that are located on or pass into the boundaries of another convention state. As the Caspian is bordered by four other states, two of which are Parties to the convention, it is considered a transboundary watercourse. Article 16 of the Convention contains requirements for public information. Under these requirements, Azerbaijan should ensure that information on the conditions of transboundary waters, measures taken to control, reduce and mitigate transboundary water pollution, and effectiveness of these measures are made available to the public. The information that should be made available to the public includes:

- water quality objectives;
- permits issued and the conditions required to be met; and
- results of analysis of water sampling carried out for monitoring and assessment, and results of checking compliance with water quality objectives.

The Parties have to ensure that the information is made immediately available to the public of their states, and is free of charge. Azerbaijani authorities should provide the information to littoral Parties to the Convention, which include the Russian Federation and Kazakstan, upon reasonable payment.

2.7 National legislation

As indicated in Section 2.1, the ACG PSA sets out the national environmental legislation specific to the exploration and development of the Contract Area. As part of the ESIA process, other national environmental legislation was also reviewed for the Phase 3 Project. Particular regard was given to the Environmental Impact Assessment process.

2.7.1 Environmental and Socio-economic impact assessment

In Azerbaijan, major private and public developments require the preparation of an ESIA. The objective of the ESIA process is to provide a means whereby adverse impacts can be identified and either avoided or minimised to acceptable levels.

The fundamental principle of the ESIA is applied by the Ministry of Ecology and Natural Resources using the Law of the Azerbaijan Republic on Environmental Protection, August 1999 and the Handbook for the Environmental Impact Assessment Process published in 1996 with the assistance of the United Nations Development Programme. The handbook includes requirements for scientific expertise and public consultation. Following its submission to the Ministry, the document is reviewed for up to three months by an expert panel.

AIOC/BP has incorporated the elements of this handbook in the Phase 3 ESIA process.

2.7.2 Azerbaijan regulatory agencies

The main environmental regulatory body is the MENR, which was formed from the merger of four state organisations comprising the State Committee for Ecology, State Committee for Hydrometeorology, State Forestry Committee, and the State Committee for Geology. This body is responsible for the following:

- development of draft environmental legislation for submission to the Parliament (Milli Mejlis);
- implementation of environmental policy;
- enforcement of standards and requirements for environmental protection;

- suspension or termination of activities not meeting set standards;
- advising on environmental issues;
- expert review and approval of environmental documentation, including Environmental and Socio-economic Impact Assessment;
- implementation of the requirements set out in international environmental conventions ratified by the Azerbaijan Republic.

3 Environmental and Socio-economic Impact Assessment Methodology

Contents

Figures

Tables

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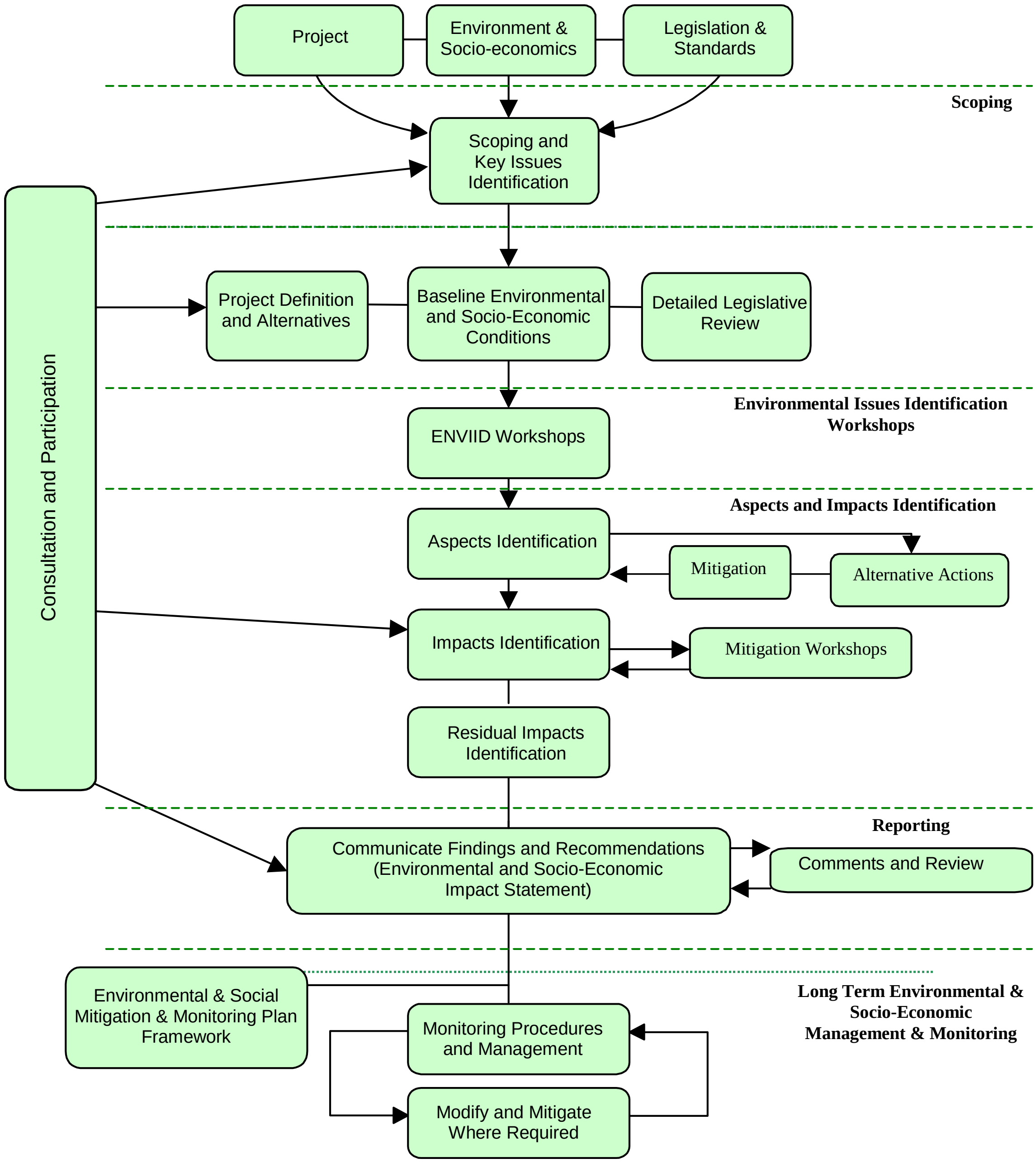
3.1 Introduction

The Environmental and Social Impact Assessment (ESIA) process for the ACG Phase 3 development incorporated a number of key steps as illustrated in Figure 3.1. The assessment process adopted for the Phase 3 development was built on a systematic approach to the evaluation of the project in the context of the natural, regulatory and socio-economic environments of the area in which the development is proposed, as developed and adhered to during Phase 1 and 2.

Figure 3.1 The ACG Phase 3 ESIA process



Note: The Environmental & Social Mitigation & Monitoring Plan is also commonly referred to as the Environmental & Social Action Plan.

The following Sections describe each of the assessment process steps illustrated in Figure 3.1.

3.2 Scoping

The first step in the ESIA was to define the proposed project activities and the natural, regulatory (i.e. legal) and socio-economic environments in which these activities would occur. This was achieved through Scoping. Scoping for Phase 3 identified which activities had a potential to interact with the environment. Scoping was conducted early in the ESIA process so that a focus on the priority issues (i.e. those that have the greatest potential to affect the natural and/or socio-economic environment) was established for the rest of the ESIA process.

The Phase 3 scoping exercise consisted of the following key elements:

- Gathering and review of environmental and socio-economic data relevant to the proposed development area (concentrating on the area in the vicinity of the existing Sangachal Terminal, onshore fabrication yards and the offshore environment in which development is proposed).
- Gathering and review of existing engineering design definition with respect to the Phase 3 development. All project elements were considered in this review, including fabrication, transportation, construction and installation, commissioning, operations, maintenance and decommissioning. Routine (normal operating conditions), planned non-routine (abnormal operating conditions e.g. planned start-up/shutdown activities) and unplanned (i.e. accidental) events were considered.
- Verification of relevant legislative requirements, environmental standards and guidelines (national and international) identified during the earlier Phases of the ACG development (Phase 1 & 2), as well as AIOC partner policy and standards.
- Consultation with project stakeholders and other potentially interested and affected parties at the scoping stage.

The scoping of Phase 3 also assisted in the identification of gaps in the environmental, socio-economic and engineering information that needed to be addressed to allow an informed impact assessment later in the ESIA process. The results of the ACG Phase 3 project Scoping exercise were presented in a Scoping Report that was submitted to International Funding Institutions (IFIs) and the Azerbaijan Ministry of Ecology and Natural Resources, Baku, Azerbaijan (MENR) (RSK, 2003) and is maintained on the BP website for public access at http://www.caspiandevelopmentandexport.com/

3.3 Detailed data gathering and review

Following Scoping, assembled legislative requirements, engineering, environmental and socio-economic data were assessed in greater detail to ensure that all of the proposed activities and their consequences were considered in full.

3.3.1 Existing environmental conditions

In order to identify any potential impact on and potential change to the natural and socio-economic environments, it is essential to have a thorough understanding of the nature of those existing environments prior to commencement of the proposed activities. This translates as a need to characterise the existing baseline environmental and socio-economic conditions including establishing the prevailing conditions for a range of media as follows:

- Natural environment media such as air, water, soil and groundwater, flora and fauna; and
- Socio-economic media such as demographics, economic activity and service provision.

A significant amount of data already exists for the region through the fieldwork, desk based data gathering and interpretation, and other studies conducted as part of the ACG Phase 1 and Phase 2 ESIAs. Within these studies, the existing environmental and social conditions were achieved by completing the following main tasks:

- Conducting a detailed review of all secondary data sources (i.e. existing documentation and literature). Significant environmental data acquisition surveys and studies have been carried out in the Sangachal area and in the vicinity of the ACG PSA Contract Area offshore during the Phase 1 & 2 ESIAs. This information was assembled and reviewed to provide an environmental and social baseline.

- As changes to the Sangachal and offshore development areas have occurred since the approval and initiation of Phase 1 & 2 projects, the above information was verified and amended during the Phase 3 ESIA. This was achieved by reviewing and assembling additional data required to supplement the existing information base. This included:
- Marine surveys;
- Socio-economic review of terminal activities and programmes;
- Production of an updated stakeholder list detailing persons/organisations and groups with an interest in the project;
- Socio-economic baseline survey of fabrication/construction areas (SPS, ATA yard) not selected at the time of ACG Phases 1 and 2;
- Meetings with BP, contractors, local community representatives, surrounding businesses, NGOs and the Executive Powers to assemble new and revised socio-economic baseline information for the ACG project area.

Both existing secondary sources and results of the new studies were analysed and integrated into coherent descriptions of baseline characteristics. These are presented in the Environmental Description (Chapter 6) and Socio-economic Baseline (Chapter 7).

3.3.2 Project alternatives and definition

3.3.2.1 Alternatives

An important step in defining a project is to identify, at a conceptual level, viable alternatives to the project so that a viable base-case design may be realised. Consideration of project alternatives occurs at two levels as follows:

- To the development as a whole including the “no development” option, and
- Engineering alternatives within the selected project’s design definition.

Once project alternatives are defined in the Project Concept stages, they pass through a process of ‘appraise’ and ‘select’ where they are assessed and compared on financial, logistical, technical design, safety and environmental criteria. The project alternative that is determined to be likely to result in the best balance in regards these criteria is typically, the one that moves forward into the detailed design phase.

Chapter 4 presents a summary of how the preferred base case project design was established for Phase 3 and where appropriate, the environmental and socio-economic implications that were considered in the selection or rejection of project alternatives.

3.3.2.2 Project Definition

ESIA environmental engineers worked alongside the Phase 3 design engineers to gather and interpret relevant engineering design information for the project. Information gathered for the proposed ACG Phase 3 project was reviewed, assessed and passed on to the assessment team.

The continuous interaction between the various project team components allowed the impact assessment team to identify and feedback to the design engineers in areas where there was a requirement for greater definition on the programme and the mitigation measures that are proposed as part of the base case design. The base case design has, for the purposes of this ESIA, been condensed into a Project Description as presented in Chapter 5.

3.3.3 Detailed legislative review

The legislative context of the ACG Phase 3 project is described in Chapter 2. The definition of relevant national and international standards and requirements has ensured that the project development has been assessed against all relevant existing environmental regulations and guidelines as well as AIOC partners' environmental and other national and international policies and standards.

3.4 Consultation

Project stakeholder consultation is a vital component of the ESIA process. The consultation process focuses on providing information on the proposed project in a manner that can be understood and interpreted by the relevant audience, seeking comment on key issues and concerns, sourcing accurate information, identifying potential impacts and offering the opportunity for alternatives or objections to be raised by the potentially affected parties; non-governmental organisations, members of the public and other stakeholders. Consultation also promotes a sense of stakeholder ownership of the project and the realisation that their concerns are taken seriously, that the issues they raise, if relevant, will be addressed in the ESIA process and will be considered during project design refinement.

Consultation takes place at several key points during the ESIA process, initially during Scoping (during the project conception phase) and later, when the definition of the project has reached a point where an informed and comprehensive presentation of the proposed activities can be made, inviting questions and comments. During the Scoping phase, relevant stakeholders were identified using the most recent and accurate information available, including referring back to Phase 1 & 2 consultation. This enabled people who may be affected by or have an interest in the proposed project to have an opportunity to express their opinions and concerns and feed into the ESIA process. Views were sought at a local, regional and national level during Scoping and the proposed methods of consultation were clearly established and committed to in a Phase 3 Public Consultation and Disclosure Plan (PCDP), which detailed:

- The consultation methods employed for the ESIA;
- A list of stakeholders consulted, and
- A summary of the issues and concerns raised during Scoping.

During Scoping, scientific and Non Governmental Organisations (NGOs) expressed a desire to be involved midway through the ESIA process, when project design had passed from the appraise to the select stage, eliminating many unknown elements of the design that were still under consideration during the Scoping phase. As a result of this request, these groups were invited to a workshop consultation session midway through the ESIA, designed to report on the progress of the project definition since Scoping and promote discussion and the exchange of ideas on key project aspects. This workshop represented the first time this approach has been adopted in the ACG project ESIAs and provided a valuable forum for discussion and transparency on the project, ensuring that key questions and concerns were incorporated into the ongoing ESIA process. Community and stakeholder issues and concerns raised during consultation are presented in Chapter 8.

3.5 Environmental and socio-economic aspects identification

3.5.1 Definition of aspects

The International Standard Organisation's standard for Environmental Management Systems (EMS), ISO 14001 defines an environmental aspect as:

"*An element of an organisation's activities, products or services that can interact with the environment*."

This definition has been used in the identification of the proposed project's environmental, legal and socio-economic aspects.

3.5.2 Environmental and Socio-economic Issues Identification (ENVIID)

To identify project environmental and socio-economic aspects, all proposed activities; Environmental and Socio-economic Issues Identification (ENVIID) workshops were held between the Phase 3 project team and the ESIA Consultants. The ENVIID workshops were focused to identify the potential environmental issues associated with each proposed activity and participants included key project engineers and Health, Safety and Environment (HSE) advisors. Proposed project activities were considered in terms of their potential to:

- Interact with the natural environment including its physical and biological elements;
- Breach the Production Sharing Agreement, relevant international, national, industry and operator and partner standards and operator/partner policy; and
- Interact with the existing socio-economic environment.

Assessed activities included:

- Planned routine activities (activities occurring during normal operating conditions);
- Planned but non-routine activities (activities that are planned to occur outwith desired normal operations but within operational design parameters); and
- Unplanned (accidental) events (events that are outwith design parameters, suggesting an operational failure).

The workshops focused on specific areas as follows:

- Onshore fabrication, transport, construction, and pre-commissioning of offshore facilities;
- Installation, hook-up and commissioning of facilities offshore;
- Drilling;
- Offshore production operations and processes;
- Subsea pipeline and facility fabrication, transport, construction, installation, commissioning and operation; and
- Phase 3 terminal construction, operation and processes.

In addition to the above, concerns and issues raised by members of the community and/or project stakeholders during Scoping and subsequent consultation were included in the process.

The ENVIID workshops provided the opportunity to:

- Confirm the definition and understanding of the project design;
- Identify and define with the design engineers, project activities that could interact with the environment and social environment; and
- Jointly determine the level and importance of those interactions with a view to focusing project design on areas of concern with a view to mitigation.

- Evaluate possible alternatives and options, and consider any known mitigation measures to be in place.

This information was used in the compilation of the project description (Section 5) and in the impact assessment for the ESIA (Section 9).

3.6 Environmental & Socio-economic impacts identification

3.6.1 Definition of Impacts

ISO 14001 defines an environmental or social impact as:

"Any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organisation's activities, products or services."

3.6.2 Determining impact significance

Once all project environmental aspects were identified (using the information provided by the ENVIIDS), the level of impact that may result from each of the activity-receptor interactions was assessed. An environmental or socio-economic impact may result from any of these identified project aspects. Activities proposed under the ACG Phase 3 project were assessed in terms of their potential to:

- Contribute to environmental or socio-economic stresses and therefore impacts;
- Result in transboundary or cumulative impacts, either in their own right, or due to the fact that the project may be immediately followed by further development projects.

In assessing the level of impact that an activity may cause, two key elements were considered:

- **Consequence:** the resultant effect (positive or negative) of an activity's interaction with the legal, natural and/or socio-economic environments; and
- **Likelihood:** the likelihood that an activity will occur.

When assigning a level of consequence to the project activities, full consideration was given to the mitigation or design known to be incorporated into the Phase 3 project. For example, Phase 1 and 2 projects have developed and implemented a range of management plans to mitigate the impacts predicted with those projects. These plans will form the baseline for ACG Phase 3 and will be implemented after first being updated based on lessons learned during these earlier projects. In view of these measures, the consequences of many potential impacts for Phase 3 were substantially reduced.

3.6.3 Consequence

To assign a level of consequence to each environmental and socio-economic impact, criteria were defined for environmental and socio-economic consequence. The level of consequence for each identified impact was determined by examining a number of factors relating to the activity including:

- The ability of the natural environment to absorb the impact based on its natural dynamics and resilience.
- Community and stakeholder issues and concerns raised (Chapter 8); and
- Level of non-compliance with legislation, policy and/or adopted project standards;

The environmental and socio-economic consequence criteria are presented in Tables 3.1 and 3.2, respectively. A ranking of "4" represents the most severe consequence going down to '1' as the lowest and '+' as a positive impact/effect.

Table 3.1 Categories and definition of consequence levels for natural environment impacts

Ranking	Definition
4	▪ Impacts on a unique habitat > 2 km, or national scale (>20km) impact resulting in: – Long term (> 5 years) change and/or damage to the natural environment and its ecological processes; – Impairment of ecosystem function; – Reduction in regional habitat and species diversity; and/or – Direct loss of habitat for endemic, rare and endangered species of fauna and/or flora and for species' continued persistence and viability (i.e. availability of necessary resources) nationally and regionally (for species unable to disperse). ▪ Natural habitat restoration time 5 + years and requiring substantial intervention. ▪ Continuous breach of environmental regulations and company policy and/or exceedance of international, national, industry and/or operator standard for an emission parameter. ▪ Public outrage, multiple complaints and/or negative adverse international/national media attention. ▪ Critical financial loss and loss to Company value (>$5M).
3	▪ Impacts to a unique habitat <2km/or regional scale (2-20km) impact resulting in: – Medium term (2-5 years) change and/or damage to the natural environment and ecological processes; – Direct loss of habitat crucial for species' (including listed species) continued persistence and viability (i.e. availability of necessary resources) in the project area (for species unable to disperse); – Introduction of exotic species of fauna and invasive floral species replacing resident 'natural communities' within the project area; and – Environmental stress lowering reproductive rates of species within the project area. ▪ Restoration time 2 to 5 years and may require intervention. ▪ Potential breach from planned/non-routine activity of regulations and company policy and/or 50% to 100% contribution of international, national, industry and/or operator standards for an emission parameter. ▪ Public frustration, complaints from communities, authorities, NGOs and/or local media attention. ▪ Large financial loss ($500K to $5M).
2	▪ Local scale impact (<2km) resulting in: – Short term (<2 years) change and/or damage to the local natural environment and its ecological processes; – Short-term (<2 years) decrease in species diversity in selected biotopes/areas within the project area; and/or – Increased mortality of fauna species due to direct impact from project activities. ▪ Restoration within 2 years requiring minimal or no intervention. ▪ Within international, national, industry and/or operator standards for an emission parameter. ▪ Public concern and/or local complaints from individuals/community. ▪ Moderate financial loss ($100K to $500K).
1	▪ Disturbance to the environment in the immediate area (<2km) but the impact is largely not discernable within the project area. ▪ Recovery within 6 months without intervention. ▪ Within international, national, industry and/or operator standards for an emission parameter. ▪ Public perception only and/or no complaints from individuals/community. ▪ Minimal financial loss (<US$100K).
+	▪ Activity has net positive and beneficial affect resulting in environmental improvement for example: – Ecosystem health; – Increase in magnitude or quality of habitat for rare and endangered species of fauna and flora as well as for those species known to naturally occur in the area; and – Growth of 'naturally occurring' populations of flora and fauna. ▪ Positive feedback from stakeholders. ▪ Potential financial gains.

Table 3.2 Categories and definition of consequence levels for socio-economic impacts

Ranking	Definition
4	▪ Critical financial loss to Company value (>$5M). ▪ Permanent adverse impacts on livelihoods or income generation source. ▪ No sourcing of manpower from Azerbaijan labour market. ▪ No sourcing of supplies and services from Azerbaijan supplier network. ▪ Irreversible impact on health and safety (e.g fatalities). ▪ Permanent or irreversible loss of access or damage to social infrastructure.
3	▪ Large financial loss to Company (>$500K to $5M). ▪ Long-term (i.e year(s)) adverse impact on the livelihoods and income generation source of between 51 and 100 households. ▪ Only limited sourcing of manpower from Azerbaijan labour market (i.e 1-29% of total employment). ▪ Only limited sourcing of supplies and services from Azerbaijan supplier network (i.e 1-9% of total value). ▪ Long-term (i.e year(s)) adverse reversible impact on health and safety of local, regional and/or national population. ▪ Long-term impact either restricting access to or incurring significant damage to social infrastructure or facilities used by between 51 and 100 households.
2	▪ Moderate financial loss to Company ($100K to $499K); ▪ Medium-term (i.e month(s)) adverse impact on the livelihoods and income generation source of between 11 and 50 households. ▪ Only moderate sourcing of manpower from Azerbaijan labour market (i.e 30-49% of total employment). ▪ Only limited sourcing of supplies and services from Azerbaijan supplier network (i.e 10-19% of total value). ▪ Medium-term (i.e month(s)) reversible impact on health and safety or local, regional and/or national population. ▪ Medium-term impact either restricting access to or incurring some damage to social infrastructure or facilities used by between 11 and 50 households.
1	▪ Minimal financial loss to Company (<$100K). ▪ Short-term (i.e days or weeks) adverse impact on the livelihoods and income generation source of between 1 and 10 households. ▪ Only considerable sourcing of manpower from Azerbaijan labour market (i.e 50-69% of total employment). ▪ Only considerable sourcing of supplies and services from Azerbaijan supplier network (i.e 20-29% of total value). ▪ Short-term (i.e days or weeks) reversible impacts on health and safety of local, regional and/or national population. ▪ Short-term adverse impact either restricting access to or incurring limited damage to social infrastructure or facilities for between 1 and 10 households.
+	▪ Potential financial gains to the Company. ▪ Beneficial impacts on livelihoods and income generation activities of local, regional and/or national population. ▪ Extensive sourcing of manpower from Azerbaijan labour market (i.e +70% of total workforce). ▪ Extensive sourcing of supplies and services from Azerbaijan supplier network (i.e +30% of total value). ▪ Improvements to health and safety situation at a local, regional and/or national level. ▪ Beneficial impacts (i.e improvements) to social infrastructure or facilities at a local, regional and national level.

3.6.4 Likelihood

Likelihood in this assessment is the probability of an activity occurring. To assign likelihood to each activity, four criteria were defined and ranked. The criteria for likelihood are shown in Table 3.3. Level four, represents the highest likelihood that an activity will occur.

Table 3.3 Likelihood categories and rankings

Ranking	Definition
4	The activity/event is certain to occur under normal operating conditions.
3	The activity/event is likely to occur at some time (1-10 years) under normal operating conditions.
2	The activity is unlikely to but may occur at some time (10- 25 years) under normal operating conditions.
1	The activity is very unlikely to occur (>25 years) under normal operating conditions but may occur in exceptional circumstances.

3.6.5 Mitigation Workshops

Mitigation workshops were held following the impact assessment of the proposed Phase 3 project. These workshops were held in London and Baku with the relevant project design teams with the following aims:

- To confirm the level and accuracy of project design defined in the Project Description (Chapter 5) and used for impact assessment;
- To discuss and confirm mitigation measures incorporated into the project to ensure that the impact assessment was informed and accurate;
- To communicate the results of the impact assessment and identify any areas where additional mitigation may be required (through the communication of significant impacts); and
- To facilitate the development of mitigation and monitoring to be committed to in the ESIA, in order to reduce significant or residual impacts as much as practicable in the Phase 3 project.

3.6.6 Residual Significance

As the mitigation measures known to be put in place as part of ACG Phase 3 were considered in the impact assessment, it was possible to determine residual significance for all of the projects proposed activities. Residual impacts are impacts that remain after mitigation measures, including those incorporated into the project's base case design and those developed in addition to the base design.

The residual Impact significance is expressed as the product of the consequence (which considers the effectiveness of mitigation) and likelihood of occurrence of an activity, and is expressed as follows:

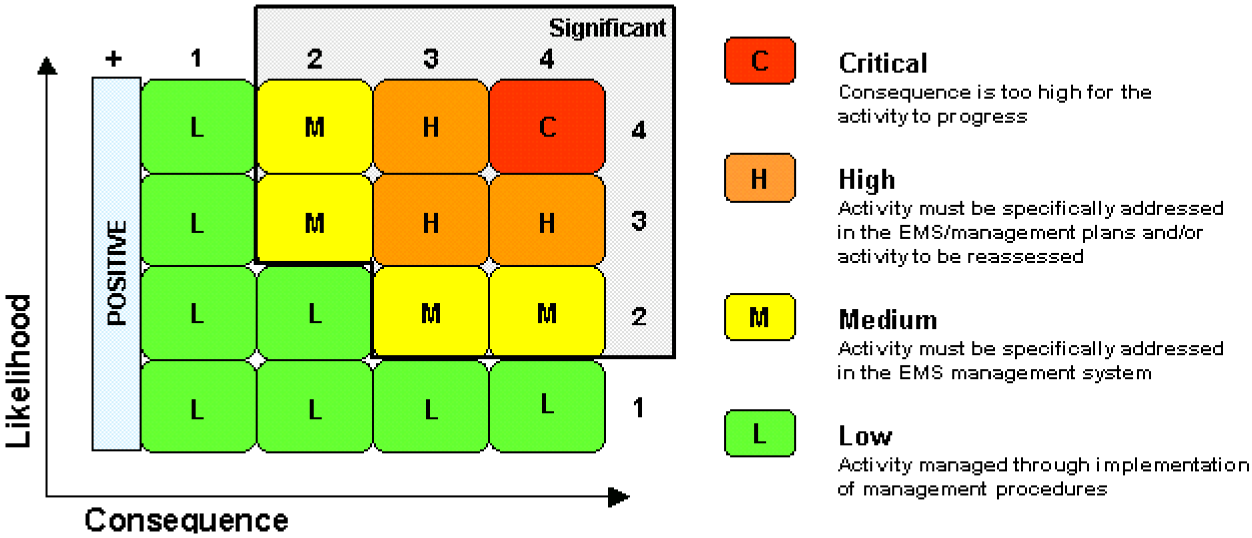
Residual Significance = Consequence x Likelihood

To assist in determining and calculating the significance of an impact, impact assessment matrices were developed listing activities on the y-axis and receptors on the x-axis (Appendices 6 & 7). Two columns were created for each receptor; one for consequence and one for likelihood. Drop-down menus containing the criteria levels, were entered into the cells in these columns.

A second matrix was then compiled to calculate the overall significance of each of the identified potential impacts. In the 'significance' impact matrix, each receptor has only one column in which the significance of the impact (i.e. consequence x likelihood) is calculated. From this matrix, those impacts that fall into the "critical" (i.e. >16) and "high" (i.e. 9-16) were identified (Appendices 6 & 7).

Based on its consequence-likelihood score, each environmental and socio-economic aspect was ranked into four categories or orders of residual significance. Figure 3.2 below illustrates all possible product results for these four consequence and likelihood categories and rankings.

Figure 3.2 Residual Impacts Significance Ranking



The results of the environmental and socio-economic impact assessment processes are presented in summary tables in Chapter 9. The impacts requiring further analysis in terms of identifying additional mitigation measures are discussed in detail and mitigation measures designed to further reduce identified residual impacts are presented in Chapter 11.

3.6.7 Cumulative impacts

The December 1998 IFC “Procedure for Environmental and Social Review of Projects” states that that an environmental assessment should also address cumulative impacts (draft Guidance Note # [G]; OP 4.01). The objective of the cumulative impact assessment is to identify those environmental and/or socio-economic aspects that may not on their own constitute a significant impact but when combined with impacts from past, present or reasonably foreseeable future activities associated with this and/or other projects, result in a larger and more significance impact(s). Examples of cumulative impacts include:

- The recurring loss of habitat in areas that are disturbed and re-disturbed over an extended period;
- Additional emissions as a processing plant is extended and expanded over a period of time, and
- The ongoing development of employment opportunities and enhancement of local labour skills base as successive projects (related or unrelated) come on stream

3.6.8 Transboundary impacts

The World Bank Operating Procedure (OP) 4.01 stipulates that transboundary impacts, (i.e. impacts that cross the border of Azerbaijan into neighbouring countries) should be considered during the ESIA process. The assessment of transboundary impacts for the ACG Phase 3 ESIA examines:

- Social and economic issues relating to the sourcing of labour, goods and services from the international market;
- Air emissions;

- Discharges to the marine environment; and
- Oil spill trajectories.

3.7 Mitigation and monitoring

3.7.1 Mitigation

As discussed, many mitigation measures are already included in the base project design and these were taken into consideration during the impact assessment process. Impacts that are identified as having a residual significance ranking of "high" or "critical" have been further analysed to identify additional mitigation measures that are potentially available to eliminate or reduce the predicted level of impact. These mitigation measures considered the reduction or avoidance of impacts from ACG Phase 3 as a stand alone project and the potential transboundary and cumulative impacts identified for the project. Potential mitigation measures considered included:

- Habitat compensation programmes;
- Species specific management programmes;
- Social and economic investment programmes;
- Engineering design solutions;
- Alternative approaches and methods to achieving an activity's objective;
- Operational control procedures, and
- Management systems.

The results of the mitigation analysis are presented in Chapter 11 for the natural and socio-economic environments respectively.

3.7.2 Monitoring

During the Phase 3 project, it will be necessary to monitor and audit project development and operation. Monitoring will provide the information necessary for feedback into the environmental management process and will assist in identifying where additional mitigation effort or where alteration to the adopted management approach may be required.

The Phase 3 ecological monitoring plan will be integrated into the Integrated Monitoring Plan (IMP) that is currently being developed to align all environmental studies required to support AzBU's development and operational practices. The IMP will initially focus on areas in which ACG Project, Shah Deniz Project, EOP and future upstream operations are (or will be) active and is discussed further in Section 11.

3.8 Long Term Environmental and Socio-Economic Management

To assist in the implementation of identified mitigation and monitoring strategies, Phase 3 will be within the existing Azeri Project Environmental and Social Management System (ESMS). This describes the various environmental management strategies and generic procedures for their implementation. It will identifies the management roles and responsibilities for ensuring that monitoring is undertaken and that the results are analysed and any necessary amendments to practices are identified and implemented in a timely manner. The ESMS is further discussed in Section 11.

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4 Options Assessed for the ACG FFD Phase 3 Project

Contents

Figures

Tables

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4.1 Introduction

The main objective of the Phase 3 project is to produce and deliver for export the recoverable hydrocarbon reserves from the Deep Water Gunashli (DWG) field of ACG. In order to achieve this, the project will require the following:

- Drilling, production and water injection facilities offshore;
- A means of transferring the produced hydrocarbons to shore; and
- Reception facilities onshore that will stabilise the product ready for export to market.

Phase 3 is being designed to achieve an estimated peak production of 316 Mbpd of oil and 350 MMscfd of gas. As the Phase 3 project follows previous phases of ACG development existing marine pipeline infrastructure will be available for the transfer of hydrocarbons to shore. Infield lines from the Phase 3 offshore facilities will tie into pre-installed connectors on the existing marine pipelines. No further export pipelines to shore will be required for Phase 3 and therefore there was no appraise/select option selection process for this part of the development.

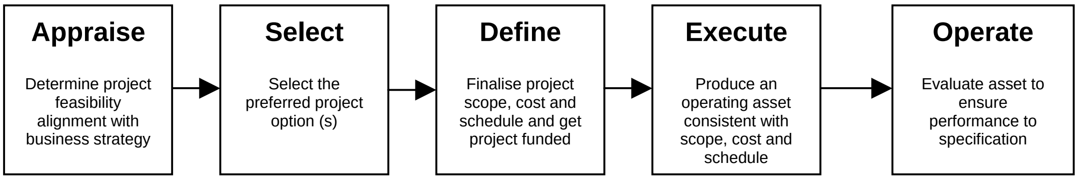
The existing pipeline infrastructure lands at the terminal facilities at Sangachal. These facilities were initially constructed for EOP and are being expanded to accommodate production from the Azeri Project (ACG Phase 1 and Phase 2). No further expansion of this terminal facility beyond the existing terminal boundaries, will be necessary to accommodate production from Phase 3 and therefore there was no option selection process for this part of the development.

The option selection process for Phase 3 therefore centred on the selection of suitable offshore facilities. As Phase 3 is the anticipated final phase of ACG full field development (FFD), the selection process considered options to develop DWG as well as options to develop reserves that Chirag is unable to recover, plus development of secondary reservoirs. As part of this, locating facilities in West Chirag (between Chirag and DWG) as well as DWG were considered.

In addition to the evaluation of each of the possible design alternatives for the development, a decision not to proceed with Phase 3 of ACG FFD was also recognised as an option. This was not considered viable following sanction of the Phase 1 and Phase 2 developments, as the programme of ACG FFD has been designed to achieve sufficient recovery of reserves that will make the investment in the region economically attractive. Without Phase 3 this would be difficult to achieve. A decision not to develop Phase 3 would also reduce revenues to the Azerbaijan government from oil export earnings that would in turn reduce the broader benefits to the Azerbaijan economy that such revenues can deliver. The Phase 3 project will also provide additional benefits including a continued source of employment for national citizens and continued use of in-country facilities and infrastructure as well as local suppliers.

As with all BP operated projects, BP's Capital Value Process (CVP) is being used as the mechanism for Phase 3 project development. The CVP is synergistic with standard engineering design phases and consists of a number of stages (Figure 4.1) that all project development decisions must pass through. This ensures consistency in approach across all projects.

Figure 4.1 BP Capital Value Process



Project concept design options are considered in terms of their feasibility during the Appraise Stage. Recommended design options are then passed into the Select Stage during which the preferred option for development is selected. At the time of writing this document the Phase 3 project was in the Define stage of the CVP.

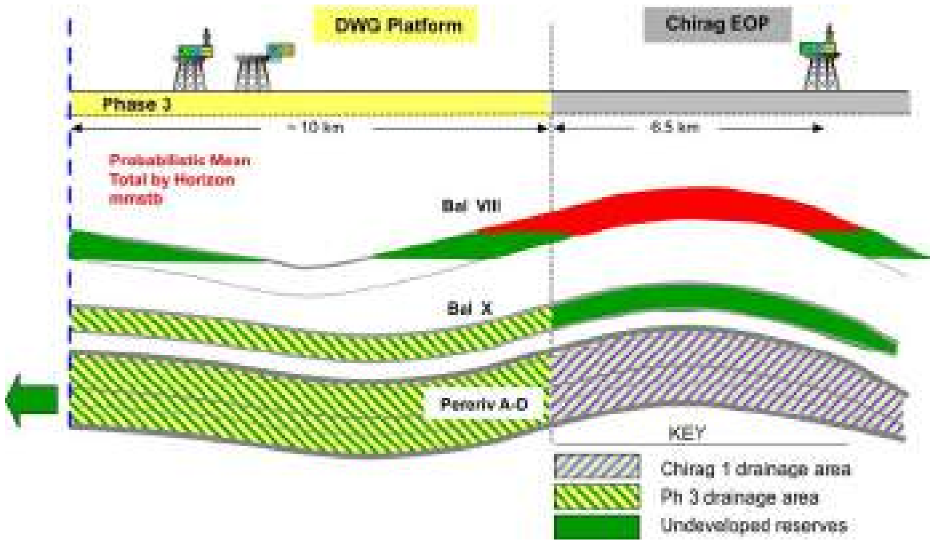
The following sub-sections provide a summarised review of the main decisions made regarding the engineering design options considered for the Phase 3 project. The selected Phase 3 project concept design is described in detail in Section 5 (Project Description) of this ESIA.

4.2 Appraise Stage

During the Appraise Stage programme a number of strategic issues, constraints and opportunities were identified for the Phase 3 offshore project. These included:

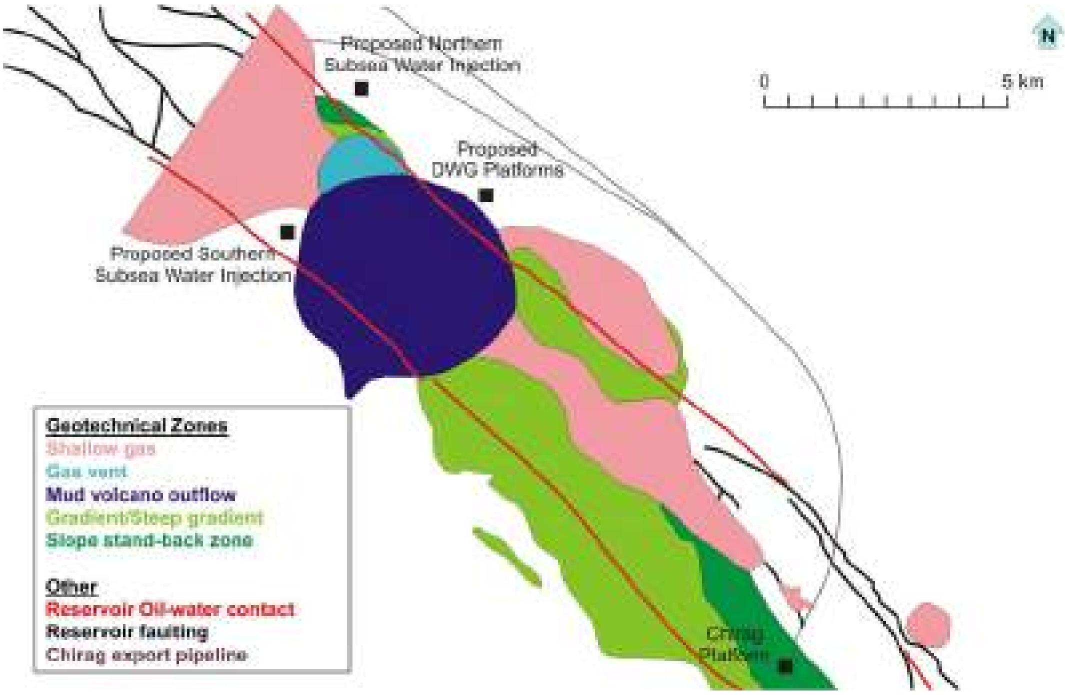
- **Reservoir** – the Phase 3 offshore facilities will primarily access the DWG reserves in the Pereriv and Balakhany X reservoir horizons. DWG reservoirs are located between the SOCAR operated Shallow Water Gunashli (SWG) field, and the Chirag field (Figure 4.2). Production from these adjacent fields has caused pressure effects in DWG, which requires re-pressurisation in order to optimise recovery of oil and gas. In order to achieve this, large quantities of water will need to be injected into the reservoir at high pressure. The Appraise stage concluded that early water injection into the DWG reservoir is necessary to optimise production rates and recovery. Achieving early water injection through subsea wells was identified as an optimum option. Gas injection as a means of re-pressurisation of the field was considered. However, it was concluded that the reservoir structure did not lend itself to this type of pressure support.

Figure 4.2 Phase 3 Development Scheme



- **Location and Geotechnics** – the Gunashli mud volcano dominates the DWG field and its location prevents placement of fixed facilities directly over the DWG field. Previous geotechnical investigations have identified and confirmed a safe location, offset to the north of the field, in a water depth of 175 m, that is outside the maximum anticipated mud outflow area of the volcano, and is suitable for standard design and installation, and allows for drilling coverage that can access the targeted reserves.

Figure 4.3 Geotechnical Hazards at the Phase 3 Location



- **Drilling** – the drilling of production wells and subsea water injection wells from a semi-submersible drilling rig prior to the installation of the Phase 3 offshore facilities was recognised as being necessary to improve the schedule and economics of the Phase 3 development. These water injection wells will be completed as subsea tie-backs to the platform facilities. The number of wells to be drilled for Phase 3 is a key factor in the optimisation of Phase 3 production and additional opportunities to improve the drilling schedule, and therefore increase the pace at which wells can be brought into production, was investigated during Appraise. A number of drilling well slot platform sizes were evaluated and, based on the production requirements, a total of 48 well slots were considered to be optimum for the project. With the use of well sidetrack technology it was considered that over 100 reservoir penetrations could be achieved from 48 slots.

- **Infrastructure and Personnel** – concept evaluation required that consideration be given to the existing infrastructure available in the region that would support the construction and installation of the Phase 3 facilities. Key factors in this evaluation included current projects underway in Azerbaijan and in particular, the Azeri Project and the Shah Deniz Project. Account was taken of the fabrication yard upgrades already carried out for these projects, the manpower available in Azerbaijan for the construction programme and the marine infrastructure available for installation of offshore facilities. The objective was to utilise existing infrastructure and manpower as far as possible without impacting the schedule of other projects already underway. It was also considered that in order to capture synergy benefits between projects and lessons learned from Azeri and Shah Deniz, a similar facility design to that selected for the Azeri Project would be favourable, as long it was appropriate for the Phase 3 development objectives. This approach allows for the optimisation of the construction schedule and reduced costs.

- **Schedule** – critical to the project schedule was the optimisation of the construction programme for Phase 3 within the context of the schedule associated with other projects underway in Azerbaijan whilst optimising the continuous use of available infrastructure and manpower.

- **Safety** – a high level risk assessment was conducted during Appraise to screen out any options, utilising lessons learned from the Azeri Project.

- **Environment and Social** – high-level environmental screening was carried out during Appraise. The principal areas investigated at this stage of the selection process were the ability of each considered concept to meet legislation and comply with project standards. Other areas considered at a high level during Appraise included:

  - Drilled cuttings generation and disposal;
  - Power requirements;
  - Flaring;
  - Space and weight availability for the inclusion of additional equipment with environmental benefits;
  - Proportion of in-country spend for the construction programme; and
  - Decommissioning.

- **Development Centre in West Chirag** (WC) – there were a number of reasons identified for investigation in to potential development options that may require additional facilities in WC. These included:
  - A number of secondary reservoirs in the area that contain additional reserves (Balakhany VII, VIII and IX above Pererev and NKP, NKG and Pre-Pereriv below) and the opportunity to access these to optimise ACG FFD hydrocarbon recovery (see Figure 4.2).
  - As an option to ensure recovery of Chirag hydrocarbons due to the uncertainty on final hydrocarbon recovery from the Chirag field.

- **Chirag Support** - as Phase 3 is the anticipated final development of ACG FFD and, like the Chirag development, is accessing the reserves from the Pereriv horizon, it was considered prudent to evaluate the opportunity to further optimise recovery from the Chirag development whilst considering the Phase 3 design.

The feasibility of all of the offshore concepts considered assumed the following constants for the project:

- Provision of offshore produced fluid processing similar to the partial processing selected for the Phase 1 and Phase 2 developments, in order to allow the utilisation of the existing marine export pipeline infrastructure to shore and allow for a similar process at the receiving terminal following Phase 3 expansion.
- Hydrocarbon transfer – using existing pipeline infrastructure following the tie-in of Phase 3 infield lines; and
- Onshore facilities – expansion of the existing Sangachal terminal to accommodate two additional processing trains, one additional dewpoint control unit and an additional oil storage tank.

The following offshore facility concepts were rejected in the Appraise Stage because they were either not feasible or offered no real economic advantage to the project:

- Gravity based structures - eliminated on the basis that no deepwater harbour is available in Azerbaijan that would support the construction and installation requirements.
- Tension Leg Platforms - eliminated due to the risks associated with these facilities in seismically sensitive areas.
- Floating Production Storage and Offloading Vessel (FPSO) – eliminated, as numerous subsea production wells would be necessary for this concept, which may adversely impact the project drilling schedule. Geohazards in the area were also considered to present an unacceptable risk to the extent of producing subsea facilities required under this FPSO concept.

- SPARS – eliminated as no SPAR (a type of offshore floating storage facility) of such a size has ever been constructed for a water depth of 175 m, considered to be too shallow for such a structure.

Table 4.1 below presents in detail the offshore concepts considered during the Appraise Stage. The table is separated into developments considered at the Phase 3 location alone (DWG standalone) and developments that would integrate with Chirag and/or West Chirag (DWG and Chirag Integration).

Table 4.1 Summary of Offshore Concept Evaluation During Appraise

Concept	Design/ technical/ cost	Infrastructure/ Personnel	Schedule	Safety	Environment	Rejected/Move to Select
DWG Standalone						
A Production, Drilling, Utilities and Quarters platform (PDUQ) bridge-linked to a gas Compression and Water injection Platform (C&WP) in DWG with subsea water injection wells.	Analogous to the ACG Phase 1 design.	Commonality with Phase 1 optimises; use of lessons learned, use of trained workforce and use of available and upgraded infrastructure. Presents a high degree of confidence in constructability. Installation of both platforms required within weeks of each other as early C&WP support necessary. Potential issues with infrastructure and manpower availability to construct two facilities at the same time in Azerbaijan. Increased jacket length requires new marine barge to support the launch weight.	Potential schedule risk associated with the construction of two platforms simultaneously and the construction of a new barge in the context of construction phasing schedule sensitivities with the available yards and manpower for all projects.	Inherently safe and allows HSE strategies for Phase 1 to be followed.	Decommissioning of the facilities considered to be a potential issue.	Move to Select Stage (DWG1)
A PDUQ bridge linked to a drilling C&WP (i.e. twin derricks) in DWG.	As above but the additional drilling rig would increase the number of simultaneous drilling operations therefore increasing the rate at which wells can be brought into production. No subsea water injection wells required.	Similar to above in that the design presents a high degree of confidence in constructability. Additional consideration required for second drill rig. Installation of both platforms required within weeks of each other as C&WP support necessary early. Potential issues with infrastructure and manpower availability to construct two facilities at the same time in Azerbaijan. Increased jacket length requires new marine barge to support the launch weight. Two drilling crews offshore.	Additional drilling rig improves drilling schedule and improves production pace. Potential schedule risk associated with the construction of two platforms simultaneously and the construction of a new barge in the context of construction phasing schedule sensitivities with the available yards and manpower for all projects.	Additional operational hazards considered to increase safety risks. Two separate drilling crews.	Decommissioning of the facilities considered to be a potential issue	Move to Select Stage (DWG3)
A single combined Production, Drilling, Utilities, Quarters, Gas Compression and Water	Development of the field using a single platform with all processing, drilling, utilities and field water	Non-standard construction. Higher risks related to construction of jacket and topsides of this size.	Potential schedule risks with non-standard construction and required new barge	Increased operational and mechanical risks on single combined	Decommissioning of the facilities considered to be a potential issue. Limited space and weight on	Move to Select Stage (DWG4)

Concept	Design/ technical/ cost	Infrastructure/ Personnel	Schedule	Safety	Environment	Rejected/Move to Select
injection Platform in DWG with subsea water injection wells.	injection requirements installed. The platform would be exceptionally large and heavy.	Size and weight an issue for transportation and installation with current marine infrastructure. A new marine barge would be required to support the floatover weight and jacket launch weight.	construction.	platform considered to increase safety risks.	topsides reduces flexibility to add additional equipment.	
A Technip Geoproduction (TPG) offshore unit with water injection, gas compression and quarters and a PDUQ in DWG with subsea water injection wells.	TPG unit considered better suited to shallower water but a modified design with large foundations could technically be installed in 175 m water depth. Initial cost estimates better than comparable fixed steel jacket structures.	Greater out-of-country construction for TPG unit Risks with transportation of large modules through the canal system into the Caspian.	The closure of the canal system into the Caspian in winter months considered to be a schedule risk.	Geohazard risks and concern over seabed fixing.	Less in-country spend for TPG unit construction.	Rejected due to schedule concerns, greater out-of-country construction requirements and risks from seabed fixing in the DWG water depth using a novel design.
A barge with water injection, gas compression and quarters and a PDUQ in DWG with subsea water injection wells.	Barge alongside PDUQ in DWG.	Construction of barge dissimilar to previous projects. Yard upgrades required for barge construction and loss of lessons learned by the workforce from previous projects.	Potential schedule risks with required barge construction.	Risk of collision from a barge lying adjacent to a fixed structure.	Risk of high pressure hydrocarbon hose rupture resulting in spills. Decommissioning of the platform facilities considered to be a potential issue.	Rejected due to the collision safety risk and risks to schedule.
A semi-submersible with drilling, water injection and gas compression, limited production facilities, utilities and quarters followed by a PDUQ.	Allows limited production from the semi-submersible through subsea production wells and removes the requirement for subsea water injection wells to be tied back to the PDUQ.	Construction of semi submersible dissimilar to previous projects. Yard upgrades required for semi submersible construction and loss of lessons learned by the workforce from previous projects.	Potential schedule risks with required semi submersible construction.	Geohazard risks to associated with the subsea development	Cuttings reinjection difficult from a semi-submersible. Decommissioning of the platform facilities considered to be a potential issue.	Rejected due to the high cost and the geohazards in the area presenting an unacceptable risk to the subsea facilities
DWG and West Chirag Integration						
Two separate self-sufficient platforms, one in DWG with subsea water injection wells and one in West Chirag with subsea water injection wells.	Access to secondary reservoirs and additional support to Chirag production. No modifications to the Chirag-1 platform required except the supply of water injection from the West Chirag platform	Higher risks related to construction of jacket and topsides of this size. Depending on final design, size and weight a potential issue for transportation and installation with current marine infrastructure. A new marine barge would be required to support the floatover weight and jacket launch weight. Two platform crews.	Potential schedule risks with non standard construction and required new barge construction.	Increased operational and mechanical risks on single combined platforms considered to increase safety risks. Two separate platform crews.	Additional cuttings generation and greater power requirements Limited space and weight on topsides reduces flexibility to add additional equipment. Decommissioning of the platform facilities considered to be a potential issue.	Move to Select Stage [DWG/WC1]
A combined single PDUQ and C&WP platform in DWG with subsea production wells and a TPG unit with production, drilling, utilities, quarters, water injection and gas	Access to secondary reservoirs and additional support to Chirag production. No modifications to the Chirag-1 platform required except the supply	Non-standard construction programme. Loss of lessons learned by the workforce from previous projects. Higher risks related to construction of platform jacket and topsides of this size.	Potential schedule risks with non standard construction and required new barge construction The closure of the canal	Increased operational and mechanical risks on single combined platforms considered to increase safety risks.	Additional cuttings generation and greater power requirements. Less in-country spend for TPG unit construction. Decommissioning	Rejected due to production recovery not found to be adequate to provide favourable economics.

Concept	Design/ technical/ cost	Infrastructure/ Personnel	Schedule	Safety	Environment	Rejected/Move to Select
injection in West Chirag with subsea injection wells.	of water injection from the West Chirag TPG unit.	Size and weight an issue for transportation and installation with current marine infrastructure. A new marine barge would be required to support the floatover weight and jacket launch weight. Greater out-of-country construction for TPG unit Risks associated with transportation of modules through the canal system into the Caspian.	system into the Caspian in winter months considered to be a schedule risk for the TPG unit.		of the platform facilities considered to be a potential issue.	
A PDUQ platform with gas compression in DWG subsea water injection wells in DWG and West Chirag and expansion of the existing Chirag-1 platform with a production and water injection barge	Access to secondary reservoirs and additional support to Chirag production. Extensive modification of the Chirag-1 platform to allow for the barge connections. Problems with fitting bridge link to Chirag-1 and mooring spread requirements for the barge.	Non-standard construction programme. Loss of lessons learned by the workforce from previous projects. Increased platform jacket length requires new marine barge to support the launch weight. Yard upgrades required for construction of the barge. Limited space and weight availability on Chirag-1 for modifications.	Potential schedule risks with non-standard construction, yard upgrades for the production and water injection barge. Schedule risk from new transport barge requirement.	Risk of collision from a barge lying adjacent to a fixed structure. Risks associated with tie in of modifications on Chirag.	Additional cuttings generation and greater power requirements. Decommissioning of the platform facilities considered to be a potential issue.	Rejected due to collision safety risk, technical problems with bridge-linking to Chirag, weight limits on Chirag, constructability concerns and production acceleration ultimately found to be negligible.
A PDUQ platform with gas compression in DWG, subsea water injection wells in DWG and West Chirag, and expansion of the existing Chirag-1 platform with a production and water injection TPG unit.	Access to secondary reservoirs and additional support to Chirag production. TPG unit considered to be better suited to the shallower water depth at Chirag. Extensive modification of the Chirag platform to allow for the TPG unit connections. Problems with fitting bridge link to Chirag-1.	Non-standard construction programme. Loss of lessons learned by the workforce from previous projects. Increased platform jacket length requires new marine barge to support the launch weight. Greater out-of-country construction for TPG unit Limited space and weight availability on Chirag-1 for modifications. Risks associated with transportation of modules through the canal system into the Caspian.	The closure of the canal system into the Caspian in winter months considered to be a schedule risk for the TPG unit. Schedule risk from new transport barge requirement.	Risks associated with tie in of modifications on Chirag. Increased operational and mechanical risks on single combined platform considered to increase safety risks	Additional cuttings generation and greater power requirements. Less in-country spend for TPG unit construction. Decommissioning of the platform facilities considered to be a potential issue.	Rejected due to technical problems with bridge-linking to Chirag, weight limits on Chirag, constructability concerns, and production acceleration ultimately found to be negligible.
A PDUQ platform with gas compression in DWG, subsea water injection wells in DWG and West Chirag, and expansion of the existing Chirag-1 platform with a production and water	Access to secondary reservoirs and additional support to Chirag production. Extensive modification of the Chirag-1 platform to allow for the semi-	Construction of semi submersible dissimilar to previous projects. Yard upgrades required for semi submersible construction and loss of lessons learned by the workforce from previous projects.	Potential schedule risks with required semi submersible construction. Schedule risk from new transport barge requirement.	Risks associated with tie in of modifications on Chirag.	Additional cuttings generation and greater power requirements. Decommissioning of the platform facilities considered to be a potential issue.	Rejected due to technical problems with bridge-linking to Chirag, weight limits on Chirag, constructability concerns, and production acceleration ultimately found

Concept	Design/ technical/ cost	Infrastructure/ Personnel	Schedule	Safety	Environment	Rejected/Move to Select
injection semi-submersible rig.	submersible connections. Problems with fitting bridge link to Chirag-1.	Increased platform jacket length requires new marine barge to support the launch weight. Limited space and weight availability on Chirag-1 for modifications.				to be negligible.
A PDUQ bridge-linked to a C&WP with subsea water injection wells in DWG and a subsea production well development in West Chirag	The platforms are located in DWG with 16 subsea production wells in West Chirag	Commonality with Phase 1 optimises; use of lessons learned, use of trained workforce and use of available and upgraded infrastructure. Presents a high degree of confidence in constructability. Installation of both platforms required within weeks of each other as C&WP support necessary early. Issues with infrastructure and manpower availability to construct two facilities at the same time in Azerbaijan. Increased jacket length requires new marine barge to support the launch weight. Subsea production never done before in the Caspian.	Potential schedule risk associated with the construction of two platforms simultaneously and the construction of a new barge in the context of construction phasing schedule sensitivities with the available yards and manpower for all projects.	Platforms design inherently safe and allows HSE strategies for the Phase 1 and Phase 2 developments to be followed Potential geohazard risks associated with the subsea development	Additional cuttings generation and greater power requirements. Decommissioning of the facilities considered to be a potential issue.	Move to Select Stage (DWG/WC3)

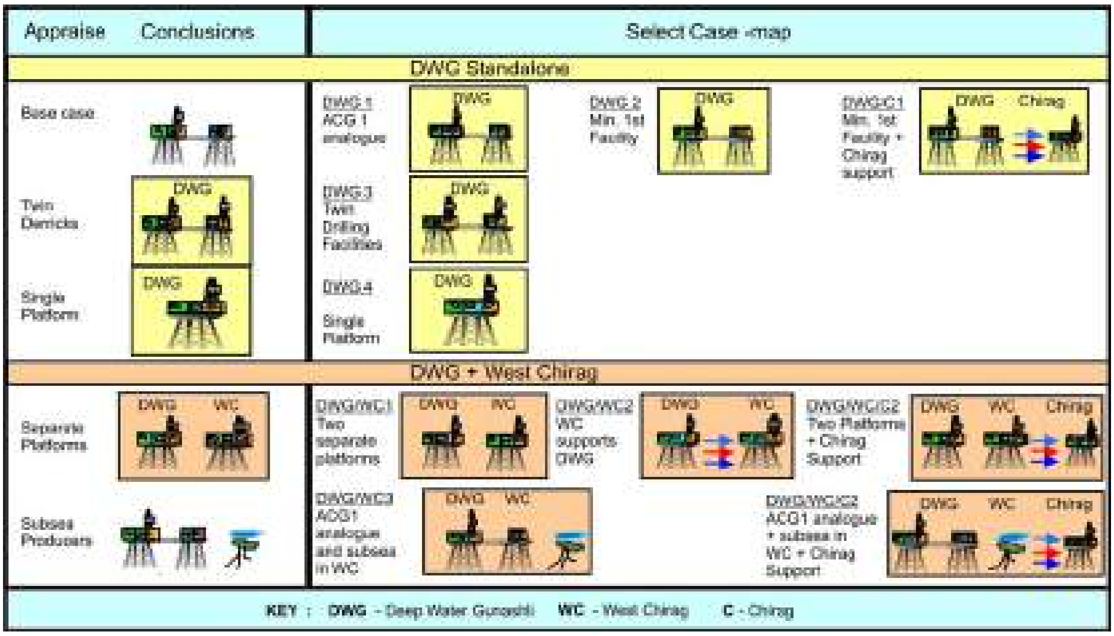
The Appraise stage concluded that five offshore design concepts should be carried forward for further consideration in the Select Stage as shown in Table 4.1 above. In summary, as illustrated in Figure 4.3, these concepts are:

- A DWG standalone concept that is analogous to the Phase 1 offshore facilities (DWG1);
- Two variants to the DWG standalone – a Phase 1 analogue with twin drilling facilities (DWG3) and a single combined platform (DWG4); and
- Two options for extending the development to the West Chirag area, including a single platform on both DWG and West Chirag (DWG/WC1) and a Phase 1 analogue at DWG with a subsea production development at Chirag (DWG/WC3).

4.3 Select Stage

At the beginning of the Select Stage ten variants of the concepts recommended in the Appraise Stage were identified, these concepts are illustrated in Figure 4.4 below.

Figure 4.4 Concepts Evaluated during the Select Stage



Each option is summarised below:

- DWG standalone development:
  - DWG1 – the Phase 1 analogue as described in Table 4.1;
  - DWG2 – a variant of DWG1 with minimal compression and water injection facilities on the PDUQ allowing for delay of installation of the C&WP;
  - DWG3 – a variant of DWG1 with a second platform drilling facility on the C&WP as described in Table 4.1;
  - DWG4 – one large, combined single platform containing all the platform facilities supplied by DWG1 as described in Table 4.1.

- DWG and West Chirag developments:
  - DWG/WC1 – two similar self-sufficient single platforms, one to be located at DWG and one to access additional reserves at West Chirag, each with a drilling rig as described in Table 4.1;
  - DWG/WC2 – a variant of DWG/WC1 with one large, combined single platform as DWG4 at West Chirag, supported by a drilling, utilities and quarters (DUQ) platform in DWG;
  - DWG/WC3 – DWG1 in DWG with a subsea development in West Chirag as described in Table 4.1.

- DWG and Chirag Support:
  - DWG/C1 – as DWG1 in DWG with water injection support provided to Chirag;
  - DWG/WC/C1 – as DWG/WC1 (one platform in DWG and one platform in West Chirag) with water injection support to Chirag;
  - DWG/WC/C2 – as DWG/WC3 (DWG1 in DWG with a subsea development in West Chirag) with water injection support to Chirag.

Six of the above options were rejected early in the Select Stage. Initially, each of the three '*DWG and Chirag support'* options were put on hold. Although it was concluded that water injection support to Chirag would provide an opportunity to enhance production at Chirag, it was considered that further analysis was required to optimise the reservoir depletion plan for Chirag prior to a decision on whether further investment was necessary or warranted.

Other options rejected at this stage were:

- The option for a large, single and combined PDUQ/C&WP platform in DWG (DWG4); and
- One DUQ platform in DWG plus one large, single combined platform in West Chirag (DWG/WC2).

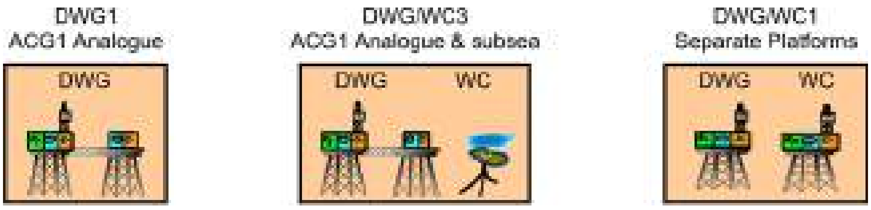
The principal concern in delivery of these concepts was related to the excessive weight of the single combined platform topsides, as there is no marine infrastructure currently available in the Caspian that could support the transportation and installation of such large structures. Furthermore, no offshore structure of this scale has been previously constructed in the Caspian and the project had concerns over a delayed construction programme due to the difference in design compared to other projects underway in Azerbaijan. Analysis of the economics were initially favourable for DWG4 due to the need for only one jacket, but the expected schedule delay associated with the construction programme eliminated the cost benefit of this concept.

DWG2 was also rejected at the Select stage. The additional water injection and gas compression on the first platform to be installed (PDUQ) would allow a postponement in C&WP installation; however this concept entailed an excessive additional capital cost. In any case, further analysis of the schedule sensitivities associated with construction of the Azeri Project facilities also indicated that it would in fact be possible to construct two platform facilities simultaneously using the existing yards and available manpower in Azerbaijan, therefore removing the requirement to further evaluate this concept.

Further work was continued on the feasibility of the four concepts remaining. The option to increase the number of drilling operations simultaneously in DWG through the installation of two drilling platforms (DWG3) was later rejected due to concerns relating to the large number of wells in such close proximity. It was considered that the prevention of collisions between wells during drilling operations would be difficult to manage.

The three concepts remaining in the final selection process are illustrated in Figure 4.5.

Figure 4.5 Select Stage final three concepts



Each of these concepts were evaluated in greater detail and the following were the key components considered in this evaluation:

- Ability to support Chirag if appropriate;
- Ability to access secondary reserves;
- Safety; and
- Environmental impacts.

4.3.1 Support to Chirag

As discussed above, further analysis of the future production volume estimates and production rates from the existing Chirag development is required to establish whether further investment from the Phase 3 development is appropriate to enhance production from Chirag. It was therefore, concluded that the potential opportunity to support future production at Chirag did not influence the decision at this stage of the Phase 3 concept selection process.

4.3.2 Access to secondary reservoirs

Both the DWG/WC1 and DWG/WC3 concepts offer the opportunity to provide access to the secondary reservoirs in the West Chirag area of the ACG field. It was concluded however, that the incremental reserves provided by these concepts was insufficient to justify the required additional investment when compared to the DWG1 concept.

4.3.3 Safety

A concept safety risk assessment was conducted and the results predicted that DWG1 offers the lowest safety risk to personnel. Inherent safety risks were higher for the DWG/WC1 (two separate self sufficient platforms) in comparison to the DWG1 and DWG/WC3 concepts which both have the greatest potential to separate the accommodation from the hazardous process.

4.3.4 Environmental Impacts

Significant environmental aspects associated with each concept were screened. The significant aspects considered included:

- Solid waste generation;
- Potential for hydrocarbon spills;
- Discharges to sea;
- Air emissions;
- Nuisance;
- Loss of habitat; and
- Decommissioning.

The screening process concluded that, apart from air emissions, the environmental performance from each concept would be similar. A key component of the concept design evaluation was the energy efficiency of each of the concepts under consideration. A reduction in energy usage leads to reductions in Green House Gas (GHG) emissions, potentially lower NO_x and SO_x emissions, and improvements to overall energy efficiency. To evaluate the energy usage of each concept a rigorous energy model was developed to determine the power usage over field life and related GHG emissions. The energy model considered all of the major equipment and utility power requirements and hence the energy required to produce and process the hydrocarbons offshore and to export them to the terminal.

At the time of the Select Stage assessment, the concepts' power requirements assumed the use of standard aero-derivative gas turbines (Rolls Royce RB211). These units are the preferred turbine technology for Phase 3 due to their proven reliability and ease of maintenance in an offshore environment. Furthermore, these turbines have been selected for the Azeri project and the use of the same technology for Phase 3 will facilitate easier support in terms of provision of spare parts and the ongoing maintenance programme for ACG FFD.

The results of the energy use studies showed that the DWG1 and DWG1/WC3 concepts (both consisting of bridge-linked twin platform concepts at DWG) would be more energy efficient than the DWG/WC3. Predicted GHG emissions to the environment were lowest for the DWG1 concept. The DWG/WC1 concept has greater weight and space constraints than both the DWG1 and DWG/WC3 concepts therefore it is considered that the DWG1 and DWG/WC3 concepts offer greatest opportunity to examine options to reduce energy consumption and hence reduce GHG emissions.

4.3.5 Select Stage Recommendation

It was recommended that Phase 3 proceed into the Define Stage with the DWG1 concept. DWG1 is analogous to the Phase 1 offshore development and the commonality of design was considered valuable in terms of using the lessons learned from construction of the Phase 1 facilities as well as the potential ability to use available and previously upgraded fabrication yards and infrastructure and the trained in-country workforce. This would reduce costs and schedule risks and presents a high degree of confidence in constructability. The concept is also inherently safe and allows the HSE strategies developed for Phase 1 and Phase 2 to be transferred to the Phase 3 design, construction and operational programme.

The DWG1 concept does not however allow access to the secondary reservoirs in West Chirag or provide opportunities to support production from the existing Chirag field. The Select Stage recommended that further work be undertaken during the Define Stage to assess whether pre-investment on the Phase 3 facilities would be appropriate for a potential future development on West Chirag.

Other issues to be considered in the Define Stage include:

- Transport and installation marine infrastructure for the jackets required for 175 m water depth and to support the PDUQ and C&WP platform topsides; and
- Further energy studies on the preferred concept so that energy efficiency optimisation opportunities can be determined.

4.4 Define Stage

Phase 3 offshore facility design at the end of the Select stage predicted facility weights that would exceed the capacity of the existing transportation and installation barge (STB-01) currently available in the Caspian. A new barge would therefore be required for transportation and installation of these facilities. The Phase 2 project had similar weight constraint difficulties and had planned to construct a new launch barge to facilitate transportation and installation of their facilities; this barge would then be available for Phase 3. Later definition of the Phase 2 facilities and construction programme concluded however that there was in fact no requirement for this new barge. This led the Phase 3 Define engineering team to investigate the possibility that the Phase 3 topsides layout may be reconfigured between the two platforms in order to balance the topsides weights and allow transport and installation with the STB-01, and thus eliminating the requirement for a new barge.

Specifically the Phase 3 PDUQ jacket design weight was significantly higher than STB-01 capacity and considerably heavier than previous Azeri project offshore facilities due to the increased water depth at DWG compared to the Azeri field. Reconfiguration of the equipment split across the topsides formed a topsides design with an adjusted weight balance between the two platforms. This balanced topsides design (a DUQ and PCWU configuration), along with an increased use of high strength steel on the jacket design, substantially reduced the weight of the DUQ jacket. Furthermore, Phase 3 will use a pre-installed foundation (pin-piles) resulting in a further reduction to the jacket installation weight and a total jacket weight that will be within the STB-01 carrying capacity. Some additional strengthening modification to the barge however will be required.

The balanced topsides design therefore means that the Phase 3 facilities will be able to be transported and installed using the existing infrastructure (STB-01) making the requirement for new build launch barge unnecessary. The configuration design of the topsides equipment across the two Phase 3 platforms is described in Section 5 (Project Description).

At the time of writing this document the project scope and schedule along with the detailed component selection for the reconfigured Phase 3 platforms was continuing during the Define stage of the CVP. Pre-investment requirements for a potential future development in West Chirag are also being included in the design of the offshore facilities. This mainly consists of definition of space and jacket riser location requirements.

Of particular relevance to this impact assessment is the environmental and social considerations taken into account during this process and these are described below.

4.5 Environmental Evaluation of the Selected Option

As with the selection of the principal Phase 3 design concept, a key strategic issue relating to the environmental evaluation of the selected option was the consideration of the engineering measures adopted by the Phase 1 and Phase 2 projects. Detailed engineering design and equipment consistency across FFD was considered to be of primary importance to the success of the ACG project. Commonality in approach is necessary as it allows for consistency across a number of areas including; operational control, HSE management and procedures, personnel training, vendor selection, the procurement and supply of spare parts and maintenance programmes. As such, the Phase 3 project design has built on the options selected for Phase 1 and Phase 2.

Considerable environmental assessment of the Phase 1 and Phase 2 facility design and project scope has already been conducted resulting in the adoption of many engineering and management mitigation measures designed to minimise environmental and social impacts associated with these projects. Further information on these can be found in the ACG Phase 1 and 2 ESIAs, and within the Phase 1 Supplementary Lenders Information Package (SLIP) (www.caspiandevelopmentandexport.com). Phase 3 will adopt these same measures and these include:

- Drilled cuttings – no discharge to the Caspian of cuttings generated from well sections drilled with non water based mud (NWBM), such as oil or synthetic based muds; these will be re-injected offshore from the platform. Prior to the availability of a cuttings re-injection well (e.g. during template drilling programme with a mobile drilling unit) or at any time that the cuttings re-injection equipment is not available these cuttings will be contained and shipped-to-shore for treatment and disposal. Cuttings from the well top hole sections that will be drilled with seawater or water based muds (WBM) will be discharged to the seabed in line with the Best Practicable Environmental Option (BPEO) conducted for the Azeri project.
- Produced water – no routine discharge of produced water offshore. Produced water will be re-injected as part of the large water injection requirements for the project and will only be discharged in the event of a water injection system failure.
- Flaring – no routine flaring for production. Gas will be used for power generation offshore and onshore. Any required flaring for Phase 3 at the terminal will use the common flare system already installed for the Azeri project. The terminal common flare system includes flare gas recovery and nitrogen purge gas. In addition, soft seat valves will be used by the project to minimise gas releases to the environment. The purge gas in the flare system will be metered so as to optimise the purge flow rate and avoid the combustion of unnecessary volumes of gas.
- Power generation – the adoption of high efficiency aero derivative RB211 gas turbines both offshore and onshore. The adoption of dry low NO_x technology gas turbines (and fired heaters) at the terminal.
- Oil storage tanks – fitted with external floating roof technology with primary and secondary rim seals and low loss fittings to minimise the release of fugitive hydrocarbon vapours to the atmosphere.

The land required for the expansion of the terminal at Sangachal to accommodate Phase 3 production has already been acquired and prepared for the facilities as part of the terminal early civil engineering work programme for FFD, therefore the Phase 3 terminal expansion programme will be conducted within the existing terminal footprint. The Phase 3 terminal facilities will integrate with the onshore sewage and drainage systems installed for the Azeri project.

In addition to these predetermined management and engineering measures to be adopted by Phase 3, further detailed environmental assessment of the alternative concepts considered, and of the selected concept for the Phase 3 project, have been conducted. The studies were designed to evaluate further options available to Phase 3 to improve environmental performance and also, where appropriate, to re-evaluate some of the decisions made for the Phase 1 and Phase 2 projects. Specifically, Best Practical Environmental Option (BPEO) and

Best Available Technology (BAT) studies were conducted to support the environmental evaluation of the concepts under evaluation during Select and further defined as the facility component design was developed during the Define stage. BPEO considers technical practicality, legislative compliance, safety and cost as well as the environment in its assessment. These studies have been subject to internal expert review. There were two key focus areas studied for Phase 3:

- Produced water; and
- GHG Emissions

4.5.1 Produced water

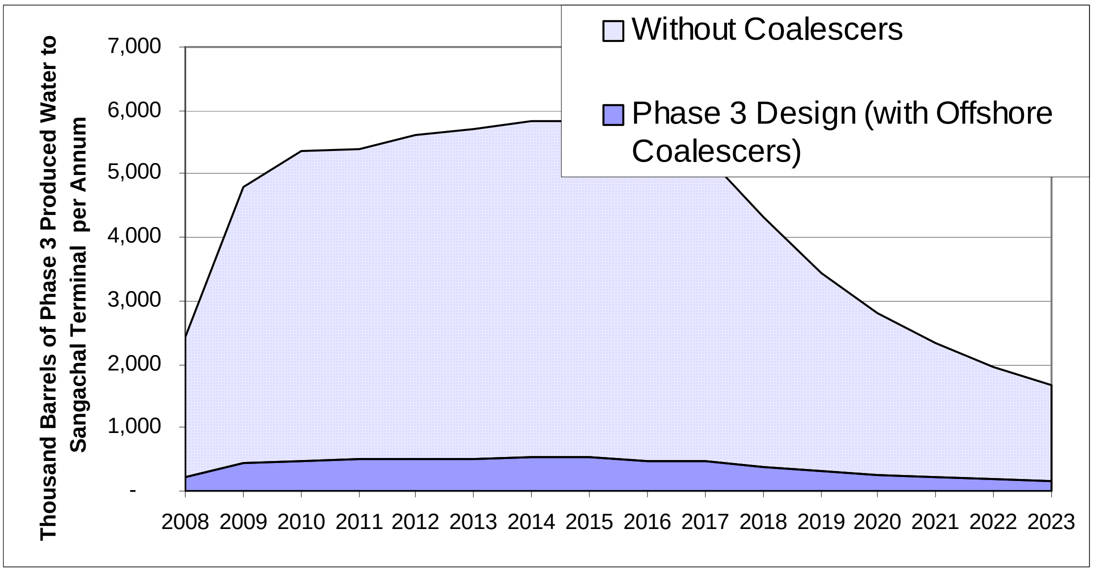
As discussed above (Section 4.2), the DWG reservoir is pressure affected and re-pressurisation will be achieved by injecting large quantities of water into the reservoir. The large water injection requirement for Phase 3 provided the opportunity to add project waste waters such as produced water and used cooling water to this water injection stream rather than discharging them to sea. This has been adopted by the project and as such produced water and cooling water discharges from the Phase 3 offshore facilities will only occur at times that the re-injection facilities are unavailable.

Produced water remaining in the oil stream will be transferred to shore and further separated from the hydrocarbon stream at the terminal. These produced waters will be co-mingled with EOP and Azeri produced waters and will be disposed of by the method under evaluation for FFD. The reconfiguration of the topside equipment, and associated reduction in space constraints on the PCWU platform provided Phase 3 with the opportunity to evaluate installation of coalescers on the offshore separation stream. Phase 3 will adopt the option. The coalescers will improve separation of oil and water and will reduce the amount of water in the oil export from the platform to the terminal to a maximum 0.5% by volume. It is estimated that without the coalescers the water cut in the oil export would be up to 5%. This has a number of advantages:

- Reduced volumes of water at the terminal that requires ultimate disposal;
- Reduction in chemicals required to aid separation (reduced demulsifiers);
- Reduction in chemical injection requirement into the export oil pipeline to shore (reduced corrosion inhibitors); and
- A reduction in water in the pipeline will result in more oil in the pipeline.

Figure 4.6 illustrates the reduction in Phase 3 produced water volume to be transferred to the terminal through the installation of coalescers on the PCWU, versus a base case of 5% water cut.

Figure 4.6 Produced Water Delivered to Sangachal Terminal With and Without the Use of Coalescers



4.5.2 GHG Emissions

The agreed set of Phase 3 HSE design standards include the requirement to evaluate options to reduce offshore flaring and to base the project design on maximising energy efficiency in line with BPEO.

The energy model developed for the project and referred to above (Section 4.3.4) calculated the power required by the various equipment items and provided information on the design optimisation of equipment size, layout and loading requirements. This energy model was used in the assessment of various energy efficient design options and technologies. The cost to reduce GHG emissions was also considered by comparing the cost per tonne of CO_2 abated against the capital expenditure (CAPEX) and operating expenditure (OPEX) required to design, procure and operate the equipment that would enable this reduction.

To maximise energy efficiencies a number of design and technology opportunities were identified that may be applied to Phase 3. Some of these design options were considered during Phase 1 and Phase 2 design definition and rejected. However as noted above it was considered necessary to re-evaluate some of these options for Phase 3 particularly in light of any new technologies that may be available as well as lessons learned from similar operations in other parts of the world.

Studies to minimise GHG emissions for the Phase 3 development focussed into three key areas, which are further discussed in the following sections:

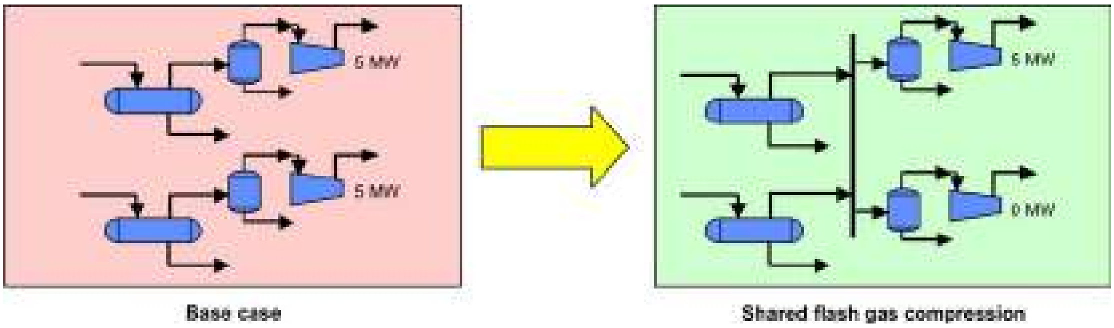
- Gas compression (Section 4.5.3);
- Combustion gas emissions from fuel burning to generate power and heat (Section 4.5.4); and
- Flare Gas Recovery (Section 4.5.5).

4.5.3 Gas Compression

4.5.3.1 Onshore

At the terminal there will be two stabilisation trains for each Phase of FFD (total 6 trains) that will run in parallel to the existing EOP process train. Each train has its own dedicated flash gas compressor designed into the stabilisation process. Studies identified that the tie in of the separator outlets from both Phase 3 process trains (trains 5 and 6) to a common compressor suction manifold / header would allow the operation of either compressor alone, versus the base case design that requires both dedicated compressors to operate at all times. This provides a corresponding reduction in compression power requirements (Figure 4.7). CO_2 emission reductions would amount to an estimated 600,000 tonnes over the life of the PSA at a cost of $0.42 per tonne. The modification has been accepted by the project and will also be included into stabilisation trains 3 and 4 (Phase 2).

Figure 4.7 Terminal Flash Gas Compression Common Feed Header



4.5.3.2 Offshore

Flash Gas Compression: Two flash gas compression trains working, each able to handle 50% of the gas inventory, have been selected as the system configuration for the Phase 3 offshore platforms. This provides higher availability than a single train processing the full inventory, and consequently provides a reduction in gas flaring should a compressor suffer downtime. The estimated reduction in CO_2 emissions based on this higher compressor availability is approximately 380,000 tonnes over the life of the PSA.

Export Compression: A compressor study was conducted for Phase 3 to establish the optimum configuration and equipment required to control and maintain a constant delivery of associated gas from the platform. The study considered gas export compression and power generation capacity at times of peak production when gas rates will be in the region of 350 MMscfd.

A number of gas turbine configurations were considered in combination with either fixed speed electrical driven compressors or mechanically driven compressors powered directly by gas turbine. Electrically driven compressors have been selected for Phase 3 in favour of gas turbine driven options as they provide higher availability and improved operability. The high availability of these electric motors (usually greater than 99.5%) in comparison to the mechanically driven units (approximately 95%) will result in a reduction in export compression downtime and hence a reduction in flaring events which in turn will reduce the overall atmospheric emissions for the project. The estimated reduction in CO_2 emissions is approximately 790,000 tonnes over the life of the PSA.

Adequate space has been designed to retrofit an additional export compressor in the future if required.

4.5.4 Combustion Gas Emissions for Power & Heat

The main sources of project combustion gas emissions will include:

- Power generation gas turbines offshore;
- Gas turbine driven water injection pumps offshore;
- Power generation gas turbines onshore;
- Fired heaters onshore.

A number of options to reduce emissions from combustion sources have been considered during the CVP stages and these are summarised below:

- **Single Power Station Onshore** – the option of having one central power station onshore for the project with transmission of power offshore through a sub-surface cable to the offshore locations. This was assessed for Phase 1 and Phase 2 but rejected due to cost and schedule, it was however considered appropriate to re-investigate the option for Phase 3 in relation to FFD.

- **Renewable Energy Sources** – a number of potential new energy sources that could replace the requirement for fuel combustion. Renewable energy power generation options were considered for Phase 1 and Phase 2 and rejected due to impracticality and cost amongst other reasons. Phase 3 evaluated the alternatives once again to assess whether anything had changed.

- **CO_2 removal and injection** – a technology where CO_2 is captured from the gas turbine generators, compressed and liquefied then transferred to a sub-surface aquifer for disposal. This was considered for Phase 1 and Phase 2 and rejected due to the immaturity of the technology, but re-investigated for Phase 3.

- **Onshore and Offshore Combined Cycle Gas Turbines** – involves the installation of waste heat recovery onto running gas turbine exhaust gases. The waste heat is recovered in a steam generation system to raise steam to run a steam turbine generator, which in turn will reduce the demand on gas turbines. This results in lower fuel use and a consequent reduction in emissions. The large number of gas turbines required for the project provides a potential opportunity to install a combined cycle system. Combined cycle power generation (CCPG) was considered for the Phase 1 and Phase 2 developments and was rejected due to high CAPEX and weight restrictions offshore and inadequate power generation onshore. The technology has been re-evaluated for Phase 3. The analysis of trade offs between fuel gas / CO_2 savings offered by CCPG and its associated cost, weight impacts and other technical considerations formed the basis of the study.

- **Onshore Terminal Process Heat Integration (Back Heat Exchange)** – cold oil arriving at the terminal is heated (by fired heaters) before entering the stabilisation train. Heat is then removed from the hot stabilised oil using large air coolers. Back end exchange would take the heat from the hot stabilised oil and use it to heat the cold incoming oil. This would reduce the fired heater capacity required as well as air cooler duty resulting in higher energy efficiency and the reduction in related combustion emissions. This technology was initially considered for the Phase 1 development but was rejected due to the high wax content of the oil and the potential for this wax to lead to equipment downtime. It was decided to re-evaluate this technology for Phase 3.

- **Onshore Terminal Waste Heat Recovery** – involves extraction of the heat from the exhaust gases of the gas turbine power generators onshore. The waste heat recovered would be delivered to the stabilisation train via a closed loop hot oil system and used to heat the crude oil entering the terminal. As with back heat exchange this has the potential to reduce required fired heaters on Phase 3 trains (trains 5 and 6) and therefore reduces energy consumption and emissions of CO_2. Waste heat recovery was evaluated for Phase 1 but it was concluded at that time that there was insufficient heat available from the gas turbines to provide sufficient heat. Phase 2 evaluation rejected the system on economic grounds and distance that the heat would need to be transported. The system was re-evaluated during Phase 3 for terminal FFD.

Ultimately, each of these options were rejected for Phase 3 for a variety of reasons including:

- Poor economics associated with the technology in relation to the level of abatement achieved;
- The complexity of the technology and associated operability of the equipment;
- The immaturity of some technologies with only limited or no offshore application;
- Unknown reliability;
- Site layout;
- Lack of commonality with other Phases of the ACG FFD.

A summary of the results of the assessment of these options is included in Table 4.2 below.

Table 4.2 Summary of Combustion Gas Emission Reduction Options

Option	Technical capability	Safety	CO_2 Saving over life of PSA	Cost ($)/ tonne CO_2	Accepted/ Rejected
Single power station onshore located at: • Sangachal Terminal; or • Apsheron Peninsula	Require construction of a new power station.	Construction risks.	Unknown but significant offshore, all emissions concentrated onshore (i.e. higher onshore emissions).	$322	Rejected due to poor economics.
Renewable energy sources including: • Solar power • Wind power • Wave power	Solar: Not capable of meeting project energy requirements without large solar collection areas.	Solar: Unknown.	Unknown but significant reductions.	Solar: estimated $100-$120	Rejected due to technical impracticality, the relatively low contribution to energy demands and poor economics Wind generated power also rejected on offshore safety grounds.
	Wind: Unsure if capability available. Structurally must be nearby or installed on platform.	Wind: Risks associated with wind turbines adjacent to platforms offshore. Rotating blades.	Will not meet project energy demands and the shortfall will be met by back-up turbines.	Wind: $14 - $140	
	Wave: Unproven. Wave energy in Caspian is relatively low.	Wave: Unknown	Diurnal energy fluctuations will require back-up turbines.	Wave: Unknown	
CO_2 removal and injection sub-surface	Untried and so unproven offshore. Requires identification of suitable aquifer for disposal. Reduction in turbine efficiency and hence increase in fuel gas consumption. Complex.	Uncertain but potential risks from CO_2 leakage.	Unknown but up to 85% of CO_2 can be recovered.	Estimated $40 - $60 for CO_2 scrubbing of exhausts only.	Rejected due to poorly defined technical and safety risks as well as poor economics
Offshore Combined Cycle Gas Turbines (CCGT) A number of optional CCGT configurations were investigated including both conventional heat recovery steam generators (HRSG) and the lighter once through	Some limited application in the North Sea sector but reliability not yet proven offshore. Require increased seawater cooling and hence increased seawater lift duty.	Adds complexity to the process. Operability concerns.	1.3 – 2.9 million tonnes	$15-$18	Rejected due to deviation from Azeri project and the requirement for consistent power generation equipment; weight restrictions on

Option	Technical capability	Safety	CO_2 Saving over life of PSA	Cost ($)/ tonne CO_2	Accepted/ Rejected
steam generators (OTSG). Applications evaluated were electricity generation; water injection; and combined electricity and water injection.					the load out barge; poor economics; and limited proven application offshore.
Onshore CCGT Investigation into CCGT on four of the terminal gas turbines using HRSG.	Technology is established onshore. Raised steam from four gas turbines could drive two steam turbines. Requires redesign of gas turbine bays to house the CC equipment.	Added complexity	1.2 million tonnes	$28	Rejected due to deviation from Azeri project design and poor economics.
Onshore process heat integration – back heat exchange.	Additional piping layout complexity required. Potential for deposition of wax on the tube exchangers. Steam generation may be required to melt any wax deposition. Potential for additional maintenance.	Increased complexity to the process train. Operability concerns.	1 million tonnes	$0	Rejected due to deviation from Azeri project process train (1-4) design, increase in plant complexity and potential for wax build up in the equipment. Potential for cost escalation
Onshore waste heat recovery	The GTs have space for WHR as part of the Phase 1 and 2 design, Phase 3 will do the same.. Indirect closed loop hot oil transportation system would need to be installed. The system would be up to 2 km in length. No space allocated in pipe racks for hot oil loop.	Hot oil pipe work would be routed through the main north-south pipe rack containing live oil and gas lines.	1.7 million tonnes	$6.7	Rejected due to the distance the hot oil would need to travel which removes the value and due to safety considerations.

4.5.5 Flare Gas Recovery

Onshore
As noted above, flaring for Phase 3 at the terminal will be using the common system installed for FFD which includes flare gas recovery and a nitrogen inert gas purge.

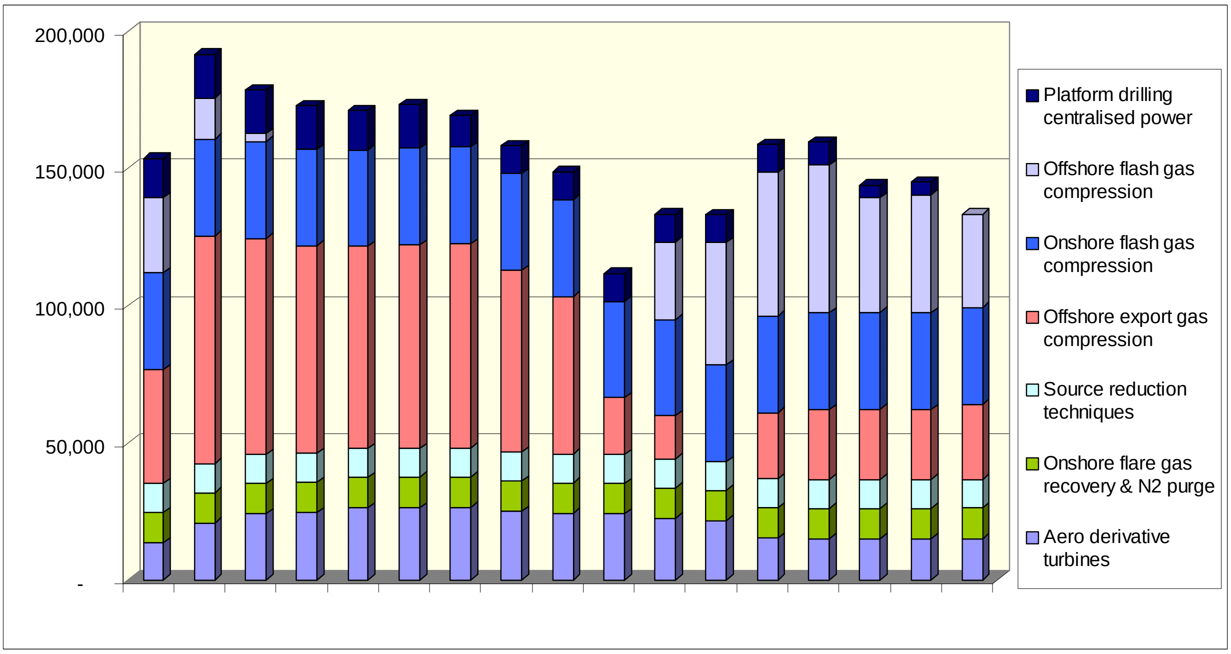
Offshore

The option to install a flare gas recovery system to enable recovery of the purge gas from the flare system and return this gas back to process was evaluated by the Phase 3 project. Due to a high CAPEX requirement and associated operational complexity, the option was rejected for Phase 3.

4.5.6 Reduction in GHG Emissions Through Phase 3 Design Decisions (CO_2eq)

As discussed in the preceeding sections, a reduction in GHG emissions has been attained through design decisions made by the Phase 3 project team. These are illustrated in Figure 4.8. For those relating to the selection of design options from the ACG Phase 1 project, further information is provided in the ACG Phase 1 ESIA (URS, 2002).

Figure 4.8 ACG Phase 3 GHG Savings through Design (Tonnes CO_2 Eq)



4.6 Ongoing Studies

Additional studies relating to the project power demand are continuing and power demand profiles have highlighted some further opportunities for power generation optimisation. In particular the terminal power demand profile indicates that there may be a potential to reduce the number of RB211s currently designed into the terminal for the ACG FFD. At the time of writing a power study was ongoing to evaluate the possibility of importing power to Sangachal Terminal from the national grid with a view of reducing the onsite gas turbine requirement and therefore increasing the ACG project energy efficiency profile.

5 Project Description

Contents

Figures

Tables

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5.1 Introduction

This section of the ESIA describes the components of the ACG Phase 3 project. The description provides the technical basis for the activities associated with the various phases, namely:

- The fabrication, construction and commissioning activities for both offshore and onshore facilities;
- Installation of the offshore facilities;
- Offshore drilling operations;
- Offshore and onshore production and processing operations; and
- Decommissioning considerations for both offshore and onshore facilities.

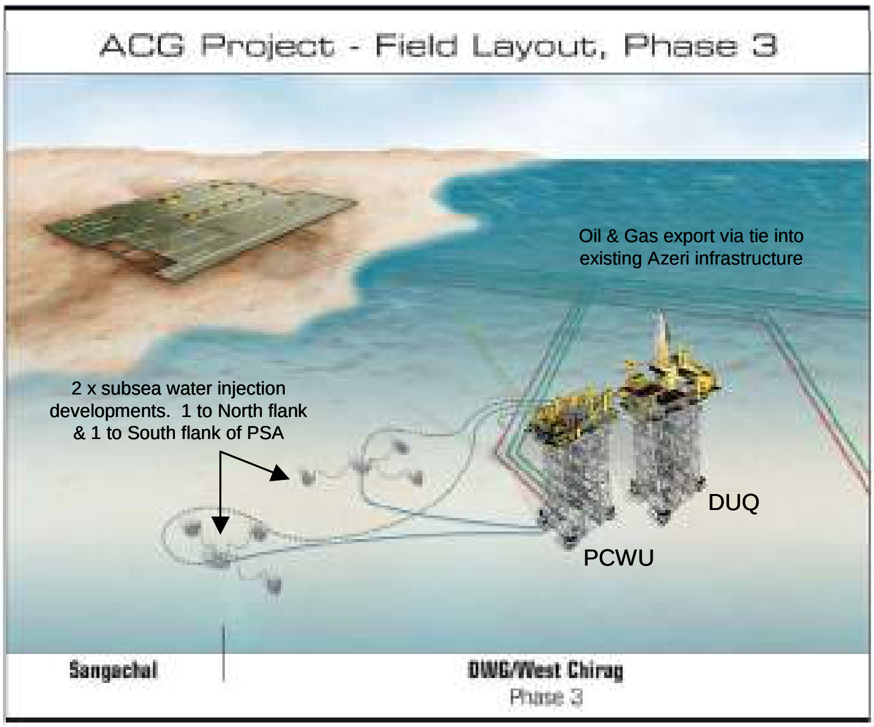
This description includes a summary of the predicted emissions, discharges and wastes from the Project and provides the basis for the environmental and social impact assessment that follows. The description and assessment of impacts was prepared during the Define stage of the project.

As described in Chapter 4 (Options Assessed), the base case design for the ACG FFD Phase 3 Project consists of the following main facilities:

- Two bridge-linked platforms offshore in the DWG field: a Drilling, Utilities and Quarters (DUQ) platform, bridge-linked to a Production, Compression, Water Injection and Utilities (PCWU) platform;
- Offshore interfield export pipelines to tie the offshore facilities into the existing Azeri Project pipeline infrastructure that extends to the onshore terminal;
- A subsea water injection development consisting of two subsea manifolds tied back to the DUQ and PCWU platforms; and
- Expansion of the existing onshore terminal at Sangachal to accommodate two additional processing trains, an additional dewpoint control unit and an additional oil storage tank.

A summary description of the Phase 3 Project design is illustrated in Figure 5.1 below.

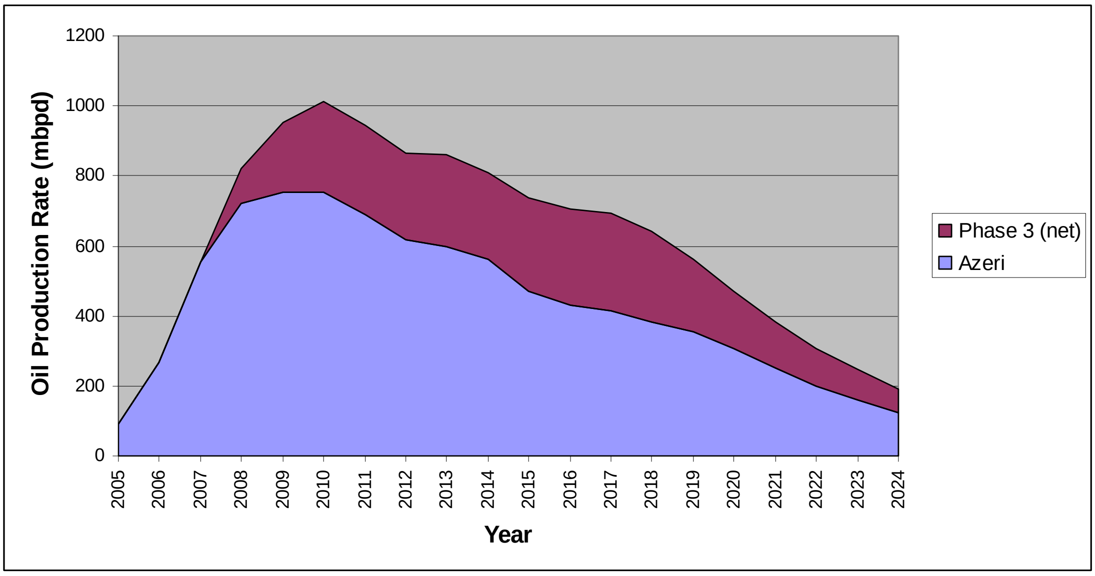
Figure 5.1 Schematic of the Phase 3 Project



The objective of Phase 3 is to deliver first oil in early 2008 with peak production anticipated in 2010. Estimated recoverable oil in the DWG field ranges between 1,000 and 1,200 MMstb and facilities have been designed to process a peak oil production rate of 316 Mbpd and a peak gas production rate of 350 MMscfd. Oil and gas export to shore will be via tie-in lines to the existing Azeri Project (Phase 1 and 2) pipeline infrastructure. The Central Azeri (CA) C&WP platform requires an additional gas compression unit to enable the export of gas produced from Phase 3.

Estimated ACG Field oil production profiles over the lifetime of the PSA are shown in Figure 5.2.

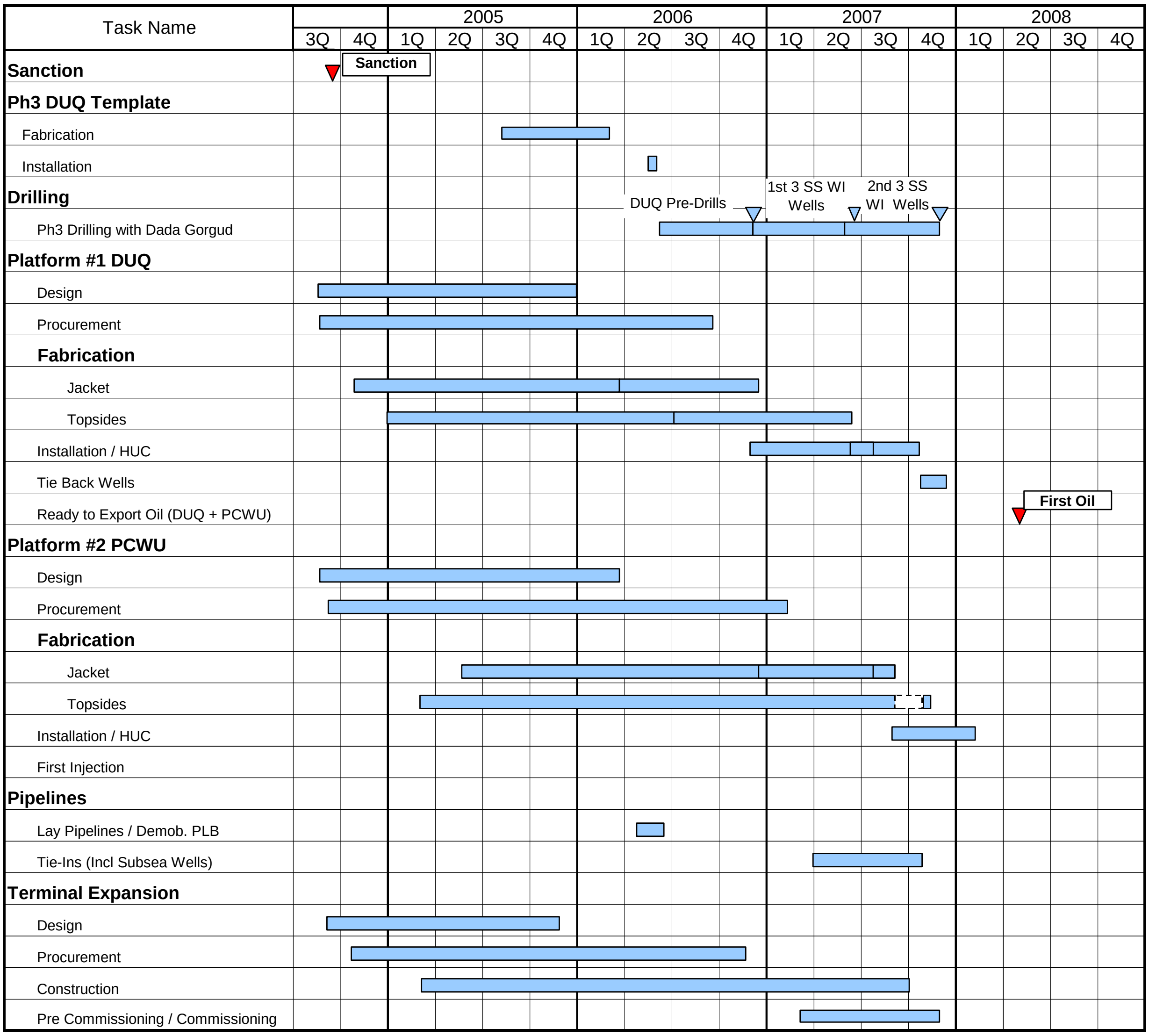
Figure 5.2 ACG Field Estimated Production Profiles



5.2 ACG Phase 3 Project Schedule

The key milestones for the Phase 3 Project development are shown in Figure 5.3. The milestones provided are based on best available knowledge at time of writing and are likely to be subject to change. The timing for each of these milestones will be finalised prior to the end of project Define.

Figure 5.3 Estimated Schedule for Phase 3 Development Activities



As highlighted in Figure 5.3, delivery of the projected production profile for Phase 3 requires drilling operations to be carried out in three key stages as follows:

- **Template drilling or "pre-drilling":**
  A number of wells will be pre-drilled at the offshore platform site from a Mobile Offshore Drilling Unit (MODU), prior to the installation of the DUQ and PCWU platforms. This will enable rapid completion and tie back of these wells and thus early production from these wells once the platforms are in place. It will be necessary to install a 12-slot drilling template at the DUQ offshore location to enable this.
- **Subsea water injection wells:**
  Following the drilling of the early production wells at the offshore platform site, a number of water injection wells will be drilled using the MODU These wells will be drilled in two locations to the north-west and south-west of the central platform location in readiness to be completed as subsea tie-backs to the platform facilities.
- **Platform Drilling:**
  Once the offshore platforms are installed at the DUQ location, subsequent wells will be drilled from the DUQ platform to utilise the 48 available well-slots.

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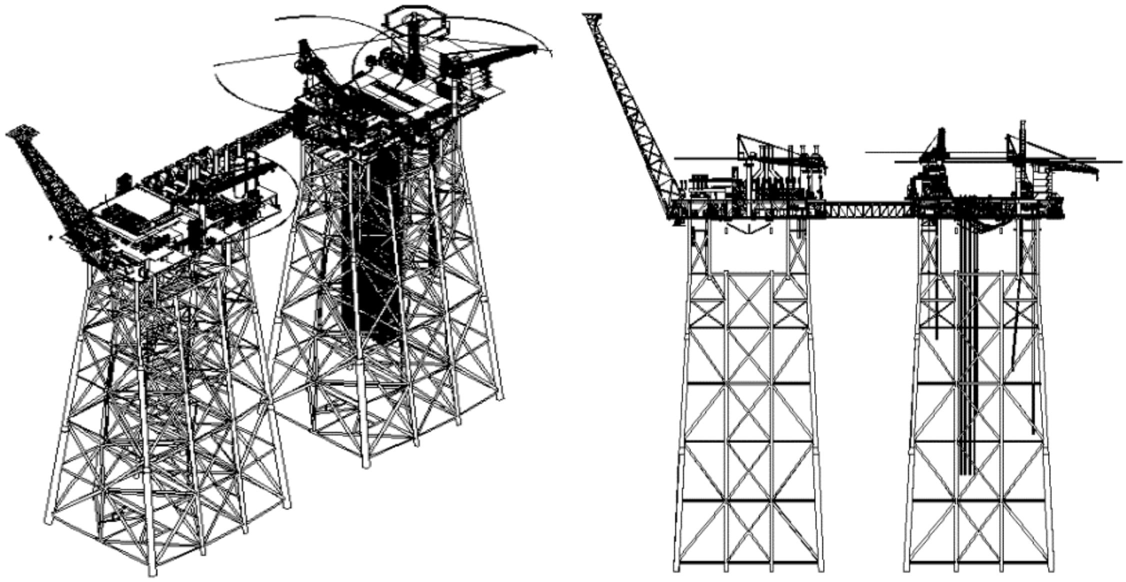
5.3 Offshore Platforms

5.3.1 Overview

The Phase 3 offshore platforms will consist of a DUQ platform bridge linked to the PCWU platform (Figure 5.4). Together, the two installations will provide the necessary facilities for the production and partial processing of hydrocarbon products prior to its export to shore, in addition to drilling and water injection requirements. The following sections summarise the platform facility design/layout, the fabrication/construction and onshore pre-commissioning activities, plus the load-out and offshore installation, hook-up and commissioning activities. Operational activities of the platforms are described in Section 5.5.

Figure 5.4 Phase 3 Offshore Platforms (Drilling derrick equipment set (DES) and drilling support module (DSM) not shown)

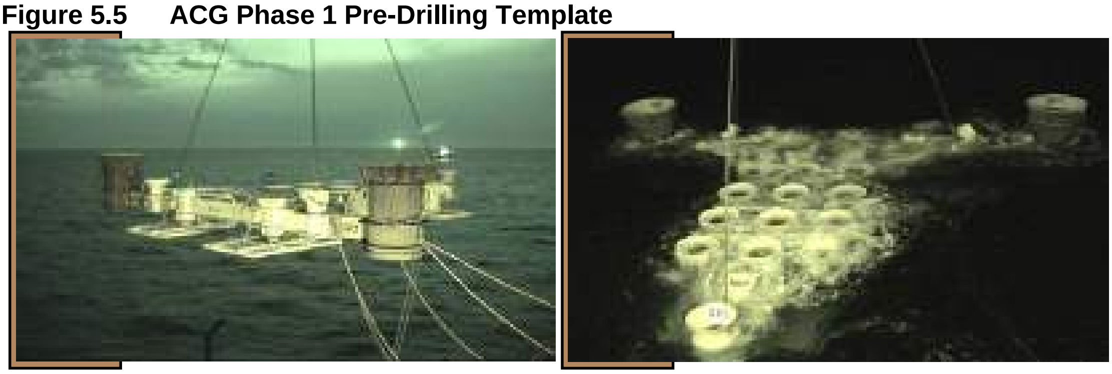


5.3.2 Design and Layout

5.3.2.1 Drilling Template

The Phase 3 drilling template will be of similar design as for the Phase 1 and Phase 2 templates (Figure 5.5). It will provide 12 well slots for the pre-drill programme. Pin Piles shall be used for the docking guides for the installation of the DUQ jacket. The template will be constructed from high-grade marine steel, with corrosion protection provided by anti-corrosion / anti-fouling paint and zinc-aluminium sacrificial anodes.

Figure 5.5 ACG Phase 1 Pre-Drilling Template

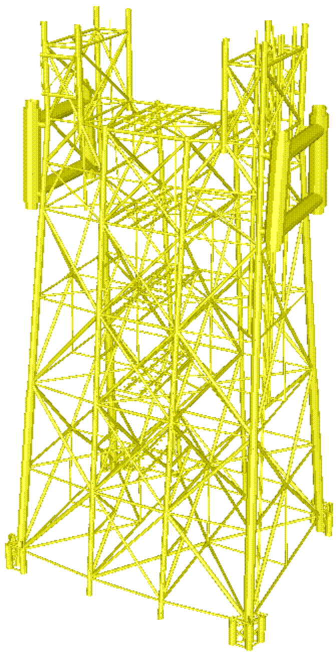


5.3.2.2 Jackets

The Phase 3 jackets will be similar in design to the Phase 1 and 2 jackets. They will be eight-leg, braced, steel structures that will support the topsides structures and will be designed for installation over a pre-installed drilling template. Each jacket will be approximately 190 m tall and will extend from the seabed (175 m deep) up to 14.3 m above the sea surface. The top of the jacket structures will be a "twin tower" configuration so as to allow "float-over" installation of the topsides deck. The design of the base of the jackets incorporates three pile sleeves at each corner to accommodate the twelve piles required to anchor it to the seafloor at the offshore location. The Phase 3 jacket design is illustrated in Figure 5.6.

The Phase 3 jackets shall use pin piles for foundation support. This differs from the Phase 1 and 2 jackets, which used mud mats to obtain the foundation support. The use of pin piles eliminates the need for mud mats, and saves approximately 1000 tonnes of fabricated steelwork per jacket.

Figure 5.6 ACG Phase 3 Jacket Design



5.3.2.3 DUQ Topsides

The DUQ topsides will be a two level facility providing equipment for power generation, drilling, hydrocarbon, separation, utilities and accommodation for platform personnel.

The upper (weather) deck of the DUQ drilling facilities will consist of:

- Centrally located derrick equipment set (DES) that operates over 48 well slots. The DES contains the drilling derrick, drill floor equipment, drilling fluid solids control system and the well control equipment.
- A fixed drilling support module (DSM) containing a mud storage and mixing area, mud pumps and cement system.
- Two identical process trains, including a high-pressure (HP) and a low-pressure (LP) separator each
- A single power generation package
- A produced water treatment package
- A living quarters module capable of supporting 200 persons onboard (POB) during normal operation and up to 300 POB (as may be required during commissioning and shutdowns activities).
- A helideck and two cranes

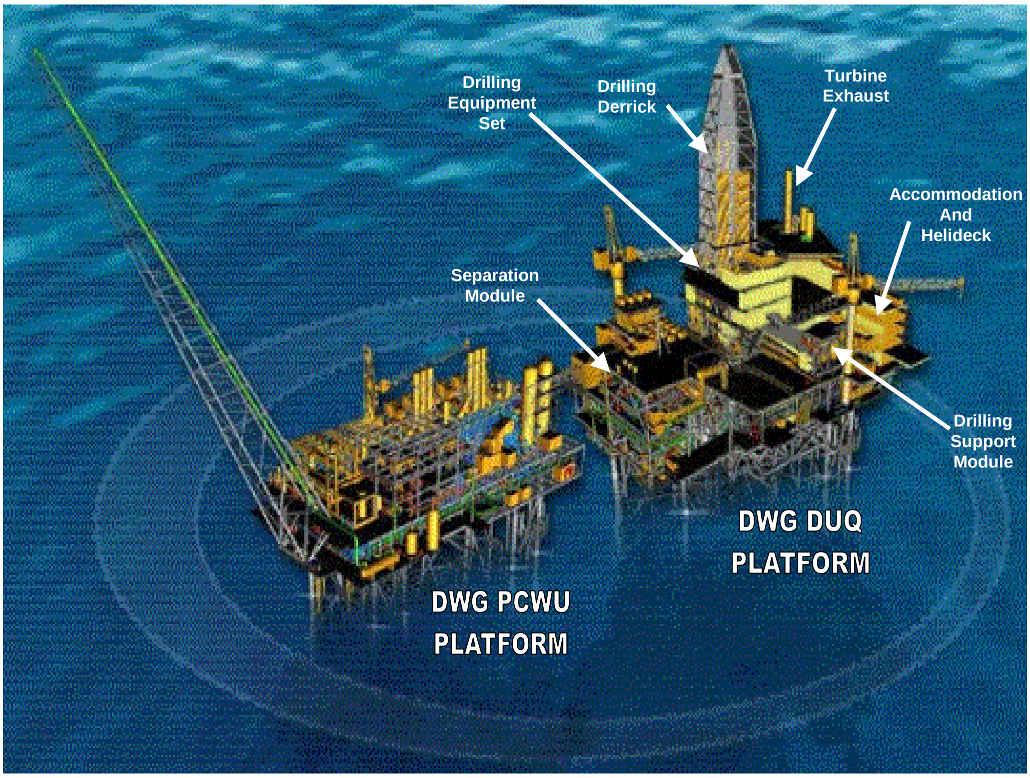
The lower (cellar) deck facilities will contain:

- The production tree and production manifolds, where wells will be completed (including tied-back pre-drill wells) and hydrocarbon will be received and passed to the process trains.
- Sand separation package and general utilities
- Four lifeboat stations located directly beneath the living quarters.

Platform utilities will be located on both the upper deck and cellar deck levels and will include workshops, a Rolls Royce RB211 duel fuel power generation turbine, switchgear room, seawater lift pumps and a seawater system, firewater pumps, sewage treatment and storage facilities. In addition, eight (8) diesel generators will be temporarily located on the DUQ for back-up power supply during the period of drilling operations that will take place prior to the installation of the PCWU platform.[1]

The proposed layout of the DUQ topsides is shown in Figure 5.7.

Figure 5.7 DUQ Topsides Layout



[1] It is planned that the diesel generators will be removed once the PCWU platform has been installed and fuel gas becomes available to power the RB211 generators on the DUQ and PCWU platforms.

5.3.2.4 PCWU Topsides

The PCWU topsides will also be a two level facility that will provide equipment for power generation, seawater lift, treatment and injection, plus gas compression and export.

The upper deck will house:

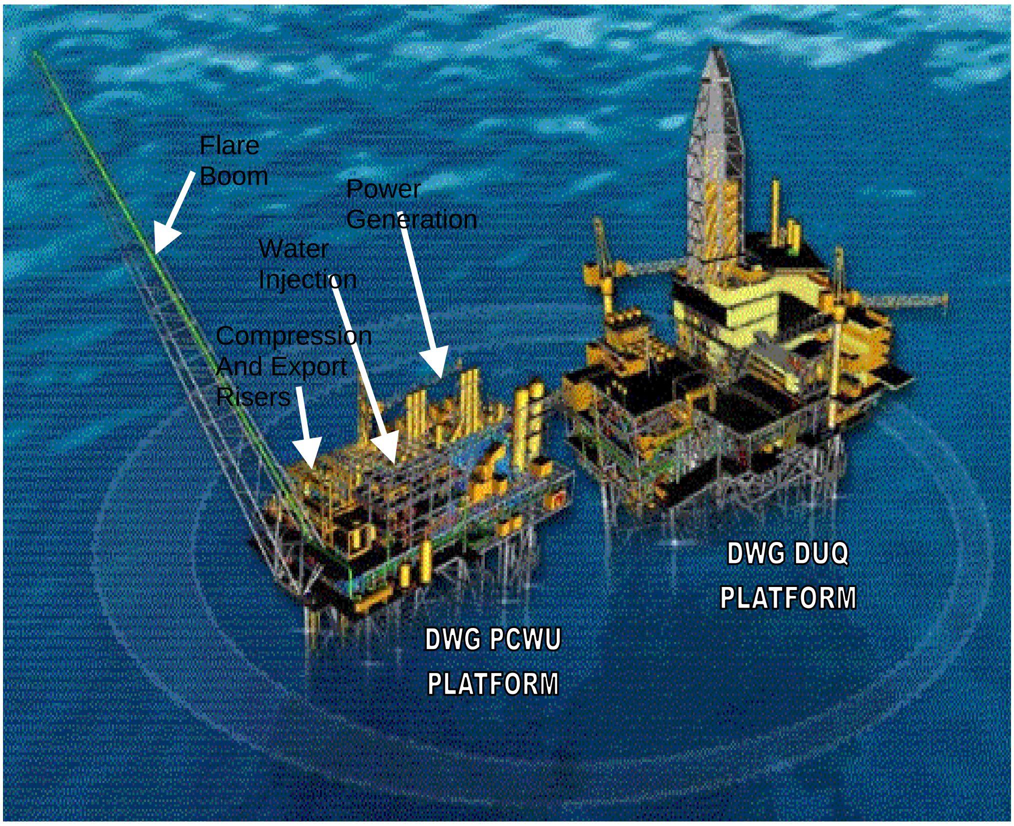
- Four RB211 dual fuel turbine generators;
- Two electrostatic coalescers
- The water injection system, driven by three RB211s; and
- Two export gas compressors and ancillaries.

The cellar deck will house:

- The seawater lift pumps;
- The gas dehydration system and glycol regeneration boilers;
- The fuel gas system;
- The main oil line pumps; and
- The cooling water medium system.

The proposed layout of the PCWU topsides is shown in Figure 5.8.

Figure 5.8 PCWU Topsides Deck Layout



5.3.2.5 Flare Boom

The flare boom enables the transfer of hydrocarbons from the DUQ and PCWU processes to the flare burner tip for combustion under non-routine operating conditions. The flare will be fitted with a pilot light that will be continuously lit. The flare will be a 110 m long structure, fixed at an angle of 60^{O} to the PCWU topsides on the opposite side to the bridge link.

5.3.2.6 Bridge Link

The bridge link between the DUQ and PCWU platforms will be 70 m long, 4.5 m wide and 7 m tall and will provide personnel access and service support between the two platforms. It will be constructed of a steel lattice structure with service supports and cable rack to support pipework, cabling and connections required for the transfer of oil, gas, cooling water / medium, electricity and air between the two topsides.

5.3.3 Offshore Facility Fabrication/Construction and Pre-Commissioning

5.3.3.1 In-country/Out-country Fabrication

The offshore facilities described in the previous sections will either be fabricated within Azerbaijan or, where this is not possible, sourced internationally and transported to the region for assembly. In-country fabrication will, where possible, utilise existing national fabrication yards, as previously used for ACG Phase 1 and 2 (Azeri Project), for the fabrication, construction and onshore pre-commissioning of Phase 3 offshore platform and jacket facilities. The principal in-country yards under consideration are the Shelfprojectsroi (SPS) yard and the Amec-Tekfen-Azfen (ATA) yard located to the south of Baku. At the time of writing, fabrication/construction contracts had not been awarded and therefore, a final selection of yard or yards has not been made.

Topsides components and modules fabricated outside of Azerbaijan will be imported into Azerbaijan by road, rail and sea using the transportation routes established for the previous Azeri Project construction programmes. The main proven routes are the Russian Federation canal system and road and rail networks through Turkey/Georgia and Iran depending on the point of origin of each component.

5.3.3.2 Drilling Template

The drilling template will be constructed of high-grade marine steel, and will be cathodically protected by means of zinc-aluminium sacrificial anodes, and will be coated with an anti-corrosion/anti-fouling paint. Individual components will be manufactured before being welded together. The template will be inspected and all weld joints will be integrity tested using a Non Destructive Test (NDT) methods, such as radiographic and ultrasonic tests, prior to load-out onto the installation vessel.

5.3.3.3 Jackets (and Piles)

The DUQ and PCWU jackets are of similar design to the ACG Phase 1 jackets and will be constructed using largely the same methods established for Phase 1. The timeline for construction of the jackets is a critical task in the schedule of the Phase 3 project. Due to the schedule it will be necessary to initiate construction of the inner lattice of the second jacket before the first jacket is completed.

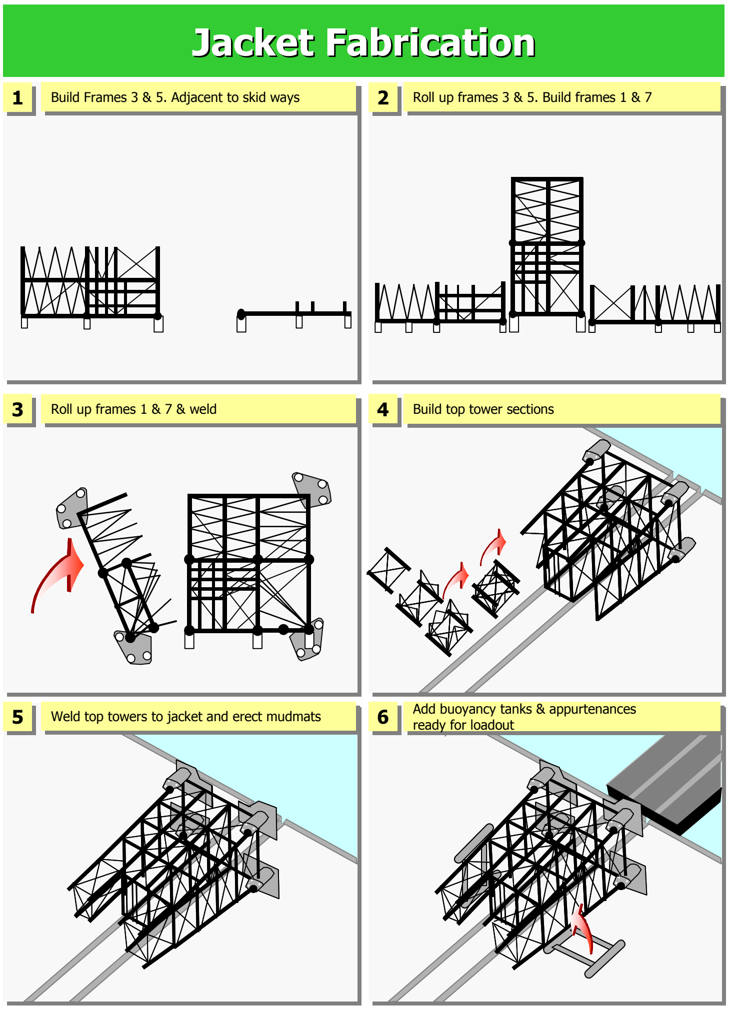
The jackets will be made of tubular rolled steel. The fabrication yards in Azerbaijan have the ability to roll locally provided sheet steel to a limited thickness, and fabrication of the majority of the jacket members will be conducted onsite. Large diameter / heavy wall steel tubulars for the jackets and piles will be supplied from international manufacturing facilities if the particular tubular member exceeds the in-country rolling capability.

Steel plate and tubes received at the fabrication yard will be cut and shaped as required and then welded together to form the various sectional pieces of the jackets. Once welding has been completed, each section will be subject to NDT to check section integrity and weld joints, and will be grit blasted in preparation for painting. Once these tests have been completed, each section will be painted with an anti-corrosion paint. Cathodic protection will also be provided by zinc-aluminium sacrificial anodes. The sections will be then transferred to the skidway where they will be crane lifted into position and welded to other jacket sections to form the complete structure. NDT will be performed on all final weld joints as required.

The seabed piles (each about 140 m in length) will be transported to the yard in pre-fabricated sections for assembly, grit blasting, inspection, testing and painting.

The jacket construction method is illustrated in Figure 5.9.

Figure 5.9 Jacket Construction Method



5.3.3.4 Topsides

The design, general construction and onshore commissioning methods for the Phase 3 topsides will be essentially the same as that employed for the Phase 1 facilities, as illustrated in Figure 5.10. Pre-fabricated components and modules will be imported from international fabrication yards and transported to fabrication yards in sections for assembly. These will include the living quarters module, helideck and the drilling modules[2] on the DUQ deck. All pre-fabricated equipment will be tested at the point of manufacture prior to arrival but will be re-tested and pre-commissioned once integrated with the topsides structure. Where possible, selected components required for the topsides will be fabricated at the local yards where the specification and quality of materials can be assured from a local supplier.

For the topsides deck frames, steel plate will be supplied to the fabrication yards where it will be cut, shaped and subsequently welded to form box girders, plate girders and tubular supports. The sections will then be grit blasted in a workshop and then painted with anti-corrosion paint in a ventilated paint facility. Pre-fabricated utility and process equipment will be installed into the structural frame, secured in place and be outfitted with power and piping connections as required. A single flare boom structure for the offshore complex will be attached to the PCWU integrated deck prior to load out. All deck frame and component weld joints will be tested using NDT methods.

5.3.3.5 Integrity and Hydrotesting

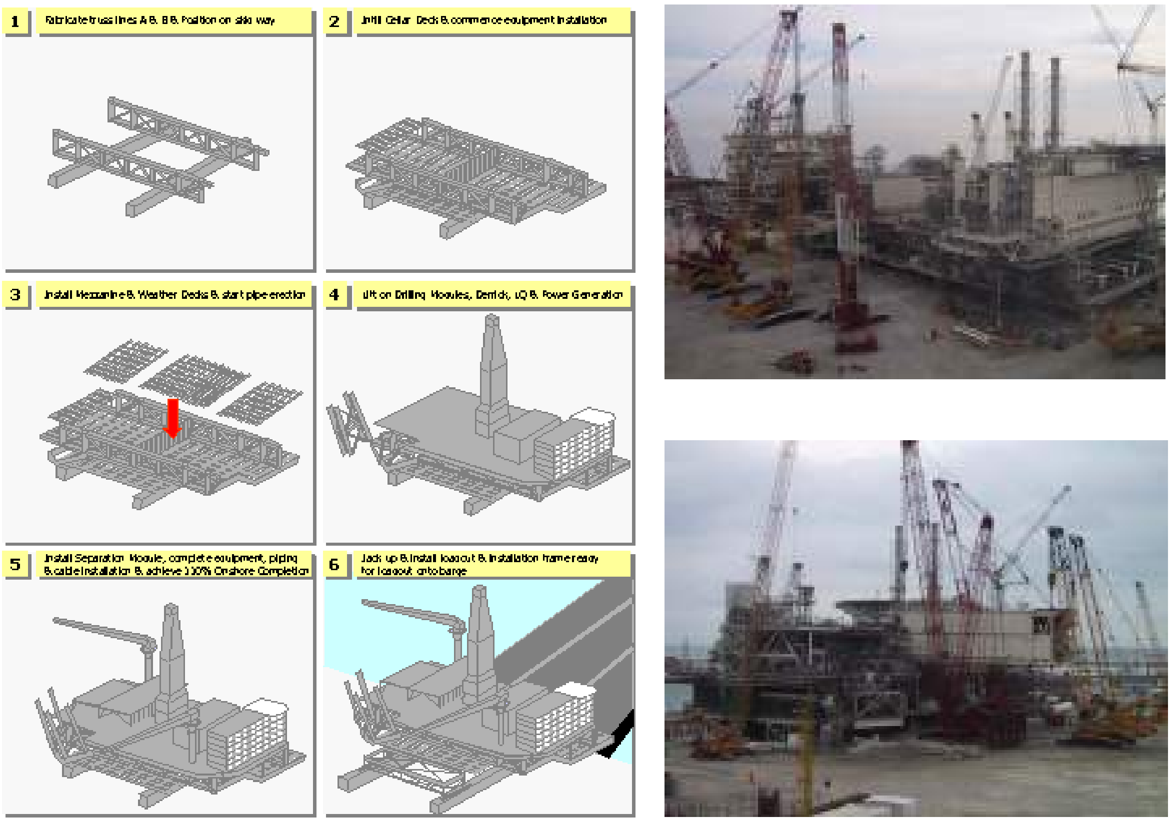
Approximately 95% of the process equipment and utilities on each of the platform topsides will be pre-commissioned onshore, following the installation of the utility and process equipment onto the deck. Pre-commissioning will include pressure testing with water or gas. Hydrotesting will be performed using either potable water wherever possible, or seawater dosed with a sterilising agent. Where seawater is used it will be dosed with sodium hypochlorite at a concentration of 2 mg/l. On completion of the pressure test the waters will be removed and reused where possible. Discharge of the hydrotest waters will be either to the municipal drains (not for seawater), or through a discharge point to the harbour. Prior to discharge any dosed seawater will be dechlorinated using sodium thiosulphate, a chemical with very low toxicity, which poses no environmental risks.

Testing will be carried out as follows:

- *Cooling Water System*: Seawater will be abstracted from the harbour, and discharged back to the harbour at a rate of 500 m^3/hour for up to 10 hours per day for up to 8 weeks. Disinfectant and neutralising chemicals (sodium hypochlorite and sodium thiosulphate as described above) will be dosed for one hour per day during testing.
- *Living Quarters*: Fresh water will be used for the living quarters hydrotest. This test is a static test with a total volume of around 120m^3. It too will be dosed with sodium hypochlorite and dechlorinated using sodium thiosulphate. The discharge will take place over a period of 3 – 4 hours at a rate of approximately 10 litres per second: this will permit a high rate of dilution, and will ensure that salinity in the harbour is not affected at a distance of more than 1m from the point of discharge.

[2] At the time of writing, the option of constructing the drilling module in-country was still being assessed. If a suitable facility including appropriately skilled workers is identified, construction will be undertaken in-country.

Figure 5.10 Topsides Construction (with illustration of Phase 1 Central Azeri (CA) topsides construction at SPS Yard)



5.3.3.6 Bridge Link

The 70 m bridge that will link the PCWU and DUQ facilities will be constructed at one of the main fabrication yards in Azerbaijan and will be loaded out with the PCWU deck. Pipe work and cabling will be fitted into the bridge and these components will be hydro- and electrically tested respectively prior to load-out of the facility. Weld joints will be subject to NDT methods.

5.3.3.7 Flare boom

The flare boom will be constructed of a steel lattice frame structure in a piece-small manner similar to that described for the jacket construction. The flare boom will be installed and tested on the PCWU platform topsides at the onshore construction yard prior to load-out of the facility.

5.3.3.8 Onshore first fill

Offshore facilities such as the topsides require consumables such as fuel and chemicals for operation. Where these are supplied by independent contained storage tanks they will be filled onshore following commissioning of the tanks. This reduces the need for and minimises the risks associated with filling the tanks offshore.

5.3.4 Load-out and Transportation

The completed and pre-commissioned offshore facilities will be loaded onto barges for transportation to the proposed installation site at DWG. Two vessels will be used for the transportation of the offshore facilities, the Derrick Barge Azerbaijan (DBA) for transportation of the drilling template and the STB-1 barge for the jacket structures and topsides. Figure

5.11 shows the completed Phase 1 CA jacket, ready for float-out, after load-out onto the installation barge. Figure 5.12 shows the DBA vessel.

Figure 5.11 Completed CA Jacket on the Installation Barge

Figure 5.12 DBA Vessel

The offshore jackets and topsides will be sea-fastened by welding and bolting the load-out frame to the barge and the barge will be ballasted and trimmed to sea-tow condition in readiness for transfer to the offshore location. Each transportation barge will be assisted by three attendant tugs during sail-away. The jacket piles will be transported to site by "wet float"; that is, towed in the water behind a tug or supply vessel.

5.3.5 Offshore Installation

The following sections present details with regards to the offshore installation of the offshore platform facilities.

5.3.5.1 Drilling Template and Pin Piles

Once at the drilling site, the drilling template will be lifted into position by the DBA and lowered onto the seabed. Once on the seabed, the template will be levelled using a hydraulic system. The template will then be anchored to the seabed by piles that will be driven into place by a hydraulic hammer operated from the DBA.

After installation of the template, two steel lattice frames will be set on the seabed and used to index the installation position of four pin piles per jacket. The frame pair are used at each jacket location to position the pin piles, and after pin pile installation, the frames are recovered for transport back to the onshore fabrication quayside, as they do not form a part of the permanent works.

5.3.5.2 Jackets

Installation of the Phase 3 jackets will follow similar methods as employed for the Azeri project. Once the jackets are at the proposed location, the barge will be anchored in place and the jacket load-out frame sea-fastenings will be removed. The barge will then be ballasted such that the stern end becomes submerged and the jacket can be slid off into the water as illustrated in Figure 5.13.

Figure 5.13 Platform Jacket Installation

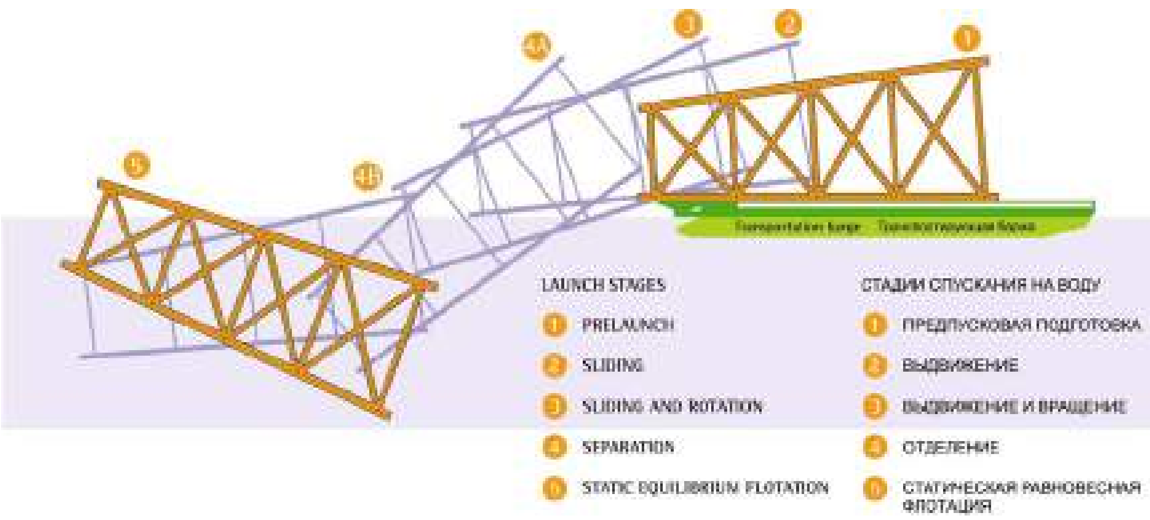


Figure 5.14 Jacket Tow Out

The jacket will be fitted with flotation tanks to provide the buoyancy required to manoeuvre the structure into position following jacket launch off the STB-01. The jacket legs will then be flooded with seawater, dosed with biocide, corrosion inhibitor and oxygen scavenger, so that the structure 'rolls' into a vertical position for lowering onto the seabed. The seawater will remain in the jacket legs for the lifetime of the facility.

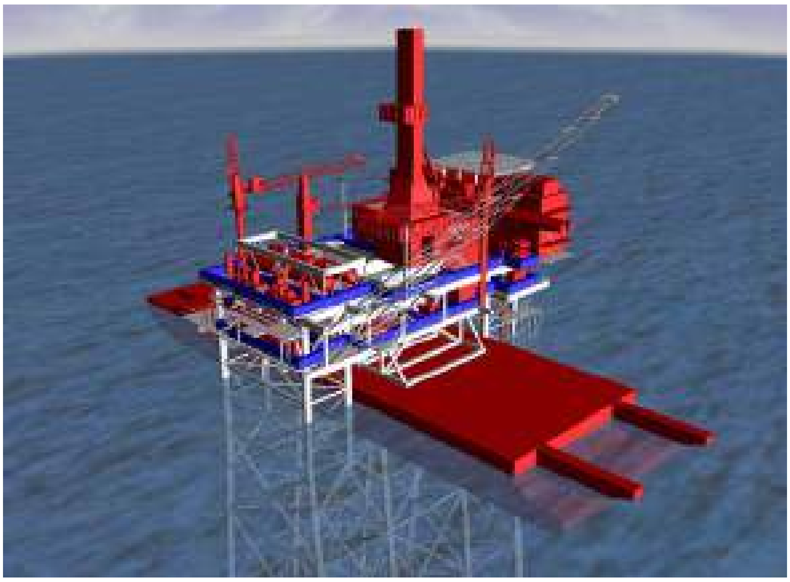
At the seabed the jackets will be docked onto the pin piles with the assistance of the DBA crane and progressive flooding of the buoyancy tanks. The operation will include the presence of support vessels. The pin piles dock into receptacle sleeves located inside the four main corner jacket legs, and once the pin piles are safely inside the sleeves, they become securely connected through a hydraulic pile gripper system. After docking the jacket onto the pin piles, the buoyancy tanks are completely flooded and removed by the DBA. The tanks are then towed back to the onshore fabrication yard for use on the next jacket to be installed. After removal of the buoyancy tanks, the jacket is secured in place by hydraulically hammering the jacket foundation piles through the base plates. Minor leaks of hydraulic fluid may result from this operation if there is a hammer failure, however the probability of this occurring is very low. The foundation piles will, once hammered into position, be grouted to the jacket pile sleeves. Grout will be supplied via flexible hoses from the DBA to the grout manifold panel located on the side of jacket from where it will be pumped down into the annulus between pile and pile sleeve via grout hoses mounted on the side of the jacket. The base of the pile sleeve will be fitted with rubber bladders to stop grout from passing through the sleeve to the seabed.

Any previous cuttings pile from the pre-drill programme will be surveyed by ROV and if it poses a problem to installation of the jacket, it will be jetted with water to disperse the cuttings.

5.3.5.3 Topsides

The topsides are designed for the "float-over" method of installation, as employed for the Phase 1 project topsides. The barge is manoeuvred between the two jacket support towers such that the topsides are positioned above their intended installation position on the jacket as illustrated in Figure 5.15. The transportation barge is then ballasted down until the topsides mating legs reach and mate with the jacket support tower structure. Approximately 32 m^3 of clean sand in total will be released from the eight sand jacks during this process.

Figure 5.15 Topsides "Float-Over" Installation Method



5.3.5.4 Bridge Link

Once the PCWU and DUQ topsides are installed offshore, the bridge will be lifted into position between the two platforms where it will be secured into place. The DBA crane barge will lift and manoeuvre the bridge into the final installed location on the platform bridge landing areas where it will be secured at both ends. Once bridge installation has been completed, the process/utility pipework and the power and process control cables will be hooked up and commissioned.

5.3.6 Offshore Hook-up and Commissioning

5.3.6.1 Tie-back and testing

A number of hook-up and commissioning (HUC) activities will need to be completed offshore prior to start-up. These include, but are not limited to, tie-in to the pre-laid subsea export and water injection pipelines, the subsea umbilicals, and tie-back of pre-drilled wells to the platform facilities (production and water injection). These HUC activities will require a number of personnel to be offshore and an additional three heavy-duty tugs to be on station. Additionally, the DBA will remain on station to provide accommodation support during hook-up and commissioning activities and it is also likely that the dive support vessel (DSV) "Tofik Ismailov" will be used to assist in tie-in operations between the offshore facilities and the interfield pipeline systems and in subsea umbilical pull-in operations (Section 5.6.4.3).

The offshore commissioning activities will require installation of temporary test equipment (e.g. pumping unit, test cabin, several quads of N_2) on the platform. The pipe work will be pressurised to test the integrity of all joints and connections with nitrogen with a 1% helium trace. Once the system test pressure is reached, the flanged joints will be examined and checked for leaks against pre-determined test criteria. The tests will be repeated for all relevant systems until all joints have been successfully tested. Pipe work between the two offshore platforms will be hydrotested to ensure technical integrity of interface systems between DUQ and PCWU. This will occur prior to N_2 gas leak testing to strength test the connections at either end of the bridge link. The hydrotest water will be potable water supplied from onshore and no chemicals will be added. At the completion of testing the water will be discharged to sea.

5.3.6.2 Offshore first fill

Once all facilities have been connected and tested and all equipment and facilities are connected together for the first time, the offshore equipment that could not be filled onshore will be subject to a first fill to provide all tanks, flowlines and equipment. All inventories of fuel, chemicals and other consumables will be supplied from the support vessels using closed connectors and hose links under careful management.

5.3.7 Emissions, Discharges and Wastes

Emissions, discharges and wastes that will be generated during the offshore facility fabrication/construction, pre-commissioning, installation and offshore HUC are quantified in Section 5.10. These will be managed in accordance with the provisions of the AzBU Waste Management Strategy and the ACG Project Waste Management Plans (i.e. Contractor Control Plans and Contractor Implementation Plans and Procedures).

Typical wastes during the onshore construction phase will include paint tins, solvent tins, oily rags, grit from sandblasting, cardboard, wood and packaging materials, scrap metal and wiring, hydro-test water, nitrogen gas (vented) and sewage. Wastes generated during the offshore facilities' installation, hook-up and commissioning activities will primarily relate to installation vessel operations and any final leak testing (hydrotest and/or gas pressure test) that needs to be completed offshore. Wastes will be segregated in skips and brought back to shore for appropriate disposal.

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5.4 Drilling and Completion Programmes

5.4.1 Overview

Drilling and completion of the Phase 3 wells will be carried out predominantly from the 48-well slots on the DUQ platform. In addition to the platform wells, a number of subsea water injector wells will be drilled at two remote subsea development locations and these will be tied-back to the PCWU platform, with their subsea controls tied back to the DUQ platform.

Initial Phase 3 well requirements are identified as:

- 33 platform producer wells;
- 13 platform water injection wells;
- 2 platform cuttings re-injection (CRI) wells; and
- 6 to 8 subsea water injector wells.

Additional reservoir penetrations will be achieved in the future by sidetracking the platform wells described above.

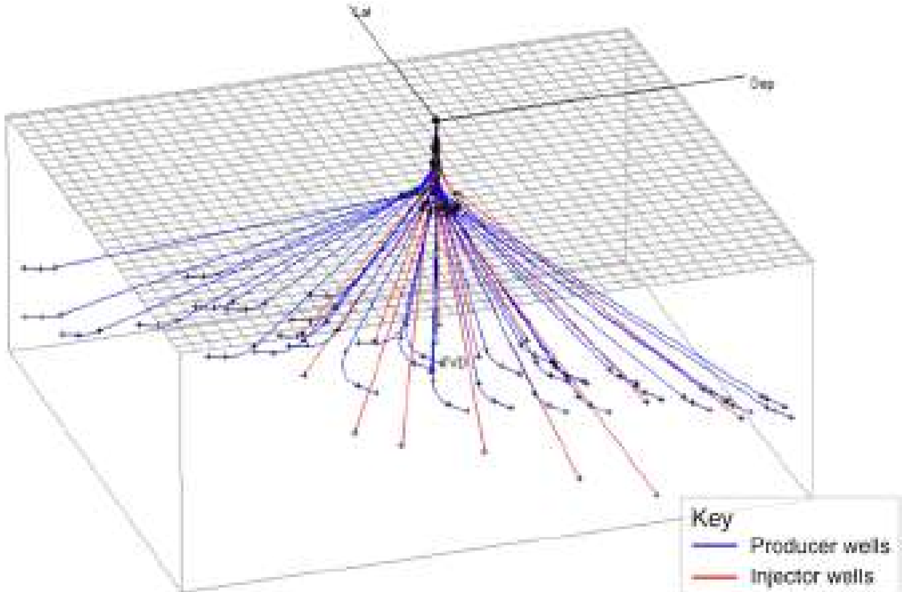
As with the Azeri field, a number of the platform wells will be pre-drilled through a 12-slot subsea template with a mobile offshore drilling unit (MODU) prior to the installation of the platform. This allows for rapid tie-back of the wells to the production facilities after installation of the platforms and thus boosts early production from the reservoir. It is envisaged that up to nine producer wells and one CRI well will be pre-drilled through the template.

The DWG reservoirs are pressure affected due to 20 years of production at the adjacent SWG field, which dictates that water injection, to increase pressure in the reservoir, is required from the outset of Phase 3 production. The subsea water injector wells will be drilled and completed with the MODU and tied-back to the platforms in order for injection to commence coincident with the start of hydrocarbon production.

It is envisaged that the pre-drill template and subsea water injector wells will be drilled by the MODU semi-submersible “Dada Gorgud” which has been utilised on the Azeri Project.

The Phase 3 platform wells plan is illustrated in Figure 5.16.

Figure 5.16 Phase 3 Platform Wells Plan



A description follows of the generic well designs (Section 5.4.2) and drilling mud systems to be used during the Phase 3 drilling programme (Section 5.4.3). Thereafter the description concentrates more specifically on the following operations:

- MODU drilling (Section 5.4.4) that describes the operations and activities of the pre-drilled DUQ template wells and the subsea water injector wells;
- Platform drilling (Section 5.4.5) that describes the operations and activities associated with drilling from the DUQ platform.

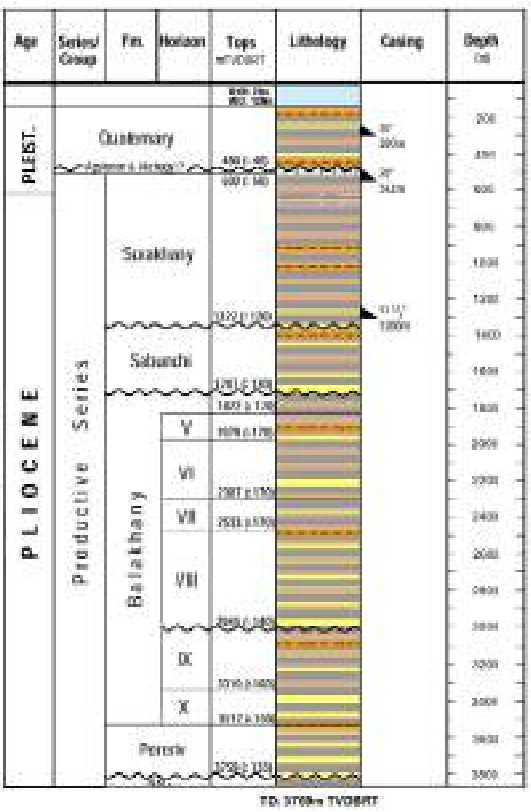
Generic potential drilling hazards are described in Section 5.4.6.

5.4.2 Well Design

The Phase 3 well designs are derived from experience gained from previous exploration and production wells drilled in the ACG field, including DWG, and the identified well control and drilling hazards are identical.

The DWG field subsurface geology is illustrated in Figure 5.17.

Figure 5.17 Phase 3 Lithology Column



The standard design for both MODU and platform wells has four casing strings to the top reservoir as follows:

- 30” conductor;
- 20” surface casing;
- $13^{3}/_{8}$” intermediate casing; and
- $10^{3}/_{4}$ / $9^{5}/_{8}$” production casing.

The reservoir is drilled with $8^{1}/_{2}$” hole and a sand control completion will be installed.

Extended reach (ERD) wells (i.e. those with a step-out from the platform >4.0 km) will have an additional 16" intermediate casing string.

5.4.2.1 MODU Well

The generic well design for MODU drilled wells (i.e. template and subsea) including drilling mud systems and cuttings disposal routes are presented in Table 5.1 below.

Table 5.1 Generic Phase 3 MODU Well Design

Hole Size (Drill Bit Diameter)	Casing Outer Dimension	Description	Setting Depth (m TVD BRT[1])	Drilling Mud System	Cuttings Disposal
36"	30"	Surface	350-375	Sodium Silicate / Potassium Chloride WBM[2]	Seabed
26"	20"	Top Hole	+/-575	Sodium Silicate / Potassium Chloride WBM[2] (with addition of bentonite)	Via caisson @ -11m. Mud recovery system utilised.
16"	$13^3/_8$"	Intermediate	1,275-1,325	SBM/OBM[3]	Ship-to-Shore
12¼"	10¾" / $9^5/_8$"	Production	Top Pereriv (~3,000)	SBM/OBM	Ship-to-Shore
8½"	NA	-	+/-5 m below base of Pereriv E (~3,650)	Salt weighted WBM or OBM	Ship-to-Shore

1 TVD BRT: True Vertical Depth Below Rotary Table.
2 WBM: Water Based Mud.
3 SBM: Synthetic Fluid Based Mud.
4 OBM: Oil Based Mud.

5.4.2.2 Platform Wells

The generic platform well design, including drilling fluids design and cuttings disposal routes, is presented in Table 5.2 below.

Table 5.2 Generic Phase 3 Platform Well Design

Hole Size (Drill Bit Diameter)	Casing Outer Dimension	Description	Setting Depth (m TVDBRT)	Drilling Mud System	Cuttings Disposal
N/A	30"	Conductor	350-375	NA	No discharge as conductor is driven with "closed end".
26"	20"	Top Hole	+/-575	Sodium Silicate / Potassium Chloride WBM (with addition of bentonite)	Via caisson @ -138m
16"	$13^3/_8$"	Intermediate	1,275-1,325	SBM/OBM	CRI
12¼"	10¾" / $9^5/_8$"	Production	Top Pereriv (~3,000)	SBM/OBM	CRI
8½"	NA	NA	+/-5 m below base of Pereriv E (~3,650)	Salt weighted WBM or OBM	CRI

5.4.2.3 Well Completion Design

The reservoir formations are weakly consolidated and as such would produce significant quantities of sand if not controlled. As with the Azeri Project well completions, Phase 3 production wells will use Open Hole Gravel Pack (OHGP) completions for sand control. Open hole means that no casing will be run for the 8½" section through the reservoir and instead a gravel pack screen will be installed for sand control purposes. In addition, expandable sand screens, an alternative sand control completion technology, may be used in some wells.

Water injection wells will employ Down Hole Flow Control (DHFC) valves to control injection rates into the stacked reservoir zones. Sand control completions are also required in water injection wells to prevent well bore sand fill caused by cross flow when the wells are shut-in.

The generic well completion designs for producer and water injector wells are shown in Figures 5.18 and 5.19 below.

Figure 5.18 Phase 3 Producer Well Design

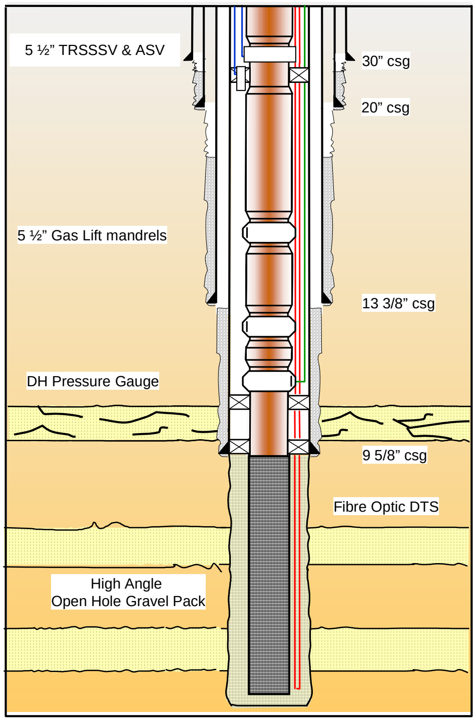
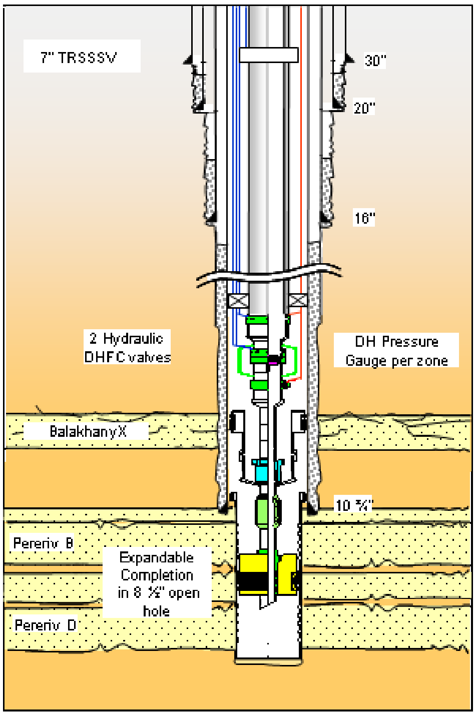


Figure 5.19 Phase 3 Water Injection Well Design



5.4.2.4 Cuttings Re-Injection (CRI) Wells

The cuttings re-injection (CRI) well designs identical to those drilled for the Azeri Project. They are essentially the same as the generic Phase 3 producer well designs as described above. They will be cased and perforated in the 9 5/8" casing, although the target formation for injection will be the shallower Sabunchi shale formation.

5.4.2.5 Completion Chemicals

The well completions will be installed in weighted brines as per the Azeri Project and a range of chemicals will be required for well completion. A list of completion chemicals (as currently planned) to be stored on the rig and to be used for well completion operations is presented in Table 5.3. The estimated usage of these chemicals is based on past experience of ACG completion operations. Chemicals used will primarily be OCNS Category E or D (see Table footnote) and will comply with Phase 3 HSE Design Standards. Completion fluids will be contained on the platform until injected down the cuttings re-injection well (preferred option), discharged to the sea as permitted or transported to shore for recycling or disposal.

Table 5.3 Completion Chemicals

Chemical	Function	Estimated Use (Tonnes)	OCNS Category (1) or OSPAR Group (2)
Sodium / Potassium Chloride	Brine (Completion)	150	E
Calcium Chloride	Brine (Completion)	150	E
Methanol	Gas Hydrate Inhibitor	7	E
TEG/MEG (Mono /Triethylene Glycol)	Gas Hydrate Inhibitor	7	E
Mutual Solvent U66	Well Stimulation Chemical	3	E
HEC (Hydroxyethyl Cellulose)	Fluid Loss Control Chemical	3	E
Calcium Carbonate	Lost Circulation Material	5	E
J559 ClearPAC	Gelling Chemical	3.5	E
HCl Acid	Well Stimulation Chemical	3.5	E
U106 Chelating Agent	Scale Dissolver	14	B
A272 Organic Acid Inhibitor	Corrosion Inhibitor	0.04	Gold
Safecor HT	Corrosion Inhibitor	1.8	D
B-34	Scale Inhibitor	0.001	E
H033 Hydrocloric acid	Scale dissolver	5	E
Glutaraldhyde	Biocide	0.5	C
CCT 3000D	Detergent (6000 litres /well)	3	D
Flo-vis	Xanthan Gum	0.1	E
Sodium Bromide	Brine (completion)	10	E
Lube XLS	Lubricant	5	Gold

[1]Offshore Chemical Notification Scheme. OCNS Category E is the lowest rating. Category E chemicals are of low toxicity, readily biodegradable and non-bioaccumulative.
[2] The present UK 'Revised' Offshore Chemical Notification Scheme has operated in accordance with the requirements of The OSPAR Harmonised Offshore Chemical Notification Format since 1 January 1996.
'Old' OCNS numerical 'Categories' ceased to exist on 1 January 2000. From this date products have been re-tested to fulfil the requirements of the HOCNF. The old numerical 'Categories' cannot be translated into Revised OCNS 'Groups' or hazard quotients, since these are derived from a more comprehensive set of tests.
Group Gold is the least hazardous category under the Revised OCNS.

5.4.3 Drilling Mud Systems

The drilling mud systems to be used for each well section are presented in Tables 5.1 and 5.2 above and are in general the same to those used in Azeri and Chirag. Lessons learned to date from Azeri pre-drilling activities have been considered when defining the Phase 3 drilling mud system design. Drilling muds that will be discharged to sea will be subject to toxicity tests prior to use in accordance with the PSA and commitments made in the Phase 3 HSE Design Standards.

5.4.3.1 MODU Wells

Surface hole and top hole: The MODU surface 36" hole and 26" top hole sections will be drilled with a low toxicity sodium silicate / potassium chloride water based mud. The mud and cuttings from the surface hole will be discharged directly to the sea, as there will no marine riser. In the case of the 26" top hole section the mud and cuttings will be returned to the rig, using a submerged mud recovery pumping system located at the susbea wellhead. The mud and cuttings will then be treated in a solids control unit, separating mud from the cuttings. Recovered mud will be reused wherever possible. The cuttings will be discharged to the sea via a caisson at 11 m below the sea surface. Any spent, excess WBM remaining at the end of the Phase 3 MODU programme will be discharged to sea. It is predicted that 1,500 bbls of WBM will be discharged to sea. However, where feasible this mud will be transferred to an operating platform for reuse. Should the mud be discharged it will first be diluted to verify that chloride levels are within the limit of 21,000 ppm (i.e. less than four times the concentration of the receiving waters). The ingredients of the silicate mud for the surface and top hole sections (as currently planned) are shown in Table 5.4.

Table 5.4 Ingredients of Surface and Top Hole - Water Based Mud

Chemical	Composition	Function	Estimated use (tones)	OCNS category[1]
Barite	Barium sulphate ore	Weighting agent	200	E
Bentonite	Clay Ore	Viscosifier and removal of cuttings	20 (26" section only)	E
KCL	Potassium chloride	Borehole stabiliser	150	E
Sodium Silicate	Sodium Silicate	Stabiliser / Encapsulater	230	E
Polypac	Poly anionic Cellulose	Encapsulater	3.6	E
Flo-Trol	Cellulose polymer/ Modified starch	Fluid loss control and reduces the risk of drill string sticking	3.6	E
Duovis	Bio-polymer	Viscosifier	3.6	E

[1]Offshore Chemical Notification Scheme. OCNS Category E is the lowest rating. Category E chemicals are of low toxicity, readily biodegradable and non-bioaccumulative.

Lower Hole: In order to improve well bore stability and optimise drilling operations for down-hole conditions it is necessary to change to a non-water based mud (NWBM) for the lower 16" and $12^1/_4$" well sections. This NWBM system will either be a low-toxic oil based mud (OBM) or a synthetic based mud (SBM) such as Linear Alpha Olefin (LAO).

For the $8^1/_2$" reservoir hole section either a NWBM or a salt weighted (viscosified brine) WBM system will be used.

No drilled cuttings or associated muds generated from these lower hole sections will be discharged to sea. They will be returned to the rig, treated in the solids control unit and containerised for transfer to shore for further treatment prior to final disposal.

5.4.3.2 Platform Wells

Surface Hole: The platform well 30" conductor will be driven "closed end" and hence there will be no requirement for drilling.

Top Hole: The 26" top-hole section will be drilled with a sodium silicate/potassium chloride WBM, as per MODU drilling. The 26" top-hole section cuttings will be discharged to the sea via the platform caisson at 138 m below the sea surface. As with the MODU drilling programme, WBM will be reused wherever possible. Any excess, spent WBM generated will be disposed via a dedicated cuttings re-injection well. If it is required to discharge the mud to sea, it will be diluted to achieve a chloride concentration of less than 21,000 ppm.

Lower Hole: The 16", $12^1/_4$" and $8^1/_2$" lower hole sections will be drilled with the same mud systems as outlined for the MODU wells (Table 5.2). Again no drilled cuttings or associated muds generated from these lower hole sections will be discharged to sea. They will be returned to the platform topsides, treated via the cuttings re-injection system and re-injected into the subsurface via one of the two dedicated cuttings re-injection wells. When the cuttings re-injection equipment is not available, these cuttings will be contained and shipped to shore for treatment and disposal.

5.4.4 MODU (Dada Gorgud) Drilling

It is anticipated that the pre-drill template wells and between six to eight subsea water injection wells will be drilled from a MODU, nominally the "Dada Gorgud" semi-submersible rig. This rig has been used for all of AIOC's pre-drilling activities in the ACG Contract Area and has been fully upgraded to international standards in order to meet Project drilling and HSE requirements.

Following completion of drilling work for the Azeri Project in the East and West Azeri Fields the Dada Gorgud will be moved, assisted by three vessels, to the DUQ platform location. Once on-site, it will be anchored over a previously installed drilling template using eight 10 te anchors and will drill up to nine producer wells and one CRI well.

Following the pre-drill template drilling programme the rig will be moved approximately 4 km to the northwest of the DUQ platform location where it will drill three or possibly four subsea water injection wells. It will then be moved to approximately 5 km to the southwest of the DUQ platform location where a further three or four water injection wells will be drilled. The maximum step-out for all the wells to be drilled from the "Dada Gorgud" will be 2.5 km. To account for the potential for a greater volume of cuttings to be released to seabed from drilling of the water injection well, it has been assumed in the impact assessment that four wells at each subsea site will be drilled.

5.4.4.1 Drilling Operations

The following sections briefly describe the pre-drilling programme at the DUQ platform and subsea development sites. The programme is essentially the same as that undertaken for the Azeri Project and includes the following major activities:

- Drilling operations (pilot holes; drilling, casing and cementing);
- Well Clean Up / Drill Stem Testing (DSTs); and
- Well suspension.

Utilities associated with the "Dada Gorgud" semi submersible rig are also discussed.

Pilot Holes

Before commencing pre-drilling a pilot hole will be drilled at a distance of approximately 50 m from the template and both subsea manifold sites to determine whether any high-pressure shallow gas zones are present in the area. The holes will be drilled with a $12^{1}/_{4}$" diameter drill bit to a depth of approximately 1,000 m. The pilot hole will be drilled using seawater with gel sweeps and the drilling mud system and cuttings will be discharged to the seabed at the seabed. Approximately 80 m^3 of cuttings will be generated and discharged.

There will be no well control devices used for the pilot holes rather ingress of any high pressure gas (from isolated pockets) in to the well will be controlled through circulation of heavy mud in the hole as required.

Drilling

Each of the wells drilled from the MODU will be drilled and completed in turn. With reference to Table 5.1 and Section 5.4.3.1, the total predicted volume of cuttings generated for disposal from all MODU well sections are detailed in Table 5.5.

Where lower hole section cuttings are returned to the rig, both they and the circulating mud are passed through the MODU Solids Circulation System (SCS) to separate muds from cuttings (i.e. via series of shale shakers, a vacuum degasser and dual centrifuges). This allows the separated muds to be re-circulated down-hole and the drilled cuttings contained in dedicated cuttings skips on the rig deck for subsequent transfer to shore for treatment and final disposal.

Table 5.5 Predicted MODU Well Cuttings Volumes

Hole Size (Drill Bit Diameter)	Description	Quantity of Cuttings (m^3) Per Well	Total Quantity Cuttings (m^3)	Drilling Mud System	Cuttings Disposal
Total 9 Producer + 1 CRI Well + 8 Injector Wells (worst case)					
36”	Surface	540	9,720	Sodium Silicate / Potassium Chloride WBM	At Seabed
26”	Top Hole	277	4,986	Sodium Silicate / Potassium Chloride WBM (with addition of bentonite)	To sea via caisson @ -11m. Mud recovery system utilised to recover muds from cuttings
16” & 12¼” & 8½”	Lower Holes	250	4,500	SBM/OBM (or salt weighted WBM or OBM for 8½”)	Ship-to-Shore

Casing and Cementing

Once each section is drilled, a casing string will be installed and cemented into place. The steel casing protects the well from weak or unstable formations and essentially provides the well’s structural strength. Each steel casing is cemented into place by pumping cement slurry into the well bore such that it passes around the open lower end of the casing and into the annulus between the casing outer wall and the host rock formation in the case of the top-hole conductor or in the case of subsequent casings, between its casing outer wall and inner wall of the previous casing. For each of the 30” and 20” casings strings, some loss of cement to the seafloor usually occurs, estimated to be approximately 100 bbls (per casing string). This amounts to a total of 3600 barrels of cement for the predrill programme for 18 wells.

The cement will contain a number of chemical constituents, as per the Azeri Project, and these and their respective volumes (as currently planned) are presented in Table 5.6.

Table 5.6 Well Cement Chemicals

Additive	OCNS Category [(1)] or OSPAR Group [(2)]
LiteCRETE	E
D175 Antifoam	Gold
D185 Dispersant	Gold
D175 Antifoamer	Gold
D500 Gasblok LT	Gold
Class G	E
S001 Accelerator	E
D075 Extender	E
D182 Mudpush II	Gold
F103 Ezeflo	Gold
Barite	Gold

[1]Offshore Chemical Notification Scheme. OCNS Category E is the lowest rating. Category E chemicals are of low toxicity, readily biodegradable and non-bioaccumulative.

[2] The present UK 'Revised' Offshore Chemical Notification Scheme has operated in accordance with the requirements of The OSPAR Harmonised Offshore Chemical Notification Format since 1 January 1996.
'Old' OCNS numerical 'Categories' ceased to exist on 1 January 2000. From this date products have been re-tested to fulfil the requirements of the HOCNF. The old numerical 'Categories' cannot be translated into Revised OCNS 'Groups' or hazard quotients, since these are derived from a more comprehensive set of tests.
Group Gold is the least hazardous category under the Revised OCNS.

5.4.4.2 Well Clean Up / Testing

The MODU drilling programme will include the flowback of some wells. This includes the 'clean up' of the well sandface and associated testing or "drill stem testing". During these tests, formation fluids will be flowed to surface and pressure, temperature and flow rate measurements will be made to evaluate well performance characteristics. Flowed hydrocarbons will need to be flared although samples of the formation fluids may also be collected for analysis.

The base-case plan includes well testing of two wells, with up to 15,000 bbls of oil flared,. Each Phase 3 well test will not exceed 32 hours duration. If this is increased to 3 wells the same volume will be flared by decreasing the flow back time. In line with the HSE design standards for the project, the need to carry out well tests or clean ups and their duration will be challenged prior to finalisation of testing requirements.

A high efficiency "Green Dragon" burner will be used to flare the oil during well testing to reduce the release of unburnt hydrocarbons. During flaring, specialist operators will monitor the mixture of hydrocarbons and air, to check that high burning efficiencies of at least 99% are achieved and to minimise any oil "drop-out" to the sea surface.

5.4.4.3 Template Well Suspension

Each template well will be temporarily suspended by filling the well with a heavy brine fluid to protect the well from any pressurised formations. The well will then be closed with a mechanical plug and a corrosion cap installed on the sub-sea wellhead following retrieval of the riser system. The well suspension programme will be designed to allow future well re-entry following installation of the DUQ platform.

5.4.4.4 Utilities

As previously mentioned, the MODU "Dada Gorgud" was upgraded for the Azeri Project. The rig description and utilities have previously described in the Azeri Project ESIA reports and are briefly summarised in Table 5.7 below.

Table 5.7 Dada Gorgud Utilities

Utility	Description	Standards
Supply Loading & Offloading	• Transfer of materials from the supply vessels to the rig either by pressurised hose or by lifting containers onto the rig by crane. • Approximately seven return supply vessel trips per week. • Approximately five return helicopter trips per week for personnel transfer	NA
Power Generation	• The main power provided by four diesel generators rated at 1, 500 kW each. • Twin diesel cement unit rated at 2 x 224 kW used intermittently. • One emergency diesel generator rated at 635 kW • Average diesel consumption 9 tonnes/day during drilling operation	NA
Cooling water	• Treated seawater used to cool drilling equipment and then discharge to sea via subsurface caisson. Biocide DA injected into the sea water service line to give maximum 0.27 mg/l at discharge. • Seawater lift pumps at a rate of 600 m^3/hr.	World Bank: +/-3^{O}C ambient temperature within 100 m of discharge point
Sewage	• Sanitary wastes generated on the Dada Gorgud are treated to by a United States Coastguard (USCG) Marine Sanitation Device (MSD)[1] or equivalent as per PSA. • Extended aeration sewage treatment process. The clear supernatant is chlorinated, floating debris is removed and the treated effluent discharged via a subsurface caisson. Levels monitored to ensure performance. • System does not require removal of sewage sludge for ship-to-shore and disposal.	Effluent treated to: - Biological Oxygen Demand (BOD) of 40 mg/l; - Suspended solids 40 mg/l; - Coliform of <200 MPN per 100 ml; and - Total residual chlorine average of 1 mg/l.
Drainage	• Three dedicated drainage routes: – Discharge to sea (clean water only); – Hazardous area drainage tank (HADT) - from drill centre and rotary table, shale shaker house, cuttings and mud pump rooms, moon-pool and pipe rack areas. Collected material is containerised and shipped to shore for disposal; and – Bilge water tank - from pontoons, compressor, hydraulic power and generator rooms, bunded areas and drip pans caisson. All tank sludges transported to shore for disposal.	Bilge Tank: - oil in water no visible sheen.

NA: Not Applicable
US CG 33 CFR 159.121: Effluent must have a faecal coliform bacteria count of less than 1000/100 millilitres and no visible floating solids. The US Coast Guard requirements do not specify a standard for chlorine. The ACG PSA stipulates that total residual chlorine will be between 0.5 mg/l to 2.0 mg/l, and the IFC guidelines require an average of 1 mg/l.

5.4.5 Platform Drilling

Following its installation, all further drilling operations at the DUQ platform location will be carried out by the platform rig. As described in Section 5.3, the platform will have all of the necessary facilities to drill and complete the Phase 3 wells programme, and the platform drilling module design and operation will be similar to that incorporated for Azeri project platforms. Drilling utilities will be shared with those used for the offshore production and water injection operations (see Section 5.5) with the exception of the first four to six months of DUQ platform operation (i.e. prior to installation of the PCWU platform) when temporary diesel generators will be in place to allow the DUQ to operate in a safe standalone mode. These temporary generators are 1MW standalone diesel generators and will only be required

[1] US CG 33 CFR 159.121: Effluent must have a faecal coliform bacteria count of less than 1000/100 millilitres and no visible floating solids. The US Coast Guard requirements do not specify a standard for chlorine. The ACG FFD PSA stipulates however, that total residual chlorine will be between 0.5 mg/l to 2.0 mg/l.

if the DUQ RB211 turbine is non-functioning. The temporary generators will be removed from the platform when the PCWU is installed and operating.

Platform drilling operations will commence in 2007 and continue through to 2016 with intermittent sidetrack drilling operations continuing through to the end of the AIOC PSA in 2024.

5.4.5.1 Drilling Operations

Ten of the 48 platform well slots available will be used to tie-back the pre-drill wells to the platform, leaving 38 remaining well slots for the platform drilling programme. With reference to Table 5.2 and Section 5.4.3.2, the total predicted volume of cuttings generated for disposal from all 38 well sections are detailed in Table 5.8. Additionally, up to 98 reservoir penetrations will be achieved by using sidetrack-drilling technology. At the time of writing it was not possible to quantify volumes of cuttings generated from side-track wells but as with the lower hole sections, these will be either re-injected or contained and shipped-to-shore when the CRI system is unavailable.

Table 5.8 Predicted Platform Well Cuttings Volumes

Hole Size (Drill Bit Diameter)	Description	Quantity of Cuttings (m^3) Per Well	Total Quantity Cuttings (m^3)	Drilling Mud System	Cuttings Disposal
Total 38 Wells					
	Conductor	N/A	N/A	N/A	No discharge as conductor is driven
26”	Top Hole	277	10,526	Sodium Silicate / Potassium Chloride WBM	To sea via caisson @ -138m.
16” & 12¼” & 8½”	Lower Holes	250	9,500	SBM/OBM (or salt weighted WBM or OBM for 8½”)	Cuttings Re-Injection

5.4.5.2 Cuttings Re-injection

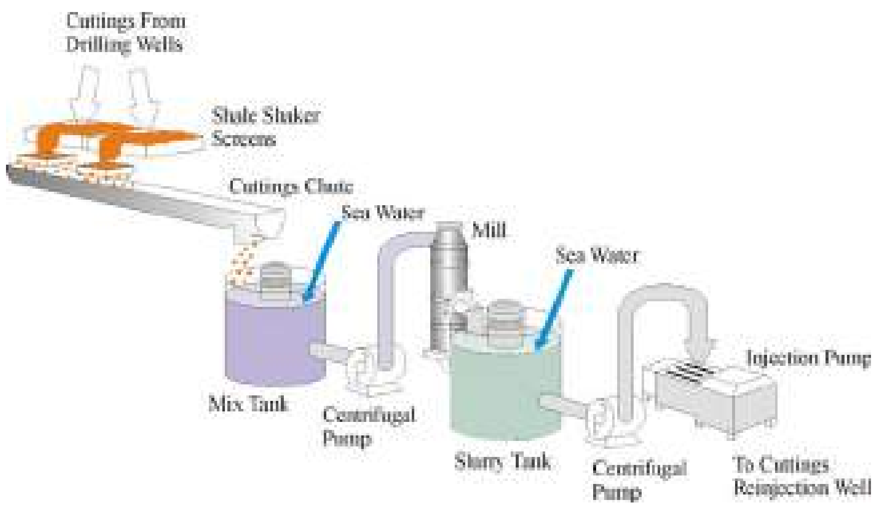
Cuttings re-injection is a proven and reliable method for disposing of cuttings that BP have successfully undertaken in a number of applications worldwide. The planned target for the injection of the drill cuttings in the DWG field is the Sabunchi shale formation. Of the two platform well slots dedicated to CRI wells, the first CRI well will be drilled from the Dada Gorgud (Section 5.4.4) so that it can be completed and tied back to the DUQ platform soon after its installation.

As with the Azeri platforms, facilities will be provided onboard the DUQ platform to collect, treat, store and re-inject cuttings generated from well sections where NWBM have been used. In addition, used drilling mud, spent drilling chemicals , spent completion fluids, and produced sand may also be sent to the CRI well for disposal. Figure 5.20 illustrates the cuttings re-injection process, which is more fully described in the Phase 1 and 2 ESIAs.

Following slurrification and milling, the resulting waste slurry is pumped down-hole and into sub-surface fractures that are initially created by injecting water at high pressure down the CRI well. Once created, fracture size and geometry will be controlled by the cuttings down-hole flow rate, injection pressure and the properties of the injected slurry. Waste slurry can be injected either continuously or intermittently in batches to create a network of induced fractures from the wellbore. It is anticipated that a viscosifier, oxygen scavenger and/or biocide will also be added to the slurry to improve its handling characteristics and to minimise corrosion in the cuttings re-injection facility

Cuttings batch sizes may range from 75 bbls to 4,000 bbls and are dictated primarily by the volume of the slurry holding tank and the cuttings generation and slurry injection rates. Each batch injection may last from a few hours to several days, depending upon the batch volume and the injection rate. Injection rates can range from 2 bbls to 10 bbls per minute.

Figure 5.20 Cuttings Re-injection Process



5.4.6 Potential Drilling Hazards

There are a number of potential drilling difficulties that may be encountered during drilling operations. A list of these potential hazards and the planned control and mitigation measures is presented in Table 5.9. This control and mitigation measures are as per those employed for the Azeri Project.

Table 5.9 Potential Phase 3 Well Hazards

Hole Section	Geological Formation	Potential Formation Pressure / Fluid	Potential Hazard	Mitigation
Surface hole	Apsheron	Abnormal pressure in paleo-volcanic sequences.	Shallow gas.	Pilot hole drilled. Drill with all returns to seabed.
26”	Apsheron Akchagyl	Abnormal pressure in paleo volcanic sequences.	Shallow gas.	Pilot hole drilled. Drill with all returns to seabed. Diverter installed (platform only). Mud weight.
16”	Surakhany	Abnormal pressure in salt-water flow sections.	Shallow gas.	Shallow gas precautions as per BP procedures: - BOP installed; and - Kill mud on standby.
12¼”	Sabunchi Balakany	Random high-pressure gas sands.	No real well control hazards apart from potential influx of stray sand.	Mud weight. BOP installed.
8½”	Pereriv	Pressure regression into Pereriv pay zone then large pressure increase at base into NKG.	Oil pay zone Large pressure transition into NKG.	Mud weight. Brine. BOP installed.

BOP (Blow Out Preventor): A BOP can be rapidly closed following an influx of formation fluids into the well bore. In an emergency situation, gas will be vented at the surface and any oil will be contained in the rig’s mud system.

A number of contingency chemicals will be retained for use in the event that difficulties are encountered in a well. At the time of writing, the predicted list of contingency chemicals to be stored on the rig and platform to be used for such contingencies is included in Table 5.10. The estimated usage of these chemicals is based on past experience of Chirag and Azeri

Project drilling operations. Chemical types and usage rates may be subject to change as further lessons are learned from these ongoing drilling operations. All chemicals used will comply with Phase 3 HSE Design Standards: their use will be continually challenged and lower toxicity chemicals used preferentially, wherever practical, over those more toxic.

Table 5.10 Drilling Contingency Chemicals

Chemical	Function	Estimated Use Per Well (tonnes)	OCNS Category [1]
Drilling Detergent	Detergent- dispersant	0.2	E
Glutaraldehyde	Biocide-Prevent Bacteria Growth	0.3	C
Sodium Bicarbonate	Calcium/pH control	1.2	E
Citric Acid	PH Control	1.5	E
M-I-X II, F.M	Fibre – LCM[2]	2.0	E
Starcarb C351	Calcium Carbonate –LCM	5.0	E
G-Seal	Seepage losses - LCM	3.0	E
Nut Plug	Ground Nutshells – LCM	5.0	E
Mica	Flake Mica – LCM	5.0	E
Defoam A	Alcohol Defoamer	0.4	D
Spersene CF	Chrome Free Lignosulfonate – Thinner	0	E
Tannathin	Chrome Free Lignite - Thinner	0	E
Tackle Plus	Polymer thinner	0	E
Ecotrol	HTHP Fluid Loss Control	5.0	E
SafeSolv	Well Cleanup Solvent	2.6	C
SafeSurf	Well Cleanup Surfactant	2.6	E
Safecor HT	Corrosion Inhibitor	2.4	D
Lubra Glide	Polymer beads – Torque Reduction	0	E

[1]Offshore Chemical Notification Scheme. OCNS Category E is the lowest rating. Category E chemicals are of low toxicity, readily biodegradable and non-bio accumulative.
[2] LCM: Lost circulation mud

5.4.7 Drilling Emissions, Discharges and Wastes

Emissions, discharges and wastes that will be generated during the offshore drilling programmes are quantified in Section 5.10. These will be managed in accordance with the provisions of the AzBU Waste Management Strategy and the Azeri Project Waste Management Plans.

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5.5 Offshore Platform Production

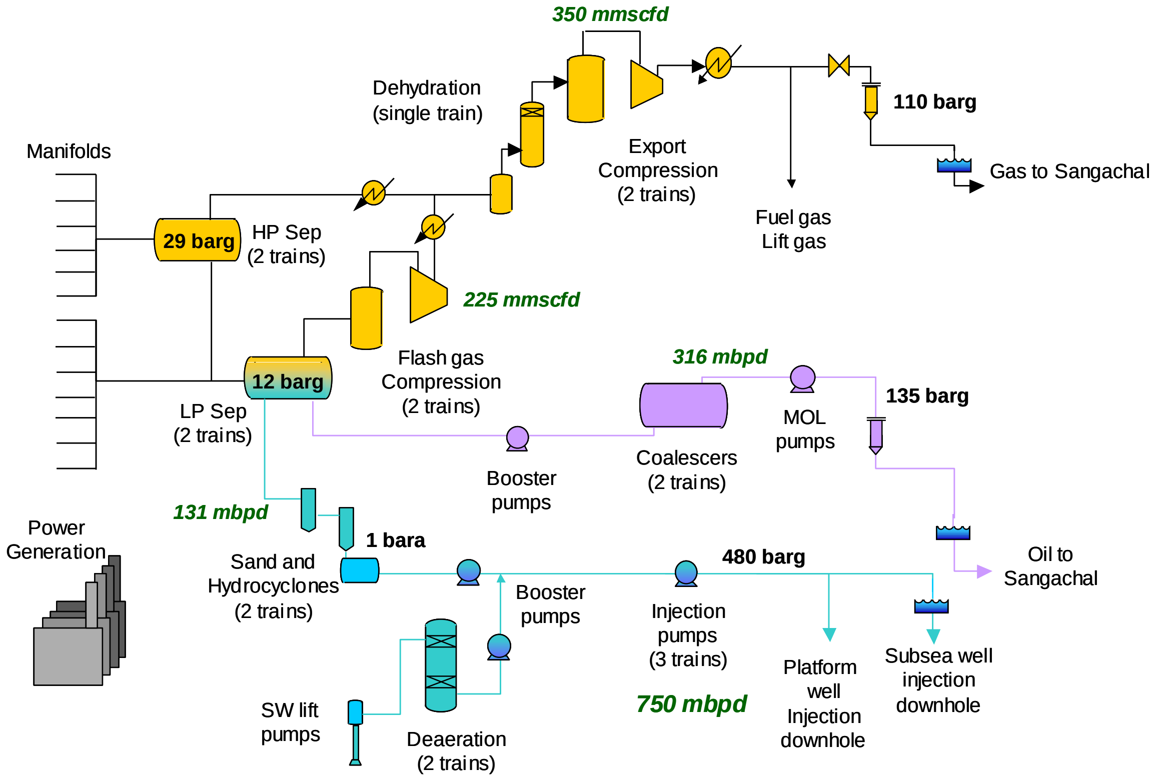
5.5.1 Overview

Offshore production consists of a number of operations that allow the safe and efficient production of hydrocarbons from the flowing wells. The key operations that will be conducted at the offshore platform include:

- Produced hydrocarbon separation;
- Gas processing;
- Oil and gas export;
- Well testing;
- Produced water treatment and injection;
- Seawater lift for cooling duty and injection; and
- Utilities to support these processes.

A simplified process flow diagram illustrating the principal offshore processes is presented in Figure 5.21.

Figure 5.21 Offshore Production Process



The principal production processes and support utilities are described in more detail in the following sections.

5.5.2 Hydrocarbon Processing and Export

5.5.2.1 Separation

Hydrocarbon flow from the producing wells will be received at either the High pressure (HP) or Low Pressure (LP) production manifolds on the DUQ platform and transferred to the two platform separation trains for separation into oil, gas and water phases. Each separation train will include a two-phase (gas from liquids) HP separator in series with a three-phase LP separator and coalescer. Table 5.11 presents the design operating specifications for the separators. Wells on test will run via an additional test manifold and separator.

Table 5.11 Separator Design Operating Specifications

	Pressure (barg)	Temperature (^{O}C)
HP Separator	29 barg	40 to 55
LP Separator	12 barg	40 to 58

The separation trains will be designed to process up to:

- 316 Mbpd of oil;
- 350 MMscfd of high-pressure gas;
- 225 MMscfd low-pressure gas; and
- 131 Mbpd of produced water.

The majority of the gas present in the produced fluids will "flash off" in the HP Separator. This gas will be routed to the gas compression and dehydration system for further processing. The liquid hydrocarbon phase from the HP separator will be routed to the LP separator for further separation into oil and water phases. Produced oil from the LP separator will flow into the oil booster pumps, across the bridge and into the coalescer located on the PCWU platform. Thereafter it will pass to the main oil line (MOL) pumps. From here, it will be exported to the onshore terminal via the two Azeri Project 30" export oil pipelines. Produced water will be routed to the produced water treatment system and then to the water injection system.

5.5.2.2 Gas Processing

Gas removed from the HP separator will be passed to the PCWU platform for treatment prior to export onshore via the Azeri 28" gas line. Treatment will involve gas cooling and dehydration to remove water. Gas removed from the fluids in the LP separator will be cooled and compressed via flash gas compression before being co-mingled with the HP gas upstream of the dehydration column (tri-ethelyne glycol (TEG) contactor). Final dehydration will involve use of glycol to remove any residual moisture to prevent hydrate formation and corrosion within the gas export pipeline. Used glycol will be recovered, treated in a glycol regeneration package and recycled. Water vapour generated in the package will be condensed and routed to the closed drains drum. Following final dehydration, the combined gas streams will be compressed to export pressure by 2 x 175 MMscfd electric driven compressors.

Unlike the Azeri facilities, associated gas from Phase 3 will not be re-injected into the reservoir for disposal or pressure support purposes. A portion of the treated associated gas will however, be taken off and used as fuel gas on the platforms and for gas lift in producing wells.

Fuel Gas

Major DUQ and PCWU platform fuel gas users and design usage rates are presented in Table 5.12 below.

Table 5.12 Major DUQ and PCWU Platform Fuel Gas Users and Design Usage Rates

Platform	User	Design Rate (Sm^3/hr)[1&2]
DUQ:	Purge gas to HP and LP flare headers:	150
	Power generators (1 unit):	7,400 (15°C) 6,812 (35°C)
PCWU:	Purge gas in the HP and LP headers:	150
	Flare pilot light:	16
	Glycol regenerator:	36
	Water injection pump gas turbines (3 units):	21,600 (15°C) 19,050 (35°C)
	Power generators (4 units):	22,200

1 Standard cubic meters per hour.
2 Gas turbine design rates for power generation and water injection provided for both iso conditions (28MW power @ 15°C) and maximum ambient design (23MW power @ 35°C).

Fuel gas will be diverted from the HP gas process train downstream of the main export compressor. It will be passed on to the fuel gas system on the PCWU platform where liquid condensate will be removed in the fuel gas knock out (KO) drum and returned to the LP separator train for processing. Gas will then be heated and filtered prior to use.

Under normal operations, the base fuel gas load will be approximately 50,000 Sm^3/hr (46 MMscfd) based on four gas turbine power generators and three turbine driven water injection pumps operating at full capacity plus nominal usage by other fuel gas users. Maximum design capacity will allow for temporary operation of eight gas turbines plus auxiliary fuel gas users and the fuel gas KO drum will be able to provide sufficient gas inventory for automatic changeover of the gas turbine generators to diesel fuel in the event of loss of fuel gas.

Facilities will be provided to enable the import of gas onto the platform fuel gas system directly from the gas export line if required.

Gas Lift

Gas lift increases production flow-rate in low-pressure production wells and all production wells will be fitted with gas lift completion equipment. Gas lift will be required after the third year of production although it may be required for some wells from start up.

Gas for gas lift service, will be diverted from the HP stream downstream of the main export compressors. Maximum well injection rates will not exceed 6 MMscfd per well and average injection rates are expected to be 4 MMscfd per well.

5.5.2.3 Production Chemicals

A range of chemicals will be required to aid the production process, inhibit corrosion of equipment, prevent the build up of scale, and to assist hydrocarbon export. AIOC has a policy to limit chemical use and where use is essential, only selected chemicals of known low toxicity (i.e. OCNS Category E or D or those approved under the Project's Design Standards) will, as far as practicable, be used. Chemicals to be used will largely be the same as those adopted for the Azeri Project wherever possible. The chemical systems will be continually evaluated and modified as necessary depending on specific operating conditions.

No production chemicals used will be discharged from the platforms to the marine environment under normal operating conditions. Any water-soluble chemicals used in the produced water system will normally be re-injected into the reservoir with the produced water. If all water injection lines become unavailable simultaneously (a very low probability event) then produced water with its chemical additives will be discharged to sea.

Chemicals will be supplied to the platform in transportable tote tanks. These tanks will be decanted into skid mounted storage tanks that feed the chemical injection pumps. All installed chemical injection pumps shall be spared. The chemical storage tanks will be sized to provide a re-supply interval of 14 days at the maximum design dosage rate.
A list of anticipated production chemical requirements along with the dosage range for these is presented in Table 5.13. These requirements may be subject to revision as detailed engineering progresses for the project.

Table 5.13 Anticipated Production Chemicals and Requirements

Chemical	**Typical Dosage (ppmv)**	**Design Maximum Dosage (ppmv)**	**Injection Points (Note 1)**	**Solubility Portion**
Antifoam	3 - 5	10	• Each production manifold; • Inlet each HP separator; • Inlet each LP separator; and • Inlet test separator	Oil
Demulsifier	20	30	• Each production manifold; • Inlet each HP separator; • Inlet each LP separator; and • Inlet test separator	Oil
Scale inhibitor	Wellhead: 20 Water lines: 30	As "typical"	• Individual wellheads; and • Water outlet from each LP separator (Note 2).	Oil
Reverse Demulsifier	10	20	• Water outlet from each LP separator; and • Water outlet of test separator.	Produced water
Corrosion Inhibitor (Oil)	30	30	• Suction of each MOL booster pump	Oil
Corrosion Inhibitor (Gas)	1 litre / MMscf	1 litre / MMscf	• Gas export line	Gas
Corrosion Inhibitor (Produced Water)	30	30	• Suction of each produced water pump.	Produced water
Biocide	500	500	• Inlet of produced water degasser.	Water
Methanol	Flowing: 50 litre / MMscf*	60 litres / MMscf 100 litres / MMscf during well start up	• Flowing: gas export line; and • Equipment: individual production wellheads. **Note:** The methanol tank is not part of the main chemical injection skid. The methanol tank is a separate inert gas blanketed vessel with its own injection pumps located on the PCWU.	Oil/gas
Oxygen Scavenger (Utility)	150 ppmv	150 ppmv	**Note:** Not part of main chemical injection Skid. Oxygen scavenger to be dosed using portable tank/pump arrangement. Oxygen scavenger dosing to process is very intermittent.	Seawater

Notes:
(1) Where more than one location is given these are generally alternatives, although in some instances multiple injection locations may be required, dependant on operational experience.
(2) Down-hole scale squeeze treatment may also be carried out. No platform facilities are required for this other than provision for entry to the production tubing as it will be carried out by the well service company.

In addition to the chemicals cited above, it is anticipated that a drag reducing agent (DRA) will be used in the oil export lines during peak production years (e.g. 2009-2010) to allow increase oil throughput. Typical dosage rate for the DRA will be 20ppmv, with a design maximum dosage of 50ppmv. DRA trials were, at the time of writing being undertaken for the EOP Chirag-1 platform and 24” oil export line. Similarly, a wax inhibitor / pour point depressant, H_2S scavenger and alternative demulsifier may be used. Space and weight provisions on the platform topsides will be provided for future utilisations.

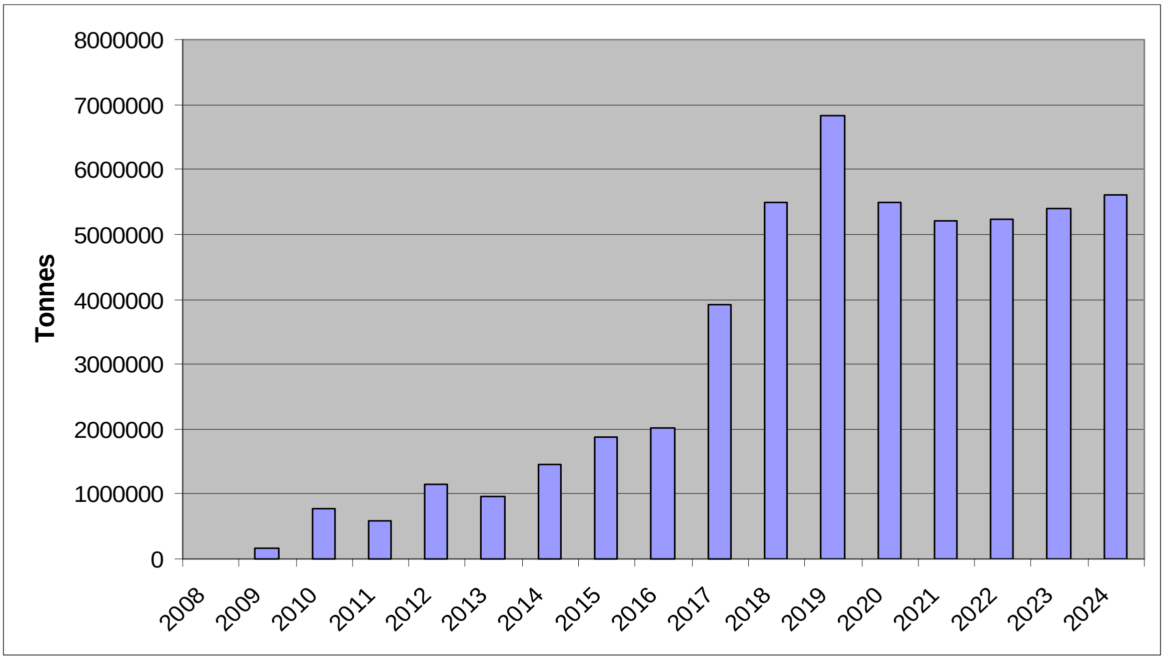
5.5.3 Well Clean-up / Testing

The test separator train will provide the requirements for well clean-up, well kick-off and well testing and will work across the full range of conditions experienced by both the HP and LP separators to cater for tests from both HP and LP wells. The test separator will also be capable of operating as a production separator in the event that one production train is unavailable. There will be no planned emissions to atmosphere or to sea as a result of these test separator activities as hydrocarbon products will be contained in the process train.

5.5.4 Produced Water

Anticipated produced water volumes for the Phase 3 Project are shown in Figure 5.22.

Figure 5.22 Predicted Phase 3 Annual Produced Water Volumes (Tonnes/year)



Under normal operating conditions, produced water will, following treatment, be sent to the water injection pumps where it will be combined with treated seawater and injected for reservoir pressure maintenance.

The produced water treatment package onboard the DUQ platform will be capable of treating up to 131 Mbpd. It includes solids removal sand cyclone units and de-oiling hydrocyclones. A separate sand cyclone unit and hydrocyclone will be provided for each of the two process trains and for the test train. Removed sand will be transferred to the sand separation package.

Treated water exiting each of the hydrocyclones will be routed to a degassing drum where any remaining gas will be "flashed" and directed to the LP flare system. The degassing drum will be equipped with an oil-skimming facility and oil / oily water will be routed back into the LP separator for re-treatment.

If the total water injection system becomes unavailable (e.g. in circumstances when all of the three available injection pumps are unavailable) produced water will be discharged to sea via caisson at 45 m below the sea surface. A sampling point will be installed downstream of the degassing drum to allow verification that water that needs to be discharged to sea meets the following IFC standards:

- 42 mg/l dispersed oil and grease – daily average; and
- 29 mg/l dispersed oil and grease – monthly average.

Produced water will be preferentially injected before seawater to minimise need for discharge of produced water to sea during any downtime of the injection system.

Through the management of the water injection and hydrocarbon production systems, it is estimated that there may be a need to discharge produced water to sea for up to 2% of the total platform operating/producing time. Based on this assumption, anticipated volumes of produced water that will be discharged to sea are quantified in Section 5.10.

5.5.5 Water Injection

Water injection to the reservoir will initially be via one pre-drilled platform well and the six to eight subsea water injection wells. Additional water injection wells will be drilled from the DUQ platform for future requirements.

Injection water will include produced water and lifted seawater. Seawater will be taken from a depth of 107 m below the sea surface using two lift pumps on the DUQ platform and four on the PCWU platform. Following filtration to remove solids, some seawater will be used for platform utilities (Section 5.5.7). Filtered seawater required for water injection will be transferred to the water injection system on the PCWU platform. The injection water treatment system consists of a de-aerator tower where water oxygen levels will be reduced via injection of an oxygen scavenger and other chemicals. The chemicals that will be added to the injection water stream (as currently planned) are presented in Table 5.14.

Table 5.14 Injection Water Chemicals

Chemical	Typical Dosage (ppmv)	Design Maximum Dosage (ppmv)	Injection Points (Note 1)
Calcium Nitrate (Souring Mitigation)	To WI: 57 To PW: 163	As "typical"	• For potential future use; • Injection points have been provided upstream of the deaerators and upstream of the produced water pumps; and • Allowance has been made in the layout for future installation of nitrate storage tanks and pumps.
Oxygen Scavenger (Water Injection)	5	10	• Each deaerator system recycle loop.
Scale Inhibitor	30	30	• Suction of each water injection pump.
Antifoam	1	2	• Inlet of each deaerator.
Biocide	500	500	• Inlet of each deaerator; and • Exit of each deaerator. • Batch dosed for 6 hours per week (period treatment)
Corrosion Inhibitor	30	30	• Suction of each water injection pump.

Notes:
(1) Where more than one location is given these are generally alternatives, although in some instances multiple injection locations may be required, dependant on operational experience.

Once de-oxygenated, seawater will be routed to booster pumps and then co-mingled with treated produced water. The combined streams will be injected using three gas turbine driven water injection pumps onboard the PCWU platform. Each water injection pump will be capable of pressurising the water to the required injection pressure of 448 barg and the water injection system in total will be capable of injecting up to 750 Mbwpd (i.e. 3 x 250 Mbwpd water injection pumps). The water injection system will be designed to operate at an overall 98% availability. When the system is unavailable, some volumes of injection water will be discharged to sea. During these periods biocide dosing will cease.

5.5.6 Platform Utilities

A number of platform utilities will be provided to support platform operations. These utilities are described in the following sections.

5.5.6.1 Power Generation

The power generation system will provide electrical power for the drilling operations, production operations and all of the platform utility systems. The principal power supply will be Rolls Royce RB211 gas turbine generators each capable of generating 22-28 MW of electrical power depending on the ambient temperature.

The PCWU will have four RB211 power generation packages (including one spare) for general power supply and an additional three dedicated to water injection duty. The DUQ will have one RB211 generator. The generators will normally operate with dry fuel gas generated by the platform fuel gas system. Diesel will however, be used in the event of unavailability of fuel gas with up to six of the generators capable of running on diesel. Back-up supply to the platforms' RB211 generators will be provided by two 1.2 MW emergency diesel generators, one on each platform. These generators will also be used for first power at platform start-up.

During drilling operations and prior to installation of the PCWU platform, the DUQ will be powered by one RB211 and will have eight temporary diesel engine generators for back-up power supply. This temporary generation will be required for 4-6 months, following which the temporary diesel engine driven packages will be removed from the platform and shipped back to shore as they will be no longer required for the project.

5.5.6.2 Diesel System

In addition to providing fuel for the back-up power generation system, the diesel system will also provide fuel to the following users:

- Cranes;
- Lifeboats; and
- Firewater pumps.

Diesel transfer to the platform will be by hose from supply boats. The hoses will be equipped with breakaway couplings to isolate supply in the event that the line tears or breaks. Diesel storage will be 109 m^3 in each of the two storage tanks located in the DUQ crane pedestals. During the initial drilling period when PCWU platform is not installed, diesel will likely be stored in the process separators located on the DUQ platform so as to reduce the number of required supply vessel trips.

From storage, the diesel will be pumped to the various platform users via the diesel treatment package, with a system design capacity rate of 33 m^3/hr. Diesel bunkering will be a continuously manned operation. The treatment package consists of a coalescing filter system that will remove water, associated salts and particulates from the diesel in order to meet the gas turbine generator quality specifications (when running on diesel). The by-products of the diesel treatment system will be passed to the closed drain system (Section 5.5.6.8.).

5.5.6.3 Flare System

The platform flare system is designed to collect and safely dispose of any gaseous releases that need to be routed to the atmosphere for safety or operational reasons. It is primarily an emergency relief system for use under abnormal conditions such as during start-up, shutdown, planned maintenance and times of equipment failure or an emergency event.

The offshore flare system will consist of a LP and a HP system designed to gather gaseous releases from platforms' equipment. It will route gas via the HP and LP header / flare drum sets (one of each on both the DUQ and PCWU) to a single flare tip on the PCWU flare boom where they will be burned. The potential sources of gaseous releases include:

- **LP Flare System:**
  - Cooling Medium Expansion Drum;
  - Flash Gas Compressor Discharge Coolers;
  - Fuel Gas Package;
  - Gas Pipeline Pig Launcher;
  - Gas Turbine Generator;
  - Glycol Regeneration Package;
  - HP Gas Cooler;
  - Methanol Drum;
  - MOL Pumps;
  - Oil Booster Pumps;
  - Produced Water Treatment Package; and
  - Sand Separation Package;
- **HP Flare System:**
  - Flash Gas Compressor Discharge Coolers;
  - Flash Gas Compressor Suction Scrubbers;
  - Fuel Gas KO Drum;
  - Fuel Gas Package;
  - Gas Turbine Generator;
  - Glycol Contactor;
  - HP Separators;
  - Ignition Package;
  - LP Separators;
  - Coalescer
  - Oil Booster Pumps; and
  - Test Separator.

There will be no routine continuous flaring of associated gas for oil production purposes from the Phase 3 facilities.

Although the flare system is primarily designed for use during abnormal operating conditions, there will be a need to continually supply a small volume of gas to the flare system and for this to be burnt at the flare tip for the following reasons:

- Fuel gas for the continually lit pilot lights to ensure ignition of any gaseous releases;
- Continuous purge gas to prevent ingress of oxygen into the system and the build-up of a potentially explosive atmosphere;
- Glycol regeneration package vent;
- Fugitives from compressor gas seals; and
- Produced water degasser vent.

BTEX (benzene, toluene, ethylbenzene, xylene) will be retained in the hydrocarbon stream from the glycol regeneration package. This will be flared. The combined HP and LP flare pilot lights consumption rate will be approximately 4 MMscf/yr. The flare tip purge gas rate will be approximately 600 MMscf/yr (not including losses from seals and vents).

During operations there will be occasions when plant upsets occur necessitating flaring of gas to allow continued oil production safe repair of equipment and safe restart of the plant. These occasions will be reduced by the procurement of robust and proven and reliable equipment and the design of plant and equipment with sparing capacity. In addition, regular inspection and maintenance programmes will be implemented for plant equipment to maintain efficiency. The overall plant design availability for individual components of the offshore and onshore plant, plus the subsea export pipelines is 95%. When all of these components operate together the overall availability equates to 92% at production plateau[1].

The flare tip will be designed to handle an emergency blow-down rate of 350 MMscfd. When flaring is necessary it will be maximised at the offshore platform location in order to minimise flaring events at the terminal. Flaring will be metered and a flaring policy will be defined for the operating phase of the Project that will be consistent with the overall flaring policy for ACG FFD. The policy will stipulate annual caps on volumes of gas that may be flared.

5.5.6.4 Seawater System

Seawater will be drawn directly from the platform seawater lift pump caissons (–107 m below the sea surface) using five of the six seawater lift pumps. One pump (plus one spare) will be located on the DUQ platform and the other four will be on the PCWU platform. Each seawater lift pump will have a normal flow-rate of 1,718 m^3/hr.

Seawater will be used for a number of purposes as follows:

- Water injection;
- Heating, Ventilation and Air-Conditioning (HVAC);
- Living quarters ablutions;
- Drilling facilities;
- Fresh water generator;
- Fire water ring main pressurisation facility;
- Bio-fouling control unit;
- Sewage treatment system;
- Sand jetting system;
- Coarse filter backwash, and
- Cooling for the cooling medium system.
- Washdown facilities

Following lifting and filtration to remove particles greater than 150 microns, a proportion of the seawater will be dosed with a copper-chlorine anti-fouling additive in order to prevent the build-up of organic matter. There will be an anti-fouling package onboard both the DUQ and PCWU platforms and design flow-rates will be 20 m^3/hr and 80 m^3/hr, respectively. The anti-fouling system will pulse dose the water for one minute in every five with a 5 ppb copper and 50 ppb chlorine mixture. Once treated, the seawater will be passed to the various uses listed above.

5.5.6.5 Cooling Medium System

The main processes requiring cooling include the following equipment and utilities:

- Flash gas compressors;
- Main gas compressors;

[1] Note: Plant design availability for offshore facilities is 95%, and onshore facility availability is 96%. Together the availability of all equipment equates to 92%

- Power generation turbine utilities;
- Turbine driven water injection pump utilities;
- MOL booster pumps;
- MOL pumps;
- Air compressor package; and
- Export gas compressor after-cooler.

The platform cooling systems will comprise of separate closed-loop cooling medium systems on each platform. The systems will be an indirect glycol-water cooling system (20 % by weight mono ethylene glycol (MEG)) that is cooled by seawater. There will be four seawater exchangers on the PCWU and two seawater exchangers on the DUQ. Top-up MEG will be supplied to the system by tote tank. The cooling medium will have an operational flow-rate of 3,142 m^3/hr on the PCWU and 180 m^3/hr on the DUQ.

Once used, cooling water will be routed to the water injection system for disposal. There will however, be two scenarios where it will be discharged to sea, namely:

1. Prior to installation of the PCWU platform (i.e. when only the DUQ platform is installed) and there will be no injection water treatment or pumping system; and
2. When the PCWU is installed but when the water injection system is unavailable.

The maximum amount that will be discharged under the first of these scenarios is 1,718 m^3/hr; that is, equal to the lifting capacity of the one seawater lift pump located on the DUQ platform at that time.

Under the second scenario, cooling water will be discharged via a caisson at 45 m below the sea surface and at a temperature of between 20^{O}C and 25^{O}C. Discharge volumes will be small and rates will be variable depending on the demand for injection water and the amount of produced water that is being generated.

5.5.6.6 Firewater

Firewater will be supplied by two diesel driven firewater pumps, each with a pumping rating of 2,150 m^3/hr at the discharge flange. The pumps will be located on the cellar deck of the DUQ platform and will provide a dedicated firewater supply for both platforms from the seawater lift system. The distribution system will supply firewater to general area deluge systems, hose reels/hydrants and monitors. Deluge protection will be provided to the majority of hydrocarbon processing areas, including the wellhead/manifold and drilling areas.

A film forming fluoro protein (FFFP) concentrate system will be provided to enhance the effectiveness of deluge water spray protecting the separator module where there is potential for hydrocarbon pool fires. FFFP is a natural protein foaming agent that is biodegradable and non-toxic.

Firewater hose reels/hydrants will be designed for a nominal capacity of 26 m^3/hr and will be located to provide coverage to all parts of the installation via two jets of water.

Firewater and foam monitors will be provided for helideck protection. At least two monitors, each capable of a minimum 5.5 l/min/m^2, will be provided for the safe landing area.

5.5.6.7 Sand Jetting and Separation System

All producer wells will have down-hole sand production control (Section 5.4.2.3). It is expected however, that flowing hydrocarbons will still carry some sand with it to the platform topsides and therefore, sand jetting equipment will be provided to remove accumulated sand from the process equipment such as separators, the produced water degasser drum and the closed drains drum. Removed sand will be directed to the sand separation package via dedicated sandwash piping.

Initially, sand-jetting water will be treated de-aerated seawater but as produced water volumes increase, this will be used in preference. Produced water used for jetting will be cleaned and routed to the water injection system.

The sand separation package consists of a de-sanding hydrocyclone and a de-oiling hydrocyclone designed to remove oil to a nominal level of 1% by weight oil on sand. Cleaned sand will be slurrified and transported to the cuttings re-injection system where it will be injected into one of the two dedicated CRI wells. The resultant oily water mixture from the de-oiling hydrocyclone will be routed to the closed drains drum. In the event that the cuttings re-injection system is unavailable, the sand will be diverted from the desanding hydrocyclone and containerised for transportation to shore for treatment and disposal.

Based on anticipated sand production volumes, vessel jetting is expected to be required on a weekly basis. Jetting systems will however be capable of removing double the design sand loadings of 5 pptb by simply increasing the jetting frequency.

5.5.6.8 Drainage System

The drainage system on the platforms will consist of non-hazardous and hazardous open drains as well as a closed drains system. There are two systems of drainage management on the DUQ and PCWU, as follows:

PCWU

- Open drains waters (including drainage from areas with a hazardous safety rating) is routed to the open drains caisson and passed through a skimmer in the caisson to draw off any oil prior to discharge at -45m.
- Closed drains waters will be directed to the LP and HP closed drains drums. Liberated gas from these drums will be sent to the flare and the liquids will be sent back to the LP separator for re-treatment.

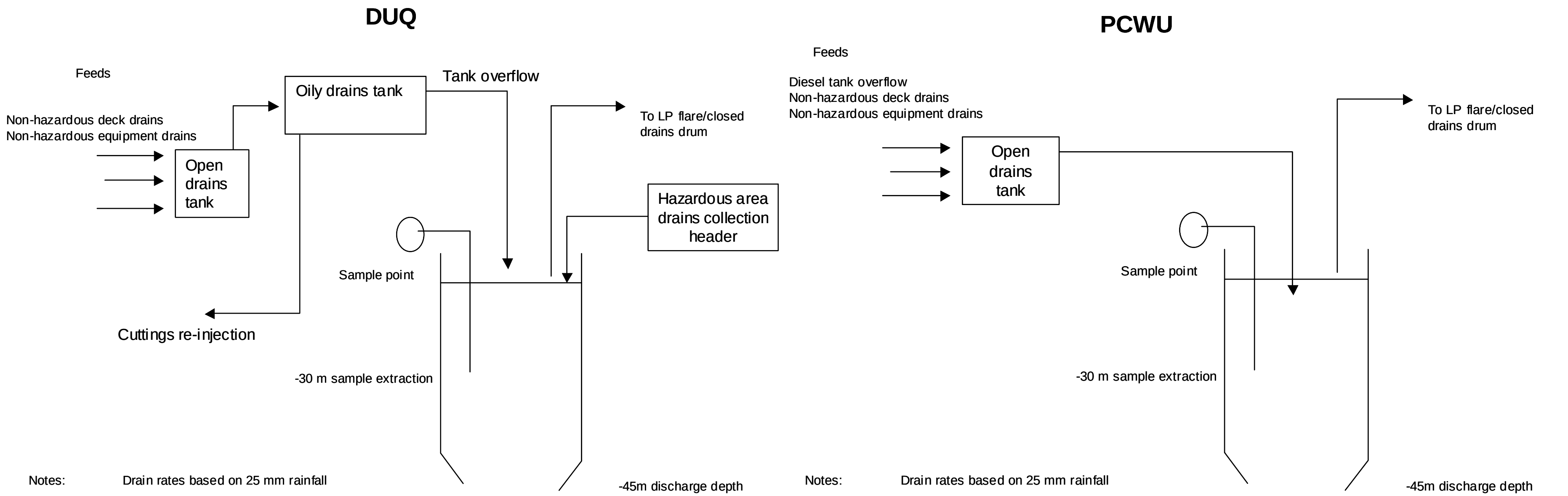
DUQ

- Open drains from areas with a hazardous safety rating will be discharged to the open drains caisson fitted with skimmer to draw off any oil, prior to discharge at -45m.
- Drainage from areas with a non-hazardous safety rating will be sent to an oil drains tank and from there to the cuttings re-injection package for downhole reinjection.
- Closed drains waters will be directed to the LP and HP closed drains drums as with the PCWU. Liberated gas from these drums will be sent to the flare and the liquids will be sent back to the LP separator for re-treatment.

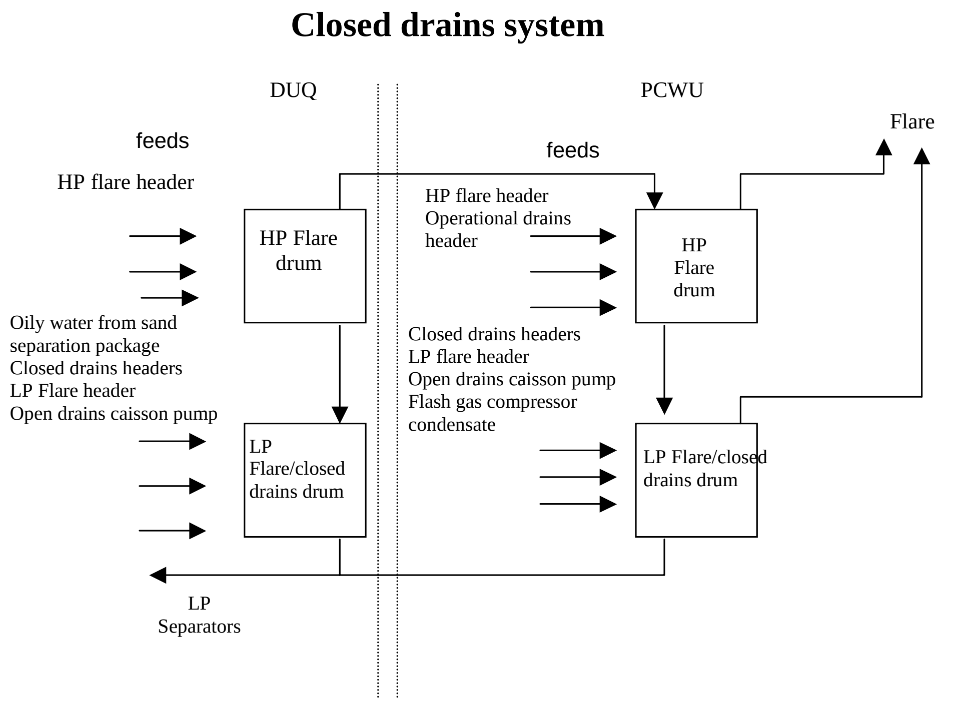
Both open drains caissons are fitted with a sample extraction point at -30m and will be monitored for no visible sheen.

Figure 5.23 Drainage System

a) Open Drains



b) Closed Drains DUQ and PCWU



5.5.6.9 Instrument Air and Inert Gas System

The instrument air system will provide plant and instrument air for use in drilling, process control and maintenance. On the DUQ, air will be provided by four oil-free air compressors rated at 33% duty each, and a further two compressors rated at 50% will provide the air on the PCWU. The total air-flow rate will be approximately 9,000 Sm^3/hr.

Inert Gas (nitrogen) will be generated on demand by a membrane package using dry compressed air. A backup inert gas supply system shall also be provided. Inert Gas users include compressor seals, cooling medium expansion drum and utility stations.

5.5.6.10 Fresh Water

The fresh water maker system will utilise a reverse osmosis (RO) process to desalinate seawater. It will include membranes to clean the seawater and will have the capacity to produce 5 m^3/hr of fresh water. Saline effluent from the fresh water maker will be directed overboard through the seawater discharge caisson.

The fresh water will be stored in a fresh water tank on the DUQ platform. Additional filtered fresh water will be supplied from the supply boats as required.

Water delivered to the accommodation module will be further sterilised in a UV sterilisation plant then passed to the potable water header tank.

5.5.6.11 Sewage

Toilet and washing facilities will be located on the DUQ platform.

Sewage will be collected via the sewer system and treated in a USGC Certified MSD. The package will have a maximum capacity of 56 m^3/day, consistent with the peak platform manning level of 300 personnel during HUC activities. The average capacity will be 37 m^3/day. An inlet surge tank will accommodate variations in sewage production rates.

The sewage treatment package will include maceration and electro-chlorination. Treated sewage will be co-mingled with seawater and untreated laundry grey water such that a residual chlorine discharge specification of 1mg/l is met after which it is discharged via the sewage caisson at 15 m below the sea surface. The package is designed to meet the discharge limits present in Table 5.15 below.

Table 5.15 Sewage Treatment System Specifications

Parameter	Discharge Limit
Total Suspended Solids (TSS)	<150 mg/l (average) <150 mg/l (peak day)
pH	6 to 9
Residual chlorine	1 mg/l
Faecal coliforms	<200 MPN/100 ml

5.5.6.12 Other Wastes

Organic food waste from the platform galley will be macerated to the MARPOL standard of <25 mm and discharged to sea via the sewage caisson.

5.5.7 Start-Up Operations

Start-up of offshore production operations will be controlled under increasing loads and hydrocarbon throughput. The oil processing equipment will be started-up before the gas processing equipment and hence, while the latter comes on stream, it is anticipated that there will be an initial requirement to flare gas. In addition, early commissioning and start-up problems may also occur resulting in the requirement for additional flaring events. It is predicted that plant availability during the first year of operation will be 75%, and 85% in the second year. Thereafter offshore availability is assumed to be 95%.

5.5.8 Offshore Production Operation Wastes and Emissions

The predicted volumes of discharges, emissions and wastes associated with the operational phase of the offshore platform facilities, including start up emissions are presented in Section 5.10.

5.6 Subsea Water Injection Development

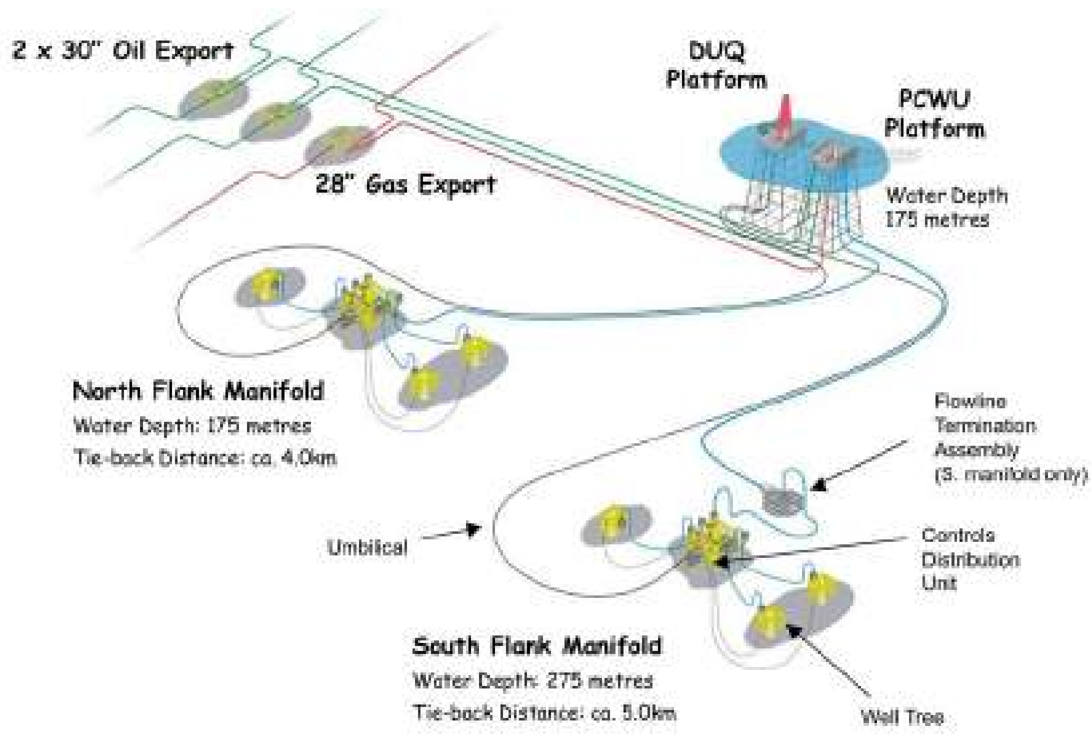
5.6.1 Overview

To provide water injection for reservoir re-pressurisation and pressure maintenance, the Phase 3 Project will include the installation and operation of two subsea water injection developments. Following the pre-drilling of water injection wells (Section 5.4), the subsea facilities will be fixed on the seabed approximately 4 km to the northwest and 5 km southwest of the bridge-linked DUQ and PCWU platforms. The facilities will be operated and controlled remotely from the DUQ platform, and the supply of water for injection will be from the PCWU platform. The facilities to the northwest will be in approximately 175 m of water and those to the southwest will be in approximately 275 m water depth. Each subsea development will consist of the following:

- A subsea manifold with distribution unit;
- Cables and piping between the manifolds and 3 well trees
- Control/command cables (umbilicals) between the DUQ and manifolds; and
- A 12" water injection flowline or 10" flexible flowline tied-back to the PCWU platform.

The generic layout of a Phase 3 subsea development is illustrated in Figure 5.24 below.

Figure 5.24 Phase 3 Subsea Development Layout



Subsea equipment will be designed to be operated remotely and maintained by Remotely Operated Vehicles (ROVs). It will also be designed for ease of retrieval to minimise and simplify well intervention procedures without affecting non-associated equipment and systems.

The following sections describe the design, fabrication and construction, installation and operation and maintenance of the Phase 3 subsea development facilities.

5.6.2 Design and Layout

5.6.2.1 Subsea Manifolds

The two Phase 3 subsea manifolds will each include the following main components:

- A foundation system;
- A structural frame including ROV interface plates;
- A controls distribution unit; and
- Piping, valves and associated flowline, umbilical and cable connector systems.

The manifolds will be up to 45 te each (approximately 4 m x 4 m x 3 m (high)) and will have provision for the connection of up to four wells, with the fourth slot allowing for future expansion if required. The manifolds will be designed for installation by the DSV, for "diverless" operation, and for complete removal other than any pile on which they are mounted.

The manifold will be made from marine grade steel and be designed for simple installation (and future removal). Protection of manifold piping, valves, hydraulic and chemical tubing and control cabling will be provided by a frame structure. The manifolds will be cathodically protected by means of zinc-aluminium sacrificial anodes and will be coated in an anti-corrosion / anti-fouling paint.

5.6.2.2 Trees and Control Pods

The trees consist of central body that house multiple valves for isolating pressure and operating the down-hole systems. The body is mounted within a support frame on which are interface plates fitted with connectors and operating knobs so that the valves inside the tree can be operated by an ROV. Valves will be either ROV and / or platform actuated.

Well tubulars (the "completion") are hung from within the tree allowing for the recovering of the tubular and any down-hole equipment without removing the tree itself. The trees will be manufactured from high-grade marine steel and will weigh up to a maximum of 40 te each so that installation from the "Dada Gorgud" semi submersible rig is possible.

5.6.2.3 Umbilicals

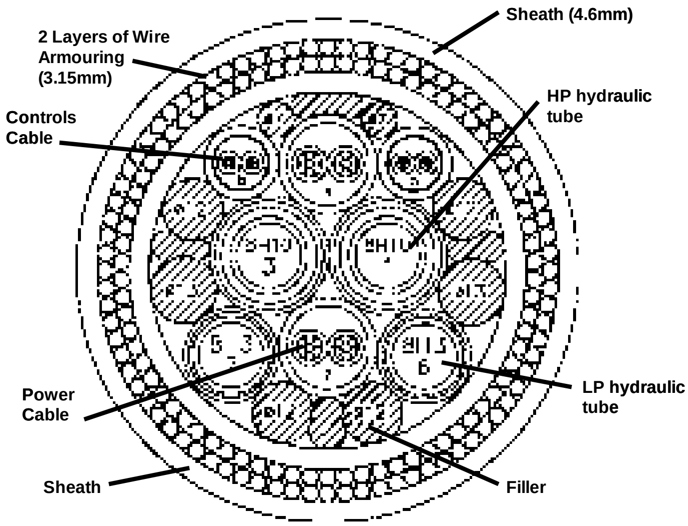
The subsea control umbilicals will include four hydraulic lines, one chemical line, two power cables and two communication cables. These will be bound together to form a composite umbilical approximately 85 mm in diameter with each single inner umbilical being approximately 10 mm inside diameter. The umbilicals will run from the DUQ to the northern and southern subsea sites. The depth of the southern subsea site is beyond Project dive limits and therefore the umbilical is designed for ROV installation (see below).

At the time of writing, it was planned that the umbilicals would be made from thermoplastic material although the option of using steel cores was still under consideration.

The thermoplastic composite umbilical will be armoured by two layers of contra-wound steel wire that also provide strength and weight to ensure on-bottom stability. The armouring will be covered with a high-density polyethylene sheath to provide a corrosion and abrasion protection.

Figure 5.25 illustrates an internal umbilical design, similar to that planned for Phase 3.

Figure 5.25 Typical Umbilical Design (Cross-Section)



5.6.2.4 Water Injection Flowlines and Spool Pieces

Injection water will be transferred to the subsea manifold injection wells from the PCWU platform via 12" rigid flow lines or 10" flexible flowlines. Details of the flowlines are presented in Table 5.16 below.

Table 5.16 Phase 3 Water Injection Flow-lines

From	To	Approx Length (km)	Flow Rate (Mbpd)	Design Pressure (barg)
PCWU	Northern Subsea Site	4.0	200	520
PCWU	Southern Subsea Site	5.0	200	520

The 12" flowlines will be constructed from solid, corrosion resistant alloy (CRA) (25% Chromium). Three-layer polypropylene coatings to protect against external corrosion will externally coat the flowlines. As the flowlines are solid CRA, there may be no requirement for cathodic protection by means of sacrificial anodes. At the time of writing, it was not anticipated that concrete coating for bottom (seabed) stability would be required.

At the time of writing, an investigation was being carried of using 10" high pressure flexible flowlines as an alternative to the 12" CRA flowines. These flexibles would have an inner lining of polyethylene, with steel armouring.

In the case for both CRA flowlines or flexibles, flowline spool pieces will be installed at both ends of the flowlines. These are short (i.e. approximately 20 m) sections between the subsea flowline connectors and the manifold or platform. These sections will also be made of CRA or flexibles and deliberately made with bends to provide flexibility and allow for flowline expansion and contraction.

5.6.3 Fabrication, Construction and pre-Commissioning

The majority of subsea components will be fabricated and constructed out-of-country. The subsea components include:

- Subsea manifolds and distribution units, although the option of having the manifold built in Azerbaijan was, at the time of writing, still being investigated[1];
- Trees and control pods (most likely in United Kingdom);
- Master Control Station and hydraulic power unit (most likely in United Kingdom);
- Umbilicals (most likely in Europe); and
- Flowline pipe sections (most likely in Japan or Europe).

The manifolds, umbilicals and trees will be fully tested out-of-country both as individual units (factory tests) and then as part of an integrated test in UK prior to shipment to Azerbaijan.

As part of the commissioning process, the flowline sections will be inspected and gauged to ensure correct internal diameter.

The facilities and equipment will be transported into Azerbaijan via the canal system. If the canal system is unavailable (e.g. during winter months), the road or rail network will be used. Each umbilical hydraulic line will be pre-filled with hydraulic fluid and the composite umbilical will be carefully wound onto a reel for transportation into Azerbaijan. Each composite umbilical will weigh up to 70 te and the umbilical ends will be covered for protection.

Once in-country, the units will be delivered to an Azeri yard where they will be re-inspected, functionally re-tested to check for transportation damage prior to installation offshore. If utilised, the 12” CRA flowline pipe sections will be transferred to the pipe coating facility in Azerbaijan where the external polypropylene corrosion protection coating will be applied.

5.6.4 Installation, Hook-Up and Commissioning

5.6.4.1 Subsea Manifolds

Once inspections and tests have been completed at an Azeri Yard, each subsea manifold will be loaded onto an installation barge or supply vessel ready for sailing to the subsea sites**.** Once on site, installation will be performed by the DSV “Tofiq Ismailov” using the vessel crane. The units will be lifted from the barge/supply vessel and lowered into place on pre-installed mono pile foundations on the seabed.

The mono-pile requires drilling and grouting piles into the seafloor. It is anticipated that the MODU the “Dada Gorgud” will be used to drill a hole into the seabed (as part of the subsea development drilling programme) and the pile conductor will then be lowered into the hole, from the rig, and grouted into place. Once the pile is installed, the manifold can be lifted by the DSV, lowered onto the piles and secured to the seafloor.

5.6.4.2 Trees and Control Pods

Installation of the trees will be undertaken from the “Dada Gorgud”. It is anticipated that the trees and associated down-hole tubular completion equipment will be installed during the subsea well drilling programme prior to installation of the subsea manifolds, umbilicals and jumpers. This will minimise the amount of time that the down-hole equipment is left exposed to down-hole conditions prior to the well being brought into operation and thus will reduce the potential for corrosion or fouling of the operating parts such as the DHFC valves.

[1] Construction of the structural frame involves cutting, shaping and subsequent welding of steel tubular sections and plates. Weld joints will be subject to NDT to check their integrity. Once constructed, the frame will be grit-blasted and painted with the anti-corrosion/anti-fouling paint.

Pre-commissioning activities will involve function testing of valves and controls and thereafter commissioning of the trees will involve the progressive start-up of the water injection process. It is anticipated that an intermittent loss of very low toxicity water based hydraulic fluid (this is expected to be Oceanic HW433 for which toxicity test results are given in Section 9.5) to sea will occur for approximately 3 months during the start up commissioning period for the subsea valves. It is predicted that this will be a total of approximately 2,100 litres for all subsea wells.

5.6.4.3 Umbilicals

The umbilicals will be installed from the DSV "Tofiq Ismailov" which has full dynamic positioning capabilities. A powered umbilical carousel will be installed onto the DSV at an Azeri yard and will be fastened to the vessel's deck.

Installation will commence at a J-tube[2] located on the DUQ jacket and will proceed out to the subsea locations. A tie-line pre-installed in the J-tube will be connected to the umbilical located on the DSVs and used to pull the umbilical through the J-tube.

The laying of the composite umbilical on the seafloor will be undertaken in a similar fashion to the pipe-lay operations. As the DSV is dynamically positioned it will not use anchors during the operation and will not require assistance from anchor handling vessels. The vessel will progress along the pre-defined course whilst progressively deploying the umbilical overboard from the carousel on the deck via a tensioner and a chute.

Once at the subsea site, the subsea distribution unit will be lowered down to the manifold where, assisted by a ROV, it will be locked into the receptacle on the manifold structure and flying leads will be connected between the subsea distribution unit and the trees. Once all connections have been made, the entire length of the umbilical will be surveyed by ROV to ensure that lay-down has been executed according to plan and that there are no unacceptable bends or freespans[3]. The platform end of the umbilical will then be connected to the subsea master control station located in the platform controls equipment room.

Commissioning of the umbilicals involves slowly bring them into full operational mode. Initially however, water based hydraulic fluid will be flushed through the individual umbilicals to remove any seawater that may have become caught between the umbilical connectors and their manifold docking points. In line with standard oil field practice, flush fluids will be discharged to sea by operating the hydraulic circuitry to flush each relevant part. The discharge volumes concerned will be very small (typically <10 litres) and the fluids will be of a known low toxicity (i.e. ONCS category E). It is currently planned to use Oceanic HW433 hydraulic fluid which has a very low toxicity.

5.6.4.4 Water Injection Flow-Lines

The pipe-lay barge "Israfil Guseinov" will be used for the installation of the CRA water injection flow-lines. Installation of the spool pieces will be performed by DSV. The installation methodology will be consistent with that applied for the Azeri Project subsea export pipelines, as described in Section 5.7.

If flexible flowlines are selected instead of CRA flowlines, these will be laid from the DSV "Tofiq Ismailov." The installation method will be similar to that employed for the laying of the umbilicals and the flexibles will be installed in approximately 1km lengths.

As the flowline pipe sections will be made from CRA, they will require special preparatory cleaning, and welding techniques will also be required onboard the lay barge. To meet these requirements, the pipe-lay barge will be equipped with the necessary welding equipment and

[2] A J-tube is a pipe, attached to the full height of the platform jacket, that has a shallow bend towards the seabed end in the shape of a "J". It is used as a conduit for umbilicals, cables etc. that are run up to the platform topsides.
[3] Freespans are areas where a pipeline, umbilical or cable is unsupported by the seabed due to pre-existing or changing seabed topography.

the deck area will be prepared before the installation programme commences. This vessel preparatory work, such as steam cleaning and the possible addition of wood cladding, may be completed at a quayside site prior to commencement of pipe-lay activities.

It is currently planned that flowline installation will commence at the platform and will progress out towards the manifold locations. Once on the seabed, the spool pieces will be lowered into place and fitted using specialist tools between the flowline termination assemblies and subsea connectors located on the manifolds.

The commissioning process will follow a typical flood-gauge-test procedure. The pipeline will be flooded with seawater containing chemical additives (e.g. biocide and oxygen scavenger.) and a gauging pig will be run to check for protrusions into the pipeline at the section weld joints. At the time of writing, it was anticipated that a pig would be pre-installed in the pipeline and that pigging would run from the manifold to the platform. Small amounts (approximately 10%) of the dosed seawater within the flowlines may need to be discharge to sea as a result of the pigging process. Once pigging operations are completed, the flowline will be subject to hydrotesting to ensure that there are no leaks. The base case for disposal of the hydrotest water in the line will be to inject it down the water injection well by forcing it through with injection water pumped from the platform.

Following completion of these commissioning activities, the subsea water injection development will be brought into operation by progressively increasing the throughput of injection waters until required operational flow rates are achieved.

5.6.5 Operation, Inspection and Maintenance

5.6.5.1 Operation

The master control station on the DUQ platform will provide the interface between the subsea control system and the platform operational and safety systems, including functions such as hydraulic power, electrical power and communications. It will be configured to provide a fully redundant system to ensure that in the event of any failure, no loss of control or monitoring will occur and that no stored data will be lost. Routine operational monitoring activities will include hydraulic fluid rate of use, valve positions and down-hole pressure and temperature.

All control commands will be administered from the platforms and passed to the subsea system via the umbilicals. The commands will be transmitted as electrical signals that will be passed through the manifold distribution unit and then onto the well trees.

The subsea control module (SCM) located on each well tree will hydraulically operate the tree valves and the well's down-hole flow control valves (DHFC) that control injection rate to the two main horizons, see figure 5.19. The operation of the subsea valves will result in a very small loss of low toxicity water based hydraulic fluid to sea and therefore, it will be necessary to intermittently top-up the fluids. This will be achieved by supplying fluids through the umbilicals from the host platform. It is estimated that approximately 2,500 litres per annum of water based hydraulic fluid will be discharged to sea as a result of the subsea system valve operations. The hydraulic fluid will be a known low toxicity.

There are no remotely operated valves on the manifold itself and manifold valves will be operated by ROV as required (e.g. for shut-in of a flowline in the event that intervention is required in an injection well).

The injection water will be treated through adequate dosage of biocides and oxygen scavenger (see Section 5.5.5), thus allowing effective management of internal corrosion of the flowlines and negating the need for routine pigging during operations.

5.6.5.2 Inspection and Maintenance

Routine pigging of the water injection flowlines or flexibles is not planned, although the pipelines and flexibles are designed to be piggable. Intermittent ROV surveys of the flowlines will be conducted to ensure that:

- The position of the facilities remains unchanged;
- No unacceptable freespans have developed;
- No seabed slumping has occurred;
- No damage is observed, particularly in the event of a major seismic event; and
- No debris is endangering the subsea facilities.

There should be no necessity to access the flowlines unless surveys indicate anomalies. The manifold facilities will be designed to allow for isolation of components to permit repair and maintenance work without the need for full depressurisation and line-fill displacement. Maintenance of the umbilicals and subsea piping and cables will simply include regular operational integrity checks and occasional ROV surveys.

The manifold structural frame will be surveyed by ROV to ensure that integrity is maintained. It is not anticipated that any repair work to the frame will be required during the life of the project. The valves within the unit will however, need to be actuated on occasion to ensure that scale build up or similar does not cause them to jam. The manifold system will be a retrievable design for ease of removal in the unlikely event that any components need repair or replacement.

In the event that there is a well tree or down-hole malfunction, attempts will be made to rectify the problem remotely. In the event that this is not possible, flow of injection waters to the tree will be shut off at the manifold and a well work-over from the MODU will be undertaken.

5.6.6 Emissions, Discharges and Wastes

In-country emissions, discharges and wastes generated during the subsea construction, installation, commissioning and operational activities will primarily relate to:

- Final assembly of the subsea facilities at an Azeri construction yard;
- Vessel operations associated with offshore installation and commissioning activities; and
- Operational discharges of hydraulic fluids.

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5.7 Export Pipelines

5.7.1 Overview

Phase 3 offshore facilities will use the existing Azeri Project marine export pipeline infrastructure to export its oil and gas to the onshore terminal at Sangachal. This existing pipeline infrastructure includes:

- A 30” diameter oil pipeline running from the Central Azeri field to shore installed as part of the Phase 1 project;
- A 28” diameter gas pipeline running from the Central Azeri field to shore installed as part of the Phase 1 project; and
- A 30” diameter oil pipeline running from the Central Azeri field to shore to be installed as part of the Phase 2 project.

There is also a 24” oil line from the EOP Chirag-1 platform to shore but this facility will not be used as part of the Phase 3 development.

To enable Phase 3 oil and gas to be exported, three (3) infield export pipelines will be installed between the Phase 3 PCWU platform and the above Azeri Project pipelines. These pipelines will be connected to the existing pipelines at connections (wye pieces) pre-installed on the Azeri Project pipelines. Details of the Phase 3 export pipelines are presented in Table 5.17.

Table 5.17 Phase 3 Infield Export Pipelines

From	To	Service	Outside Diameter (inches)	Length (km)
PCWU	Subsea Wye at circa KP 22 on the Phase 2 30” pipeline	Oil	30	2.4
PCWU	Subsea Wye at circa KP 22on the Phase 1 30” pipeline	Oil	30	2.2
PCWU	Subsea Wye at circa KP 22 on the Phase 1 28” pipeline	Gas	28	2.0

5.7.2 Design

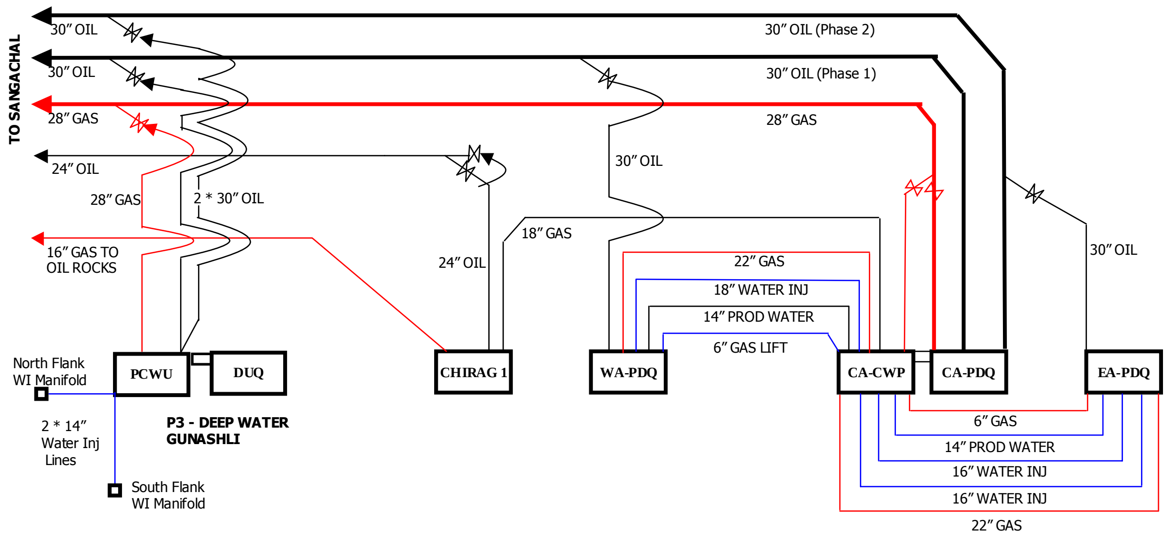
The Phase 3 export pipeline materials and design will be consistent with that used for the Azeri Project. The pipelines will be constructed of carbon steel (SAW Pipe Grade X65) and will be designed to ensure that they are suitable for the environmental conditions in the development area including seawater properties and geo-hazards. All the pipelines will be fitted with non-return “check valves” near base of the PCWU platform.

The pipelines shall have external corrosion protection that will consist of a three-layer polypropylene/polyethylene coating. Additional external corrosion protection will be provided through cathodic protection by means of conventional aluminium-zinc-indium sacrificial anodes attached to the pipelines at regular intervals. The pipelines will also be externally coated with concrete or steel to provide the weight required to ensure stability on the seabed as well as mechanical protection against impact.

5.7.2.1 Proposed Route and Crossings

The Phase 3 export pipelines will run from the PCWU platform in a northerly direction towards the existing Azeri Project pipeline corridor where they will connect into pre-installed subsea pipeline wyes as illustrated in Figure 5.26.

Figure 5.26 Phase 3 Export Pipeline Connections to Azeri Project Pipelines



NOTES:

= 2 ball valves, I.e. double block & bleed.

Subsea Pipeline Check Valves not shown on this schematic, for clarity.

Fibre Optic Cables, Power Cables and Umbilicals not shown on this schematic, for clarity.

The pipeline routes have been selected to optimise line spacing and to minimise lay-barge anchor pattern interference and risk of damage to existing lines due to dropped objects. The pipelines will need to cross existing pipelines on route to the connection wyes of the main export pipelines. Crossing structures (e.g. concrete on steel support) will be placed along the flanks of the existing pipelines and underneath the Phase 3 pipelines so that sufficient spacing between the individual lines is provided. The separation will ensure no mechanical or cathodic protection interaction occurs between the lines. Further information can be found in the Phase 1 ESIA, Section 5.6.4.

5.7.3 Fabrication

Carbon steel pipeline sections will be manufactured outside Azerbaijan: most likely in Japan or possible Europe. The pipe sections will be transported to the Caspian via the canal system or by road or rail. It is planned that the pipes receive the application of corrosion protection and concrete coating in Azerbaijan.

5.7.4 Installation

The pipe-lay barge "Israfil Guseinov" will be used for the Phase 3 project. It was upgraded for the Azeri Project pipeline installation programme so that it could handle that project's 30" and 28" pipelines. The upgrade included works on the pipe roller, tensioners and accommodation facilities as well as a general equipment overhaul and upgrade. No further upgrade work is required for the Phase 3 Project export pipeline installation programme.

Criteria for clearances of existing pipelines and safe methods of pipeline construction will be evaluated and defined prior to commencement of the Phase 3 pipeline installation programme. The installation methodology will be consistent with that applied for the Azeri Project. It is anticipated that the installation programme for the three export pipelines will be completed within a 50-day period.

On the lay-barge, each pipe section will be welded to the preceding one and the weld joints will be visually inspected and integrity tested using NDT techniques. The weld area will then be field-coated for protection with anti-corrosion material. The pipeline will be progressively deployed from the stern of the lay-barge via the “stinger”, a support boom that extends out the stern of the barge. Deployment will be from the platform out towards the pre-installed wye pieces on the Azeri project pipelines, and will be aided by a tensioning system that maintains a constant deployment rate and thus reduces the risk of bending stresses being incurred.

The pipe-laying operation is continuous with the barge moving progressively forward as sections of the pipe are welded, inspected, coated on board, and then deployed to the seabed. The barge is held in position by anchors.As pipe-laying proceeds, the anchors are periodically moved by two anchor handling tugs to pull the barge forward (with one more on standby). The distance of this varies but is typically every 500 m to 600 m of pipeline length. The lateral anchor spread of the pipe-lay barge is typically between 600 m to 700 m either side of the pipeline.

Once in place, the line will be flooded with inhibited seawater in preparation for commissioning (Section 5.7.5) and then tied-in to the wyes and spools at the platform.

5.7.4.1 Support Vessels

A number of vessels will support the pipeline installation activities. Pipe-haul vessels will transport pipe sections from the pipe storage yard to the installation site. Some of these vessels will also collect wastes including sewage sludge generated onboard the pipe-lay barge and will transport these to shore for treatment and disposal. The number of attendant vessels and anticipated persons on board (POB) these vessels during the installation programme are presented in Table 5.18.

Table 5.18 Pipe-Lay Support Vessels

Vessel and Description	Number	POB
Lay-barge:	1	210
Anchor handling vessels:	2-3	15
Pipe-haul barges and tugs:	3	14

Power generation onboard the pipeline lay-barge will be provided by five diesel generators rated at 1,150 kW each. The other support vessels will also have diesel generator for power supply.

As for the Azeri project, vessels proposed for use in the installation programme will be equipped with a USCG certified (or equivalent as per PSA) sewage system. Water from showers, sinks and laundry (grey water) will be discharged directly overboard without treatment although it may be possible to divert it to the sewage treatment plant if required. The final sewage effluent will be treated to a BOD of 40 mg/l, suspended solids 40 mg/l and coliform 200 MPN per 100 ml prior to discharge. Sewage sludge from operational vessels will be transported to shore on board the pipe haul barges to a designated reception facility.

There are three main vessel drainage routes, accompanied by manual/mechanical clean up where appropriate:

- Discharge to sea (clean water only);
- To the oily bilge water tank for treatment and discharge of the treated effluent to the sea and transport of the ‘sludge’ onshore; and
- To the waste oil tank.

Galley food waste will be treated in a macerator prior to discharge to meet specifications of the MARPOL 73/78 Annex IV Regulations for the Prevention of Pollution by Garbage from Ships which requires that the waste be broken down into particles of less than 25 mm diameter.

5.7.5 Commissioning

Once installed on the seabed, the export pipelines will be gauged and hydrotested (integrity leak tests). The pipelines will be flooded with seawater dosed with biocide and oxygen scavenger, and pressure will be supplied to the pipeline from the platforms.

On completion of hydrotesting the pipelines will be tied into the connector wyes and platform and subsequently dewatered. The dewatering process will be different for the oil and gas lines as follows:

- Oil pipelines:

  A pig will be launched from the platform with the oil. The pig will be driven into the Phase 1 and 2 pipelines where it will continue on to the terminal. At the terminal, the hydrotest water will be removed in the onshore oil separation and stabilisation process trains, and the recovered hydrotest water will be disposed of through the produced water disposal system.

- Gas pipeline:

  A pig will be launched from the platform. A glycol “slug” will be injected behind the pig and in front of the flowed export gas. The hydrotest water will be discharged to sea at the connector wye on the Azeri gas pipeline via a 4” valve. The gas will then be allowed to flow into the Phase 1 and 2 gas pipelines and onto the onshore terminal.

5.7.6 Operation and Maintenance

Each of the Phase 3 oil pipelines will be pigged on a regular basis, predicted to be every 3 days. The pipelines will be designed to be capable of being pigged by the following types of pigs:

- Foam Pigs (installation phase);
- Batching pig;
- Scrapers; and
- Intelligent pigs.

Pigging will be from offshore to onshore. Based on data from the EOP Chirag-1 24” oil pipeline that generates ~200 kg of wax and sand per pigging run, it is estimated that the 30” Phase 3 pipeline lines, including the section from the connector wye to the shore, will generate 1 tonne of wax and sand per pigging run. This equates to approximately 250 tonnes per year from both pipelines. Any wax and sand removed will be disposed in accordance with the AzBU Waste Management Strategy and ACG Project Waste Management Plan.

Leak detection in the pipelines will be achieved by monitoring pipeline pressure and export volumes. The pipeline will also be intermittently surveyed using a ROV to check for unacceptable freespans under the pipeline and that no damage to the external coating has been sustained. Supply vessels and helicopters will travel the pipeline route on routine journeys as an additional leak detection measure.

5.7.7 Other Subsea Cables

A new fibre optic cable will be installed from the Phase 3 DUQ to the Central Azeri PDQ Platform for connection to the WAN system installed by the Azeri Project. The Azeri Project will have pre-installed a cable end on the Central Azeri PDQ platform for this Phase 3 connection. Installation of the subsea communication cables on the seabed will likely be completed by the DSV “Tofiq Ismailov” supported by a ROV. However, other suitable vessels such as an anchor handling tug may be used; the choice of vessel will depend on the vessel schedules closer to installation time.

5.7.8 Subsea Pipeline Wastes, Emissions and Discharges

In-country emissions, discharges and wastes generated during pipeline coating, installation, commissioning and operation will primarily result from power generation at the pipe coating yard and operation of the pipe-lay and support vessels, in addition to the discharge of hydrotest water.

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5.8 Sangachal Terminal

5.8.1 Introduction

The Phase 3 onshore facilities will be located at Sangachal Terminal alongside the existing EOP, Phase 1 and Phase 2 facilities. They will be located within the current terminal boundaries and land clearance area approved under the Early Civil Work Programme (ECWP) approved by MENR in 2000. The terminal facilities will receive partially stabilised crude oil from all ACG project offshore facilities as a co-mingled stream via the offshore export pipelines. Here it will be processed to remove any remaining associated gas (stabilisation) and residual produced water (separation), prior to export via the Baku-Tbilisi-Ceyhan (BTC), Western Route Export Pipeline (WREP) and Northern Route Export Pipeline (NREP) pipelines for export to markets.

The facilities will also receive separated gas from offshore for conditioning. Any associated gas from the onshore separators will be compressed and combined with the gas received from offshore and will be treated in Dew Point Control Units to meet the export specification. The majority of the gas will be supplied to SOCAR for input into the national grid, although a portion will be used to support power generation and other utility requirements required for terminal operations.

5.8.2 Phase 3 Terminal Facility Design

5.8.2.1 Overview

The Phase 3 expansion provides the following facilities required to accommodate the additional processing requirements from the project. These facilities are essentially identical to Phases 1 and 2 installed equipment:

- Tie-ins to existing Oil and Gas reception facilities.
- Two additional crude oil stabilisation and separation trains with a capacity of 175 Mbpd each, each comprising of:
  - Fuel gas fired process heater
  - MP Separator
  - LP Separator
  - Electrostatic Coalescer
  - Rundown cooler
- Two trains of flash gas compression;
- One additional dewpoint control unit;
- One additional 800 Mbbl crude oil storage tank;
- One additional 30 Mbbl Offspec Crude Oil Tank;
- Utilities or connections to existing utilities to support the Phase 3 production operations;
- Addition of two power generators.

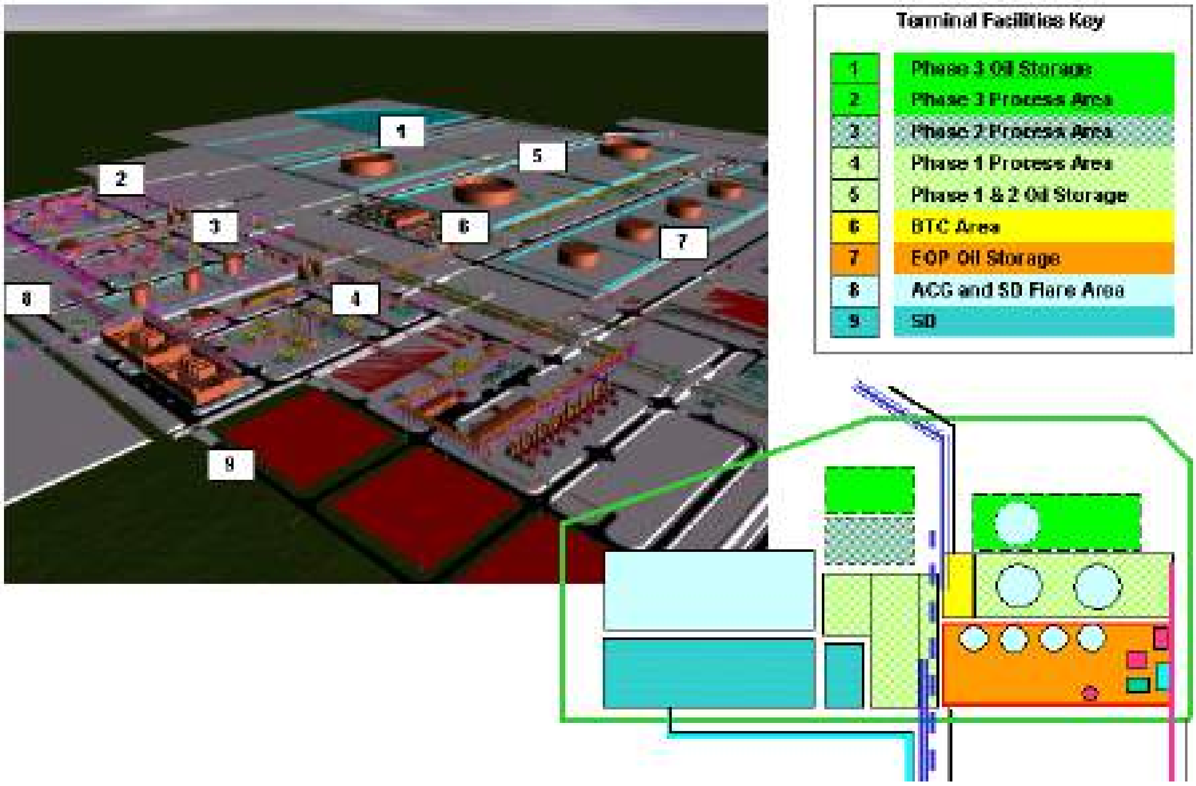
Once Phase 3 facilities are in place, Sangachal Terminal will consist of the following ACG project facilities:

- Oil and Gas reception facilities
- Six separation and stabilisation trains
- Three crude oil storage tanks,
- Two dew point control units
- One produced water tank
- Three offspec crude oil tanks
- PSA1 Pump Head Station operated by BTC under the Export Business Unit (BU)
- Standalone and back-up support and utility systems

In addition, the terminal will host the process facilities for the Shah Deniz and ACG Early Oil Projects (EOP).

As described, the location of the Phase 3 terminal will be sited alongside the existing terminal facilities (Figure 5.27) in land already prepared during the early civil engineering work carried out for ACG FFD in 2001, including site grading and leveling. As a result, only a minor amount of foundation excavations will be required for the Phase 3 construction programme and a small amount of excess soil will be produced during these construction works.

Figure 5.27 Phase 3 Development at the Sangachal Terminal



5.8.3 Phase 3 Terminal Construction Activities

The construction activities required for the Phase 3 terminal expansion are minor in comparison to those required for Phase 1 and 2, but will involve a number of common activities. The majority of the Phase 3 steel, process vessels, pipework and equipment will be manufactured outside of Azerbaijan and will be imported by rail or via rivership through the Russian canal system. Construction materials will however, be sourced from local Azerbaijani suppliers wherever possible.

Typical activities involved during construction programme are the establishment of underground services such as drains and the firewater systems; earthworks to establish foundations, plus surface pipework, tank and facility construction and tie-in. Construction methods will be based on those already established for previous phases. It may be necessary to carry out 'hot work' at times adjacent to producing plant as the terminal will be in operational mode during the Phase 3 construction phase.

5.8.3.1 Testing and Commissioning

At various stages through the construction of Phase 3 terminal facilities, Non-Destructive Testing (NDT) and inspection will be used to confirm the integrity of welding. Hydrotesting will be used to test the integrity of the equipment and facilities.

Hydrotesting for Phase 3 will follow the approach established for Phases 1 and 2. It has been established that the majority of hydrotests will be performed with potable water as the duration of the test and materials being tested are such that corrosion inhibitor chemicals are not required. Corrosion inhibitor will only be added to hydrotest water when testing carbon steel piping. The selected corrosion inhibitor additive is an amine carboxylate, 'VpCI 609', which is readily degradable, has a low mammalian toxicity and moderate aquatic toxicity. The corrosion inhibitor was selected based on its non-hazardous, low toxicity and biodegradable characteristics.

Given the low toxicity and risk from the corrosion inhibitor additive, all hydrotest water disposal will be by direct discharge to the land and terminal non-contaminated open drainage system within the STEP boundary at controlled rates to minimise erosion potential. Where chemical additives have been used for corrosion protection an assurance programme will be implemented to analyse the hydrotest water to ensure that the resultant discharge is acceptable for disposal.

5.8.4 Construction personnel

The composition of the construction contractor workforce throughout the Phase 1 and 2 terminal expansion programme has been largely made up of national staff and it is intended that this will be maintained throughout the Phase 3 project expansion. Where required, additional staff will be sourced from the local communities, wherever possible, as well as from the Baku area and wider Azerbaijan if necessary. Construction personnel may also be sourced internationally for positions requiring specific/specialised skills that cannot be sourced locally or provided by short term training programmes.

Workers from the local communities will live in their own homes whilst working at the terminal construction site. These staff will be transported to and from the site to their hometowns using buses or minibuses. In addition, buses and minibuses will be used to transport any AIOC staff housed in Baku, including third country nationals (TCN).

A proportion of the construction and supervisory personnel will be housed in the terminal construction camp. The facility is sized for a maximum of approximately 820 workers and is fully equipped with office block, storage area, training facility comprising classroom, an outside training area and an operations training centre, residential quarters and medical and recreational facilities. A full description of the camp facilities is provided in the ACG Phase 1 ESIA, Chapter 5 and is not repeated here. Predicted manpower requirements for the Phase 3 project is provided in Section 9.10.

5.8.5 Terminal Construction Utilities

Utilities required during the Phase 3 terminal construction phase will be provided by existing facilities at the Sangachal terminal, as described in the Phase 1 ESIA. This includes both power generation requirements and sewage and wastewater arrangements. All diesel required for construction plant and equipment operation will be supplied from the existing storage areas. These areas were installed during the early civil engineering work programme. The tanks are bunded, ensuring that the bund is sufficient to contain 110% of the largest storage tanks. In addition, diesel storage and refuelling facilities will be located on areas of hard standing (concrete) to avoid potential contamination of the soil.

5.8.6 Wastes and Emissions

Estimated atmospheric emissions and wastes types and amounts that will be generated during the construction programme are provided in Section 5.10

Waste management for Phase 3 activities will be in line with the current waste management strategy at the terminal. Waste will be segregated and disposed at an appropriate disposal facility as appropriate. Where a final disposal route is yet not identified it will be stored for final treatment and/or disposal. The terminal has constructed and commissioned a Central

Waste Accumulation Area (CWAA) for the reception, segregation and storage of all wastes prior to their transfer offsite for disposal or further storage. This is currently in operation and will form the final onsite storage/collection point for all Phase 3 wastes, as detailed in AIOC's Waste Management Procedure. Main air emission sources are the earth moving operations, construction and delivery vehicles, power generation, and welding and paint fumes.

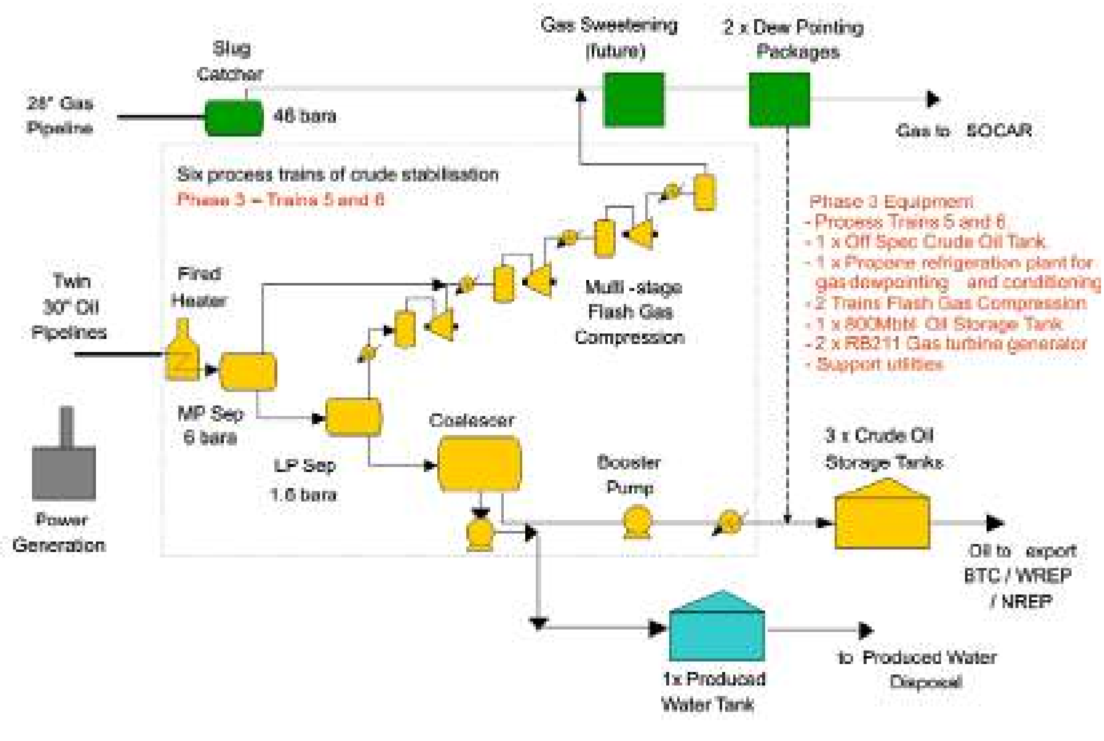
5.8.7 Terminal Operations

Production operations for Phase 3 terminal facilities will be consistent with those for all Phases of the ACG development and essentially consist of oil reception, separation and stabilisation. Gas processing will be minimal and will consist of reception and gas dewpointing.

The Phase 3 hydrocarbon product will be received along with the Phase 1 & 2 product via the existing pipeline landfalls. Processing of the commingled ACG product will be shared between the six process trains that will be in place at the terminal following installation of the Phase 3 facilities. Phase 3 processing (Trains 5 and 6) will operate in parallel to the existing facilities installed for the previous Phases of ACG development. A simplified schematic of the overall ACG terminal process (including Phase 3) is illustrated in Figure 5.28, with the additional Phase 3 components highlighted. As with the offshore facilities, it is anticipated that there will be additional requirements to flare gas to accommodate the start up and commissioning of terminal operations to receive Phase 3 oil and gas. A proportion of this flaring will take place at the terminal. Operations are discussed in the following subsections:

- Oil Process
- Gas Process
- Produced Water
- Personnel and Transport
- Utilities

Figure 5.28 Simplified ACG Terminal Process Flow Diagram, showing Phase 3 equipment



Oil Process

The Phase 3 oil and water separation, oil stabilisation and gas dew-point control plant will operate in parallel to the existing EOP and Phase 1 and 2 facilities. Together these facilities will supply stabilised oil to three available 800 Mbbl storage tanks prior to metering and export. The third crude oil storage tank is required to meet the storage requirement of the Phase 3 project and is identical in design and size to the two tanks installed as part of the development scope for Phases 1 and 2. This includes an external floating roof with primary and secondary seals and low loss fittings to minimise the release of hydrocarbon vapours to atmosphere. Underlying the base of the tank will be an impermeable butyl liner and a cathodic protection system to protect the base from corrosion. The tank will sit within a bund of compacted clay soil with a concrete facing, built to contain 150% of the volume of the tank. At the time of writing, the third tank was being constructed as part of the Phase 1 scope to ensure availability and flexibility at the start-up of the Phase 1 project and the BTC project. The operational aspects of the additional phase 3 crude that will be processed via the tank are considered as part of this ESIA.

Wet or under-treated crude received at the terminal will be routed to the three available 30 Mbbl offspec crude oil tanks for re-running through the process (not on the schematic). The offspec tanks can receive oil from the oil pipelines, the export system and the closed drains drums.

The two new parallel oil processing trains will have a nominal capacity of 175 bpd per train and each will comprise the following aspects:

- Direct fired heating: One direct fired heater per train will be utilised to heat the incoming partially stabilised crude oil to temperatures of 75 to 80°C required for efficient stabilisation and water removal from the crude oil. Each heater is rated at 43MW thermal output and is fired on sweet fuel gas. The heaters are fitted with Low NOx burners.

- Separation: Following process heating, the oil is passed through 3 separation vessels per train:

- Medium Pressure (MP) Separator: This first stage of separation is capable of removing any sand that settles out of the received fluids. Any removed gas from the crude oil is directed to the flash gas compression trains. If necessary, demulsifier and antifoam agent are injected into the MP Separator to enhance the separation process.

- Low Pressure (LP) Separator: This second stage of separation in the stabilisation process controls the final vapour pressure of the stabilised crude product. Associated gas is removed and routed to the flash gas compression trains.

- Electrostatic coalescer (liquid filled oil-water separators); The coalescer is the final separation stage that separates the produced water from the oil. It will reduce the water content of the oil to meet the final required crude specification (maximum water content of 0.5% by volume in oil product). The vessels operate by using electrostatic fields to promote the gravitational settling out of small water droplets from the crude. The coalescers will also remove the majority of entrained oil from the separated produced water phase to reduce the demand on any produced water handling/disposal facilities downstream of the process.

- Cooling and Storage: Crude oil pumps will supply the crude oil to the storage tanks via ‘fin fan’ crude oil rundown coolers (one per train) that cool the crude to 46°C. Each cooler is rated at 13 MW.

- Export: Following storage the crude oil is ultimately pumped from the tanks via booster pumps, fiscally metered and transferred to the oil export shipping pumps into the export pipelines.

Gas Process

Within each Phase 3 process train, flash gas from the MP and LP separators will be processed via a three-stage electric motor driven flash gas compression train, similar to Trains 1-4. At each compression stage, the gas is cooled by means of 'fin fan' coolers, and compressed to remove water and hydrocarbon liquid condensation. These liquids are removed in a series of scrubber vessels, and are recycled to the process via the closed drains drum. The compressors will be installed with common suction manifolds, which will allow for the potential of single compressor set use at lower gas turndown rates.

After compression the gas from the Phase 3 Trains (Trains 5 and 6) is combined with both the gas from Trains 1-4, and the gas received via the 28" subsea gas pipeline from the offshore facilities. The combined gas is then forwarded to the two gas dewpoint packages (including one installed for Phase 3), and then onto SOCAR via pipeline. The gas dewpoint package comprises a mechanical propane based refrigeration process with a glycol dehydration unit. Recovered liquids are stabilised and blended with the crude product, whilst off gas from the glycol contactor is routed to the LP flare system. A proportion of the gas will be diverted for use as fuel gas throughout the terminal.

At present it is not proposed to install any gas sweetening treatment systems for the removal Hydrogen Sulphide (H_2S). Current information on the sourness of the gas indicates that the Phase 3 DWG reservoir is sweet, however the potential for formation in the future has yet to be confirmed and therefore provision of space for this, upstream of the gas dewpointing package, is included in the design in case of any possible future requirement. The gas sweetening would use a selective amine process on the combined gas stream to satisfy gas delivery specifications. The sulphur recovery system has yet to be evaluated.

5.8.7.1 Produced Water

As discussed in Section 5.5, the Phase 3 offshore platform facility design will include electrostatic coalescers as part of the offshore water separation process. This will result in the oil being transferred to the terminal reception facilities containing maximum water cut of 0.5%. This compares favourably with the original design basis of 5% water cut, and results in a significant minimisation in volumes of water at the terminal that require ultimate disposal, as described in Chapter 4 – Options Assessed. Figure 5.29 illustrates the predicted volumes of produced water that will be transferred to the terminal with the Phase 3 crude oil. Figure 5.30 shows the forecast total volume of produced water (plus terminal drainage water) that will require onshore disposal)

The Phase 3 produced water contribution will be removed by any of the six process train coalescers at the terminal, along with the produced water from Phases 1 and 2 (as described above). It will then be transferred via produced water pumps to the produced water storage tank, where it will mix with recovered produced water from the EOP oil process trains prior to final disposal.

The final disposal route for the onshore produced water is still to be defined and will not be covered as part of this environmental and social impact assessment for Phase 3. A number of potential disposal routes for the onshore produced water are under evaluation by AIOC and studies are underway to assess the feasibility of these options. These studies will assess viable options to define the best option by determining which of the potential disposal routes are capable of receiving the predicted volumes of produced water to the technical, environmental and safety standards required by AIOC. The results of this assessment will be considered in a dedicated and separate ESIA that will pass through statutory public consultation and disclosure before being submitted to MENR for consideration.

Figure 5.29 Predicted Phase 3 Produced Water Volumes Onshore (te/yr)

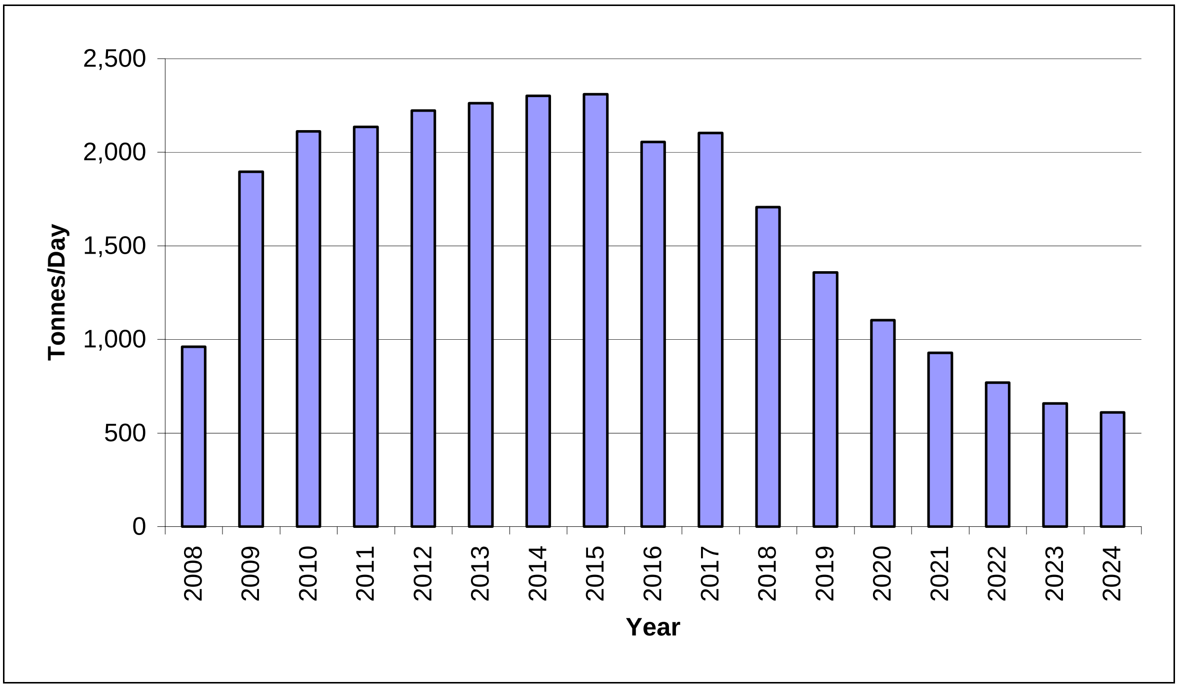
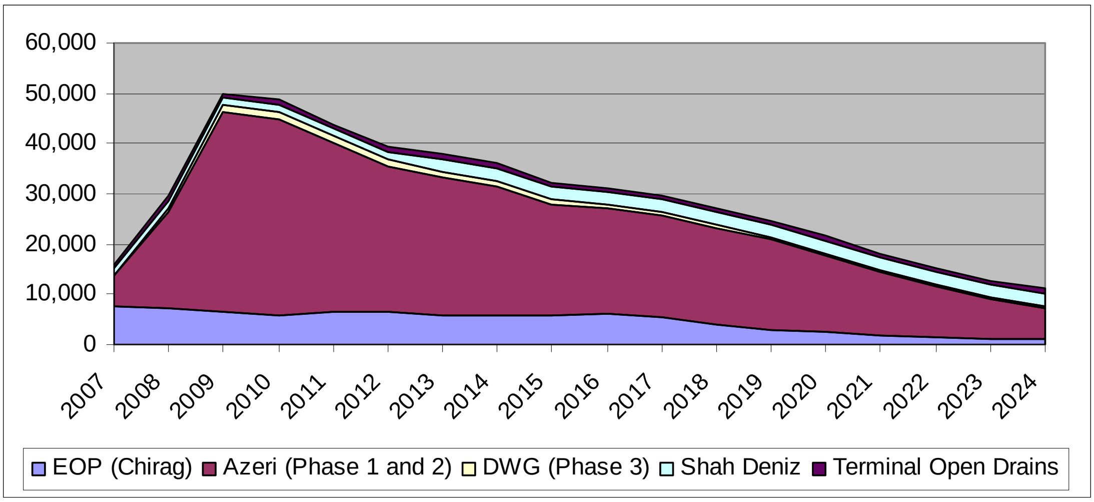


Figure 5.30 Onshore Produced and Waste Water for Disposal, average bpd – Most Likely Case



5.8.7.2 Personnel and transport

During routine operation it is anticipated that approximately 8 additional positions will be created at the terminal to add to the 152 that will already be employed by EOP and the Azeri project. This will require an additional staff of approximately 35 personnel, as there will be some elements of shift work.

Personnel will travel daily to the terminal site by car or minibus and there will be capacity for approximately 50 operations personnel to be housed in the construction camp where necessary. In addition to this regular personnel transport there will be a requirement for goods delivery on a regular basis for the provision of spare parts, chemicals, consumables, office equipment and stationary and food etc, as well as for the removal and transport waste, from the CWAA to an approved waste disposal facility.

5.8.7.3 Phase 3 Terminal Utilities

The majority of terminal utilities required to support the oil and gas processing requirements for Phase 3 will be provided directly by tie-in to the utilities installed as part of Phases 1 and 2. At the time of these earlier projects, these facilities were designed as far as possible to have sufficient capacity to meet future phases of the ACG project and are discussed in detail in ACG Phase 1 and Phase 2 ESIAs. A summary of these is provided in Table 5.19, and indicates where any additional utilities or differences in design will be required specific for Phase 3.

Table 5.19 Sangachal Terminal Utilities

Terminal Utility	Existing Utility Description (ACG Phase 1 and 2)	Phase 3 requirements
Fuel Gas System	Gas taken form gas export line downstream of dewpoint packages. Entrained liquids removed via knock out drum and then heated, filtered for use. Phase 1, 2 and EOP users: Crude oil offspec tanks Blanket gas Crude oil fired heaters Gas turbine generators Flare pilot, ignition & header Produced water system Shah Deniz Gas dewpointing package EOP fuel gas header	Additional Phase 3 produced gas will be commingled with other ACG gas. Additional fuel gas package (scrubber and heaters) required for Phase 3. Additional fuel gas users specific to Phase 3: Crude oil fired heaters Gas turbine generators New Gas dewpointing package
Diesel Fuel System	System includes a diesel storage tank; diesel treatment package to remove water and particles; a transfer pump and pipework.	No additional requirements. Phase 3 will tie into existing system
Power Generation	Onshore electrical requirements for Phases 1&2 met by five (4+ 1 spare) RB211 gas turbine generators, each rated at 28 MW (iso rating). Three Phase 1 turbines are dual fuel and will be retrofitted with Low Emission (NOx) burners after first major engine maintenance. Phase 2 turbines are fuel gas-fired and fitted with Low Emission (NOx) burners. 40MVA electrical grid supply connection in place to a local substation (via 5km overhead cable link between the terminal and local main distribution substation). This connection is primarily in place to enable the import of standby power supply during Phase 1 and 2 commissioning and start-up periods. Standby power for the control room and other services is supplied from a 1.8 MW diesel generator.	Additional two Dry Low Emission NOx fuel gas fired turbine generators, with one operating as standing spare (*N + 1)* At the time of writing the opportunity to reduce the number of turbines at the terminal through the use of imported power was being investigated.

Terminal Utility	Existing Utility Description (ACG Phase 1 and 2)	Phase 3 requirements
Flare Systems	*Low pressure system (LP):* rated at 70 MMscfd. Collects gases from following Phase 1&2 sources, and provides to LP flare drum, via header system. Fuel Gas System Flash gas compression trains Offspec crude oil tanks Sand separation packages LP & MP Separators Closed Drains Drums LP flare gas recovery in place to recover up to 1 MMscfd gas from flare header and recycle to flash gas compression trains. Flow in excess of 1 MMscfd directed to flare tip where they are ignited. Nitrogen purge supplied to prevent air ingress into system. *High Pressure System (HP)*: rated at 100 MMscfd. Collects gases from following Phase sources, and provides to HP flare drum, via header system: Fuel Gas System Flash Gas compression trains Gas turbine generators Designed to enable flare gas recovery for recycle of small gas quantities to flash gas compression.	Phase 3 will tie into existing Phase 1 and 2 flare systems, including the flare gas recovery and nitrogen purge systems. LP: The following Phase 3 sources will tie into the existing Phase 1 and 2 LP flare header system. Fuel Gas System Flash gas compression trains Offspec crude oil tank Sand separation package LP and MP Separators Closed Drains Drums HP: The following Phase 3 sources will tie into the existing Phase 1 and 2 HP flare header system: Fuel Gas System Flash gas compression trains
Open Drains	*Contaminated Open Drains* receives and disposes open drainage waters from paved areas, including; process area, offspec tank and produced water tank areas, utilities, booster and injection pumps; and pig receiving areas. Fully described in Phase 1 & 2 ESIAs, contaminated open drainage is routed to Oil Water Sump for treatment prior to either; discharge via *Non-contaminated Open Drainage**; or disposal to produced water tank (first flush). Recovered oil from Sump is pumped to Offspec oil tanks. Drains philosophy in place to minimise impact of any spilled oil in paved or bunded areas, as described in Phase 1 and 2 ESIA.	No additional requirements. Phase 3 facilities will tie into existing open drains system as appropriate.
Closed Drains	*The Process Closed Drains System* collects the residual fluids from the equipment located in the Phase 1 and 2 process and utility areas. Drain connections from this equipment and lines are tied into the drains header, which subsequently ties into the Closed Drains Drums. Liquids from the drums are returned to one of the LP Separators via Closed Drain Pumps. A manual connection is also provided to route the liquid to the Offspec crude oil tanks in the event of a process shutdown. Drains connections from the *Pig Receiver and BTC areas* (including the crude oil storage tanks) are connected to dedicated Closed Drains Drums from where liquids are returned to the Offspec crude oil tanks. Liquids most handled in the Closed drains collection systems will primarily include crude oil and condensate; associated gas and produced water. In addition to smaller quantities glycol, diesel fuel and production chemicals. Provision to purge all closed drains drums with low pressure fuel gas to the LP flare system.	An additional Closed Drains System of similar design to the existing Phase 1 and 2 system will be installed to receive contaminated drainage from Phase 3 facilities and route this to the terminal storage, treatment and disposal utilities. The system will include a new drains header, closed drains drums and pumps to allow transfer of liquids to either the LP Separators or the Offspec crude oil tanks. Provision is also provided to purge the closed drains drums with low pressure fuel gas to the LP flare system.

Terminal Utility	Existing Utility Description (ACG Phase 1 and 2)	Phase 3 requirements
Sewage Treatment	Wastewater treatment system in place for construction phase, designed to treat up to 300 m3/day of wastewater. Treatment plant comprises collection sumps, biological reactors and final holding tanks. Biologically treated water will be used for irrigation of trees/shrubs around terminal and potentially for dust suppression. Note: at time of writing, the dedicated sewage treatment system at the terminal was yet to be commissioned.	No additional requirements. Phase 3 will tie into the sewage treatment system design to be implemented for Phases 1 and 2.
Sand Separation	Sand separation package required to de-sand MP Separators and Closed Drains Drums; in addition to removing oil from recovered sand to allow disposal. Estimated sand accumulation rate for Phases 1 & 2 is 0.030 te/day Package includes desanding hydrocyclone and bag filter. Water jetting utilises and recycles water from produced water tank. Any gaseous releases directed to LP flare system.	Addition of new sand separation package for Phase 3, identical to that installed for Phase 1. Estimated sand accumulation rate for Phase 3 is 0.015 te/day. Any collected contaminated sand will be transported offsite for treatment and/or disposal in accordance with AzBu waste management strategy.
Chemical Injection	Separation & Stabilisation process requires use of chemicals to be stored in utility area. The chemical injection system receives, stores, pumps and distributes several different chemicals to the chemical injection points in the process systems Types and volumes are listed in Table 5.20: Each chemical storage tank is fitted with a local level indicator, with high and low alarms connected to the control room.	Phase 3 process trains will utilise existing chemical injection system to provide injection as described for Phases 1 and 2. Two new storage tanks (size still to be defined) will be installed in the Phase 3 process area as contingency storage capacity. Spare injection pumps will be provided where required. Chemical storage volumes on site are not predicted to increase however the frequency of supply to replenish volumes may increase. The terminal chemical injection process will be optimised once Phase 1 is online.
Air and Inert Gas (Nitrogen)	The plant and instrument air system will provide oil free compressed air to the plant air, instrument air and inert gas users. Together, Phase 1 and 2 systems consist: 2 x Compressor packages 2 x Air Dryer Packages 2 x Instrument Air Receivers 2 x Plant Air Receivers The inert gas (nitrogen) system provides dry inert gas for the flare recovery package, gas dew point unit, compressor dry gas seals, purging, blanketing and to utility stations. Wet plant air from the common plant air distribution header is fed to the Inert Gas Package. The wet air is filtered, heated and passed through membranes. The package is designed to generate design flow of 290 Sm3/h of dry inert gas (nitrogen) at 97%vol purity and 7.8 barg.	Phase 3 will share with existing systems. Additional 2 air dryer packages (one as standing spare) and nitrogen generation will be provided to ensure that the requirements of Phase 3 are satisfied.
Potable Water	Plant water supplied form existing EOP potable water system.	Phase 3 will tie-in into the overall distribution system. Potable water equipment will be spared 2 x 100%.
Buildings**		Combined LSR7/LER3 building within Greenfield Phase 3 area; (Local Switch Room and Local Equipment Room) – combined area of 1,300 sq.meter Two new buildings to be constructed in P1/2 live operating areas: - MSR-1A separate but adjacent to Phase 1 & 2 MSR: area 354 sq.meter - LER-1A separate but adjacent to Phase 1 & 2 LER : area 125 sq.meter

*Non-Contaminated Open Drains are routed to central drainage channel from where water is disposed of to land. Non-contaminated drainage designed so that oil in water content meets specification of <10 mg/l as a monthly average and <19mg/l on a daily basis.

** Buildings will be designed & constructed in compliance with Uniform Building, Mechanical, Plumbing Codes; Industry Standards and local codes. Building design based on materials and construction methods best suited for the project including analysis of climate, location, seismic zone, cultural background, construction time, maintenance, material availability, performance/life, safety, required spaces, overall site plan and design life.

Table 5.20 Sangachal Terminal Chemical Injection Rate, Storage and Usage

Chemical	Use	Design Dosage Rates	Volumes Stored (m^3)[1]
Methanol	Possible injection into flash gas compression to prevent hydrate formation under certain conditions.	200 litres / hr	N/A
Antifoam	Injected upstream of MP separators to prevent foaming during separation process	5 ppm	2.3
Demulsifier	Injected upstream of MP separators to enhance oil/water separation process	20 ppm	9.0
Corrosion Inhibitor	Possible requirement only, provision for injection included in design.	50 ppm	1.5
Wax Inhibitor	If required, injected into crude oil line to prevent wax build up within process trains and export pipelines.	200 ppm	30.0[2]
Scale Inhibitor	Possible injection later in field life when produced water breaks through	20 ppm	1.0
Reverse Demulsifier	Possible future requirement	N/A	N/A

Notes: [1] based on 7 days supply
[2] based on 2 days supply

As with previous Phases, all storage tanks constructed as part of the Phase 3 programme will be bunded to protect against the release of any spills. The bunds are sized to be at least 110% of each tanks working capacity.

Pigging Operations

As discussed in Section 5.7, it will be necessary to pig each of the 30" export oil pipelines from the offshore facilities to the terminal every 3 days. The majority of wax within the crude oil will stay in solution and pass into the terminal process trains, however it is estimated that these pigging runs of the two oil pipelines will generate approximately 250 te/ yr of residual wax and contaminated sand. These will be transported offsite for final treatment, reuse or disposal in accordance with approved routes defined by the AzBU Waste Management Strategy.

5.9 Facility Decommissioning

In view of the operational lifetime of the ACG Phase 3 development it is not possible to provide a detailed methodology for the potential decommissioning of the onshore and offshore facilities. In accordance with the PSA, AIOC will produce a field abandonment plan one year before 70% of the identified reserves have been produced. The decommissioning plan will give details of the strategy for required measures for the offshore and onshore facilities, including well abandonment, subsea pipeline decommissioning, offshore facility removal, where appropriate, and onshore terminal decommissioning.

Decommissioning is further discussed in Section 10: Wider Issues.

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5.10 Project Emissions and Discharges

5.10.1 Introduction

5.10.1.1 Data Sources and Assumptions

Calculation of the project's emissions and discharges relies on both real and predicted data, the latter obtained through interface with the design team. Calculation of atmospheric emissions is based on the quantity of fuel combusted and conversion factors provided by the US EPA and the E&P Forum. Full details on the methodology and assumptions used to quantify atmospheric emissions are detailed in Appendices 3 and 4.

Sewage quantities are estimated on the basis of workforce size, duration of the activity, and standard multiplication factors (i.e. 0.1 m^3 black water and 0.22 m^3 grey water per person).

Accurate estimates of waste quantities are not currently available for all project phases; waste quantities given for construction are based on real data and operational waste quantities (offshore only) are based on predictions. Where available, actual data has been used to determine potential impacts arising from project emissions and discharges (see Chapter 9 Environmental and Social Impact Assessment).

5.10.1.2 Approach

Construction and operation of Phase 3 facilities will result in a range of emissions and discharges to the environment. These will be considered in relation to the following main categories:

- Air emissions;
- Effluents;
  - Sewage;
  - Produced Water;
  - Cooling water; and
- Hazardous and non-hazardous waste.

For each of the above categories, where appropriate and feasible, emissions and discharges will be considered under each of the following major project activities:

- **Offshore:**
  - Facilities construction: Onshore construction of DUQ and PCWU jackets, topsides and associated facilities. Pre-drilling atmospheric emissions and sewage are also included in this section.
  - Facilities installation, hook up and commissioning: including platforms, subsea pipelines and manifolds.
  - Facilities operation: Operation of platforms, including associated supply and maintenance vessels, from 2008 to 2024.
  - Cuttings volumes from pre-drilling and platform drilling operations are quantified in Section 5.4 in tables 5.5 and 5.8, respectively.

- **Onshore:**
  - Terminal facilities construction: Expansion of the existing onshore terminal at Sangachal to include two additional processing trains, an additional dewpoint control unit and oil storage tank.
  - Terminal facilities operation: Operation of Phase 3 facilities at Sangachal terminal from 2008 to 2024.

The following figures show the emissions and effluent points of the offshore platform facilities, DUQ (Figure 5.31) and PCWU (Figure 5.32).

Figure 5.31 DUQ Facilities Showing Emissions and Effluents Points

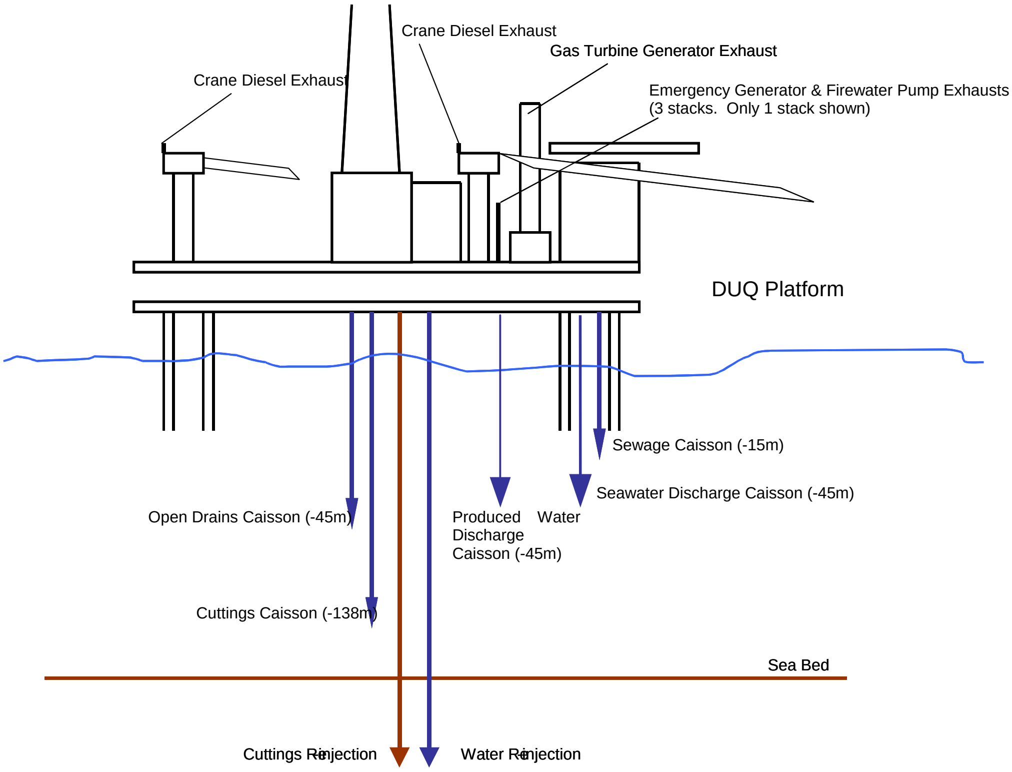
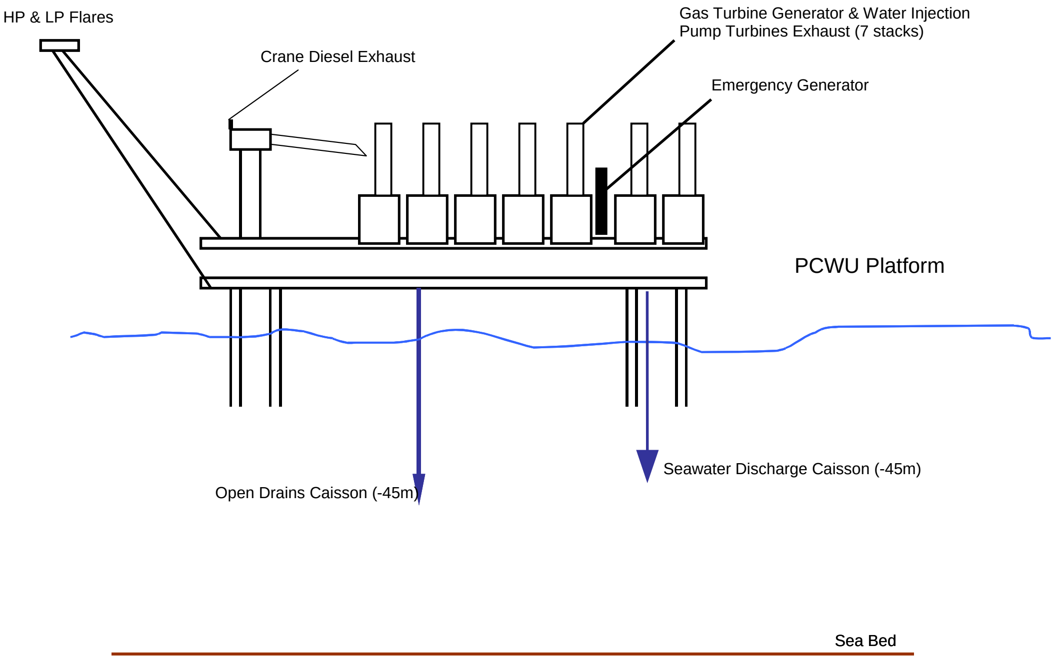


Figure 5.32 PCWU Facilities Showing Emission and Effluent Points



5.10.2 Air Emissions

This section summarises the emissions data obtained from a study of atmospheric emissions for the Phase 3 project, the assumptions behind which are provided in Appendices 3 and 4.

Total atmospheric emissions (NO_X, SO_X, CO, CO_2, VOC and CH_4) resulting from the ACG FFD Phase 3 project are presented in Table 5.21. These are presented in more detail in Appendices 3 and 4.

Table 5.21 Total ACG Phase 3 Emissions

	CO_2	CO	NO_X	SO_X	CH_4	VOC
MODU Drilling:	50,983	179	832	116	35	209
Offshore Facility Construction:	172,545	1,012	3,499	1,116	59	337
Onshore Facility Construction:	72,177	402	1,275	530	36	206
Offshore Installation & HUC:	48,067	120	886	113	4	35
Offshore Operations:	11,696,525	12,145	24,610	0	4,269	2,936
Onshore Operations:	2,922,471	1,959	4,740	0	795	746
TOTALS:	**14,962,768**	**15,817**	**35,842**	**1,875**	**5,198**	**4,469**

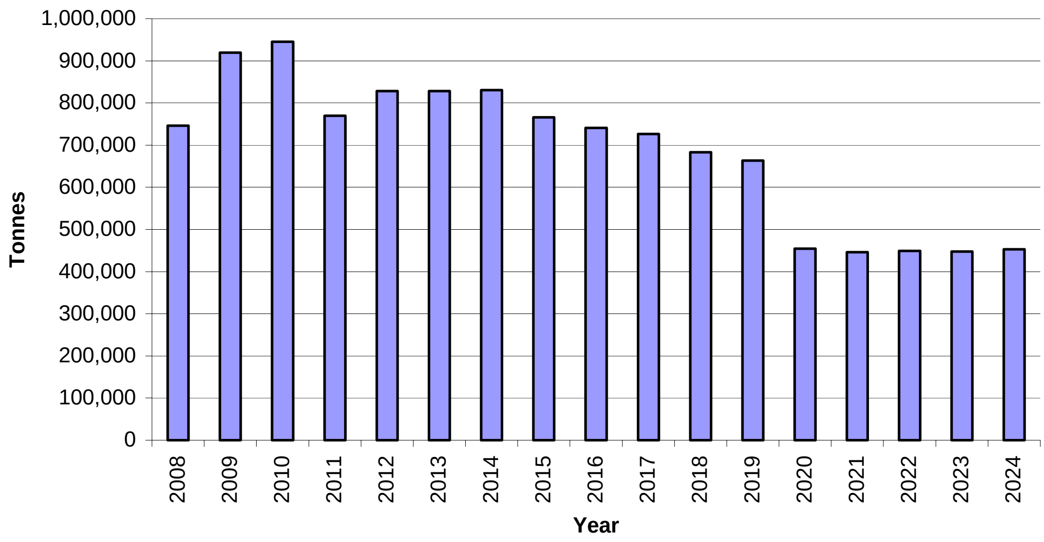
From Table 5.21 it is evident that the major contribution to atmospheric emissions occurs during the operations phase of the Project.

These activities that will result in atmospheric emissions are considered in more detail below, beginning with the major contributors, offshore and onshore operations, followed by offshore and onshore construction and installation hook up and commissioning (of offshore facilities).

5.10.2.1 Offshore Facilities Operation

Offshore operations are by far the largest contributor to the project atmospheric emissions, anticipated to release a total of 11,696,525 te of CO_2 from 2008-2024. CO_2 emissions are expected to increase rapidly from 750,000 tonnes in 2008 and peak around 2010 at approximately 945,000 tonnes (Figure 5.33). This is due primarily to to start-up flaring.

Figure 5.33 CO_2 Emissions to the Atmosphere Resulting from Offshore Operations Including Flaring (2008-2024)



Other releases to the atmosphere as a result of offshore operations are depicted in Figure 5.34. The figure illustrates the influence of power generation on atmospheric emissions. NO_X is clearly the major species released, with the next most abundant release being CO. Emissions of SO_X are not recorded as these are considered to be minimal based on the experience in Phase 1 and 2. It is currently expected that the DWG reservoir will be sweet, therefore H_2S and hence SO_2 is not expected to be an issue at the offshore platforms. Offshore SO_2 emissions resulting from diesel usage will be of short duration during start-up.

Figure 5.34 Other Emissions to the Atmosphere Resulting from Offshore Operations (2008-2024)

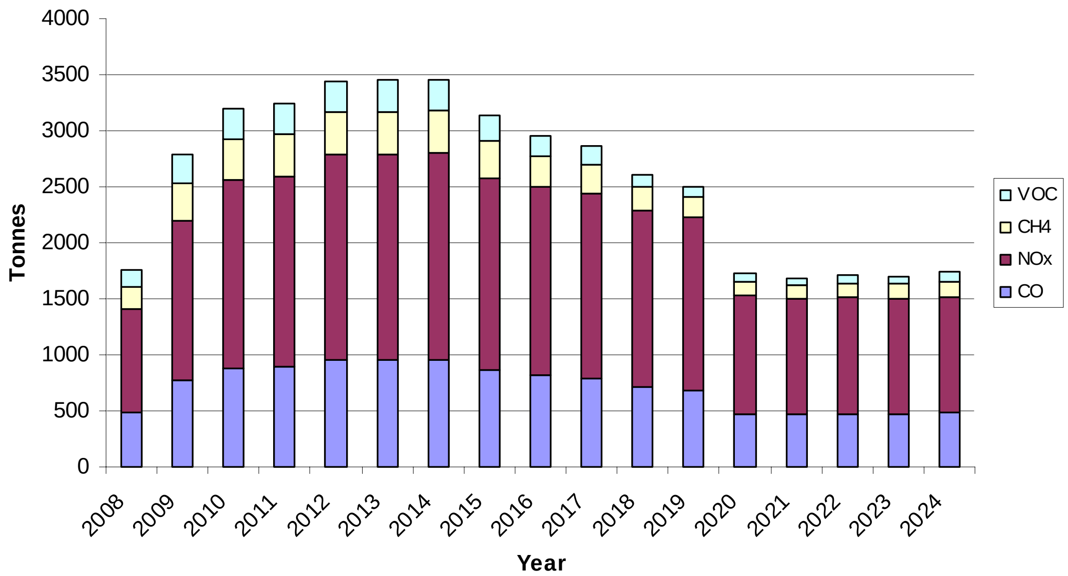
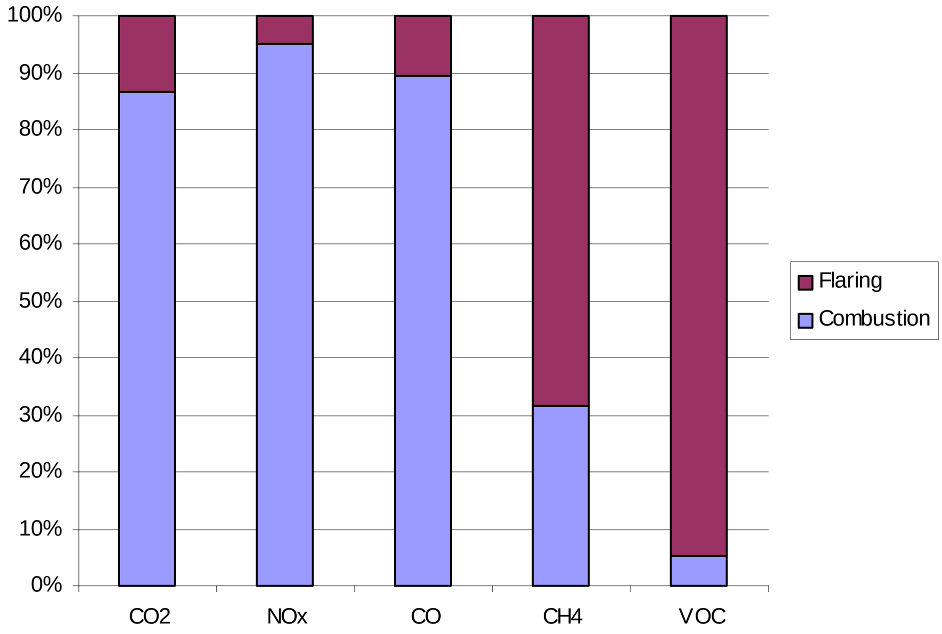


Figure 5.35 presents a breakdown of the offshore emissions by source expressed as a percentage of the total. Combustion emissions from generators used for power generation and water injection pumps constitute the largest sources of CO_2, CO and NO_X.

Figure 5.35 Total Offshore Emissions by Source (%)



5.10.2.2 Onshore Terminal Operation

Phase 3 terminal operations are anticipated to produce approximately 2,922,470 tonnes of CO_2 between 2008 and 2024. Figure 5.36 below depicts the annual CO_2 emissions for the duration of project operations including flaring. CO_2 emissions increase from 2008, peaking in 2010 at approximately 260,000 te declining gradually to just over 100,000 tonnes in 2024. The first three years of operations show increased CO_2 emissions due to increased flaring events predicted during start-up years.

Figure 5.36 Annual CO_2 Emissions for Onshore Operations (2008-2024)

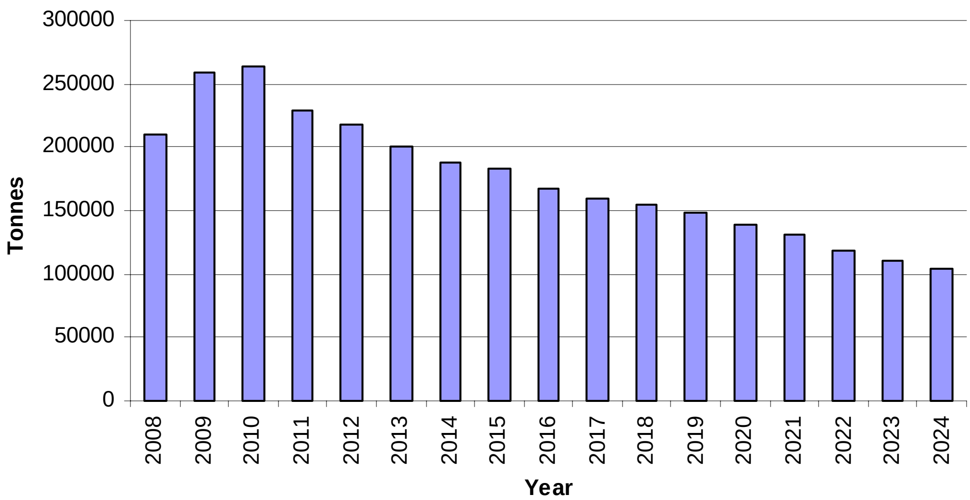


Figure 5.37 shows the trend in atmospheric emissions for other species released to the atmosphere; the trend in emissions during the operational phase is similar to that for CO_2 emissions described above. As observed for offshore operations (Figure 5.34), NO_X is the major species released to the atmosphere.

Figure 5.37 Other atmospheric emissions for onshore operations (2008-2024)

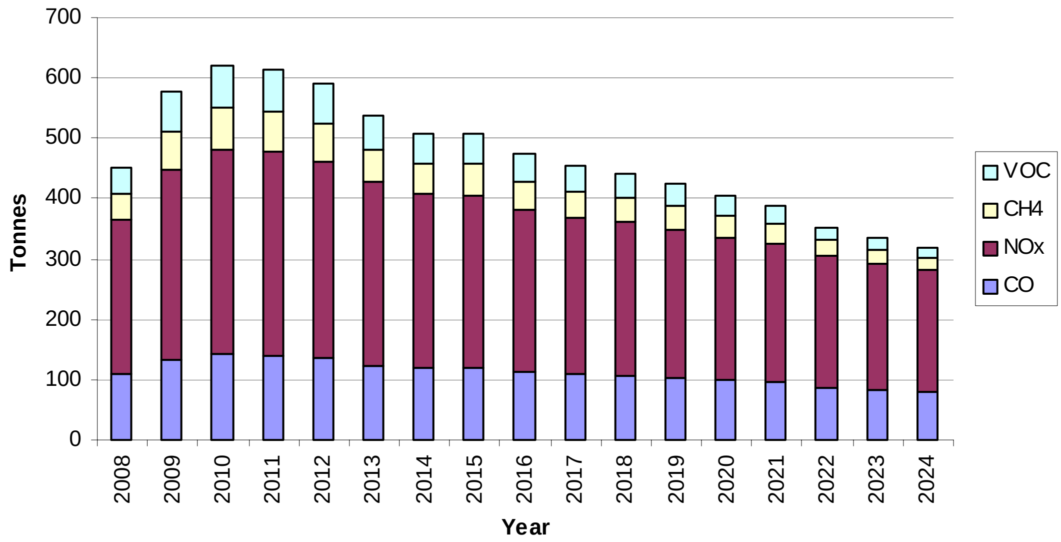
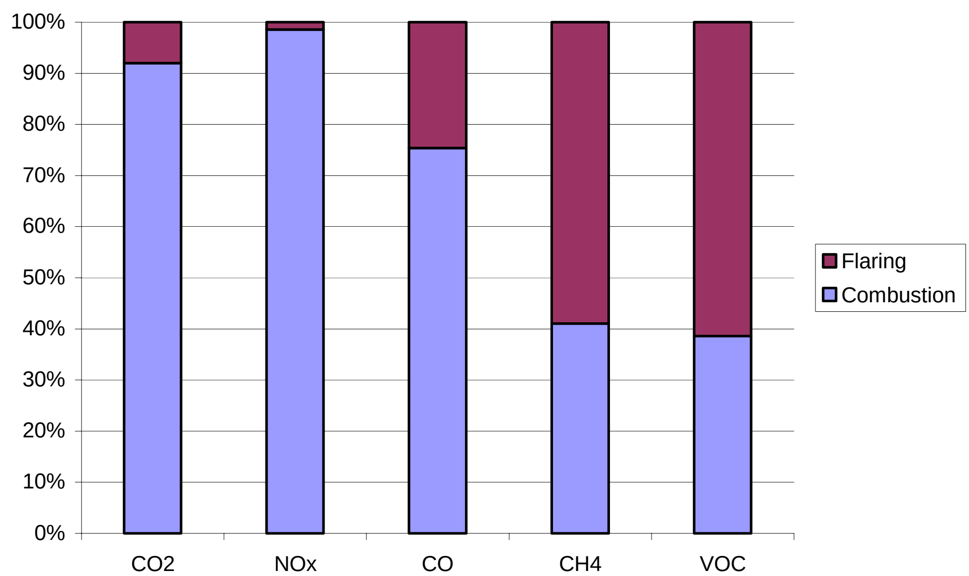


Figure 5.38 presents a breakdown of the onshore emissions by source expressed as a percentage of the total. Combustion emissions from RB211 generators for power generation and fired heaters used for crude oil separation and stabilisation and the dew point control units constitute the largest sources of CO_2, CO and NO_X.

Figure 5.38 Other Atmospheric Emissions for Onshore Operations (2008-2024)



5.10.2.3 Offshore Facilities Construction

Carbon dioxide is the major component of atmospheric emissions resulting from the construction and assembly of the DUQ and PCWU at 172,244 tonnes. Predicted atmospheric emissions resulting from construction of offshore facilities are illustrated in Figures 5.39 and 5.40. Emissions are mainly the result of power generation (~53 %) along with the use of plant and equipment (~47%).

Figure 5.39 CO_2 Emissions During Construction of DUQ and PCWU

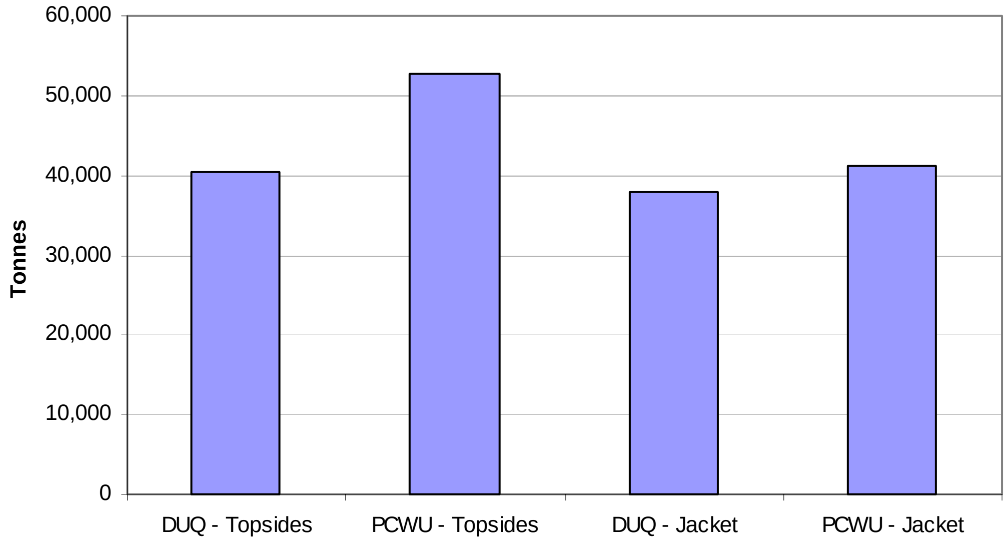
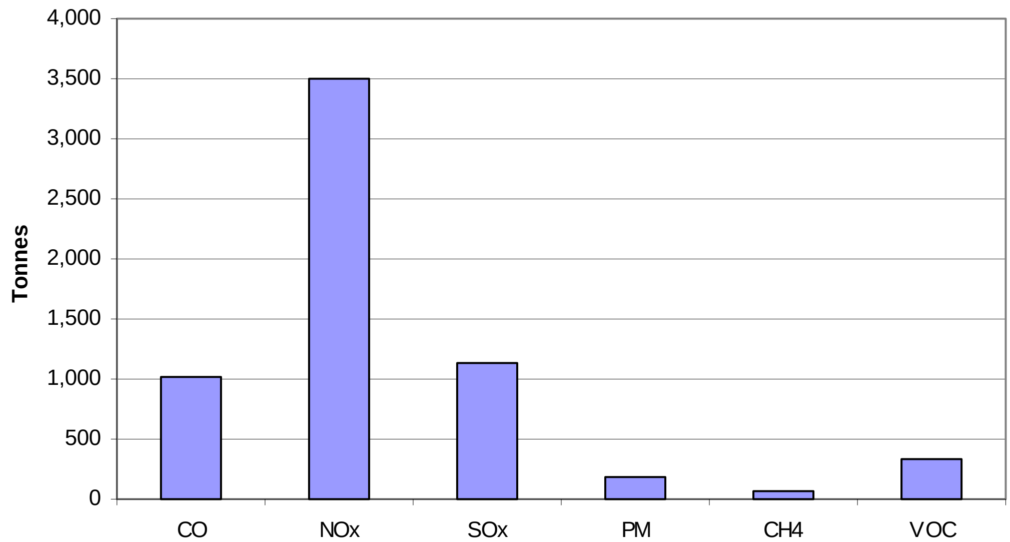


Figure 5.40 shows other atmospheric emissions associated with the construction of the DUQ and PCWU. NO_X is the major species released.

Figure 5.40 Other atmospheric releases during construction of DUQ and PCWU

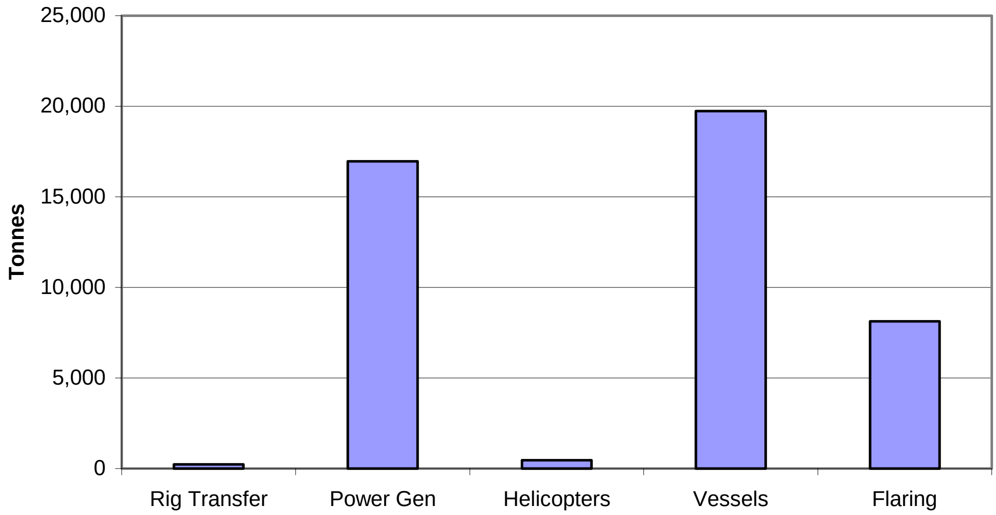


Note: PM = Particulate Matter

5.10.2.4 Pre-drilling

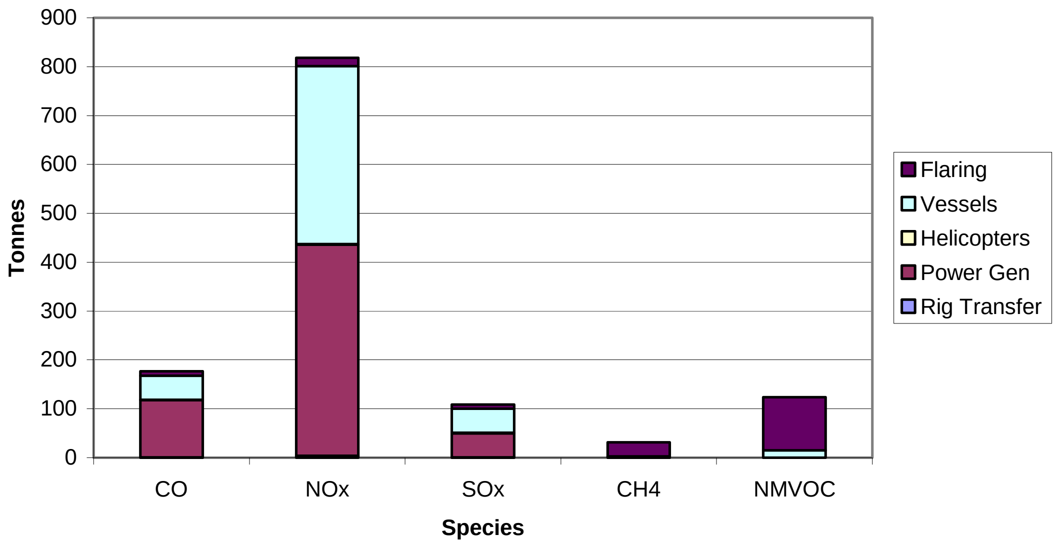
Pre-drilling results in the release of a total of 45,499 tonnes of CO_2. As illustrated in Figure 5.41, the largest contributors are power generation (37%), vessel operation (43%) and flaring (well testing) (18%).

Figure 5.41 CO_2 Emissions During Pre-Drilling



Other emission species are presented in Figure 5.42.

Figure 5.42 Other Atmospheric Releases During Pre-Drilling



5.10.2.5 Onshore Terminal Construction

Terminal construction is predicted to result in the release of 72,177 tonnes of CO_2, the vast majority of which derives from the use of plant and equipment (90%) as illustrated in Figure 5.43. Other atmospheric emissions are shown in Figure 5.44. Of these other atmospheric emissions, NO_X and SO_X are emitted in the greatest quantities, respectively 1,275 tonnes and 530 tonnes.

Figure 5.43 CO2 emissions to the atmosphere resulting from terminal construction

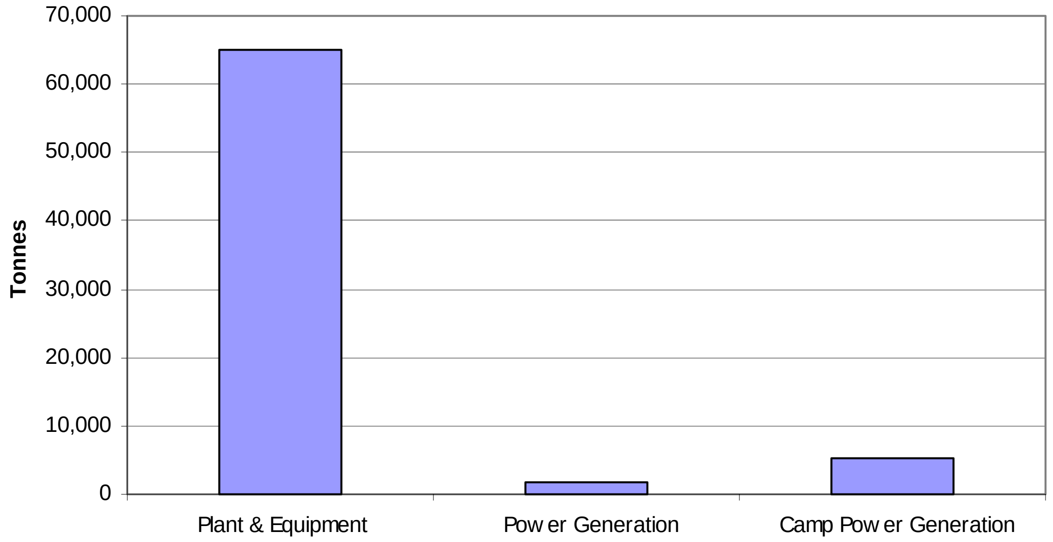
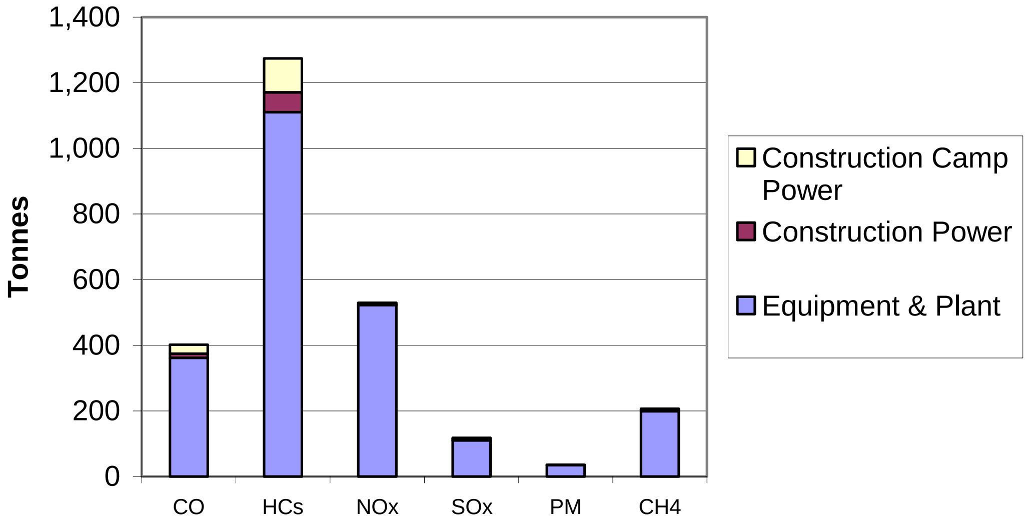


Figure 5.44 Other emissions to the atmosphere resulting from terminal construction



5.10.2.6 Offshore Facilities Installation, Hook-Up and Commissioning

A total of 48,667 tonnes of CO_2 is released as a consequence of the installation, hook up and commissioning of offshore facilities. Figure 5.45 provides a detailed breakdown by facility. Installation and commissioning of subsea infrastructure and water injection lines (except inter-field pipelines) is the major contributor of CO_2, producing almost 19,142 tonnes (40% of total emissions for offshore installation, hook up and commissioning). This is a consequence of the number of vessels and time required to install and commission subsea facilities. Other emissions are depicted in Figure 5.46. Again subsea installation is the major contributing activity and NO_X the major species released.

Figure 5.45 CO_2 Emissions for Offshore Facility Installation, Hook-Up and Commissioning

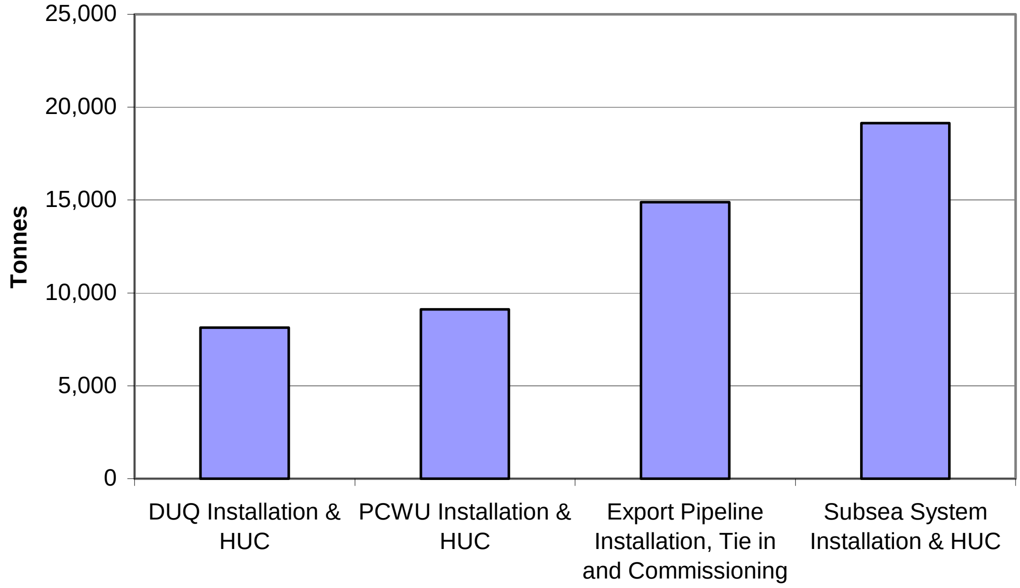
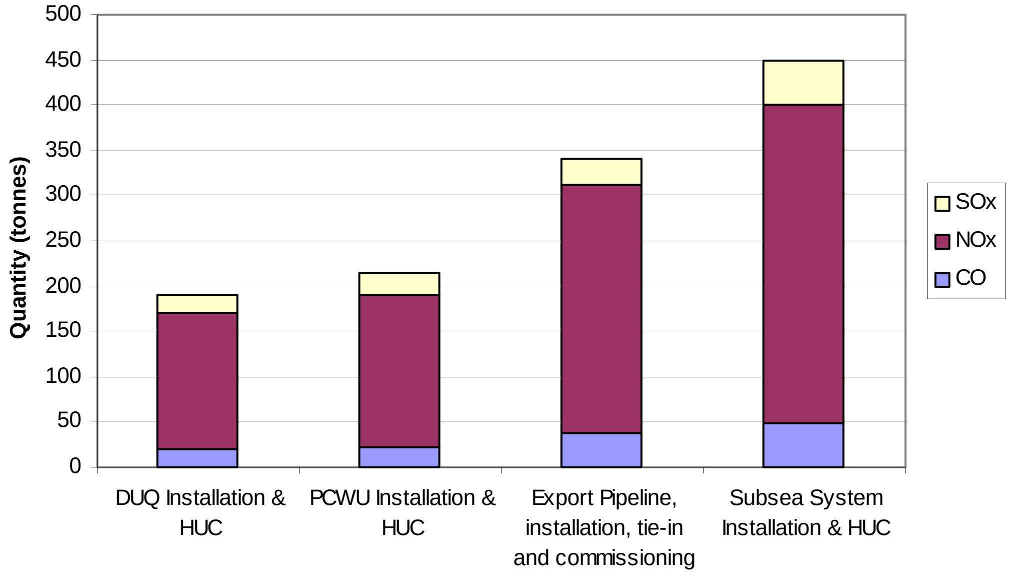


Figure 5.46 Other atmospheric emissions for installation, hook up and commissioning of offshore facilities (major species only)

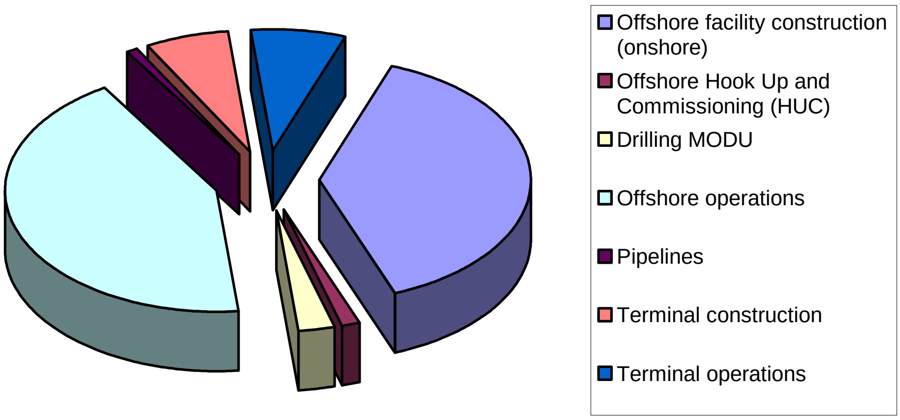


5.10.3 Effluents

5.10.3.1 Sewage

Sewage production figures are based on the conservative assumption that an individual produces 0.1 m^3 of black water and 0.22 m^3 of grey water per day. Figure 5.47 demonstrates that sewage production is greatest from offshore operations (392,000 m^3), with a substantial quantity also being generated by the construction of offshore facilities (355,000 m^3).

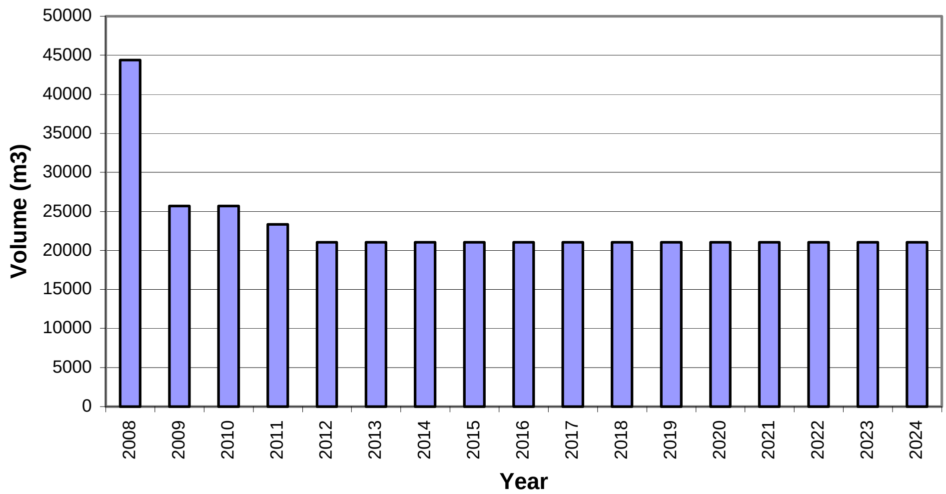
Figure 5.47 Total sewage production for ACG FFD Phase 3



5.10.3.2 Offshore Facilities Operation

Operation of offshore facilities results in the generation of 392,500 m^3 of sewage (based on manpower requirements). Sewage volumes generated per year by offshore operations are presented in Figure 5.48. It is expected that the number of personnel working offshore will decline rapidly within one year of operations commencing (i.e. post start-up), resulting in sewage production declining considerably between 2008 and 2009.

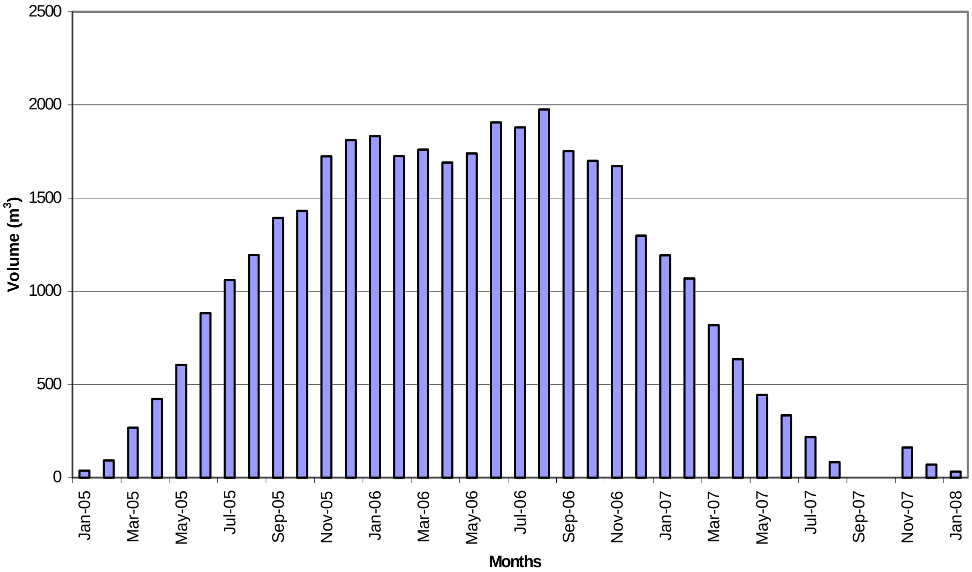
Figure 5.48 Annual Sewage Volumes Generated During Offshore Operations (2008-2024)



5.10.3.3 Offshore Facilities Construction

355,000 m^3 of sewage is generated during the construction of DUQ and PCWU topsides and jackets. A breakdown of the volumes generated annually is provided in Figure 5.49. Peak sewage production occurs between November 2005 and November 2006, corresponding with the predicted peak manpower period, reaching consistently above 1,500 m^3.

Figure 5.49 Monthly Sewage Volumes Generated During Construction of Offshore Facilities



5.10.3.4 Pre-Drilling

There will be 120 persons onboard (POB) during pre-drilling operations and the pre-drilling programme will last for up to 24 months (i.e. 730 days). On the basis that one person generates 0.22 m^3 grey water and 0.1 m^3 black per day, 19,272 m^3 and 8,760 m^3 of grey and black water respectively will be discharged to sea after treatment from the Dada Gorgud during the entire pre-drilling programme. That is an average of 26.4 and 12 m^3/day of grey and black water respectively. These volumes will elevate the oxygen demand in the waters close to the point of discharge but will disperse rapidly in these open waters.

5.10.3.5 Onshore Terminal Construction

The construction of onshore facilities at Sangachal terminal is anticipated to take 25 months, with a total of almost 190,000 person days required. Based on this, sewage production is estimated at 60,000 m^3 (7% of total sewage production).

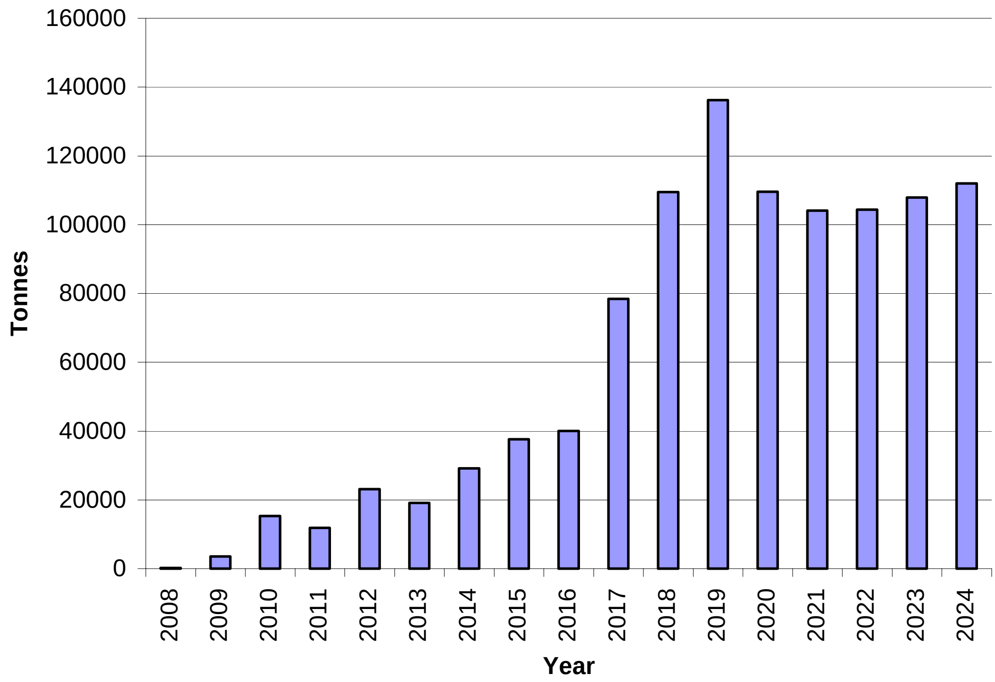
5.10.3.6 Onshore Terminal Operation

Onshore facilities at Sangachal terminal are expected to employ a total of 35 persons, sewage volumes produced, over life of PSA although significant (65,000m^3), are a relatively small proportion (7%) of overall sewage production.

5.10.3.7 Produced Water

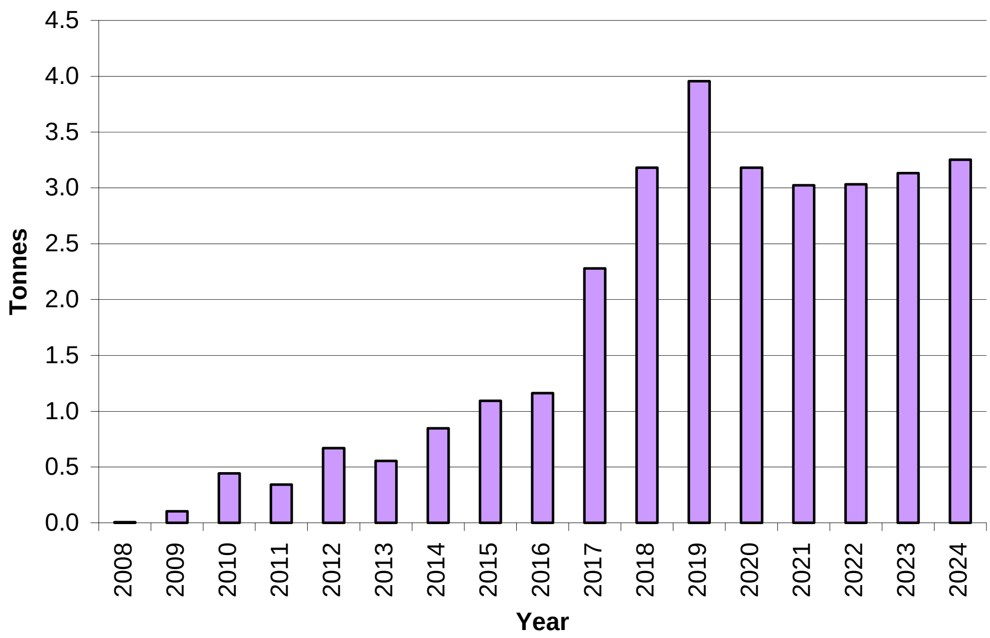
As discussed in Section 5.5.4, it is anticipated that produced water generated offshore could potentially be discharged to sea for up to 2% of operational time, this being, when the water injection system is unavailable. Figure 5.50 presents the anticipated volumes (tonnes) of produced water that may be discharged to sea.

Figure 5.50 Annual Produced Water Discharged to Sea During ACG Phase 3 Operations (2% Down-Time)



The produced water will be treated prior to discharge in order to remove sand and hydrocarbons. Residual hydrocarbon concentrations will be less than 29 mg/l, on a monthly average. Figure 5.51 presents the total volume of oil that may be discharged to sea annually as a result of the discharge of produced water.

Figure 5.51 Annual Oil Discharged to Sea During ACG Phase 3 Operations (2% Down-Time)

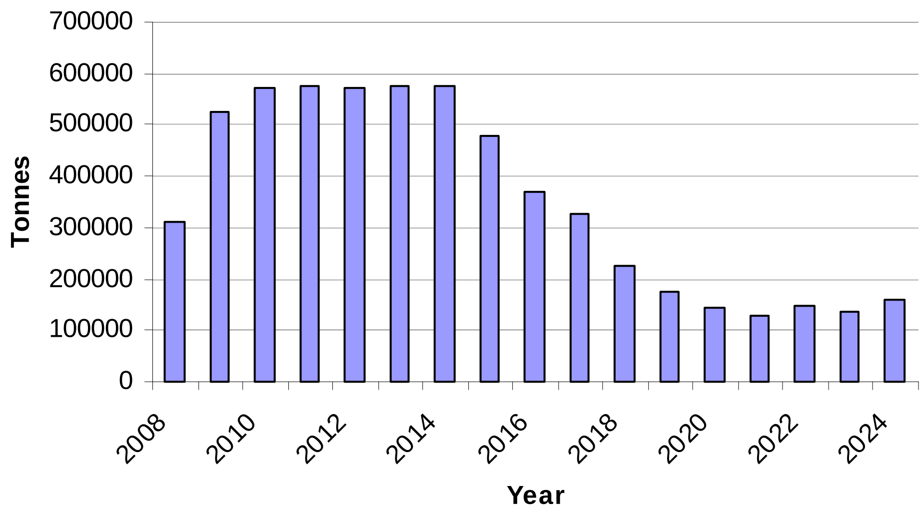


5.10.3.8 Cooling water

Seawater will be lifted at the platforms for use as cooling water. Each seawater pump will have a normal operational lift capacity of 1,718 m^3/hr. The demand for cooling water (seawater) will however, vary over the life of the field and therefore, the actual amount of seawater that will be lifted will also vary.[1] The cooling water will, once used in the cool medium, be injected along with the produced water for reservoir pressure maintenance.

The current design and reservoir profile indicates that no cooling water will need to be discharged to the Caspian Sea during routine offshore operations as the volumes required for injection are always larger than the combined produced water and cooling water volumes. Cooling water will however, need to be discharged in the event of unavailability of the water injection pumps. This is anticipated to be 2% of operational time. Figure 5.52 shows the predicted amount of cooling water that will need to be discharged to the Caspian Sea over the life of the field.

Figure 5.52 Annual Cooling Water Discharges to Sea During ACG Phase 3 Operations (2% Down-Time)



5.10.4 Hazardous and Non-hazardous waste

AIOC is committed to managing and disposing of wastes in a manner that minimises environmental impacts and is in line with corporate policy requiring international best practice to be achieved. The waste streams included in this section are those that require disposal onshore, therefore WBM cuttings and other streams discharged offshore are not included. Section 10.2.2 provides the final disposal routes for these wastes.

5.10.4.1 Offshore facilities construction

The data presented in this section is based on real waste volumes generated during the construction of offshore facilities for the ACG Phase 1 Project. Given the similarities between ACG Phase 3 and Phase 1 in terms of the scale of construction operations and the type of facilities constructed, it is expected that wastes generated during 2003 provide a reliable indication of the wastes likely to be produced during ACG Phase 3 construction on an annual basis. Major hazardous and non-hazardous waste streams generated during the onshore construction of offshore facilities are detailed in Table 5.22. Figure 5.53 depicts the quantities

[1] The main cooling demand on the platforms will be the gas processing equipment. The amount of associated gas that will be separated from the hydrocarbon stream will vary over the life of the field and therefore, utilisation of the equipments' design capacity will not always be 100%. On this basis, equipment cooling requirements will also vary.

of hazardous and non-hazardous wastes generated during ACG Phase 1 offshore facility construction. Out of a total waste production of 15, 780 m^3 in 2003, 97% was non-hazardous, with the topside construction programme generating the most significant waste volume. Figure 5.54 shows the waste production by activity during the ACG Phase 1 offshore facility construction work.

Table 5.22 Typical waste streams generated during offshore facility construction[2]

Category	Treatment	Current Disposal Route
Non-Hazardous Waste		
General waste	Landfill	Municipal Waste Site
Canteen waste	Landfill	Municipal Waste Site
Cooking oil	Recycle	Karvan-L Plant
Drums metal	Wash and re-use	Baku Steel Company or re-use by originator or Karvan L
Drums plastic	Wash and re-use	Re-used by originator or Karvan L
Electrical cables	Recycle	Baku Steel Company
Used air filters	Landfill	Municipal Waste Site
Grit blast	Landfill (bagged)	Municipal Waste Site
Ferrous metal	Recycle	Baku Steel Company
Paper and card	Recycle	Azersun Carton Factory
Plastic	Landfill	Municipal Waste Site
Rubber hose	Landfill	Municipal Waste Site
Stainless steel	Recycle	Baku Steel Company
Tyres (used)	Re-use	Re-used by originator
Wood/waste timber	Donate to local community	Local community via World Vision
Hazardous Waste		
Absorbent materials	Incineration	Ecoservices
Batteries	Temporary storage	Serenja
Bilge water / oily water	Treatment and re-use	Ecoservices
Chemicals Clinical waste	Temporary storage Incineration	Serenja Central Clinical Hospital
Fluorescent tubes	Temporary storage	Serenja
Grease	Temporary storage	Serenja
Hydraulic oil / lubricants / used oil	Re-use	Karvan-L Factory
Used oil filters	Incineration	Ecoservices
Oily rags	Incineration	Ecoservices
Oily soils	Temporary storage	Serenja
Paint cans and sludges	Temporary storage	Serenja
Solvents (including thinners)	Treatment and re-use Temporary storage	Karvan-L Factory Serenja

[2] These disposal routes are based on the current contractors used. This list may change as new companies become known and fulfill all the necessary criteria.

Figure 5.53 Hazardous and Non-Hazardous Wastes Produced (m^3) During ACG Phase 1 Offshore Facility Construction, 2003

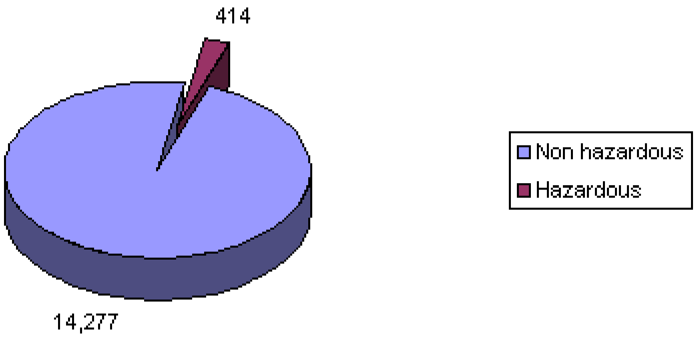
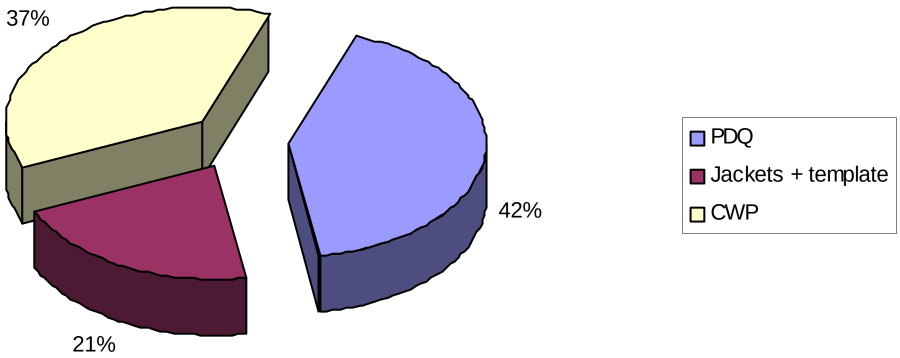


Figure 5.54 Waste Production by Activity During ACG Phase 1 Offshore Facility Construction Work, 2003



5.10.4.2 Pre-drilling

Waste production from pre-drilling operations associated with the ACG Phase 1 project are detailed in Table 5.23 below. Given the similarity in scale it is anticipated that waste production for Phase 3 pre-drilling operations will be comparable with Phase 1.

Table 5.23 Waste Volumes Generated During ACG Phase 1 Pre-Drilling Operations (1 year)

Waste stream	Unit	Quantity	Disposal Route Options
Domestic/General Waste	MT	80	Reuse/recycle where possible, otherwise landfill
Drill Cuttings (NWBM drilling)	MT	9,000	Temporary storage. Thermal Desorption treatment under temporary MENR approval
Oil contaminated Rags, Wood & Packaging	MT	36	Temporary storage at controlled site, potential for incineration or landfill
NMBM residues	MT	65	Temporary storage at controlled site
Thread Protectors	MT	17	Recycled where possible
Liquid Oily Wastes	m3	19	Treatment and disposal at local contractor
Medical	m3	1	Hospital Incinerator
Chemicals	MT	1	Reuse & treatment and disposal at local contractor where possible, otherwise temporary storage at controlled site
Fluorescent Tubes	number	800	Temporary storage at controlled site
Scrap Metals	MT	22	Recycle at Baku Steel
Drums	number	265	Wash and crush where possible, prior to reuse or landfill

5.10.4.3 Offshore Facilities Operation

Tables 5.24 and 5.25 detail the typical wastes and predicted waste volumes generated offshore on an annual basis during the operational phase.

Table 5.24 Typical operations waste streams and current disposal routes[3]

Category	Treatment	Current Disposal Route
Non-Hazardous Waste		
General waste	Landfill	Municipal Waste Site
Canteen waste (onshore)	Landfill	Municipal Waste Site
Cooking oil	Recycle	Karvan-L Factory
Drums metal	Wash and re-use or recycle	Baku Steel Company or re-use by originator or Karvan L
Drums plastic	Wash and re-use or landfill	Re-used by originator or Karvan L
Electrical cables	Recycle	Baku Steel Company
Used air filters	Landfill	Municipal Waste Site
Grit blast	Landfill (bagged)	Municipal Waste Site
Ferrous metal	Recycle	Baku Steel Company
Paper and card	Recycle	Azersun Carton Factory
Thread protectors	Recycle	Ecoservices
Plastic	Landfill	Municipal Waste Site
Stainless steel	Recycle	Baku Steel Company
Tyres (used)	Re-use	Re-used by originator
Wood/waste timber	Donate to local community	Local community via World Vision
Hazardous Waste		
Absorbent materials	Incineration	Ecoservices
Batteries / transformers	Temporary storage	Serenja
Bilge water / oily water	Treatment and re-use	Ecoservices or ATT
Chemicals	Temporary storage Sitara says some can be reinjected at terminal	Serenja
Clinical waste	Incineration	Central Clinical Hospital
Fluorescent tubes	Temporary storage	Serenja
Grease	Temporary storage	Serenja
Hydraulic oil / lubricants / used oil	Re-use	Karvan-L Factory
Used oil filters	Incineration	Ecoservices
Oily rags	Incineration	Ecoservices
Waste oil	Reuse	Karvan-L
Oily soils	Temporary storage	Serenja
Process and produced water	Reuse	Garadagh Cement Plant
Production chemicals	Reuse or temporary storage	Supplier or Ecoservices (reuse) or Serenja (storage)
Pigging wax	Recycle	Ecoservices
NWBM drill cuttings, produced sand (when CRI not available)	Thermal desorption or bioremediation	Serenja
Paint cans and sludges	Temporary storage	Serenja
Solvents (including thinners)	Treatment and re-use	Karvan-L Factory

[3] These disposal routes are based on the current contractors used. This list may change as new companies become known and fulfill all the necessary criteria.

Table 5.25 Annual waste volumes generated during offshore operations (m^3)

Category / Waste Type	Annual waste volumes generated			
	<10 m^3	<100 m^3	<500 m^3	>500 m^3
Non-Hazardous				
Domestic/General Waste			♦	
Paper	♦			
Wood / Packaging	♦			
Scrap Electrical Cables		♦		
Scrap Metals			♦	
Plastic	♦			
Hazardous				
Drill Cuttings (NWBM drilling)				♦
Pigging Wax / Residues	♦			
Oily Contamnated Rags & Packaging		♦		
Bilge Waters & Tank Washings		♦		
Oily Sands / Grit Blast Material		♦		
SBM residues	♦			
Thread Protectors	♦			
Liquid Oily Wastes		♦		
Medical	♦			
Production Chemicals	♦			
Batteries / Transformers		♦		
Paint Cans & Sludges	♦			
Drums		♦		
Used Oil Filters	♦			
Hydraulic Fluid	♦			
Drilling Chemicals		♦		

From Table 5.25 it is evident that drill cuttings are the major waste stream generated by offshore operations. Based on the number and type of wells to be drilled during Phase 3 platform drilling programme, a total of 9,500 m^3 of lower hole NWBM drill cuttings will be generated, which will be re-injected.

5.10.4.4 Onshore terminal construction

Waste production figures are available for terminal construction activities taking place over a six month period during 2003. The data indicates that the vast majority of wastes generated are non-hazardous (9,000 m^3 per month), compared to hazardous wastes of only 22 m^3 per month.

5.10.4.5 Onshore terminal operation

Operational wastes generated by Sangachal terminal during the Early Oil Project in 2002 are provided in Table 5.26. The types of waste generated provide an indication of likely waste streams that will be produced during Phase 3 operations at the terminal. Volumes are not comparable.

Table 5.26 EOP Operational Wastes Generated by Sangachal Terminal in 2002

Waste stream	2002 (Tonnes unless otherwise shown)	2003 Tonnes unless otherwise shown)
General waste	15.2	23.1
Vegetation	2.8	5.2
Wax and sludge	49.82	28.8
Oily materials	4.82	15.4
Fluorescent tubes	0.01	0.003
Asphalt	1	40
Drums	53 (by number)	35 (by number)
Construction waste	-	8
Scrap metal	0.3	-
Medical waste	0.01	0.015
Batteries	0.05	0.9
Process and produced water	8951 m3	45711 m3
Used UPS (electric accumulator)	0.65	-
Aluminia dessicant	-	0.3
Contaminated gravel and soil	-	5.72
Grit	-	30.6

6 Environmental Description

Contents

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6.1 Introduction

This chapter defines and describes the environment within which the ACG Phase 3 Project will take place. The ACG Phase 3 ESIA covers activities in locations common to the ACG Phase 1 ESIA (URS, 2002) and the ACG Phase 2 ESIA (RSK, 2003), therefore, this chapter draws largely on these reports and identifies key environmental sensitivities against which project impacts will be assessed.

This chapter adds to the previous environmental descriptions in the following respects:

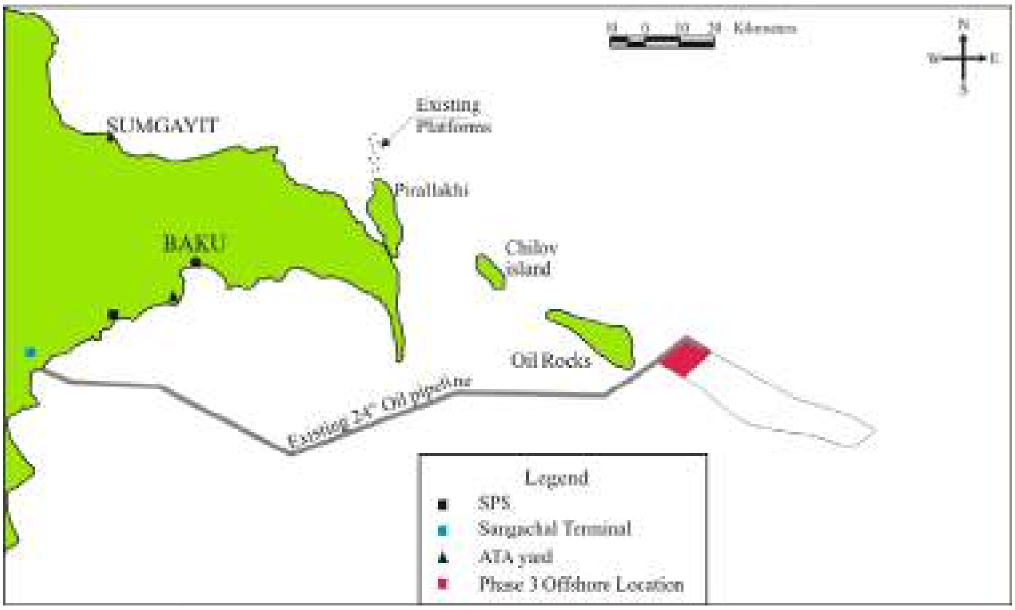
- The incorporation of onshore data which has become available since the submission of the Phase 2 ESIA specifically, a study of the wetlands near Sangachal Terminal, a 2003 and 2004 survey of bird populations in the coastal zone, and a desk study which models surface water flows in the watersheds surrounding Sangachal Terminal.
- The integration and re-assessment of all the available nearshore and offshore marine monitoring data, including data not available at the time of submission of the Phase 2 ESIA (a baseline survey of the West Chirag area).

The onshore environment includes Sangachal terminal and the ATA and SPS yards. All Phase 3 activities and resulting infrastructure will be contained within the existing terminal boundary. Previous ESIAs have described in some detail the area in and around Sangachal terminal. This section will summarise that information and will incorporate the additional information mentioned above.

A brief description of the environment in which the ATA and SPS yards are located is also provided. These facilities may be utilised for construction and fabrication of infrastructure required for Phase 3 of the FFD. Should activities take place at either yard these activities will be restricted within existing boundaries. Although some uncertainty remains regarding the utilisation of these yards, for the purposes of completeness, they are included in the environmental baseline.

For the purpose of the Phase 3 project the offshore environment is the ACG Contract Area (See Figure 6.1). The Contract Area is approximately 40 km in length, 11.5 km wide, and lies in the Middle Caspian. The location of Phase 3 offshore facilities is shown in Figure 6.1 and a fuller description given in Chapter 5- Project Description.

Figure 6.1 Location of project



6.1.1 Data Sources

A series of environmental surveys and data reviews have been carried out in and around the ACG contract area, pipeline route, nearshore environment at Sangachal Bay and onshore environment in the vicinity of Sangachal terminal. These surveys have been drawn upon as the main information sources for the description of the environment provided below. Table 6.1 lists the documents reviewed. Documents that have become available since the submission of the Phase 2 ESIA are highlighted.

Table 6.1 Data sources

Date	Title of Survey
Marine Surveys	
1992	Pilot Environmental Survey, Chirag oilfield
1995	Environmental baseline study: Review of the existing scientific literature
1995	AIOC Offshore Environmental Baseline Survey 1995, September and December
1996	Pipeline landfall survey: sediments and macrobenthos
1996	AIOC Contract Area Long Term Monitoring Stations, 1996
1996	AIOC Appraisal Well 1 Pre and Post Appraisal Drilling Seabed Environmental Survey
1996	Sangachal coastal environmental survey, 1996
1997	AIOC Appraisal Well 1 Pre and Post Appraisal Drilling Seabed Environmental Survey
1997	AIOC Appraisal Well GCA No. 3 GCA No. 4, Post Appraisal Drilling Surveys
1998	AIOC Chirag 1 mid drilling environmental survey, 1998
1998	AIOC Phase 1 environmental description, 1998 (draft)
1998	Phase 1 Platform 1a and 1b environmental baseline surveys
1999	Review of AIOC environmental monitoring, 1999
1999	Chevron Absheron Exploration Drilling EIA
1999–2001	Gunashli field fisheries surveys
2000	Chirag 1 post Saraline survey, 2000
2000	GCA 5 and 6 post well survey, 2000
2000	Chirag - Sangachal sub-sea pipeline survey, 2000
2000	Sangachal coastal environmental survey, 2000
2001	ACG Phase 1 ESIA Surveys
2001	SD1 (and pipeline) survey
2001	GCA7 environmental survey (ACG Phase 3 offshore area)
2000-2001	Sangachal fisheries monitoring programme
2002	ACG Phase 2 environmental survey
2003	West Chirag environmental baseline survey
Terrestrial Surveys	
1996	EOP Sangachal Terminal survey
2001	Phase 1 Terrestrial Survey
2002	Phase 2 Terrestrial Survey
2002/2003	Overwintering bird survey, Absheron to Kura
2003	Sangachal Terminal Watershed Analysis
2003	Sangachal Wetlands Survey Summer/Autumn 2002
2003	BP Technical Note, Environmental and Socio-economic Assessment C&WP Topsides Construction and Fabrication Programme ATA Yard
2004	BP Logistics Supply Base Development Project, Environmental and Socio-economic Impact Assessment, Draft Report.
2004	Overwintering bird survey, Absheron to Kura

6.2 Physical Environment - General

6.2.1 Geology and Geomorphology

A detailed description of the geology and geomorphology of the Caspian region, and specifically the ACG contract area, can be found in the Phase 2 ESIA, Section 6.2.1. A description of seabed geology and topography for the Deep Water Gunashli area where Phase 3 drilling and production activities will take place is provided in Section 6.4.1.1.

6.2.2 Seismicity and tectonics

Azerbaijan is known for its seismic activity, particularly in the Greater and Lesser Caucasus Mountains. Seismic activity is also evident offshore; in addition to the presence of mud volcanoes on the seafloor, the epicentre of the most recent earthquake on 25th November 2000 was in the Caspian, 30km east-north-east of Baku. Five earthquakes with a magnitude greater than 6.0 on the Richter scale have occurred since 1842; the most recent measured 6.5.

6.2.3 Coastal Morphology and sea level change

The coastal morphology of Azerbaijan is fully described in the Phase 2 ESIA (Sect. 6.2.2) and is not repeated here. Where relevant, for instance if oil spill modelling shows potential coastline impacts, the nature of the coastline at those points potentially impacted will be described within the relevant discussion.

6.2.4 Climatic conditions

Climatic data is based upon data collected from the meteorological station at Alyat, approximately 25km south of Sangachal, with the exception of wind data that has been obtained from Baku Airport meteorological station. The Baku Airport wind data is considered to be representative of conditions in the study area and is more reliable than other datasets available.

6.2.4.1 Temperature

Nearshore and onshore

The Sangachal area is classified as being warm, semi-arid steppe, with an annual mean air temperature of 14.4 °C. July, with an average air temperature of 26.4 °C, is the warmest month, while January, with an average of 0 °C, is the coldest. Temperature extremes of 41 °C and –16 °C have been recorded in July and January respectively.

Offshore

Air temperatures show considerable seasonal variation in the Caspian area. According to Kosarev and Yablonskaya (1994), average air temperatures above the Caspian Sea itself typically peak at 25.5 °C during the summer, and may drop to 0 °C for some periods in the winter.

6.2.4.2 Precipitation

Nearshore and onshore

The Sangachal area is one of the driest in Azerbaijan. Based on data from Alyat meteorological station, mean annual rainfall over the period from 1977 to 2000 was 217 mm. The highest monthly rainfalls are recorded in November, receiving an average of around 32 mm/month, with the drier periods occurring during July, receiving an average of 3 mm/month. October to March is the period of greatest rainfall with intensities often exceeding 25 mm/day.

Offshore

Table 6.2 provides rainfall data from the Absheron Peninsula for 1999 and 2000 on a monthly basis The Absheron Peninsula experiences relatively dry summers and winters with rainfall increasing in the spring and autumn months and it is expected that rainfall in the ACG Contract Area would be similar to the data listed in Table 6.2.

Table 6.2 Absheron Peninsula 1999 and 2000 rainfall data (mm) (FAO, 2001)

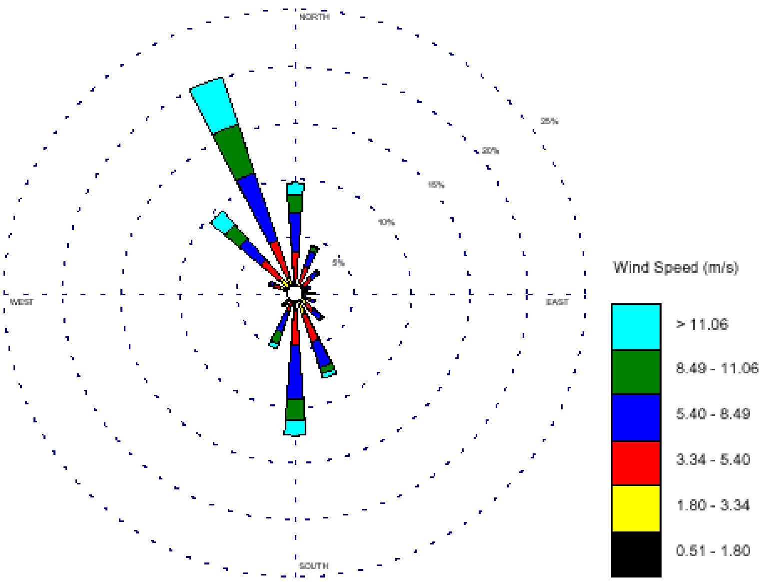
Year	J	F	M	A	M	J	J	A	S	O	N	D	Total
1999	14	7	46	34	52	26	41	53	60	41	61	5	440
2000	46	20	34	18	45	20	2	15	45	64	44	33	386

6.2.4.3 Wind

Nearshore and onshore

The wind regime of Sangachal Bay is on the whole consistent with that for the Absheron peninsula, although it is recognised that there is a local thermally driven wind system. The effects of the local system are most noticeable offshore within the bay, resulting in a slight (1-2 $m.s^{-1}$) offshore wind during the early hours of the morning, which then drops and becomes a stronger onshore wind as the land heats up. This thermal influence coupled with the meteorological dynamics of the region can result in strong winds occurring with little forewarning. Figure 6.2 shows a wind rose compiled from data collected over the period between January 1999 and October 2001 at Baku airport.

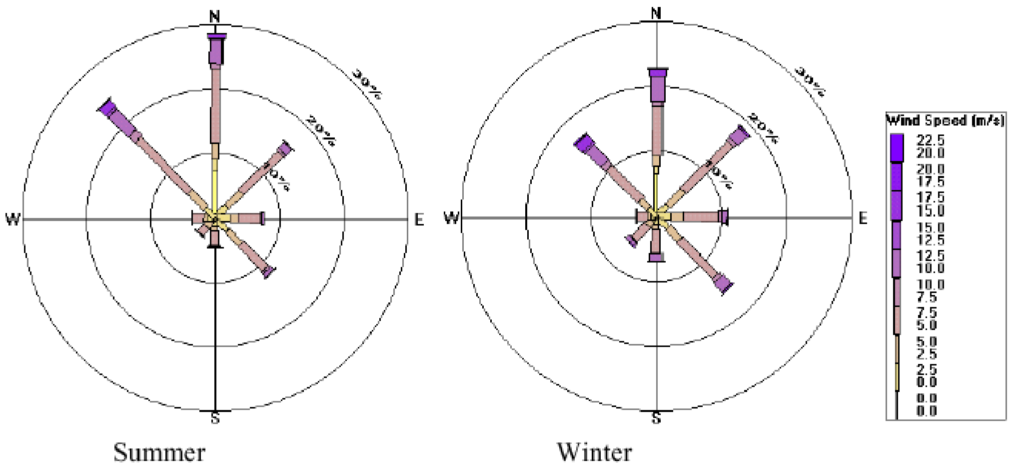
Figure 6.2 Annual wind rose for the Sangachal area (data from Baku airport)



Offshore

Wind conditions have been calculated from isobar maps over a 9 year period between 1980 and 1989 (Figure 6.3).

Figure 6.3 Summer and Winter wind roses for the ACG area (data from BMT, 1997)



6.2.5 Noise

6.2.5.1 Onshore

Noise in the vicinity of the terminal was measured during a baseline survey carried out over a period of 3 days in November 2001 (includes contribution from normal operations at the site). Noise measurements were taken at the Umid and Umbaki Settlements, the West Hills herding settlement (due to be relocated), and a roadside Cafe/Garage. The locations of these sites are shown in Figure 6.4. Table 6.3 provides the noise level summaries for these sites.

Table 6.3 Measured noise levels at receptors from the Baseline Noise Survey

Location	Noise Level, dB (A)			
	L_{eq}		L_{90}	
	Day Time	Night time	Day Time	Night time
Roadside Cafe	59-67	54	46-52	45
Umid Settlement	48	45	41-45	40
Cheylidag (Azinkend) Settlement	43-48	42	38-41	38

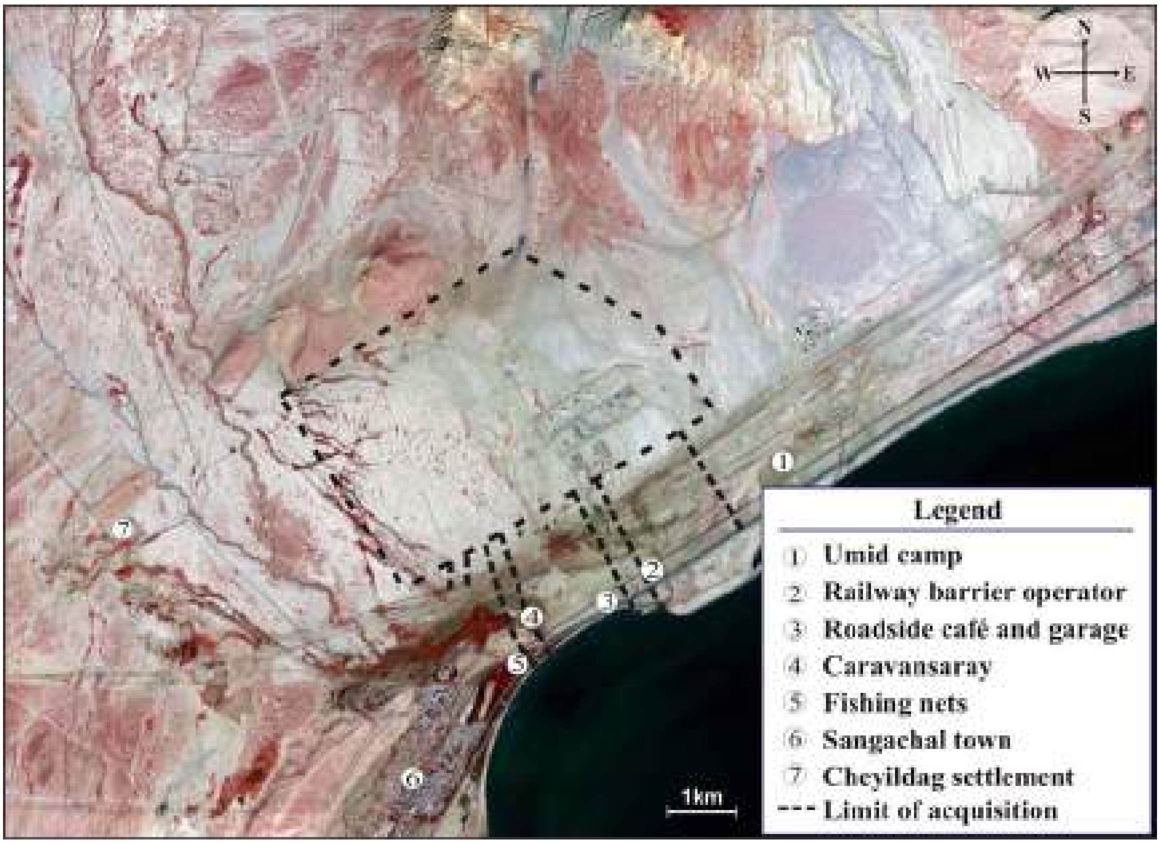
A night time measurement at the herder settlement was not possible, levels shown for night time were actually measured in the early morning.

Referring to Table 6.3, the L_{eq} figure is a measure of the equivalent continuous sound level, that is, the sound level averaged over a period of time. The L_{90} is a measurement of the background noise level. As context, the L_{eq} measurements taken during the day and at night at the Roadside Cafe are below the World Bank Guidelines for commercial properties of 70dB(A) both day and night. For the residential properties (Umid and Cheylidag settlements) noise levels are also below the World Bank Guidelines set at 55 dB (A) for day and 45 dB (A) for night.

Since the 2001 noise survey, noise measurements have been taken at several locations in the vicinity of the terminal as part of a compliance monitoring programme for the terminal expansion project. These show that most measurements still fall below the World Bank threshold levels. Exceedences have occurred on occasion due to project activity, e.g. 71dBA has been recorded at Roadside Café, due to adjacent pipe lay activity, or in most cases to unrelated events, e.g. passing trains or high winds.

At the time of writing noise monitoring data was not available for the ATA and SPS yards.

Figure 6.4 Location of existing EOP terminal, and nearby sensitive receptors.



6.2.5.2 Offshore

There have been no subsea noise measurements taken in the vicinity of the existing ACG offshore facilities.

6.2.6 Marine pollution sources

In general terms the greatest volumes of pollutants enter the Caspian via rivers, especially the Volga, Ural, Terek, and Kura. It has been estimated that during the period 1986-1990, the annual input of oil and oil products was 100,000 tonnes (Kosarev and Yablonskaya, 1994). About 90% of river discharges enter the north Caspian.

Pollution enters the western coastal areas of the south Caspian from domestic and industrial sources along the coast and also via the rivers, in particular the Kura River. The most polluted waters are off the coast of Sumgait, on the north side of the Absheron Peninsula, and Baku Bay. The main sources of pollution are the oil refineries, oil production plants, the Baku sewerage system and the Sumgait industrial complex. Recent economic decline has reduced industrial activity resulting in a reduction of approximately 25% in discharges. In addition, Azerbaijan has been taking measures to reduce environmental pollution. During the last decade, 59 water protection measures have been implemented and approximately 170 wastewater treatment facilities have been constructed. As a result of these measures, the projected capacity of the treatment facilities of the country has increased by a factor of 4 from 1.28 to 4.46 million m^3 per day. These measures are not sufficient to treat current levels of wastewater discharge. Azerbaijan annually discharges approximately 300 million tonnes of highly contaminated and 300 million tonnes of normally treated sewage. As a result, these waters bring 4,000 tonnes of oil products, 28,000 tonnes of suspended solids, 550,000 tonnes of solid residue, 74,000 tonnes of sulphates, 150,000 tonnes of chlorine and 300,000 tonnes of surfactants, as well as introducing 5 tonnes of phenols and other hazardous substances into the Caspian Sea (UNDP, 1997).

The Kura River is a major source of contaminant discharge to the south Caspian. During the period from 1970 there was intensive development of mining, metallurgical, chemical and processing industries, as well as energy production and agricultural irrigation. This, together with a rapid increase in water consumption and sewage discharges to the river basin, resulted in a significant decrease in the water quality of the Kura River and its large tributaries (Mamedov, 1999). More than 74% of the Kura River's water enters the system from outside of Azerbaijan and its overall ecological status is dependent to a significant extent on the conditions in neighbouring countries (UNDP, 1997).

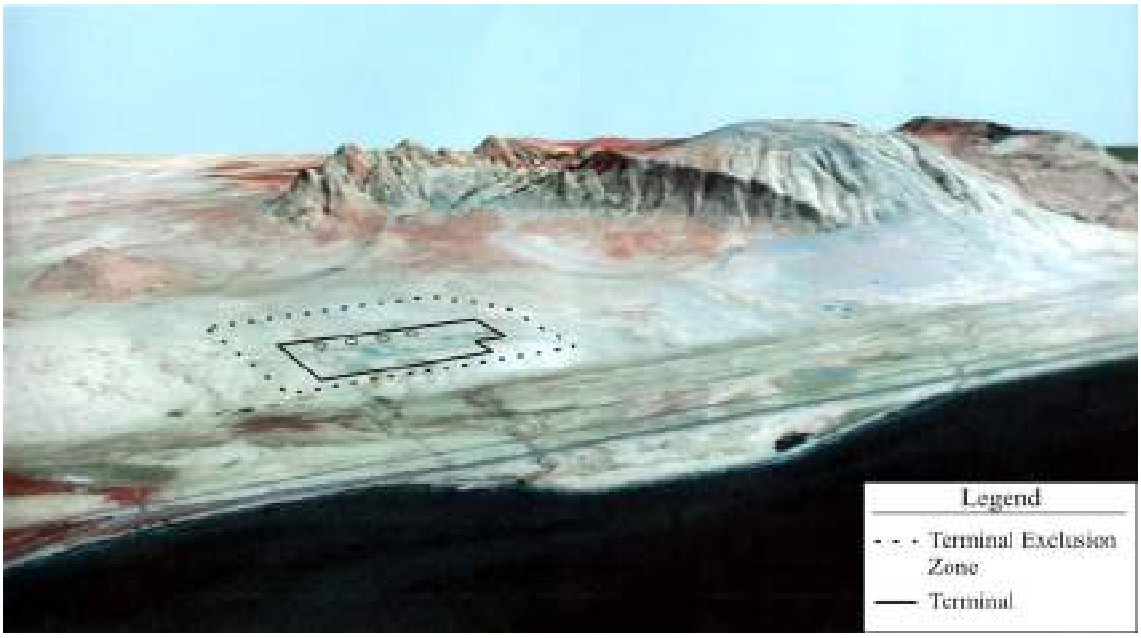
6.3 Terrestrial and Coastline Environment

6.3.1 Physical Environment

6.3.1.1 Topography and landscape

The Sangachal terminal is located in a semi-desert area, close to the centre of a flat, low-lying basin that occupies an area of around 32 km^2 along the margin of the Caspian Sea. Within the basin the land surface is typically 12 to 14 m below the world ocean datum (taken to be the Baltic Sea in Former Soviet Union (FSU) countries) and is approximately 10 to 12 m above the local sea level. The land rises sharply to the north of the basin to form a range of steeply sloping hills with a maximum elevation of 300 to 400 m above the world ocean datum (See Figure 6.5). Across the site, ground surface elevations rise gradually from the Sangachal terminal to the north west. Topography in the vicinity of Sangachal terminal is fairly uniform with gentle undulations of less than a metre. A railway and highway run parallel to the coastline approximately 100 m inland. From the road, the terrain gradually slopes 10 m down to the beachfront. In addition to the rail and road infrastructure, the area is also crossed by a number of underground and above ground pipelines (oil, water and gas), and contains a number of poorly abandoned exploration wells.

Figure 6.5 Topography surrounding Sangachal terminal



The coastline of Sangachal Bay is formed from sedimentary deposits and vegetated with fragmented areas of reeds and seagrass. The seabed slopes evenly and gradually out to the open sea.

The ATA Yard is located on the shores of the Caspian approximately 8 km to the south of Baku (Figure 6.1). The Caspian Sea bounds the site to the east and south. To the west of the yard is undeveloped land with a residential development approximately 1km beyond. To the north is the Bibiheybat oil field, which contains numerous working oil wells in varying states of working order.

The SPS yard lies approximately 20 km southwest of Baku on the western coastline of the Caspian Sea (Figure 6.1). A coastal plain with undulations of up to 2m surrounds the yard, backed by steeply sloping hills forming a ridgeline that runs approximately parallel to the coast. The coastline in the vicinity of the yard is characterised by shallow lagoons. The yard area itself is significantly degraded with little apparent ecological value.

6.3.1.2 Soils and contamination

Sangachal Terminal

Surface soils in the terminal location have been formed in semi-arid conditions. High summer temperatures and evaporation rates have led to high rates of organic matter decomposition. Consequently, soils have a low humus content, short soil profile and low agricultural productivity. The soils typically comprise fine-grained clayey silts or silty clays with a low porosity and high salt content due to evaporative losses.

During 2001, soil samples were taken from across the terminal site and in the area between the shoreline and the terminal. The soils were analysed for Total Petroleum Hydrocarbons (TPH), Poly- aromatic Hydrocarbons (PAHs), metals and Total Organic Carbon (TOC). Particle size analysis was also undertaken. The full survey results are presented in the ACG Phase 1 ESIA (URS, 2002).

Whilst some areas of the site showed higher metal concentrations in the soil than others, all metal concentrations were within the range considered to be “protective of human health and the environment” (URS, 2002). None of the soil sample results for TPH and PAH exceeded the significance screening criteria applied for the study[1]. The particle size analysis conducted on surface soil samples indicated that sites located at or near the coastline comprised well-sorted fine to medium sands with a high carbonate, but low organic content, while the samples from the inland area generally comprised fine to medium silts with low organic and low carbonate content. The study concluded that the soils in the vicinity of the terminal site have been slightly impacted in localised areas as a result of past activities and, most probably, historic oil exploration and production activities. Contamination was not significant and is not considered to have resulted from AIOC activities at the EOP Sangachal terminal.

Fine grained, low porosity soils are typical of the Sangachal terminal area as there is very little infiltration of rainfall and therefore the proportion of rainfall running off the land is predicted to be very high (in the order of 80 to 90%). In addition, the fine-grained silts are non-cohesive and are therefore more likely to be mobilised during storms. Consequently, rainwater erosion of the soil surface is a characteristic of the Sangachal catchment, with a continuous process of erosion in the uplands and deposition within the coastal zone.

The ATA Yard

The ATA Yard comprises made ground resting on natural deposits of inter-layered clays and sands that are of marine origin. The made ground consists of an uppermost layer of light brown sandy clay with inclusions of boulders and cobbles of limestone and brick underlain by a layer of black sandy clay with occasional cobbles of brick and limestone and inclusions of wood. The natural material underlying the made ground across the site is dark grey clayey sand and shells.

[1] Human health screening criteria have been developed from a hierarchy of international sources namely; the CLEA (Contaminated Lands Exposure Assessment Model) soil guideline values (UK), the ASTM (American Society for Testing and Materials) RBCA (Risk Based Closure Assessment Methodology) framework (USA) and the SNIFFER (Scotland and Northern Ireland Forum for Environmental Research) framework (UK).

Free hydrocarbons are evident on the soil surface, in some locations significant areas are covered. Development activities have been ongoing at the site since the 1920s and these are likely to have contributed to current contamination of the site.

Several borehole samples have been taken across the site to detect the presence of hydrocarbon and other contaminants. The levels of contamination recorded are not considered to pose a risk to human health for the proposed end use of the site.

The SPS Yard

The SPS yard has been utilised for industrial purposes in the past and several derelict structures including buildings, storage tanks and wellheads are present in the surrounding area. Based on a previous study conducted in the vicinity of the SPS yard (ERM, 2003 cited in URS, 2004) it is likely that at least part of the surrounding area will have surficial and buried debris and hydrocarbon contamination associated with previous developments.

6.3.1.3 Hydrogeology

Aquifers

No reported aquifers supplying potable drinking water are found in the vicinity of the Sangachal terminal, ATA or SPS fabrication yards.

Groundwater and contamination

Two intrusive investigations into the presence of groundwater were conducted at the terminal site, one in 1996 (Fugro, 1996) and one in 2001 (URS, 2001). In 2001, from a total of six boreholes, only one showed a slight indication of moisture after a few days. This suggests low permeability with slow ingress of water. It was concluded that there is no significant groundwater within 20 m of the surface beneath the site.

Groundwater at the ATA yard occurs at shallow depths across the site, typically between 0.6 metres below ground level (mbgl) and 2.7 mbgl. It is found either within the natural superficial deposits or at the base of the made ground. . It is assumed that groundwater flows towards the Caspian Sea in the east and that the hydraulic gradient is shallow.

Groundwater contamination surveys of the ATA Yard indicate that there is hydrocarbon and heavy metal contamination. Such contamination is attributable primarily to historical oil field development activities.

Groundwater sampling has not been undertaken at the SPS site. However, a survey of surface water in an adjacent area indicated that several contaminants, such as hydrocarbons (C8-C35), PAH and the heavy metals Copper and Selenium were present in concentrations in excess of Tier 1 criteria[2].

Ephemeral watercourses

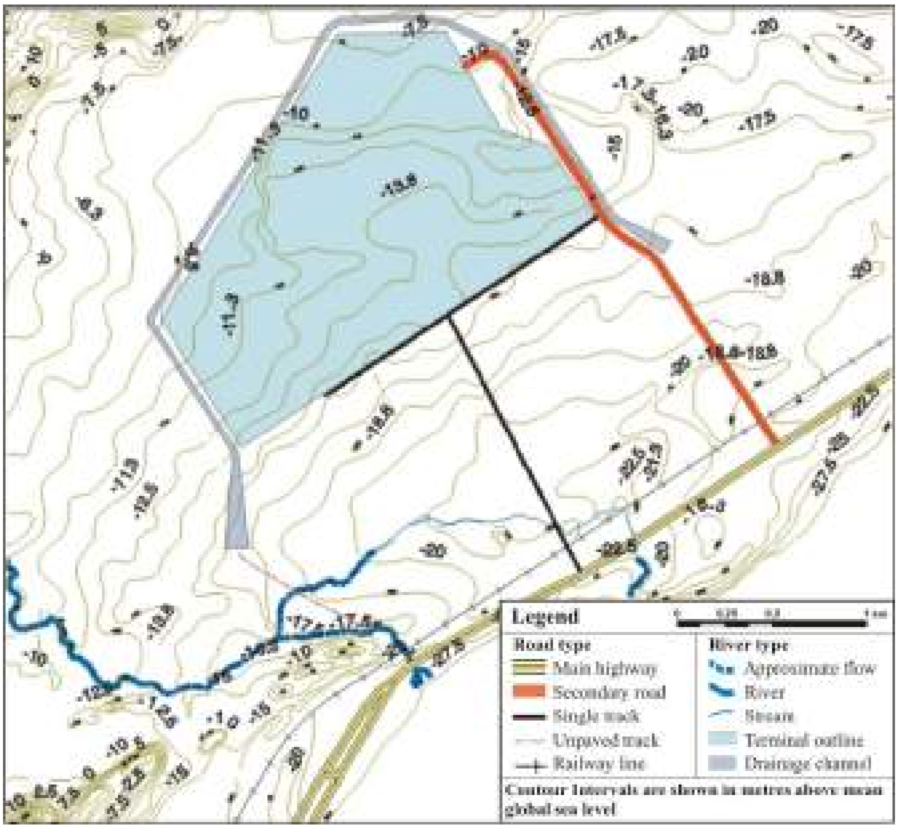
There are a number of ephemeral watercourses (wadis) within the vicinity of the terminal site, mostly to the west of the site. For the majority of the year these incised channels are dry, as transmission losses (through bed leakage and evaporation) are normally substantial. The largest wadi in the vicinity of the terminal area is that associated with the Djeyrankechmes River. This watercourse, which is often dry, exhibits poor bank stability and is liable to flash flooding during periods of heavy rain. During periods of flow it has a high sediment load. Water resources here are the scarcest in Azerbaijan, and the Djeyrankechmes basin delivers an average water yield of just 1.0 $l.s^{-1}$ km^{-2}, decreasing to zero near the coast. In addition to the above, there is a large man-made drainage ditch around the perimeter of the terminal site.

[2] Based on a hierarchy of international standards including WHO and UK drinking water standards.

Watershed analysis

A flood protection drainage channel has been built around the perimeter of the Sangachal terminal site just north of Sangachal settlement. The channel is designed to divert floodwaters around the terminal site into existing natural drainage lines. In addition, the drainage systems for the terminal site have been constructed to divert clean drain water from within the terminal area to natural drainage systems between the terminal and the Caspian Sea (Figure 6.6).

Figure 6.6 Topography and drainage in the Sangachal Terminal Area



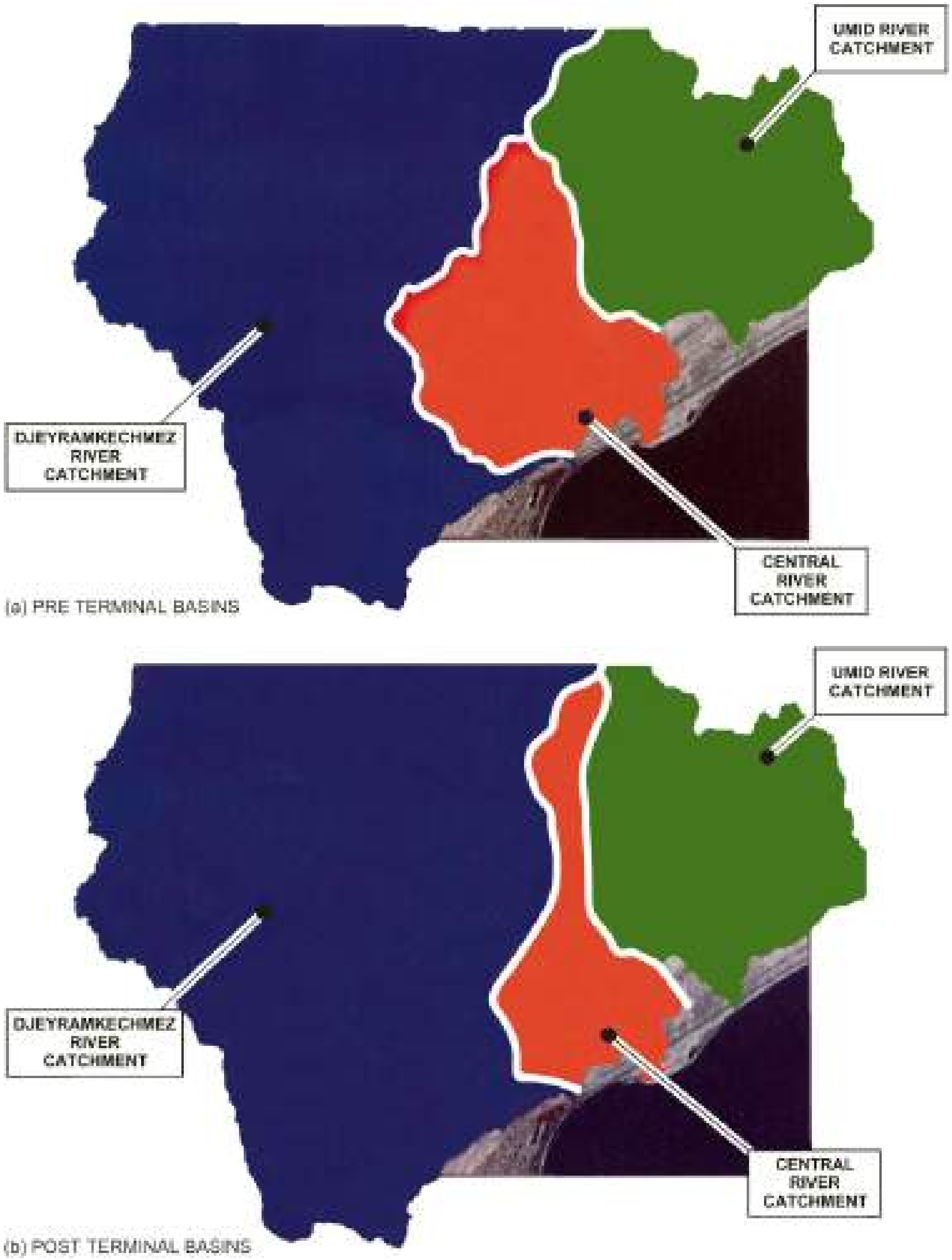
The southern flood protection system drains a proportion of the central river catchment to the Sangachal catchment, while the northern flood protection system drains a proportion of the Umid catchment to the Central catchment.

A watershed analysis, conducted in 2002, has quantified the changes to the hydrological flow regime as a result of the construction of the Sangachal Terminal. It shows that the terminal has altered catchment areas as follows:

- The Sangachal river catchment has increased by 7.1 km^2 due to the southern flood protection channel intercepting water from the north west of the Central catchment, into the Sangachal river;
- The Central river catchment has decreased by 4.0 km^2; and,
- The Umid catchment has reduced by 3.1 km^2 as a result of the northern flood protection channel draining part of the Umid catchment.

The revised catchments are shown in Figure 6.7.

Figure 6.7 Catchment areas pre- and post terminal construction



6.3.1.4 Air Quality

Sangachal Terminal

AIOC monitored baseline air quality in 1997 prior to the start of the Early Oil Project (EOP), and in 2000, when EOP was in operation (AIOC, 2000). Ambient levels of NO_2, SO_2, hydrocarbons and particulates were monitored and reported. Diffusion tubes were deployed which give average concentrations over the exposure time; hence these results are used for background annual average concentrations.

NO_2 / SO_2

For both NO_2 and SO_2, there was little to suggest a significant seasonal fluctuation- see Table 6.4.

Table 6.4 Ambient concentrations of NO_2 and SO_2 (2000)

Background concentrations	Nitrogen Dioxide		Sulphur Dioxide	
	Hourly $g.m^{-3}$	Annual $g.m^{-3}$	Hourly $g.m^{-3}$	Annual $g.m^{-3}$
Terminal	6	3	56	28
Sangachal Town	8	4	12	6
Pipeline Landfall	4	2	12	6
WHO	200	40	125	50
World Bank	n.a.	n.a.	350	50

The data indicates that the current EOP operations at Sangachal are having no significant negative impact on the level of NO_2 and SO_2 in the air. Ambient air concentrations of NO_2 and SO_2 are similar to those reported before start-up of the operation in 1997, and levels at the site boundary are well within the World Bank standards for ambient air conditions (World Bank General Environmental Guidelines 1998).

Hydrocarbons

Benzene values around Sangachal Terminal ranged from <0.3 ppb to 1.0 ppb, with the highest values consistently occurring at a location near the South fence (0.6 to 1.0 ppb). All values remained lower than the current 5ppb UK Air Quality Standard. Concentrations of other aromatic hydrocarbons remained low throughout the monitoring period and were comparable with values reported in 1997. Total hydrocarbon concentration (C_5 -C_{10}) was in the range 6 to 34 ppb around Sangachal Terminal and average values were very similar to background values reported in 1997, which ranged from 12 to 30 ppb.

Particulates

Particulates were surveyed over six 24 hour periods at a location close to the main Sangachal site entry security gate, in an area where construction activities were creating a significant amount of dust. Particulate levels varied from 16 – 115 ug/m^3. The World Bank General Environmental Guidelines (1998) require an ambient air concentration at the site boundary of 50 ug/m^3 (annual arithmetic mean) and a maximum 24-hour average of 70 ug/m^3. Further, more representative, particulate monitoring is planned in 2003/2004.

ATA Yard

Table 6.5 presents the results of an air quality survey undertaken in May 2003 to measure the concentration of sulphur dioxide (SO_2), nitrogen dioxide (NO_2), nitrogen monoxide (NO), hydrogen sulphide (H_2S), and volatile organic compounds (VOC) at various locations within the ATA site (CEL, 2003).

Table 6.5 Emission measurements in comparison to ambient air quality standards

Location	Parameter, µg/m³								
	Particulate–24h	**H2S-24h**	**H2S-1h**	**NOx-24h**	**NOx-1h**	**SO2-24h**	**SO2-1h**	**VOC-24h**	**VOC-1h**
Main security office	147	< 2	< 26	< 47	< 550	< 2	< 26	140	290
No 5 security office	89	< 2	< 29	< 42	< 540	< 2	< 26	1,200	290
Stone col. pil. cont.	29	2.1	< 32	< 44	< 720	< 2	< 32	240	320
Skid way area	127	4.3	< 36	< 49	< 870	< 2	< 36	1,300	550
WHO	n.a	n.a	n.a	150	200	125	350	n.a.	n.a
World Bank	70	n.a.	n.a.	150	n.a.	125	n.a.	n.a.	n.a.

n.a. None available

Ambient air conditions did not exceed the World Bank General Environmental Guidelines or WHO Ambient air quality guidelines for 24 hour averages for Nitrogen Oxides and Sulphur Dioxide. On the day of sampling, WB Environmental Guidelines were exceeded at 3 sampling stations for Particulates (PM-10). However, it should be noted that PM-10 measurements vary from day to day and that values of 100 $\mu g/m^3$ are regularly exceeded in many areas in Europe (CEL, 2003). Exceedence can often be due to local weather conditions such as high winds. The occupational hygiene measurements completed at the site fall within published European Occupational Exposure Standards (OES).

At the time of writing air quality monitoring data was not available for the SPS yard.

6.3.2 Terrestrial habitats

This section primarily summarises the results of the two terrestrial (flora & fauna) surveys carried out in the vicinity of Sangachal terminal during May/June 2001 (ACG Phase 1 ESIA, URS 2002) and March 2002 (ACG Phase 2 ESIA, RSK 2003). The timing of the 2002 survey enabled easier recording of ephemeral species flowering before May/June, easier identification of some faunal species (e.g amphibians), and the inclusion of migratory bird populations. Full details of the survey results and methodology can be found in the ACG Phase 1 and 2 ESIAs (respectively Sections 6.3.2 and 6.4.9).

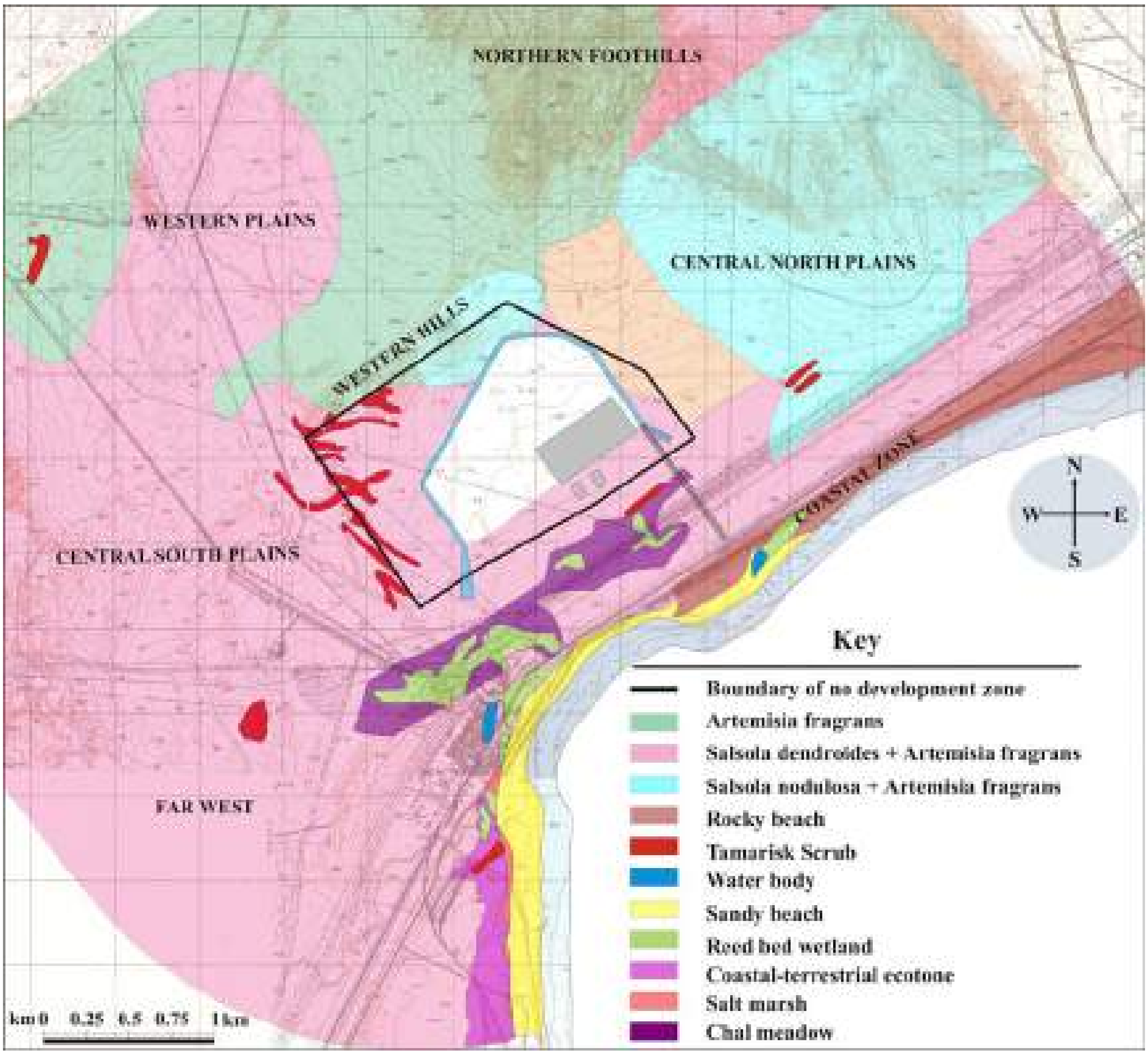
Since the submission of the Phase 2 ESIA, additional survey work has been carried out to study in more detail the wetland habitats to the south and southeast of Sanghachal terminal. The results of this study are also reported here.

The Phase 2 ESIA provided a detailed description of the habitats surrounding Sangachal terminal. This section summarises the description, focusing on habitats adjacent to the terminal area. A brief description of the terrestrial habitats surrounding the SPS and ATA yards is also provided. It is important to recognise that both the ATA and SPS yards have been used historically for industrial purposes, for this reason less emphasis has been placed on the environmental descriptions for these sites.

6.3.2.1 Sangachal Terminal

It should be noted that the Sangachal terminal expansion area has now been cleared as part of the Phase 1 and 2 developments. The major habitat types in the Sangachal terminal area are shown in Figure 6.8.

Figure 6.8 Indicative Terrestrial habitats



6.3.2.2 Flora - Higher plants

Based on the vegetation types identified in Figure 6.8 and topography, the terminal and surrounding area has been categorised into seven zones. Table 6.6 summarises the main floral constituents of each zone. For details of the survey methodology the reader is referred to the Phase 2 ESIA Section 6.3.2. The zone in which the terminal is now located, the central north plains, is highlighted in Table 6.6. Protected species were restricted to zones 1, 3 and 4 and are highlighted in bold.

Table 6.6 Description of habitats surrounding Sangachal Terminal

Zone	Description
1.Coastal zone	Several sub habitats including a rocky coastline with sparse vegetation cover (primarily *Convolvulus persicus and Argusia siberica*), littoral reedbeds (*Juncusetum acutus* and *Phragmites australis*), shallow lagoons, a salt marsh dominated by *Salicornia europea* and semi-desert areas with two main components (*Artemisia fragrans* and saltwort species (*Salsola denroides and Salsola nodulosa*). Several ARB (Azeri Red Book) species were recorded, namely ; ***Ferula persica*, *Cladochaeta candidissima* (IUCN, Indeterminate), *Glycyrrisa glabra*** and ***Nitraria schoberii*.** Dead individuals of ***Calligonum bakuensis*** an IUCN (Indeterminate) and ARB species were also recorded.
2.Northern foothills	Rocky foothills with frequent mudflows and a sparse cover of *salsoletum nodulosa.* Patches of spring flowering ephemerals occur (*Veronica arvensis, Tragopogon graminifolius, Torularia contortuplicata and Nonea lutea*) and grasses *(Cynodon dactylo*n, *Anisantha rubens* and *Aegilops biunciali.*
3.Central south plains	Semi-desert communities (*Salsola dendroides, S. nodulosa* spp. and *Artemisia fragrans*), reed dominated wetlands (*Phragmites australis* and *Typha latifola*) and a large number of Tamarisk stands (*Tamarix spp*.). Seeds of ***Iris acutiloba*** (ARB and IUCN Endangered) were recorded.
4.Western and far northernplains. 5. Western hills	Dominant species include *S. dendroides and A. fragrans,* the latter being particularly dominant in drier areas. *Tamarix spp*., grasses and flowering ephemerals were evident in lower lying areas. The ARB species ***Astragalus bakuensis*** was recorded. ***Ferula persica*,** an ARB and IUCN (Indeterminate) species, was recorded in this area.
6.Central north plains	A flat expanse of desiccated fine clay soil with minimal vegetative cover. Individual plants of *Salsola nodulosa* and *Suadea microphylla* and stunted clumps of *P.bulbosa* and *Medicago minima.*
7.Far west	Tamarisk scrub including *Tamarix Meyeri* and a continuous groundcover of grassess including *Colpodium humile*, *Poa bulbosa* and *Eremopyrum triticeum*, the emphemeroid *Calendula persica* is also present. Higher ground dominated by *S.dendroides* and *A.fragrans* with Tamarisk thickets and camelthorn (*Alhagi psuedalhagi*) in lower lying areas.

The two botanical surveys have, in combination, identified a total of eight protected (including two proposed) Azerbaijan red list plant species. Four of these species are also included in the IUCN red list,1997. Due to seasonal variations in vegetation composition it should be noted that the surveys may not have identified all species present at all of the sites surveyed.

Sensitivity

The time needed for vegetation to recover following an adverse impact varies according to the type of vegetation and the soil conditions. Estimated recovery times for habitats in the coastal zone are provided in Table 6.7 (URS, 2002). From Table 6.7 it is evident that reedbeds and *A.siberica* dominated coastal habitats recover relatively rapidly following disturbance, taking two and three years respectively. All other habitat types take much longer to recover, between nine and twelve years.

Table 6.7 Recovery time for major habitats in the vicinity of Sangachal Terminal

Zone	Habitat	Soil type	Recovery time (years)
1	*A.Siberica* dominated coastal habitat	Wet coastal sand	3
1	*J.acutus* dominated littoral ecotone	Clay/argillaceous sand mixture	9
1/3	Reedbeds comprising *P.australis* and *J.acutus*	Clay/argillaceous sand mixture/wet	2
1	Coastal semi-desert ecotone	Clay/argillaceous sand mixture	9
3	S.nodulosa and S.dendroides association	Argillaceous saline	12
1/3	A. fragrans and S.nodulosa association	Argillaceous saline	12
3/4/7	T.i meyeri thickets	Relatively moist, Argillaceous soil	12
2/3	Marsh /meadows	Argillaceous saline	12

6.3.2.3 Fauna

As described in the introduction to Section 6.3.2, two faunal surveys were conducted in parallel with the flora surveys, in May/ June 2001 (ACG Phase 1 ESIA, URS, 2002) and in March 2002 (ACG Phase 2 ESIA, RSK, 2003). The transects used for the floral survey were reused for faunal observations[3]. Details of survey methodology and results are presented in the ACG ESIAs for Phase 1 and 2, and a summary of the findings for both the Phase 1 and Phase 2 surveys is presented in Table 6.8 including details of the fauna recorded in the vicinity of Sangachal terminal. Species of conservation concern (IUCN listed or ARB) are highlighted. Avian fauna are separately described under Section 6.3.2.4.

All direct sightings of mammals and herpetofauna (reptiles and amphibian) species were recorded including the time and place of observation. Photographs were taken where possible. Indirect evidence of species, e.g. burrows, nests, tracks, scat, food remains, calling, etc, were recorded by location and type of observation.

Table 6.8 Description of Fauna in the Vicinity of Sangachal Terminal

Zone	Description
1. Coastal zone	Of the 23 faunal species recorded during the Phase 2 survey, 15 species were located in this zone. An area of Phragmites located to the south-east of the terminal was particularly diverse, with evidence of Wolf (*Canis lupus*), Fox (*Vulpes vulpes*), Marsh frog (*Rana ridibunda*) and European grass snake (*Natrix natri*). Caucasian agama (*Agama caucasia*) and Dahl's whipsnake (*Coluber najadum*) were also recorded (during the Phase 1 survey). A dead **Caspian Seal** (***Phoca caspica***) (IUCN Vulnerable) was recorded in this zone
2. Northern foothills	Two lizard species recorded (***Eremias arguta*** and *Eremias. velox*). *E. arguta* is a rare species in Azerbaijan and has been proposed for inclusion in the ARB.
3. Central south plains	The highest diversity of amphibian species including *R. ridibunda, Bufo viridis, B. viridis* and **European tree frog** (***Hyla arborea***) which is IUCN Listed as "Near Threatened" (2000). Fox, wolf and hare tracks were also observed.
4. Western and far northern plains	Limited faunal diversity, primarily rodents, although the **spur thighed tortoise** (***Testudo graeca***), an IUCN (Vulnerable) and ARB species, was observed.
5. Western hills	Edge habitat between semi-desert areas and rocky slopes supports a relatively diverse assemblage of mammalian species.
6. Central north plains	Least diverse of the areas surveyed in terms of animal species due to the lack of water and vegetation combined with anthropogenic impacts such as soil disturbance and topsoil dumping.
7. Far west	High density of rodent burrows, only evidence of other fauna was the shed skin of a Levantine viper *(Viper libetina*).

[3] Although the floral survey combined the Western and far northern plains zone with the western hills zone, given the differences observed between these zones during the faunal survey they have been kept separate in the description.

Lizards (*Agama, Eramias spp.*) were common throughout most of the areas surveyed during both the Phase 1 and Phase 2 ESIA. Amphibians were observed during the Phase 2 survey but not during the Phase 1 survey that took place earlier in the year.

A bat survey undertaken as part of the Phase 1 survey recorded three species; the horseshoe bat (*Rhinolophus spp*.), the Asian barbastelle (*Barbastella leucomelas*) and Kuhl's bat. No bat was carried out during the Phase 2 survey as bats are less active in March and unlikely to be recorded.

During the Phase 2 survey the small rodents *Allactaga elate*r, *Meriones erythrourus* and *Microtus socialis* appeared to be common throughout the study area based on the number of burrows observed.

Sensitivity

Mammals and herpetofauna are most sensitive to disturbance during mating, pregnancy and juvenile stages. Anthropogenic disturbances are a potential cause of stress, resulting in a possible decrease in reproductive success. Lifecycle tables can be found in the Phase 1 ESIA (Technical Appendix 11, Flora and Fauna).

6.3.2.4 Wetlands

The Sangachal wetland lying to the south and southeast of the terminal is a complex natural wetland sustained by water flowing from the Djeyrankechmez river and possibly also from leaking above and below ground water pipes. The wetland is quite extensive and is a habitat for a range of faunal and floral species as identified by previous surveys (Section 6.3.2.1 and Section 6.3.2.2), including several nationally red-listed species.

The terminal, enclosed by a bund wall and fence, covers an area of approximately 260 ha. In the event of continuous heavy rainfall the site is susceptible to flooding. To counter any potential damage to the facility, a flood protection channel has been excavated around the terminal. The channel lies within the terminal's land acquisition area (Figure 6.6) and has been designed to divert floodwater from around the terminal, discharging it onto the plain to the front (east-southeast) of the facility.

A survey of this wetland area was undertaken during the late summer of 2002 to characterise and qualitatively assess the ecological significance, permanence and vulnerability of the wetlands (URS, 2003). Included in the survey was an analysis of the flora, fauna and wetland water quality, both within the wetland area and in the surrounding areas outside the land acquisition zone. The wetland was characterised using a combination of remote sensing and ground-truthing; this section summarises the main findings of the survey.

The drainage pattern of the Djeyrankechmez river is complex and has been influenced by natural and anthropogenic events such as the laying of pipelines, road and railway construction.

The Djeyrankechmez river flows into a large reed bed, located to the south of the terminal and to the north of the Sangachal settlement (see Figure 6.6). An area of higher ground to the south of the reed bed provides a natural barrier to the water flow, and prevents the river continuing its flow southeast and out to sea. Instead, the river turns in a north-easterly direction and forks. The lower fork follows the contours of the higher ground eastwards before ultimately heading once again southeast into the Caspian Sea. The upper fork, however, continues to flow steadily northeast, across the plain in front of the terminal. The river eventually turns southeast and out to sea at a point between the old and new entry roads to the terminal site. (See Figure 6.6)

The area in front of the terminal forms a natural depression and during periods of high flow in the Djeyrankechmez River this area is dissected by streams. The more northerly fork supports wetlands in front of the terminal and, due to the relatively low and sporadic flow of water through this area, these wetlands are ephemeral. Reeds grow opportunistically along the banks of the stream and at any other points where water pools for any prolonged period of time. Further away from the stream, Alhagi shrubs (*Alhagi pseudoalhagi*) and Tamarisk (*T. meyeri*) dominate.

The spatial distribution of major habitat / vegetation associations is presented in Figure 6.8. The combination of reedbeds, *Tamarix spp*., low shrubs and steppe desert provide habitat for a number of species. Additionally, Alhagi shrubs are a major source of fodder and domesticated stock frequently browse in the area. The wetland is therefore an important resource for herders.

The wetlands have been impacted by anthropogenic factors, the most significant of which is the barrier effect of Baku-Alyat Highway and Baku-Georgia railway line which has restricted the flow of water from the wetlands to the sea. Water now flows through three culverts. Re-enforcement of the railway embankment around the culverts appears to have controlled any potential for erosion.

Roads within and close to the terminal area may have an influence on wetland hydrology. Of these roads, two pre-date the terminal expansion programme and the third has adequate culverts and is some distance from any natural water flow and is therefore unlikely to have any direct influence on the wetland. Annual monitoring will be conducted in the vicinity of the terminal and any significant changes in the distribution and composition of flora as a consequence of possible changes to the hydrological regime will be recorded.

The survey indicated that the Sangachal wetlands support at least 36 plant species, four species of amphibian, six species of reptile, 31 bird species and 17 species of mammal. The number of floral and faunal species recorded is partly a reflection of the season during which the survey was undertaken (late summer/early autumn) and it is reasonable to assume that the numbers observed would be higher during spring or summer.

6.3.2.5 Flora and Fauna at ATA yard

Being reclaimed land and an industrial site with historic pollution resulting from oil field activities, the ATA Yard and its surrounding are virtually devoid of flora. Given the lack of suitable habitat fauna is also minimal.

The coastal area adjacent to the yard is heavily polluted and the benthic sediments are contaminated as a result of urban run-off, sewage discharge from the greater Baku area, and by industrial activity including oil exploration and production both at and near the site. Anecdotal evidence suggests, however, that fish occur in the coastal waters.

6.3.2.6 Flora and Fauna at SPS yard

A survey of a proposed development area adjacent to the SPS yard quayside supply base indicated the area is of limited ecological value and is virtually void of any flora and fauna. Adjacent areas and in particular the coastal areas of the Caspian Sea however host considerable bird life.

The following section provides a summary of the floral and faunal features of the general area surrounding the SPS yard. The information in this section is based on the findings of an ESIA conducted by URS in October 2003 (URS, 2004).

Flora

As illustrated in Figure 6.9, the area adjacent to south-southeastern end of the site (adjacent to the Caspian Sea coastline) has a more contiguous ground cover of *S. dendroides*.

Figure 6.9 Ground Cover of Salsolsa dendroides

The shoreline of the Caspian Sea near to the SPS quayside supports relatively extensive tracts of reed beds (Figure 6.10) dominated by *P. australis*. These reed beds provide habitat for an appreciable number of waterfowl and protect the shoreline against wind and wave action.

The area to the west of the site is higher ground, some of which may be the result of anthropogenic activity. This hilly ground is relatively well vegetated at about 70% ground cover of *A. fragrans* (Figure 6.10).

Figure 6.10 Coastal Reed Beds (*P.e australis*) and higher ground with *A. fragrans*

6.3.2.7 Fauna

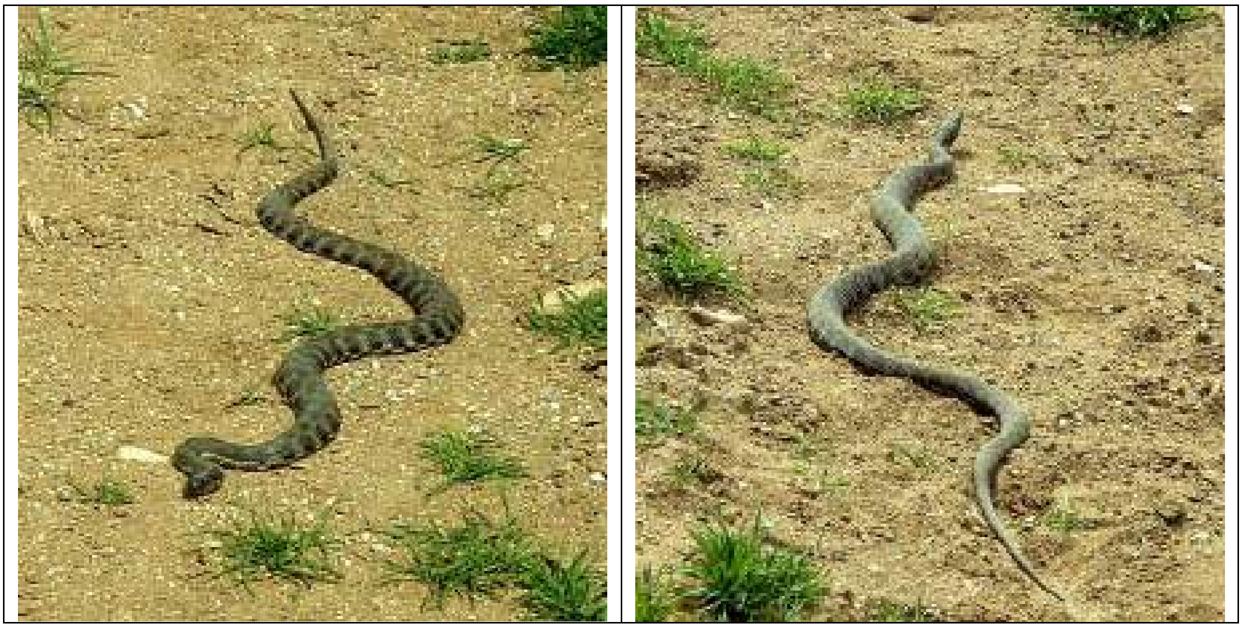
There is minimal higher order flora adjacent to the site (URS, 2004). As such, the range of habitats present is limited and the diversity and abundance of fauna will likely be limited to species that can utilise sparse vegetation and (vertically) low plants. Nevertheless, based on the habitat types present in the area, it is possible that some red listed species may be present or could visit intermittently.

The following sections present an overview of the fauna that is considered potentially present on a permanent or temporary basis.

Reptiles and Amphibians

The Caspian terrapin (*Maryemus caspica*) and European pond terrapin (*Emys orbicularis*) may be present at the site (URS, 2004). The former is likely, while the latter, which is internationally red listed (Lower Risk/near threatened), is a remote possibility. The Tessellated (grass) snake (*Natrix tesselatus*) is present; one individual was observed during a site inspection (Figure 6.11).

Figure 6.11 Natrix (tesselatus or natrix) Observed at Site - April 2003



Amongst amphibians, the internationally Red Listed European tree frog (*H. arborea*) (Lower Risk/near threatened) is doubtfully present, but Green toad (*B. viridis*) is likely to be present in the vicinity of the site (URS, *ibid*).

Mammals

No mammals or evidence of mammals was observed during the site survey and it is therefore considered unlikely that any mammals, other than rodents, inhabit the site, although individuals may occasionally traverse from surrounding areas.

Birds

There is limited ornithological interest in the immediate development site area but the neighbouring area to the south hosts significant waterfowl populations in winter (URS *ibid*) (see below regarding the sensitivity of this area). Lagoons in this area are of international importance, although they remain unrecognised and unprotected by local legislation, despite their proposal for designation as a protected area. The area is also a candidate Ramsar site[4]. A description of avian fauna present in these lagoons is given in Section 6.3.2.8.

Nesting birds in the immediate vicinity of the site would be few and would not include threatened species. Based on the habitat types present possible nesting birds include Little ringed plover (*Charadrius dubius*), Kentish plover (*Charadrius alexandrinus*) and Crested lark (*Galerida cristata*). No vulnerable species would be expected to occur on site during migration periods or overwintering.

Floral and Faunal Sensitivity

The period required for vegetation to recover following an adverse impact is given in Table 6.6. With the exception of reedbed areas, most vegetation in the vicinity of the SPS and ATA construction yards is likely to require 9-12 years to recover following an impact. Faunal sensitivity was addressed in Section 6.3.2.3.

6.3.2.8 Avian fauna

Bird populations in the vicinity of the project areas are of regional and international importance and, in view of their particular vulnerability to potential impacts resulting from oil related developments, are considered in some detail.

This section presents the results of several ornithological surveys carried out in the terrestrial and littoral coastal zones in recent years. Specifically the results are described in the following subsections:

- Ornithological characteristics of the coastal environment - based on the results of three surveys of overwintering birds conducted in February 2002 (URS, 2002a), February 2003 (URS, 2003a) and January 2004 (URS, 2004a).
- Sangachal Area: Two surveys conducted in the Sangachal area in 2001 and 2002 are described. The 2002 survey was conducted along the same transects as the Phase 2 terrestrial survey (as described in Sections 6.3.2.1 and 6.3.2.2).
- Shelf Factory Lagoons in the vicinity of the SPS yard

Ornithological characteristics of the coastal environment[5]

The coastal zone of the Caspian is one of international ornithological importance. It regularly supports both internationally and nationally significant numbers of migrating and overwintering birds, as well as species afforded protected status both within Azerbaijan and Europe. Several sites located in the coastal region of Azerbaijan and Iran are of particular significance – see Table 6.9

[4] A Ramsar site is a site that is protected under the Ramsar Convention which entered into force in Azerbaijan on September 21st 2001.
[5] The information in this section is based on a review of the Phase 1 and Phase 2 ESIAs and three coastal bird surveys (URS 2002, 2003 and 2004).

Table 6.9 Important Ornithological Sites

Important Ornithological Sites	Description
Kura Delta	Supports large populations of waders during the spring migration period.
Kyzyl-Agach State Nature Reserve	Established in 1929 for the protection of wintering and migratory waterfowl, wader and steppe birds. It has been estimated that there are 248 bird species within the reserve including a number of red data book species and species of European or international importance (UNDP, 1997). The coastal fringes and shallow bays of Kyzyl-Agach are wintering grounds for some 300,000-400,000 waterfowl and during the spring period, 20,000-24,000 pairs of birds breed here.
Pirsagat Islands	Important seabird colonies are located here
Shahdili spit and Pirilahi Island	Shahdili spit is designated as a sanctuary, and together with Pirilahi Island is proposed as a single Ramsar Site. Some 45,000 waterfowl were counted in this area during a survey carried out in February 2002 (URS 2002a).
Bandar Kiashar Lagoon and Mouth of Sefid Rud	The area is an important staging and wintering area for a wide variety of migratory wildfowl

Figure 6.12 depicts the locations of the above sites in relation to the Contract Area.

Figure 6.12 Sites of particular ornithological importance

The predominant direction of currents within the Middle and South Caspian Sea is towards the south (See Figure 6.17). Waterfowl surveys (URS, 2002a, 2003a and 2004a) have therefore focussed on the south Caspian coastline as the area most likely to be impacted should an oil spill occur.

Wintering waterfowl surveys were carried out, firstly in February 2002, and then repeated in February 2003 and late January 2004. The surveys covered the area between the Absheron Peninsula/Pirilahi Island and the Kura Delta, and were subdivided into separate areas, of unequal size, on the basis of coastal configuration (Figure 6.13).

Figure 6.13 Ornithological Survey Locations

In the 2002 survey, a total of approximately 150,000 waterfowl were counted throughout the entire survey area. When the survey was repeated in February 2003 nearly 91,000 waterfowl were counted (39% reduction on the previous year). In 2004 numbers recovered and were only 6% less than that recorded in 2002 - see Table 6.10.

Table 6.10 Total bird counts 2002-2004

Year	Total count	% -ve change from 2002
2002	150,000	-
2003	91,000	39
2004	141460	6

The reduction in numbers in 2003 is likely to be a result of the severely cold winter that may have resulted in some species, notably Coot (*Fulica atra*) and Red-crested Pochard (*Netta rufina*), overwintering further south. The subsequent increase in the number of birds recorded in 2004 was likely a result of the milder winter that year.

Over the course of the three surveys, thirteen out of the sixteen sub-areas surveyed were found to support internationally significant populations[6] of overwintering waterfowl in at least one year. Only Areas 13 (Shirvan reserve) and 15 (Kura delta) did not support internationally significant populations (Figure 6.13).

The most important bird groups were wildfowl and other waterfowl, excluding shorebirds (or waders) that occurred in only very low numbers. Table 6.11 lists those areas surveyed that were identified as potentially being of international importance in one or more years. Nine areas held internationally significant populations in 2002 and 2003, this increased to 12 in 2004. Five areas were consistently ranked as being of international importance, namely areas 5,7,10,11 and 14.

Table 6.11 Important concentrations of waterfowl by area, 2002-2004

Species	Year			All years
	2002	2003	2004	
Great Cormorant	-	16	-	
Great crested grebe	1	1	-	
Red crested Pochard	Area 7,14	7,14	7,14	7,14
Pochard	2, 10, 11	11	1,2,10,11	11
Tufted duck	2,5,6,8,10,11	4,5,6,10,11	2,3,4,5,9,10,11,12	5,10,11
White headed duck**	-	5	-	
Coot	7	-	-	
Bewick's swan*			12,15	
>20,000 waterfowl	Area 1, 2, 7	-	1,2	
White-tailed Eagle*/**		1,2		2
Purple Gallinule*				2
Total	9	9	12	5

* - Azerbaijan Red List ** - Internationally Red listed species

The majority of all wildfowl and allied species counted in the study area were ducks and coot. Flamingos (*Phoenicopterus spp.*), Cormorants (*Phalacrocorax spp.*) and Grebes (*Podiceps spp.*) each accounted for under 1% in 2002, but to fractionally over 2% in 2003, largely due to an increase in the numbers of Great cormorants. Collectively all waders and gulls accounted for only about 1.5% of the total of all birds counted in both 2002 and 2003, declining to 0.5% in 2004.

Very few species or individuals of estuarine and coastal waders were recorded. This is partly due to the time of year the surveys were conducted, but primarily to the lack of intertidal feeding opportunities along the Caspian coast as it is an essentially a tidal sea.

[6] Sites of international significance are defined as those sites that support 1% of the regional flyway population of a single species or subspecies, or alternatively support more than 20,000 waterbirds.

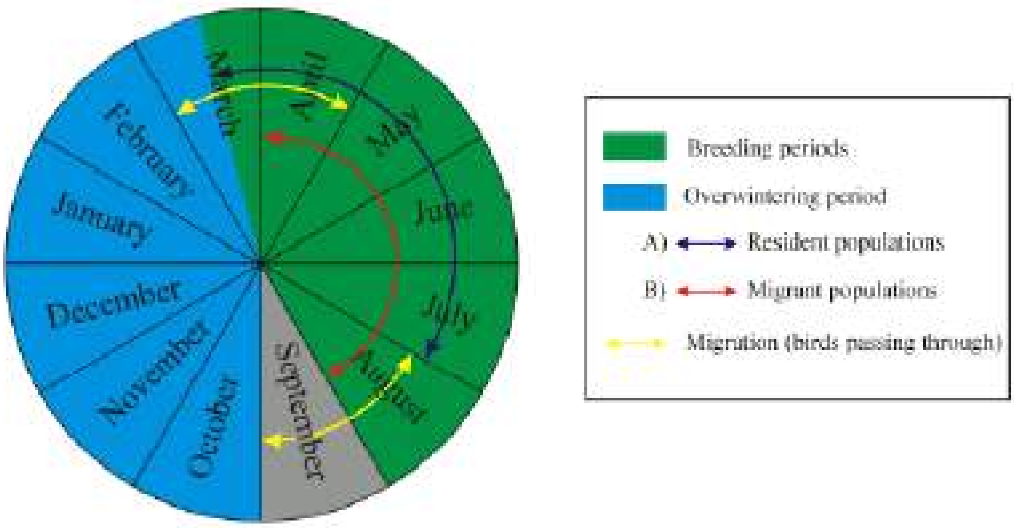
Important species (national & international Red Data species)

Four Azerbaijan Red Data Book (ARB) species, namely Mute swan (*Cygnus olor*), Greater flamingo (*Phoenicopterus rubber)*, White-tailed eagle (*Haliaeetus albicilla)* and Dalmatian pelican (*Pelecanus crispus)* were recorded during the 2003 study, the latter two also being considered internationally threatened. The White-Tailed eagle (*H. albicilla*), was present in 2003 (Areas 1, 2) but was not recorded in 2004. Dalmatian Pelican (*P. crispus*) was also recorded in 2003 and in 2004, this also being nationally and internationally red listed, although significant numbers were not observed. Neither the Dalmatian pelican nor the White tailed eagle exceeded the estimated 1% population threshold for the relevant biogeographic area. Dalmatian pelican is certainly internationally important in the Kura delta in the breeding season, on migration, and perhaps also in winter, although did not reach the 1% level in any area studied. Three further species recognised as international red data species, Pygmy cormorant (*Phalacrocorax pygmeu*), Ferruginous duck (*Aythya nyroca*) and White-headed duck (*Oxyura leucocephala*), were recorded in the study area, yet none of them appears in the ARB. Only the White-headed duck occurs in numbers exceeding its respective international 1% level, and this is at one area, Lokbatan (Area 5 in Figure 6.13).

Avian Movement Patterns

The seasonal patterns of bird movements within Azerbaijan are shown in Figure 6.14

Figure 6.14 Seasonal patterns of bird movements



Migrating and wintering birds tend to move widely along the open coast, and factors which determine their distribution include water depth, food availability, inter-specific competition for food, roost location, weather conditions and disturbance by human activities (primarily hunting) or natural predators.

Diurnal movements

The Caspian sea is atidal and surface currents are mostly wind generated. There is consequently no need for waterbirds to move away from particular feeding areas, other than, for example, to take shelter. However, some large-scale diurnal movements have been detected. Most waterfowl, particularly the tufted duck flocks, are known to alternate between the open sea near Baku at night to the Shelf Factory lagoons during daytime. Such movements are also observed around the Kura delta, and could be related to the presence of hunters.

Weather-Related movements

Anecdotal weather-related movements are known in many parts of the study area (Sultanov & Babayez *pers. obs*.). Although not observed during the 2003 survey, there are documented accounts of waterfowl movements during inclement weather to sheltered bays. One such major movement is known from the open sea off the eastern side of Shahdili Spit during northerly winds when birds move into the lee of the west coast (See Figure 6.13).

Intersite movements (intra-seasonal)

Although the movement of waterfowl from one area to another during the course of the winter might be expected, as they seek food or sheltered areas during inclement weather, this cannot at present be confirmed. During migration, flocks of birds may appear in areas where they were not present during the winter months, even if only residing for a few days.

There is evidence of movement between certain adjacent areas, for example between southern Gobustan - Sixlar Bay and the northern part of Alat Bay, Areas 10 and 11 respectively (Sultanov *pers. obs*.). Movement may be partly related to weather or to resource depletion during the course of the winter. It should be noted that the main species involved in this instance were diving ducks, which feed mostly on the seabed.

Site fidelity (Inter-year intersite shifts)

There appears to be strong loyalty to individual sites by particular species, no doubt reflecting their ecological requirements, and there is no evidence to suggest that there may be any rotation between sites in different years. Moreover, it seems that after arriving in the late autumn most waterfowl populations remain in a single site for the winter. The lack of tides and currents in the Caspian Sea probably explains the relatively sedentary nature of overwintering bird populations.

Seasonal movements

During winter the highest number of birds are present from the end of December until the end of February, with migration or other mass movements during this time negligible in most years. Generally species arrive at and depart from the area at different times, and there is also inter-year variation in the onset of late winter or spring departures from the area depending on temperature and other variables (URS, 2003 a).

Population trends

All available evidence from past counts suggests that populations of almost all species of wintering wildfowl have declined along the Caspian sea coast over the past thirty to forty years. Whether such apparent declines are, in all instances, real or due to shifting patterns of site usage is at present unknown.

Other than changes in migration patterns or wintering sites, the reasons for declines are likely to be many fold and may include any or all of the following: drainage of wetlands and other breeding habitat loss, hunting, pollution, toxic poisoning and natural population fluctuations. There is, however, only relatively sparse data available to permit direct comparisons of population variations temporally and spatially.

Sangachal Area Surveys

An ornithological survey was conducted around the Sangachal Terminal in March 2002 as part of the Phase 2 ESIA. This supplemented survey work carried out as part of the Phase 1 ESIA in May/June 2001. Full results of the surveys can be found in the Phase 1 ESIA, section 6.4.1.5 and the Phase 2 ESIA, section 6.3.3. The survey carried out during May/June 2001 focused on assessing breeding populations of birds in the survey area, but sightings of migratory/ visiting birds were also registered. In the March 2002 survey both overwintering, breeding and migratory populations were recorded.

The most common birds sighted during March 2002 in the *A. fragans* and *S.nodulosa* dominated arid areas, included; the Crested lark (*Galerida cristata*), Calandra lark (*Melanocorypha calandra*) and a number of wheatear species (*Oenanthe spp.*) During the May/June 2001 survey the highest diversity of birds inland were found in the South Central Plain zone, with the most common group being warblers (*Acrocephalus* spp.) Several birds of prey were recorded in both the 2001 and 2002 surveys in the hilly areas, including; Long-legged buzzard (*Buteo rufinus*), Kestrel (*Falco tinnunculus*), Lesser kestrel (*Falco naumanni*) and the Marsh harrier (*Circus aeruginosus*). Opportunistic scavengers were also relatively common and included Hooded crow (*Corvus cornix*), Rook (*Corvus fruigilegus*) and Choughs (*Pyrrhocorax pyrrhocorax*).

A number of species observed in both surveys were considered to be associated with human settlements including; House sparrow (*P. domesticus*), Starling (*Sturnus vulgaris*), Rock dove (*C. livia*), Black bird (*Turdus merula*) and summer visitors such as Barn swallow (*Hirunda rustica*) and House martin (*Delichon urbica*).

Large numbers of bird species pass through the Sangachal terminal area in spring and autumn as the Azerbaijan coast lies on a major flyway[7] for waterfowl, raptors and other birds migrating between breeding grounds that extend to the Arctic and wintering areas in south Asia and Africa. Several species of passage migrants were recorded in March 2002, most notable of which were *P. crispus*, Greylag goose (*Anser anser*) and *F. naumanni*. During the May/June survey in 2001 fewer birds were sighted in the coastal sector reflecting the seasonal variation between surveys, with less than 10 individual sightings per species of terns *Sterna* spp, Plover (*Charadrius alexandrinus*), Warbler (*Acrocephalus scirpaceus*) and Pratincole (*Glareola pratincola*).

The wetland areas close to the coast have a high abundance of migrating wildfowl and passerines such as ducks, waders, warblers and plovers, and the coastal waters supported large numbers of grebes *(Podiceps nigricollis, P. cristatus* and *Tachybaptus ruficollis*) gulls *(Larus argentatus, L. melanocephalus* and *L. ridibundus*) and Great cormorants *(Phalacrocorax carbo*). A summary of ARB and IUCN listed species recorded during the Phase 1 and Phase 2 field surveys is provided in Table 6.12.

Table 6.12 Azeri Red Book / IUCN Red List Bird Species Encountered During the Phase 1 and Phase 2 Fieldwork

Genus species	Designation	Phase 1 Survey	Phase 2 Survey
Black-bellied sandgrouse (*Pterocles orientalis*)	ARB, 2000 IUCN Red List.	Recorded in western plains.	Not recorded.
Dalmatian pelican *(Pelecanus crispus)*	ARB, 2000 IUCN Red List.	Not recorded.	Recorded migrating north over northern foothills.
Lesser kestrel *(Falco naumanni)*	2000 IUCN Red List. Proposed for inclusion in ARB.	Recorded in central plains.	Recorded in far northern plains.
Long-legged buzzard *(Buteo rufinus)*	Proposed for inclusion in ARB.	Recorded in foothills of northern hills and in western plains.	Recorded in foothills of northern hills and in central southern plains.

[7] A flyway is the migration routes(s) and areas used by waterbird populations in moving between their breeding and wintering grounds.

Shelf Factory Lagoons

Information on bird populations present at this site was acquired primarily through the overwintering bird surveys previously described. The Shelf Factory Lagoons are two adjacent shallow, sheltered lagoons located close to the SPS yard and almost isolated from the Caspian Sea by sand and shingle banks and reeds (See Figure 6.13). The area, although not protected by domestic legislation, is proposed as a candidate Ramsar site. Waterfowl in the area are subjected to regular hunting pressure. Three ARB species occur in this area either on passage or overwintering, namely; the Pygmy cormorant (*Phalacrocorax pygmeus*), Bewick swan (*Cygnus columbianus bewicki*) and Mute swan (*Cygnus olor*).

The area supports well over 20,000 waterfowl in winter; the threshold level for international recognition under the Ramsar Convention. Some 44,500 waterfowl were counted in the area in February 2002 making this numerically the third most important wetland site in Azerbaijan after Kyzyl Agach and the Kura delta. The most common species, Coot (*Fulica atra*) is of international importance (under the Ramsar convention this is defined as greater than 1% of the estimated regional flyway population). Three other overwintering species, namely Red-crested pochard (*Netta rufina*), Pochard (*Aythya ferina*) and Tufted duck (*A. fuligula*) also exceed the Ramsar Convention’s threshold for internationally significant populations.

Sensitivity

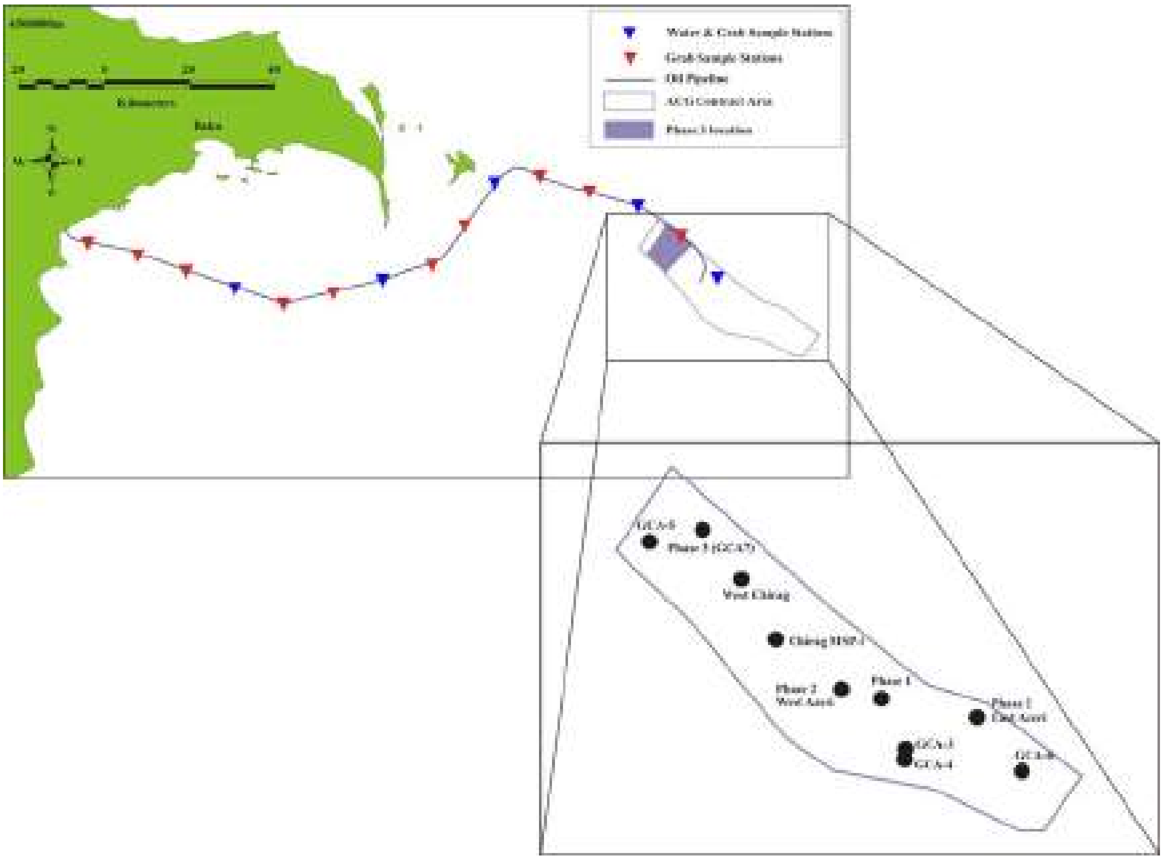
The vulnerability of a bird population, estimated as the potential recovery time for the population after an impact, is related to the behaviour and reproductive strategy of the species as well as geographical distribution and size of population. Loss of habitats, hunting and toxification are the most probable anthropogenic impacts. For birds that live in or close to the sea, oil spills are a particular concern.

With regard to oil spills at sea, ducks, grebes and cormorants are the three groups that, due to the extended periods of time they spend on the water, are regarded as being most vulnerable. Usually birds exposed to oil die, even where only small amounts of oil are on the feathers (due to hypothermia from loss of insulation, toxic poisoning from ingestion, or an inability to feed as a direct or indirect result of spills). Areas where a large proportion of a species’ population is present are particularly sensitive given the potential impact on the species’ regional population. The assumed most sensitive areas for bird populations in this respect are those sites shown in Figure 6.13 that have consistently held greater than 1% of the regional population between 2002 and 2004.

6.4 Offshore Environment

The Phase 3 offshore project scope falls entirely within the ACG Contract Area, with no export pipeline construction to shore, and so this marine description will focus primarily on providing an overview of the status and trends of the Contract Area, and specifically the Phase 3 location where available. In addition to the Phase 3 location, the environment at two proposed Phase 3 subsea water injection manifold locations will be briefly considered. Survey data from the Azeri pipeline corridor and Sangachal Bay locations is also described where it provides valuable context for the purpose and scope of this ESIA. The location of Phase 3 offshore developments is shown in Figure 6.15.

Figure 6.15 Phase 3 location showing baseline and drilling survey locations.



In total, 13 offshore environmental surveys have been conducted on behalf of AIOC since 1995, 10 of which lie within the ACG Contract Area. The year and month of each of these key marine seabed/water column surveys are indicated in Table 6.13 (Phase 3 GCA7). The baseline survey is highlighted in this table, and the location is shown in Figure 6.15. This shows that most of the surveys were conducted in the second half of each year, largely due to unavoidable constraints on the timing of post-drilling surveys (i.e. drilling was generally undertaken during spring or early summer). These surveys have been previously described in the ACG Phase 1 and Phase 2 ESIAs; however, a further analysis of all AIOC surveys results has since been carried out, including the West Chirag baseline survey conducted in April 2003. The West Chirag location was a potential candidate for the Phase 3 location, and the survey was conducted prior to the selection of the GCA7 location. The following section describes the findings of this analysis, as appropriate to the Phase 3 development scope. The data include both baseline and post-drilling surveys, and the data are arranged in geographical sequence from north-west to south-east across the Contract Area. Consequently, baseline and post-drilling data are juxtaposed, and it should be borne in mind that the post-drilling data do not accurately reflect general environmental gradients.

The planned Phase 3 subsea water injection development locations are approximately 4,000m north-west and 5,000m south-west of the Phase 3 platform location. The southern subsea location is very close the GCA 5 exploration drilling location, and lies within the post-drilling survey area. The results of the GCA5 survey therefore represent an appropriate pre-installation baseline for the south-western subsea template.

There are no data available specifically for the northern subsea template location, since no seabed ecological surveys have been conducted within 2,000m. However, this location does lie close to the line of the EOP pipeline (maybe about 500m to the south), and is equidistant from the Phase 3 location and from the south-western subsea location. The available information for this northern part of the Contract Area is sufficient to provide a general but reliable indication of the general characteristics of the ecology at the subsea template location.

Table 6.13 Offshore surveys conducted in and around the Contract Area (baseline surveys in bold type, post-drilling and post-pipelay surveys in italics)

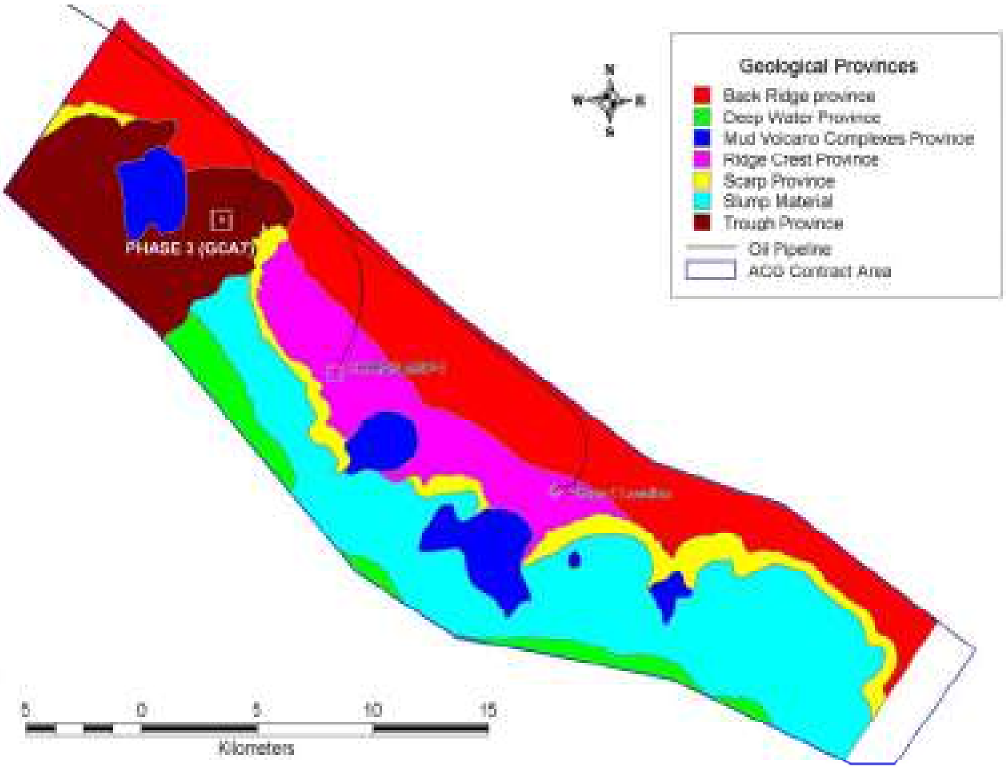
Survey title	Year	Type of survey	Month											
			J	F	M	A	M	J	J	A	S	O	N	D
Sangachal	1996	Baseline												
GCA3	1997	Post-drilling												
GCA4	1997	Post-drilling												
Sangachal	2000	Baseline												
Chirag 1	2000	Mid-drilling												
Pipeline	2000	Post-lay												
GCA5	2000	Post-drilling												
GCA6	2000	Post-drilling												
Phase 3 (GCA7)	2001	Baseline												
Phase1 (Central Azeri)	2001	Baseline												
Phase 2 (East Azeri)	2002	Baseline												
Phase 2 (West Azeri)	2002	Baseline												
West Chirag	2003	Baseline												

6.4.1 Physical and Chemical Environment

6.4.1.1 Bathymetry and seabed topography

The ACG Phase 3 location is situated in the Deep Water Gunashli field close to the northern boundary of the Contract Area. Water depth at the Phase 3 location ranges from 170 to 200m and a mud volcano is situated in the vicinity (see Chapter 4, Figure 4.3). Seabed topography throughout the area is irregular see Figure 6.16)

Figure 6.16 Seabed geology and topography



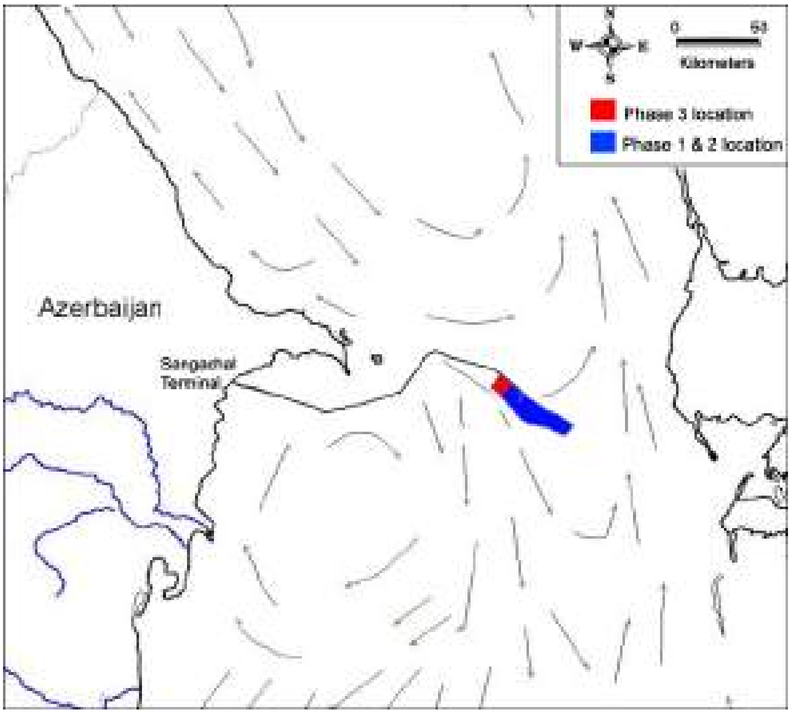
6.4.1.2 Currents

Current patterns in the Phase 3 Contract Area generally conform with the main wind directions, with the strongest and most stable currents normally occurring in the upper water layers. Thus, with winds from the north, a southern surface current generally prevails. Similarly, with southeasterly winds, the resulting surface currents are usually in a northwest direction.

Closer to shore, currents are also influenced by the configuration of the coastline, bathymetry and bottom relief.

River discharges may also have an influence on currents in the Contract Area. Late spring river flows create a southwards flow down the west coast of the Middle Caspian (Kosarev & Yablonskaya, 1994). This is likely to drive counter currents up the east coast and create a residual circulation in the South Caspian where the contract area is located. According to Furman and Shukarova, 1995 (cited in Woodward Clyde, 1995) residual currents in the contract area were southerly in direction. Prevailing current patterns in the vicinity of the Phase 3 location are depicted in Figure 6.17

Figure 6.17 Prevailing Currents in the vicinity of the Phase 3 Location



Measurements of water currents made in the Contract Area from October to December 1996 indicated that currents were generally weak; less than 0.2 ms-1 90 % of the time (Phase 1 ESIA, URS 2002). Maximum surface currents were 0.4 m s^{-1} and mean surface currents 0.1 m s^{-1}. Maximum measured current velocity in the mid-water column was 0.65 m s-1, at a depth of 50 m (*ibid*) Near the seabed, current speed and direction data collected along the Chirag pipeline corridor from October 1999 to May 2000, recorded a maximum current velocity of 1.26 m s^{-1} (*ibid*). Current direction and speed are depicted in Figure 6.18.

Figure 6.18 Mean current vectors showing mean speed (ms^{-1}) and direction along the existing pipeline route

6.4.1.3 Storm surges and waves

Storm surges are a common event in the Caspian causing temporary rises or falls in sea level. Significant sea level changes occur in the middle basin of the Caspian where the contract area is located. These events are associated with persistent strong winds, particularly the strong prevailing regional winds that blow along the axis of the Caspian, from north and northwest or from south and southeast (Kosarev and Yablonskaya 1994). Waves in the Caspian Sea, including in the Contract Area, are wind driven and subsequently the windiest months also exhibit the greatest wave action. The largest waves can be expected when the wind direction is northerly or southerly, as waves have longer time to build up at these wind directions.

Wave height data recorded at Nyeftyanye Kamni/Oil Rocks indicates that the months of July, August and September have the strongest winds and storms, with a higher frequency of wave heights in excess of 2m recorded. The period of October to February however shows the greatest number of wave heights between 1 and 2m, reflecting the steady occurrence of strong winds during this period.

South of the Absheron Peninsula northerly winds will create a fall in sea level while southerly winds result in a rise. In Baku Bay this change can be ±70-80 cm. The typical time period for a storm surge is estimated at between 6-24 hours (Kosarev and Yablonskaya 1994).

The area of greatest wave development extends from the western portion of the Middle Caspian basin, down and across the central section of the Absheron Ridge[8].

6.4.1.4 Sea Temperature

Sea surface temperatures in the Contract Area vary seasonally from a mean minimum of approximately 5 °C between December and February to a maximum temperature of approximately 25°C in July and August (Kosarev and Yablonskaya, 1994). Temperatures in deeper waters in the South Caspian remain at 6 °C year round. Ice does not occur in the Contract Area, however, during extreme winters, dense cold water is believed to flow under warmer surface waters from the North to the South Caspian basins.

A stratified water column develops in the Contract Area from late spring through summer. A thermocline occurs at water depths between 20 and 60 m (Kosarev and Yablonskaya 1994). Across this thermocline the water temperature may drop sharply from above 20°C to 10-12 °C. The depth of the thermocline increases during the summer and autumn months as surface water temperatures and wind-driven turbulence increase. During winter the thermocline breaks down, reforming again the following spring.

6.4.2 Water Column

6.4.2.1 Sea Water Chemistry

The Caspian contains waters of oceanic origin, which have been diluted and changed by river outflows. This process has reduced the relative concentration of chloride salts in the water and increased the proportion of carbonates, sulphates and calcium compounds.

Disturbance of the water surface and phytoplankton activity during winter and spring increase the oxygen content of surface waters. During the summer, stratification of the water column reduces oxygen levels below the thermocline.

The average salinity of the South Caspian Sea, including the Contract Area is approximately 12.9 ‰. For offshore areas of the Middle and South Caspian basins, seasonal and spatial differences in salinity are less than 1 ‰, ranging between 12.5 and 13.4‰.

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[8] The Contract Area is located just to the south of the Absheron Peninsula.

6.4.2.2 Water quality

Nine water column surveys were conducted between 2000 and 2003 (Table 6.15). The surveys conducted were not entirely consistent with regard to timing and methodology, however, they do provide an indication of general trends in water quality. Several parameters were recorded during the surveys, including Total Suspended Solids (TSS), Total Hydrocarbon Compounds (THC), Biological Oxygen Demand (BOD), and the concentrations of surfactants and phenols. Nutrient and heavy metal concentrations were also measured but were close to, or below the levels of analytical detection and are not considered further. THC, surfactants, and (in some instances) phenol concentrations were quantifiable, and are summarised in Table 6.14.

Table 6.14 Concentrations of selected parameters at sampling locations throughout the Contract Area, pipeline route and in Sangachal Bay

Description	Type of survey	Level	TSS ($mg.l^{-1}$)	THC ($\mu g.l^{-1}$)	BOD ($mg.l^{-1}$)	Surfactants ($mg.l^{-1}$)	Phenols ($mg.l^{-1}$)
Phase 3 (GCA7) 2001	Baseline	Maximum	0.4	78.4	1.2	0.4	< 0.1
		Minimum	0.1	21.0	0.1	0.3	< 0.1
		Median	0.1	40.3	0.4	0.4	< 0.1
West Chirag 2003	Baseline	Maximum	64	25	1.3	0.4	<0.1
		Minimum	21	13	0.8	0.3	<0.1
		Median	44	21	1.1	0.3	<0.1
Phase 2 (East and West Azeri) 2002	Baseline	Maximum	10	68.7	0.5	0.6	0.15
		Minimum	3	27.3	0.3	0.4	<0.025
		Median	6	52.0	0.4	0.5	<0.025
Phase 1 (Central Azeri) 2001	Baseline	Maximum		42.0	1.0	0.5	0.73
		Minimum		4.8	0.6	0.3	<0.05
		Median		18.3	0.7	0.3	0.61
Sangachal 2000	Baseline	Maximum		9.1	4.2	0.135	0.0105
		Minimum		3.5	0	<0.10	<0.002
		Median		4.3	0.5	0.13	0.002
Chirag 2000	Post-drilling	Maximum	69	61.2		0.46	<0.002
		Minimum	8	18.0		0.22	<0.002
		Median	26	42.8		0.39	<0.002
GCA6 2000	Post-drilling	Maximum	83	143		0.55	0.002
		Minimum	17	49		0.16	<0.002
		Median	45	74		0.46	<0.002
GCA5 2000	Post drilling	Maximum		80.9		0.6	0.002
		Minimum		19.3		0.2	<0.002
		Median		42.0		0.5	<0.002
Pipeline 2000	Post-lay	Maximum	55	75		0.5	0.002
		Minimum	2	23		0.2	<0.002
		Median	23	60		0.4	0.002

Phase 3 location is highlighted in blue

Total Suspended Solids (TSS) have an important role in the fate of contaminants, such as hydrocarbons, metals and nutrients, as the contaminants may absorb to particulate matter, and are thereby removed from the water column (Witt, G. 2002). From Table 6.15, TSS concentrations in the Contract Area ranged in most cases between 26 and 44 $mg.l^{-1}$, but samples collected during the Phase 2 and Phase 3 surveys (Table 6.15) were substantially lower than this, at 6 and 0.1 $mg.l^{-1}$, respectively. The calm weather prevailing during the collection of the Phase 2 and Phase 3 samples is the likely explanation for this.

THC analysis provides a measure of water contamination from both natural (hydrocarbon seeps and mud volcanoes) and industrial hydrocarbon sources. The national Maximum Permissible Concentration (MPC) for surface waters is 50 $ug.l^{-1}$. Median THC measurements ranged from 18.3 $\mu g.l^{-1}$ (Phase 1, 2000) to 74 $\mu g.l^{-1}$ (GCA6, 2000), although there was substantial variation around these median values, with at least one sample exceeding the MPC[9] at all sampling locations, except the West Chirag and Phase 1 (2000) locations. The highest single value of 143 $\mu g.l^{-1}$ was recorded in a sample collected at the GCA6 location. The Phase 3 location (GCA7) surveyed in 2001 ranged from 21 to 74 $\mu g.l^{-1}$. The median level was 40 $\mu g.l^{-1}$, which is typical for the Contract Area. It is likely that a proportion of the contamination detected is naturally occurring, due to venting of hydrocarbons from mud volcanoes on the sea floor.

BOD is a measure of the quantity of oxygen consumed by micro-organisms during organic matter decomposition, and it therefore provides an indirect measure of the concentration of biodegradable organic compounds in a water sample. BOD measurements were taken at four locations within the Contract Area, and median values were between 0.4 and 1.1 $mg.l^{-1}$, which all fall below the MPC of 3 $mg.l^{-1}$.Surfactant concentrations (non-ionic surfactants) were generally in the range of 0.2-0.6 $mg.l^{-1}$. Phenol concentrations were generally below detection limits (including the Phase 3 location), but high values were observed at the Phase 2 (2002) and Phase 1 (2000) sampling locations, respectively 0.15 $mg.l^{-1}$ and 0.73 $mg.l^{-1}$.

6.4.2.3 Benthic Environment

A description of the benthic environment in the ACG Contract Area and near shore areas was provided in the Phase 1 ESIA Chapter 6. This description draws relevant information from the environmental seabed surveys conducted on behalf of AIOC since 1995. With the exception of the EOP 1995 and 1996 surveys, the same team of Azeri scientists has carried out the survey analysis, thereby providing a high degree of consistency and comparability. The information collected during these surveys is sufficient to compile a general picture of the characteristics and status of the area. The sampling locations are as described previously for water quality sampling (see Table 6.12).

Given the heterogeneity of the seabed environment, there was considerable variation between sampling locations in the results for the parameters measured. The median value for a parameter is therefore the most useful representation of ‘typical’ properties, and is used in this section when describing results.

6.4.2.4 Sediment Characteristics

Caspian sediments generally comprise components from distant sources, such as silt, clay and gravel of geological and fluvial origins, together with shell fragments and shell sand. Sediments can be characterised and distinguished using three basic parameters - mean particle diameter, silt/clay content (to indicate the geological component) and carbonate content (to indicate the biological component). Figure 6.19 depicts silt and clay content for sediments in the Contract Area, along the pipeline route, and in Sangachal. Figure 6.20 depicts the mean particle size diameter for the same locations.

9 MPC: Maximum Permitted Concentration is the national standard that defines permissible concentrations for dissolved constituents within the water column.

Figure 6.19 % silt-clay and carbonate for sediments across the Contract Area, pipeline route and Sangachal Bay (post-drilling surveys highlighted in yellow)

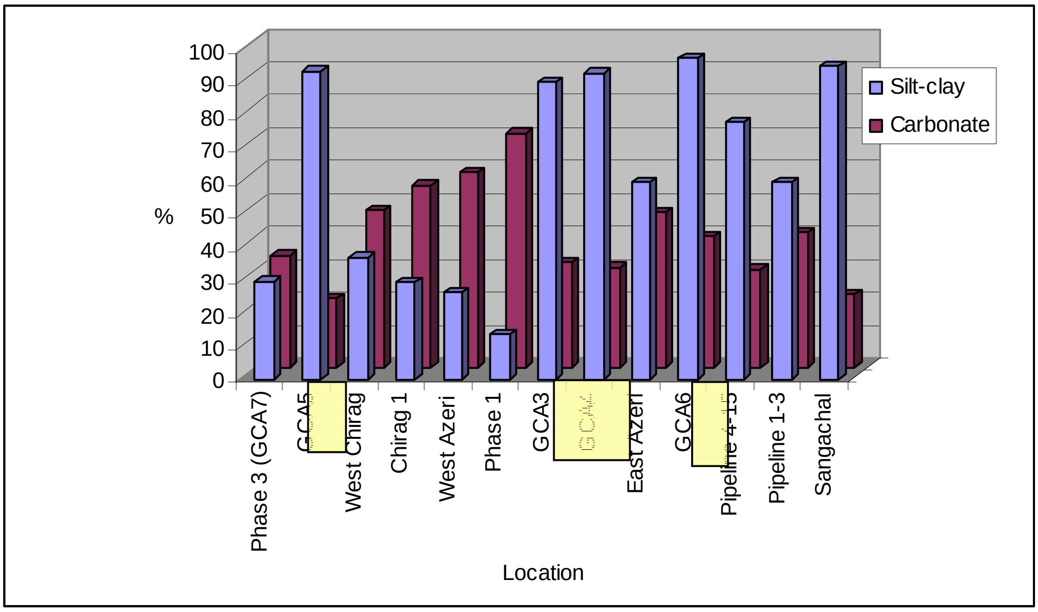
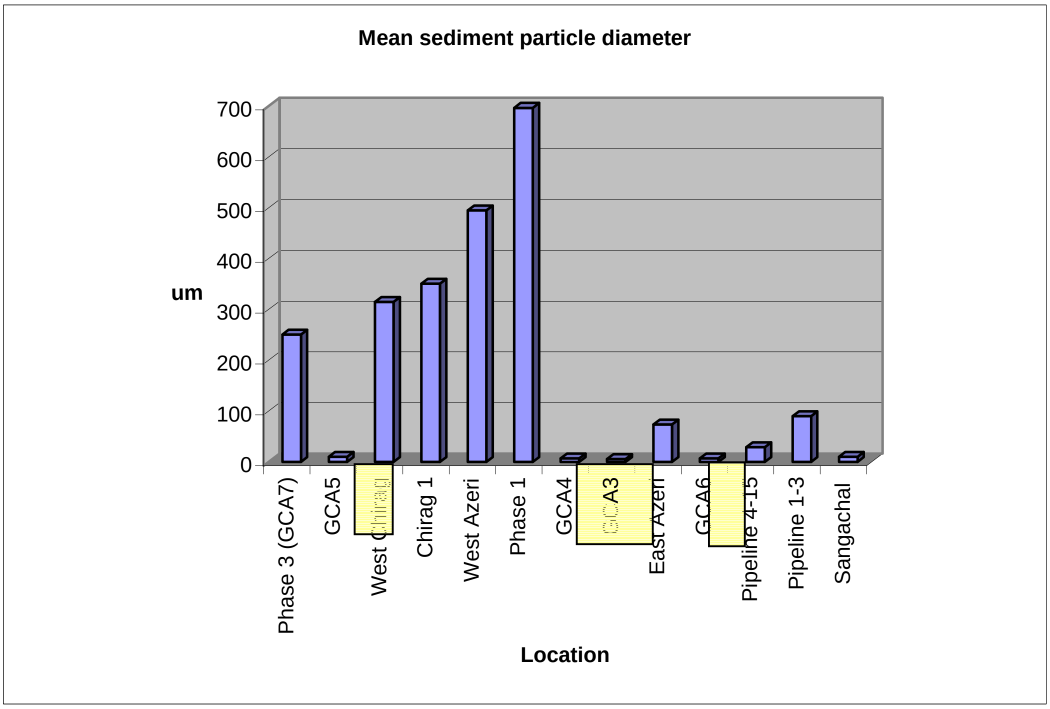


Figure 6.20 Mean sediment particle diameter across the Contract Area, pipeline route and Sangachal Bay (post-drilling surveys highlighted in yellow)

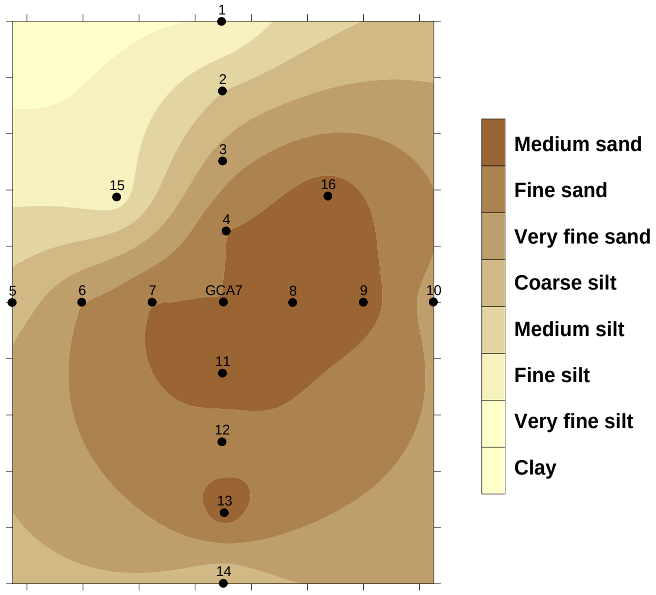


Silt-clay content is typically high at Sangachal, along the pipeline, and at the post-drilling locations. The survey data show that silt-clay content declines as particle diameter increases along the pipeline corridor from nearshore to offshore, and that it continues to decline gradually from northwest to southeast across the Contract Area, rising again at East Azeri. Silt-clay content is inversely related to both carbonate content and particle diameter.

The distribution of carbonate content is similar to that for particle diameter, indicating that shell material contributes significantly to sediment coarseness.

The seabed in the Contract Area comprises a wide range of sediment types, predominantly medium to coarse sand (350 to 700 µm). The sediments are often locally very variable in composition; most of this is due to variation in the amount of carbonate shell sand present. There is no clear correlation between particle diameter and water depth at the investigated sites. However, there is a tendency for the fine mud sediments to occur in the deeper water areas. The GCA7 baseline study revealed that sediment composition at the Phase 3 location varied from medium sand to clay at the different stations investigated, as shown in Figure 6.21. Particle diameter in the Contract Area increases gradually from north-west (Phase 3, GCA7) towards the south-east (Phase 1 location).

Figure 6.21 Sediment types at the phase 3 survey locations (GCA7) (Wentworth sediment classification)



Sediment chemistry

Hydrocarbons

Levels of hydrocarbon detected in sediments across the Contract Area are given in Table 6.15. Total Hydrocarbon Concentrations (THC) ranged from about 9 to 454 µg.g^{-1} in the Contract Area baseline locations. THC concentrations at the Phase 3 location were amongst the lowest recorded in the Contract Area, ranging between 6 and 75 µg.g^{-1}, with a median of 28 µg.g^{-1}.

Table 6.15 Sediment hydrocarbons. Median values for each location are given.

Location	Year	Type of survey	THC ($\mu g/g^{-1}$)	%UCM	%NPD
Phase 3 (GCA7)	2001	Baseline	28	79	46
West Chirag	2003	Baseline	25	73	60
Phase 2(West Azeri)	2002	Baseline	24	79	49
Phase 1 (Central Azeri)	2001	Baseline	42	79	56
Phase 2(East Azeri)	2002	Baseline	9	67	50
Sangachal	2000	Baseline	40	79	71
GCA5	2000	Post-drilling	20	41	54
Chirag	2000	Post-drilling	128	65	27
GCA4	1997	Post-drilling	121	69	
GCA3	1997	Post-drilling	79	74	
GCA6	2000	Post-drilling	454	4	62
Pipeline 4-15[10]	2000	Post-lay	280	87	51
Pipeline 1-3[11]	2000	Post-lay	22	73	60

Phase 3 location highlighted in blue

With the exception of GCA5, hydrocarbon concentrations were higher at those locations where drilling has taken place in recent years i.e. GCA4, GCA6 and Chirag. However, it is not possible to ascertain whether the source of these hydrocarbons is natural (e.g. mud volcanoes) or anthropogenic. The UCM (Unresolved Complex Matrix)[12] % indicates that most hydrocarbons have been present for some time. Only GCA6 showed evidence of a fresh source of hydrocarbon. THC concentrations in baseline survey sediments ranged between 9 $ug.g^{-1}$ (East Azeri) and 42 $\mu g.g^{-1}$ (Central Azeri). The baseline value for the Phase 3 location is 28 $\mu g.g^{-1}$.

The proportion of naphthalene + phenanthrenes and dibenzothiophenes (NPD) indicates the balance of inputs between petrogenic (i.e. petroleum related compounds) and pyrogenic (compounds formed from combustion) of hydrocarbons. The range of % NPD values at baseline locations in the Contract Area, including the Phase 3 location, were low, indicating a uniform distribution and therefore absence of any local 'point source' inputs. Median values in the Contract Area generally lay in the range of 45-60%. Fresh petroleum aromatics typically have an NPD content of about 80%.

Heavy metals

Table 6.16 summarises the survey medians of sediment concentrations of six heavy metals (copper, iron and zinc, which are naturally present in all sediments; and lead, mercury and barium, which are common industrial pollutants). Although these are not the only metals for which analytical data are available, they provide a comprehensive picture of the natural inorganic chemistry of the sediments in the ACG operational areas and also indicate the extent to which drilling activities may have a localised effect on concentrations..

[10] A total of 15 sampling stations were located along the pipeline route between the Contract Area and Sangachal terminal. For the purposes of hydrocarbon analysis an average figure was obtained for stations 4-15, which represent the shallow-water section of the survey

[11] Pipeline sampling stations 1-3 are located in deep water within (or close to) the Contract Area, and were combined to provide an average figure.

[12] UCM is a measure of the degree of hydrocarbon weathering. Low levels of UCM indicate a fresh hydrocarbon source.

Table 6.16 Median trace metal concentrations in sediments (µg.g^{-1}) at each survey location.

Location	Type of survey	Ba	Fe	Hg	Pb	Zn	Cu
Mean continental crust concentrations		630	43200	0.04	15	65-106	25
Phase 3 (GCA7)	Baseline	3591	46007	0.02	51	75	19
West Chirag	Baseline	4609	20608	0.103	15	54	24
Phase 2 (West Azeri)	Baseline	1319	19620	0.022	27	38	20
Phase 1 (Central Azeri)	Baseline	7188	14005	0.031	19	40	18
Phase 2 (East Azeri)	Baseline	1042	20320	0.018	23	46	23
Sangachal	Baseline	1500	32967	0.03	23	87	42
Chirag 2000	Post-drilling	7980	25851	0.0275	22	61	20
GCA5	Post-drilling	998	27170	0.03	17	73	21
GCA4	Post-drilling	889	20950	0.1645	22	23	39
GCA3	Post-drilling	1209	21255	0.0725	19	24	40
GCA6	Post-drilling	1450	22232	0.04	19	55	32
Pipeline 4-15	Post-lay	538	32072	0.215	26	99	27
Pipeline 1-3	Post-lay	1368	38594	0.022	24	82	27

Phase 3 location is highlighted in blue

Heavy metal concentrations in the Contract Area are within a consistent range and are deemed to be "background" levels. Mercury concentrations were uniformly low at the Phase 3 location (CGA 7), and at most of the other baseline survey locations, with concentrations in the typical background range of 0.01-0.06 µg.g^{-1}. Variation at these locations was also small, suggesting that the observed baseline levels were attributable to natural sediment composition. Some evidence of mercury contamination was observed in the form of two high mercury concentration samples at West Chirag in 2003, although its median value is generally consistent with other survey locations in the area.

The highest individual iron concentrations for all surveys were recorded at the Phase 3 location (in the region of 35-65,000 µg.g^{-1}), but the median value (46,007 µg.g^{-1}) was close to typical background levels. Zinc and Copper concentration at the Phase 3 location was, like most other locations in the Contract Area, within the range expected for natural sediments in the Caspian.

There was no obvious regional trend in lead concentrations. The highest median concentration for all surveys was observed at the Phase 3 location (GCA7), which was more than twice the value for any other location within the Contract Area, and more than three times the typical background value. There is no obvious explanation for this.

Barium concentrations exceeded 1000 µg.g^{-1} at all locations except the nearshore pipeline corridor. There was no obvious association between barium concentrations and drilling operations. Barium concentrations at the Phase 3 location (GCA7) were highly variable, with a median value of 3591 µg.g^{-1}. Typical background levels (earth crust values) are around 630 µg.g^{-1}.

Radioactivity in sediments

Radioactivity in sediments were measured in the Chirag 1 post Saraline survey (2000), the GCA5 and GCA6 Post well survey, and the Chirag 1 - Sangachal sub sea pipeline survey (2000).

Ranges observed for selected isotopes were:

- ^{241}Am (60 keV): 1 – 4 Bq/kg;
- ^{137}Cs (662 keV): 0.6 – 25 Bq/kg; and,
- ^{210}Pb (Uranium series 46 keV): 23 – 111 Bq/kg.

(Source: AIOC ACG Monitoring Database.)

The results were all within the range that would be expected for surface marine sediments. In most cases, ^{210}Pb activities exceeded those of ^{226}Ra, again consistent with expectation. Any contamination with radium containing tailings or scale would be apparent as a significant excess of ^{226}Ra activity over that of ^{210}Pb or excess of ^{228}Ra over ^{212}Pb and this was not observed in any sample.

Considerable variability was apparent in the specific activities of ^{234}Th and ^{210}Pb, but this is consistent with the well-established behaviour of these radionuclides in the marine environment and the observed specific activities were not abnormal. The data revealed no evidence of contamination with radium isotopes at any of these survey locations following drilling activities.

In a survey of sediment quality carried out under the Caspian Environmental Programme (Mora and Sheikholeslami, 2002) all sediment samples in the Azerbaijan sector of the Caspian Sea contained <5 $\mu g.g^{-1}$ uranium, consistent with background levels. Results from other sectors of the Caspian Sea are not presented here as not considered relevant to ACG Phase 3.

6.4.3 Biological Environment

6.4.3.1 Plankton

6.4.3.2 Phytoplankton

The distribution and abundance of phytoplankton have been previously described in the Phase 1 and Phase 2 ESIAs. This section provides a summary of the key results of a recent evaluation of all AIOC marine survey information collected to date, as appropriate to the Phase 3 development scope.

As for water quality analysis the sampling has been limited to stations visited during the course of seabed surveys Both spatial and temporal coverage for phytoplankton is therefore limited. There is no obvious seasonality in either diversity or abundance, in part due to the limited spatial and temporal coverage provided by the surveys.

A total of 101 species were identified in samples collected from the 11 surveys conducted between 1995 and 2003 (Table 6.17). Of these, 55 occurred in only a single survey, and 46 occurred in two or more surveys. Baccillariophyta (diatoms) were the most diverse group overall, represented by 56 species. Dinophytes were the next most diverse group, represented by 27 species. Cyanophytes (blue-green algae) were represented by 15 species, and chlorophytes by 5 species. The nearshore community (Sangachal 2000) was amongst the most diverse; of the 30 species recorded here, 16 did not occur in any other location.

Table 6.17 Number of phytoplankton species recorded in AIOC surveys.

Survey	Year	Month	Number of species
Phase 3 (GCA7)	2001	August	21
EOP	1995	September	45
EOP	1995	December	19
Chirag 1 2000	2000	November	24
GCA5	2000	November	16
GCA6	2000	November	16
Phase 1 (Central Azeri)	2001	July	17
ACG Phase 2 East & West Azeri	2002	February	15
West Chirag	2003	April	21
Pipeline 2000	2000	November	24
Sangachal 2000	2000	October	30

The Phase 3 location is highlighted in blue

The phytoplankton community is dominated by nine species (Table 6.18), two of which (*Prorecentrum* species) were recorded and were numerically important in all surveys. The diatoms *Pseudosolenia fragilissima* and *Chaetoceros wighamii* occurred in similar frequency, and often similar abundance to the two dinophyte species. The cyanophyte *Oscillatoria redeki* was occasionally present in high abundance, for example in the Phase 3 location.

Table 6.18 Most abundant Phytoplankton species recorded in AIOC surveys (median no cells.l-1)

Survey		Phase 3 (GCA 7)	Sep 1996 baseline	Dec 1996 baseline	Sangachal 2000	Chirag 1 2000	Pipeline 2000	GCA5	GCA6	ACG Phase 1	ACG Phase 2	ACG Phase 3 (W Chirag)
Year	Type	2001	1996	1996	2000	2000	2000	2000	2000	2001	2002	2003
Month		Aug	Sep	Dec	Oct	Nov	Nov	Nov	Nov	July	Feb	Apr
Prorecentrum cordata	D	18267	1295	1285	23500	8800	9160	11600	4880	9067	2300	7730
Prorecentrum scutellum	D	1840	461	488	5000	1160	2611	1200	1160	2200	533	474
Pseudosolenia calcar-avis	B	320	1313	1165		490	500	560	493	300	500	4965
Prorecentrum obtusum	D	2067	350		933	952	2040	933	800	5567	100	480
Nitzschia tenuirostris	B	300			5345	930	7953	616	352	400	300	7730
Pseudosolenia fragilissima	B	3550			1400	1107	7733	1140	1600	1267	46700	7365
Chaetoceros wighamii	B	114933			4200	15896	15429	39200	20560	22667	35267	37535
Microcystis pulverea	C	433			520	2880	2900	3760	4400	800	33	380
Oscillatoria redekei	C	426667				1400	13200	10000			6533	17886

B - bacillariophyta (diatoms); D- dinophyta; C- cyanophyta (blue-green); Chl – chlorophyta

Biomass was dominated (>95%) in all surveys by the larger dinophytes (*Prorecentrum scutellum, P. obtusum)* and diatoms *(Pseudosolenia calcar-avis, P. fragilissima*).

The phytoplankton community at the Phase 3 location is broadly similar in abundance, composition and diversity to other locations within the ACG Contract Area (see Table 6.17 and Table 6.18). Given the inconsistencies in the timing of sampling it is not possible to analyse differences in plankton counts between the various locations surveyed. The data can however provide a baseline for future studies should these be undertaken at the appropriate time of year.

6.4.3.3 Zooplankton

The comments with respect to the limitations of the available data for phytoplankton apply equally for the zooplankton investigations carried out during the same environmental surveys. In most cases samples were collected by vertical net haul, the only method available, but one which does not provide information on actual population densities, and which can be biased by differences in water depth at different sampling locations. The data should for this reason be regarded as a qualitative indication of the general composition of the zooplankton community. The zooplankton community is shown in Table 6.19.

Table 6.19 Number of zooplankton species recorded in AIOC surveys.

Species	Baseline Sep 96	Baseline Dec 96	Sangachal 2000	Pipeline 2000	GCA5	GCA6	Chirag 1 2000	GCA7 (Phase 3)	ACG Phase 1	ACG Phase 2	ACG Phase 3 W
Acartia tonsa Dana	26	21	217	3	3		2	41	1214	31	5
Eurytemora grimmi Sars	30	54		6		2	3	35	360	8	11
Eurytemora minor Sars.			25	19	8	9	13		643	1	11
Limnocalanus grimaldii (Guerne)	1	2		8	4	3	4	79	12	4	13
Limnocalanus macrurus	2										
Calanipeda aguae dulcis Kritsch.			26	5	1	1				1	
Halicyclops sarsi Akatova					2	1					1
Pleopis polyphemoides (Leuckart)	1		66	3	1	2	3	28	60		7
Polyphemus exiguus Sars	2		23	4	2		4	26	22		5
Podonevadne trigona Sars	1		26			1			42		
Podonevadne camptonyx Sars.				4							
Evadne trigona	0	1		4	2	2					
Evadne anonyx Sars	0	25	23	3			1	9	8		
Copepodites	38	23									
Cercopagis socialis (Grimm)	1			2							2
Bivalve sp.1	2	1									
Bivalve sp.2	3										
Chirocephalus sp.	0										
Mysis amblyops	0	0									
Cumacean sp	0										
Cirripedia nauplius	0										
Cyprid	0	1									
Paramysis loxolepis	1	1									
Fish larva Clupeoid	0	1									
Barnacle naup	6										
Anthomedusal	2										
Paramysis lacustrts		0									
Harpacticoid sp.		2									
Mnemiopsis leidyi (A.Agassiz)			533	12	5	5	3	173	98	117	

Zooplankton diversity and abundance is generally low in all surveys and samples, with typically only 6-10 species of all types present in any single survey. Of the 29 taxa recorded during the AIOC surveys from 1995 to 2003, 13 were recorded only during the 1995 EOP baseline surveys. A number of these taxa were larger organisms such as *cumacea*, mysids or fish larvae, and the absence of these categories from later surveys is most likely to be a consequence of variations in sampling methodology. In samples collected between 2000 and 2003, seven copepod species, seven cladoceran species, and one ctenophore were recorded. The species most consistently present (and generally most abundant) were:

- the copepods Acartia tonsa[13], Eurytemora grimmi, E. minor and Limnocalanus grimaldi
- the cladocerans Pleopis polyphemoides, Polyphemus exiguus and Evadne anonyx
- the ctenophore Mnemiopsis leidyi

Numerical dominance by *Acartia* in the copepod fauna has been noted previously as a characteristic of near shore waters (Woodward Clyde 1996). A number of these species are likely to have been introduced into the Caspian Sea, including the numerically dominant copepods *Calinipeda aqua dulcis* and *Limnocalanus grimaldi*.

The ctenophore, *Mnemiopsis leidyi*, was present in all surveys since 2000, with the exception of the most recent survey (West Chirag, April 2003). This organism was not recorded during the 1995 surveys, and is believed to have established itself in the Caspian during the late 1990s. *Mnemiopsis* is now frequently encountered in plankton samples, although at present there is insufficient information to properly assess its population dynamics and impact in the ACG Contract Area.

The low diversity and abundance of zooplankton at the Phase 3 location (GCA7) was comparable to most other locations within the Contract Area.

6.4.3.4 **Plankton Sensitivity**

Both phytoplankton and zooplankton are considered sensitive to chemical contamination, and it is for this reason that planktonic species are widely used in toxicity testing. If chemical contamination is present in the water column for any reason, the plankton are likely to respond more sensitively and rapidly than other water column species. Plankton diversity and abundance is important, since these organisms represent a significant source of food and energy for higher organisms, and in particular for ecologically and commercially important fish species such as kilka.

However, high individual sensitivity does not mean high population sensitivity. Plankton populations can grow rapidly from just a few individuals (phytoplankton populations can double in 12 hours, copepod zooplankton populations in 2-3 days). This means that populations can re-establish quickly, this is a natural feature of plankton ecology. In some instances, rapid growth can offset the effects of chemical contamination.

Sustained impact on plankton populations is likely to occur only under conditions where there is a sustained, wide-field discharge of chemicals at continuously toxic concentrations. Short-term, near-field discharges are unlikely to have a measurable impact.

Plankton abundance varies significantly throughout the year. For a detailed description of seasonality see the Phase 1 ESIA, Chapter 6. The impact of the ctenophore *Mnemiopsis* is the subject of a number of studies sponsored by the Caspian Environment Programme and the littoral Caspian states, but no conclusions are yet available about the nature and extent of the impact of this organism on the Caspian ecosystem.

6.4.4 Fish and Fisheries

Table 6.20 provides the results of a series of seasonal surveys for the presence of a number of fish species, and their age classes, in the Gunashli field in 1999 and 2000. The table indicates that kilka were the most abundant species, particularly during spring and summer. Only a small number of sturgeon were caught.

[13] The correct identification of the copepods as *Acartia tonsa* (as opposed to *Acartia clausi*) is currently being verified.

Table 6.20 Catch data from sampling program carried out in the Gunashli field, 1999-2001.

Fish species	Years									
	1999				2000				2001	
	Apr	Aug	Oct	Dec	Apr	Aug	Oct	Dec	Apr	Aug
Anchovy kilka	192 /2-3	263 /2-3	23 /2-3	-	117 /2	44 /2	15 /2	-	11 /1-2	-
Bigeyed kilka	184 /2-3	190 /2-3	37 /2-3	22 /2	51 /2	48 2	22 /1-2	14 /1-2	6 /1-2	-
Sandsmelt	16 /1-2	10 /1-2	-	21 /1-2	11 /1-2	9 /1-2	-	9 /1-2	8 /1-2	7 /1-2
Blackback shad	15 /3-4	26 /3-4	8 /3-4	-	6 /3-4	2 /3-4	-	-	-	-
Goby-A. profundorum	-	-	-	-	-	1 /3	-	-	-	-
Sturgeon	-	-	1 12	2 /14-16	-	-	-	1 /14	-	-

Note: Numerator – number of individuals; denominator – age of i (years).

A number of surveys have been conducted in Sangachal Bay, adjacent to the terminal (ERT, 2001). Four seasonal surveys were conducted between July 2000 and June 2001 to assess the status of resident fish populations in the bay. This information may be of value in assessing the vulnerability of the Bay to oil spills.

The surveys identified a total of 17 fish categories to species level or family. Of these, three species, *Atherina mochon caspia* (sandsmelt), *Rutilis rutilis kurensis* (vobla) and *Neogobius fluviatilis pallasi* (goby) were sampled in sufficient numbers to collect a range of physical measurements to describe demographic characteristics of each population.

Samples caught throughout the survey period showed no external signs of stress or pathology. It is likely that the data presented in this report describe fish populations that are currently healthy, and that there is thus a reliable baseline against which to compare future observation.

Empirical studies of fish populations in the ACG Contract Area have been limited to seasonal surveys conducted in the Gunashli field. In order to develop a more comprehensive understanding of fish populations in the Contract Area a review of the available literature was conducted to identify those species likely to be present in the Contract Area. These species are detailed in Table 6.21 along with a brief description of their ecology. The species listed are organised into three groupings as explained below.

6.4.4.1 Migratory species

On the basis of the literature review conducted the anadromous species of sturgeons, Caspian salmon (Salmo trutta caspius), Caspian lamprey (Caspiomyzon wagneri) and seashad may occur in the Contract Area and pipeline corridor area as juveniles and outside their spawning periods. Typically these species overwinter (November to February) in the deep water areas of the Middle or South Caspian. Spawning grounds for sturgeons and Caspian salmon are the rivers Kura, Terek, Samur and other rivers of the southwestern and southern Caspian. For several species of sturgeon the Volga is an important spawning river.

6.4.4.2 Resident species

Several non-commercial species such as gobies (*Gobidae, e.g. Neogobius*) and the pipefish (*Syngnathus nigrolineatus*) are present within the nearshore and, less frequent, in offshore waters of the South Caspian throughout the year (Kosarev and Yabonskaya 1994). Therefore, individuals may be present within the ACG Contract Area during all seasons.

6.4.4.3 Other species

The kilka (herring family) is the most abundant fish in Caspian fisheries. Kilka are plankton feeders and have a wide distribution in the Caspian with important areas in the south and the middle Caspian, which may include the Contract Area. They are themselves important prey for other species such as sturgeon, salmon and the Caspian seal (Kosarev and Yablonskaya 1994).

Mullet were introduced from the Black Sea in the 1930's. They normally overwinter in the southern Caspian, and they migrate in the spring to feeding grounds in the middle and northern Caspian. Spawning takes place in deep waters between June and September (Kosarev and Yablonskaya 1994). Mullets can be expected in the Contract Area.

6.4.4.4 Fish sensitivity

Over fishing, general levels of high pollution and habitat loss are common threats to fish populations in the Caspian Sea. Potential impacts from the oil industry include direct impacts from accidental discharge of contaminants such as oil or chemicals, or indirect impacts through the consumption of contaminated prey. Egg, larvae and fry are the most sensitive stages in the lifecycle, and fish species that spawn near the Contract Area would be the most vulnerable in this respect. Species potentially spawning in the Contract Area are herring (*Clupidae*), kilka (*Culpeonella grimmi* and *C. angrauliformis*) and mullet (*Liza saliens* and *L. auratus*).

In the case of a short-term discharge, the effect on any fish population due to direct contaminant effects in the water column is thought to be limited due to the short exposure period. Any sustained impact on fish populations through contamination of plankton is only likely to occur under conditions where there is a sustained, wide-field discharge of chemicals at continuously toxic concentrations. As fish reproduce seasonally, the timing of reproduction can be critical in ensuring an adequate food supply for maturing adults, larvae and juveniles. A temporary impact on plankton therefore could deprive sensitive life stages of fish, in turn potentially impacting recruitment to local fish populations.

A larger oil spill that reaches a river outlet during migration of fish into or out of the river would also have the potential to impact adult fish directly, or by reducing the reproductive success for that year. The closest large river in proximity to the Contract Area is the Kura River. In the unlikely event of a major offshore blowout during drilling operations, the outlet of the Kura River is within the area of influence and, given its importance for fisheries, it would be an important area to protect.

Oil spill modelling shows that in the unlikely event of a major offshore well blowout, oil could spread widely and would potentially beach in Azerbaijan, Turkmenistan and Iran. Chapter 9.11,Accidental Events, reviews the potential impacts of a major oil spill.

6.4.4.5 Fisheries

Fishing activity within the Contract Area is not frequent. The closest fisheries to the ACG Contract Area are the kilka fisheries, concentrated on offshore banks along the western coast of the southern Caspian. The closest bank is Makarov Bank, which is approximately 115 km to the west of the Contract Area (Figure 6.22). However, it should be noted that the Contract Area may be used by fishing vessels from other Caspian littoral states.

Figure 6.22 Location of major fisheries

Table 6.21 Anticipated fish species distribution and characteristics in the ACG Contract Area.

Family / Genus / Species	Distribution and presence in Contract Area	Importance
Migratory species		
Sturgeon (*Acipenseridae*): **Beluga (*Huso huso*)** **Russian (*Acipenser gueldenstaedtii*)** **Persian (*A. gueldenstaedtii persicus*)** **Spiny (*A. nudiventris*)** **Stellate/starred (*A. stellatus*)**	**Five species and subspecies of pelagic and bottom feeding fish. Feeding predominantly on small fish and benthic invertebrates. Generally present in less than 50 m water depths except whilst overwintering in southern Caspian (20 to 200m). They are anadromous fish, migrating in the spring (March and April) to spawning grounds in several rivers including Volga, Ural, and Kura.** Adults return to the southern Caspian during the autumn months of September to November. Very valuable as food fish and for caviar. Legal fishing for sturgeon is confined to the deltas and lower reaches of the rivers.	Most valuable commercial fish species within the Caspian both for caviar and food fish. All are classed as endangered on IUCN Red List.
Kilka (*Clupeonella)* **Caspian shad (*Alosa caspia*)** **Big-eyed shad (*A. saposhnikovi*)** **Blackback shad (*A. kessleri*)** **Dolginka shad (*A. brashnikovi*)** **Caspian salmon (*Salmo trutta caspius*)** **Caspian lamprey (*Caspiomyzon wagneri*)**	**Predators of kilka and other small fish, shad overwinter in the southern and south western Caspian between November and February at 30 to 100m depth. During March and April they undertake a spring migration to the northern Caspian to spawn. Adults return to the southern Caspian during the autumn months (September to November). They have also been collected in the Contract Area in August (see Table 6.19). Caspian salmon and Caspian lamprey both migrate to spawn in rivers, but do not appear frequently or in high abundance in the Contract Area.**	Valuable food fish.

Family / Genus / Species	Distribution and presence in Contract Area	Importance
Resident species		
Sandsmelt (***Atherina mochon pontica***)	Pelagic marine fish, plankton feeders. Present in southern Caspian throughout the year. Major concentrations in shallower coastal waters, only individuals found in offshore areas, usually at water column depths of 5 - 10m. Spawning has been recorded in southwest part of northern Caspian, near the Buzachi Peninsula and in Kyzyl-Agach Bay during April / May.	Non-commercial. Constitutes diet for sturgeons, predatory shads and other species.
Pipefish (*Syngnathus nigrolineatus*)	Plankton feeding marine fish. Numerous but do not congregate in shoals. Majority in shallower coastal areas, only single individuals found in deep water areas. Spawning all over Caspian during spring/summer period but mainly in coastal areas. Eggs not planktonic.	Non-commercial fish, however, provide food for sturgeons, zanders and predatory shads.
Gobies (***Gobiidae***) **Including *Anatirostrum profundorum***	**Generally small benthic and predatory feeding marine fish. Over 30 species present in Caspian, majority are coastal species. Fish eggs and larvae present during April/May period.** Spawn in shallow coastal waters, down to 70 m, during April/ May. Eggs benthic.	Non-commercial fish, however, provide food for other fish and seals.
Other species		
Big-eye kilka (*Clupeonella grimmi*) **Anchovy kilka (*C. engrauliformis*)**	Pelagic feeders on zooplankton. Undertake diurnal and seasonal vertical migrations in the water column following their food source (Big eye: 20-80m spring/summer, 60-500m winter. Anchovy: 40-60m spring/summer, 200-750m winter). They overwinter in the southern Caspian before undertaking a short spring migration to spawning areas in the South and Middle Caspian at depths of between 20 and 200m, (Big-eye: January to September. Anchovy: May to November) which potentially impinge on the Contract Area (April and May). Adults return to the southern Caspian during the autumn months (September to November). **Consequently they can be expected in the Contract Area all year round and spawning from April to November.**	Important food for fish and seals. Also important commercially for canning, smoking and fish meal.
Mullet (*Mugilidae*) **Grey mullet (*Liza saliens*)** **Golden mullet (*L. auratus*)**	Omnivores found throughout water column and over a wide range of water depths. Migrate to northern Caspian in spring to feed and migrate south in autumn to overwinter. Migratory path follows the western and eastern coasts of the Caspian. Eggs and larvae present in the southern and middle Caspian during the period June – July (Grey) and August to September (Golden) and throughout the water column (Belyaeva et al., 1989). Pre-larval and larval stages at depths of 10 - 40 m. Larvae migrate from central Caspian towards shallower coastal areas.	Food fish.

6.4.5 Avian Fauna

Of the bird species that are likely to be present in offshore areas the principal species are:

- Great cormorant (*Phalacrocorax carbo*)
- Herring gull (*Larus argentatus*)
- Common tern (*Sterna hirundo*)
- Sandwich tern (*Sterna sandvicensis*)

These four species have been highlighted as being the most numerically abundant in published data for the Absheron Peninsula (Gambarov *et al*., 1958; Gambarov, 1968; Mustafaev *et al*. 1968) and the Shakhdilli-Pirallahi area (Sultanov and Kerimov, 1998, 1999).

None of the four species listed above are currently listed nationally or internationally as being of conservation concern. All breed in the region and are likely to be present throughout the year, though population sizes will vary with some migration occurring.

6.4.6 The Caspian Seal

The Caspian seal (*Phoca caspica*) is listed by the IUCN as Vulnerable and is the only aquatic mammal in the study area. It is endemic to the Caspian and is the world's smallest species of seal with a lifespan of up to 50 years. The number of Caspian seals is not presently known.

However, in 1987 there were estimated to be between 360,000 and 400,000 individuals (Krylov,1989).

The Absheron and Baku Archipelago, Shakdilli Spit, and Ogurchinsk Island (Turkmenistan) are used as year-round haul-out sites (Gadjiev and Aybatov 1998). Helicopter surveys of the coast and islands of the Absheron Peninsula identified year-round haul-out sites on Shakdilli spit, Zilhoy Island, and other nearby islands. Two thousand seals were recorded within these sites during the winter period between 1996 and 1997 (*ibid*).

The majority of the seal population (85-90%) migrates during the late autumn/winter to the northern Caspian where they remain to breed until early spring. It is estimated that approximately 10-15 % (40-60,000 individuals), mainly consisting of juveniles and other non-breeding individuals, remain in the in the middle and southern Caspian all year round, During the late spring (April/May), migratory individuals from the north begin to reach the feeding areas of the middle and southern Caspian. The migratory seals initially confine their feeding activities to the coastal waters while replenishing their fat reserves, which have been depleted by up to 50% during the winter.

Once reserves have been replenished, and buoyancy restored, the seals move into the deeper water areas of the middle and southern Caspian, including the Contract Area (during May to June), where they feed predominantly on kilka, returning periodically to their haul-out sites. In October and November the seals commence the return migration northwards.

6.4.7 Benthic fauna

6.4.7.1 Diversity and abundance

Approximately 180 invertebrate species have been recorded in the Contract Area, the pipeline corridor and in Sangachal Bay between 1995 and 2002. Of these, 107 species occur infrequently (in less than 5% of more than 250 stations sampled); only 73 species could be considered common.

Most benthic invertebrates identified during surveys in the Contract Area are listed in Table 6.21. The table shows the number of common (found in more than 10% of samples) and scarce species in each group. Most of these animals are very small (from a few millimetres to one or two centimetres in length), and most feed directly from the sediment, or on particulate material in the water just above the sediment.

Table 6.22 Benthic invertebrates observed in the Contract Area

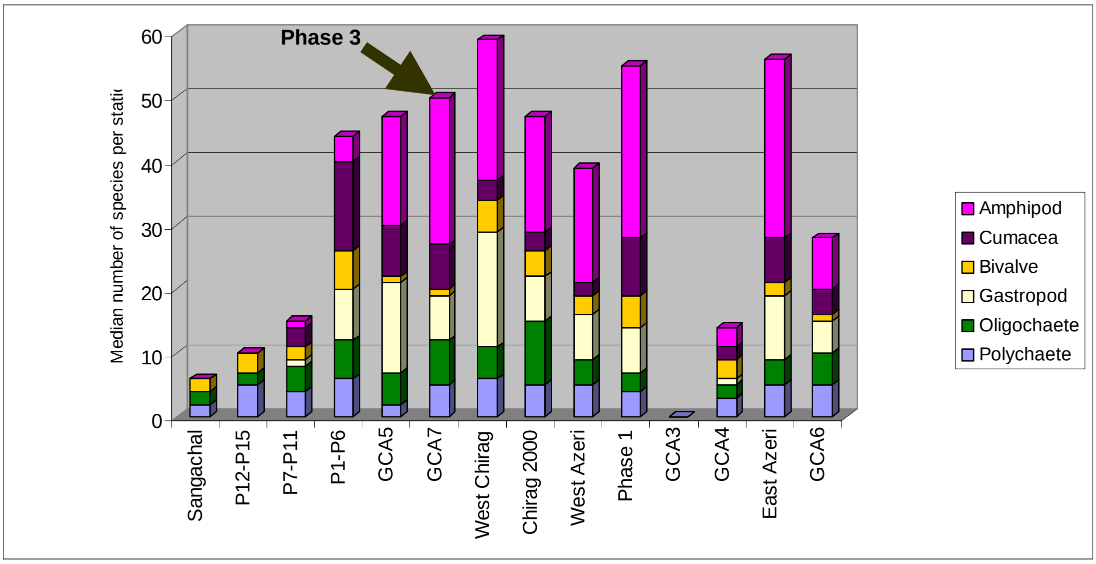
Group	Number of species		
	Common	Uncommon	Total
Polychaetes	6	3	9
Oligochaetes	10	5	15
Gastropods	15	33	48
Cumacea	7	14	21
Bivalve	2	4	6
Amphipods	17	33	50

From Table 6.22 it is evident that amphipods and gastropods are the most diverse groups in the Contract Area with total species counts of 50 and 48 respectively. This is a distinctive characteristic of the Caspian Sea. However, less than one third of the species in each group have been recorded as common. Typically between 30 and 60 species of all types are recorded at any single survey location. Numerically, oligochaetes, polychaetes and amphipods dominate, but the insect *Chironomus* is also a numerically important member of the seabed community in many locations. Abundant species are; amphipods *Gammarus* *pauxillus* and *Corophium* sp. (occurring at 121 and 105 of more than 250 stations respectively), the polychaete worm *Hypania invalida* (present at 163 stations), and the oligochaete *Isochaetides michaelseni* (present at 130 stations). The insect larva *Chironomus albidus* was present at 105 stations. This species was not common during the original 1995 studies, but has become very common throughout the Contract Area since 1998, and is now one of the most abundant. The reasons for the increase in abundance are not at present known.

There is significant variation in the composition of the benthic community from the Contract Area along the pipeline route into Sangachal Bay. The offshore community is largely dominated by native Caspian species (amphipods, polychaetes, oligochaetes and gastropods). In contrast, benthic communities in the shallow near shore area and Sangachal Bay are dominated by 'alien' species (either deliberately or accidentally introduced into the Caspian). In shallow water areas, polychaete worms such as *Nereis,* and shellfish such as *Abra* are the most numerous organisms also comprising most of the biomass.

The abundance and diversity of amphipods, gastropods and *Chironomus* is lower in shallow water areas compared to offshore. The locations within the Contract Area exhibited similar characteristics in terms of overall diversity and abundance, and no distinctive overall trends were observed. Amphipod diversity was lower close to drilling locations compared to other sampling locations. An overview of species distribution at various locations within the Contract Area is shown in Figure 6.23.

Figure 6.23 Median number of benthic species per station in each major taxonomic group from the Contract Area, pipeline route and Sangachal Bay surveys



Benthic biomass in the shallow water regions is substantially higher than offshore, with median values of 74-127 g.m^{-2} along the shallow-water part of the pipeline corridor and in Sangachal Bay, compared to 2-16 g.m^{-2} at offshore locations.

Species diversity at the Phase 3 location was similar to other Contract Area locations, the eight most common species found were:

- *Hypania invalida*
- *Isochaetides michaelseni*
- *Psammoryctides deserticola*

- *Caspiohydrobia curta*
- *Gammarus pauxillus*
- *Gammarus warpachowskyi*
- *Saduria entomon caspia*
- *Chironomus albidus*

The majority of other species are recorded at only a small number of stations, and this is typical of the Contract Area as a whole. The Phase 3 location is distinguished to some extent by a greater degree of numerical dominance by amphipods, but in other respects it is biologically similar to the Phase 1 and Phase 2 locations.

6.4.7.2 Relationships between environmental and biological characteristics

The benthic dataset has been subjected to a variety of multivariate analyses (statistical analyses which search for patterns within complex data sets comprising a large number of variables), with the aim of identifying any systematic relationships between environmental factors and seabed community composition and characteristics. Distance from shore, which is correlated with water depth, and to some extent sediment type, is the major factor affecting the composition of benthic communities. Within the Contract Area there are no clear, consistent or systematic relationships between biological community composition and individual environmental factors.

Benthic invertebrate sensitivity

The seabed environment offshore is dominated by oligochaetes, polychaetes (predominantly ampharetid polychaetes) and amphipods. These organisms share several important characteristics:

- They are small - no more than 1-2 cm long
- They have short generation times - between 4 and 12 weeks, which means that they can produce several generations per year
- They are either deposit or suspension feeders, which means that they are largely dependent on fine settled or suspended sedimentary material for food, and that they are also exposed to any chemical contaminants associated with sediment particles

Deposit and suspension feeders are well-adapted to maintaining their position in environments with high sediment deposition rates. Relatively short generation times mean that populations of these animals also have the potential to replace losses within months rather than years. Persistent impact is only likely in instances where there is sustained or persistent chemical contamination. Amphipods, for instance, are sensitive to hydrocarbons in sediment, and populations may be reduced for as long as significant contamination is present.

In addition to the amphipods, oligochaetes and polychaetes, several other biological groups are important in the Contract Area. Bivalves become increasingly important closer to shore, although there are areas offshore where *Dreissena* and *Didacna* are present. Bivalves are either deposit feeders (*Abra*) or filter feeders (*Dreissena, Didacna, Cardium, Mytilaster*). Bivalves reproduce and grow relatively slowly. Consequently, any damage to bivalve populations can take longer to repair. With the exception of *Abra*, bivalves are relatively vulnerable to water contamination because they filter large volumes of water.

Caspian gastropods are a diverse group, all of which are very small and are surface deposit feeders. Under good conditions, gastropods are generally capable of achieving high population densities quite rapidly, although there is no evidence of this in the Contract Area. Gastropods will be primarily vulnerable to surface sediment contamination, and may also be relatively vulnerable to physical smothering.

The insect, *Chironomus* is similar in size and in its habits to the small annelids, but may be capable of suspension feeding as well as deposit feeding. Larvae can develop to adulthood in approximately 4 weeks, so this species has the capacity to recover rapidly from temporary disturbances.

Larger crustacea, such as cumacea and isopods, occur throughout the contract area, although only cumacea achieve significant abundance. Both types of crustacean are surface-dwellers and scavengers; isopods are often encountered in higher abundance in the most 'impacted' areas close to well centres after drilling.

7 Socio-Economic Baseline

Contents

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7.1 Introduction

The following section provides an overview of the socio-economic environment within which the Project will be constructed and also operated. It discusses the socio-economic conditions at a national, regional and local context and identifies the socio-economic receptors within the vicinity of the Project's activities.

7.2 Methodology for compiling the socio-economic baseline[1]

The approach undertaken during the socio-economic baseline data collection is outlined below. The work comprised a number of main elements:

- collection of previously compiled baseline reports including those within the ACG Phase 1 and 2 ESIAs, Shah Deniz Stage 1 ESIAs and BP Regional Review;
- collection and interpretation of key secondary data sources;
- structured and semi structured interviews;
- information request to Garadag Executive Power;
- compilation and interpretation of data collected;
- preparation of baseline report; and
- incorporation of data into the ESIA process.

7.2.1 Baseline data

7.2.1.1 Previous ESIA data

The socio-economic baseline sections of the ESIAs developed during the earlier phases of the ACG project and Shah Deniz Stage 1 were used as a basis for this baseline description.

7.2.1.2 Secondary data sources

A number of key known and up-to-date secondary data sources were accessed and these are referenced by footnote, for example:

- Azerbaijan Human Development Report, United Nations, 2003;
- Azerbaijan State Statistics Committee. Azerbaijan Statistical Yearbook, 2002 (ASY, 2002); and
- The State Statistical Committee of Azerbaijan (ASSC), 2004.

7.2.1.3 Information Request

A specific information request was issued to Garadag Executive Power. The request sought to gather up-to-date socio-economic data specific to Garadag Region.

7.2.1.4 Structured and semi-structured interviews

As discussed in Section 7.2, a considerable amount of data has been gathered for the region of the ACG Projects and data for ACG Phase 1 and Phase 2 are presented in the respective ESIA documents and readers are directed to those documents for such data as health, population and employment applicable at that time (URS, 2001; RSK, 2001). However, as a result of the ACG Phase 1 and Phase 2 projects the baseline has changed for the ACG Phase 3 project. As a result of this, effort has been made to update the 2000 and 2001 data presented in these earlier reports with 2003 or most recent data for ACG Phase 3. These efforts included field visits, which were undertaken of the area associated with the Phase 3 project. These visits provided site specific information to augment the other sources of information collected. In addition, the following representatives were also consulted:

[1] Various caveats apply to the reliability of the information gathered from the sources listed in this section. These caveats have been outlined in the introductions to, and footnotes for, the regional and local sections of this chapter.

- Head of Garadag Executive Power;
- Deputies of Garadag Executive Power
- Representative of Garadag Executive Power in Sahil;
- Representative of Garadag Executive Power in Umid; and
- Representative of Garadag Executive Power in Sangachal.

Questionnaires were used as the basis for collecting information whilst on the field visits. These questionnaires sought to gather updated quantitative and qualitative information on topics such as economic activity, health and education. All those interviewed were made aware of the nature and purpose of the interview and questionnaire process.

7.3 Geopolitics

Azerbaijan is the largest of the three Transcaucasian republics of the former Soviet Union, which gained independence in 1992. It is located on the Caspian Sea and is bordered by the Russian Federation (specifically Dagestan) to the north, Georgia to the north-west, Armenia to the west and Iran to the south. The territory of Nagorno-Karabakh (populated mainly by Armenians) is situated within the borders of Azerbaijan and forms the basis of an ongoing dispute between Azerbaijan and Armenia. The Autonomous Republic of Nakhchivan, located between Iran and Armenia, also belongs to Azerbaijan.

The largest city in Azerbaijan is Baku, the capital, with a population of nearly 2 million. Baku is situated on the Apsheron Peninsula, which juts about 40 miles out into the Caspian Sea, and is a large port. Other large towns in the republic include Ganja, Sumgait, Mingacevir and Nakhchivan. (UZ Azerbaijan 2000).

The Caspian has traditionally been a region of strategic importance, providing a direct link between Europe and Asia and a transition between two world religions. With a central role in this region, Azerbaijan is surrounded by newly independent states and more established countries such as Turkey and Iran. The advent of independence from the Former Soviet Union (FSU) and the ensuing economic and social transformation process has been marked by armed conflict, social unrest and ethnic tension. There are ongoing disputes between Azerbaijan and Armenia, the Chechnyans and the Russians and between the Georgians and the population of Abkhazia and South Ossetia (AIOC, 2000a).

The collapse of the former Soviet economy revealed that many Soviet enterprises were loss making and uncompetitive. This accelerated the decline in industrial output that had begun in the Soviet Union in the late 1980s. As a result, independence left the Caspian states with the task of reforming their economies towards a market-orientated system while coping with a severe drop in industrial output and budget revenues (AIOC, 2000a).

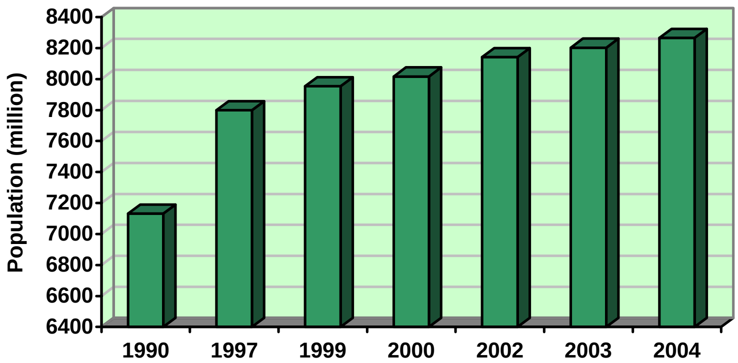
Much hope is placed on oil revenues as an opportunity to finance economic and social development. There are estimated reserves of 28 billion barrels in Azerbaijan and additional unconfirmed reserves estimated between 70 to 200 billion barrels in the Caspian Sea. It is possible that once the required exploration, production and transport infrastructure is in place the region could produce about 6 million barrels per day. The infrastructure investment required to achieve this is estimated at between $70-100 billion (AIOC, 2000a).

7.4 National

7.4.1 Population and demographics

Since 1990 the rate of population growth has declined as a result of social and economic hardship, substantial immigration, military conflict with Armenia, a decreasing birth rate and a declining life expectancy. Despite these factors, the total population has risen from 7.1 million in 1990 to 8.2 million in 2003 (UNHDR, 2002 and the ASSC, 2004) and is expected to reach approximately 9.4 million by 2015 (UNHDR, 2003). This is illustrated in Figure 7.1 below. Of the total population, some 50.6% reside in urban areas and 49.4% in rural areas (ASSC, 2004).

Figure 7.1 Population Change 1990 - 2002



The ethnic mix is dominated by Azerbaijanis and follows a trend of increasing homogeneity since independence. Ethnic minorities such as Russians, Armenians and Lezghins make up approximately 20% of the total population. Around 10% of the population are refugees or Internally Displaced Persons (IDPs). According to the ASY, 2002 there are 783 200 refugees and IDPs. This group reaches nearly 1 million if it is expanded to include those who where forced to leave their homes because of the hostilities and occupation of neighbouring areas (Azerbaijan UNHDR 2002 and ASY, 2002).

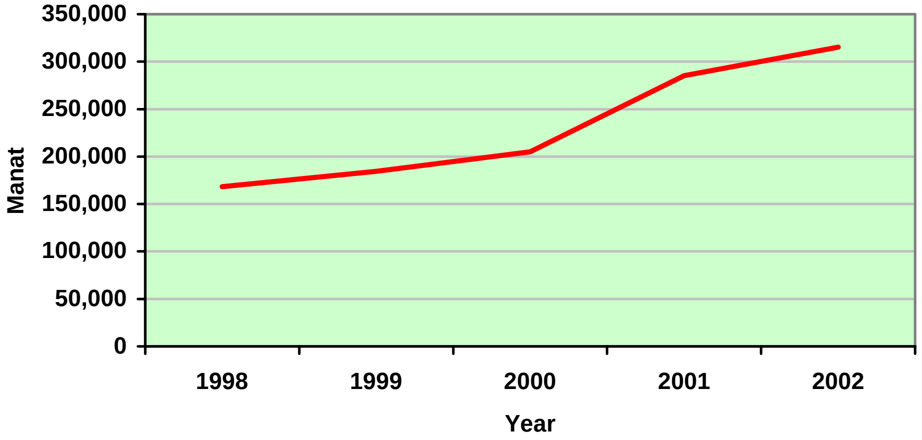
The religious distribution in Azerbaijan is relatively homogenous with the majority of the population defined as Muslim. Other religions include Orthodox Christianity, Judaism, Catholicism and Protestantism.

In Azerbaijan women and men possess equal rights and liberties under the constitution. The country's labour law also explicitly prohibits wage discrimination on the basis of genderWomen's employment is concentrated in lower-paying sectors of the economy, however, women are poorly represented at the higher levels of management, even in sectors that employ predominantly women. Currently the participation of women in Government average about 11 % in Parliament (Milli Majlis), 9% at Ministerial level positions, 9% as regional heads of administration, and 11% of Ambassadors to foreign countries (Azerbaijan UNHDR 2003) . An inter-ministerial State Committee for Women's Problems to address gender concerns and formulate gender-sensitive policies and programmes has been introduced (UNFPA 2001).

7.4.2 Income

The income level of most Azerbaijani households remains low, although several indicators suggest that real household incomes have increased in recent years. Average monthly salaries for Azerbaijan are presented in Figure 7.2 below. For the period 1998 through 2000, according to government statistics, salaries increased by 21.8%. However, according to the Azerbaijan Human Development Report (2003) per capita income in 2003 was 4.320 000 AZM ($879.7). This is an increase form the 2002 figure of 297,915 AZM in 2001 ($ 59.6).

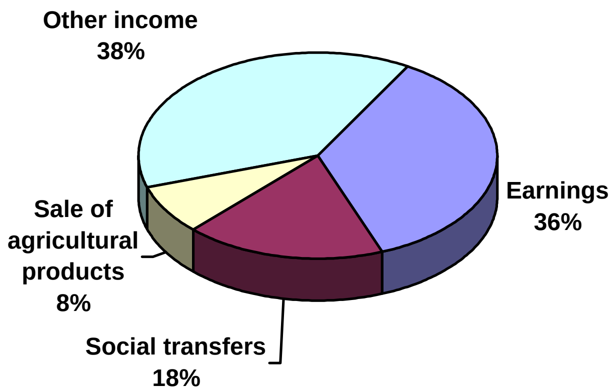
Figure 7.2 Average Monthly Salaries in Azerbaijan (in manat).



Source : Azerbaijan Economic Trends Oct-Dec 2000, United Nations Azerbaijan Human Development Report 2002 , ASSC, 2004..

Wages together with other monetary earnings constitute the main part of total household incomes, as illustrated in Figure 7.3 below. (UNHDR, 2002).

Figure 7.3 Household Income – Azerbaijan 2000 (Source : UNHDR 2002)



7.4.3 Employment profile

Employment in the public and private sectors has been decreasing in recent years. However employment in agriculture and also the service sector has been increasing. As a result of these trends, the current employment structure shows that the majority of people are employed in the services sector (48.4%) and agriculture sector (40.1%), The public sector currently accommodates 32.3%of the workforce in Azerbaijan. The industry and construction sector provides for 11.5% of the employment in Azerbaijan. (UNHDR, 2003).

Informal labour markets for which workers are hired on a daily basis exist in many urban areas but most notably in Baku. Their presence is an obvious sign of high unemployment and low incomes. The problem is complicated by the presence of a considerable number of refugees and IDPs, amongst whom the unemployment level is particularly high. An additional problem is the emigration of skilled labour, thereby diminishing the nation's skill base (AIOC, 2000b).

In 2001, only 2,500 (5.2%) of the 47,900 applicants who approached the relevant state bodies were registered as unemployed and given unemployment allowances. The number of those officially registered as unemployed does not therefore reflect the true situation in the labour market. According to the results of 1999 census, 11.6% of population is unemployed. Recent government figures show that 50 963 people received unemployment status in 2002, however, only 3292 individuals received government assistance (ASSC, 2004). The distribution of unemployed people in the country show apparently higher levels of unemployment in urban areas.

7.4.4 Human Development

A review of the Human Development Index (HDI)[2] indicators shows that expected life duration decreased between 1992 and 1995. However, since 1996, a growth in Gross Domestic Product (GDP) and an improved quality of life have resulted in increased life expectancy. Life expectancy at birth is estimated at 75.1 for women and 69.5 for men (UNHDR, 2003). Although the education index influences the HDI, the HDI has grown since 1995 primarily due to GDP growth. Although GDP growth is a positive sign, uneven income distribution and disparities in regional development remain a serious constraint for genuine development.

7.4.5 Economic Activity

7.4.5.1 Overview

In the early 1990s, GDP in Azerbaijan was declining. First positive growth was not recorded until 1996 and a growth trend has continued since. However the rate of growth throughout this period has been variable, for example following a reduction to 7.4% in 1999, there has been positive growth ever since with 2003 showing an 11.3 % increase in GDP from the previous year (ASSC, 2004).

The key industries in Azerbaijan include oil and gas, steel, cement, chemicals, and textiles. In 2002, the oil sector accounted for 20% of GDP and over 50% of total industrial output (UNHDR, 2002), whilst agriculture accounted for approx 20% of production. Figure 7.4 depicts GDP trends by sector and shows significant changes in the contribution of the construction sector to GDP growth. Between 1996 and 2000 trade, industry, transport and communications continued steadily to increase their contribution to GDP, whereas agriculture has declined by almost 30% over the same period. In recent years, the private sector has become an important contributor to economic growth. The private sector's contribution to GDP increased from 34% in 1995 to 71% in 2001.

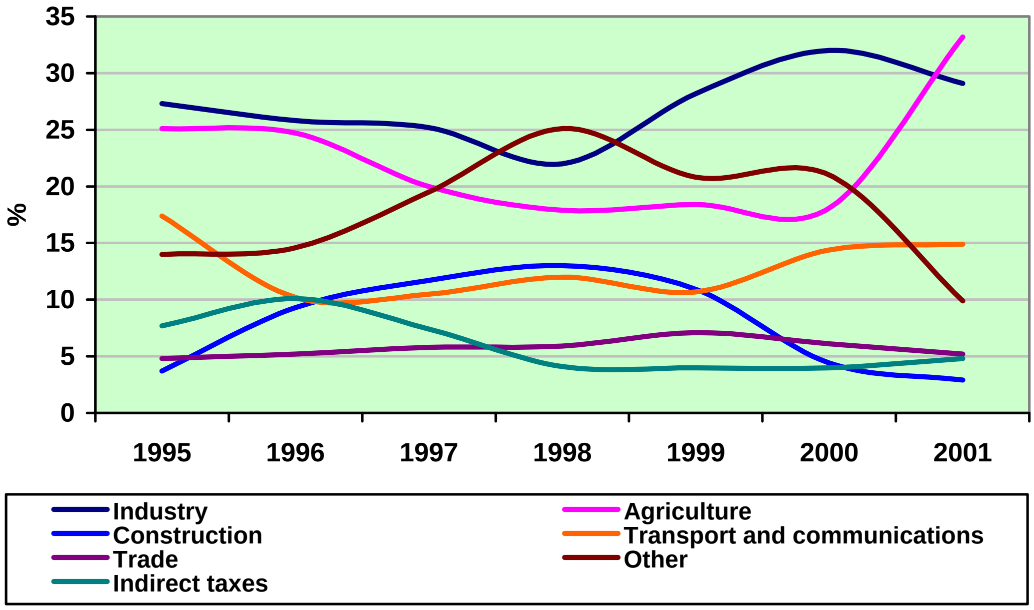
Cumulative net Foreign Direct Investment (FDI) from 1994 through 2000 is estimated at $4.1 billion, of which most went into the oil and gas sector. Inflows of FDI are predicted to increase over the years ahead as major investments into the ACG, BTC and Shah Deniz/SCP projects proceed and this has contributed to the 2003 FDI figure of $ 3,273 billion (ASSC, 2004) The level of FDI in other sectors remains low. Foreign investors have improved logistics facilities for the oil industry, introduced mobile telephony, rehabilitated the construction materials industry and increased demand for modern commercial property and business services in Baku. Foreign investment has however, made little impact on industry or on the agriculture/agri-business that is central to the Azerbaijani economy. Continued state ownership of utilities has limited the level of direct foreign investment in this sector.

Recent monetary and fiscal policies appear to be stabilising the economy and creating a platform for recovery. The level of national debt is relatively low for a transitional economy at around 2.4% of GDP in 1999. Whilst efforts are being made to improve the quality and transparency of public finances, business confidence could be increased through further

[2] a summary measure of human development

improvements in transparency, particularly regarding public sector wages, pensions, electricity and other tariffs. Persistent tax arrears by major taxpayers are a source of concern although at present they are not a destabilising influence on the overall economy (AIOC, 2000a).

Figure 7.4 GDP by Sector (%)



Source: UNDP Human Development Report, 1999; Azerbaijan Economic Trends, Fourth Quarter 1998 p25; ASSC Statistical Yearbook of Azerbaijan 1999, p211; Azerbaijan Economic Trends October-December 2000.

Since 1995, the Azerbaijani government has begun implementing economic reforms supported by the World Bank and International Monetary Fund (IMF). Rapid progress has been made in restoring financial stability through tight fiscal and monetary policies. During 2000 the budget deficit fell to –1.1% or AZM239 billion (approximately $50 million) (ASSC, 2001). This was below the government's target of 2.6% and considerably lower than the levels of 4-5% in 1998-99.

At the beginning of the 1990s, the economy of Azerbaijan was characterized by high inflation, largely fuelled by declining production, rapid growth of the money supply and the slow pace of institutional reform. Subsequently, the rate of inflation, which was running at a hyperinflation level in 1994, fell substantially, averaging 3% in 2001. Inflation was estimated to be 2.6% in 2002.

Government finances are highly dependent on oil revenues for financial stability. Between January and September 2000 export revenue from oil and oil products was $1,308million, four times higher than the same period in 1999. This was a result of high oil prices (AET, 2000). In 1992, the Social Protection Fund was created as Azerbaijan's social insurance programme, and almost one-third of government expenditures are transfered through the fund. Pension arrears are a significant problem for state finances.

The rapid expansion of the private retail sector has, to a considerable extent, overtaken price liberalisation. While state-owned stores that sell subsidised bread and other staples remain in operation, large and vigorous markets that sell a wide variety of goods exist in almost every city and town of any size. Gasoline prices were liberalised in 1995, however, power and telecommunications prices remain artificially low.

The European Bank for Reconstruction and Development (EBRD) sees three key challenges currently facing Azerbaijan's economy:

- A more balanced development of the non-oil and gas sectors of the economy through prudent management of the Oil Fund resources, an improved investment climate, and increased financial intermediation and strengthened governance;
- Effective implementation of the second privatisation programme to support private sector development; and
- Tackling the quasi-fiscal deficit in the energy sector by the adoption of a new regulatory framework, including tariff and subsidy changes, and the restructuring and privatisation of key enterprises.

The main export commodities are oil and gas, machinery, cotton and foodstuffs. Key export partners in 2001, in order of amount of export, included Italy, Israel, Georgia, Russia and Turkey (ASSC, 2004). In 1999, the value of Azerbaijan's merchandise exports were $929 million. This increased to $2314 million in 2001, a growth rate of 249% (ASY, 2002). The geographical location of Azerbaijan means that it is dependent on its neighbours for the transport of imports and exports, with 90% of road freight and 95% of rail freight passing through Russia. Barriers to trade such as duties and strict licensing restrictions have been eased. While these efforts have allowed new trades routes to develop in light of the collapse of the traditional Soviet distribution network, Azerbaijan may still have to wait some time before pre-Soviet volumes of trade are yet to be realised (AIOC, 2000b).

7.4.5.2 Resource based industry

Resource based industries are growing in importance, due principally to the development of the oil sector. Resource based light industry remains underdeveloped due to the former reliance on Soviet markets and competition for markets with imported goods. Although privatisation efforts did yield an initial gain in output in 1996, production and yields continue to be lower than pre-1990 figures (URS, 2000a). Industrial production has collapsed to less than one-third of its 1991 levels. The total rate of growth for gross industrial output in 2002 was 3.6% (ASY, 2002).

Today the oil sector continues to drive national macro-economic performance and strongly influences GDP growth. Investment in the oil sector has reversed the previous downward trend in oil production and built a sound basis for subsequent growth in this sector. Since 1998, there has been a stable growth in oil production. Relative to its 1999 level, oil exports in 2001 increased nearly 2 fold. Oil and oil product exports make up 91% of all exports (SCS, 2001). This noticeable growth in oil exports led to an improvement in the balance of payments.

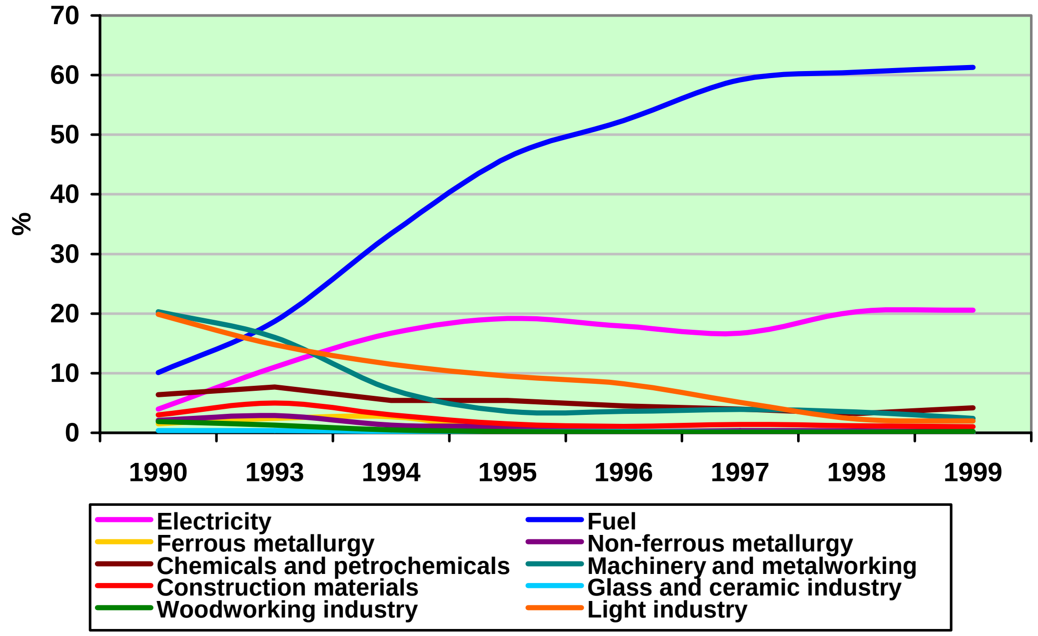
As new oil and gas fields and pipeline routes come on stream, export of oil and gas will dwarf the export of other goods and services. The projected export boom is expected to improve Azerbaijan's economic prospects and improve its credit worthiness. Whilst the potential for export revenues is substantial, there are issues associated with the volatility of commodity-related income streams, political threats to the various export routes and the capacity of the domestic oil and gas industry to capture a reasonable share of the increased production (AIOC, 2000a). The accumulation of foreign assets through the Azerbaijan State Oil Fund, and the development of the non-oil economy will be vital for providing Azerbaijan with some protection against adverse changes in the price of oil.

Azerbaijan has an oil refining capacity of about 20 million metric tonnes per year but domestic oil production is approximately half this quantity with refineries operating well below capacity. In past years crude oil has been imported from Russia to make up some of the shortfall, however this practice ceased recently.

Despite gas reserves estimated at 100 billion cubic metres, domestic gas production does not currently meet Azerbaijan's needs. In 1994, the deficit of approximately 2 billion cubic metres was supplied by imported gas from Turkmenistan. In 1995 a gas collection and treatment facility was commissioned to recover gas from offshore oil fields where associated gas had previously been flared. This will allow a reduction in gas imports and fuel oil consumption as gas is substituted for oil in the generation of electricity (AIOC, 2000b).

The production of energy, including fuel and electricity, has declined less significantly than production in any other industrial sub-sector (Figure 7.5). The fuel industry alone has accounted for more than half of the total value of industrial production for the past three years. Despite the high potential that exists in Azerbaijan for development of both light and food industry, this sector of the economy has declined from almost 20% in 1990 to less than 2% in 1999.

Figure 7.5 Structure of industrial production by sectors (%)



Source: SCS 2000

7.4.5.3 Shipping

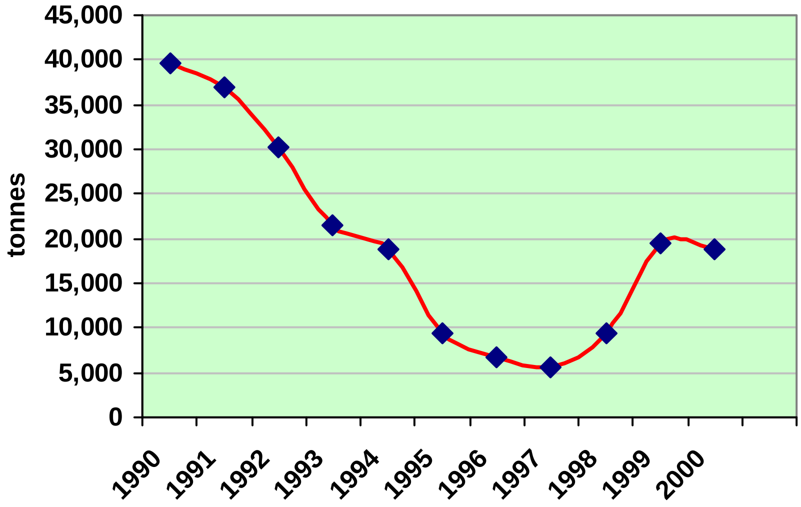
The shipping activities in Azerbaijan waters include commercial trade, passenger and vehicular ferry transport, military, scientific and research operations, and service and supply operations to the offshore oil and gas industry. Merchant shipping levels have varied in the last decade, with a sharp decline in the early and mid-1990s followed by a substantial increase beginning in 1996. The increased vessel traffic over the last two years is mainly related to new oil activities, particularly those of AIOC. Azerbaijan has eight commercial ports which are centred around the Apsheron Peninsula and Baku. The Caspian Shipping Fleet is operated by the Caspian Shipping Company (CSC), the Volgotanker River Shipping Company, and other smaller companies, owning a variety of cargo tankers, roll on-roll off ships and railroad sea cargo/passenger ferries.

7.4.5.4 Fishing

The Caspian is an important fishing area, with fishing representing 1% of Azerbaijan GDP. Main activities involve commercial catches of sturgeon, sprat, carp, darters, gobies, herring, salmon and mullet. Since the advent of independence among the littoral states Caspian fish stocks have fallen substantially. The industry today is in serious decline, not only as a result of falling stocks, but also disrupted export routes and markets, and inadequate supplies of materials for processing and packaging. It is widely considered however, that the primary reasons for the reduction in fish stocks within the Caspian is due to a lack of regulation and control of the fishing industry, which has lead to increased illegal and over-fishing; and due to contamination.

Figure 7.6 below provides details of the fish catch in Azerbaijan between 1990 and 2001. These figures however are unlikely to reflect the actual numbers of fish caught, as has been highlighted through inspection checks. It is estimated that legally caught fish amount to only 30% of that caught.

Figure 7.6 Fish Catch in Azerbaijan 1990 –2001 (ASY, 2002)



Fish caught in the Caspian is primarily for food. For example, in districts such as Neftchelar and Lenkoran fish is the daily, basic food. In addition to providing a basic food resource, the fish catch is also used for the production of caviar, cannery, smoking and fish flour. There are also two fish factories, located in the Lenkoran Region; the Narimanov factory and the Taiev factory, which support this industry.

7.4.6 Infrastructure

Most of Azerbaijan's infrastructure (gas, water, electricity, roads, communication etc.) is in poor condition due to inadequate investment. Health infrastructure is limited with poor and deteriorating medical facilities, particularly in rural areas. A high proportion of medicines and medical equipment are provided through international humanitarian assistance. A decline in preventative care and epidemic control measures has resulted in an increasing incidence of tuberculosis and outbreaks of malaria (Government of Azerbaijan, Interim Poverty Reduction Strategy, 2001).

The power generation and distribution system is deteriorating, and gas, water, electricity, and oil product shortages are common in the capital. In 2000, Azerbaijan switched its power-generating facilities from fuel oil to gas in an effort to free up more oil for export, but problems with gas supplies to power plants at the beginning of 2001 caused electricity shortages, forcing the state oil company, SOCAR, to use more oil domestically. As part of the Full Field Development, ACG associated gas will be provided to the national gas distribution system, up to an estimated 620 MMscfd at peak.

7.4.7 Water

Clean water resources are limited in Azerbaijan with more than 80% of the population living in areas without modern water or sewage networks. The Kura and Arax rivers that provide most of Azerbaijan's fresh water are contaminated with industrial, agricultural and domestic wastes generated both inside and outside Azerbaijan (Azerbaijan National Program On Environmentally Sustainable Socio-Economic Development, 2002).

The problem of clean water scarcity is compounded by inefficient water use; for example approximately 45 – 50 % of the drinking water distributed to the Apsheron peninsula is lost in the pipe distribution system. The degraded and poorly managed irrigation system is responsible for agricultural water losses of about 50%, and in industry, recycling of water is virtually non-existent (Azerbaijan National Program On Environmentally Sustainable Socio-Economic Development, 2002).

7.4.8 Health

The quality of health care in Azerbaijan is compromised by structural characteristics inherited from the Soviet years[3 4]. The system consists of a complex, hierarchical network of medical structures that remain almost completely within the public sector. The lack of funding for the health sector has resulted in deteriorating hospitals and shortages of modern medical equipment. This has been compounded by the near collapse of emergency services and primary care in most rural areas. A number of modern health facilities have recently become operational within Baku, however, the majority of the population is unable to access these services.

Overall, specialists consider health care in Azerbaijan to be in a critical state. Measures taken in recent years, as well as the development of fee-for-service arrangements and assistance from international humanitarian organisations, have however allowed the problem to become less acute in several important areas of health care work.

The leading causes of mortality in Azerbaijan, in order of magnitude, include:

- cardiovascular disease;
- cancer;
- respiratory infections; and
- accidents.

The incidence of communicable diseases is increasing, having been successfully reduced during Soviet times. The steep decline in attention given to preventive care, and the difficulty of carrying out therapeutic and public health and epidemic prevention measures at an appropriate level, has resulted in epidemics of polio, diptheria, malaria and other infectious diseases (GOA IPRSP: 2001). HIV/AIDS, hepatitis A, diarrhoea, sexually transmitted diseases and acute respiratory infections are all important public health problems, along with reported instances of botulism, tetanus and malaria (ERM, undated). Tuberculosis (TB) is a serious problem in Azerbaijan, with mortality from TB increasing from 4.6 per 100,000 in 1990 to 10.4 per 100,000 in 1993. Malaria is still significant in the Region and remains a problem in Azerbaijan. An increase in the incidence of diptheria was registered in the country, as in most other Newly Independent States (NIS), in 1994-1995. The spread of this disease was since halted and incidence fell, due to the joint efforts of the Ministry of Health, UNICEF and WHO (WHO: Highlights of Health in Azerbaijan, 2001).

Azerbaijan is one of the countries with a low prevalence of HIV infection. Recently, however, the number of new cases of infection has begun to rise sharply with 376 HIV cases confirmed by January 2001 (UN, 2000). The real number of HIV+ is estimated to be 15 times higher (UNAIDS, Azerbaijan: Country Information, current). Due to changes in testing policy and economic constraints, the number of HIV tests performed has decreased from more than 300,000 per year (excluding blood donations) in the early 1990s to 12,000 in 1998. (UNDP Azerbaijan, 2000). One of the drivers of an increasing HIV/AIDS infection rate is labour migration and mobility, with workforces being disconnected from their families (UNAIDS, Azerbaijan: Country Information, current).

[3] Ref: Dr Vladimir Verbitski, WHO Regional Office for Europe in Azerbaijan. and Dr Richard Zalesky, Head of the Chair of Tuberculosis of the Latvian Medical Academy. Article published in Azerbaijan International (3.4) Winter 1995.
[4] Dr Irada Yusifli, The Return of Infections and Contagious Diseases, published in Azerbaijan International, (3.4) Winter 1995.

The number of health problems connected with drug addiction and alcoholism has increased since the late 1980s.

7.4.9 Education

Azerbaijan inherited a strong and comprehensive system of education from the Soviet Union, a system characterised by total centralisation and standardisation in approaches to education. The law of the Azerbaijan Republic "On Education" guarantees the right to education for all its citizens irrespective of race, nationality or sex.

There are more than 2.2 million people studying at the various institutions throughout the country (27.5% of the total population). High school enrolment rates are high with 165,870 students enrolled in secondary schools in 2001/2002. This translates to 84.1% of the population between 6 to 16 (GOA IPRSP, 2003). They are taught by over 400,000 instructors, teachers, plus on-the-job training supervisors and other workers (GOA IPRSP, 2001). The system encompasses:

- 1,794 pre-school institutions, serving 111,352 children,
- 4,538 secondary education schools (with 1.6 million students),
- 109 vocational schools and academic preparatory schools (with 21,619 students),
- 25 public and 18 private universities (with 113,000 students), and
- 70 colleges (with 35,000 students).

A system of private educational institutions is being developed. Specialised secondary schools play an important role in training more than 70,000 pupils for specific jobs. Today about 86% of the workers in the national economy have received an education to secondary level or above and there is almost universal literacy. Many foreign students, particularly from Turkey, India, Arab countries like Iran and others attend special institutes in Azerbaijan.

Azerbaijan's educational progress is jeopardised by current funding problems and structural weaknesses within the education system. The view is that there is a need for fundamental improvements and to be brought closer in line with progressive world standards. This applies not only to improving the quality of the educational and instructional process and the qualifications of teaching personnel, but also to improving the administrative structure in the educational sphere. Moreover, the current material and technical base of educational and training institutions, and especially general education schools, lags significantly behind what is needed. (UNDP, 1999 and GOA IPRSP, 2003)

Over the past ten years very few schools have been built in Azerbaijan and, due to the limited budget, it has not been possible to purchase up-to-date equipment. As a result, it is not possible to incorporate new technologies into the learning process at many educational institutions, especially in rural areas, and the absence of adequate computer equipment prevents students and teachers from obtaining the necessary information and organising the educational process on a contemporary level (GOA IPRSP, 2003). Additional problems include low salaries for teachers and the shortage of suitable buildings, textbooks and furniture.

7.4.10 Poverty

In 2001, the State Statistical Committee of Azerbaijan introduced a new Households Budget Survey. Using an absolute poverty line of 120,000 AZM per capita per month ($24) it is estimated that 49% of the population is living in poverty. The survey also shows that:

- Poverty is greatest in urban areas;
- One quarter of the total poor population lives in Baku;
- Larger households have a greater risk of being poor than small households;
- Children have a slightly higher poverty risk than the elderly;

- Households where the head has refugee or IDP status are more likely to be poor; and
- Employment is one of the most important ways of protecting households from poverty.

The major causes of increasing poverty are the general economic decline and the fragmentation of the social welfare systems, which in Soviet times provided a minimum standard of living for all. Support services appear to have collapsed, wages and pensions frequently go unpaid or are severely delayed, unemployment has risen, and the real value of social support payments has fallen.

This poverty is intensified by reduced access to social services, such as health care and education systems. Many people continue to live without access to safe water, sewage systems or energy. Social inequality is also a rising problem. Market reforms are very focussed on Baku, leading to increasing income disparity between the population of Baku and the rest of the country.

The ongoing economic crises, the uneasy peace with Armenia, and the need to accommodate over half a million people displaced from territories now occupied by Armenia (the occupied sections covering approximately 20% of Azerbaijan) add to the country's social problems.

During 2001 and 2002 the Government worked to develop the first State Programme on Poverty Reduction and Economic Growth (PRSP). Sector working groups have tackled issues related to economic development, poverty monitoring, fiscal policy, monetary and exchange rate policy, social benefits, investment policy, the education and health sectors, IDPs and refugees, the energy sector, juridical reform, agriculture, environmental safety and tourism, sport and culture.

The Government's Strategy identified the need to target social benefits to the most vulnerable groups, for example children, women, the elderly, the disabled plus refugees and IDPs. It is designed to mitigate in the short term, the impact of the new public utility policies (e.g. increasing the collection of utility payments, and reducing energy subsidies).

7.4.11 Refugees and Internally Displaced Persons (IDPs)

The number of refugees and IDPs in Azerbaijan is estimated at between 800,000 and 1 million. The IDPs come from the various regions around Nagorno-Karabakh, which are occupied by Armenian forces. IDPs are accommodated in prefabricated houses, railway wagons and tent camps managed by international humanitarian organisations. The major camps are located in Sabirabad, Saatly, Bilasuvar, Agdam, Barda, Agjabadi, Sumgait, Goranboy, Yevlax, Seki, Deveci, Imisli and Mingacevir. Other groups of refugees and IDPs reside in rehabilitated public buildings. Most of these buildings are overcrowded and in severe disrepair. Many IDPs have been residing in these buildings for four years or more, however, much progress have been in recent years to provide more suitable living conditions.

Male household heads tend to make extended stays away from home in order to pursue seasonal labour. This significantly weakens family ties and has greatly increased the number of single-parent households headed by women. Only 10% of men are capable of providing for their families. The resultant psychological stress and frustration of not being able to meet the needs of their families tends to decrease their life expectancy.

Only 62.4% of refugee and IDP families have children who regularly attend school; children in 21.8% of these families do not attend school at all[5]. The government and various international organizations have sponsored initiatives to provide assistance to IDP and refugee education facilities but this has not radically improved the situation. The percentage of refugees and IDPs above 16 years of age who have not completed secondary education is twice the national average (20.6%).

[5] Sigma Centre 1998

Studies show that the majority of refugees and IDPs are deprived of adequate nutrition. It should be noted that while consumption levels of certain food items by the general population of Azerbaijan is already below the required norms, the indicators among the refugee and IDP population are even worse.

Approximately half (48.5%) of refugees and IDPs have an average per capita monthly income of about $6, with 21.6% having around $11. It is therefore clear that most refugees and IDPs live well beneath the poverty line. Only around 19.7% of the total number of refugees and IDPs are employed and earn wages. However, salary only accounts for 49% of their average monthly per capita income. The remainder of their income comes from aid, pensions and casual earnings. (UNDP Azerbaijan, 2002)

State programs provide financial assistance, amounting to 25,000 AZM per month, to refugees and IDPs. IDPs and refugees are exempt from payment of utilities (electricity, water and sewage). Firms operating in areas where refugees and IDPs are located are exempt from paying certain forms of taxes and transfers: value-added tax, property tax, automotive tax and social security transfers.

7.4.12 Civil Society

There are approximately 950 NGOs officially registered in Azerbaijan. Of these only approximately 90 to 110 are active (ISAR-Azerbaijan 1998). NGOs include women's groups, charitable organisations, environmental associations and public policy institutes. The strongest national NGOs are those that work on refugee issues and have contacts with organisations such as the United Nations High Commission for Refugees. There are also well-established groups working on health and children's issues.

The 1995 constitution and a 1992 press law ostensibly guarantee free media. Most popular newspapers are published in Baku. The majority of newspapers, magazines and journals are privately owned. More than 300 newspapers exist, but many of these are published irregularly and have limited circulation. Newspapers are free to choose topics and positions in their coverage of domestic and foreign policies, events and processes. However, misunderstandings about freedom of the press occasionally lead to the violation of laws and subsequent lawsuits. In the event that the publication is found to be at fault, fines are levied.

The two state-owned television stations, AzTV-1 and AzTV-2, dominate the electronic media and provide the population with most of its news. Several independent stations exist, a number of private and two Russian TV channels, although a tightening of private broadcast regulations has forced them to narrow their coverage to a range of subjects acceptable to local authorities (Nations in Transit, 2000). Recent reports suggest a lifting of these restrictions.

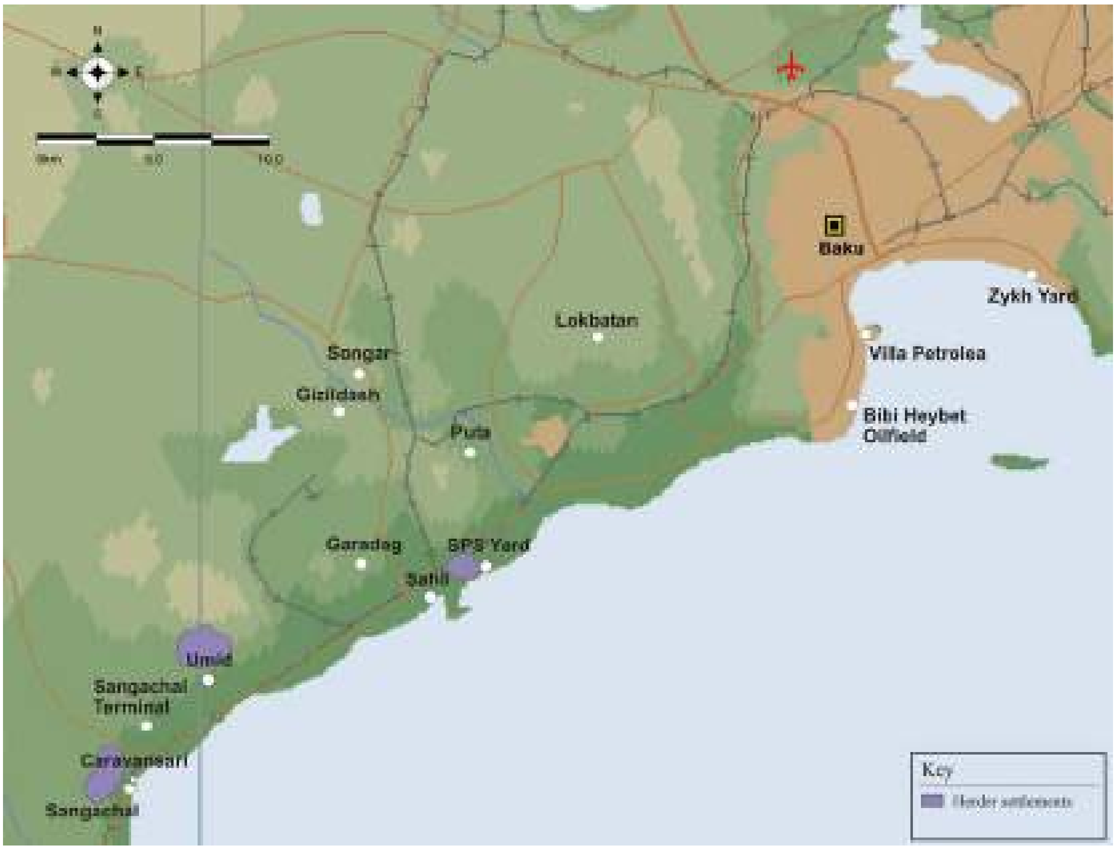
Azerbaijan's telephone system is a combination of old Soviet era technology and modern cellular telephones, the latter used by an increasing middle class, large commercial ventures, international companies, and most government officials. Internet and e-mail services are available in Baku (Nations in Transit, 2000). Satellite services also exist. Azerbaijan is a signatory of the Trans-Asia-Europe Fibre-Optic Line (TAE), although the necessary infrastructure has not yet been put in place.

7.5 Regional

7.5.1 Overview

This section provides an overview of socio-economic conditions of the Garadag district, in which the majority of the Phase 3 activities will be undertaken. Both Sangachal Terminal and the potential fabrication yard, Shelfprojectstroi (SPS) are located within this region.” (Note, ATA is not in Garadag but in Sabaiyl district). Figure 7.7 below illustrates the location of key settlements and receptors in the region.

Figure 7.7 Location Map



During the last couple of years there has been significant levels of activity in the region as a result of the construction associated with Phases 1 and 2 of ACG and also Shah Deniz Stage 1. In particular, construction has been taking place at Sangachal terminal and also the ATA and SPS fabrication yards. Additional investment has been undertaken in the local communities near to Sangachal terminal and the ATA and SPS fabrication yards through Community Investment Programmes that are being implemented in association with the construction activities. This investment has resulted in a number of projects being implemented in the area e.g community centres, schools, education, etc.

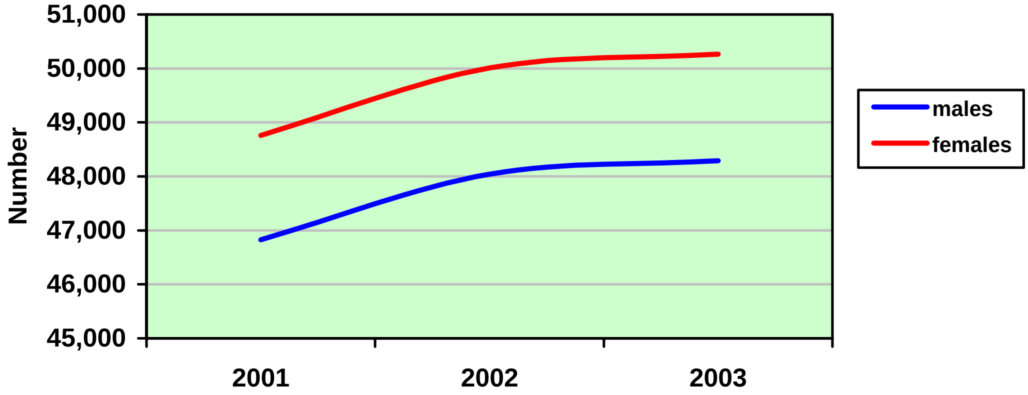
In addition to construction related activities undertaken in the region, a Community Investment Programme is also being implemented by the STEP Human Development Forum. Projects implemented by the Forum mainly focus on the development of education, community infrastructure, income generation and other human development initiatives. Where appropriate, these projects have been mentioned in the following pages, with further information available in Appendix 5.

7.5.2 Population and demographics

Recent discussions with Garadag Executive Power[6] indicate that 98,555 people were officially registered in the District in 2003. This is in comparison to the 95,586 that were registered in 2001 and indicates a 3.1% increase in population levels in the district between 2001 and 2003. This is illustrated in Figure 7.8 below, along with the gender distribution of the population. In 2003 the population in the District was split 49% male and 51% female, the same gender ratio as recorded during 2001 and 2002. The age profile has stayed relatively stable over recent years, with the main growth sectors in the <4, 10-14 and 35-39 brackets.

[6] Meeting held between Garadag Executive Power, URS and Synergetics on 20.10.03

Figure 7.8 Population of Garadag District Council 2001 - 2003



Source: Garadag Executive Power 2001 and 2003.

Table 7.1 below details the ethnic origin of those within the District. The majority of the population in the District is of Muslim religion, with only a small minority, approximately 7.4%, being Christian. Garadag reflects the ethnic mix in Azerbaijan as a whole. Neither the main religious groups nor ethnic origins evident in the district have changed in recent years[7].

Table 7.1 Ethnic origin Garadag (2001)

Ethnic Origin	People	
	Number	%
Azeri	76,000	90.0
Russian	2,970	3.5
Lezghin	2,660	3.1
Tatar	1,250	1.5
Ukranian	1,100	1.3
Kurd	230	0.27
Others	93	0.11
Turkish	32	0.03
Jewish	23	0.03
Georgian	19	0.02
Armenian	16	0.02
Avar	15	0.02
Tat	7	0.008
Sakhur	6	0.007

Source : Garadag Executive Power Office.

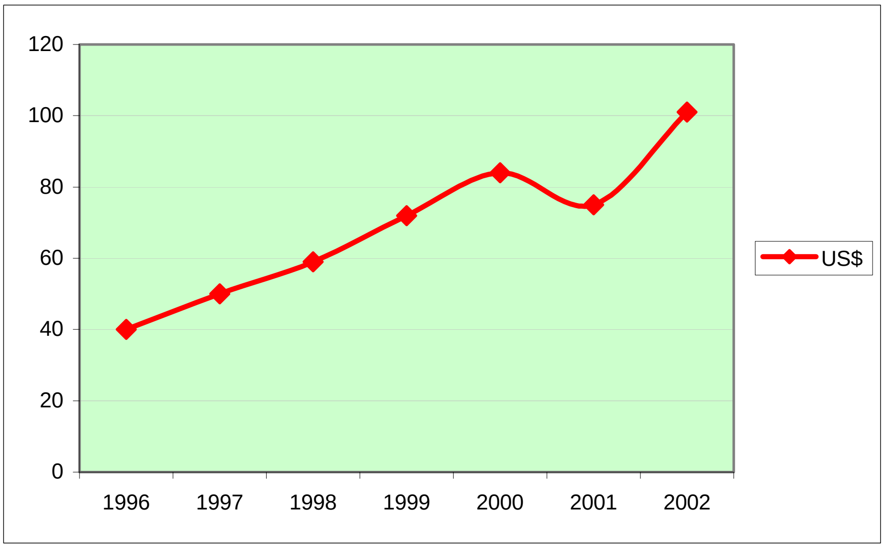
Many settlements within the district contain IDPs and this is discussed further in Section 7.5.9.

7.5.3 Income

Income levels in Garadag District between 1996 and 2002 are detailed in Figure 7.9. As illustrated, the average monthly salary in the district has increased by 154% between 1996 and 2002.

[7] Meeting held between Garadag Executive Power, URS and Synergetics on 20.10.03

Figure 7.9 Average Monthly Salary, Garadag District 1996 – 2002



Source : Garadag Executive Power Office 2001 and 2003.

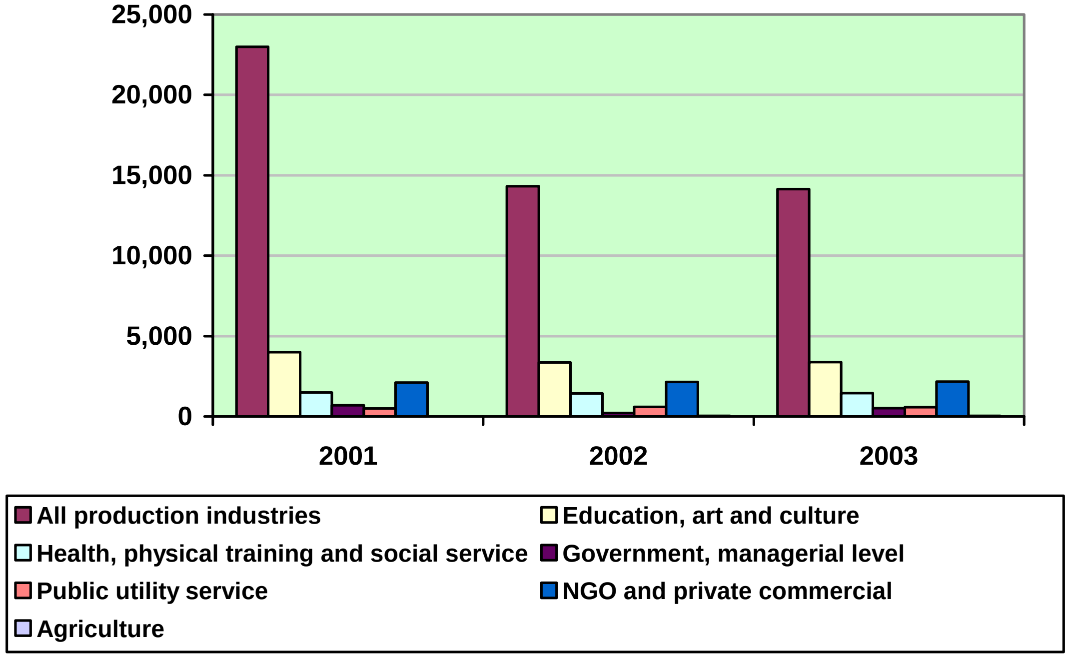
Discussions with representatives of Garadag Executive Power believe that the quality of life for the people in the district has bettered in the last few years. They believe this change is, in part directly linked to the increased employment opportunities that have arisen through the construction activities on BP/AIOC projects in the region[8]. Increased employment opportunities have resulted in increased income levels in households, thus helping to improve the quality of life for many adults since 2001. At the same time the Executive Power believe that the quality of life for children in the region has also increased, assisted through better educational and sporting facilities that have been developed through BP/AIOC led community development projects, e.g. new sports grounds, school and library upgrades, computer courses etc.

7.5.4 Employment profile

Garadag's economy is dominated by its proximity to the industrial and economic centre of Baku and by industry in Sahil (e.g. the SPS rig fabrication yard and the nearby Garadag Cement Plant, Gobustan and Lokbatan (AIOC, 2000a)) and this is reflected in Figure 7.10. Recent information indicates that one of the main contractors at the Sangachal Terminal was employing approximately 1,370 construction personnel from Garadag Region at the terminal[9]. The oil and gas industries support large numbers of workers relative to the employment base in the area, and have traditionally contributed significantly to productivity. Agriculture is less important in this area, although the desert and semi-desert areas provide important winter pasture for stock. There is very little arable farming due to the poor climatic and soil conditions. Some small market gardens exist around settlements but no evidence of large scale commercial farming (AIOC, 2000a).

[8] Garadag Executive Power meeting, 20/10/2003
[9] AIOC-BP-Tekfen Azfen, Azeri Project, Recruitment and Training Follow-Up Report, 14/3/04

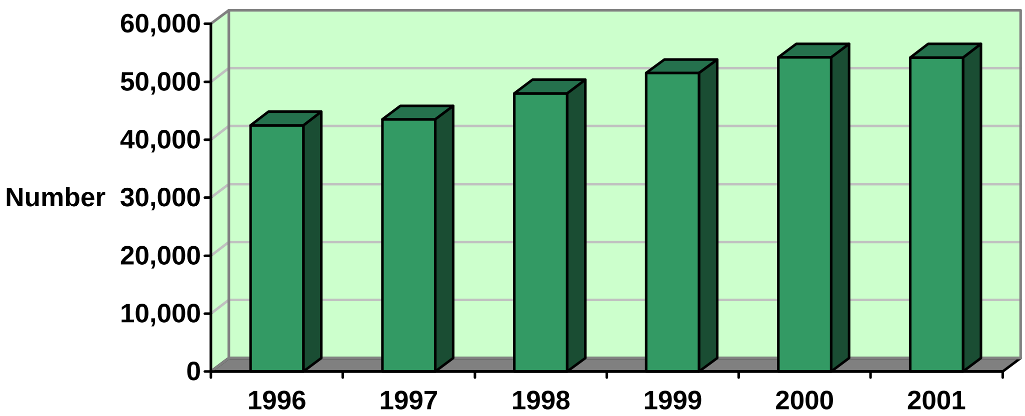
Figure 7.10 Employment by industrial sector, Garadag District 2001 - 2003



Source : Garadag Executive Power Office 2001 and 2003

Figure 7.11 details the available labour force in Garadag District between 1996 and 2001. As illustrated there has been a continuing increase in the available labour force in the District in the last 6 years, with a 28% increase between 1996 and 2001. However, additional figures from the same source suggest that the total population of working age (20 and 59), is 46,749 for 2001. This does not correspond to the figures provided for the total employable population by age. This discrepancy may be due to a lack of reliability in data collection or reporting in the District.

Figure 7.11 Labour Force, Garadag District 1996 - 2001



Source : Garadag Executive Power Office.

A large percentage of the population has no formal source of monetary income. Those without employment make use of a range of strategies in order to maintain a basic livelihood including small scale trading, remittances, small-scale fishing and horticulture. Many of the unemployed are IDPs.

Official figures for 2001 provided by the Garadag Executive Power indicate that unemployment for the Garadag region was 5% in 1998. However, given the general collapse of industrial activity, lack of local agriculture, and few employment opportunities, it is expected that real unemployment was closer to 40% (Garadag Executive Power 20/10/2003). Accurate figures for unemployment in the region since 2001 are not available, however, it is thought that unemployment has decreased since this time due to growth of the oil and gas sector and associated industries and services (Garadag Executive Power 20/10/2003).

7.5.5 Economic activity

Table 7.2 below details GDP for Garadag District, in addition to illustrating the contribution of the two main sectors of the local economy. On average the oil and associated industries account for 50% of GDP. The construction industry accounts for approximately 30% of GDP.

Table 7.2 Gross Domestic Production (million $) Garadag District (2001)

Year	Total GDP	Of which: Oil and associated industries GDP[1]	Of which: Construction Industry GDP[1]
1997	160	82	48
1998	162	83	49
1999	169	86	51
2000	159	81	47
2001[2]	82	42	25
% change 1997-2000	(49)	(49)	(48)

1. Approximate.
2. First 6 months.
Source : Garadag Executive Power Office

Whilst no up-to-date official figures are available Garadag Executive Power believe that the regional economy has expanded since 2001, as a result of the increased opportunities arising from the additional construction work in the region associated with the oil and gas sector[10]. This expansion they explained has been in the trade sector. During this time they have also seen other sectors of the economy decline in size, including manufacturing.

The fishing industry is relatively limited in Garadag District with fishing activities concentrated around Elet, Sangachal and Lokbatan. It is estimated that approximately 25-30 people are employed in the fishing industry in the area between Baku and Gobustan, the majority of whom are employed at a fish hatchery at Sahil. Salaries in the fishing sector are determined on a quota basis and in 1997 the monthly salary of a fisherman was Az 23,000 (approx $6). The fishermen were allowed to keep a portion of their catch as an additional income source. Specifically fishing activities in the region can be summarised as follows:

- Fish Hatchery - The only authorised commercial fishing in Sangachal Bay supports a nearby fish hatchery, which is part of the MENR (formerly Azerbalyk). Since 1976, the hatchery has bred salmon and white sturgeon fry, with the goal of releasing them into the Caspian. The farm is also involved in salmon and white sturgeon fishing along the coastline up to the town of Alyat, with most of the fishing done using nets spaced every few hundred metres. Occasionally boats and fishing platforms are used. The fish found in this area include sturgeon, salmon, herring, carp and mullet.

- Sander Fishing - The area used to be a significant source for sanders, with between 7 and 10 tonnes of sanders being produced annually. However in recent years the level of sanders has drastically reduced and there are now none. Whilst offshore developments have been blamed for this loss, the role of uncontrolled fishing and the use of banned

[10] Garadag Executive Power, 20/10/2003

fishing equipment is also recognised as having contributed to the decline. The majority of the fishing grounds are based in and around the coast areas of Neftchelar.

- Non-Commercial Fishing – The majority of fishing in Sangachal Bay are both recreational and subsistence rather than for commercial purpose. Rod fishing is the only type of fishing allowed for leisure purposes and nets are banned. Fishing takes place primarily at weekends either from the jetty in Sangachal Bay built for the Early Oil project, or from the fishing platforms that are situated slightly further out into the sea. There are six platforms, which are in a state of disrepair, but provide a useful position from which to fish.

- Offshore fishing - Fishing vessels catch kilka approximately 40-60 km from the shore. The fish are caught using a combination of lights and nets to attract the sprats. Historically, between 140-150 boats were active fishing for sprats, but this level has now decreased to approximately 100 boats and the fleet is in the process of restructuring. The main fishing ports are Baku port, Neftchala, Lenkoran and Siyazan.

There are also a number of illegal nets in the area to catch fish for subsistence and for sale. The number of fishermen involved, their domicile, the size of fish catches, and composition and the contribution of the catch to their livelihoods and incomes is not known accurately. It is possible that they may number between 150-200 in total.

Other economic activities for the region include small-scale independent economic activity by various households. However, very few people are involved in this form of income generation (Garadag Executive Power, 20/10/2003).

The Garadag Cement plant is also situated in the area and is the only cement producer in Azerbaijan. It provides employment to approximately 2000 people and is located 35 kilometres west of Baku, close to the Caspian Sea. It is the main provider for Azerbaijan’s 1 million ton cement consumption.

7.5.6 Infrastructure

The Baku-Alyat throughout highway routed along the Sangachal Bay coastline passes to the east/southeast of the terminal location. This section of road is a main highway in Azerbaijan. It is part of the main transportation route north from Baku to Boyuk and to Kesik at the Georgian border (a total of 510 km) and south from Baku to Astara at the Iranian border (a total length of 313 km). Both of these routes carry two-thirds of all road freight through Azerbaijan. Most of the main roads in the region are viewed as being in a satisfactory condition and are covered with asphalt[11].

The passenger flow along the Baku-Alyati highway section in 1999 amounted to 40,000 persons travelling from Baku and 35,000 going to Baku. It can be expected that this has since increased with the onset of further fabrication and construction activities associated with the ACG development.

The Baku-Alyati electric railway, owned and operated by Azerbaijan Railways, runs parallel to the highway through the Garadag District, and is part of the main transportation route for Azerbaijan. This section of the railroad is part of the main rail routes that run to the Georgian and Iranian borders, and towards Armenian administered districts, which ceased operation in 1993.

The maximum carrying capacity[12] of the Baku-Alyati railroad amounts to 109 million tonnes per annum, or up to 180 trains in each direction every day. The railroad is, however, significantly under utilised. In total, the Baku-Alyati section of the railroad transportation load in 1997 was approximately 4 million tonnes, or nine trains in each direction daily. The data is,

[11] Garadag Executive Power (20/10/2003)
[12] The maximum carrying capacity is taken and recognised as the line’s projected capacity.

however, outdated and it is expected that the number of trains is higher. The railroad has been undergoing repairs for the last two years.

A number of utility lines and pipelines are also routed along the coast parallel to the highway and railway line. These utility lines provide electricity, communications, oil, gas and water as detailed in Table 7.3.

Table 7.3 Utility lines Garadag District

Description	Owner/User
Communication Cable (flooded)	SOCAR Onshore Oil &Gas Production Association's Communication Department
Communication Cable (destroyed)	Baku Telephone Network Production Association
Communication Cable	SOCAR MOLPA
Communication Cable	Unidentified
Communication Cable (2 cables)	Technical Unit of Cable Trunks
Gas pipeline (5 lines, 1 cut)	CJSS AZERIGAS
Gas pipeline	SOCAR BULA OFFSHORE
Oil pipeline (2 lines)	SOCAR MOLPA
Condensate Line	SOCAR BULA OFFSHORE
Water Pipeline (5 lines, 1 abandoned)	Aspheron Water Company
Water Pipeline	SOCAR Amirov O&GPD
High Voltage Overhead Line (HOVHL)	Azerbaijan Railways
High Voltage Overhead Line (HOVHL) (4 lines)	JSC AZENERGI
Unidentified pipelines (3 lines)	Unidentified

Source : Shah Deniz and ACG Third Party Pipelines, Road and Rail Crossings. Information Pack; Shah Deniz Gas Export Project (Doc. BRCDZZZZCMGUI0006 Rev A1).

Most households in the region have constant and reliable access to energy in the form of gas and electricity; Garadag Executive Power (20/10/2003).

7.5.7 Health

Most settlements in Garadag District have an ambulance station. These stations together are able to serve some 3,400 people during one shift (i.e. 3.5% of the total population for Garadag District). Within Garadag District there are 11 hospitals, including 4 united state hospitals, 2 united children hospitals, 2 state city polyclinics, 1 dental care clinic, 1 maternity hospital and 1 children's cardio-rheumatic health centre. These provide the area with 470 beds. As illustrated in the table below, the scale of health care provision is lower in Garadag District compared to the national average and has been decreasing during recent years.

Table 7.4 Comparison of healthcare provision statistics

Indicators	National Level	Garadag District		
		2001	2002	2003
Number of physicians per 10,0000 population	33.7	22	29.8	14.9
Paramedic staff per 10,000 population	72.5	58	42.4	21.2
Number of hospital beds per 10,000 population	83.4	47	44.1	22
Number of hospitals	714	11	11	11

Source: ACG Phase 2 ESIA and Garadag Executive Power

Garadag Executive Power indicated that tuberculosis is a major health problem for adult males and females in the region, whilst anaemia is also a major health concern amongst females in the district. Meanwhile, amongst children there is a large prevalence of beriberi, tonsillitis, laryngitis and bronchitis.[13] In addition, those employed in the opencast 'Firuza' stone mine near Sangachal tend to be affected by respiratory problems. However no figures were available to support these statements.

[13] Garadag Executive Power; 20/10/2003

Official statistics indicate that cardio-vascular illness is the primary source of mortality in the region, particularly amongst men. This is followed by illness to the digestive system and neoplasm (tumours). Mortality from respiratory illnesses is relatively low, accounting for nearly 9% of deaths. From the evidence available, the Garadag health situation in terms of mortality and morbidity is broadly similar to the national situation.

Mortality statistics vary between different age groups. For individuals less than one year old, prenatal conditions and respiratory illness are significant sources of mortality; for 1-4 years old, in addition to respiratory infection injuries, poisoning and nervous system related diseases are important. Significant adult diseases include circulatory system problems, tumours, endocrine, nutritional, metabolic and immunity disorders. The most significant illnesses relate to the respiratory system, injuries and poisoning, nervous system, sense organs related illness and infectious diseases.

The AIOC Human Development Forum[14], and World Vision undertook a needs assessment of health education, and also professional training needs assessment in Garadag region. It was determined that providing refresher training to community health workers would be more sustainable than rehabilitating and supporting health care facilities. By training health professionals currently working in the area the community will also be direct beneficiaries.

7.5.8 Education

There are 24 elementary and secondary schools, and 4 colleges in the Garadag District, with a capacity for 13,736 students at any one time (Garadag Executive Power; 23/7/01 and 20/10/03). In total however, between 25,000 and 27,000 children study in these schools and colleges. Overcrowding in schools has always been a problem in the region, and despite two new schools opening in Garadag since 2001, the problem remains. This is consistent with data at a national level that indicates a lack of available buildings and equipment within the education system.

According to Garadag Executive Power, a minority of children do not attend school due to insufficient transport links or financial constraints (Garadag Executive Power; 20/10/2003). They also indicate that the schools in the region present a satisfactory level of education even though schools have deteriorated in recent years. Books and other equipment are provided to an acceptable level, although problems remain with the inadequate technical support.

Some 1,260 students graduated from secondary school in Garadag District in 2000 (Garadag Executive Power; 23/7/01). Although no figures are available for the percentage of graduates from the total school population, approximately 5.7% of school age (rather than school attending) children graduate from secondary school[15]. Of these about half of the male graduates and less than half of the female graduates continue their education in colleges and other higher education institutes (Garadag Executive Power; 20/10/2003). Many graduates do not attend tertiary institutes due to lack of financial support. However Garadag Executive Power has provided financial assistance to some female students to enable them to attend tertiary institutes (Garadag Executive Power; 20/10/2003). No further information on this initiative was available.

The colleges offer qualifications relating to the oil and construction industries, as well as driving, welding, painting and carpentry. Table 7.5 below illustrates that the number of teachers and schoolchildren per 10,000 people have been increasing in recent years.

[14] Further details on the activities of the AIOC Human Development Forum can be found in Chapter 11
[15] This figure is the sum of the total population for the district between 10-14 and 15-19 and calculating 1,260 as a percentage of this.

Table 7.5 Comparison of educational statistics

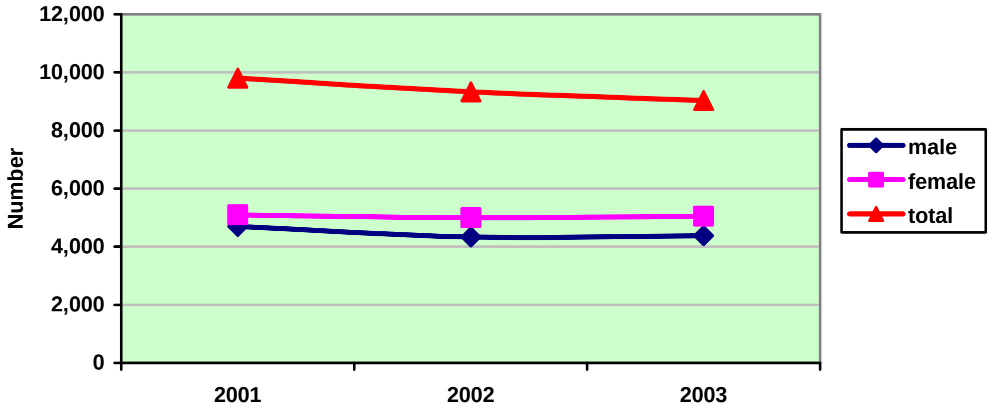
	2001	2002	2003	% change 2001-2003
Number of teachers per 10,000 people	181	186	193	6.6
Number of schoolchildren per 10,000 people	2,472	2,683	2,652	7.3
School places (two shifts)	22,755	23,193	23,035	1.2
Actual attendance	25,216	26,143	25,975	3.0

Source : Garadag District Executive Power (2001 and 2003)

7.5.9 Poverty, refugees and internally displaced peoples

The total numbers of IDPs within Garadag District between 2001 and 2003 are detailed in Figure 7.12. The IDPs in the District are primarily located in Lokbatan, Sahil, Gizildash and Sangachal and Umid Settlements. Just over 20% of the IDPs in the District are from Armenia and the remaining 80% are IDPs from Fizuli, Agdam, Zengilan, Gubadli, Kelbejer, Jebrayil, Lachin districts and Shusa, Khojavend, Khojali cities and villages of the Nagarno Karabakh region (Garadag Executive Power; 23/7/01).

Figure 7.12 Gender Distribution of IDPs – Garadag Region 2001 - 2003



Source: Garadag Executive Power Office

The majority of the IDPs in Garadag arrived between 1993 and 1994, although a small number still continue to arrive to date. Most live in government provided shelters although an unknown number do rent property privately. Despite approximately 50% of the IDPs in the region being employed as manual labourers, unemployment is still viewed as one of the key problems for IDPs, alongside a lack of housing (Garadag Executive Power; 20/10/2003).

7.6 Local Socio-economic Profile

7.6.1 Overview

The following section, which outlines the socio-economic profile of the area local to the ACG Phase 3 Project facilities and activities, has been compiled from a number of sources. Meetings and site visits were undertaken with relevant stakeholders, and data was collected using questionnaires.[16] In addition some information has been included from the sociological survey undertaken by the Azerbaijan-Holland Friendship Society (AHFS) in 2001 on behalf of BP and socio-economic baseline reports compiled on the areas surrounding the SPS and ATA Yards[17]. Information was also sourced from the AIOC Human Development Forum. The relevant activities from the forum and the associated development impacts have been reflected in the baseline where appropriate.

The information sourced illustrated the following socio-economic receptors[18] within the local area[19] around the proposed ACG Phase 3 Project developments:

- Sangachal town;
- Herding settlements;
- Umid IDP/cement workers camp;
- Sahil town and
- Bibiheybat oil field.

Each of these receptors is discussed below and their location is illustrated in Figure 7.7.

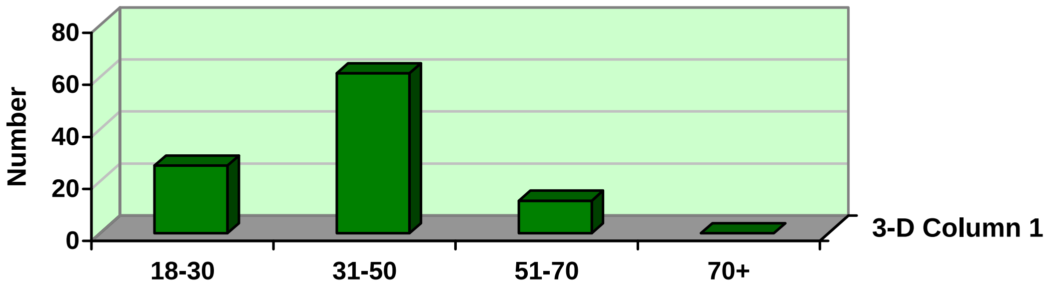
7.6.2 Sangachal Town

7.6.2.1 Population and demographics

There were approximately 3,595 residents in Sangachal Town in 2003. This figure includes more than 500 IDPs from the 10 different districts within Azerbaijan that are currently occupied by Armenia. This is in comparison to the 4,000 recorded residents in 2001, a 10% decrease between 2001 and 2003. Approximately 62.5% of the population is male and 37.5% female (AHFS, 2001). Figure 7.13 is the age profile of the residents in Sangachal. The majority of residents are within the 31-50 year age category.

[16] Details of individuals interviewed and sites visited are presented in Section 7.2.
[17] ATA Yard – Socio-Economic Baseline Survey, URS, May 2003.
[18] A socio-economic receptor is defined as something that could be impacted upon by the proposed development that would affect the economic or social profile of the area
19 Local is classed as 2-5km around the various facilities, whilst regional is taken as the wider surrounding area and in this instance, the Garadag District area as illustrated in Figure 7.1

Figure 7.13 Age Profile of Sangachal Residents (2001)



Source: Azerbaijan-Holland Friendship Society, Sociological Survey, Baku 2001

Some 97% of the residents are Muslim with the remaining 3% Christian. In a community survey residents identified themselves as the following nationalities:

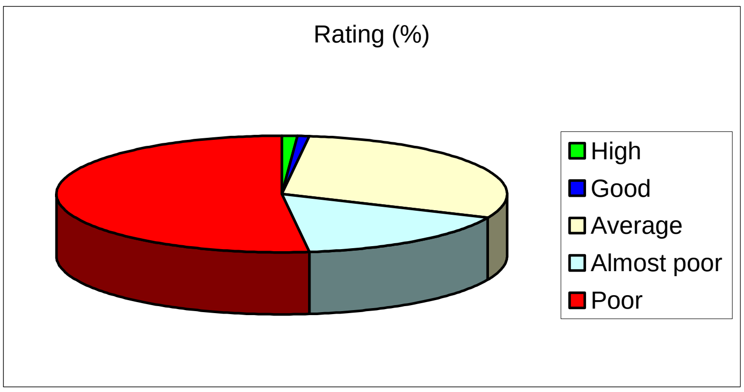
- Azeri Turk (95.2%);
- Russion and Slav (2.9%); and
- other 1%[20].

According to the representative of Garadag Executive Power for the Sangachal settlement (22/10/2003) there are now also residents from Tallish, Lezghin, and Ukrainian descent.

7.6.2.2 Livelihood

As noted in 7.5.3 above, the average income level for the Garadag region as a whole in 2001 is $75 or AZM346,500 ($1 = AZM4,620). The AHFS survey gathered a range of data on Sangachal residents' perception of family welfare and income levels. This is presented in Figures 7.14 and 7.15.

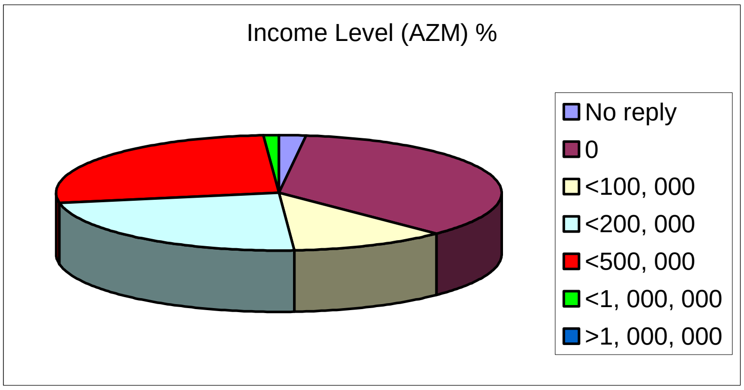
Figure 7.14 How would you estimate your family's welfare standard?



Source: Azerbaijan-Holland Friendship Society, Sociological Survey, Baku 2001

[20] 1% of respondents gave no answer to this question.

Figure 7.15 Family's monthly earnings



According to the Garadag Executive Power's representative for Sangachal the quality of life of residents in this settlement has risen since 2001 (Garadag Excecutive Power 2003). The reason for this is said to be the increased employment opportunities available for local residents. Levels of marriage or kinship has increased, as increased security and the desire to settlement down often develops from the security of having paid employment. However increased employment opportunity for women at the Sangachal Terminal site is also thought to have contributed to their increased quality of life(Garadag Excecutive Power 2003).

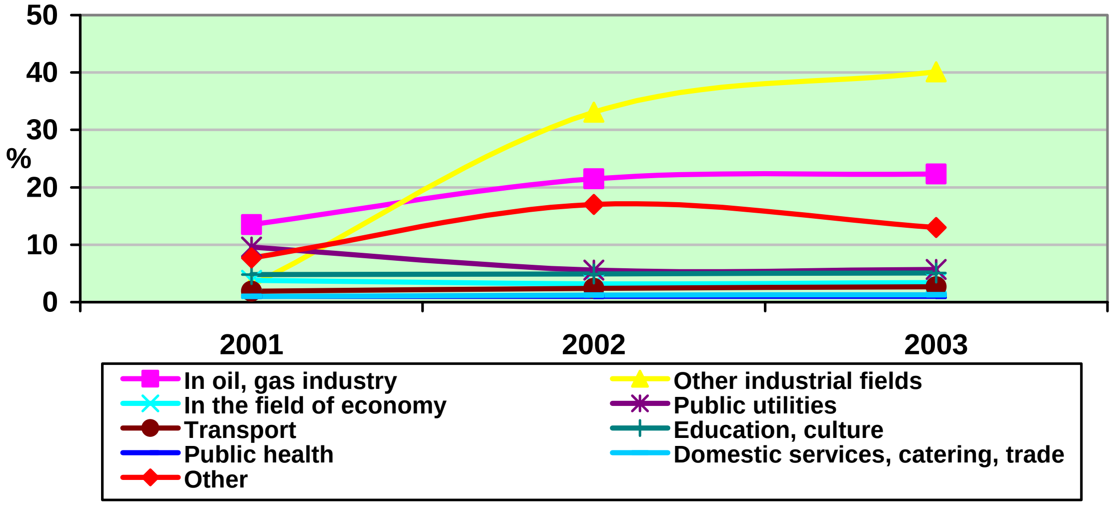
According to the community the infrastructural improvements to the schools in Sangachal that have been funded by BP/AIOC in the past two years have had a positive impact on the standard of life for most of the children in the town. The projects have included: renovating the school, donating materials and equipment, introducing foreign language courses and the creation of hobby groups in the culture club.

7.6.2.3 Employment profile

Figure 7.16 illustrates the employment profile of Sangachal residents between 2001 and 2003. Since 2001 the main increases in employment have been felt within the oil and gas industry, other industrial fields and transport. For example, at the time of writing approximately 280 people from Sangachal are employed at Sangachal Terminal by one of the main contractors[21]. It should be noted these employment levels will fluctuate dependent on project requirements.

[21] AIOC-BP-Tekfen Azfen, Azeri Project, Recruitment and Training Follow-Up Report, 14/3/04

Figure 7.16 Employment Profile of Sangachal Residents



Source: Azerbaijan-Holland Friendship Society, Sociological Survey, Baku 2001 and Garadag Executive Power 2003.

The size of the available labour force within Sangachal is not known. It is understood from consultations with the Garadag Executive Power that a percentage of informal work is undertaken in the area and few people sign up for unemployment benefits due to the complexity of the process and the paucity of benefits actually provided[22].

According to new figures provided by Garadag Executive Power (22/10/2003) unemployment has dropped considerably since 2001. Unemployment was approximately 53.8% in 2001, 10.1% in 2002 and 6.4% in 2003. This represents a dramatic change since 2001 and the Executive Power believe this is primarily a result of the employment associated with the construction works at Sangachal terminal and the local fabrication yards.

Information was also gathered on Sangachal residents' satisfaction with their current employment and is illustrated in Table 7.6.

Table 7.6 Sangachal residents' job satisfaction rating

How satisfied are you with your job?	%
No reply	40.9
Fully satisfied	19.4
Not bad	19.4
Unhappy	20.4

Source: Azerbaijan-Holland Friendship Society, Sociological Survey, Baku 2001

[22] See the National section of this chapter for a discussion on social security conditions within Azerbaijan.

7.6.2.4 Economic activity

The main economic activities in Sangachal revolve around industry, oil and gas and trade sectors. The expansion of Sangachal Terminal and activities at ATA and SPS are viewed as key reasons for the economic development occurring in the area since 2001. Alongside this, a proportion of the local community are involved in independent economic activity e.g. fishing and cattle breeding (Sangachal Executive Power, 22/10/03).

Less than 1% (i.e. approximately 40 people) of the Sangachal population are involved in fishing in the nearby Sangachal Bay (Garadag Executive Power; 05/07/01)[23]. Sangachal Bay is under the jurisdiction of the MENR. Azerbalyk once had a license to fish commercially in the bay however it expired and was not renewed by the MENR. Therefore, no commercial fishing is allowed.

Other independent economic activity involves agriculture but according to the Garadag Executive Power less than 10 residents are involved in large-scale agriculture within Sangachal. Any planting of crops that is done seems to be for subsistence purposes only and livestock farming seems to be the only agricultural activity of note. Many of the households own some form of livestock for subsistence purposes and this equates to approximately 140 cows and 500 sheep, and some goats and poultry in total (Garadag Executive Power; 05/07/01). Typical scenes at Sangachal are presented in Figure 7.17.

Figure 7.17 Typical Scenes at Sangachal

7.6.2.5 Home ownership

The population is housed in a total of 697 apartments, of which most are state-owned (Garadag Executive Power; 22/10/03). No information was available on whether there is a shortage of housing stock within the town. The housing stock includes four apartment blocks and a number of older single storey houses along with an army barracks (AIOC, 1996; p. 251). The area has many summer homes owned by families normally resident in Baku (*ibid*).

7.6.2.6 Infrastructure

There are very few roads in and around Sangachal and most of these are gravelled. According to the Garadag Executive Power the quality of the road network has improved since 2001 and this has been linked to the construction works at the Sangachal terminal

The busiest traffic route from Sangachal is to Baku. The number of vehicles that use the road has increased in the past few years; specifically the number of local buses operating between the Sangachal area and Baku has increased. The time that it takes to travel to Baku is approximately 45 minutes by bus and costs AZM1, 500 – 3,000 (approximately $0.30 – 0.60) for a one-way trip. This compares to the same journey taking 1 hour and costing approximately AZM1,000 ($0.20) in 2001.

[23] As there is some confusion over the legality of various types of fishing in the area it may be that greater numbers of local residents are involved in fishing and that numbers of those involved are under reported.

According to official sources all houses in the town, except some of those housing IDPs, have electricity and gas, and supplies are regular, reliable and sufficient. Wood is not used for heating or cooking by the general public but some herders and IDPs do utilise wood for energy.

The cold water supply is piped into the town from the Baku-Kura pipeline and is said to be sufficient for the purposes of the settlement. There is no certified hot water supply to Sangachal, although this is typical for the area. Bottled water is not used for drinking, washing or cooking (Garadag Executive Power; 05/07/01).

The present sewage system is basic. Enclosed canals are utilized to take sewage out of the town to where it is collected near the sea. These canals are open between the town and the collection point. From the collection point, sewage is transported out to sea without any treatment. There are plans for the sewage system to be renovated through the Community Investment Programme managed by the Sangachal Terminal Expansion Programme Human Development Forum.

There are five garbage disposal sites in the town and they are emptied once or twice a week, depending on the site, and taken to the main landfill disposal site near Sangachal. The material is either burnt or simply covered.

7.6.2.7 Health

Based on discussions with the Garadag Executive Power, it appears there are no major health problems in Sangachal town. However, health was discussed as part of the AHFS survey undertaken in Sangachal and Table 7.7 details the results. Over 50% of the population assess their health as poor, however no official figures were available to support this assertion. The AHFS survey ascertained that the state of health services is viewed as a problem area although not one requiring urgent or immediate attention.

Table 7.7 How do you assess your health?

Response	%
No reply	1.9
Absolutely healthy	41.3
Not very healthy	35.6
Sick	21.1

Source: Azerbaijan-Holland Friendship Society, Sociological Survey, Baku 2001.

An immunisation campaign has been undertaken within the town, and was administered by doctors from the United Hospital in Sahil (Garadag Executive Power; 22/10/03).

There is no hospital or pharmacy within Sangachal. There is however, an ambulance station that provides basic first aid. From discussions with Garadag Executive Power it was ascertained that the station and ambulance are not in a sufficient condition. Although Sahil United Hospital is not far away in terms of distance (about 15 minutes by bus), with few cars in Sangachal, and unreliable public transport, the United Hospital is not ideally positioned to serve the Sangachal community.

Even though the health services are limited, the Garadag Executive Power is of the opinion that existing services are satisfactory and has improved since 2001.

The distribution of diseases between Sangachal, Sahil and Umid follow similar patterns for Garadag District as a whole. However, there are differences in the total incidence of disease between the settlements. For children under 5 there are about twice as many reports of morbidity per person in Umid compared to Sahil, and nearly three times compared to Sangachal, as illustrated below.

Table 7.8 Comparison of morbidity within Sahil, Sangachal and Umid for children under 5 years

	Sahil	Sangachal	Umid
Total number of incidences of morbidity	1,044	134	128
Population of settlement	21,239	3,559	1,300
No of reported cases per settlement population	0.049	0.038	0.098

Source: Garadag Executive Power, Department of Statistics (2001)

There are a range of factors that can explain the differences between the settlements in terms of levels of morbidity. There are demographic and economic differences between each settlement. Umid is an IDP camp and as a result the quality of housing and sanitation is poorer. Further study would be required to confirm any interpretation.

According to Garadag Executive Power (22/10/03) the most common health problems for adult males in Sangachal are respiratory or cardiologic in nature while adult females have more ailments of an oncological nature. There is also no form of maternity welfare support in the settlement and most women give birth at home.

The Human Development Forum is undertaking an anti-malarial campaign developed jointly by the Ministry of Health and World Vision. The objective of the programme is to prevent possible outbreaks of malaria through vector control.

7.6.2.8 Education

The Human Development Forum has assisted in the repair of the sports hall at Sangachal School, in addition to providing various sports materials.

Several children travel to the school in Sahil in order to participate in extra curricular activities (e.g. sports and music) and attend the vocational training school. Such activities are not available in Sangachal (Garadag Executive Power; 5/7/01). Most of the children between the ages of 6 and 17 attend school although some do not to due to financial difficulties.

The number students going on to tertiary education are slowly increasing but the numbers who go on to such higher education varies from year to year (Garadag Executive Power; 5/7/01) and has attendant difficulties. Some universities charge an attendance fee and as public transport to Baku is not reliable (i.e. the service is irregular and seats can be limited), it can make regular attendance at university difficult.

To contribute to the development of local education in Sangachal the Human Development Forum has initiated various related programs, including:

- A scholarship programme that aims to assist selected young adults to access higher education. This programme selects five students from Sangachal to receive a monthly allowance to support their tertiary education. The programme will run until the end of the Azeri construction project in 2007. The candidates selected will be those who receive satisfactory scores at the State Entrance exam.

- A teaching programme to provide supplementary teaching (i.e. beyond that provided at the school) to Sangachal pupils in a number of subjects (i.e. physics, chemistry, biology and maths) in order to improve their chances of achieving university entrance requirements.

- Renovation and ongoing building maintenance to Sangachal School which, according to the Garadag Executive Power also has a problem with overcrowding, common amongst the schools in the region.

- Summer internship programmes to provide young people from Sangachal with the opportunity to become summer students at the terminal with both AIOC and contractors, thereby widening their exposure to the project and allowing them to gain professional experience. These internships will be run every summer until the end of the project. Each student receives a daily allowance and also lunch at the project canteen and transportation to/from his/her respective settlement.

7.6.2.9 Refugees and IDPs

Almost 13% (i.e. approximately 520) of Sangachal residents are classified as IDPs. Most IDPs arrived in Sangachal in 1992, although people continued to arrive throughout 1993 and 1994. IDPs within Sangachal do not live in permanent accommodation. They are housed in public buildings, abandoned homes or railway cars.

Whilst IDPs receive free medical services and education, they do have to pay for medication. The receipt of foreign aid for IDP in both Sangachal and Umid is limited and infrequent. No figures were available on amounts, frequency or purpose of aid. According to the Garadag Executive Power most of the IDPs living in Sangachal are employed, specifically providing labour to the oil and gas sector.

7.6.2.10 Civil society

About 100 households (i.e. approximately 30% of all households) within Sangachal have telephones. According to the Garadag Executive Power the majority of people have access to televisions, although exact figures are unavailable and it is unclear whether “access” means a television in the home or within a communal area. Sangachal community receives most of its information from the television and the most frequently watched channels are ANS, SPACE and AZ.TV. There is no newsagent within Sangachal. Those who subscribe to newspapers tend to be government staff. Radio is accessible to all.

Officials within the government, at the national and regional level, undertake decisions affecting the community, such as those connected with investment and events. These decisions are then fed down to the local executive power. According to the Garadag Executive Power, in addition to this formal process, Sangachal has a group of elders[24] who bring forward issues and concerns from the residents to the local executive power. This process was also evident from the results of the AHFS survey where residents identified the elders as the most influential people in the settlements, followed by government officials and politicians.

The role of the elders appears to be the preferred community method for raising concerns. However, before such an assumption could be made further investigation would be required in order to understand how the individuals are chosen for this task, by whom and exactly how this interacts with the more formal decision making processes.

The residents of Sangachal are very sensitive to the opinion of their family members, with 28.9% of those in Sangachal discussing personal problems with family members. In addition, many accept and follow the guidance provided by those family members, illustrating the importance of family members in an individual decision making (AHFS 2001).

7.6.3 Herding settlements – Central North and West Hills

The area surrounding the existing Sangachal Terminal is used as winter grazing land for a number of pastoralists, their families and their animals as part of a livestock breeding enterprise. The pastoralists, an extended family of thirty people, have been using the Sangachal land for winter pasture since 1961.

The land acquisition prevented them from using some of the area for grazing and subsequently they requested to be moved. AIOC are currently (February 2004) in discussion with the various parties concerned on the exact nature of the re-location. The herders will be moved once agreement has been reached between all parties concerned. Full details of the

[24] A direct translation of the name or responsibilities of this group was difficult to ascertain and “group of elders” appears to be the most appropriate description

process is contained within the ACG Phase 1 and Shah Deniz Stage 1 Resettlement Action Plan.

7.6.4 Umid Camp

Umid Camp (shown in Figure 7.18) is essentially two camps within one settlement; one camp houses IDPs and another camp is for workers from the Garadag Cement Plant at Sahil. The camp has been given permanent status, in that it is now recognised as a formal settlement. Where the information in this section applies only to the IDP section of the settlement this has been indicated within the text.

Figure 7.18 Umid Camp

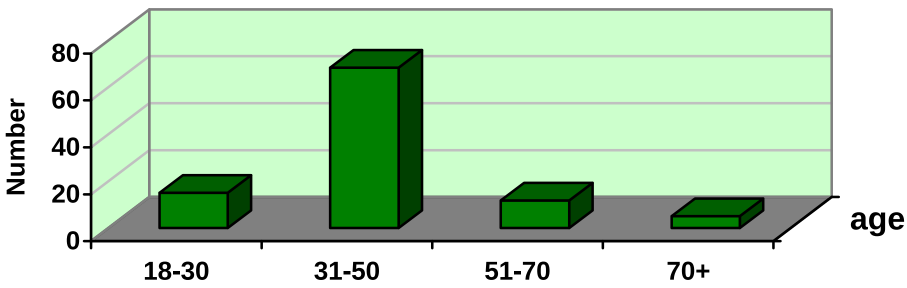
7.6.4.1 Population and demographics

In total there are 1,200 people currently living in Umid Camp, compared to 1,300 people in 2001, a 8% decrease between 2001 and 2003. Of the present 1,200 people, 67% are IDPs and the remaining 33% local residents.

The major ethnic groups include Azeri, Tallish and Lezghin and the majority of residents are Muslim. Since the construction works undertaken at the terminal in recent years the overall conditions for the inhabitants are considered to have improved, largely associated with the increased employment that the residents have been able to gain (Garadag Executive Power 22/10/03).

It is estimated that 48.3% of the population is male and 51.7% female. This illustrates a far greater percentage of females within Umid compared to Sangachal, whose population figures illustrate that 37.5% of residents are female. Figure 7.19 below illustrates the age profile of those resident within Umid Camp.

Figure 7.19 Age Profile of Umid Residents



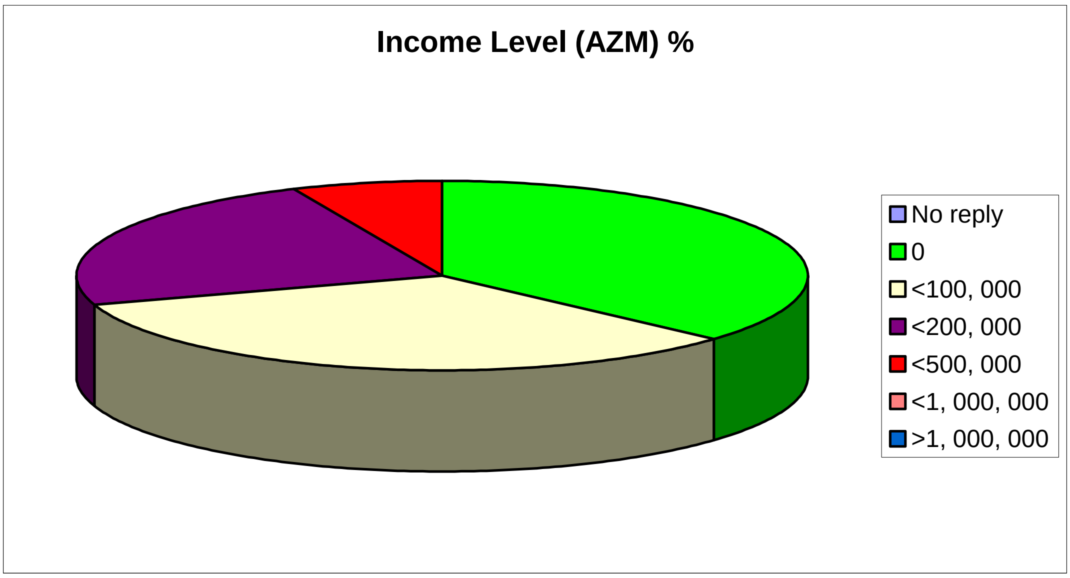
Source: Azerbaijan-Holland Friendship Society, Sociological Survey, Baku 2001

The IDP camp at Umid has been in existence for almost five years. According to Garadag Executive Power most IDPs would return to their homes if their land were released (Head of Garadag Executive Power Representation, Umid Settlement; 05/07/01). The cement camp that forms part of Umid has been in existence for about three years. Previously the cement camp was under the administration of Sahil. Recently it, along with the IDP camp, was granted the status of a town in its own right. This confers a more formal status and feeling of permanency on the settlement.

7.6.4.2 Livelihood

Figure 7.20 below provides an estimate of the income levels within IDP Umid Camp. Generally income levels are estimated to be low and this is consistent with other data such as the limited level of foreign and national aid and the high incidence of injuries to working age men. No data was available for income levels in the cement camp.

Figure 7.20 Family's monthly earnings IDP Umid Camp (2001)

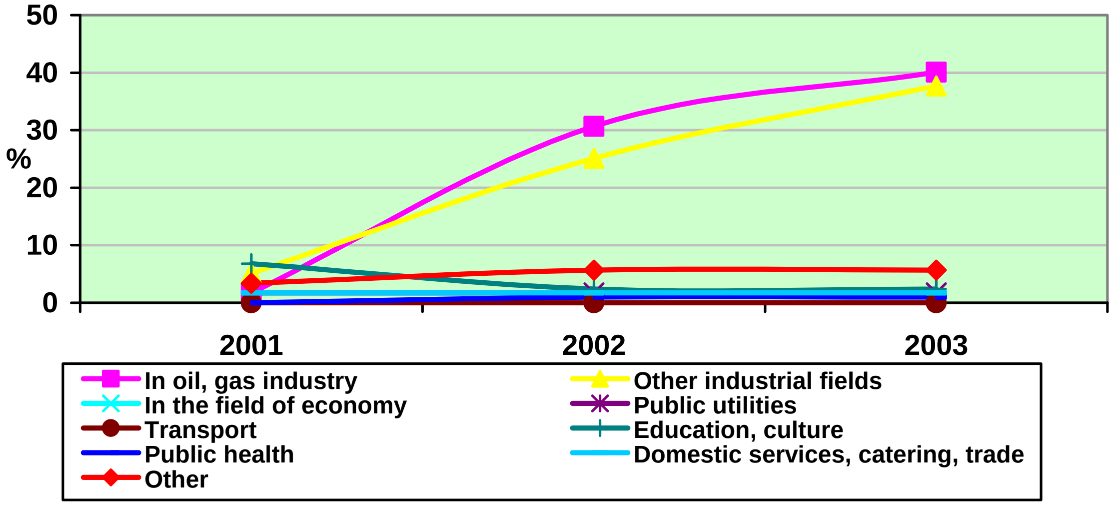


Source: Azerbaijan-Holland Friendship Society, Sociological Survey, Baku 2001.

7.6.4.3 Employment profile and economic activity

Information from the AHFS survey and also Garadag Executive Power on the employment profile of Umid residents is contained in Figure 7.22 below. Between 2001 and 2003 there have been noticeable increases in the numbers employed within the oil and gas sector and other industrial fields. For example, approximately 80 personnel are currently employed at Sangachal Terminal by one of the project's main contractors[25]. It should be noted that these employment levels will fluctuate depending on project requirements.

Figure 7.21 Employment profile of Umid Residents



Source: Azerbaijan-Holland Friendship Society, Sociological Survey, Baku 2001 and Garadag Executive Power.

According to the Garadag Executive Power unemployment within Umid settlement decreased from 78% in 2001, to 8% in 2003. It is believed that a significant proportion of those now employed are employed in construction activities at Sangachal Terminal and the ATA and SPS fabrication yards.

Despite the increased employment opportunities for local residents and resultant spending, no private businesses or small enterprises have developed (Garadag Executive Power, 22/10/2003). A few residents are involved in fishing and this is for subsistence purposes to supplement diet. Such fishing is by rod from the shores nearest to the camp, including from the jetty built for the Early Oil Project (EOP).

Many of the IDP families have been affected by the war, which specifically affects employment opportunities where the men have been injured. Information given indicates that 10 households within the IDP population of the camp have war veterans as a member of the household and a further 14 households have officially injured war veterans as members of the household. No information was available as to whether the injured members of the household were the main income earners, however, this is likely to be the case. This information would imply that it may be the women within the household who work and not the men, as would normally be the case. No information was available on how this gender change in the main income earner might affect family income.

The key concerns of war veterans in Umid Camp are the perceived lack of government support and the small amount of pension received (Head of Garadag Executive Power Representation, Umid Settlement; 05/07/01).

[25] AIOC-BP-Tekfen Azfen, Azeri Project, Recruitment and Training Follow-Up Report, 14/3/04

The Human Development Forum has initiated an income generation project in Umid which involves the manufacture of working gloves to international standards. The project is seen as providing a sustainable form of income, whilst providing self-employment opportunities for women.

7.6.4.4 Infrastructure

Both the IDP and the cement camp have grown in size since their inception. They were originally two separate settlements, but their expansion in the last few years means that they are now virtually one settlement. The IDP camp started with only 30 households. The whole camp, including the IDP and cement camp, now has 220 households. There are no plans for further expansion of the IDP camp through new residents joining, although some increase in population can be expected as a result of births and marriages. Expansion can only occur in areas where permission has been given and, as a result, the camps cannot currently expand further towards the Sangachal terminal site. New houses being built in the cement camp are being built on the opposite side of the camp to the terminal site.

There is a school, medical office, bakery and post office within Umid Camp. There is a sewage system, however plans exist to upgrade this in the near future through the ACG Community Investment Program. There are telephones in every house in the IDP camp but only one phone in the cement camp.

It takes approximately 50 minutes to travel to Baku by public transport and a similar time by car. A one-way trip to the capital by public transport costs about 1,500 AZM. The roads in and around the camps are gravel based. Approximately 1.6 km of these roads have recently been resurfaced as a result of funding support from the Human Development Forum at the request of the community. Most of the roads are, however, still in bad condition.

All households have regular access to electricity and gas within their homes. Wood is not used for heating nor cooking purposes. Sufficient quantities of water are piped to households from the Kura River and the supply is regular. The water supply is cold water only, which is normal for the area. No use is made of bottled water for drinking, washing or cooking.

There are three waste disposal points in the IDP Umid Camp and one in the Cement Camp. The waste points consist of bins that allow for segregation of the different types of waste. The waste is collected every week and then transported to a landfill disposal site at the Garadag Cement Works.

7.6.4.5 Health

According to the Garadag Executive Power, Umid Camp has not experienced any major health problems to date.

Medical services within the camp are limited and the existing medical facility is a basic first aid post capable of providing only limited services. It has however been recently refurbished as part of the ACG Phase 1 Community Investment Programme. Most women give birth at a maternity home and for more serious health problems, residents must use the hospitals at either Sahil or Baku. The unreliable public transport system this is not ideal as a health service option.

All of the children from the IDP Umid Camp are immunised by doctors from Sahil hospital. Doctors visit the camp at vaccination time. Whilst the medical facilities are free, there is a limited supply of medicine and often one can only get access to what is available, rather than what is required. There is however, a general belief held by Garadag Executive Power that the health services are getting better. Assistance from international organisations is on a very infrequent and ad hoc basis and so it cannot be replied upon (Head of Garadag Executive Power Representation, Umid Settlement; 05/07/01).

Medical education, including first aid training is being given to people in Umid as part of the Community Development Programme being run by the Human Development Forum. In addition, communities are also being taught (through trained community trainers) topics including: hygiene and sanitation, intestinal worms, diarrhoea, immunization and vaccination, viral hepatitis, Acute respiratory tract infections, nutrition, family planning, sexually transmitted diseases and care of newborns.

7.6.4.6 Education

One school in the Camp provides secondary level education and has been refurbished through the ACG Community Investment Programme. Approximately 200 pupils attend the school now, in comparison to the 120 pupils in 2001 (Head of Garadag Executive Power Representation, Umid Settlement; 22/10/2003). There are only seven classrooms and therefore a serious problem with overcrowding exists. A shift system also applies at this school similar to the rest of the region whereby pupils attend either the morning or the afternoon sessions. The school also lacks a sport hall. Even though the technical and material basis of the school is not sufficient, the teaching is said to be of a good quality. Very few male students continue with higher education because of limited finances and compulsory military service. A limited number of female students also continue with tertiary education.

As in Sangachal (Section 7.6.2), the Human Development Forum has recently implemented similar programmes that support the Umid local education. These include:

- Provision of additional teaching to young people from Umid (i.e beyond that provided at the school) in a number of subjects as described in the section on Sangachal;
- Local student summer internships at the Terminal; and
- A University scholarship scheme.

7.6.4.7 Refugees and IDPs

The IDP population is housed independently in houses that were built by the socio-economic development fund of the Garadag Region. The IDPs receive free medical services, free education and assistance with securing employment. All the houses within the camp are full and at present no more people are arriving at the camp. This is expected to remain the situation for the foreseeable future. The IDPs receive an allowance of $US5 per month per person. There is some international humanitarian assistance given to IDPs, although this is ad hoc and inconsistent.[26]

7.6.4.8 Civil society

All of the households have telephones, televisions and radios, but they do not have access to newspapers. The Umid community receives most of its information from television, particularly the channels ANS, SPACE and AZ.TV.

Any decisions about the community are undertaken by either Garadag district or Baku region. There is, however, also a committee of elders consisting of those from the Camp who discuss issues, make decisions, resolve disputes and take the ideas/concerns to the head of the camp. The elders in the camp are not viewed as quite so influential as in Sangachal with 36.7% of community people interviewed considering the elders the most influential, compared to 46.2% in Sangachal (AHFS 2001).

The AHFS survey concluded that the residents of Umid are sensitive to the progress of the political processes and, as a result, place more trust in the hands of politicians than do the residents of Sangachal or Sahil. The residents of Umid are also sensitive to the opinion and advice of their family members and as a result are seen to reflect traditional features within the family system.

The view of the Garadag Executive Power is that the IDP camp residents live together without conflict and tend to be bonded by a common background. During the field work there was no sign of conflict between IDPs and other local residents.

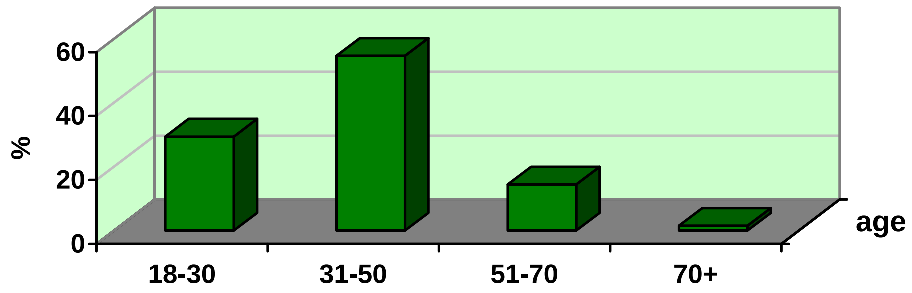
[26] information sourced from Garadag Executive Power

7.6.5 Sahil

7.6.5.1 Population and demographics

Figures for 2003 indicate that there are approximately 20,904 people living within the Sahil boundaries. This is compared to 21,000 residents in 2001, illustrating a 0.5% population decrease between 2001 and 2003. The gender split of the current population is 48.8% male and 51.2% female, which is similar to Umid but different from Sangachal with 62.5% males. The age data for Sahil is presented in Figure 7.22. The major ethnic groups in the settlement are Azeri (93%) , Russian (4.3%), Caucasian nations (1.8%) and other (0.6%) with Muslim and Christian being the most widely supported religions.

Figure 7.22 Age Profile of Sahil Residents



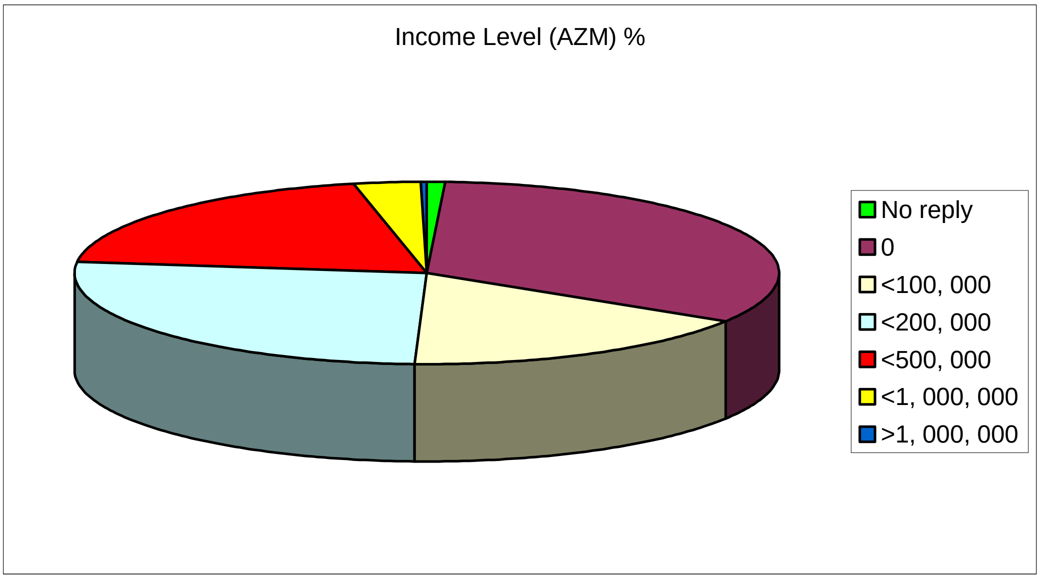
Source: Azerbaijan-Holland Friendship Society, Sociological Survey, Baku 2001

7.6.5.2 Livelihood

The AHFS survey gathered a range of data on Sahil residents' perception of family welfare and income levels in 2001. This showed that 52.3% of informants claim to be poor or very poor[27]. However, according to Garadag Executive Power (20/10/2003) the indications are that the general quality of life for the residents in Sahil has increased since 2001. This has largely been due to increased employment opportunities for both males and females of the settlement. In addition the funding of various development projects has benefited children in the area e.g. a new computer centre, day care centre for handicapped children and entertainment centre has likely added to the quality of life for children in the settlement.

Official figures for the current income brackets in Sahil are not available and however 2001 data is presented in Figure 7.23. Given the increased number of jobs in the region and the reduced unemployment figures, it can be assumed that the income levels in Sahil have increased.

Figure 7.23 Family's monthly earnings



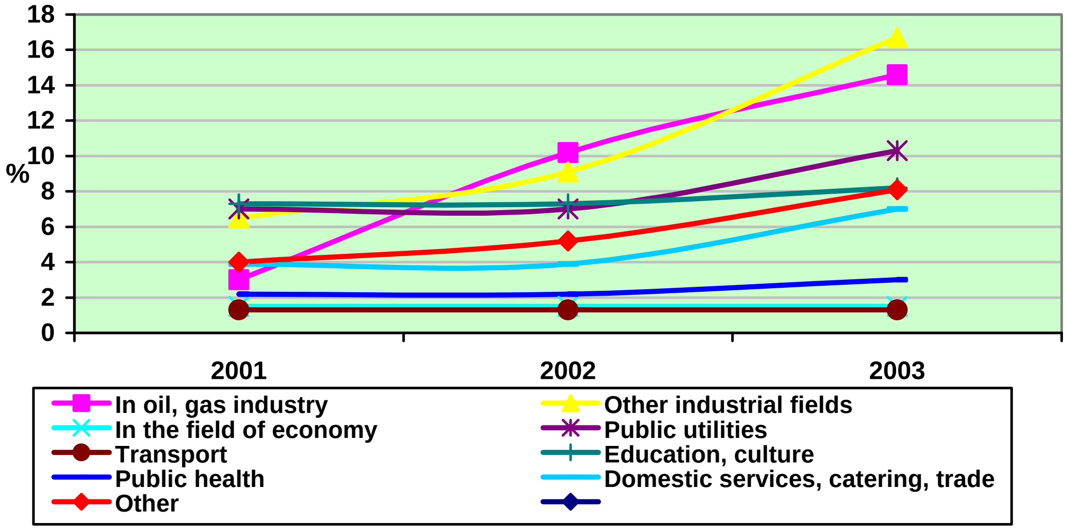
Source: Azerbaijan-Holland Friendship Society, Sociological Survey, Baku 2001.

7.6.5.3 Employment profile and economic activity

Figure 7.24 details the employment profile of the residents of Sahil between 2001 and 2003. The key areas of employment for Sahil residents during 2003 were the oil and gas sector, other industries and public utilities. Employment within oil and gas and other industrial fields has increased significantly since 2001, with employment in public utilities, education and culture, domestic services, catering and trade increasing only slightly. Increases are primarily related to ACG project activities at STEP and the SPS and ATA fabrication yards however levels will fluctuate depending on project requirements.

[27] Source: Azerbaijan-Holland Friendship Society, Sociological Survey, Baku 2001

Figure 7.24 Employment profile of Sahil residents



Source: Azerbaijan-Holland Friendship Society, Sociological Survey, Baku 2001 and Garadag Executive Power

Although not formally recognised there appear to be a proportion of residents involved with agricultural activities mostly in the form of livestock farming. It is believed that this however is for subsistence purposes. Similarly there are also some residents involved in limited fishing activities.

According to the AHFS survey that was conducted in 2001 the unemployment rate was 63.2% in Sahil. Data received from Garadag Executive Power indicates that this figure has decreased to 52.3% in 2002 and 29.3% in 2003.

7.6.5.4 Home Ownership

There are approximately 282 houses and 2,089 flats in Sahil. All of the flats are privately owned, however the majority of the houses (90%) are owned by government. It is unclear if there is a shortage of houses, although during 2003 site visits the survey team noted a lot of construction activities underway in the settlement and this may be aimed at solving any existing shortage of housing.

7.6.5.5 Infrastructure

The roads in and around Sahil are mostly covered in asphalt and are viewed as satisfactory, despite the poor condition of the surfacing and lighting. According to the representatives of Garadag Executive Power based in Sahil, the quality of the road network has not changed in the past three years. A typical scene in Sahil is shown in Figure 7.25.

The busiest traffic route from Sahil is to Baku. There has been an increase in the number of vehicles that use the road; particularly the number of local buses operating between the Sangachal area and Baku. The time that it takes to travel to Baku is still approximately 45 minutes by bus and costs between 1,000AZM and 1,500AZM ($0.20 – 0.30) for a one-way trip.

According to official sources all houses in the town have electricity and gas, and supplies are regular, reliable and sufficient. Wood is generally not used for heating or cooking.

The cold water supply is piped into the town from the Baku-Kura pipeline and is said to occasionally be insufficient for the purposes of the settlement. There is no certified hot water supply to Sahil, although this is typical for the area. Bottled water is not used for drinking, washing or cooking (Garadag Executive Power; 20/10/03). The settlement also has both centralised sewage and garbage disposal systems in place. However, according to the Garadag Executive Power the sewage system needs to be repaired.

Figure 7.25 Typical Street Scene in Sahil

7.6.5.6 Health

According to Garadag Executive Power (20/10/03) the health of the residents of Sahil is good. However this does not correspond with the feedback from the Sahil population in 2001, as illustrated in Table 7.9.

Table 7.9 How do you assess your health?

Response	%
No reply	0.6
Absolutely healthy	42.1
Not very healthy	30.9
Sick	26.4

Source: Azerbaijan-Holland Friendship Society, Sociological Survey, Baku 2001.

Sahil Central Hospital #23 serves approximately 25,000 people. 65 beds are available, sheets, blankets and food are not provided. There are 47 doctors, 7 midwifes, 120 nurses and a further 46 assistants working at the hospital. The hospital is open 7 days a week, 24 hours a day, and provides the following services: immunisations, URI in children, treatment of diarrhoea in children, child growth monitoring, anti-natal care, delivery services, patronage, family planning services, laboratory analysis, health education, basic emergency care and treatment of minor injuries.

The local population believe the level of medical care received here is satisfactory, as are the fees levied. The facility is also conveniently located (i.e 1-3km from the town). Those interviewed in the AHFS survey estimated that they spent between 80,000 and 100,000 manat in 2000 on medical care.

Medical supplies are sourced from the government, the community pharmacy and humanitarian aid donations. Delays in receiving supplies can occur and are a result of inadequate transportation, roads being impossible to pass in bad weather, administrative difficulties, financial problems, insufficient fuel and too few staff. The hospital is supplied with antibiotics, cardiovascular drugs, emergency drugs and intravenous fluids.

Patient records are maintained, as are details on immunisations, antenatal care, births and deaths. The hospital receives referrals from the First Aid Station and other health facilities to undertake x-rays and other laboratory work. The hospital finances its services through government funds and a fee on services provided. The facility has electricity, piped water, a toilet, wash stand and heating (boiler house). The overall state of the building is viewed as good[28] and is currently being renovated with the assistance of the cement plant.

7.6.5.7 Education

There are 5 schools in Sahil including 3 secondary, 1 boarding school and one lyceum. Children from Sahil, Umid and Sangachal attend the schools in Sahil. Some pupils from Sahil do attend specialised schools in Baku. The ACG Community Investment Programme assisted in the rehabilitation of the refugee school in sahil which was in very poor condition.

To overcome overcrowding, schools operate on a shift system with up to three shifts daily. At the Kasabasi school, the Human Development Forum is providing computer courses for 341 children.

Almost all of those surveyed by AHFS had completed secondary education[29]. Those who had not completed secondary education cited reasons such as financial constraints, compulsory military service and/or inadequate grades.

7.6.5.8 Refugees and IDPs

There are approximately 7,175 IDPs living in Sahil. The majority of IDPs in Sahil arrived in 1992, although people continued to arrive throughout 1993 and 1994. IDPs within Sahil are housed in public buildings or dormitories, private houses, or rented accommodation.

Whilst IDPs receive free medical services and education, they do have to pay for medication. The receipt of foreign humanitarian aid for IDPs in Sahil is viewed as limited and infrequent, however no figures were available on amounts, frequency or purpose of aid.

7.6.5.9 Civil society

Most of the houses within Sahil have telephones. According to the Garadag Executive Power the majority of people have access to televisions although exact figures are unavailable and it is unclear whether “access” means a television in the home or within a communal area. Sahil community receives most of its information from the television and the most frequently watched channels are state and private Azeri, Turkish and Russian channels. The Respublika, Yeni Azerbaijan and Xalg are the most common newspapers read in the Settlement and Lider, ANS, Space and Araz radio channels are accessible to all.

Officials within the government, at the national and regional level, undertake decisions affecting the community, such as those connected with investment and events. These decisions are then fed down to the local executive power. According to the Garadag Executive Power, in addition to this formal process, Sahil has a group of elders[30] who bring forward issues and concerns from the residents to the local executive power. This process was also evident from the results of the AHFS survey where residents identified the elders as the most influential people in the settlements, followed by government officials and politicians.

As in Sangachal, the role of the elders appears to be the preferred community method for raising concerns. However, before such an assumption could be made further investigation would be required in order to understand how the individuals are chosen for this task, by whom and exactly how this interacts with the more formal decision making processes.

[28] This information was sourced from a focus group discussion of 8 people from the local Sahil community (Completed 2003)
[29] Source: Azerbaijan-Holland Friendship Society, Sociological Survey, Baku 2001
[30] A direct translation of the name or responsibilities of this group was difficult to ascertain and “group of elders” appears to be the most appropriate description

7.6.6 SPS Yard

There is a range of domestic and commercial buildings and associated activities within the vicinity of the SPS Yard. Specifically a drive-through survey identified; 3 groups of residential buildings, a range of commercial activities (e.g vehicle renting company, AzGas Plant, shop), signs of agricultural activities and a number of buildings at which the exact nature of the activities being undertaken was not confirmed. It would appear that some of the buildings exist due to the presence of the SPS Yard facility. While unconfirmed, it is considered that some of the residents may be employed at the facility or at least work in small commercial enterprise that support the Yard's operations. The juxtoposition of local residential and riparian activities and facilities to those industrial is shown in Figures 7.26 – 7.28.

Figure 7.26 House near SPS yard

Figure 7.27 Herding activities near SPS yard

Figure 7.28 Small restaurant near SPS yard

7.6.7 Bibiheybat Oil Field[31]

7.6.7.1 Introduction

This section provides socio-economic receptors for the Bibiheybat Oil field, which surrounds the ATA yard where fabrication activities may occur as part of the construction programme during ACG Phase 3. There are a number of companies and households situated within the oil field, with an example of one such facility, the Caspian Shipyard, shown in Figure 7.29.

Figure 7.29 Caspian Ship Yard

7.6.7.2 Business Activity

There are nine companies employing 2,945 people within 1.5 km of the ATA yard. The companies, the service they provide, the distance from the Yard, and number of employees at each business is presented in Table 7.10.

[31] All of the information contained on the Bibiheybat Oil Field is sourced from ATA Yard : Socio-Economic Baseline Survey, Final Report, URS, November 2003.

Table 7.10 Location of Businesses

Company	Service/Supply Provided	Location	Number of Employees
South Construction Service (TREST)	Construction of platforms for drilling oil and gas wells	In ATA yard	305
Caspian Basin State Ship Department (KASPAR)	Ship construction and repair	30 m	350
Caspian Shipyard Company (CSC)	Shipyard business	1 km south	831
Caspian Basin Emergency Salvage (AJSC)	Lift up the ships, underwater work, emergency works	300 m	150
State Oil Company Azerbaijan	Ship repair	500 m	810
Caspian Basin Road Department	Drilling	50 m	300
Bibiheybat Oil and Gas Producing Department	Oil and gas producing and extracting	1.5 km	90
Bibiheybat Oil and Gas Producing Department	Compressor plant, oil transfer station	1.2 km	57
Bibiheybat Oil and Gas Producing Department	Constructing-and-mounting department	1.5 km	52
Total			**2,945**

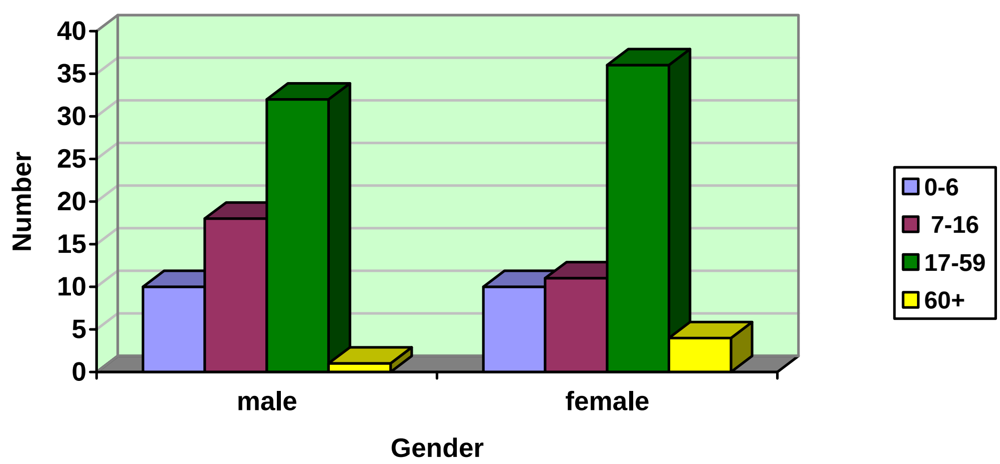
Source : ATA Socio-Economic Baseline, URS June 2003.

The majority of companies are well established with some being based at their present site since the 1920s and 1930s. Most employees arrive at work by public service bus, primarily from Bayil district. Specific buses are provided for employees working at the ATA Yard.

7.6.7.3 Households

122 people live within 1.5km of the ATA Yard. Some 16.4% of the population is aged six or below, 23.8% is between the ages of seven and 16, 55.7% between 17 and 59 years of age and the remaining 4.1% being 60 years old or over. All of those households surveyed were Muslim. The areas' demographic profile is presented in Figure 7.30. The majority of the households in the area have been resident since 1993 - 1997. No conclusive statement can be made as to whether the population level in the area has changed in recent years. Some households live in houses and others in former governmental buildings, as shown in Figure 7.31.

Figure 7.30 Demographics of population surrounding ATA Yard



Source : ATA Socio-Economic Baseline, URS June 2003.

Figure 7.31 Residential Buildings near ATA yard

A slight majority of the population believe that living conditions in the local community have become worse in recent years (Table 7.11). Respondents indicated this was a result of various issues including; limited employment opportunities, limited income, reductions in the level of humanitarian aid, poor living conditions and ill health.

Table 7.11 Living Conditions

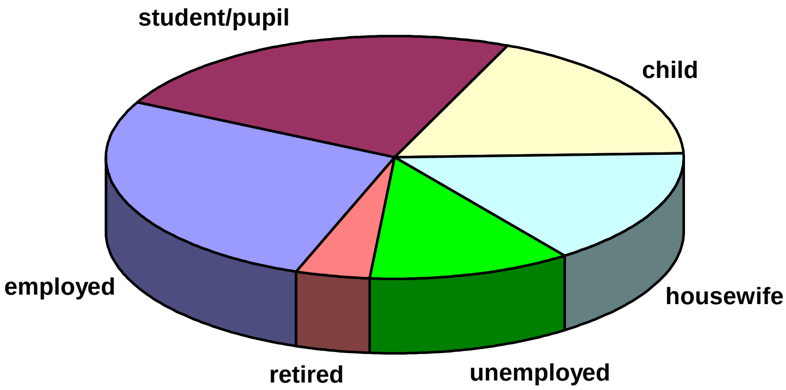
Change	Number of Respondents	% of Respondents
Better	7	25.0
Worse	12	42.9
Not changed	9	32.1
Total	**28**	**100.0**

Source : ATA Socio-Economic Baseline, URS June 2003.

7.6.7.4 Livelihood

The main sources of income for households in the survey area are industry, the service sector and government/humanitarian support. For the majority of households surveyed, these income sources have remained the same in recent years. Figure 7.32 summarises the employment status of residents. 27% of people living within the survey area are employed, with the majority actively employed by businesses located within the Bibiheyat Oil Field.

Figure 7.32 Employment Status ATA Yard (Source ATA Socio-Economic Baseline, URS June 2003).



Nine of the surveyed households (i.e. 32% of the total) own livestock (mainly poultry). In all cases the livestock are kept for their eggs and meat and live in the area surrounding the house. Only one household (i.e. 4% of total) is involved in fishing. The residents fish in the Caspian Sea for "Miller's Thumb" throughout the year, and the meat is use to feed their domestic animals.

7.6.7.5 Health and Nutrition

Almost 65% of household residents surveyed stated that they had health problems. A broad range of health problems were cited, but the main health issues identified were liver and heart conditions, glandular fever and child birth trauma. Residents in the survey area indicated that they access a variety of different hospitals located in Baku, Bibiheybat, Bail and Shixor settlements.

7.6.7.6 Education

Seven schools were identified as being accessed by residents in the survey area[32]. There are 2 schools in Bibiheybat, 4 in 20th settlement and 1 in Bailov. Of these seven schools, 3 are IDP schools. Almost 25% of residents in the area are currently pupils or students and almost 16% have achieved either secondary technical or university level education.

7.6.7.7 Infrastructure and Utilities

Access roads to households in the survey area are primarily earth or gravel, although some are asphalt. Almost 90% of surveyed residents indicated that they consider the roads to be of poor quality. Those able to access asphalt roads regard the roads as either good or satisfactory. The roads used to access the businesses in the area are primarily asphalt covered and 60% of respondents viewed them as being in good condition with the remaining 40% indicating that they are satisfactory. None of the businesses surveyed regarded the road conditions as bad.

The majority of the household residents surveyed take between 30 minutes and one hour to travel to the centre of Baku. The majority of those interviewed indicated that they pay between 500--5,000 manats for a one-way trip using public transport. The main reason cited for visiting Baku is for shopping, although other reasons include going to work, visiting relatives and accessing medical facilities.

All surveyed businesses and households have access to electricity. Only 50% of businesses and 43% of households have access to gas. Only six households (i.e. 21% of the total) use wood for cooking and heating in the home.

All businesses obtain water from the main Baku supply and the supply was reported as being regular, although one business reported shortages during the summer months. Residents of surveyed households indicated that they either obtain water from the main Baku supply or from the shipyard's water pipeline. Again, both supplies were reported as being regular. 54% of residents believe however, that the quality of the water is bad and a further 25% viewed it as satisfactory. 80% of businesses reported that the water quality is satisfactory and only 10% viewed it as bad. Almost 90% of surveyed households find the water supply sufficient for household purposes. Ninety percent of businesses have hot water but none of the surveyed households have access to this resource.

Only one business and three households have a centralised sewage system. All businesses stated they have a centralised garbage collection and disposal system but only eight households(i.e. 29% of the total) have access to such a service.

[32] Schools in Baku are often numbered rather than named.

7.6.7.8 Civil Society

All businesses surveyed reported that they have access to a telephone. Sixteen of the 28 surveyed households (i.e 57%)) have access to a telephone. 90% of businesses and almost 86% of households have a television. The preferred television channels include ANS, ATV, AzTv 1, LIDER, RTR, Space and TRT.

The survey found that there is limited use of newspapers in sourcing information within local households, with residents of only two of the 28 surveyed households (i.e. 7%) reading newspapers. All representatives interviewed at the identified businesses reported that they read newspapers to gather information. The preferred newspapers are Azerbaijan, Azer Press, Azeri Times, Bak Rabochii, Baku Sun, Baku Post, Caspian Energy, Exo, Iki Sahil, Izvestiya, Respublika, Vishka and Xalg. Only 30% of businesses and just under half of the households surveyed listen to the radio for information. The preferred radio channels include ANS, Araz, Azadlig, Baki, BBC, Burc FM, Space and 104 FM.

The preferred means of communication expressed by interviewed businesses is either TV or newspapers, whereas households favour TV.

The residents of surveyed households indicated that disputes within the local community are primarily addressed within the household and through discussions with neighbours and relatives. Some 50% of those surveyed indicated that disputes were resolved by household entities themselves.

8 Consultation and Disclosure

Contents

Figures

Tables

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8.1 Introduction

The Phase 3 project of the ACG FFD is in practice an extension of an existing work programme; a work programme that has already undertaken extensive consultation. As a result, consultation for Phase 3 was able to build on the framework of consultation established during the earlier Phases of the ACG development, whilst at the same time, drawing on the lessons learnt during this process. Undertaking the consultation process for Phase 3 in this manner allowed it to be highly effective in communicating both information about the development and receiving feedback from stakeholders.

8.2 ACG Phase 3 Consultation and Disclosure Process

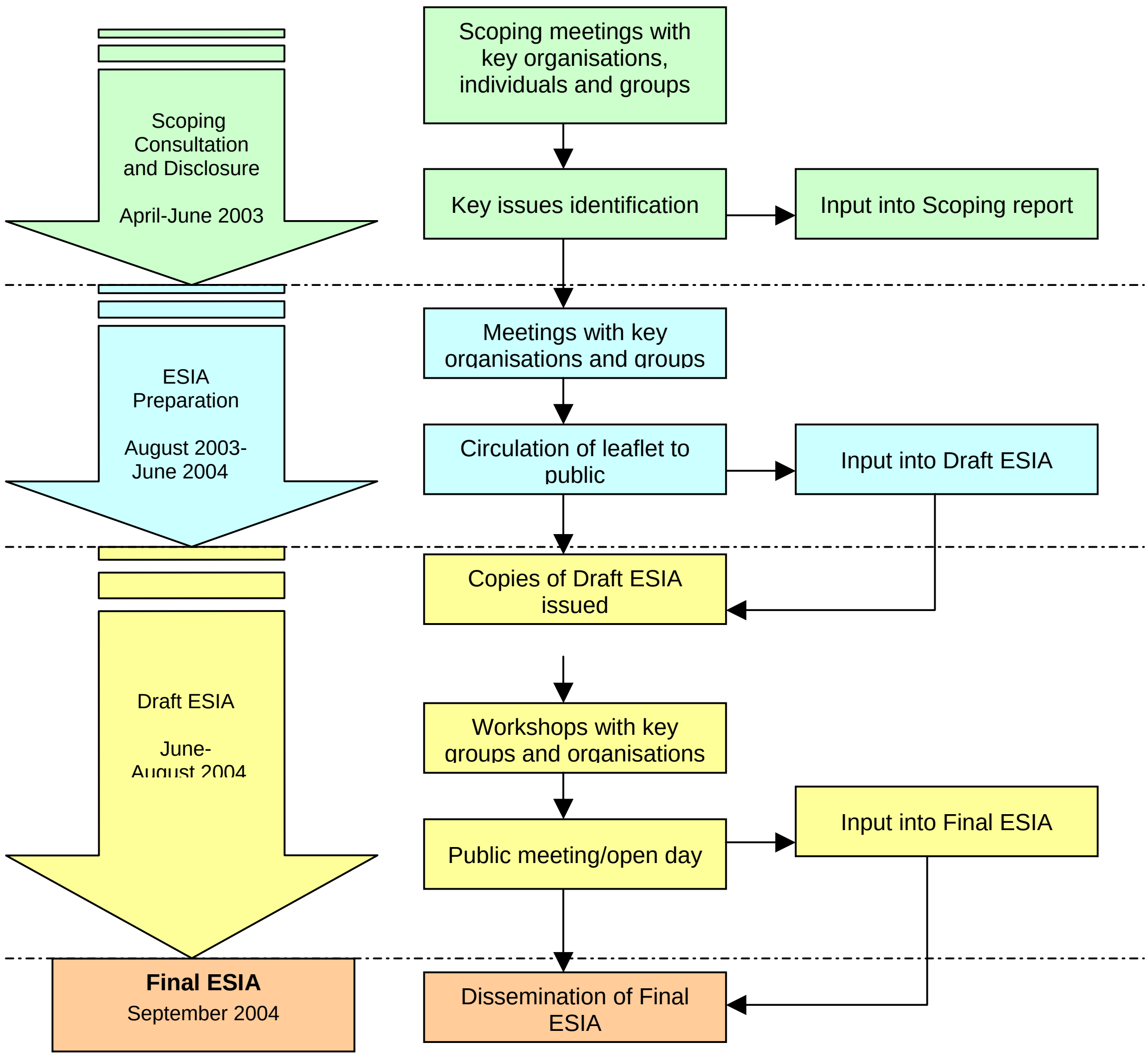
8.2.1 Overview

The approach adopted for the consultation programme for Phase 3 had the following characteristics:

- It made use of the existing framework of consultation and infrastructure established earlier in FFD and other BP projects in Azerbaijan, eg Shah Deniz and used for consultation and disclosure during the earlier phases of the ACG project.
- It was developed with reference to accepted guidance on expectations of ESIA consultation and disclosure.
- It considered the extent of consultation and disclosure already undertaken in recent years and thus was sensitive to stakeholder fatigue from continued consultation on different Phases of the project.
- It incorporated recommendations made from a 'Lessons Learned' review of earlier consultations.

Figure 8.1 below illustrates the Phase 3 consultation and disclosure process and the accompanying text provides further detail. Full details of the consultation and disclosure process undergone during the ACG Phase 3 ESIA are contained within the ACG Phase 3 Public Consultation and Disclosure Plan (PCDP). The PCDP was initially drafted during the scoping phase of the ESIA and subsequently revised and updated at appropriate stages throughout the ESIA process. The PCDP includes an outline of the consultation and disclosure undertaken during earlier phases of the ACG FFD and the lessons learnt from these processes. It is these activities that have provided the framework and learning for the consultation and disclosure process developed for Phase 3.

Figure 8.1 ACG Phase 3 consultation and disclosure programme



8.3 Scoping Consultation and Disclosure

During the scoping phase of the ESIA a variety of consultation and disclosure meetings were held. The Scoping report is available at the following:

- BP website (www.caspiandevelopmentandexport.com);
- Local libraries/information centres;
- BP Villa Petrolea reception, Baku; and
- Environmental Information Centre at MENR.

Full details of the Scoping consultation and disclosure meetings, including meeting minutes can be found in appendices to the ACG Phase 3 Scoping Report. A summary is provided below:

- AIOC Research and Monitoring Group (which includes representatives of the MENR);
- Azerbaijani Scientific Community;

- Azerbaijan Non-Governmental Organisations;
- Representatives of communities local to the project activities, including:
  - Head of Garadag Power;
  - Representatives of Garadag Executive Power in Umid and Sangachal;
  - Sangachal and Umid Community Elders;
  - Directors of Sangachal and Umid School;
  - Manager of AIOC Information Centres;
  - Members of Community Development Committees of Umid and Sangachal;
  - Women Focus Groups; and
  - Teenager Focus Groups.

Section 8.9 of this chapter summarises the key issues raised during the scoping consultation process, as well as those raised at other points in the ESIA process. It also outlines how and where these issues have been addressed.

8.4 ESIA Preparation

During the ACG Phase 3 Scoping, a request was made for an additional round of consultation and disclosure between the ESIA Scoping and draft ESIA report stage. As a result a series of meetings were undertaken during the preparation of the ESIA. These meetings were held with:

- AIOC Research and Monitoring Group;
- Azerbaijani Scientific Community; and
- Azerbaijani Non-Governmental Organisations.

The meetings allowed for the following:

- Presentation of an update of the ACG Phase 3 Project;
- Providing an update on key issues raised during the ESIA Scoping process; and
- Gaining feedback from attendees for consideration in completing the ESIA process.

Alongside this, an information leaflet was provided to the general public in the areas around the proposed project facilities (e.g Sangachal, Umid, Sahil and Bibi-Heybat). The leaflet provided a general description of ACG Phase 3, an overview of the ESIA process and when drafts will be available for comment, whilst providing contact details if there were any questions or concerns.

Copies of the minutes from the meetings held during the preparation of the ESIA and also the information leaflet can be found appendiced to the ACG Phase 3 PCDP.

8.5 Draft ESIA report

On completion, the Draft ESIA will be available for comment and discussion at a variety of venues and locations between June and August 2004. Full details of those involved in the consultation and disclosure of the Draft ESIA are contained in the ACG Phase 3 PCDP, including minutes of these meetings. A summary is however provided below:

- Copies of the Draft ESIA will be made available at:
  - BP website;
  - Information centres at Sangachal, Umid and ATA;
  - Human Development Centre, Sangachal;
  - BP Villa Petrolea reception, Baku; and
  - Garadag Executive Power offices in Snagachal, Umid and Sahil.

In addition, the ESIA will be made available at a new Environmental Information Centre at the Ministry of Ecology and Natural Resources (MENR). The centre will be opened as part of a joint initiative between the OSCE, together with the MENR to implement the Aarhus Convention (UN ECE Convention on Access to Information, Public Participation in Decision-Making, and Access to Justice in Environmental Affairs of Åarhus, 1998), acceded to by the Government of Azerbaijan on March 23, 2000.

The Centre will be equipped with free library/internet resources and conference room facilities and is aimed at providing governmental, scientific, and non-governmental organisations engaged in environmental activities, as well as interested individuals with free and open access to environmental information. The main objective of the Centre is to promote public access to such information and encourage participation in decision-making in environmental affairs.

During the ESIA, meetings/workshops will be held with the following:

- AIOC Research and Monitoring Group;
- Azerbaijani Scientific Community;
- Azerbaijan Non-Governmental Organisations;
- Sangachal and Umid Community Elders;
- Members of Community Development Committees of Umid and Sangachal;
- Women Focus Groups;
- Teenager Focus Groups; and
- The general public.

Comments received on the Draft ESIA will be collated and analysed using a standard reporting template. AIOC response to comments received will also be recorded in this template*.* The completed template with an account of consultations undertaken will be included in the final ESIA Report. In line with the need for feedback to consultees, the summary of comments received and AIOC responses will be issued as soon as possible after completion of the 60-day consultation period.

8.6 Final ESIA Report

Copies of the Final ESIA Report will be made available at the:

- BP website;
- Information centres at Sangachal, Umid and ATA;
- Human Development Centre, Sangachal;
- BP Villa Petrolea reception, Baku;
- Garadag Executive Power offices in Snagachal, Umid and Sahil; and
- OSCE Environmental Information Centre at MENR.

8.7 Post-ESIA Project Consultations

Following the issue of the Final ACG Phase 3 ESIA there will be a need to continue consultation and disclosure during the construction and operations phases of ACG Phase 3, in agreement with the PDCP. There is already a well-established consultation and disclosure process established around the Sangachal Terminal Expansion Programme (STEP) and it is proposed that this is used as the basis for consultation and disclosure during the construction period of ACG Phase 3, whilst bearing in mind the differences in geographical scope that

ACG Phase 3 brings in comparison to earlier phases. Further details of the consultation and disclosure process undertaken during the construction phases of ACG Phases 1 and 2 is detailed further in Section 5 of this report and outlined in more detail in the Community Liaison Management Plan available on the project's website.

When the development enters its operations phase the consultation will be revisited to check that it is effective and appropriate.

8.8 Consultation Under the Espoo Convention

As discussed in Section 2 Legislation, Azerbaijan is a signatory to the Convention on Environmental Impact Assessment in a Transboundary Context (the Espoo Convention). This requires the Azerbaijan Government to provide initial notification to countries that may be subject to transboundary environmental impacts as a result of a development within Azerbaijan. Scoping identified potential for transboundary impacts related to Phase 3 development in the event of a major oil spill (eg. blowout).

AIOC, has formally informed the Azerbaijan Government of the Phase 3 project ESIA via provision of the ESIA Scoping documentation for the project. Additionally, through the Caspian Environmental Programme initiative, AIOC informally shared information on the Phase 3 project with the littoral states, bordering the Caspian Sea, to facilitate participation in the ESIA process where requested. At the time of writing, AIOC has not been made aware of any responses from littoral states indicating a desire to participate in the ESIA process.

8.9 Issues Raised During Consultation and Disclosure

Table 8.1 below provides a summary of the issues raised during the consultation and disclosure exercise outlined above. It also indicates which section within the ESIA the issue is addressed.

Table 8.1 Key issues raised during ACG Phase 3 ESIA consultation process

Issue	Concern	Issues Raised By				During			Section Addressed
		Research & Monitoring Group	Academics/ Scientists	NGOs	Local communities	Scoping	Interim Consultations	Disclosure	
Onshore emissions	Concern over air quality around Sangachal terminal and perceived negative impact on health of local inhabitants.		▼		▼	▲			9.8
	Perception that herbicides have been used at the Sangachal Terminal and air borne drifting of these are affecting the surrounding population, ecology and animals.				▼	▲			9.10
	Concern over potential for fugitive emissions from untreated drill cuttings which are shipped to shore and stored at Serenja.			▼		▲			10.2
Impacts on fauna at Sangachal Terminal	Concern over interactions between terminal personnel and local animals, whether stray or farmed animals.			▼		▲			9.10.5
Discharges and emissions from offshore facilities and potential effects on marine environment	Disposal of gas at offshore platforms.		▼	▼		▲			9.5.1.9
	Discharge of cuttings.		▼	▼		▲			9.5.1.1
	Disturbance of benthic habitat.		▼	▼		▲			9.5.1.1, 9.3.1.4, and 9.4.1.1
	Noise and vibration.		▼			▲			9.4, 9.3.1.6, and 9.5.1.8
	Hydrotest water from offshore pipelines.		▼			▲			9.6.1.3
	Cooling water – potential temperature impacts.		▼			▲			9.4.1.3, 9.5.1.4
	Produced water.		▼	▼		▲	▲		9.5.1.4
	Clear quantification required for discharges and standards to be met.		▼			▲			Appendix 2, HSE Design Standards
	Possibility of a chemical or hydrocarbon spill and effectiveness of emergency response.		▼	▼		▲	▲		9.11.2
Drill cuttings (onshore disposal)	Concern that a waste management strategy is not yet in place	▼	▼	▼			▲		10.2.3
	Concern that the Serenja facility will be used for long term storage of waste	▼					▲		10.2.2
	Concern that the trials of using treated drill cuttings carried out at the cement plant were not conducted in a proper manor	▼		▼			▲		10.2.4.4
	Concern about the safety of treated material for reuse			▼			▲		10.2.4.1

Issue	Concern	Issues Raised By				During			Section Addressed
		Research & Monitoring Group	Academics/ Scientists	NGOs	Local communities	Scoping	Interim Consultations	Disclosure	
	Concern that bioremediation may not be an appropriate disposal method in Azerbaijan and may lead to soil and ground water contamination			▼			▲		10.2.4.4
Environmental monitoring	Perceived need for ongoing environmental monitoring and disclosure of data in the following areas:								
	• Fish numbers and fish pathology.		▼			▲	▲		11.7.3
	• Naturally Occurring Radioactive Material (NORM).		▼			▲	▲		9.5.1.10
	• Microbiology		▼				▲		11.7.3
	• Birds		▼				▲		11.7.3
	• Malaria in standing water around near Sangachal terminal		▼				▲		9.10.5
	Request for greater NGO involvement in the monitoring programme			▼		▲	▲		11.7.3
Seabed geology and seismicity	Fear that increased operations will increase the number of seismic events in the offshore environment.		▼	▼		▲			9.5.1.1
Reservoir stability	Unknown effects of produced water reinjection.		▼			▲			9.11.2
Employment	Dissatisfaction with wage differential between nationals and expatriates.			▼	▼	▲			Not addressed
	Impact of loss of employment at demobilisation after completion of the construction phase of the project.			▼		▲			10.3
	Employment opportunities for women.			▼		▲			Addressed in Recruitment and Training Plan and Community Investment Plan
	Concern to maintain expertise/employment opportunities at the end of the construction phase through vocational training and alternative opportunities.				▼	▲			10.3.2

Issue	Concern	Issues Raised By				During			Section Addressed
		Research & Monitoring Group	Academics/ Scientists	NGOs	Local communities	Scoping	Interim Consultations	Disclosure	
	Need to improve intra-sectoral linkages and other job-creating industries such as fish farming.			▼		▲			To be addressed in Regional Development Initiative
Supply chain	Concern that products and services are sourced from within Azerbaijan rather than imported. Tender conditions seen to act against local companies.			▼		▲			9.10.3
Corruption	Expectation that AIOC will take steps to prevent corruption.			▼		▲			Not addressed
Amenities and Public Infrastructure	Pressure on local amenities due to increase in population resulting from economic impact of terminal construction.				▼	▲			9.10.8
	Concern over long-term health implications of poor housing conditions of workers in Umid.				▼	▲			Not addressed
	Expectation that ACG will improve local amenities, including provision of mourning place, playground, sports facilities, nursery school, shops, hospitals.				▼	▲			Not addressed
Community investment	Promises over community investment should be fulfilled.			▼	▼	▲	▲		Will be addressed in RDI
	Need to improve transparency of social investment program.			▼		▲	▲		Appendix 5
	Need to demonstrate how the performance of NGOs carrying out projects within the social investment programme is evaluated.			▼			▲		Appendix 5
Consultation and disclosure	Would like more consultation and involvement.		▼	▼		▲	▲		8.4
	Suggestion that project documentation should be lodged at the Azeri Open Society Institute Soros Foundation, and made available on CD.			▼		▲			Not addressed
	Suggestion that the project documentation should be lodged at the International Ecoenergy Academy.			▼		▲			Not addressed
	Need for improved communication with local community particularly with regard to emergency situations			▼			▲		9.11
	Need for the results of environmental monitoring to be published		▼				▲		Not addressed

Issue	Concern	Issues Raised By: Research & Monitoring Group	Academics/ Scientists	NGOs	Local communities	During: Scoping	Interim Consultations	Disclosure	Section Addressed
Decommissioning	Removal and disposal of installations at end of project life.		▼			▲			10.4
	Mechanisms to transfer ownership of the Phase 3 facilities at the end of the PSA	▼					▲		10.4
	Details of safe removal of offshore facilities during decommissioning to avoid potential hazards to shipping		▼				▲		10.4

9 Environmental and Social Impact Assessment

Contents

Figures

Tables

9.1 Introduction

This section of the Environmental Statement (ES) identifies and assesses the potential environmental and socio-economic impacts associated with the ACG FFD Phase 3 project. The impact assessment methodology followed is described in Section 3. To conduct the assessment the project was separated into the following project phases:

- Offshore facilities – onshore construction and pre-commissioning;
- Offshore facilities – offshore installation, hook-up and commissioning;
- Mobile offshore drilling unit (MODU) drilling (template and subsea water injection sites);
- Offshore facilities – platform drilling, production and operations;
- Offshore interfield pipelines – installation and operations;
- Onshore facilities – construction and commissioning; and
- Onshore facilities – operations.

Table 9.1 Document Road-Map for the Impact Assessment

Section	Topic
9.2	Offshore Platform Facility Construction in Azerbaijan Construction Yards
9.3	Offshore Facilities Offshore Installation, Hook-up and Commissioning
9.4	Mobile Offshore Drilling Unit – Template and Subsea Injection Well Drilling Programme
9.5	Offshore Facilities – Platform Drilling, Production, Facilities Operations and Maintenance
9.6	Interfield Pipeline Installation, Commissioning and Operation
9.7	Terminal Engineering, Construction and Commissioning
9.8	Terminal Operation
9.9	Cumulative Atmospheric Emissions (CO2 and CH4) and GHG Potential
9.10	Socio-Economic Impacts
9.11	Accidental Events

As per Section 3 the following steps were undertaken in the assessment:

- Routine and planned non-routine activities within each project phase were identified and the potential environmental and socio-economic aspects[1] associated with these activities were identified and discussed with project engineers through the ENVIID workshops.
- For each aspect, potential impacts[2] were considered and the effect of mitigation measures established through the design process/mitigation workshops were then taken into account. These measures comprise either specific design components or operational management procedures intended to eliminate or reduce the potential for impacts from the identified activities. In particular, lessons learned from the offshore facility and terminal expansion programmes for Phase 1 and Phase 2 of ACG FFD were taken into consideration, particularly the environmental and social management procedures that have been put in place and an assessment of their success in mitigating impacts related to Phase 1.
- Where issues remained and the potential for residual impacts was identified, these issues were assessed and their significance ranked using the methodology, probability of occurrence (likelihood) and consequence criteria described in Section 3. Where the residual impact was found to be of low significance, no further mitigation measures are

[1] Environmental aspect defined as "An element of an organisation's activities, products or services that can interact with the environment", Environmental Management Standard ISO 14001.
[2] Environmental impact defined as "Any change to the biophysical environment, positive or negative, that wholly or partially results from a project activity or associated process", Environmental Management Standard ISO 14001.

considered necessary. Where potentially significant residual impacts were identified, these will require additional mitigation measures above and beyond those already in place for the project. These additional mitigation measures are discussed in the Mitigation and Monitoring section of this ESIA (Section 11).

Matrices showing activity/receptor interactions and the quantitative results of the assessment are provided in Appendix 6 & 7. The key elements of these matrices specific to each stage of the project have been summarised in separate tables for the environmental and socio-economic impact assessments and are included in Sections 9.2 to 9.8 and 9.10 respectively. Within each section a discussion of the key findings is also presented, including where relevant, details of mitigation and management procedures built into the construction and operation process, including contractual requirements to be imposed on construction contractors.

It should be noted that the impact assessment (and the impact significance ranking) assumes that all specified management and mitigation measures, as summarised in the matrices, are implemented by the contractors and monitored by AIOC. The Environmental Management System (EMS) described in Section 11 will act as a tool to assess the implementation of these measures, and their effectiveness.

Consultation between AIOC, the Project, and its stakeholders has been ongoing throughout the phased development of the project and has continued as part of the ESIA process for Phase 3 (Section 8). Key comments and feedback from the stakeholders were included in the assessment process in terms of perceived impact from the project and have been considered when assessing the requirement for further mitigation measures. These comments have been included in the impact summary tables and discussed within each of the above-referenced sections.

When considered in isolation for the project, a large number of proposed Phase 3 activities have been predicted to result in an insignificant impact, either due to the small scale of the activity, the distance of the activity from receptors, or through the effective mitigation of impacts through careful design and management developed and implemented by the project. Phase 3 will however follow the EOP, Phase 1 and Phase 2 developments and as such needs to be considered within the context of FFD. The assessment of potential cumulative impacts considers those impacts that may result from the combined or incremental effects of past, present or future activities on environmental or socio-economic receptors.

There is the potential for Phase 3 activities to contribute to an accumulation of activities, issues and impacts associated with FFD, such as noise, air emissions and socio-economic issues. The cumulative effects of impacts are discussed within the project-specific discussion, with the exception of greenhouse gas emissions, which are discussed separately in Section 9.9.

The potential for accidental events to occur during the different stages of the Phase 3 project has also been assessed in terms of probability of occurrence and the resulting consequence of these accidents. These events have been separated into offshore and onshore activities and the mitigation measures already in place for the project to prevent these accidents have been considered in the impact assessment. Matrices showing activity/receptor interactions and the results of this process are also included in Appendix 7 and 8, and the findings are discussed in Section 9.11.

In addition, Phase 3 activities may contribute to the challenge of meeting wider operational issues relating to FFD or other BP AzBU activities in the region. Such issues have been assessed in a cumulative context for all BP projects in the Caspian region (i.e. not in terms of Phase 3 on its own) and are discussed in Section 10 Wider Issues. The decommissioning aspects of the Phase 3 project are discussed here.

9.2 Offshore Platform Facility Construction and Commissioning in Azerbaijan Construction Yards

The following facilities will be constructed and assembled for the Phase 3 project in preparation for load-out and installation offshore:

- DUQ jacket;
- PCWU jacket;
- DUQ topsides;
- PCWU topsides;
- Platform bridge link; and
- Drilling template.

The offshore facilities will either be fabricated within Azerbaijan or, where this is not possible, sourced internationally and transported to the region for assembly. In-country fabrication will, where possible, utilise existing national fabrication yards, for the fabrication, construction and onshore pre-commissioning offshore platform and jacket facilities. The principal in-country yards under consideration are the Shelfprojectsroi (SPS) yard and the Amec-Tekfen-Azfen (ATA) yard located to the south of Baku. At the time of writing, fabrication/construction contracts had not been awarded and therefore, a final selection of yard or yards has not been made. It has been assumed for the purpose of this impact assessment that the construction will occur within Azerbaijan, in yards that have either been or will be upgraded as far as is possible to meet international standards.

The key activities identified are common to the construction programme for each individual facility. Therefore one impact assessment has been conducted, as opposed to repeating the assessment for all elements for each of the six separate facilities. Onshore commissioning of these facilities prior to their load-out onto the transportation barges has also been considered.

9.2.1 Environmental Impacts

The results of the environmental impact assessment are summarised in Table 9.2. The assessment of routine and planned non-routine activities associated with the construction and onshore commissioning of these facilities predicted that only environmental impacts of low residual significance would result from these activities.

Table 9.2 Summary of Environmental Impact Assessment for Offshore Platform Facility Construction and Commissioning in Azerbaijan

ID	Activity	Environmental Aspects	Existing Environmental Mitigation	Cumulative Contribution	Environmental Impact Significance	Justification/Comments	Residual Environmental Issues to be Addressed
A	Offshore Platform Facility Construction / Fabrication, Assembly and Commissioning in Azerbaijan Construction Yards[1]						
A1.	Road transportation (equipment, materials and workforce)	Atmospheric emissions, noise.	Vehicle maintenance as per pollution prevention procedures; Transport Management Plans.	▲	L	Volumes insignificant.	None.
A2.	Rail transportation (equipment and materials)	Atmospheric emissions, noise.	Use of existing infrastructure.	▲	L	Low contribution to overall air emissions from the project.	None.
A3.	Sea transportation to Azerbaijan (modules, equipment and materials)	Atmospheric emissions, noise, wastes, effluent discharges, ballast water discharges.	Bilge water, sewage water standards and control; Waste management planning and implementation; Ballast water management procedures.	▲	L	Localised minor impacts that are rapidly dispersed. Wider concern in the Caspian about introduced species.	Ballast water management. Refer to Section 9.2.1.1.
A4.	Onsite transportation and craneage	Atmospheric emissions, noise, dust	Vehicle and plant maintenance as per pollution prevention procedures; Transport Management Plans; Dust suppression through watering down.		L	Low contribution to overall air emissions from the project and within international standards.	None.
A5.	Steel works (rolling, cutting and welding)	Noise, atmospheric emissions, wastes.	Waste management hierarchy, planning and implementation.	▲	L	Cumulative waste generation issue across AzBU activities. Issue of waste management raised during consultation.	Waste treatment & disposal Refer to Section 10.2.
A6.	Painting and blasting	Noise, atmospheric emissions, wastes.	Paint shed emission abatement procedures; Waste management planning and implementation.	▲	L	Cumulative waste generation issue across AzBU activities. Issue of waste management raised during consultation.	Waste treatment & disposal Refer to Section 10.2.

[1] Offshore facilities includes: Jackets; topsides; drilling templates, bridge link

ID	Activity	Environmental Aspects	Existing Environmental Mitigation	Cumulative Contribution	Environmental Impact Significance	Justification/Comments	Residual Environmental Issues to be Addressed
A7.	Hydro testing	Liquid wastes.	Fresh water used and re-used where possible. Treated seawater used where necessary and re-used wherever possible. Where chemical use needed, selection is through the chemical management system. Treated waters are dechlorinated prior to discharge. No residual chlorine. Dispersion of warmed testing waters maximised at point of discharge.		L	Only required during the commissioning phase and relatively small volumes of water required for a short length of time. Modelling has confirmed that IFC standards will be met and temperature effects on receiving waters will be limited.	None.
A8.	Leak/integrity testing	Atmospheric emissions.	Inert gas decanted into other system and re-used where practical. Controlled venting in open atmosphere.		L	Inert gases used. Only during commissioning phase, small volumes.	None.
A9.	First fill of facilities	Wastes. Potential spills of oil or chemicals.	Waste management planning and implementation. Refuelling procedures, chemical storage procedures, labelling as per pollution prevention planning. Spill prevention and response plan.		L	Single event. Cumulative waste generation issue across AzBU activities. Issue of waste management raised during consultation.	Waste treatment & disposal Refer to Section 10.2.
A10.	Yard power generation	Atmospheric emissions.	Power supplied from the electricity grid where possible, backed up by diesel generators where required. Regular maintenance of generators required under pollution prevention procedures.		L	Low contribution to overall air emissions from the project and within international standards.	None.
A11.	Yard drainage and sewage	Liquid wastes	Sewage treatment in municipal works; Drainage to municipal system; All hazardous materials bunded and contained.		L	Low but indirect discharge of sewage to sea following treatment in the municipal system treatment works. Non–hazardous drainage to soakaway or municipal drains.	None.
A14.	Support facilities (including construction camp)	Wastes.	Waste management planning and implementation.	▲	L	Cumulative waste generation issue across AzBU activities. Issue of waste management raised during consultation.	Waste treatment & disposal Refer to Section 10.2.

ID	Activity	Environmental Aspects	Existing Environmental Mitigation	Cumulative Contribution	Environmental Impact Significance	Justification/Comments	Residual Environmental Issues to be Addressed
A15.	Load out of offshore facilities[2]	Noise.	Operations restricted to daylight hours where possible. Use of existing yards where receptor sensitivity to noise has been assessed and noise measurements have been conducted.		L	Short duration.	None.

[2] There will be eight load-out activities – template x 1, jacket x 2, topsides x 2, bridge link x 1, subsea manifolds x 2 – each of these activities will occur at a different time

It is expected that the Phase 3 construction programme will be carried out at yards that have or will be developed to international standards. The programme will use the lessons learned from Phase 1 and Phase 2 facility construction programmes to assist in the effective management of activities and the mitigation of predicted impacts during the Phase 3 construction programme. As a result of current effective management of these sites, the Phase 3 construction programme overall is predicted to result in only low impacts on the environment.

As discussed, construction contractors will be required to implement these management measures as part of their contract conditions. The system of contractor management used by AIOC to provide assurance of effective management of the activities is described in the Mitigation and Monitoring section of this ESIA (Section 11). Details of the key mitigation considered in the impact assessment, which support the judgement of low significant residual impacts, are summarised in the following subsections.

9.2.1.1 International Transportation

Large facility components and pre-fabricated modules will be transported to the Caspian Sea through international waters via the Russian Federation canal system. Current predictions estimate that eight vessels will be used for these transportation requirements for the Phase 3 offshore facility construction programme.

Shipping through international waters has the potential to introduce non-native marine species via ballast and bilge waters, engine cooling waters, and through hull and anchor fouling. The introduction of non-native species that can feed on or out-compete native species within the local ecosystem would have an ultimately damaging effect on the Caspian environment. This issue is of particular importance since the discovery of the planktonic comb jelly *Mnemiopsis leidyi* in the Caspian in recent years. The comb jelly has caused a noticeable change in the ecosystem of the Caspian, as the species feeds on the zooplankton that forms a primary diet of sprat. Sprat is an important commercial species in the Caspian and also forms a key component of the diet for other fish species such as sturgeon.

Phase 3 will adopt Azeri Project ballast water management measures designed to reduce the potential for alien species introduction. In view of this and the low numbers of vessels that are required for Phase 3, the environmental impacts from international shipping for the project will be low.

9.2.1.2 Transportation within Azerbaijan

The Phase 3 project will result in an increase in surface transportation, through the movement of materials and of the workforce by road. The contractors will be required to adopt the project transport management procedures established during Phase 1, which include the provision of a workforce bus service, controls on speed limits, route selection and other mechanisms to minimise traffic and avoid traffic congestion as far as possible. Furthermore all vehicles will be regularly serviced to ensure acceptable performance and reduce atmospheric emissions.

9.2.1.3 Air Emissions

Public attention on atmospheric emissions has increased in recent years with concerns being focussed on local and regional pollution (i.e. human health issues) and global warming. It has been generally acknowledged that the so-called “greenhouse gases” (primarily CO_2 and CH_4) in excessive quantities, contribute to global warming with the potential for consequent climate change. At an international level, efforts are being made to get individual countries to reduce their emissions of these greenhouse gas species. These issues are addressed in Section 9.9.

The environmental fate and effect of other gaseous species that would be emitted at some time from the ACG Phase 3 development, are summarised as follows:

- Carbon dioxide (CO2). A 'greenhouse' gas that contributes to climate change.
- Methane (CH4). Contributes indirectly to climate change by enhancing low level ozone production. Poisonous at high concentrations and can potentially enhance photochemical smog formation
- Carbon monoxide (CO). Contributes indirectly to climate change by enhancing low level ozone production. Highly toxic to human health at concentrations of several percent (by volume) and can augment photochemical smog formation
- Oxides of nitrogen (NOx, including predominantly NO and NO_2). NO_2 is a toxic gas, even at relatively low concentrations. NOx also contributes to the formation of acidic species which can be deposited by wet and dry processes. Acidic species may impact both freshwater and terrestrial ecosystems. NOx can also augment the formation of ozone at ground level when mixed with VOCs in the sunlit atmosphere. NO is a relatively innocuous species, but is of interest as a pre-cursor of NO_2
- Sulphur dioxide (SO_2). SO_2 is a toxic gas, and is known to contribute to acid deposition (wet and dry) which may impact both freshwater and terrestrial ecosystems. Direct health effects potentially causing respiratory illness.
- Volatile organic compounds (VOC) Non-methane (NMVOCs) play an important role in the formation of 'photochemical oxidants', such as tropospheric ozone. Many are also known or suspected carcinogens.
- Particulate Material resulting from the combustion of hydrocarbons has the potential to reduce local air quality and cause respiratory irritation in sufficient concentrations.

For the offshore platform facility construction stage of ACG Phase 3, air emissions will result from all equipment, plant and vehicles during each Phase 3 facility's construction and commissioning programmes.

The total volumes that would be released are small. Total emissions resulting from construction of the two jackets and the two platform topsides, based on diesel consumption, a construction period of 15 months, and operation of plant, equipment and vehicles (assuming the same number and diesel consumption rates made for the Phase 1 offshore facility construction programme) are shown in Table 9.3.

Table 9.3 Estimated Emissions to the Atmosphere during Construction (tonnes)

	CO_2	CO	NO_X	SO_X	CH_4	NMVOC	PM
DUQ - Topsides	40,374	237	819	261	14	79	42
PCWU - Topsides	52,727	309	1,069	341	18	103	54
Topsides Sub-Total	***93,102***	***546***	***1,888***	***602***	***32***	***182***	***96***
DUQ - Jacket	38,014	223	771	246	13	74	39
PCWU - Jacket	41,429	243	840	268	14	81	43
Jackets Sub-Total	***93,102***	***546***	***1,888***	***602***	***32***	***182***	***96***
Total	**186,203**	**1,092**	**3,777**	**1,205**	**64**	**364**	**192**

PM – Particulate Matter
[1]Based on an sulphur content in diesel of 1% average (diesel fuel)

It is emphasised that these are total amounts for the entire construction programme and will be emitted at different locations as well as over different time periods. Concentrations of species emitted during the activities will be low (Section 5.10) and will not lead to a deterioration of local air quality. With reference to the GHG potential of gases, this issue is discussed in Section 9.9. In common with ACG Phase 1, air quality monitoring will be conducted during the construction phase at sites where this is a perceived issue in relation to the presence of sensitive receptors. For example, for Phase 1 monitoring is not conducted at the SPS yard as no receptors exist in proximity to the site. Where monitoring is deemed necessary it will record the following parameters:

- Entrained dust as a result of human disturbance
- Records of fuel consumption of each engine and vehicle
- Daily records of hours and location of operation of each engine and generator
- Primary source emissions and aerosol species (e.g. CO, NOx).

Once released, emissions will be rapidly diluted and dispersed and no deterioration in air quality will be expected. The contractor will be required to implement a system of frequent maintenance of plant and equipment with the expectation they will ensure compliance with vendor performance standards and minimise emissions. A record of diesel consumption will be maintained and the total emissions calculated using emission conversion factors. Results from Phase 1 construction activities show that total emissions are in fact lower (by approximately 40%) than was initially predicted in the Phase 1 ESIA.

Dust generation will be suppressed by damping down the site as necessary, although this has not been found to be a problem during Phase 1 construction, as the yards have laid aggregate cover across most working areas. Air monitoring will also monitor dust levels in and around construction areas, where appropriate.

9.2.1.4 Sewage and Drainage

Sewage waters generated from site toilets and showers, sinks and the canteen will be contained and routed to the nearest municipal sewage treatment plant for treatment prior to disposal. Sewage sludge will be collected in site septic tanks will be periodically emptied by AIOC approved contractors and transferred to a sewage treatment plant. Stormwater drains will soakaway on the surrounding ground. All areas where bulk hazardous materials are used or stored will be bunded and drainage from these areas will be directed to the site closed drainage system. The potentially contaminated water will be either treated prior to discharge to the stormwater system or will be containerised and disposed of at an AIOC approved facility.

9.2.1.5 Hazardous and Non-Hazardous Wastes

A number of non-hazardous and hazardous wastes will be generated during the offshore facility construction programmes (Section 5.10). The contractors will be required to implement strict waste management and control procedures that meet the stipulated requirements of AIOC their activities. BP AzBU and all operations conducted on behalf of BP AzBU will follow a waste hierarchy as follows:

- Prevention,
- Reduction,
- Re-use, Recover,
- Recycle,
- Remove; and finally,
- Disposal.

Reduction of wastes at source and waste minimisation procedures, along with recovery and recycling methods where possible, are required for operations to reduce the amount of wastes generated e.g. from ACG Phase 1, wood, steel and other materials are recycled and reused. The wastes generated from Phase 3 will be segregated according to categories at the waste collection points close to the work location, prior to transfer to Centralised Waste Accumulation Areas (CWAA). The CWAAs, as temporary storage points, receive wastes and ensure segregation and storage is undertaken in accordance with international standards. Further, operation of the facilities ensures that waste receipt and transfer from the site records are maintained; that is, that a Waste Consignment Note scheme is implemented. Operated by trained staff the CWAAs further sort the waste and reduce the volume by crushing drums and cans, baling plastics and paper in preparation for final disposal. Once ready for final disposal or further treatment the wastes are transferred to AIOC approved sites using AIOC approved contractors. Waste management is an issue that is common to all projects in the region and as such, the operation of the CWAAs and final disposal of wastes in Azerbaijan by the AzBU is described in more detail in Section 10 Wider Issues.

9.2.1.6 Facility Testing and Pre-commissioning

Up to 95% of the offshore facility testing and commissioning (pre-commissioning) programme will be conducted onshore at the fabrication yards prior to facility load-out. Maximising onshore commissioning has the advantage of allowing simpler alteration or rectification of defects identified and also reduces the time required for the commissioning team to be located offshore and the attendant vessels required for such a programme. An added advantage is that the handling of commissioning wastes is simpler at the onshore construction yard. One of the waste streams resulting from the commissioning programme is from the use of water for equipment and systems hydrotesting (pressure testing). As discussed in Section 5.2, hydrotesting will be performed using either fresh water wherever possible, or seawater dosed with a sterilising agent. Where seawater is used it will be dosed with sodium hypochlorite at a concentration of 2 mg/l. This dose rate for is defined by the vendor specification. The water is dosed for only around an hour a day which is sufficient to prevent biological growth.

The dechlorinating agent is of very low toxicity (LC50 approximately 26g/l, safe environmental concentration approximately 26g/l, maximum dose concentration 3 mg/l) and is approved by OSPAR as a chemical posing no environmental risks. On completion of the pressure test the waters will be removed and reused where possible. Discharge of the hydrotest waters will be either to the municipal drains (for fresh water), or through a discharge point to the harbour (for seawater). Prior to discharge any dosed seawater will be dechlorinated using sodium thiosulphate, a chemical with very low toxicity, which poses no environmental risks. The residual chlorine in the discharged water will be within the World Bank standard of 0.2 mg/l.

Water will also be used to test the cooling water system, and the freshwater pipework system accommodation block on the topsides. For the cooling water tests, seawater will be abstracted from the harbour, and discharged back to the harbour at a rate of 500 m^3/hour for up to 10 hours per day and for up to 8 weeks. Disinfectant and neutralising chemicals (sodium hypochlorite and sodium thiosulphate as described above) will be dosed for one hour per day during testing. On completion, the test waters will become warmed and will be of a higher temperature than the harbour waters on discharge. Thermal modelling has been conducted to determine the effect of this discharge on the ambient environment and has confirmed that the discharge will meet the IFC guidelines on cooling water (i.e. the effluent will result in a temperature increase of no more than 3°C, 100 m from the point of discharge).

Fresh water will be used for the living quarters hydrotest. This test is a static test with a total volume of around 120m^3. It too will be dosed with sodium hypochlorite and dechlorinated using sodium thiosulphate. The discharge will take place over a period of 3 – 4 hours at a rate of approximately 10 litres per second: this will permit a high rate of dilution, and will ensure that salinity in the harbour is not affected at a distance of more than 1m from the point of discharge.

A monitoring programme will be developed to ensure that the targets for residual chlorine and temperature are being achieved. The monitoring programme will be designed to capture the potential variability in the effluent quality e.g. the load placed on the turbines. During discharge of hydrotest waters, samples will be collected and analysed to provide additional checks that residual chlorine levels are being met. A temperature probe will be used to check water temperatures at the intake and exit.

Thermal dispersion modelling was carried out during the phase 1 ESIA to ensure that temperature effects in the receiving water were within IFC guidelines. These guidelines stipulate that the temperature increase at the edge of a mixing zone (100m if no other radius specified) should not exceed 3°C. The modelling exercise in fact demonstrated that the 3°C limit was achieved within 4m of the point of discharge under 'worst case' stagnant conditions. Temperature data collected of the discharge from the cooling water system during the commissioning of the phase 1 Central Azeri Topside turbines, confirmed this.

As a result of the management measures to be implemented for the control of the discharge of hydrotest water there will not be any significant environmental impacts on the receiving waters of the harbour.

Inert gases, such as nitrogen, will also be used for integrity (leak) testing and these will be purged to the atmosphere, where they will be rapidly dispersed.

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9.3 Offshore Facilities Offshore Installation, Hook-Up and Commissioning

Once constructed, the following offshore facilities will be installed at the Phase 3 offshore locations:

- 12 slot drilling template;
- DUQ and PCWU jackets;
- DUQ and PCWU topsides;
- The platforms bridge-link; and
- Two subsea manifolds and associated facilities.

Installation of each offshore facility will be carried out separately and at different times in the Phase 3 development schedule as detailed in Chapter 5, Figure 5.3. Whilst the level and type of activity varies depending upon the facility being installed, there are many similarities between the different operations and the subsequent potential for environmental impacts. Therefore one impact assessment has been conducted for all installation activities.

There will be considerable vessel activity in the Phase 3 offshore location during the installation of each facility and for the hook-up and commissioning (HUC) phase of the programmes. In addition to the vessel movements required to transfer the individual facilities to site, some support vessels will be located on site to support the installation and HUC activities throughout the programme whilst others will supply equipment and materials and travel between the shore and the offshore location.

The results of the impact assessments for these activities are described below.

9.3.1 Environmental Impacts

The results of the environmental impact assessment are summarised in Table 9.4. All of the installation and subsequent HUC activities will take place in a relatively small area of the Caspian Sea at the Phase 3 offshore location and over a relatively short period of time (refer to Section 5 Project Description). As such the residual environmental impacts associated with these activities, following their mitigation, are ranked low and are not predicted to be significant.

As discussed in Section 9.2, contractors will be required to implement specific management measures intended to minimise/mitigate environmental impact as part of their contract conditions. Details of the key mitigation measures considered in the impact assessment are summarised in the following subsections together with procedures/standards/comments specific to some of the proposed activities.

Table 9.4 Summary of Environmental Impact Assessment for Offshore Facility Installation, Hook-Up and Commissioning (HUC)

ID	Activity	Environmental Aspects	Environmental Mitigation	Cumulative Contribution	Environmental Impact Significance	Justification / Comments	Residual Environmental Issues to be Addressed
B	Offshore Installation, Facility Hook-up and Commissioning of Offshore Facilities[1]						
B1	Vessel operations including facility tow out, transportation and positioning[2]	Atmospheric emissions, noise, wastes, effluent discharges, physical seabed disturbance.	Bilge water, certified sewage treatment system to sewage water standards; All solid and hazardous wastes shipped to shore; Waste management planning and implementation. Anchor procedure	▲	L	Localised minor impacts that are rapidly dispersed. Issue of waste management raised during consultation. Concern over disturbance of the benthic habitat raised during consultation.	Waste treatment & disposal Refer to Section 10.2. Benthic sensitivity Refer to Section 9.3.1.4.
B2	Installation of template and jackets (including piling)	As B1 and facility physical presence.	As B1; Short duration.		L	Disturbance over a localised area and over a short time period. Fish, seals and birds will adopt temporary avoidance behaviour due to noise but will return to the area. Concern over disturbance of the benthic habitat raised during consultation.	As B1
B3	Grouting of jackets to seafloor	Physical seabed disturbance, toxicity.	Minimise grout losses by accurate estimation of grout; ROV post installation survey.		L	Disturbance over a localised area, low toxicity Concern over disturbance of the benthic habitat raised during consultation.	Benthic sensitivity Refer to Section 9.3.1.5.
B4	Floatover and installation of topsides and bridge link	As B1 and facility physical presence.	As B1 and B2		L	As B1 and B2	As B1 and B2
B5	Hydrotesting of bridge link	Liquid waste and effluent.	As B1. Hydrotest water potable water supplied from onshore and no chemical additives used before discharge to sea.		L	Discharge of freshwater will rapidly disperse and salinity levels will not be significantly affected.	Refer to Section 9.3.1.5.

[1] Offshore facilities includes: Jackets; topsides; drilling templates, subsea manifolds and facilities; bridge link
[2] There will be eight tow out/transportation activities – template x 1, jacket x 2, topsides x 2, bridge link x 1, subsea manifolds and associated facilities (e.g. umbilicals and flowlines) x 2, – each of these activities will occur at a different time

ID	Activity	Environmental Aspects	Environmental Mitigation	Cumulative Contribution	Environmental Impact Significance	Justification / Comments	Residual Environmental Issues to be Addressed
B7	Installation and testing of subsea facilities	Liquid waste and effluent. Physical presence.	As B1; No trenching for installation of subsea facilities. Caspian specific toxicity test will be used to confirm the OCNS ranking of E (lowest toxicity) for the hydraulic fluid.		L	Disturbance over a localised area and over a short time period. Concern over disturbance of the benthic habitat raised during consultation.	As B1
B8	Power Generation (black start)	Atmospheric emissions.	Short duration for diesel fired power generation.	▲	L	Low contribution to overall air emissions from the project.	None.
B9	Leak/integrity testing	Atmospheric emissions. Liquid wastes.	Maximise onshore commissioning Inert gas decanted into other system and re-used where practical Hydrotesting using potable water with no chemical additives Controlled venting in open atmosphere.	▲	L	Only during commissioning phase, small volumes.	None.
B10	Fire system tests	Liquid wastes.	Chemical management to select low toxicity and biodegradable foam.		L	No residual impacts as just seawater.	None.
B11	Helicopter operations	Atmospheric emissions, noise.	Regular maintenance; Defined flight path, scheduling.		L	Low contribution to overall air emissions from the project.	None.

9.3.1.1 Vessel Atmospheric Emissions

Vessel activity at the Phase 3 offshore location and between the site and the shore will result in increased atmospheric emissions from vessel engine and power generation exhausts and liquid waste discharges to sea such as sewage waters and machinery space (bilge) waters. These emissions and discharges will occur over a relatively short time period and will rapidly disperse after release, resulting in a short-lived low impact to the offshore atmosphere and sea respectively, within a very localised area.

Vessel air emissions will be small and emitted species concentrations will be low and will be minimised through regular servicing and maintenance of vessel engines and generators. The total volumes that will be released from all vessel activity for the entire Phase 3 offshore installation and HUC programme have been estimated based on predicted diesel consumption rates and the duration of the activities.

Table 9.5 Estimated Emissions to the Atmosphere during Offshore Facility Installation and HUC (tonnes)

	CO_2	CO	NO_X	SO_X[1]	CH_4	NMVOC
DUQ Installation & HUC	8,131	20	150	20	1	6
PCWU Installation& HUC	5,914	15	109	15	0.5	4
Export Pipeline Installation, Tie-in and Commissioning	14,880	37	274	30	1.4	11
Subsea System Inst. & HUC (including water injection lines)	19,142	48	353	48	2	14
Sub-Totals (Installation & HUC):	***48,067***	***120***	***886***	***113***	***4.9***	***35***

PM – Particulate Matter
NMVOC – Non-Methane Volatile Organic Compounds
[1]Based on Sulphur content in diesel of 0.8% (marine diesel)

9.3.1.2 Sewage and Drainage for Vessels, Barges, etc.

In order to minimise environmental impacts from vessel activity related to the project, a number of controls in relation to liquid discharges from vessels will be put in place. Sewage water disposal will be conducted in adherence with the sewage water standards for the project and will be treated in a US Coast Guard certified or equivalent Marine Sanitation Device (MSD) if discharged to sea. The effluent stream will be monitored for the presence of floating solids on the sea surface. Sewage waters generated on board vessels that do not have a US Coast Guard certified MSD fitted will be off-loaded and transferred to shore for disposal at a municipal sewage treatment works. All sewage sludges will be pumped out of the vessels and off-loaded for transfer to shore for disposal.

Table 9.6 presents the estimated total volume of sewage that will be discharged based on the assumption that all vessels operating offshore will have MSD fitted and hence will discharge to sea. It is assumed that each person will produce 0.22 m^3 grey water and 0.1 m^3 black water per day. In total, an estimated 5,392 m^3 of grey water and 3,429 m^3 of black water will be discharged to sea during installation of the platform facilities and subsea system.

Table 9.6 Estimated Volume of Sewage During Offshore Facility Installation and HUC (tonnes)

Activity	Vessels	Number Of Vessels	POB	Duration (Days)	Grey Water (m^3)	Black Water (m^3)
DUQ Jacket/Topsides Installation	Tugs	3	14	77	712	323
	Barge	1	14	77	237	108
PCWU Jacket/Topsides Installation	Tugs	3	14	56	517	235
	Barge	1	14	56	173	78
Subsea System Installation	Lay-barge	1	210	50	2,310	1,050
	Anchor handling vessel	4	15	50	660	300
	Pipe-haul barges & tugs	2	14	25	154	70
	Diving Support vessel	1	26	35	200	91
	Survey vessel	1	26	30	172	78
	Dada Gorgud	1	26	45	257	117
TOTAL					5,392	3,429

Sump oils pumped out of the vessel bilge will be contained and treated on board to reduce the oil content to the PSA standard of no visible sheen on disposal at sea. Effluents will be monitored for their oil-in-water content. Oily bilge waters from vessels that do not have oily water treatment facilities on board will be off-loaded and transferred to shore for disposal.

9.3.1.3 Solids and Liquid Wastes

Other solid and liquid wastes will be transported to shore for disposal in accordance with the AzBU waste management plan, excluding food waste, which will be macerated and discharged overboard. Food waste discharges will slightly increase the organic matter content in close vicinity to the discharge but this will be rapidly diluted and dispersed and impacts will not be significant.

9.3.1.4 Seabed Disturbance

Installation activities will result in a direct disturbance to the seabed at the offshore location. Seabed disturbance will be greatest during installation and securing in place (i.e. piling) of each jacket. The installation of the drilling template, the water injection lines, umbilicals, and the two subsea water injection manifolds will also cause seabed disturbance. The installation vessels for the water injection lines will be held in place by anchors. During the installation of the umbilicals, the DSV vessel will use dynamic positioning and so seabed disturbance will be reduced.

The interaction with the seabed will result in the localised destruction of benthos in the area occupied by the facilities, and the smothering of benthic communities in the immediate vicinity of the facilities, due to mobilisation and resettlement of seabed sediments. The seabed at the Phase 3 platform location consists of very fine particles and sand of medium particle size. Benthic studies have indicated species diversity typical to this region of the Caspian Sea and no areas of seabed sensitivity have been identified. As such the residual impact associated with installation of the offshore activities has been predicted to be low.

9.3.1.5 Grouting

Once the piles have been installed the jacket legs will be further secured into position by grouting. The grouting process will leave some excess grout on the seabed surface. In order to minimise any toxic effects related to this activity the cement grouting of offshore pilings will use Portland Cement prepared to BS12 Type 52.5 with seawater. No chemical additives will be used thereby minimising the toxicity to the marine environment. The grout requirements will furthermore be carefully calculated to minimise unnecessary over-use. There are three primary possibilities for environmental interaction following discharge and these are:

- Seabed smothering;

- Alkalinity effects on the seawater in contact with the cement; and
- Chromium leaching from grouting cement into surrounding seawater.

The amount of cement is carefully calculated using the lessons learnt during ACG Phase 1 and Phase 2 and consequently, this will be reduced to as small an areas as possible, which will be restricted to within the footprint of the platform. This will result in smothering of the underlying benthic communities. This is not therefore considered to be a significant impact.

During the cement curing process, there may be an effect on the alkalinity of the seawater in immediate contact with the cement. Raised alkalinity may affect a small quantity of plankton in the immediate vicinity, but plankton will not be abundant at the depth at which discharge will take place. Testing has shown that alkalinity effects will be limited to part of the period between initial setting time and final setting. This may range from between 1 and 10 hours, although effects are not predicted after initial setting (1 hour). A small volume of water may be temporarily affected during this time, but the effect will be limited as alkaline components leach out of the cement and disperse in the surrounding water. As discussed in the environmental description (Section 6) fish occur at all depths in the Caspian and may be expected to be at this depth in the Contract Areas. However, any fish will detect the raised alkalinity and will avoid the immediate vicinity. No significant environmental impact is predicted from these localised effects of alkalinity.

Chromium (Cr III and VI) is an acknowledged handling hazard of grouting cement, although there is no evidence that establishes the aquatic ecological hazard of chromium in cement. In addition, it is unlikely that a significant amount of Cr would leach into the surrounding seawater. If leaching occurred, this would be limited to the surface of the cement. A worst-case assumption would be for leaching to occur from the surface 2cm of the cement during the initial setting period, and this would represent a maximum of 5% of the total amount of Cr that may be present (approximately 24g of Cr VI and 360g of Cr III). Based on dilution rates, if these quantities were released, it would require volumes of 1,600m^3 and 24,000m^3 of seawater to dilute them to Environmental Quality Standard (EQS) concentrations. Thus, water quality would not be significantly affected at a distance of more than 15 m. In reality, since the concrete will form a localised layer on the seabed, the distance within which water quality would be affected will be considerably less. Leaching rates would also decline rapidly during the setting process. However, these worst-case assumptions indicate that the potential zone of impact is very small, and that Cr concentrations would be well below the safe threshold very close to the location of use.

9.3.1.6 Noise

The increased vessel activity during these activities and the installation activities themselves will result in an increase in underwater noise. Seals and fish in the Caspian are accustomed to the noise generated from passing vessels and may exhibit avoidance behaviour initially but would be expected to return to their preferred location as they become accustomed to the disturbance.

The most significant noise source during offshore facility installation would be the piling of the jackets into place. A total of 12 piles will be used to secure each jacket and the pile driver normally operates at up to 40 “blows” per minute and at its source, can produce noise emissions up to 206 dB (BP, 2001). Overall impacts resulting from these noise emissions would last for between seven and 10 days for each jacket installation programme and are hence considered to be short-lived. It is expected that fish and marine animals would initially move away from the area during this time, returning once the piling activities were complete. The overall noise impacts are therefore considered to be low with no residual effects expected.

9.3.1.7 Hydrotesting

A small amount of equipment will require hydrotesting offshore, such as pipework on the bridge link between the two platforms. This will be carried out using potable water shipped from shore. Chemical additives will not be used and the water will be discharged to the sea following the hydrotest. As only small quantities of fresh water will be discharged at a controlled rate, it is not considered a significant environmental impact.

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9.4 Mobile Offshore Drilling Unit – template and subsea injection well drilling programme

As discussed in the Project Description (Section 5.4.4), the Phase 3 pre-drilling drilling programme will utilise a Mobile Offshore Drilling Unit (MODU), nominally the Dada Gorgud, prior to the installation of the Phase 3 offshore facilities, and will consist of the following wells:

- Up to 10 wells at the Phase 3 location in 175 m water depth, consisting of nine production wells and one cuttings re-injection (CRI) well; and
- Between six and eight water injection wells to the northwest (175 m water depth) and southwest (275 m water depth) of the central offshore location that will all be completed as a subsea facility.

Prior to commencing drilling the above wells, pilot holes will be drilled at distances of approximately 50 m from the central offshore location and 50 m from each of the subsea facility sites to determine whether there are any high-pressure shallow gas zones in these areas.

The Phase 3 MODU programme is scheduled to last for between 18 and 24 months (Figure 5.3).

9.4.1 Environmental Impacts

The results of the environmental impact assessment of the Phase 3 pre-drilling programme are summarised in Table 9.7. The impact assessment predicted that there would be only low residual environmental impacts resulting from the routine and planned non-routine activities associated with the pre-drilling programme.

Table 9.7 Summary of Environmental Impact Assessment for MODU Drilling Programme

ID	Activity	Environmental Aspects	Environmental Mitigation	Cumulative Contribution	Environmental Impact Significance	Justification / Comments	**Residual Environmental Issues to be Addressed**
C	MODU Drilling – template and subsea injection wells						
C1.	Tow out and positioning of MODU	Atmospheric emissions, noise, wastes, ballast, physical seabed disturbance.	Bilge water, sewage water standards and control; All other wastes shipped to shore for treatment/disposal; Waste management planning and implementation; Anchor management plan.		L	Localised minor impacts that are rapidly dispersed. Small area of the seabed disturbed by anchors. Marine organisms will adopt temporary avoidance behaviour due to noise. Issue of waste management raised during consultation. Concern over disturbance of the benthic habitat raised during consultation.	E effluent treatment and discharge. Refer to Section 9.4.1.3 Waste treatment & disposal Refer to Section 10.2. Rig Positioning and Seabed Disturbance Refer to Section 9.4.1.1
C2.	Vessel support including standby, supply to MODU and backload to shore.	As C1	As C1	▲	L	As C1	As C1
C3.	Drilling with Water Based Muds (surface and top hole sections drilling)	Noise, cuttings and muds discharge, physical seabed disturbance.	Selection of low toxicity water based mud system; Mud systems ecotoxicity testing; Mud recovery unit; HSE design standards.	▲	L	Low residual impact when considered as a single activity but a cumulative contribution to ACG Phase 3 cuttings discharges. Only physical impacts, no toxicity related to mud. Concern over cuttings discharge and disturbance of the benthic habitat raised during consultation.	Cuttings discharge. Refer to Section 9.4.1.2
C4.	Drilling with Non Water Based Muds (lower hole section drilling)	Noise, wastes.	All muds/cuttings contained and shipped-to-shore for treatment and disposal.	▲	L	Low residual impacts but cumulative cuttings and treatment/disposal issue across AzBU activities. Issue of waste management raised during consultation.	Waste treatment & disposal Refer to Section 9.4.1.4 and Section10.2.
C5.	Cementing/cement pump – losses to surface	Atmospheric emissions, physical seabed disturbance.	Minimise cement losses by accurate estimation of cement; Chemical Selection Management Plan HSE design standards		L	Disturbance over a localised area, low toxicity	None.

ID	Activity	Environmental Aspects	Environmental Mitigation	Cumulative Contribution	Environmental Impact Significance	Justification / Comments	**Residual Environmental Issues to be Addressed**
C6.	Seawater lift and cooling.	Noise, entrainment of marine biota, warm water discharge.	Seawater lift caisson at –10 m Low toxicity biocide used; Discharges will meet delta 3 degrees centigrade at 100 m from end-of-pipe;		L	Biocide predicted to dilute rapidly to no effect concentration	None.
C7.	Well completions	Liquid wastes	Spent excess completion fluids re-injected, discharged to the sea in accordance with requirements of PSA, or shipped to shore for disposal or recycling; Waste management planning and implementation.	▲	L	Low residual impact but cumulative waste generation issue across AzBU activities. Issue of waste management raised during consultation.	Waste treatment & disposal Refer to Section 9.4.1.4. and 10.2.
C8.	Well testing/clean up (disposal to burner)	Atmospheric emissions, oil on sea surface.	Requirements to be challenged in line with Phase 3 HSE Standards; Volume of fluids and test duration minimised; High efficiency green burner selected.		L	Minor contribution over the lifetime of the project.	Oil drop out. Refer to Section 9.4.1.6
C9.	Power generation	Atmospheric emissions.	Regular maintenance of turbines.		L	Low contribution to overall air emissions from the project, rapidly dispersed.	None.
C10.	Drainage, sewage, firewater	Liquid waste discharges.	Sewage treatment to 40 mg/l BOD, 40 mg/l Suspended Solids, Coliforms <200 MPN/100ml, Residual Chlorine <1mg/l; Hazardous area drainage tank contents shipped to shore for disposal; Bilge waters treated prior to disposal for no visible oil sheen; No chemicals are used in firewater tests.		L	Minor contribution over the lifetime of the project, rapidly dispersed and degraded. Strong Ministry controls over discharges to the Caspian.	Effluent treatment and discharge. Refer to Section 9.4.1.3
C11.	Provision of accommodation and catering	Wastes.	Food waste macerated prior to discharge; All wastes shipped to shore for treatment/disposal; Waste management planning and implementation.	▲	L	Rapidly dispersed and degraded. Waste generated is a cumulative issue across AzBU activities. Issue of waste management raised during consultation.	Waste treatment & disposal Refer to Section 9.4.1.4 and Section 10.2.
C12.	Helicopter operations	Atmospheric emissions, noise.	Regular maintenance; Defined flight path, scheduling.		L	Low contribution to overall air emissions over the lifetime of the project.	None required.

ID	Activity	Environmental Aspects	Environmental Mitigation	Cumulative Contribution	Environmental Impact Significance	Justification / Comments	**Residual Environmental Issues to be Addressed**
C13.	Well suspension	Brine discharge.	All wastes shipped to shore for recycling, treatment or disposal; Waste management planning and implementation.	▲	L	Low residual impact but cumulative waste generation issue across AzBU activities. Issue of waste management raised during consultation.	Waste management and disposal 9.1.4.4. and 10.2.
C14.	MODU removal	Interference to other sea users, atmospheric emissions, noise, wastes, ballast, physical seabed disturbance.	Bilge water, sewage water standards and control; All wastes shipped to shore for treatment/disposal; Waste management planning and implementation; Anchor management.		L	As C1	As C1

9.4.1.1 Rig Positioning and Seabed Disturbance

Once on location the drilling rig will be secured into position by anchors and mooring chains. This will disturb the seabed close to the rig. The total area affected will however, be small and will be re-disturbed by the later installation of the platform jackets as discussed in Section 9.3.1 above.

9.4.1.2 Drill Cuttings Discharge

As discussed in Section 5.4.1, nine producer wells and one CRI well will be pre-drilled through the template by the MODU. For the pre-drilling programme Water Based Muds (WBM) will be used for 36" surface-hole and 26" top-hole sections for each of the wells. The drilled cuttings resulting from these top two sections will be discharged to the sea. The well lower-hole sections will be drilled with non-water based mud systems (NWBM) such as synthetic based mud (SBM) or oil-based mud (OBM). Cuttings generated during lower-hole drilling will be contained on the rig and transferred to the supply vessel for transfer to shore for treatment and final disposal. The treatment options for these cuttings are described in Section 10.2.

A Best Practicable Environmental Option (BPEO) study into the discharge of WBM cuttings was completed as part of the Phase 1 ESIA. Discharge overboard, containment/ship-to-shore transportation and re-injection into a subsea formation were the three options studied. The study concluded that on balance, the best disposal option for top-hole section cuttings is discharge to seabed. The key factors leading to this conclusion were:

- Drilling muds to be used for the 36" and 26" hole sections will either be water-based mud or seawater systems that have been carefully formulated to ensure that they contain very low toxicity components as per the HSE Design Standards;
- The bulk of discharged cuttings are predicted to be deposited close (i.e. within hundreds of meters) of the discharge point;
- Energy consumption and therefore atmospheric emissions, would be least for discharge overboard (as opposed to ship-to-shore);
- Ship-to-shore transportation requires considerably more handling of cuttings and mud, with attendant safety risks;
- High rates of cuttings generation during 26" hole drilling could compromise the integrity of re-injection facilities, where available;
- Dedicated re-injection wells would be necessary to re-inject the high volumes generated from the top-hole from multiple wells; and
- The economic case for discharge overboard is more robust than that for cuttings re-injection and ship-to-shore transportation.

During the MODU drilling programme, 36"surface-hole drilled cuttings and mud will be released directly to the seabed. Cuttings from the top-hole section will be returned to the MODU via a marine riser with the circulating drilling mud. The cuttings will then be separated from the mud in the mud recovery unit. Once separated, they will be discharged to the seabed via a caisson set at 11 m[1] below the sea surface.

Cuttings releases will result in an impact on the seawater column and the seabed. The significance of the impact will however depend on the type and quantity of the cuttings discharged, the cuttings dispersion characteristics and the sensitivity of the surrounding environment. To establish the dispersion of these cuttings a dispersion model was conducted using MUDMAP. The hydrodynamic model for these simulations was established for the Phase 1 ESIA project and was validated using current measurements collected along the existing EOP subsea pipeline between the shore and the Chirag platform. The full Phase 3

[1] Maximum depth possible to allow the rig to be brought into dock for maintenance

cuttings dispersion modelling study report is included in Appendix 9 and the results are summarised in the following subsections.

Turbidity Effects of Cuttings

The main physical impacts on the surrounding seawater from the discharge of cuttings and entrained drilling fluids are associated with a localised increase in water turbidity in the vicinity of the discharge point and changes in local water quality. Turbidity in the water column can increase the reflection and scattering of light thus reducing light penetration and subsequently, biological activity. Reductions in phytoplankton production rates would only persist for as long as a turbid plume was present and would only be observable where turbidity was greatest; that is, close to the point of discharge. As unused nutrients would remain in the water column and would still be available after plume dilution, production rates would typically return to normal relatively quickly after the discharge event ceases. In addition, organic material in the discharge will be broken down biologically and chemically using oxygen and this will increase the biochemical oxygen demand (BOD). The potential impact of this is depletion in the level of oxygen in the surrounding waters. However, in view of the scale of the discharge in respect of the receiving waters this effect is not significant.

In open waters where short-term fluctuations in turbidity can be common (e.g. due to storm events), discernable negative affects associated with increased turbidity would only be expected where the artificial increase is significant in terms of degree and duration.

For phase 3 drilling, the surface and top-hole well sections will generate and discharge cuttings at a rate of approximately 36 m^3/hr and 20 m^3/hr, respectively. The maximum settling time is predicted to be 53 hours for an individual discharge: 30 hours for the discharge and an additional 23 hours for settling.. On the basis of approximately 540 m^3 and 277 m^3 total cuttings volumes for the 36” and 26” sections respectively for each well (Section 5.4), the longest duration of the 36” and 26” cuttings discharges as a combined release will be approximately 30 hours. Discharged cuttings and in particular the finer particles will however, take some time to settle to the seabed. Table 9.8 presents the predicted particle size distribution[2] and associated fall velocities.

Table 9.8 Predicted Cuttings Size Distribution and Fall Velocities

Nominal Grain Size (µm)	Specific Gravity	Percentage of Total Mass	Fall Velocity (m/hr)
12,500	2.5	85	2,582
9,625	2.5	1.25	2,266
6,750	2.5	1.25	1,897
3,875	2.5	1.25	1,437
1,000	2.5	1.25	730
74	3.0	10	11.39

Release of the 36” surface-hole section will increase turbidity but as cuttings are released directly at the seabed, the impact from this will be negligible. Increased turbidity will be more of an issue during the release of the 26” top-hole sections as the cuttings from these sections will be discharged to the sea from the rig. In addition the discharge point for cuttings is located at 11 m below the sea surface, within the biologically productive zone (which extend to 40 m below the sea surface). As discussed, high turbidity in the productive zone has the potential to restrict the penetration of light needed by phytoplankton for photosyntheis and so can reduce biological production in these surface layers. Below the productive zone, the penetration of light is limited and this causes a natural reduction in biological productivity at these depths. Therefore the impact of turbidity reduces with depth. Thus the rate of descent and dispersion of the cutting are considerations when assessing the potential impacts of this discharge on the productive zone of the Caspian.

Table 9.7 shows that the largest percentage of the cuttings total mass is expected to be the larger particle size rock chippings and that the fall velocity of these larger particles is relatively

[2] Cuttings particle size distributions were established for the ACG Phase 1 ESIA based on samples taken from earlier AIOC drill cuttings.

quick at over 70 cm/s. Finer particles will reside in the water column for longer as they will fall to the seabed more slowly and hence will be subjected to the prevailing dispersive currents for longer. These finer particles will be transported further away from the discharge point. With a fall distance from end-of-pipe of approximately 164 m at the central Phase 3 location and northern subsea water injection well location and 264 m at the southern subsea water injection well location, the majority of the larger particles will have reached the seabed in less than four minutes and just over six minutes, respectively. The finest particles in the discharge will however take up to approximately 14 hours to reach the seabed at the central Phase 3 location and northern subsea water injection well location and up to 23 hours at the southern subsea water injection location.

Each well will be drilled to completion in turn (i.e. lower hole sections will be drilled before a new well is commenced). It is estimated that there will be over 38 days between each surface and top-hole drilling programme when cuttings are discharged during which time the lower-hole sections of each well will be drilled. As such, there will be a substantial period of time between each cuttings discharge event and settling period during which turbidity in the water column will be able to return to ambient conditions. It is therefore concluded that any residual turbidity impact on the water column from cuttings discharges from the rig would be low.

Deposition of Cuttings

Deposition of cuttings on the seabed can accumulate to form a cuttings pile near to the drilling operations. The MODU drilling programme MUDMAP model results for the four seasonal simulations are shown in Table 9.9. Modelling cuttings discharges at the northern subsea site was not carried out as the water depth and the prevailing current regime at this location are similar to the central Phase 3 location. Therefore, the results from the central Phase 3 location drilling discharge simulations can be 'transposed' to the northern subsea site on a pro rata basis. The MUDMAP model predicts the deposition of drill cuttings to a model design parameter of 1 mm.

Table 9.9 Summary of MODU Cuttings Deposition After Release

Season	Area Around Drill Centre Covered by > 1mm Thickness (m^2)	Maximum Horizontal Extent (m) of 1 mm Thickness	Maximum Deposition Thickness (cm)
Main DWG Platform/Production Site – 10 wells			
Summer Maximum	25,223	139	154
Summer Average	25,094	95	168
Winter Maximum	24,594	106	151
Winter Average	23,096	95	160
Averages	24,502	109	158
Southern Subsea Site Wells – 4 Wells			
Summer Maximum	21,939	104	57
Summer Average	21,429	85	57
Winter Maximum	25,692	112	46
Winter Average	20,799	96	60
Averages	22,465	99	55

The average area coverage of cuttings to a thickness of 1 mm from the drilling of 10 wells at the central Phase 3 location was predicted to be 24,502 m^2, with a maximum horizontal extent of 109 m, indicating that the vast majority of the cuttings will be deposited in close proximity to the well. The maximum depth of the cuttings accumulation was predicted to be 158 cm.

The maximum four wells at the northern subsea site represents 40% of the 10 wells at the central Phase 3 location and hence, it can be expected that the cuttings discharge spread on the seabed at the northern subsea site will be approximately 40% of that modelled for the central Phase 3 location. On this basis, assuming a circular configuration for the deposition of cuttings and using πr^2, and an average cuttings spread to a 1 mm thickness, the cuttings spread at the northern subsea site will be 16% of that predicted for the 10 wells. This equates to an area coverage of 3,920 m^2.

At the southern subsea site where the water depth is greater, the average maximum predicted area of coverage to a thickness of 1 mm is similar to the main central Phase 3 location at 22,465 m^2 but this results from only four wells[3]. This larger coverage from four wells is attributable to the greater distance between the discharge caisson end-of-pipe and the seabed, which allows for greater lateral dispersion during settlement of discharged cuttings. The maximum cuttings pile depth at this site is approximately a third (i.e. 55 cm average) of the maximum depth predicted at the central Phase 3 location.

The total estimated amount of cuttings that will be discharged during the Phase 3 MODU pre-drilling programme, assuming a maximum of 18 wells, will be 14,706 m^3. The model predicts that these cuttings will cover a combined maximum area of seabed of approximately 56,770m^2 to a thickness of >1 mm.

The principal impact associated with the deposition of these solid cuttings particles and the accumulation of a cuttings pile on the seabed will be the physical smothering of benthic organisms that the cuttings settle on. Biomass in the offshore region ranges from 2 g/m^2 to 16 g/m^2. Assuming an average biomass of 9 g/m^2 and a worst-case scenario of all benthic organisms within the Phase 3 MODU cuttings piles being lost at a cuttings thickness of 1 mm, a total of approximately 510 kg of biomass will be lost. These losses are not significant when considering the total biomass of the ACG Contract Area. However, the reader should be aware that there will be additional biomass losses at the platform location due to platform drilling (ref. Section 9.5).

Toxicity Effects

Some contamination of the seabed close to the well will result from residual mud attached to the cuttings particles. The chemicals in the mud systems to be used for surface hole and top hole drilling have been selected using a Chemical Selection Management System which ensures that the chemicals with the lowest environmental impacts are selected. Table 9.10 presents details on the proposed mud chemistry.

Table 9.10 Composition and Categories of WBM Chemicals

Chemical	Composition	OCNS Category[1]
Barite	Barium sulphate ore	E
Bentonite	Clay Ore	E
KCL	Potassium chloride	E
Sodium silicate	Sodium Silicate	E
Polypac	Poly anionic Cellulose	E
Flo-Trol	Cellulose polymer / Modified Starch	E
Duovis	Bio-polymer	E

[1]Offshore Chemical Notification Scheme. OCNS Category E is the lowest rating. Category E chemicals are of low toxicity, readily biodegradable and non-bioaccumulative.

The chemicals are categorised as either E or D on the Offshore Chemical Notification Scheme (OCNS) (Section 5.4.2.5) and have the lowest toxicity ranking. In addition the mud system will be subjected to toxicity testing according to the HSE design standards. The residual impact from release and deposition of the MODU pre-drill programme cuttings will be low and is not considered significant due to the low toxicity of the drilling mud system constituents, the limited loss of biomass and the size of the total area covered when considered in the context of the wider Contract Area and the overall middle Caspian Sea environment. In addition, according the HSE design standards, water-based drill cuttings and fluids are only discharged to sea providing the mud systems used are tested and meet US

[3] While the base-case drilling programme at the subsea sites is for three wells, four wells were modelled in order to capture a worst-case scenario.

EPA 96 Hour LC 50 toxicity tests (i.e., > 30,000 ppm) or have been subject to Caspian Specific Ecotoxicity Tests, should these be agreed.

Cementing of the well surface casing, and cleaning of equipment used for cementing will result in small amounts of cement being released to the seabed. It is estimated that 100 bbls of cement will be lost to sea for each of the 30" and 20" casings strings cemented. Since the pre-drilling programme consists of 18 wells there will be 3,600 bbls of cement discharged as part of this programme. The chemical constituents in the cement are shown in Chapter 5 (Table 5.6) and will be tested in line with project HSE design standards. In addition, the losses will be minimised by carefully calculating the cement required for the operation and these estimates will be further refined based on lessons learned from the Phase 1 and Phase 2 drilling and cementing programmes. As a result there will only be a low residual environmental impact associated with this activity. It should also be noted that the area disturbed by the cement will have already have been covered and impacted by the surface and top-hole cuttings discharges.

9.4.1.3 Effluent Discharges

Liquid discharges from vessels will meet the project standards and control and treatment will be as described for the installation vessels in section 9.3.1 above.

Effluent that will be released from the Dada Gorgud during the drilling programme comprise:

- Drainage discharges to sea. Drainage water from the bilge tank will be treated by filtration prior to discharge. The discharge will be monitored for no visible oil sheen. Clean water will be discharged to sea.
- Sewage waters. Sanitary wastes will be treated in a certified US Coast Guard Type II marine sanitation device. This is an extended aeration sewage treatment process with chlorination prior to discharge to sea. The effluent will be regularly monitored to verify treatment is within the limits 40 mg/l BOD, 40 mg/l Suspended Solids, Coliforms <200 MPN/100ml, Total Residual Chlorine average of 1mg/l. This sewage system does not require the removal of sewage sludge. There will be 120 persons onboard (POB) during pre-drilling operations and as noted above, the pre-drilling programme will last for up to 24 months (i.e. 730 days). On the basis that one person generates 0.22 m^3 grey water and 0.1 m^3 black per day, 19,272 m^3 and 8,760 m^3 of grey and black water respectively will be discharged to sea after treatment from the Dada Gorgud during the entire pre-drilling programme. That is an average of 26.4 and 12 m^3/day of grey and black water respectively. These volumes will elevate the oxygen demand in the waters close to the point of discharge but will disperse rapidly in these open waters.
- Cooling water. Cooling water will be taken from the sea at a rate of 600 m^3/hr and will be discharged so that the temperature is no more than than 3°C within 100 m of the discharge. Biocide DA is added to this cooling water at a dose rate of 0.27mg/l. This cationic biocide has low toxicity, and if the biocide is discharged at the dose rate (i.e no loss in the system), then the discharge would still be diluted to no-effect levels within 50-100 metres of the point of discharge. In practice the discharge will be lower than the dose rate as a portion of the biocide will adhere to internal pipework. There will be no acute or chronic effects on fish and only limited effects on plankton within, or very close to, to the initial dilution plume. Furthermore the product is readily biodegradable, so there will be no significant impacts from persistence or long-term far-field effects. Given the low quantities of this chemical that will be used, and the high dilution upon discharge, it is not considered a significant impact.
- Spent well completion fluids. Well completion fluids will consist of simple brines and chemical additives. Spent fluids will be discharged to sea following dilution in a mud pit to less than 21,000 ppm chloride, or shipped to shore for disposal or recycling.

9.4.1.4 Other Wastes

Other wastes, including NWBM drilled cuttings, will be segregated on the drilling rig in readiness for transfer to the supply vessel and transported to shore for final disposal in adherence with the AzBU waste management plan. A waste transfer consignment documentation procedure will be in place. Once onshore the wastes will be further sorted, where appropriate, at a waste transfer station ready for recycling or for final disposal at an AIOC approved site using an AIOC approved contractor. The final disposal of wastes in Azerbaijan by the AzBU is discussed in more detail in Section 10.

9.4.1.5 Atmospheric Emissions

Air emissions will arise from the rig diesel power generation turbines as well as from vessels and helicopters. The total amounts that will be generated during this drilling programme, based on fuel consumption and the duration of the programme are shown in Table 9.11 below.

Table 9.11 Estimated Emissions to the Atmosphere during MODU Drilling (tonnes)

Activity	Atmospheric species						
	CO_2	CH_4	CO	NO_X	SO_X[1]	PM	NMVOC
Rig Transfer to Site	230	0	1	4	1	-	0
Rig Power Generation	16,954	1	117	432	49	-	0
Supply and attendant vessels	19,728	2	49	364	49	-	0
Helicopters	451	0	1	2	1	-	15

PM – Particulate Matter
NMVOC – Non-Methane Volatile Organic Compounds
[1]Based on the Sulphur content in diesel of 0.8% (marine diesel)

These total amounts are for the entire MODU drilling programme over a period of up to two years. Concentrations of species emitted during the activities will be low and will be well below air quality standards. Once released, emissions will be rapidly diluted and dispersed in the offshore atmospheric environment.

It will be necessary to carry out some well clean-up / testing from the MODU for the Phase 3 project. The requirement for well testing will be challenged in accordance with the Phase 3 HSE Standards. However, it is anticipated that at least two well tests, up to a maximum of four, will be necessary. During these tests, hydrocarbons from the reservoir will be flowed to the surface for pressure, temperature and flow rate measurements to help evaluate well performance characteristics. The Dada Gorgud is unable to contain the hydrocarbons following testing and consequently the hydrocarbons will be sent to the burner boom for disposal by flaring. It is anticipated that up to 15,000 bbl of oil and 18.75 MMscf per well will be sent to flare (oil/gas ratio of 1250 scf/bbl) for 2 wells. Flaring of hydrocarbon products is a very rapid process with each test flaring expected to last for approximately 32 hours. Total air emissions resulting from the planned two well tests are shown in Table 9.12 below.

Table 9.12 Estimated Emissions to the Atmosphere during Well Clean-up / Testing (tonnes)

Atmospheric Species	CO_2	CO	NO_X	SO_X	CH_4	NMVOC
Emissions in Tonnes	8,135	9	16	8	29	108

NMVOC – Non-Methane Volatile Organic Compounds

The short duration of this flaring event and the rapid dispersion of these emissions in the offshore environment indicates that any residual impact would be insignificant. The potential contribution of these gaseous emissions in terms of GHG is considered in Section 9.9.

9.4.1.6 Oil Drop-out

No flare system is 100% efficient at combustion. During well testing at the MODU the hydrocarbons cannot be contained and so will be sent to the flare. During flaring, a small portion of unburned or partially burnt hydrocarbon products will drop-out of the flare and land on the sea surface. This normally results in the formation of a small slick of oil visible on the on the surface waters. The MODU is fitted with a four-headed “Green Dragon Burner” which will be used to burn the hydrocarbons from the well tests. This is a high efficiency burner and has a combustion efficiency rating of 99%. Assuming this performance and the predicted volumes of hydrocarbon that will be sent to flare during the well tests, it is estimated that a maximum of 75 bbls of oil will fall to the sea surface per well based on 1% drop-out. In reality drop-out is expected to be far less than this (a few barrels). Therefore it is estimated that at least 150 bbls of oil will be discharged to the sea surface during the pre-drilling programme should there be two well tests.

During burning, operators will check that the mixture of hydrocarbons to air is kept to an optimum to reduce the potential for hydrocarbon fallout. Should anything other than normal drop out occur an Oil Spill Response will be mounted and the hydrocarbons will be contained/cleaned according to the Tiered response categories established for different sizes of spills (refer to Section 9.11). Given these factors and the relatively small amount of hydrocarbons drop-out estimated above, impacts on seawater and seawater biology associated with oil droplet fallout from the burner boom are considered to be low and restricted to a small area around the MODU.

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9.5 Offshore Facilities – Platform Drilling, Production, Facilities Operations and Maintenance

The main offshore activities for Phase 3 will be hydrocarbon extraction and partial processing. These are described fully in the Project Description (Chapter 5). The results of the impact assessments for these activities are presented below.

9.5.1 Environmental Impacts

The results of the environmental impact assessment of the Phase 3 platform operations are summarised in Table 9.13 and are discussed below. For the assessment of impacts from the platform operations, only one was judged to have a medium residual significance. This is from the discharge of drilling cuttings and associated mud from the water based mud surface hole drilling programme. This is discussed in Section 9.5.2.

Table 9.13 Summary of Environmental Impact Assessment for Platform Drilling, Production, Facilities Operations and Maintenance

ID	Activity	Environmental Aspects	Environmental Mitigation	Cumulative Contribution	Environmental Impact Significance	Justification / Comments	Residual Environmental Issues to be Addressed
D	Offshore Facilities – Platform Drilling, Production, Facilities Operations and Maintenance						
D1.	Vessel support	Atmospheric emissions, noise, wastes, liquid discharges.	Bilge water, sewage water standards and control; All solid and sludge wastes shipped to shore; Waste management planning and implementation.	▲	L	Localised minor emissions and discharges that are rapidly dispersed. Waste generated is a cumulative issue across AzBU activities. Issue of waste management raised during consultation.	None
D2.	Flaring during commissioning	Atmospheric emissions.	Maximise onshore commissioning; Flare gas metering.	▲	L	Low residual impact when considered as a single activity but a cumulative contribution to ACG Phase 3 emissions as well as to the wider ACG FFD.	Atmospheric Emissions Refer to Section 9.5.1.9
D3.	Drilling with WBM	Noise, cuttings and muds discharge, physical seabed disturbance.	Seawater and WBM cuttings and muds discharged – selection of low toxicity chemicals only; Mud systems used are tested and meet US EPA 96 Hour LC 50 toxicity tests (i.e., > 30,000 ppm) or Caspian Specific Ecotoxicity Tests.		M	Length of drilling programme and number of wells will result in a repeated impact from WBM cuttings and muds on the benthos, preventing recovery until drilling stops. Low toxicity related to mud. Concern over cuttings discharge and disturbance of the benthic habitat raised during consultation.	Drill cuttings discharge Refer to Section 9.5.1.1
D4.	Drilling with NWBM & Cuttings reinjection	Atmospheric emissions, sub-surface pressure	Regular maintenance of pumps; Downhole modelling; Well maintenance; Surface well control. Ship to shore if CRI unavailable.	▲	L	Localised minor emissions that are rapidly dispersed. Cuttings re-injection location carefully selected and modelled. Concern raised during consultation that operations will increase seismic risk. Cumulative cuttings and treatment/disposal issue across AzBU activities in the event of CRI failure. Stockpiling cuttings onshore raised during consultation as a concern affecting air quality. However Serenja EIA predicted no impact on ambient air quality.	Drill cuttings reinjection Refer to Section 9.5.1.2 Waste treatment & disposal Refer to Section 9.5.1.4 and Section 10.2.
D5.	Well completions (sand control)	Wastes.	Re-injected into cuttings re-injection wells, discharged to seas following dilution to ensure chloride levels <21,000 ppm chloride, or shipped to shore for disposal or recyling; Waste management planning and implementation.	▲	L	Cumulative waste generation issue across AzBU activities.	Waste treatment & disposal Refer to Section 9.5.1.4 and Section 10.2.

ID	Activity	Environmental Aspects	Environmental Mitigation	Cumulative Contribution	Environmental Impact Significance	Justification / Comments	Residual Environmental Issues to be Addressed
D6.	Well workover	Wastes.	All wastes shipped to shore for recycling, treatment or disposal; Waste management planning and implementation.	▲	L	As D4	As D4
D7.	Power generation	Atmospheric emissions, noise.	Maximise turbine efficiency through routine maintenance; Optimisation of operating range; Modelling of emissions dispersion Power Management System. Pollution prevention management plan within ESMS	▲	L	Low residual impact when considered as a single activity but a cumulative contribution to ACG Phase 3 emissions as well as to the wider ACG FFD.	Refer to section 9.9.
D8.	Water injection	Atmospheric emissions, noise	As D6	▲	L	As D6	As D6
D9.	Gas compression	Atmospheric emissions.	Direct electrically driven compressors with high reliability.	▲	L	As D6	As D6
D10.	Seawater lift and cooling.	Noise, entrainment of marine biota, chemicals, warm water discharge.	Seawater lift caisson below productive zone (-107m); Bars on inlet; Cooling water injected as far as possible; Discharges at depth below the productive zone (-45 m) Cu/Cl antifoulant system selected to reduce Cl requirement; Discharge designed to meet delta 3 degrees centigrade at 100 m from end-of-pipe.		L	Regulator concern over discharges to the Caspian.	Assurance of effluent management. (treatment & discharge) Refer to Section 9.5.1.4
D11.	Produced water discharge	Liquid waste discharge.	Produced water re-injected, discharge only when injection system fails. Preferential produced water reinjection; 3 x 95% reliable pumps providing spare capacity to increase reliability; Produced water treatment offshore to oil-in- water international standards (29 mg/l monthly average; 42 mg/l maximum concentration) Chemical Selection Management System.		L	Infrequent event and treated before discharged, rapidly diluted and dispersed Regulator concern over discharges to the Caspian. Stakeholder concern over the potential accumulation of Normally Occurring Radioactive Material (NORM)	Assurance of effluent management. (treatment & discharge) Refer to Section 9.5.1.4. NORM Refer to Section 9.5.1.10

ID	Activity	Environmental Aspects	Environmental Mitigation	Cumulative Contribution	Environmental Impact Significance	Justification / Comments	Residual Environmental Issues to be Addressed
D12.	Chemical Use	Chemicals	No routine chemical discharges; Cooling water; Discharges only with produced water in event of water injection pump failure; Careful chemical selection through Chemical Selection Management System; Chemicals evaluated and tested, based on the European Harmonised Off-shore Chemical Notification Format (HOCNF) and UK OCNS classification, until such time as Caspian-specific standards are agreed. Chemicals iin dedicated and bunded store offshore; Excess chemicals shipped to shore for recycling or disposal.		L	Low residual impacts as none will routinely enter the environment.	None.
D13.	Flaring	Atmospheric emissions, light, heat, noise	No routine flaring - only purge and pilot; Flare tip designed to maximise combustion efficiency; Purge minimised through flare gas metering; Flare for emergencies and equipment upsets only; Flaring Policy to be developed; Electric motor gas export compression for higher reliability.	▲	L	Low residual impact when considered as a single activity but a cumulative contribution to ACG Phase 3 emissions as well as to the wider ACG FFD. Low impact on birds and seals only when flaring through upset conditions. The effects of gas disposal raised during consultation.	Atmospheric emissions during flaring. Refer to Sections 9.5.1.9 and 9.9.
D14.	Sand production	Wastes	No sand discharges; All sand re-injected via CRI or shipped-to-shore for treatment and disposal in the event of a CRI failure.	▲	L	As D4	As D4
D15.	Platform drainage, sewage, firewater	Liquid waste discharges.	Dedicated hazardous and non-hazardous drainage; Caisson skimmed oil transferred back to process; Sewage treated in USCG certified system (or equivalent as per PSA) achieving <150 mg/l Total Suspended Solids, a pH of 6-9, Faecal Coliforms <200 MPN/100ml and Residual Chlorine average of 1mg/l; Firewater to be dosed with film forming fluoro protein (FFFP), an aqueous film forming foam (AFFF) it is a natural protein foaming agent that is biodegradable and non-toxic; No chemicals to be used during fire system testing		L	Discharges rapidly diluted and dispersed. Regulator concern over discharges to the Caspian.	Assurance of effluent management. (treatment & discharge) Refer to Section 9.5.1.4

ID	Activity	Environmental Aspects	Environmental Mitigation	Cumulative Contribution	Environmental Impact Significance	Justification / Comments	Residual Environmental Issues to be Addressed
D16.	Potable water generation	Wastes.	Excess brine discharged via the seawater at -45m below surface, but not at concentrations higher than 4 times the ambient salt concentration of the Caspian.		L	Discharges rapidly diluted and dispersed. Regulator concern over discharges to the Caspian.	Assurance of effluent management. (treatment & discharge) Refer to Section 9.5.1.4
D17.	Operation of hydraulic valves for subsea facilities	Chemicals, discharges.	Correct design; Careful fluid selection through chemical management system; All systems tested on Caspian species Low toxicity fluid. Minimise volumes discharged.		L	Small volumes of low toxicity chemicals, released in deep waters, rapidly diluted and dispersed. Regulator concern over discharges to the Caspian.	Assurance of effluent management. (treatment & discharge) Refer to Section 9.5.1.4
D18.	Provision of accommodation and catering.	Wastes.	Food waste macerated prior to discharge; All wastes shipped to shore for treatment/disposal; Waste management planning and implementation.	▲	L	Rapidly dispersed and degraded. Waste generated is a cumulative issue across AzBU activities. Regulator concern over discharges to the Caspian.	Waste treatment & disposal Refer to Section 9.5.1.4 and Section 10.2. Assurance of effluent management. (treatment & discharge) Refer to Section 9.5.1.4
D19.	Helicopter operations	Atmospheric emissions, noise.	Regular maintenance; Defined flight path, scheduling.		L	Low contribution to overall air emissions from the project.	None.

9.5.1.1 Water Based Mud Drilling and Drill Cuttings Discharge

The Phase 3 drilling programme, initiated from the mobile drilling unit, will continue from the DUQ platform once installed. The facility will have 48 well slots. Ten of these slots will have been used to tie-back to the 10 pre-drilled wells. A further 38 well slots will therefore be available for the platform drilling programme.

Platform well surface-holes will not be drilled, but a closed-end 30" conductor will be driven through this first section. No cuttings will be generated from this section. The 26" top-hole section will be drilled with a WBM system containing the same component chemicals as in the pre-drilling mud system, with the addition of benonite. As discussed in Section 9.4, the mud chemicals selection will be according to the strict rules of the established HSE design standards (Appendix 2). The cuttings will be returned to the platform topsides solids control system and once separated from the mud will be discharged via the cuttings caisson at 138 m below the sea surface. There will be no discharge of cuttings unless the maximum chloride concentration is less than four times the ambient concentration in the receiving waters of the Caspian, that is the cuttings discharge will meet 21,000 ppm limit for chloride. The cuttings will be diluted if necessary in a mud pit to meet this limit before being discharged. The estimated volume of cuttings that will be discharged from each 26" section is 277 m^3, with the total volume from the 38 wells amounting to 10,526 m^3.

Turbidity Effects of Cuttings

The depth of cuttings discharge (at 138m) is well below the water column primary productive zone that extends 40m below sea surface. Impacts to marine organisms from the turbid plume generated by the discharge are therefore predicted to be minimal. Furthermore, the residence time of the solid material in the water column will be considerably low as the fall distance from end-of-pipe to the seabed will be around only 37 m. The largest cuttings particles are predicted to reach the seabed in approximately 50 seconds; the finest materials to take up to 3.5 hours to settle.

Deposition of Cuttings

As with the pre-drilling programme, drilled cuttings discharged from the platform will accumulate on the seabed to form a cuttings pile. This pile will be in addition to and largely on top of the cuttings material already deposited on the seabed during the pre-drilling programme conducted from the MODU. The dispersion characteristics for the platform drilling discharges were, as for the pre-drilling programme, simulated using MUDMAP for characteristic seasonal periods. The full Phase 3 cuttings dispersion modelling study report is included in Appendix 4. Table 9.14 presents a summary of the cuttings dispersion as established by the modelling exercise. It should be noted that the data presented represents the final cuttings pile deposition at the central Phase 3 location that would be generated from both the pre-drilling and platform drilling programme, since both drilling programmes will take place at the same location.

Table 9.14 Summary of Platform and MODU Cuttings Deposition

Seasonal Conditions	Area Covered by > 1mm Thickness (m^2)	Maximum Horizontal Extent (m) of 1 mm Thickness	Maximum Deposition Thickness (cm)
Summer Maximum	273,917	1,345	366
Summer Average	364,421	470	385
Winter Maximum	255,783	1,240	351
Winter Average	356,789	706	401
Annual Average Conditions	312,728	940	375

The model predicts an average coverage of cuttings to a thickness of 1 mm from the Phase 3 drilling programme of 312,728 m^2 with a maximum horizontal extent of between 470 m and 1,345 m from the central platform location. The maximum depth of the cuttings pile has been predicted to range from between 3.5 m and 4 m.

Toxicity Effects

The residual drilling mud adhering to the cuttings will contain low toxic properties as the mud system will contain components that are either inert or have very low toxicity characteristics. Many of the mud components are water-soluble and hence will tend to dissolve upon release or as the cuttings discharge falls to the seabed. The main components reaching the seabed, apart from the drilled cuttings, will therefore be the weighting and viscosity control agents barite and bentonite. Barite is in the form of very finely grained barium sulphate, which is a highly insoluble inert material, and bentonite is inert clay. Elevated levels of barium will be expected in the cuttings accumulations, however this trace metal will be in a form that is biologically unavailable (Hartley, 1990) and thus will have no toxic effect on benthic fauna (Jenkins *et al*., 1989). Barites have been known to contain other trace metals including cadmium and mercury. The concentration of these metals in the barite depends to some extent on the geological source of the barite. It should be noted however, that all barites are analysed by the supplier, before they are used to ensure that cadmium and mercury concentrations meet the IFC standards of less than 3 mg/l and 1 mg/l, respectively. In any case, Neff *et al*. (1989a) found that metals associated with drilling mud barite are not in practice bio-available to marine organisms that might come into contact with the discharged drilling fluids or cuttings piles.

Smothering Effects

The principal impact from these accumulated cuttings will be the physical smothering of the benthos. Assuming as a worst-case basis that all benthic organisms within the cuttings piles will be lost at a cuttings thickness of 1 mm and using the average biomass figure of 9 g/m^2, an approximate and estimated 2,815 kg of biomass will be lost. However, the reader should note that this does not account for the cuttings from wells that will be drilled from the MODU due to the limitations of the modelling.

The total area that will be impacted by the Phase 3 drill cuttings is not considered significant in terms of the whole ACG Contract Area and the wider middle Caspian Sea area. Further, there are no sensitive benthic communities present at the Phase 3 drilling location. The Phase 3 drilling programme will however, last for up to 10 years and re-colonisation of the area of deposition by benthic organisms would not occur, with a high success rate, until the drilling stops. As such the residual impact from the entire Phase 3 drilling programme is considered to be of medium significance and is discussed further in Section 11 Mitigation and Monitoring.

Recovery of the benthos

As discussed in Section 6, benthic sensitivity has been assessed for the Phase 3 location. Caspian gastropods are a diverse group, all of which are very small and are surface deposit feeders and therefore will be relatively vulnerable to physical smothering. The insect, Chironomus is similar in size and in its habits to the small annelids, but may be capable of suspension feeding as well as deposit feeding. Larvae can develop to adulthood in approximately 4 weeks, so this species has the capacity to recover rapidly from temporary disturbances. Larger crustacea, such as cumacea and isopods, occur throughout the Phase 3 area, although only cumacea achieve significant abundance. Both types of crustacean are surface-dwellers and scavengers; isopods are often encountered in higher abundance in the most 'impacted' areas close to well centres after drilling.

Monitoring results at well sites in the southern Caspian have shown that very little chemical contamination was detectable at single well drilling locations where WBM has been used (URS, 2002). There have however, been detectable changes in the physical character of the sea bed particularly within 50 m of the well-head where the drilled cuttings from the upper well sections were discharged directly to the sea bed (ERT, unpublished data). Macrofaunal biomass may be reduced by up to 90% close to the wellhead where the cuttings pile is thickest. Beyond 50 m, changes in the benthos caused by cuttings discharge were found to be indistinguishable from those due to natural variation.

With regard to recovery of the seabed and macrofauna around such wells, the same studies provide evidence that the areas most impacted (i.e. close to the wellheads) can support communities similar albeit somewhat impoverished, to those expected for the region within four months of cessation of drilling. After 12 months, recovering communities at up to 50 m distance from the well-head may have a biomass similar to or exceeding that recorded prior to drilling.

There are insufficient data at present to characterise faunal succession during recovery from these impacts. What can be stated is that species inhabiting the most impacted areas within four months of drilling a single well include abundant populations of the cumacean Stenocuma diastyloides, the tube-dwelling amphipod Corophium spp. and the mussel Mytilaster lineatus. As nored, small crustacea such as cumaceans and amphipods tend to be sensitive to chemical/hydrocarbon contamination and therefore their presence in large numbers may be indicative of the absence of significant chemical impacts (URS, 2002).

9.5.1.2 Non Water Based Mud (NWBM) Drilling

The lower-hole sections and any well side-tracks of the platform wells will be drilled with a NWBM system and the cuttings generated, along with any excess drilling muds, will be sent to the cuttings re-injection unit where they will be slurrified and re-injected at high pressure into the Sabunchi formation (2,000 – 2,350 m) via one of two dedicated cuttings re-injection (CRI) wells. It should be noted that produced sand removed from all equipment and piping will also be routed to the CRI system to be injected.

The well and cuttings injection programme has been studied using a number of modelled simulations. Simulations confirm that sub-surface fractures formed by the re-injection process will be confined to the low permeability shales of the Subanchi formation and no loss of fluids to the surface is expected.

Given the high level of seismicity in the Phase 3 drilling area, stakeholder concern has been raised that the injection of cuttings into deep sub-surface geology formations at high pressure might trigger a seismic event. Internationally, the current technical view, based on industry experience is that drilling a well is not a cause for induced seismic events. However, seismicity is of a greater consideration when considering fluid injection and waste disposal, such as cuttings re-injection, as these involve working with high fluid pressures.

In the ACG field, there are no direct linkages between the shallow faults that break the seabed and the deeper faults beneath the anticline. Studies of the area performed as part of the 1998 Geohazard study, identified many structural and stratigraphic features that suggest detached deformation by buckle folding of the Apsheron anticline. As a result, activities in the shallow part of the field above the productive series, do not have any direct fault linkage to the deeper tectonic faults which drive natural seismicity in the area. As such, the risk of induced seismicity from the fluid and cuttings re-injection has been assessed as being very low. This assessment will be supported by further study based on the ACG Phase 1 production programme to gain operational data. These data will be used to further determine the low risk prior to Phase 3 production activities.

CRI will require energy for the re-injection pumps. The associated emissions to air from these pumps will however be low and considerably less than the vessel emissions that would result if all of these cuttings were containerised and shipped to shore for treatment and disposal. No cuttings generated from drilling with NWBM will be discharged to sea and should the re-injection system become unavailable at any time, then the ship-to-shore option will be implemented.

9.5.1.3 Cementing

During platform drilling the 30” conductor will be driven, so there will be no coment used. The 20” conductor will be cemented so some returns might be seen at the top of the conductor (at the platform). Inner string cementing will minimise cement returns. Returns will be monitored and cementing completed. Around 100 bbls might be returned at the platform and this would be discharged to sea.

9.5.1.4 Effluent Discharges to Sea

In addition to cuttings discharges there are various liquid discharges that will be discharged to sea from the platform during drilling and production operations. These include:

- Treated produced water and untreated seawater when water injection facilities are unavailable;
- Treated cooling water when water injection facilities are unavailable;
- Treated sewage waters;
- Drainage waters, and;
- Brine from the potable water maker.

Produced Water

As described in the Project Description (Chapter 5), the Phase 3 reservoir is depleted and significant water injection is necessary. As such, water injection will begin in early production and will continue over the life of the field. Produced water generated at the platform will be one of the water streams used for injection and will be re-injected with treated seawater.

There will be occasions when the water injection system may become unavailable. The Phase 3 project has been designed so that if the injection capacity is reduced (e.g. through the failure of one of the three injection pumps), lifted seawater for reinjection purposes will be discharged in preference to produced water as biocide dosing of seawater will cease when it is being discharged to sea. However, during periods when produced water cannot be injected it will be discharged to sea via a caisson at 45 m below the sea surface. If discharge is required, the produced water will not be dosed with biocide (as will be done prior to injection). The water injection system is designed to operate at an overall 98% availability. Discharge of treated produced water to the sea is common practice in international offshore oil and gas operations and is considered Best Available Technology (BAT) for this waste stream in the absence of injection facilities.

Section 5.8 presents the anticipated volumes of produced water to be discharged to the sea based on a worst-case scenario of 2% total injection volume.

Prior to injection or discharge the produced water will pass through the produced water treatment package, which removes oil, gas and sand. A sampling point will be installed to allow verification that the treated produced water meets the IFC dispersed oil and grease standards of 42 mg/l (24 hour daily average) and 29 mg/l (monthly average). Section 5.10, Figure 5.49 presents the estimated amount of oil that would be discharged to the sea over the life of field is presented based on the above worst-case scenario.

The treated produced water contains a complex and variable mixture of components at low concentrations including: dispersed and dissolved hydrocarbons, trace metals, dissolved inorganic salts and organic components such as fatty acids. Production chemicals will be present as a result of contact with the offshore production process, although the amount of production chemicals that may remain in the produced water discharge is very much dependant on the solubility coefficient between water and oil of each chemical (Section 5.5, Tables 5.14 and 5.14). The exact chemical formulations to be used for the production operations is unknown at present, however the project has committed to minimising chemical use and to the selection of low toxicity chemicals wherever this is possible. The chemicals considered in ACG Phase 3 and their solubility coefficients are provided in Section 5.5, Tables 5.13 and 5.14.

Studies have shown that biodegradation rates upon discharge to open waters of the majority of components in produced waters are relatively rapid with only some of the heavier hydrocarbon components being more persistent (Varskog, 1999). Measured standard biodegradation rates for produced water compound groups are presented in Table 9.15 below.

Table 9.15 Biodegradation Rates of Produced Water Compounds

Compound Group	Biodegradation Rate (½ Life in Days)
BTEX	0.5
Naphthalenes	1.5
2-3 ring PAH	17
4^+ ring PAH	350
Alkyl phenols (C0-C3)	1.2
Alkyl phenols (C4+)	10
Aliphatic hydrocarbons	60
Metals	No degradation
Organic acids	Organic acids are highly water soluble and degrade rapidly
Production chemicals	Product specific

Source: Johnsen et al., 2000.
Note: BTEX = benzene, toluene, ethylbenzene, xylene; PAH = polycyclic aromatic hydrocarbons.

Overall, as produced waters will be re-injected for an anticipated minimum 98% of the time, there will be only limited periods when the produced waters will be discharged to sea. In these scenarios, the discharge will be treated to international (IFC) standards and rapid dilution of the discharge in the open offshore waters will reduce the concentration of the components present to negligible levels within tens of meters of the discharge point. The depth of discharge is also below the most biologically active primary production zones. As such it is considered that resulting residual environmental impacts from these produced water discharges are not significant.

Cooling water

As described in the Project Description (Chapter 5) seawater will be lifted from a depth of 107m below the sea surface. A total of five seawater lift pumps will be available for this service with typically four in operation at any one time. Each pump will have an operational capacity of 2,270 m^3/hr, although the normal flow-rate is anticipated to be 1,718 m^3/hr. On the basis of four pumps operating at full normal flow-rate, 6,872 m^3/hr of seawater will be lifted for a number of requirements on the offshore facilities including water injection, firewater, potable water making and cooling water.

Marine biota can become entrained in the seawater intake. Bars will be fitted to the inlet on each seawater lift caisson to prevent the ingress of larger organisms, although larger fish would be expected to avoid the area. The water intakes, set at 107 m below the sea surface, will be well below the productive surface layers of the water column. Phytoplankton abundance is greater in the surface waters although zooplankton will be present in these deeper waters and will become entrained in the seawater intake. The loss of zooplankton biomass will however, be negligible when compared to the overall plankton biomass of the Contract Area and as such no discernable impact on plankton populations will result.

The portion of the lifted seawater stream that is used for cooling duty will, once used, be routed to the water injection system for disposal. As discussed above, there will be periods when the water injection system may become unavailable and at these times the used cooling water will be discharged to sea. The discharge will also be from the caisson at 45 m below the sea surface. Water injection unavailability is predicted to be approximately 2% annually as discussed in relation to produced water.

Thermal Effects

During periods of cooling water discharge (only during periods when injection is not possible) a thermal plume will form close to the point of release. The plume will disperse and its temperature will fall rapidly. Thermal plume dispersion modelling was conducted for the Phase 1 and Phase 2 ESIAs to establish whether cooling water discharges from these facilities would meet the IFC guidelines[1] relating to cooling water discharges. This standard

[1] World Bank Operational Policy 4.01: Environmental Assessment (1999).

states that the water temperature 100m from the point of discharge must be less than +/-3°C of ambient seawater temperatures. Phase 1 and Phase 2 simulations were conducted for cooling water discharge at a temperature of 25°C, at rates of between 1,700 and 10,161 m^3/hr and at discharge depths beneath the sea surface of between 40 m and 67 m. The modelling results showed, for all seasonal scenarios, that the thermal plume was well within +/-3°C ambient seawater temperature within 100 m from the discharge point in all directions. In fact, all simulations showed a temperature rise of only between 0.5 - 1.0°C above ambient conditions. It was concluded that thermal impacts of these cooling water discharges on seawater and seawater biology were not significant. In addition, on the occasions that it will be necessary for the Phase 3 facilities to divert the cooling water to the discharge caisson, the cooling water discharge rate will be substantially less than either the Phase 1 or Phase 2 discharges: the maximum rate of discharge could only be 1,718 m^3/hr. The prevailing seawater current regime at each of the locations of the Phase 1, Phase 2 and Phase 3 locations are essentially the same and it is therefore concluded that Phase 3 cooling water discharges will not exceed the IFC standard.

Toxicity

To prevent the build-up of organic matter a Biofouling and Corrosion Control (BFCC) System that uses chlorine and copper together at low concentrations as an antifoulant will be fitted to both the DUQ and PCWU platform. Copper and chlorine will be added to the seawater intake so that the cooling water will be in the order of 1 ppb (parts per billion or μg/l) and 5 ppb respectively, achieved by dosing at 5 times that concentration for one minute in every five. Copper and chlorine will be contained within any cooling water discharges.

Cooling water discharge will be continually subject to dispersion and dilution. Dispersion and dilution of the copper and chlorine in the Phase 1 cooling water discharges was modelled for the ACG Phase 1 ESIA. At a total continuous discharge rate (which Phase 3 will not have) of 5,900 m^3/hr the model predicted that, in a steady state (i.e. balance between discharge and dilution), the maximum concentrations of copper and chlorine in the dispersion plume would be 0.006 ppb and 0.06 ppb, respectively, below the Maximum Allowable Concentration (MAC) of 5 ppb chlorine for Azerbaijan and within the agreed chlorine limit for sewage discharge in the PSA (2,000 ppb). The maximum concentrations predicted by this modelling study are very low and Phase 3 concentrations would be expected to be similar, but only during the intermittent periods of discharge. No residual environmental impact would be expected. However, seabed sediment copper concentrations will be monitored as needed as part of the benthic studies that will be conducted under the Integrated Monitoring Programme. In addition, mussel cages are currently deployed from the Chirag Platform, which has a similar cooling system, in order to monitor bioaccumulation of any pollutants including copper.

Sewage waters

Sewage waters will be discharged following treatment in the platform sewage treatment system that will be designed to treat a maximum capacity at a peak platform manning level of 300 people on board (although during the operations phase there will be an average of 200 people on board). The average discharge of black and grey waters during operations will be 47 m^3/day; the maximum discharge will be 56 m^3/day. Discharge will be via a caisson at 15 m below the sea surface. The system will achieve <150 mg/l Total Suspended Solids, a pH of 6-9, Faecal Coliforms <200 MPN/100ml and Total Residual Chlorine average of 1 mg/l, meeting the project discharge limits. Organic food waste will also be discharged from the platform via the sewage water discharge caisson. Prior to discharge the food waste will be macerated to <25 mm to aid dispersion.

The selected sewage treatment package on the platform will include maceration and electro-chlorination (chemical treatment). In this system all of the sewage that is generated is broken down and therefore there is no requirement for the manual removal of sewage sludge and transfer to shore. A BPEO study was conducted for Phases 1 and 2 to select this technology and this study was revisited for Phase 3 to ensure that this treatment system is still the BPEO. Chemical treatment was considered to be the BPEO for a number of reasons:

- The chemical system is a proven system that can be designed to achieve the required specifications;
- The chemical system is the only system that does not require the manual removal of sewage sludge to shore;
- The ozone system and biological system would require the manual removal of sewage sludge and shipment to shore for disposal (a variant of the ozone system could be developed that would provide total treatment but the system has not yet been designed and is therefore untried); and
- The biological system would be susceptible to any ‘shock’ loading of detergents from grey waters that could kill the biological activity.

The environmental impact assessment concluded that the discharge of treated sewage waters to the sea would not result in any significant impacts. Although, an elevated biological oxygen demand will be found close to the point of discharge the waters will be rapidly dispersed and diluted to ambient levels.

Drainage

The drainage system on the platforms will consist of non-hazardous and hazardous open drains as well as a closed drains system. There are two systems of drainage management on the DUQ and PCWU, as follows:

PCWU

- Open drains waters (including drainage from areas with a hazardous safety rating) is routed to the open drains caisson and passed through a skimmer in the caisson to draw off any oil prior to discharge at -45m.
- Closed drains waters will be directed to the LP and HP closed drains drums. Liberated gas from these drums will be sent to the flare and the liquids will be sent back to the LP separator for re-treatment.

DUQ

- Open drains from areas with a hazardous safety rating will be discharged to the open drains caisson fitted with skimmer to draw off any oil, prior to discharge at -45m.
- Drainage from areas with a non-hazardous safety rating will be sent to an oil drains tank and from there to the cuttings re-injection package for downhole reinjection.
- Closed drains waters will be directed to the LP and HP closed drains drums as with the PCWU. Liberated gas from these drums will be sent to the flare and the liquids will be sent back to the LP separator for re-treatment.

Both open drains caissons are fitted with a sample extraction point at -30m and will be monitored to check for visible sheen.

Brine from Potable Water Maker

A small amount of brine will be discharged to sea from the potable water maker on board the DUQ platform. It will not be a significant amount given the low flow rates ($5m^3$ / hour) through the potable water maker. The brine will be discharged together with seawater from the seawater caisson at a depth of –45 m. The brine will be rapidly diluted in the Caspian and this discharge is not considered a significant impact.

Vessel Discharges

Vessels used for supply and support of the offshore operations will follow the project operational controls on sewage and bilge water treatment as described for facility installation vessels (Section 9.2.1). Only low residual environmental impacts will result from these discharges in open waters.

9.5.1.5 Other wastes

Wastes that require transfer to shore will be segregated on the platforms offshore and transferred to shore for final treatment and disposal in adherence with the AzBU waste management plan. A comprehensive waste consignment documentation procedure will be in place. Once onshore the wastes will be further sorted at a waste transfer station where appropriate ready for recycling, treatment or for final disposal at an AIOC approved site using an AIOC approved contractor. The final disposal of wastes in Azerbaijan by the AzBU is described in more detail in Section 10.2

9.5.1.6 Subsea Manifold Fluid Discharges

The water injection subsea manifold will use a hydraulic system to control the tree valves and the well down-hole flow control valves (DHFCV) that control the water injection rate. An open loop hydraulic system has been selected for this purpose. This system will result in the intermittent release of hydraulic fluids to the sea from the DHFCVs and the down-hole safety valve (DSV). A water based hydraulic fluid will be used and will be evaluated and tested, based on the European Harmonised Off-shore Chemical Notification Format (HOCNF) or UK OCNS classification. The selected chemical will be of the lowest toxicity/highest biodegradability. The chemical being considered for use is Oceanic HW443[2]. This chemical has been tested to Caspian specific and OSPAR standards. In summary, the toxicity tests for the fluid (EC50s) are as follows:

Caspian specific toxicity test results:

- Caspian herbivore test: Calanipeda 48hr LC50 >10,000 mg/l
- Caspian phytoplankton test: Chaetoceros tenuissimus 72hr EC50 501 mg/l
- Caspian sediment dweller: Pontogammarus maeoticus 96 hr LC50 > 32,000 mg/kg

The results from testing according to OSPAR protocols are:

- Skeletonema Costatum (Algae) 72h EC50 1069.9 mg/1
- Arcartia Tonsa (Crustacean) 48h LC50 >10,000 mg/1
- Corophium Volutator (Sediment Reworker) 10 Day LC50 16,303 mg/kg

These test results are consistent and show acute toxicity to be low. Further, the material safety data sheet indicates no components with a tendency to bioaccumulate.
Under normal conditions the amount of hydraulic fluid released will be very low (40.5 tonnes over the entire life of field). If leaks are detected in the system a fluorescent dye may be added to aid in swift repair. The proposed dye will be also OCNS Category E. In addition, on

[2] Oceanic HW443 is the current planned fluid for use, however this selection will be reviewed in detail design according to future recent changes in legislation which may alter how the fluid is regulated. If selected, any new fluid would be submitted to the Caspian Laboratory for Ecotox testing.

consideration of the release depth and toxicity/biodegradability of the chemical, only a low environmental impact is predicted for this discharge.

The only option that was available to reduce this discharge was to select a closed loop system. This system however, still results in some release of hydraulic fluid, estimated to be approximately 8 tonnes over the life of the PSA. The open loop system has a number of advantages over the closed loop system and in particular, reduced complexity with associated increased reliability and a lighter, more easily installed umbilical. These factors led to the system being selected. Particulates can also build up in the fluids contained in the closed loop and cause blockages which are problematic to repair and will ultimately require that the fluids be flushed out to sea.

9.5.1.7 Chemical Use

A number of chemicals will be used in well completions, the production process, and for seawater treatment prior to water injection. The project will minimise chemical use where practicable and, through a careful selection process, will select chemicals of known low toxicity as tested under the European Harmonised Off-shore Chemical Notification Format (HOCNF) or UK OCNS classification. No production chemicals will be discharged to the sea under normal operating conditions. Excluding WBMs from the drilling programme, the only means of release of chemicals to the sea will be:

- The discharge of water soluble production chemicals that come into contact with the produced water stream with produced waters discharged in the event that the water injection facilities become unavailable (see above);
- The copper-chlorine antifoulant at trace concentrations in the event that the water injection facilities become unavailable;
- Chemicals in the injection water that might be discharged in the event that the water injection facilities become unavailable;
- Residual chlorine in sewage discharges;
- Chemicals in the well completion fluids; or
- Through a chemical spill (abnormal event).

Excluding a spillage scenario, only very small amounts of low toxicity chemicals will be released and only when the water injection facilities become unavailable. As such no residual impacts are expected from the use of chemicals offshore.

9.5.1.8 Underwater Noise

Marine animals are known to congregate around offshore installations and it is considered that they become accustomed to predictable noise from sources such as stationary offshore sites and ships that follow a constant course. The Caspian seal is frequently observed close to the operational Chirag-1 platform in the Contract Area indicating that they become habituated to the sound and are largely undisturbed by operations noise. Evidence of similar behaviour by marine mammals is available for other offshore oil production operations, where seals and dolphins are regularly observed close to offshore installations and around support vessels. Underwater noise impacts from the Phase 3 offshore facilities are therefore not considered to be significant.

9.5.1.9 Atmospheric Emissions

As described in Section 5.10, the principal sources of emissions to the atmosphere during offshore platform operations include:

- Power generation;
- Water injection;
- Purge gas (and pilot light) flaring; and
- Flaring during plant upsets.

The estimated total emission quantities over the life of field by gaseous species are shown in Table 9.16 below. Emissions per year are shown in Figures 9.1 and 9.2.

Table 9.16 Summary of Species Emitted Offshore, by Species (tonnes)

	CO_2	NO_X	CO	CH_4	VOC
Combustion:	10,148,585	24,198	9,751	1,517	184
Flaring:	1,547,940	489	2,837	3,261	3,261
TOTALS:	**11,696,525**	**24,687**	**12,588**	**4,778**	**3,445**

Figure 9.1 Estimated Total Emissions by Species, Offshore Platform Operations (tonnes)

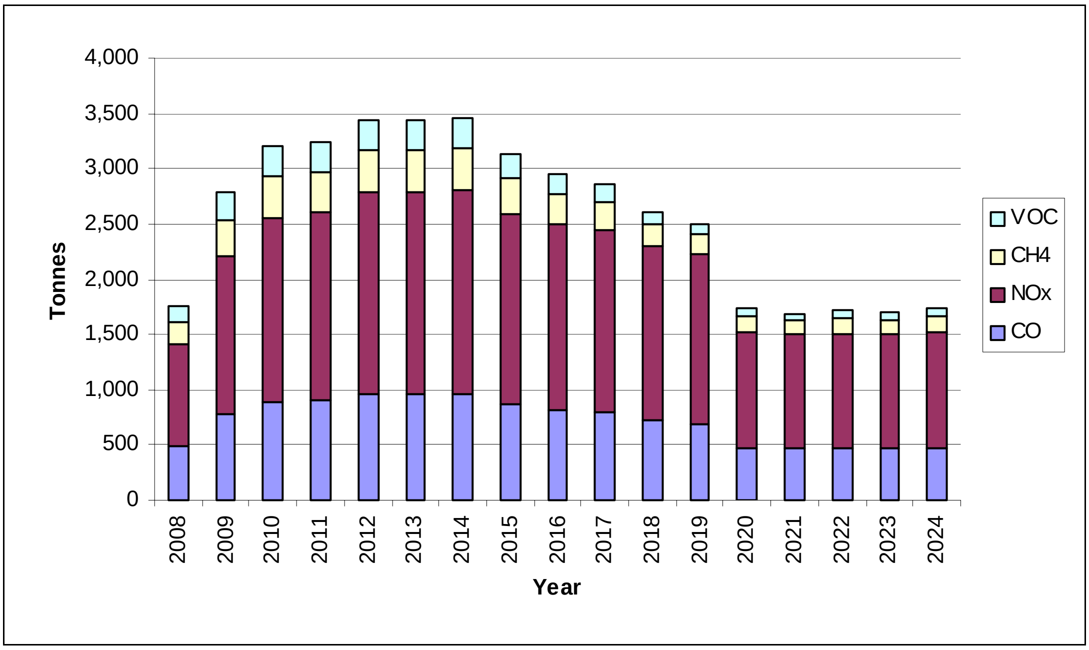
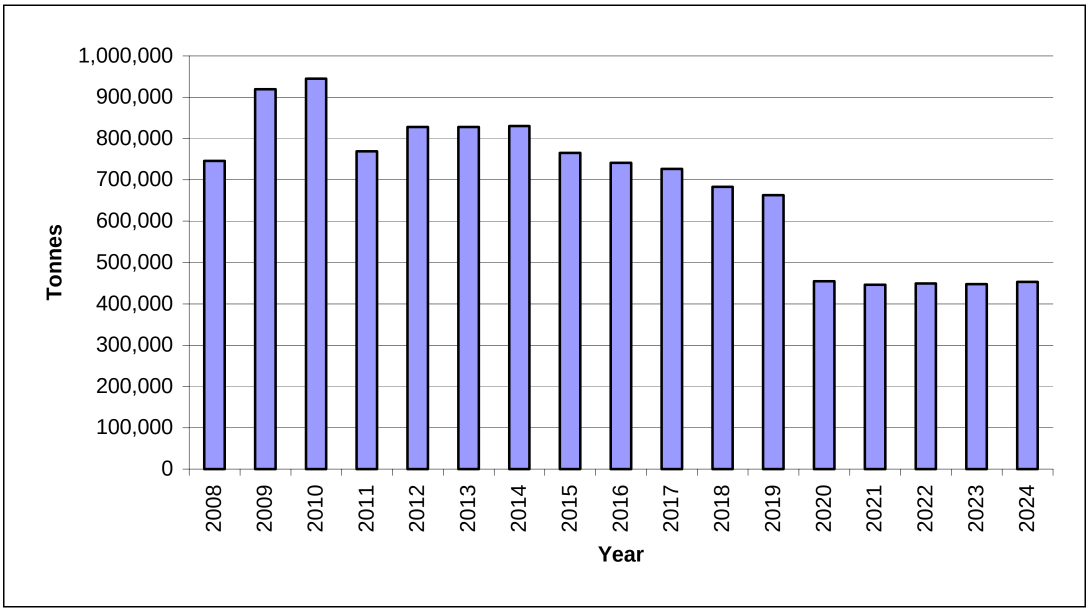


Figure 9.2 Estimated Total Emissions of CO_2, Offshore Platform Operations (Tonnes)



The data presented in Table 9.16, and Figures 9.1 and 9.2 assumes a planned platform equipment availability of 75%, 85% and 95% for years 1, 2 and 3+ of production operations. Lower availability overall is assumed for the first two years of production to account for the predicted lower availability of the plant during the start-up and commissioning period. In addition to an emergency situation flaring of gas offshore will be necessary under two scenarios as follows:

- During offshore platform gas compressors (for gas export to shore) upsets; and/or
- During onshore terminal gas processing train upsets.

Flaring as a result of normal maintenance schedules will not be necessary as there is an overcapacity in the number of engines to allow for normal operations to continue when one turbine is being serviced. The offshore facilities have been designed such that losses in gas export capability, or upsets in the gas conditioning system (dew point control unit) result in the bulk of the gas being flared offshore whilst only the flash gas will be flared onshore. At the time of writing this ESIA report, the policy had not been finalised. For the purposes of estimating emissions from flaring, a flaring split of 86% offshore and 14% onshore has been assumed. The data presented in Table 9.14 above in regards flaring offshore is based on this assumption.

The dramatic decrease in total emissions over the years 2019 and 2020 is attributable to Phase 3 reservoir characteristics and planned production profile. As the DWG field is depleted, water injection will be necessary from start of production (2008). The reservoir characteristics are such that use of gas for pressure maintenance is not viable. Pressurising lifted seawater (and produced water and cooling water) for water injection will require substantial energy and as such, the Project's base-case design includes three dedicated RB211 gas turbines for this duty (Section 5.5.5). In 2019 / 2020 however, the water injection rates will be decreased because of diminishing returns of oil for the water injected. As the water injection rate is reduced and the amount of oil produced reduces, the amount of associated gas produced offshore will also reduce. As such, the power requirements for gas export to shore will also reduce further adding to the dramatic reduction in emissions per year in the latter years of the Phase 3 PSA.

Atmospheric Emission Dispersion Modelling

There are no sensitive human receptors in the offshore environment (the workforce offshore are already protected by occupational health measures) and therefore, there is no specific requirement, in terms of the environmental and social impact assessment process, to model dispersion of air emissions. Nevertheless, air dispersion modelling of offshore emissions from all of the AIOC facilities within the offshore ACG FFD Contract Area (i.e. EOP (one platform), Phase 1 (two platforms), Phase 2 (two platforms) and Phase 3 (two platforms) was completed for two reasons; for occupational health and safety to ensure that workers on the offshore facilities would not be adversely affected, and to confirm that onshore receptors would not be affected. This modelling demonstrated that emissions would be rapidly dispersed and also that there would be no impact on onshore air quality as a result of the offshore emissions. The results of the offshore air dispersion modelling are not discussed further here. The total volume of offshore emissions is however pertinent to the impact assessment process and especially in terms of GHG. This is discussed further below.

Greenhouse Gas

The offshore CO_2 emissions will be considerable in terms of volume and hence, on this basis, their contribution in terms of greenhouse gas (GHG) emissions is considered to be a significant issue. GHG emissions are further discussed in Section 9.9 in relation to cumulative issues.

9.5.1.10 Normally Occurring Radioactive Material (NORM)

The issue of Normally Occurring Radioactive Material NORM was raised as a concern during stakeholder consultation. It is the co-precipitation of naturally occurring radium isotopes (and other naturally occurring radionuclides) with sulphate and carbonate scales that results in the accumulation of NORM (i.e. scales or sludges with higher than background levels of radioactivity).

Typically, during oil and gas production, scale or sludge collects in areas of the production system where there is a drop in flow, such as bends in pipe-work and in process vessels. Not all scale or sludge resulting from oil and gas activities contains NORM as it is a feature of the composition of reservoir fluids and associated physical and chemical conditions resulting from the production of oil and gas. However, the following liquid and solid waste streams have been identified as having a potential to contain NORM:

- Produced water
- Sludges and scales resulting from maintenance and shut down activities (cleaning of pipework and process vessels)

A water analysis from the Chirag well A6 has been used to determine the scaling potential in the ACG field as a whole as a consequence of pressure and temperature changes. This study also included the consequences of mixing with Caspian seawater. The study found that calcium carbonate scaling is likely both offshore and onshore. However, sulphate scales (most commonly associated with radiation) are unlikely, even when there is seawater mixing.

Analysis of produced water from Chirag Platform (conducted in 2004) also shows there to be little propensity for NORM to occur since no measurable levels of radioactive elements (such as radium) were detected. However, in order to ensure that the installations are fully prepared to deal with NORM issues, BP procedures require an ongoing monitoring plan. Further details of NORM potential and management are provided in Appendix 10.

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9.6 Interfield Pipeline Installation and Commissioning and Operation

As described in the Project Description (Chapter 5.7), Phase 3 will tie-in to the existing Azeri Project marine export pipeline infrastructure to export its oil and gas to the onshore terminal at Sangachal. This will require the installation of three infield pipelines from the offshore facilities and connection to the existing pipelines via pre-installed wye pieces as described in Table 9.17 below.

Table 9.17 Phase 3 Infield Export Pipelines

Infield line	To	Length (km)
30” oil line	Phase 2 30” oil pipeline	2.4
30” oil line	Phase 1 30” oil pipeline	2.2
28” gas line	Phase 1 28” gas pipeline	2.0

The results of the impact assessments of the installation, commissioning and operational activities associated with these Phase 3 infield pipelines are described below.

9.6.1 Environmental Impacts

The results of the environmental impact assessment are summarised in Table 9.18. Pipeline installation and commissioning will be conducted over a relatively short period of time. It is anticipated that installation, tie-in and commissioning activities will not exceed 50 days, 20 days and 30 days respectively for all three infield pipelines. Furthermore, once installed, the pipelines will cover only a small area of the seabed. As such the residual environmental impacts associated with these activities are ranked low and are not predicted to be significant.

Table 9.18 Summary of Environmental Impact Assessment for Interfield Pipeline Installation Commissioning and Operation

ID	Activity	Environmental Aspects	Environmental Mitigation	Cumulative Contribution	Environmental Impact Significance	Justification / Comments	Residual Environmental Issues to be Addressed
E	**Infield Pipeline Installation, Commissioning and Operation**						
E1.	Installation and commissioning pipelay vessel and vessel support	Atmospheric emissions, noise, wastes, liquid discharges.	Bilge water, sewage water standards and control; All wastes shipped to shore; Waste management planning and implementation; Lay barge anchoring procedure plan.		L	As B1.	As B1 Refer to Section 9.6.1.1
E2.	Installation and tie-in of pipelines, flowlines and umbilicals	Physical seabed disturbance, physical presence.	As E1; Structural frames installed to protect wyes for tie-in.		L	As B1 Narrow pipeline corridor used. Concern over the disturbance of the benthic habitat raised during consultation.	Benthic sensitivity Refer to Section 9.6.1.2
E3.	Rectification of freespans and crossing existing lines	Physical seabed disturbance, physical presence.	As E2; Crossing supports installed to protect existing lines.		L	As E2	As E2.
E4.	Testing and commissioning (hydrotesting)	Liquid wastes.	Interfield oil lines hydrotest waters transferred to terminal for treatment and disposal; Gas line hydrotest water to be discharged offshore – careful selection of chemical additives using Chemical Selection Management system; The use of chemical additives to hydrotesting water will be challenged in line with the Project HSE Standards;		L	Discharge from gas line only and relatively low volume offshore, will disperse rapidly. Regulator concern over discharges to the Caspian.	Assurance of chemical selection management Refer to Section 9.6.1.3.
E5.	Pigging of pipelines	Solid wastes, liquid wastes	Pigging required for oil lines only. Pigging wastes sent to shore for incorporation into process or treatment/disposal as per the Waste Management Plan; Material selection and chemical use for the water injection flowlines removes the requirement for routine pigging. Use of wax inhibitor to prohibit wax build up	▲	L	Low residual impacts but cumulative waste generation issue across AzBU activities. Issue of waste management raised during consultation.	Waste treatment & disposal Refer to Section 9.6.1.4 and Section 10.2.

9.6.1.1 Vessel emissions and discharges

Up to 10 vessels will be present at the installation location during the installation and commissioning programme including the pipelay barge, anchor handling vessels, pipe haul barges and other attendant vessels. This will result in additional emissions to the atmosphere from vessel engines and exhausts and discharges to the sea of treated sewage waters and bilge waters.

With respect to effluent discharges all of these vessels will be subject to the same operational controls as described in Section 9.3.1 above in that effluents will be treated to the required project standards prior to discharge. Where vessels do not have effluent treatment facilities the effluents will be containerised then transferred to shore for disposal. The volumes of sewage waters that will be generated are shown in Table 9.19. It is assumed that each person will produce 0.22 m^3 grey water and 0.1 m^3 black water per day.

Table 9.19 Estimated Volume of Sewage During Interfield Pipeline Installation and Commissioning (m^3)

Activity	Vessels	Number Of Vessels	POB	Duration (Days)	Grey Water (m^3)	Black Water (m^3)
Pipeline installation	Lay-barge	1	210	50	2,310	1,050
	Anchor handling vessel	3	15	50	495	225
	Pipe-haul barges & tugs	4	14	25	308	140
	Diving Support vessel	1	26	15	86	39
	Survey vessel	1	26	50	286	130
Pipeline tie-in	Lay-barge	1	210	20	924	420
	Diving Support vessel	1	26	20	114	52
Pipeline commissioning	Tugs	5	30	30	990	450
TOTALS					5,513	2,506

Total emissions to the atmosphere that will be released from all vessel activity for the pipeline installation and commissioning programme, based on predicted diesel consumption rates and the duration of the activities are shown in Table 9.20.

Table 9.20 Estimated Emissions to the Atmosphere during Interfield Pipeline Installation and Commissioning (tonnes)

Activity	Duration (Days)	Emission species						
		CO_2	CH_4	CO	NO_x	SO_x[1]	PM	NMVOC
Pipeline installation	50	9,120	1	23	168	23	-	7
Pipeline tie-in	20	2,880	0	7	53	0	-	2
Pipeline commissioning	30	2,880	0	7	53	0	-	2
TOTALS		14,880	1	37	274	23	-	11

PM – Particulate Matter
NMVOC – Non-Methane Volatile Organic Compounds
[1]Based on an H_2S content in diesel of 0.8% (marine diesel)

Other vessel solid and liquid wastes will be transported to shore for disposal in accordance with the AzBU waste management plan, excluding food waste, which will be macerated and discharged overboard.

Overall the total volumes of vessel emissions and discharges during pipeline installation and commissioning activities are relatively small and will occur over a short time period. Once released in the open offshore environment they will be rapidly dispersed and diluted to ambient levels. Environmental impacts associated with discharges to sea during offshore vessel activities are therefore considered to be insignificant.

9.6.1.2 Benthic Disturbance

As with the installation of the offshore platforms and other subsea facilities (Section 9.3.1), the installation of the pipelines will also result in some disturbance to the seabed during installation and the presence of the pipelines will result in a permanent loss of seabed habitat.

The pipe-laying operation is continuous with the lay-barge moving progressively forward as sections of pipe are welded, inspected, coated on board the lay-barge and then deployed to the seabed. The barge is held in position by up to eight anchors which also provide the mechanism by which the lay-barge moves forward along the pipeline installation route. As pipe-laying proceeds, the anchors are periodically moved by two anchor handling tugs (with one more on standby). The interval at which this occurs varies but is typically between every 500 m to 600 m of pipeline length laid. The lateral anchor spread of the pipe-lay barge is typically between 600 m to 700 m either side of the pipeline.

Anchoring during pipeline installation will disturb the seabed and potentially create anchor mounds in the seabed sediments. Anchor, wire and chain drag disturbance to the seabed will be reduced by adherence to an Anchoring Management Plan that will be prepared for the installation programme. The plan will minimise the total number of anchor drops and lifts. Further, during installation the anchors will be positioned using positioning survey equipment so that correct position is achieved at first drop thereby avoiding unnecessary drops and lifts. The plan will also address the risks of damage to an existing and operating pipeline cables during lay-barge anchor handling activities.

Prior to pipeline installation a pre-lay survey will be conducted using side scan sonar and ROV to assist with the planning of the installation activities, as well as to confirm seabed data including sediment type, bathymetry and topography. The survey will also ensure that the target lay area is free of any obstacles, will map all identified subsea hazards and will confirm the position and status of all existing seabed pipelines and other subsea cables. The pipeline routes will be selected to optimise line spacing and to minimise lay-barge anchor pattern interference and risk of damage to existing lines.

The Phase 3 pipelines will need to cross existing pipelines on route to the connection point on the main Phase 1 / Phase 2 export pipelines. Concrete or steel crossing structures will be placed along the flanks of the existing pipelines so that sufficient spacing between the individual lines is provided. An acoustic transponder array will be installed at each crossing to provide positioning control during protection mattress and pipeline installation activities.

As described in Section 9.3.1, no areas of seabed sensitivity have been identified in the Phase 3 offshore location. Furthermore, the infield pipelines will not be buried which will reduce seabed disturbance and once installed will only cover a relatively small area of the seabed. These measures, along with the careful operational management designed to minimise disturbance during the installation programme, indicates that only low residual environmental impacts to the seabed will result from these infield pipelines.

The surfaces of the unburied pipelines will provide a new hard substrate for colonisation by organisms in areas where they previously would be unlikely to occur. This implies that a slight structural change in the marine faunal assemblage will result in the offshore environment through which the infield pipelines pass. The relatively short length of these pipelines would mean however, that the total new hard surface that is available for colonisation is not large and therefore, this change in faunal assemblage would not be significant.

9.6.1.3 Hydrotesting

Once in place, each pipeline will be flooded with seawater drawn from the open sea in order to test for damage and to ensure the pipeline's integrity. This pressure testing with water is known as “hydrotesting”. The water will be treated with chemicals, which are added in order to avoid any internal corrosion of the pipe whilst the seawater is in the line.

The Phase 3 30" oil export lines will be laid, flooded and tested during early 2006 and they will be dewatered by first oil in early 2008, equating to a period of two years where the lines will contain dosed water. The water will be sent to Sangachal in the Azeri 30" oil export lines.

The Phase3 28" gas export line will be dewatered and dried offshore, prior to gas export. The dosed hydrotest water will also stay in the line for two years as above.

The Phase 3 water injection flowlines will be laid and hydrotested during 2007 and dewatered in early 2008 soon after first oil. The water will be injected downhole into the water injection wells. The time water would be present in these flowlines is from 2 to 18 months.

The chemicals to be used are the same as were used in Phase 1 and are included in Table 9.20 below, together with their dose rates.

Table 9.21 Pipeline Hydrotest Water Chemicals

Chemical	Dose rate ppm	Function	Composition	OCNS Category[1]
TROSKILL 88	100	Biocide	THPS (tetrakishydroxymethylphosphonium sulphate) and quaternary ammonium	D
TROS TC 1000	300	Oxygen Scavenger	Ammonium bisulphite	E
TROS SEADYE	100	Tracer Dye	Fluorescein	E

[1]Offshore Chemical Notification Scheme. OCNS Category E is the lowest rating. Category E chemicals are of low toxicity, readily biodegradable and non-bioaccumulative.

The components of the hydrotest water have the following characteristics:

- **Oxygen scavenger:** reacts with the oxygen in the water to form sulphates. The chemical can only react with oxygen once and once the reaction is complete, the residues are harmless. The main ingredient, ammonium bisulphite has a very low toxicity and is considered to pose no risk to the environment.
- **Tracer dye:** fluorescein dye that is poorly degradable but that is highly water-soluble and does not bioaccumulate. Although it is moderately persistent, it does not present any long-term environmental hazard.
- **Biocide:** readily biodegradable product that is also not bioaccumulative. Test results have shown that THPS completely hydrolyses in seven days at pH 9. Seawater typically has a pH of 8.1. The active ingredient in the biocide, THPS, will degrade in the pipeline prior to discharge, hence discharge concentrations will be significantly lower than the dosage concentration. This is supported by evidence published by Baker Petrolite (January 2000), which indicated that only 12% of the original concentration of THPS remained in the pipeline after 80 days.

The oxygen scavenger and biocide chemicals hydrolyse and degrade almost entirely within in the pipeline, with a proportion being adsorbed on the pipeline surfaces. Used hydrotest water contains very little active oxygen scavenger and biocide.

On completion of hydrotesting the pipelines will be tied into the connector wyes and platform and subsequently dewatered. The oil pipelines will be dewatered by launching a pig from the platform driven by the Phase 3 produced oil. The water will be pushed along the pipeline and on into the Phase 1 and 2 pipelines via the connector wyes, where it will continue on to the onshore terminal, and routed with the produced water for disposal.

The infield gas pipeline will also be dewatered by launching a pig from the platform. The pig will be driven by produced gas and a glycol slug will follow the pig in front of the flowing gas. Unlike the oil pipeline, hydrotest water from the gas pipeline will be discharged to sea via a 4” valve at the connector wye on the 28” gas export pipeline. The gas will continue to flow into the Phase 1 and 2 gas pipelines and onto the onshore terminal. The total volume of hydrotest water to be discharged will be approximately 1000 m^3.

The discharged hydrotest water will contain residues of oxygen scavenger and biocide, and tracer die. Upon discharge the chemicals will disperse, not persisting in the environment in any potential harmful form.

The chemicals to be used for dosing the hydrotest water were carefully selected using a Chemical Selection Management System to ensure that the chemicals selected on the basis of lowest toxicity, using the OCNS. The chemical components were also subjected to Caspian specific toxicity tests, as follows:

- The hydrolysis, adsorption or degradation of the individual chemicals were tested over 24 hours;
- The hydrolysis, adsorption or degradation of mixtures of the selected chemicals in seawater, at the actual doses to be used, were tested over 24 hours.

The results of the tests are presented below in Tables 9.22-9.24

Table 9.22 Hydrotest Water Single Chemical Tests (EC/LC_{50}, $mg.l^{-1}$)

Type	Name	Zooplankton		Phytoplankton	
		Standard	WAF[11]	Standard	WAF[1]
Dye	TROS Seadye Fluoroscein	>5,600	1,095	672.6	1,007.3
Oxygen scavenger	TROS Oxygen Scavenger	397.5	>560	608.2	525.5
Biocide	TROSKIL 88 Biocide THPS	13.3	13.3	Approx. 1	2.10

Table 9.23 Hydrotest Package, Zooplankton Toxicity Tests (LC_{50}, $mg.l^{-1}$)

Name	Dose[2]	Standard		WAF	
		LC50 (%)[3]	Equivalent	LC50 (%)	Equivalent
TROS Oxygen Scavenger	100	4.36	4.36	4.77	4.77
TROSKIL 88 Biocide THPS	300		13.08		14.31
TROS Seadye	100		4.36		4.77

Table 9.24 Hydrotest Package, Phytoplankton Toxicity Tests (EC_{50}, $mg.l^{-1}$)

Name	Dose[2]	Standard		WAF	
		EC50 (%)	Equivalent	EC50 (%)	Equivalent
TROS Oxygen Scavenger	100	3.44	3.44	3.96	3.96
TROSKIL 88 Biocide THPS	300		10.32		11.88
TROS Seadye	100		3.44		3.96

[1] WAF refers to test preparations where the chemical or mixture was added to the sea water and allowed to equilibrate for 24 hours before the commencement of the toxicity tests.
[2] Dose refers to the manufacturer's recommended concentration in the hydrotest package. The tests were carried out on a series of percentage dilutions of this package. The 'equivalent' concentration of biocide is estimated from the dose and the 50% effects concentration.
[3] Toxicity value as a concentration of the entire fluid in seawater expressed as a percentage.

The single chemical test results show very low toxicity to both zooplankton and phytoplankton from the tracer dye and the oxygen scavenger. Phytoplankton were more sensitive than the zooplankton to the biocide: phytoplankton gave results with EC_{50} values ranging between 1 and 2.1 $mg.l^{-1}$ and zooplankton LC_{50} values of approximately 13 $mg.l^{-1}$. The tests on the whole hydrotest package (chemicals in seawater at the specified dosage) also indicated that the phytoplankton were the more sensitive: tests on standard and WAF preparations, under 'fresh' and 'aged' conditions, produced very consistent results, with the EC_{50} values for all four variants in the range of about 3.4% to 4.8%; that is, the percentage concentration of the whole package in seawater.

The above evidence confirms that no significant impact on the receiving environment will result from the discharge of the hydrotest water package tracer dye or oxygen scavenger. While phytoplankton show a higher sensitivity to the biocide, they live in the upper thermal layers of the sea whereas the hydrotest water will be released in deep water, thus avoiding contact with phytoplantkon. These factors along with the low biocide dosage rates in the hydrotest waters and the relatively small volume to be discharged from only one of the infield lines indicates that any residual impacts associated with this discharge would be low.

9.6.1.4 Pigging Wastes

During operation, the Phase 3 oil pipelines will be pigged on a regular basis to remove waxes (and sands) accumulating on the internal surfaces. Pigging will be based on experience from the Chirag platform. Each line will be pigged every 3 days. That equates to 122 times per year for each pipeline. It is calculated that the ACG lines will produce 1 te of wax and sand each, or around 250 te per year. Pigging will be from offshore to onshore via the export lines and the wax, sand and any other materials received at the terminal will be handled in accordance with the AzBU Waste Management Strategy and Azeri Project Waste Management Plan. The AzBU waste management programme is further discussed in Section 10.2.

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9.7 Terminal Engineering, Construction & Commissioning

The expansion of Sangachal terminal to provide the capacity and facilities required for the increased oil export resulting from the Phase 3 development will occur entirely within the current terminal boundaries created during the ACG Phase 1 project. These areas were partially prepared for the Phase 3 construction programme during the Early Civil Works Programme for the FFD and all areas were cleared of vegetation, mechanically graded and prepared at that time to leave the site ready for Phase 3 construction.

9.7.1 Environmental Impacts

The onshore reception facilities for Phase 3 will be located within the existing terminal boundary. Therefore there will be no impacts in terms of loss of vegetation and habitat, large-scale earthworks outside the boundaries of the terminal.

The results of the environmental impact assessment conducted for the construction and onshore commissioning of Phase 3 terminal are summarised in Table 9.25. The assessment of routine and planned non-routine activities shows that all proposed Phase 3 specific activities result in low residual significance.

Table 9.25 Summary of Environmental Impact Assessment for Terminal Engineering, Construction & Commissioning

ID	Activity	Aspects	Environmental Mitigation	Cumulative Contribution	Environmental Impact Significance	Justification / Comments	**Residual Environmental Issues to be Addressed**
F	Terminal Engineering, Construction and Commissioning						
F1.	Road transportation (equipment, materials and workforce)	Aatmospheric emissions and noise.	Vehicle maintenance as per pollution prevention procedures; Transport Management Plan.		L	Low contribution to overall air emissions from the project. Atmospheric emissions raised during consultation as a perceived concern affecting air quality on local inhabitants.	Atmospheric emissions Refer to Section 9.7.1.2
F2.	Foundation laying	Direct disturbance, atmospheric emissions; noise; vibration; dust	Use cleared and graded area already established within terminal fenceline; Dust suppression through watering down; Aggregate management.		L	Foundation and construction area already established and within existing land take. Low contribution to overall air emissions from the project Atmospheric emissions raised during consultation as a perceived concern affecting air quality on local inhabitants.	Atmospheric emissions Refer to Section 9.7.1.1 & 9.7.1.2
F3.	Construction, of structures, pipe racks, pipework, electricals, tanks, equipment interconnections.	Atmospheric emissions; noise; vibration; dust; visual impact.	As F2		L	Foundation and construction area already established and within existing land take. As F2	As F2
F4.	Tie-in to existing site services/utilities	Atmospheric emissions.	No environmental mitigation required.		L	Low contribution to overall air emissions from the project	None.
F5.	Power generation	Atmospheric emissions.	Maintenance of diesel generators; Diesel storage bunded; Optimisation of power requirements.		L	As F1	As F1
F6.	Drainage and sewage	Liquid and solid wastes	No discharge of untreated sewage waters or hazardous drains; Charcoal filters on storm water drains. Sewage sludge to approved facility		L	Use of existing system and no discharges of hazardous effluents. No residual impacts but cumulative waste generation issue across AzBU activities.	Waste treatment & disposal Refer to Section 10.2.
F7.	Support facilities (including construction camp)	Wastes.	Waste management planning and implementation.	▲	L	No residual impacts but cumulative waste generation issue across AzBU activities.	As F6.

ID	Activity	Aspects	Environmental Mitigation	Cumulative Contribution	Environmental Impact Significance	Justification / Comments	**Residual Environmental Issues to be Addressed**
F8.	Testing and Commissioning	Liquid Wastes.	Potable water, chemicals use restricted to essential components; Chemicals carefully selected using chemical management system; Re-used where possible.		L	Minimal chemical use, biodegradable chemicals selection, no direct discharge. Discharge of chemically treated waters of concern to regulators.	Refer to Section 9.7.1.4.
F9.	Onsite transportation and craneage	Atmospheric emissions; dust	Vehicle and plant maintenance as per pollution prevention procedures; Transport Management Plan; Dust suppression through watering down.		L	As F1.	As F1.

Table 9.33 shows that although there are a range of activities associated with the construction and commissioning of the Phase 3 terminal expansion, in terms of potential environmental impacts the environmental aspects of these activities are principally associated with the generation of wastes and atmospheric emissions. As discussed in Section 9.2 Construction of Offshore Facilities, a number of environmental management plans have been developed since initiation of the Phase 1 project and these apply to all activities at the terminal location. As described, these management plans contain control measures designed to minimize the environmental and social impacts of the construction programme and the Phase 3 construction contractor will be required to implement these during the construction programme. This will be monitored by AIOC.

A number of measures discussed in Section 9.2.1 for activities at the onshore fabrication yards will be applied to the same activities at the terminal. These include:

- The approach and measures for the reduction and management of wastes generated onsite. The terminal has developed a CWAA, which will be used for all construction stages and operations (Section 9.2.1) at the site.
- Transportation management measures to control the movement of materials, equipment and personnel to and from the terminal site.
- Maintenance of plant and equipment to minimise atmospheric emissions to the extent practicable.
- Storage of bulk fuels and chemicals within bunded areas.

As discussed in Section 5, the sizing of many ACG facilities as part of the Phase 1 terminal expansion programme was designed to provide for the requirement of later Phases of FFD including Phase 3. This has resulted in a reduction in the amount of new facilities and hence construction required. Some facilities constructed for Phase 1, such as the construction camp and mess facilities onsite will continue to provide for Phase 3 requirements without needing modification. Other systems, such as drainage, firewater and flare facilities will be connected to the new Phase 3 operational area via small tie-ins. Subsurface work, such as pipelines and connections will be initiated at the onset of the construction programme to provide the control systems required for the Phase 3 development, for example enabling water to enter the drainage systems and be contained for treatment.

Details of the key mitigation measures considered in the impact assessment are summarised in the following subsections together with procedures/standards/comments specific to some of the proposed activities.

9.7.1.1 Dust generation

Issues such as dust generation will not be as significant for Phase 3 compared to earlier phases, as the only earthworks required for the project involve the provision of foundations for some facilities, such as the crude oil tank. Wetting will be used in these areas to further reduce the potential for dust generation.

9.7.1.2 Atmospheric Emissions

Atmospheric emissions during terminal construction will be small. Total emissions based on the assumptions made for Phase 1 data for diesel consumption, along with the duration of the terminal expansion programme and the required plant, equipment and vehicle use are shown in Table 9.26. Power generation during the construction phase will come from the existing gas turbine generators at the terminal, and the electrical grid. In addition small, mobile diesel generators may be used.

Table 9.26 Estimated Emissions to the Atmosphere During Terminal Expansion (tonnes)

	CO2	CO	NOx	SOx[1]	CH4	NMVOC	PM
Terminal Construction (including power generation for construction and construction camp)	72,177	402	1,275	530	36	206	118

PM – Particulate Matter
[1]Based on an H_2S content in diesel of 1% average (diesel fuel).

Concentrations emitted during construction and commissioning activities for the Phase 3 terminal expansion will be low and well within air quality standards. Once released, emissions will be rapidly diluted and dispersed and no deterioration in air quality will be expected. STEP currently calculates emissions from diesel usage and conducts an air-monitoring programme at various sites within and around the terminal. This programme is likely to continue though its value will be reviewed and aligned with ongoing monitoring plans. A comprehensive air quality monitoring programme is scheduled to commence in 2004. This will be ongoing when Phase 3 construction begins.

9.7.1.3 Sewage

Sewage at the terminal is currently managed by containing the effluent and tankering this to the nearest municipal sewage treatment plant for treatment prior to disposal. Sewage sludge is collected in site septic tanks and is periodically emptied by AIOC approved contractors and transfer to the sewage treatment plant. As the Phase 3 construction location is close to existing amenities at the terminal, no new permanent facilities will be required. During the construction stage however, there will be the requirement to provide temporary, mobile toilet facilities close to some of the construction areas. These facilities will have self-contained tanks which will be regularly emptied by the approved sewage contractor for transportation to the sewage treatment plant.

At the time of writing, a sewage treatment plant was being installed at the terminal to remove the need to collect and transport sewage to an independent treatment facility. Once the system is operational it will enable the terminal to treat its own effluent to international standards, and the resulting cleaned water can be used to meet water demands for soil stabilisation and tree planting within the terminal site. The residual sewage sludge extracted from the system can be used for soil enrichment. The new sewage treatment facility will be sized for predicted operations at the terminal, including Phase 3.

9.7.1.4 Hydrotesting and Commissioning

Once constructed the Phase 3 terminal facilities will be tested and commissioned. Hydrostatic tests will be performed using potable water and in the majority of cases will not require chemicals due to the short duration of the test. When hydrostatic testing of carbon steel piping cases is required, a corrosion inhibitor solution will be added. The selected corrosion inhibitor additive is an amine carboxylate, 'VpCI 609', which is readily degradable, has a low mammalian toxicity and moderate aquatic toxicity. Details of the toxicity tests for VpCL 609 were submitted to MENR for their approval prior to use in the testing of Phase 1 facilities. These toxicological test results are as follows:

- Biodegradability in the marine environment LD50: 100%;
- No bioaccumulation potential as tested by administering 5000 mg orally (rat)[1].
- No nitrate,phosphate or heavy metal content.
- US EPA test results - M. beryllina NOEC[2] 150ppm LOEC[3]: 300 ppm;

  M. bahia NOEC 300 ppm LOEC 600 ppm.

[1] Testing performed in accordance with the Oslo Paris Commission protocol.
[2] NOEC = No Observable Effect Concentration
[3] LOEC = lowest observable effect concentration.

In common with the approach at the onshore fabrication and construction yards, hydrostatic test water will be reused wherever possible. When testing is complete the water will be directly discharged to land within the terminal. Where chemicals have been used the water will be subject to a monitoring programme to ensure representative samples are within acceptable limits. As a result, there will be no significant residual impacts associated with hydrostatic testing and subsequent discharge of test waters.

9.8 Terminal Operation

Once constructed and commissioned, the Phase 3 terminal facilities will receive commingled partially stabilised crude oil from the DWG and Azeri (Phases 1 and 2) fields (Section 5.3) and process it to remove any remaining associated gas (stabilisation), separate any residual produced water. The terminal will also receive separated gas for conditioning and export.

The stabilised oil product is routed to storage tanks before being pumped to the Baku-Tbilisi-Ceyhan (BTC) pipeline for export to markets. The majority of the gas will be treated to meet the export specification and supplied to SOCAR for input into the national grid, although some of the gas will be diverted to support power generation and other utilities at the terminal.

9.8.1 Environmental Impacts

The results of the environmental impact assessment are summarised in Table 9.27. The assessment of routine and planned non-routine activities associated with the operation of ACG terminal facilities predicted that no residual impacts or impacts of only low residual significance would result from these activities. A number of activities do however, have implications for consideration in respect to the contribution to wider impacts from Phase 3 in the context of other BP projects in the region.

Table 9.27 Summary of Environmental Impact Assessment for Terminal Operation

ID	Activity	Environmental Aspects	Environmental Mitigation	Cumulative Contribution	Environmental Impact Significance	Justification / Comments	**Residual Environmental Issues to be Addressed**
G	Terminal Operation and Maintenance						
G1.	Transportation of goods, materials and personnel	Atmospheric emissions; dust	Vehicle and plant maintenance as per pollution prevention procedures; Dust suppression through watering down. Transport management plan	▲	L	Low contribution to overall air emissions from the project and within international standards. Atmospheric emissions raised during consultation as a concern affecting air quality on local inhabitants.	None.
G2.	Process crude oil heating and fin fan cooling.	Atmospheric emissions, wastes	Temperature regulation; Regular maintenance; Dry Low (low NOx) Emission fired heaters as standard.	▲	L	Low residual impact when considered as a single activity but a cumulative contribution to ACG Phase 3 emissions as well as to the wider ACG FFD. Atmospheric emissions raised during consultation as a concern affecting air quality on local inhabitants. Issue of waste management raised during consultation.	None.
G3.	Oil storage and export	Atmospheric emissions, landscape.	Floating roof tanks with low loss fittings and secondary seals.		L	Low as minimal fugitive emissions. Atmospheric emissions raised during consultation as a concern affecting air quality on local inhabitants.	None.
G4.	Gas compression and cooling/Dew point control using propane refrigeration.	Atmospheric emissions, gas supply.	Common compressor suction manifold/header.	▲	L	Low residual impact when considered as a single activity but a cumulative contribution to ACG Phase 3 emissions as well as to the wider ACG FFD. Atmospheric emissions raised during consultation as a concern affecting air quality on local inhabitants.	None required
G5.	Flaring	Atmospheric emissions, light, heat, noise	No routine flaring to produce, only lit pilot Flare gas recovery and nitrogen purge; Flare gas metering; Smokeless Flare.	▲	L	Low as flaring due to process upsets only. Cumulative contribution to wider ACG FFD. Atmospheric emissions raised during consultation as a concern affecting air quality on local inhabitants.	Flaring policy See section 9.8.1.1
G6.	Drainage, sewage, firewater	Liquid and solid wastes;	No discharge of sewage waters or hazardous drains; Charcoal filters on storm water drains.		L	Low due to use of existing system and no discharges of hazardous effluents.	None

ID	Activity	Environmental Aspects	Environmental Mitigation	Cumulative Contribution	Environmental Impact Significance	Justification / Comments	**Residual Environmental Issues to be Addressed**
G7.	Power generation	Atmospheric emissions, noise	Regular maintenance of turbines; Optimisation of operating range; Dry Low (low NOx) Emission as standard on gas turbines; Power Management System.	▲	L	Low residual impact when considered as a single activity but a cumulative contribution to ACG Phase 3 emissions as well as to the wider ACG FFD. Atmospheric emissions raised during consultation as a concern affecting air quality on local inhabitants.	None.
G8.	Produced water generation and disposal	Liquid waste	Subject to separate evaluation.	▲	L	No residual impacts but cumulative produced water generation issue across AzBU activities. Issue of waste management raised during consultation.	Subject to separate evaluation.
G9.	Produced sand generation and disposal	Solid waste	No uncontrolled discharge of produced sand. Sand jetting/cleaning to reduce contamination.	▲	L	No residual impacts but cumulative waste generation issue across AzBU activities if CRI fails. Issue of waste management raised during consultation.	Waste management Refer to Section 10.2
G10.	Hydrogen Sulphide (H_2S)		Subject to separate evaluation.	-	-	Subject to separate evaluation.	Subject to separate evaluation.

The operation of the Phase 3 terminal facilities incorporates a number of activities ranging from logistical tasks, such as the mobilisation of personnel, equipment and resources, to operational requirements such as oil processing and gas compression. As discussed in Section 9.7, a number of facilities are already present at Sangachal Terminal that will meet the demands of the Phase 3 project, for example the CWAA, toilet, mess, accommodation, warehouses, and storage area. Furthermore, operational wastes, such as sewage effluents, clean water drainage and hazardous drainage can be collected, treated and disposed of in line with current operational practices at the terminal.

Readers are referred to Section 9.2 Onshore Fabrication of Offshore Facilities for summary details of the existing management and mitigation of any potential environmental impacts for construction. Some of these apply to operations, such as:

- The approach and measure for the reduction and management of wastes generated onsite. As with the onshore fabrication and construction sites, the terminal has developed a CWAA, which will be used for all construction stages and operations (Section 9.8) at the site.
- Transportation management measures to control the movement of materials, equipment and personnel to and from the terminal site.
- Maintenance of plant and equipment to minimise atmospheric emissions to the extent practicable.
- Storage of bulk fuels and chemicals within bunded areas.

The new ACG Phase 3 terminal process trains will operate in parallel with EOP, ACG Phase 1 and 2. Operations at the Shah Deniz gas processing plant will also be underway. As such, terminal operations cannot be considered in isolation but as cumulative to all projects. Processing and export operations will result in the cumulative contribution to atmospheric emissions and waste generation onsite. As discussed in Section 8, local scientists and the community have raised both of these issues during consultation. These are discussed in the following subsections. Health concerns raised by local residents relating to atmospheric emissions are discussed in Section 9.8.3 Socio-economic Impacts.

Details of the key mitigation measures considered in the impact assessment are summarised in the following subsections together with procedures/standards/comments specific to some of the proposed activities.

9.8.1.1 Atmospheric Emission Sources and Modelling

The main sources of air emissions at the terminal are the exhaust gases from the gas turbine generators, with diesel back up generators, and the fired heaters. Both the gas turbine generators, and the fired heaters will have Dry Low-NO_X Emission burners (DLE) to minimise NO_X emissions. Non-routine operational flaring during plant upsets will also contribute to emissions from the terminal. Under normal operating conditions however, the flare will only burn a small amount of gas to sustain the safety pilot, and the requirement to routinely flare gases from the process system will be avoided through the application of flare gas recovery. Table 9.28 presents the total estimated atmospheric emissions by species and source from Phase 3 terminal operations between 2008 and 2024.

At present, it is uncertain as to the exact souring mechanism in the ACG reservoirs, whether from Sulphur reducing bacteria or through a naturally sour aquifer, consequently absolute prediction of concentrations is not available. Historically, for the Azeri Project, 500ppm H_2S has been used as the blended gas concentration as a worst-case scenario for design. ACG FFD Air Dispersion Modelling was carried out for Phase 2 ESIA based on this assumption and this showed that there were no exceedences in air quality standards for SO_2 at nearby receptors. Full results of this can be accessed in the ACG Phase 2 ESIA.

Recent studies show 45ppm to 200ppm as a more realistic concentration. Current reservoir information indicates that H_2S is shown around the oil water contact layer, however the Chirag field currently remains sweet. Further data is now becoming available and will result in a full field review of the design requirements for potential H_2S handling. A strategy will be developed and best choice of technology made considering the future souring potential, environmental impact and end product disposal.

Souring of the reservoir that could occur due to the injection of seawater into the reservoir may be mitigated offshore by the use of liquid scavenger injection. However this will be subject to a separate evaluation when more information is available on amount of H_2S likely to present and timing that this will occur.

The fuel gas that will be used in the power generators and fired heaters will be derived from the produced gas delivered to the terminal by the 28" gas subsea export pipeline. Emissions per year are shown in Figures 9.3 and 9.4. As the level of H_2S in the DWG reservoir remains uncertain SO_2 emissions are not currently predicted for Phase 3.

Table 9.28 Forecast Atmospheric Emissions by Species and Source from Phase 3 Terminal Operations (2008 – 2024) (tonnes)

	CO_2	CO	NO_X	CH_4	VOC
Combustion:	2,744,302	1,567	4,516	410	370
Flaring:	238,398	511	65	589	589
Total:	**2,982,700**	**4,581**	**2,078**	**999**	**959**

Figure 9.3: Estimated Total Emissions by Species, Onshore Operations (tonnes)

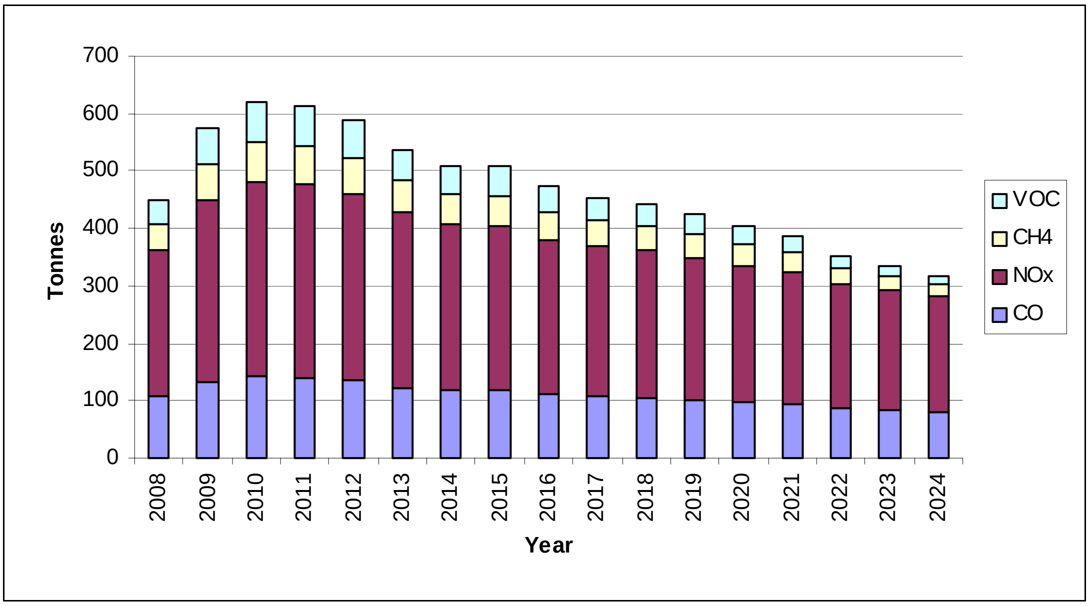
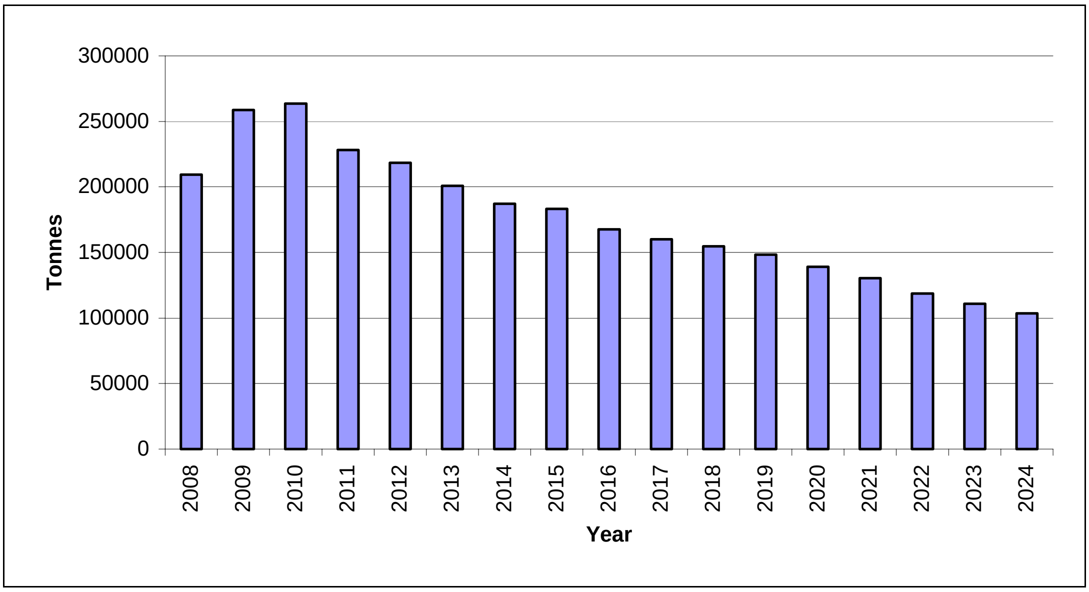


Figure 9.4: Estimated Total CO_2 Emissions, Onshore Operations (tonnes)



As discussed, flaring (excluding purge gas and the pilot light flare) will only be undertaken during operational upsets and emergency situations. Under these scenarios, the majority (estimated at 86%) of flaring will be undertaken preferentially offshore with the balance (estimated at 14%) being undertaken at the onshore terminal. Emissions resulting from operational upset flaring including start-up years (first two years), when availability of plant will be less, have been accounted for in the above estimates.

The onshore environment around the terminal site includes sensitive human receptors (Section 6 Environmental Description). As such, air dispersion modelling was carried out for future developments including ACG Phase 1, 2 and 3 and Shah Deniz Gas Export Stage 1 to ensure that the proposed developments would not exceed the internationally recognised air quality standards and guidelines. The full modelling report, ACG FFD Phase 3 and Shah Deniz Air Dispersion Modelling is presented at Appendix 11 to this ESIA report.

Scenarios were designed to model a number of aspects for planned routine operations at Sangachal terminal from EOP operation through to the operation of EOP, ACG phase 1, 2 and 3, and Shah Deniz. Emissions of nitrogen dioxide (NO_2) and carbon monoxide (CO) were modelled to give a forecast of air quality in the area. Sulphur dioxide (SO_2) was not modelled because of the reasons noted above.

Combustion of fuel gas at the terminal will result in the emission of principally carbon dioxide (CO_2) and water vapour, together with carbon monoxide (CO) and oxides of nitrogen (NO_X) in smaller quantities. These latter emissions have the potential to affect human health and vegetation in the vicinity of the plant. The modelling study therefore focused on the potential to impact local air quality as a result of emission of the NO_X and CO species.

NO_X emitted from the combustion source comprises a mixture of the relatively low toxicity nitric oxide (NO) and the more toxic nitrogen dioxide (NO_2). The majority of NO_X produced from a combustion process is in the form of NO. The NO is converted to NO_2 by oxidation in the presence of ozone and sunlight in the atmosphere. In accordance with standard practice (DETR, 2000[1]), the dispersion modelling conservatively assumed that 50% of the NO_X would be present in the form of $NO_{2,}$ and it is the NO_2 concentration that has been modelled.

At the terminal ACG Phase 1 requires dual fuel turbines for start up capabilities, with the option is to retrofit DLE NO_X at a later date. ACG Phase 2 has DLE low-NOx turbines and ACG Phase 3 will fit DLE NO_X turbines as standard. For purposes of the modelling it has been assumed that after the start up of ACG Phase 2, the DLE gas turbines will be used preferentially. The number of gas turbines used in the model reflects the power requirements for the period modelled.

Scenarios modelled were those when emissions are likely to be highest, ie. during start up and at peak production:

- EOP, ACG Phase 1, 2, Shah Deniz in normal operation plus ACC Phase 3 start up (2008);
- EOP, ACG Phase 1, 2, 3 and Shah Deniz in normal operation (2010), at peak production.

In addition, emergency shutdown (ESD) scenarios were modelled. The ACG and Shah Deniz facilities do not share a common flare system and are independent processing operations and therefore, the chance of both facilities going into an ESD is extremely unlikely. As such, the modelling has taken into account the possibility of emergency flaring from ACG FFD Phase 1, 2 and 3 and EOP only or from Shah Deniz only. The following worst case scenarios were modelled:

- EOP, ACG Phase 1, 2, 3 and Shah Deniz operation with the addition of Emergency Shut Down (ESD) of ACG FFD via elevated flare at a rate of 100 MMscfd for 1 hour;[2]
- ACG Phase 1, 2, 3 EOP and Shah Deniz operation with the addition of ESD of Shah Deniz via ground flare at a rate of 990 MMscfd.[1]

The scenarios listed above were modelled and the resulting NO_2 and CO emission species' concentrations were compared to internationally accepted air quality standards and guidelines as presented in Table 9.29 below.

Table 9.29 International Standards and Guidelines of Air Quality

Pollutant	Air Quality Objectives		
	Concentration ($\mu g/m^3$)	Averaging Period	International Standard/Guideline
Nitrogen Dioxide	200	1 hour mean (99.8%ile)	WHO, EC, UK
	150	24 hour average	WHO, World Bank
	40	Annual mean	WHO, EC, UK
Carbon Monoxide	30,000	I hour mean	WHO, EU, UK
	10,000	8 hour rolling average	WHO

NB 99.8%ile = standard not to be exceeded more than 18 times per year.

1 DETR 2000, Review and Assessment of Pollutants. Specification Guidance TG4 (00).
2 The design rate for both flares are for emergency shut downs. This rate will only last for a few minutes and will decay exponentially. For modelling purposes the full blow down rate was assumed to last for one hour.

The model calculated hourly, daily and annual averages. CO standards include an 8-hour averaging period but the hourly average was selected as the critical standard for comparison.

Modelling results for the above four scenarios (two routine and two unplanned) are presented in Tables 9.30 through 9.34 below. The tables and figures are arranged as follows:

- ACG Phases 1, 2, EOP and Shah Deniz in Normal Operation and Phase 3 in Start-Up (2008); Table (a) NO2 with isopleths and (b) CO;
- ACG Phases 1, 2 and 3, EOP and Shah Deniz in Normal Operation (2010); Table (a) NO2 with isopleths and (b) CO;
- ACG Phase 1, 2, 3 EOP and Shah Deniz Operation with the Addition of Emergency Shut Down of ACG FFD via Elevated Flare at a Rate of 100 MMscfd for 1 Hour; Table (a) NO2 with isopleths and (b) CO;
- ACG Phase 1, 2, 3 EOP and Shah Deniz Operation with the Addition of Emergency Shut Down of Shah Deniz via Ground Flare at a rate of 900 MMscfd; Table (a) NO2 with isopleths and (b) CO .

The spatial distribution of the predicted concentrations of NO_2 and CO is presented as a series of isopleths in corresponding diagrams to the tables (Figures 9.5 through 9.8). The plots present the results for hourly mean predictions of NO_2 for the scenarios modelled. The background concentration in the area was added to the predicted Process Contribution (PC) from the terminal to give a Predicted Environmental Concentration (PEC), which was then compared to the relevant Air Quality Standard (AQS) for NO_2 and CO concentrations. The full results of the modelling are presented in Appendix 9 to this report. Table 9.30 below presents the measured background (ambient) levels of NO_2 at nearby sensitive receptors. It is noted that no measurements were taken for CO.

Table 9.30 Baseline Data for Nitrogen Dioxide (NO_2) at Nearby Sensitive Receptors

Background concentrations	Hourly μgm^{-3}	Annual μgm^{-3}
Terminal	6	3
Sangachal Town	8	4
Pipeline Landfall	4	2
Cement Camp	6	4

Table 9.31(a) ACG Phases 1, 2, EOP and Shah Deniz in Normal Operation and Phase 3 in Start-Up (2008) – Concentrations of NO_2

Receptor	Air Quality Std. *ugm^{-3}*	Back ground *ugm^{-3}*	Process Contribution *ugm^{-3}*	Total Concentration *ugm^{-3}*	Compliant yes/no
Maximum hourly average					
Cement camp	200	6.0	81.9	87.9	yes
Sangachal Town	200	8.0	65.7	73.7	yes
West Hill herders	200	6.0	34.9	40.9	yes
Cheyildag	200	6.0	65.9	71.9	yes
Peak	200	8.0	91.2	99.2	yes
Maximum 24 hr Average					
Cement camp	150	na	23.0	na	na
Sangachal Town	na	na	26.0	na	na
West Hill herders	na	na	18.6	na	na
Cheyildag	na	na	26.0	na	na
Peak	na	na	33.5	na	na
Forecast Annual Average					
Cement camp	40	4.0	0.7	4.7	yes
Sangachal Town	40	3.0	1.4	4.4	yes
West Hill herders	40	3.0	1.4	4.4	yes
Cheyildag	40	3.0	1.1	4.1	yes
Peak	40	4.0	2.3	6.3	yes

Figure 9.5(a) Isopleths for ACG Phases 1, 2, EOP and Shah Deniz in Normal Operation and Phase 3 in Start-Up (2008) – Hourly Concentrations of NO_2

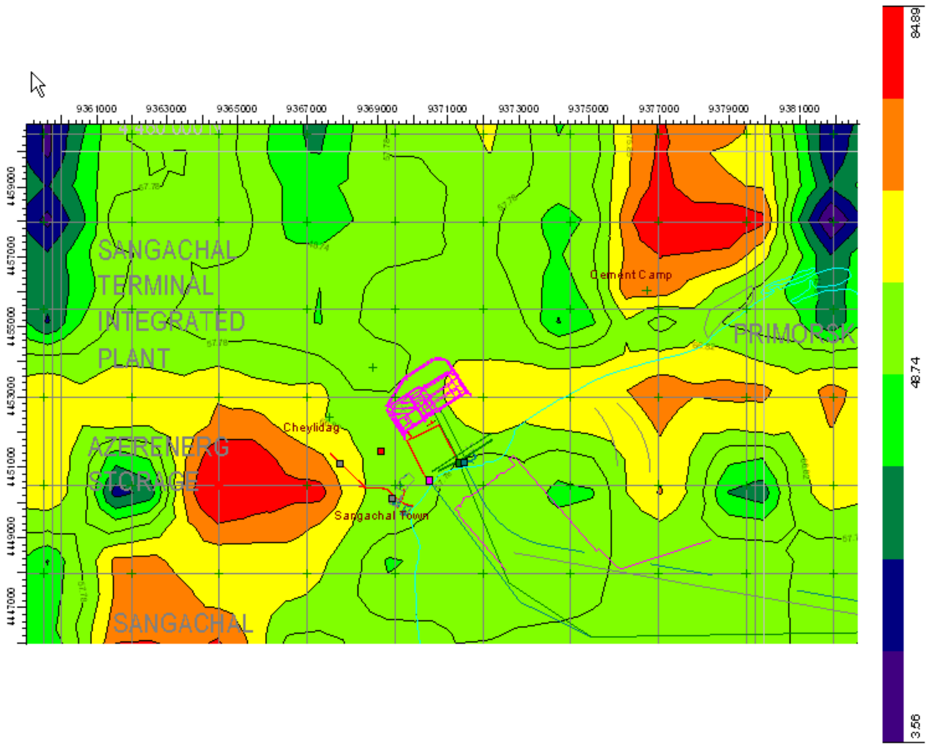


Figure 9.5(b) Isopleths for ACG Phases 1, 2, EOP and Shah Deniz in Normal Operation and Phase 3 in Start-Up (2008) – Hourly Concentrations of CO

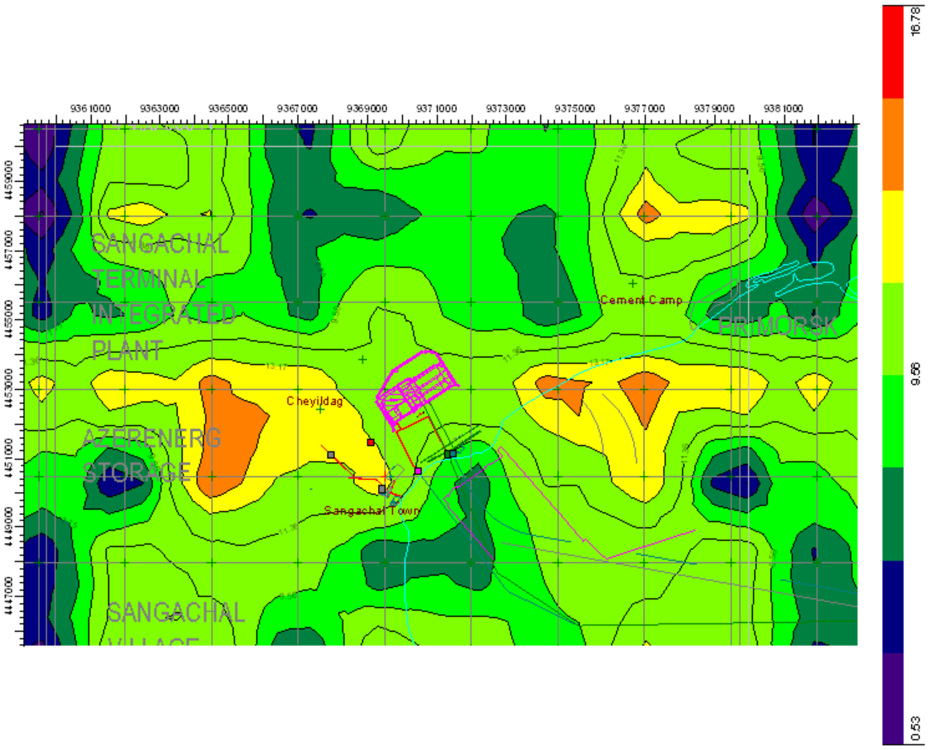


Table 9.32(a) ACG Phases 1, 2 and 3, EOP and Shah Deniz in Normal Operation (2010) – Concentrations of NO_2

Receptor	Air Quality Std. *ugm^{-3}*	Back ground *ugm^{-3}*	Process Contribution *ugm^{-3}*	Total Concentration *ugm^{-3}*	Compliant yes/no
			Maximum hourly average		
Cement camp	200	6.0	83.6	93.6	yes
Sangachal Town	200	8.0	67.7	71.7	yes
West Hill herders	200	6.0	34.9	40.9	yes
Cheyildag	200	6.0	66.1	72.1	yes
Peak	200	8.0	93.9	101.9	yes
			Maximum 24 hr Average		
Cement camp	150	na	24.2	na	na
Sangachal Town	na	na	26.2	na	na
West Hill herders	na	na	18.6	na	na
Cheyildag	na	na	26.6	na	na
Peak	na	na	34.6	na	na
			Forecast Annual Average		
Cement camp	40	4.0	0.8	4.8	yes
Sangachal Town	40	3.0	1.5	4.5	yes
West Hill herders	40	3.0	1.5	4.5	yes
Cheyildag	40	3.0	1.2	4.2	yes
Peak	40	4.0	2.4	6.4	yes

Figure 9.6(a) Isopleths for ACG Phases 1, 2 and 3, EOP and Shah Deniz in Normal Operation (2010) – Hourly Concentrations of NO_2

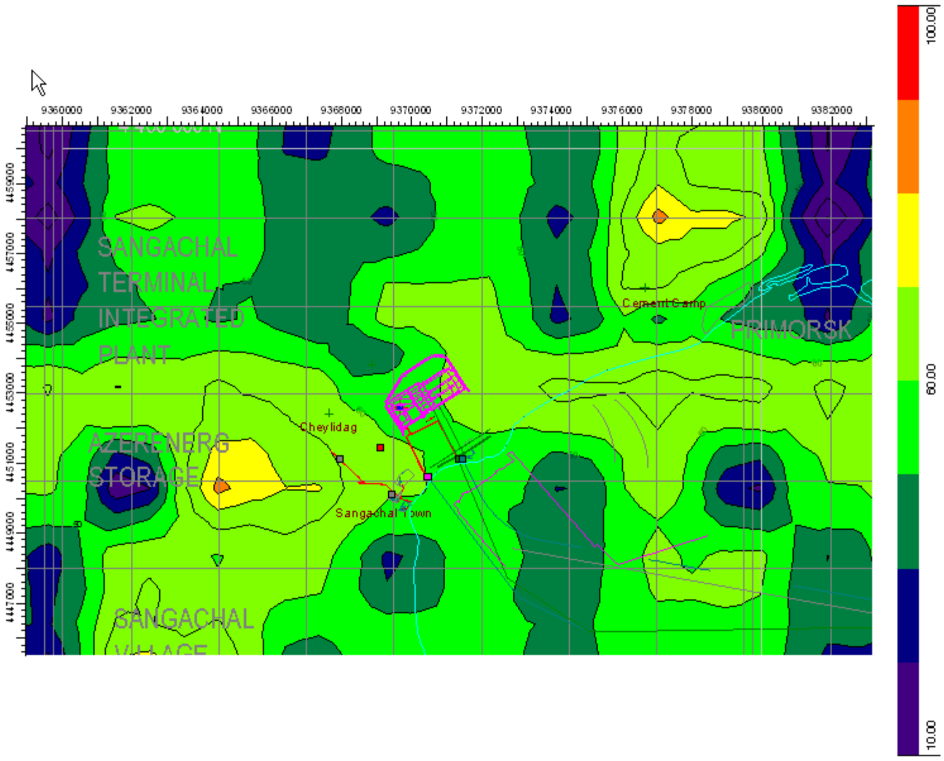


Figure 9.6(b) Isopleths for ACG Phases 1, 2 and 3, EOP and Shah Deniz in Normal Operation (2010) – Hourly Concentrations of CO

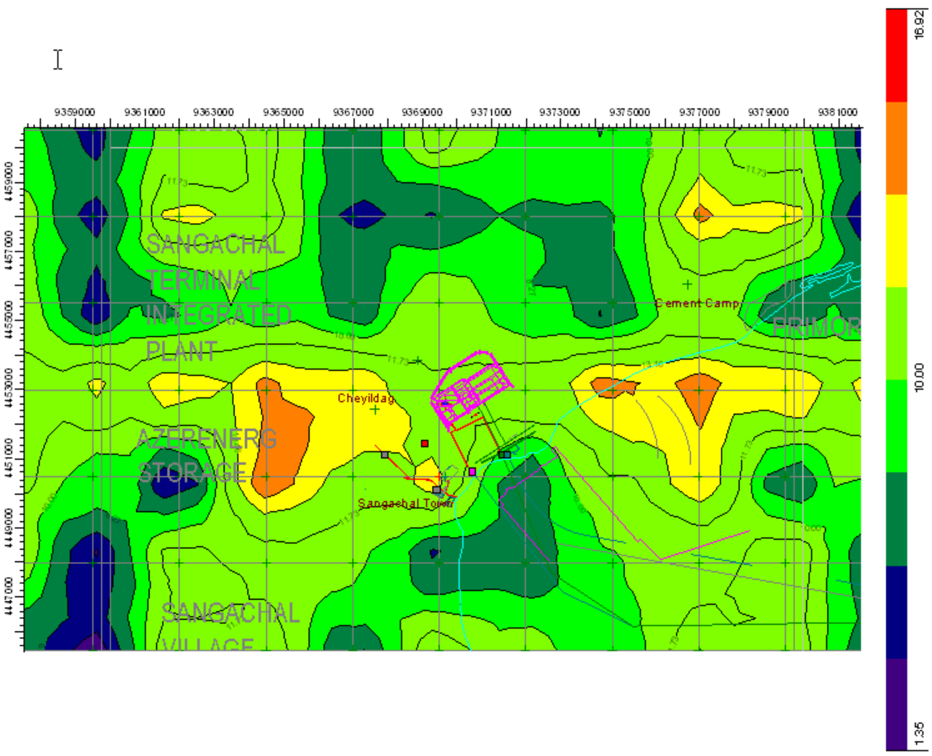


Table 9.33(a) ACG Phase 1, 2, 3 EOP and Shah Deniz Operation with the Addition of Emergency Shut Down of ACG FFD via Elevated Flare at a Rate of 100 MMscfd for 1 Hour – Concentrations of NO_2

Receptor	Air Quality Std. *ugm^{-3}*	Back ground *ugm^{-3}*	Process Contribution *ugm^{-3}*	Total Concentration *ugm^{-3}*	Compliant yes/no
Maximum hourly average					
Cement camp	200	6.0	83.7	93.7	yes
Sangachal Town	200	8.0	67.7	71.7	yes
West Hill herders	200	6.0	34.0	40.0	yes
Cheyildag	200	6.0	66.1	72.1	yes
Peak	200	8.0	93.9	101.9	yes
Maximum 24 hr Average					
Cement camp	150	na	24.2	na	na
Sangachal Town	na	na	26.2	na	na
West Hill herders	na	na	18.6	na	na
Cheyildag	na	na	26.7	na	na
Peak	na	na	34.6	na	na
Forecast Annual Average					
Cement camp	40	4.0	0.8	4.8	yes
Sangachal Town	40	3.0	1.5	4.5	yes
West Hill herders	40	3.0	1.5	4.5	yes
Cheyildag	40	3.0	1.2	4.2	yes
Peak	40	4.0	2.4	6.4	yes

Figure 9.7(a) Isopleths for ACG Phase 1, 2, 3 EOP and Shah Deniz Operation with the Addition of Emergency Shut Down of ACG FFD via Elevated Flare at a Rate of 100 MMscfd for 1 Hour – Hourly Concentrations of NO_2

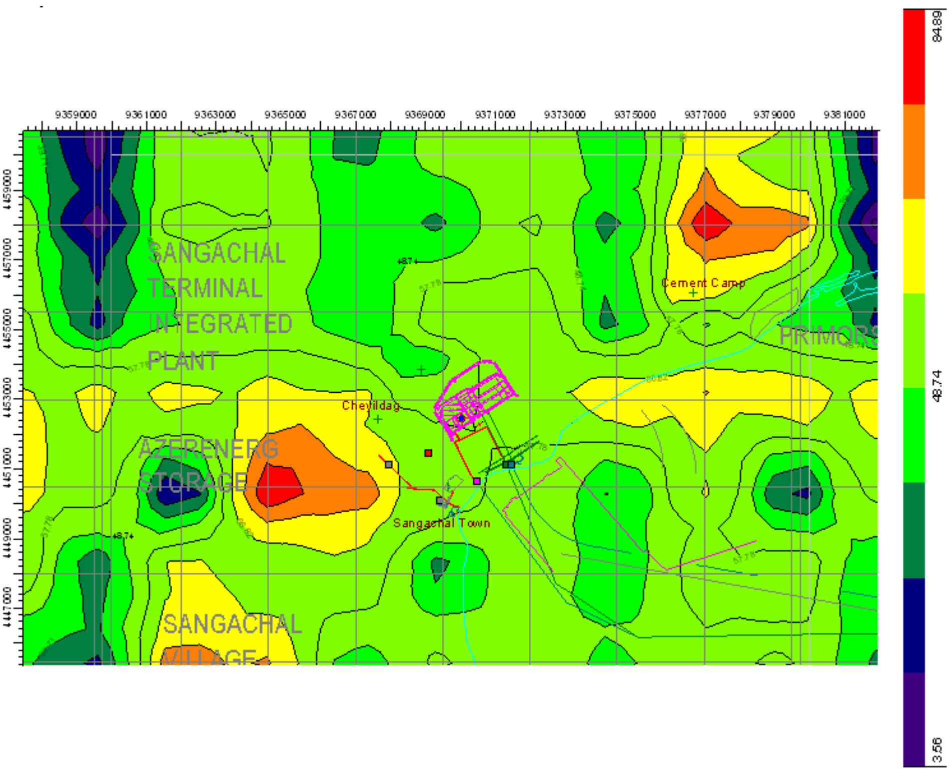


Figure 9.7(b) Isopleths for ACG Phase 1, 2, 3 EOP and Shah Deniz Operation with the Addition of Emergency Shut Down of ACG FFD via Elevated Flare at a Rate of 100 MMscfd for 1 Hour – Hourly Concentrations of CO

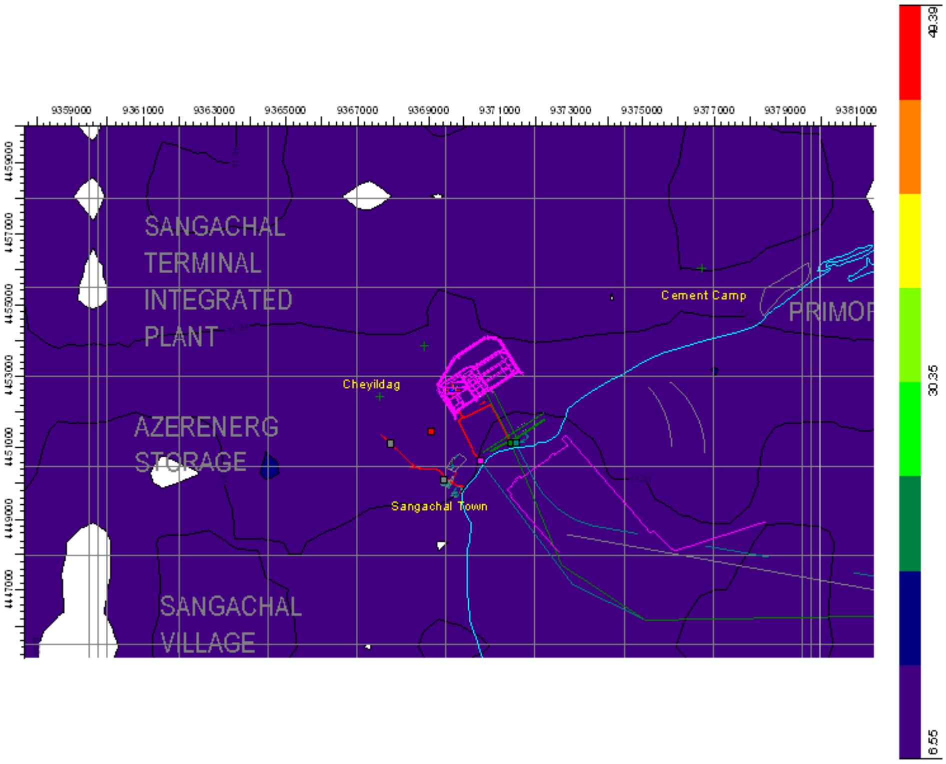


Table 9.34(a) ACG Phase 1, 2, 3 EOP and Shah Deniz Operation with the Addition of Emergency Shut Down of Shah Deniz via Ground Flare at a rate of 900 MMscfd –Concentrations of NO_2

Receptor	Air Quality Std. *ugm^{-3}*	Back ground *ugm^{-3}*	Process Contribution *ugm^{-3}*	Total Concentration *ugm^{-3}*	Compliant yes/no
			Maximum hourly average		
Cement camp	200	6.0	83.7	93.7	yes
Sangachal Town	200	8.0	67.7	71.7	yes
West Hill herders	200	6.0	34.9	40.9	yes
Cheyildag	200	6.0	66.1	72.1	yes
Peak	200	8.0	94.0	102.0	yes
			Maximum 24 hr Average		
Cement camp	150	na	24.2	na	na
Sangachal Town	na	na	26.2	na	na
West Hill herders	na	na	18.6	na	na
Cheyildag	na	na	26.7	na	na
Peak	na	na	34.7	na	na
			Forecast Annual Average		
Cement camp	40	4.0	0.8	4.8	yes
Sangachal Town	40	3.0	1.5	4.5	yes
West Hill herders	40	3.0	1.5	4.5	yes
Cheyildag	40	3.0	1.2	4.2	yes
Peak	40	4.0	2.4	6.4	yes

Figure 9.8(a) Isopleths for ACG Phase 1, 2, 3 EOP and Shah Deniz Operation with the Addition of Emergency Shut Down of Shah Deniz via Ground Flare at a rate of 900 MMscfd – Hourly Concentrations of NO_2

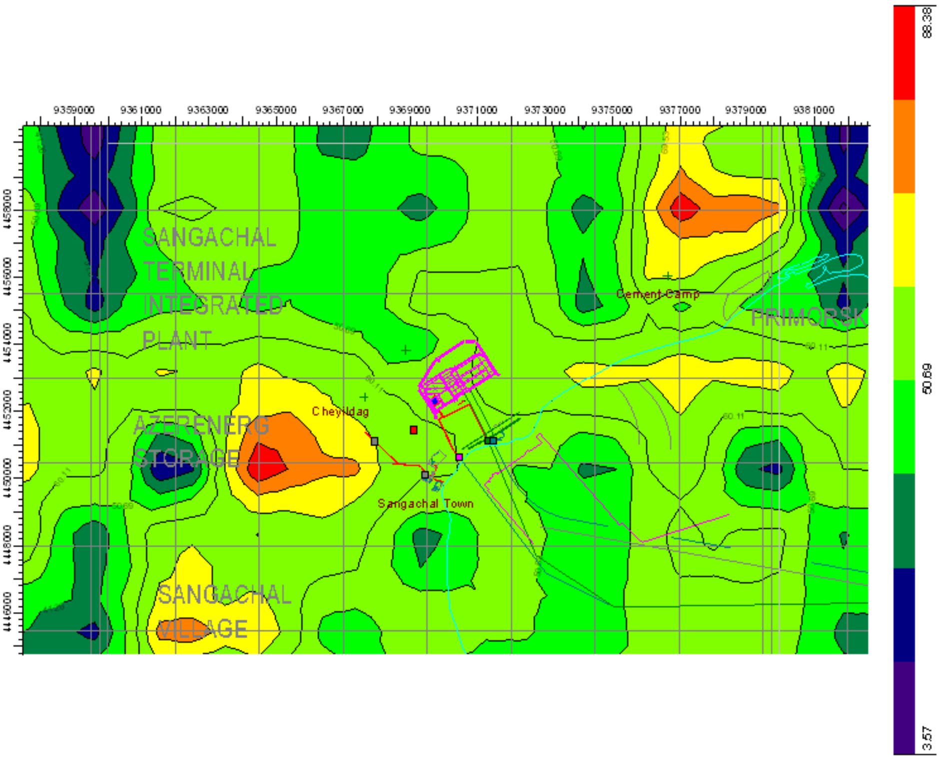


Figure 9.8(b) Isopleths for ACG Phase 1, 2, 3 EOP and Shah Deniz Operation with the Addition of Emergency Shut Down of Shah Deniz via Ground Flare at a rate of 900 MMscfd – Hourly Concentrations of CO

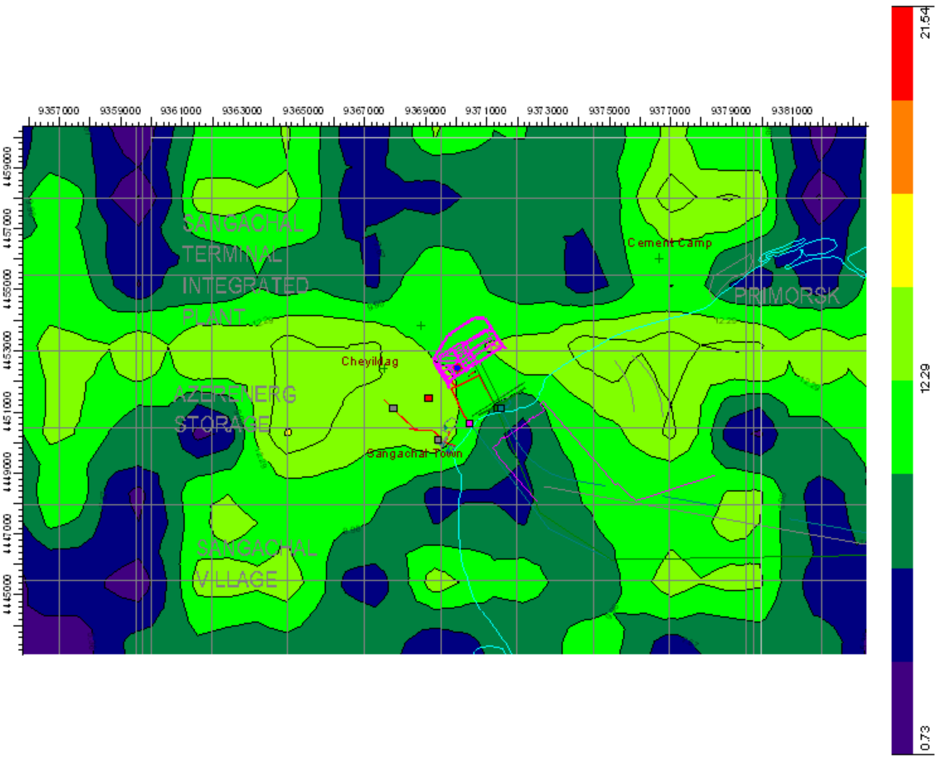


Table 9.31(b) ACG Phase 1, 2, EOP and Shah Deniz in Normal Operation with ACG Phase 3 Start-Up (2008) – Concentrations of CO

Receptor	Air Quality Std. ugm^{-3}	Back ground ugm^{-3}	Process Contribution ugm^{-3}	Compliant yes/no
Maximum hourly average				
Cement camp	30,000	na	11.9	yes
Sangachal Town	30,000	na	9.1	yes
West Hill herders	30,000	na	11.3	yes
Cheyildag	30,000	na	14.7	yes
Peak	30,000	na	17.0	yes
Maximum 24 hr Average				
Cement camp	na	na	3.3	na
Sangachal Town	na	na	3.3	na
West Hill herders	na	na	5.6	na
Cheyildag	na	na	5.4	na
Peak	na	na	7.0	na

Table 9.32(b) ACG Phase 1, 2, 3 EOP and Shah Deniz in Normal Operation (2010) – Concentrations of CO

Receptor	Air Quality Std. ugm^{-3}	Back ground ugm^{-3}	Process Contribution ugm^{-3}	Compliant yes/no
Maximum hourly average				
Cement camp	30,000	na	12.0	yes
Sangachal Town	30,000	na	9.1	yes
West Hill herders	30,000	na	11.3	yes
Cheyildag	30,000	na	14.7	yes
Peak	30,000	na	17.0	yes
Maximum 24 hr Average				
Cement camp	na	na	3.4	na
Sangachal Town	na	na	3.3	na
West Hill herders	na	na	5.6	na
Cheyildag	na	na	5.4	na
Peak	na	na	7.0	na

Table 9.33(b) ACG Phase 1, 2, 3 EOP and Shah Deniz in Normal Operation with Addition of Emergency Shut Down of ACG FFD via Elevated Flare at a rate of 100MMscfd for 1 hour – Concentrations of CO

Receptor	Air Quality Std. *ugm^{-3}*	Back ground *ugm^{-3}*	Process Contribution *ugm^{-3}*	Compliant yes/no
Maximum hourly average				
Cement camp	30,000	na	12.1	yes
Sangachal Town	30,000	na	9.1	yes
West Hill herders	30,000	na	11.3	yes
Cheyildag	30,000	na	14.8	yes
Peak	30,000	na	17.0	yes
Maximum 24 hr Average				
Cement camp	na	na	3.6	na
Sangachal Town	na	na	3.3	na
West Hill herders	na	na	5.6	na
Cheyildag	na	na	5.5	na
Peak	na	na	7.1	na

Table 9.34(b) ACG Phase 1, 2, 3 EOP and Shah Deniz in Normal Operation with Addition of Emergency Shut Down of Shah Deniz via Ground Flare at a Rate of 990 MMscfd – Concentrations of CO

Receptor	Air Quality Std. *ugm^{-3}*	Back ground *ugm^{-3}*	Process Contribution *ugm^{-3}*	Compliant yes/no
Maximum hourly average				
Cement camp	30,000	na	12.4	yes
Sangachal Town	30,000	na	9.1	yes
West Hill herders	30,000	na	11.3	yes
Cheyildag	30,000	na	14.9	yes
Peak	30,000	na	17.4	yes
Maximum 24 hr Average				
Cement camp	na	na	3.7	na
Sangachal Town	na	na	3.3	na
West Hill herders	na	na	5.6	na
Cheyildag	na	na	5.5	na
Peak	na	na	7.3	na

The modelling of onshore air emissions determined that, while considerable in terms of volume, local air currents would ensure that dispersion of the emission plumes would be such that under all plant conditions (i.e. normal operation and emergency/upset worst case flaring conditions) air quality, including NO_2 and CO, would be within the cited air quality standards. As such, impacts on human health would not be expected. On this basis, the operation of the terminal is not considered to constitute a significant environmental impact in regards deteriorating local air quality. BP is currently conducting a one-year atmospheric monitoring programme within the terminal boundary and at various external sites surrounding the facility. At the completion of this monitoring programme monitoring will continue as appropriate under the IMP. The data obtained from the monitoring will be used to support modelling results and assist in facility management at the terminal.

Phase 3 onshore terminal operations will also result in considerable emissions of CO_2 being released to the atmosphere and these would also be in addition to the Phase 1 and 2, EOP and Shah Deniz emissions from both onshore and offshore operations. The CO_2 contribution from the combined operations is considered to represent an appreciable GHG contribution and hence is considered to be of significance. CO_2 emissions are further discussed in Section 9.9.

9.8.1.2 Wastes

As with the onshore fabrication and construction sites, the terminal has developed a CWAA, which will be used for all construction stages and operations (Section 9.2.1) at the site.

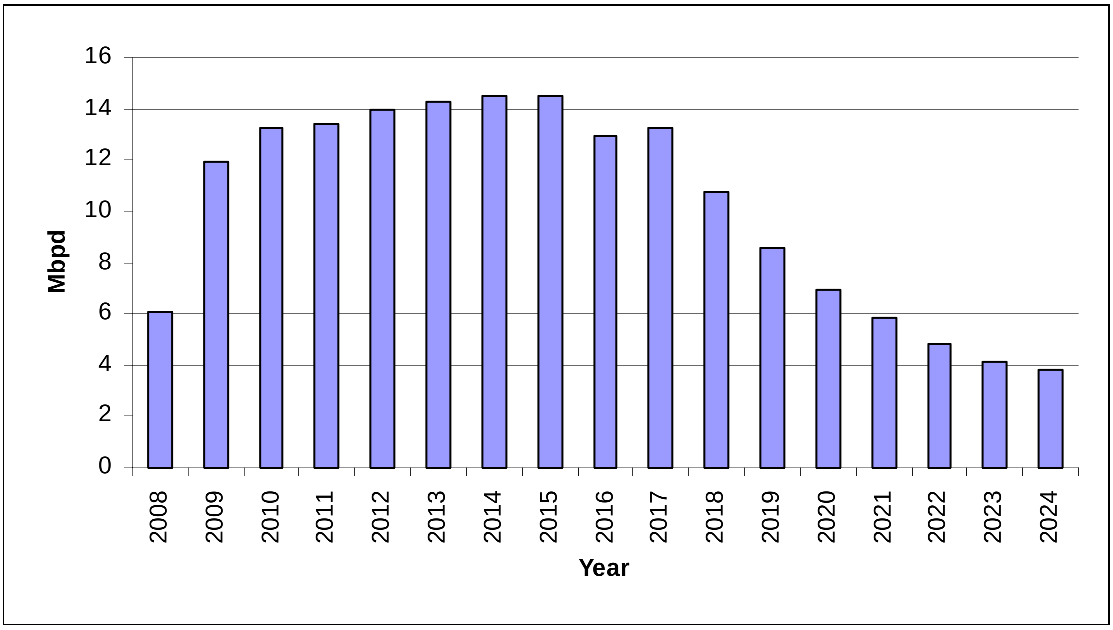
The cumulative contribution to waste generation and the final disposal of these wastes in Azerbaijan is an AzBU managed issue and is discussed in more detail in Section 10.

A key waste issue is onshore produced water. The management of onshore produced water has been an area of considerable investigation by AIOC. As this issue relates to all phases of the ACG FFD it is discussed more fully in Section 10.

The ACG Phase 3 project has taken steps to minimise the volume of produced water that will be transferred with oil to the terminal reception facilities. This includes an enhanced offshore water separation process (i.e. addition of electrostatic coalescers) that will minimise the water cut of the oil transported to shore to 0.5%[1]. The volumes of Phase 3 produced water that require ultimate disposal onshore are thus significantly minimised. This reduction in water cut also brings with it other associated benefits such as reduction in chemicals required offshore to aid the separation and export process, and more room in the export pipelines to shore for oil during peak production periods.

Figure 9.9 illustrates the predicted volumes of produced water that will be transferred to the terminal with the Phase 3 crude oil, which shows that volumes will peak at approximately 14.5 Mbpd in 2015.

Figure 9.9 Predicted Phase 3 Produced Water Volumes Onshore (Mbpd)



The disposal of any produced water at the terminal from Phase 3 operations will align with the disposal solution defined for the ACG FFD. Produced water volumes associated with the

[1] It should be noted that the inclusion of coalescers into the offshore design for previous ACG project phases was evaluated but could not be included due to weight and space constraints for these topsides. As such oil transported from the ACG Phase 1 and 2 offshore facilities will contain a maximum water cut of 5%.

Chirag-1 platform (EOP) are currently being transferred to the Garadagh Cement Plant north of the terminal site for use in the cement manufacture process. This solution however will handle limited volumes only, and as such a produced water management strategy is being formulated to address the higher volumes of produced water that are predicted from the ACG and Shah Deniz fields in 2007. Currently there are three long-term disposal options under evaluation by AIOC and AzBU:

- Disposal to a dedicated injection well at the Lokbatan onshore oilfield;
- Subsea pipeline back to ACG Field and re-injection via existing offshore facilities;
- Treatment and disposal to the marine environment at a suitable distance offshore.

Evaluation of the above options is continuing to assess the equipment, design, cost and potential environmental impacts to determine a preferred final option to pursue. The final decision will be subject to a separate Environmental and Social Impact Assessment, and will require review and approval by the Ministry of Ecology and Natural Resources.

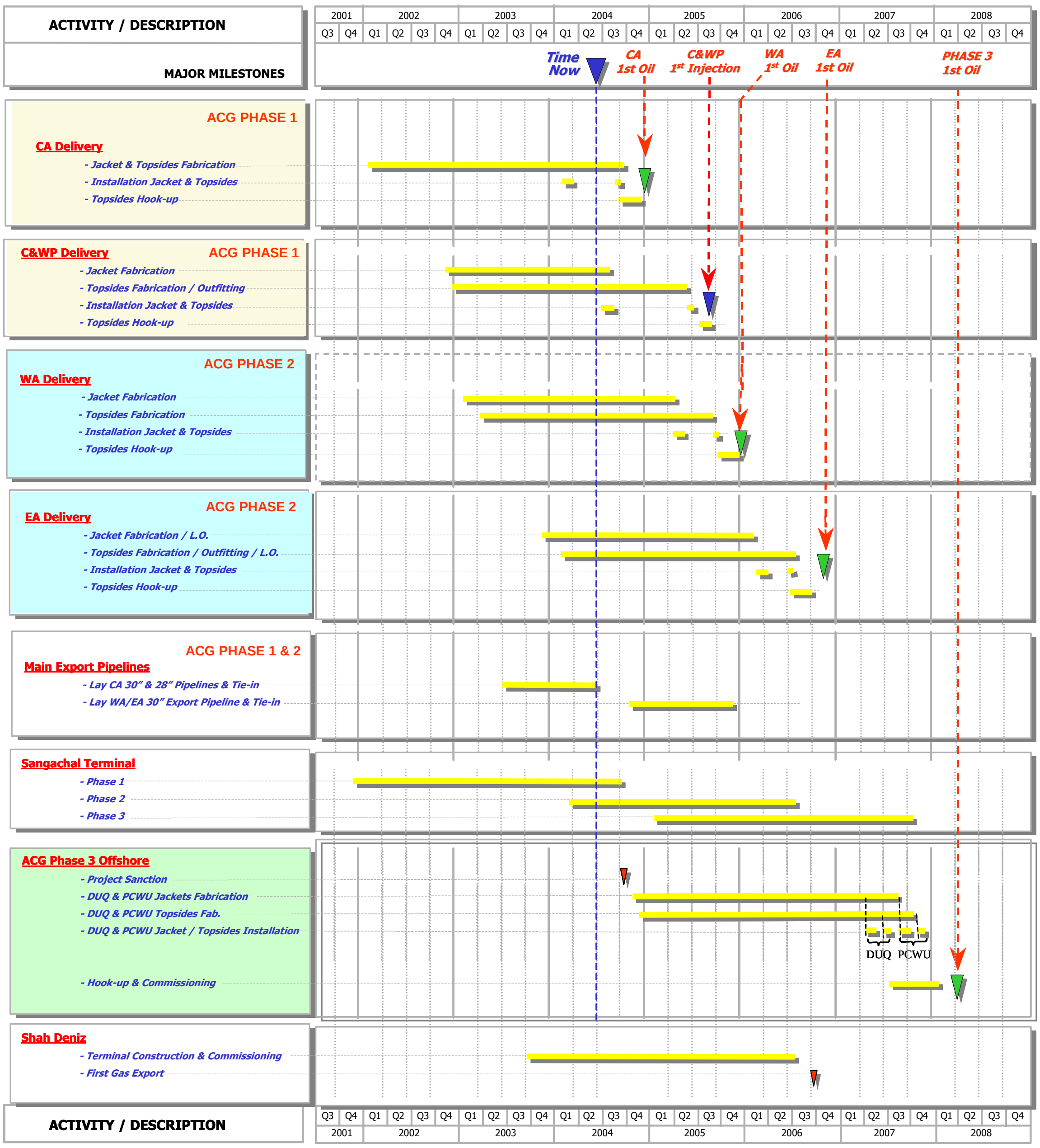
9.9 Cumulative Environmental Impacts

9.9.1 Introduction

As discussed in the Introduction (Section 1), there are a number of existing and planned oil field activities in Azerbaijan, including developments in offshore waters. Of these, the only field currently in operation by the Azerbaijan International Oil Operating Company (AIOC) is the ACG Early Oil Project (EOP) with production from the Chirag-1 platform conveyed to the EOP terminal at Sangachal. Remaining offshore activities in the area are operated by SOCAR, with the Shallow-Water Gunashli, situated adjacent to the Phase 3 Deep-Water Gunashli tract in the Contract Area and Oil Rocks located to the northwest.

In terms of AIOC and BP projects, ACG Phase 1 and Phase 2 are currently in the early stages of onshore construction and offshore installation and pre-drilling. The construction activities are ongoing at the Sangachal terminal, Shelfprojectstroi (SPS) fabrication yard and Bibiheybat oil field. These activities are described in the ACG Phase 1 and Phase 2 ESIA documents (URS, 2000; RSK 2001). In addition, the Shah Deniz project is currently in the early stages of site upgrading and fabrication. These activities are ongoing at the Bibiheybat oil field. The proposed schedule for these projects in relation to ACG Phase 3, is provided in Figure 9.10 below.

Figure 9.10 Proposed Schedule for Projects Concurrent with ACG Phase 3



On consideration of these projects, there is the potential for cumulative impacts to occur. As discussed in Sections 3 and 9.1, cumulative impacts are those that may result from the combined or incremental effects of past, present or future activities. While a single activity may in itself, result in an insignificant impact, it may, when combined with other impacts (insignificant or significant) in the same geographical area and occurring at the same or similar time, result in a cumulative impact that may have a detrimental effect on important resources. Cumulative impacts such as potential increases in transportation, noise, social or socio-economic effects, have been discussed within the previous sections in relation to the activity, whether onshore construction, pre-drilling or platform operations. In addition, considerable attention has been paid to the cumulative effect of activities during the ACG Phase 1 ESIA Chapter 12 to include drill cuttings; physical presence and biological effects of discharges and these have not been repeated here.

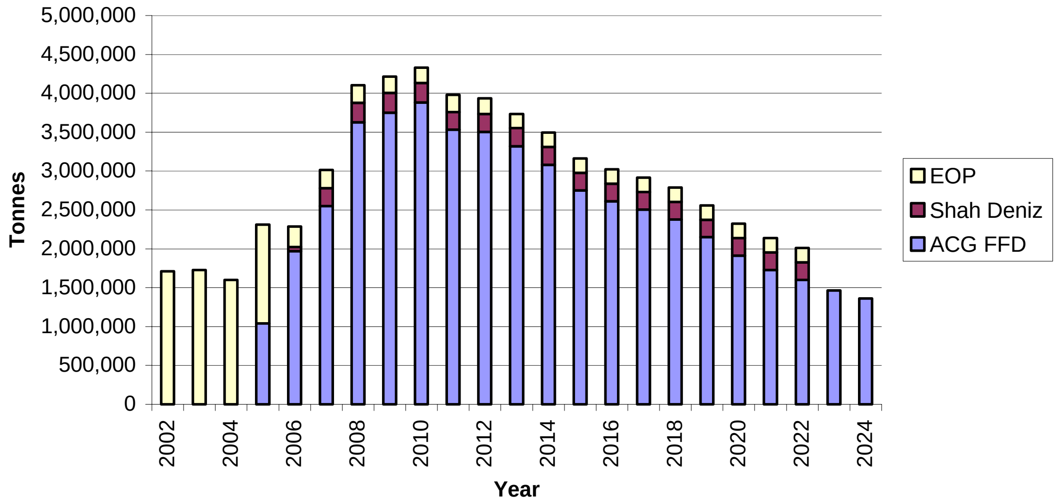
With regard to ACG Phase 3, of concern for cumulative effects are atmospheric emissions and these are discussed in the following section.

9.9.2 Atmospheric Emissions

9.9.2.1 Introduction

The information provided in Sections 9.5 Platform Operations and 9.8 Terminal Operations indicates that air emissions from EOP, ACG FFD and Shah Deniz operations will not result in any significant impact on local air quality due to good dispersion in the vicinity of the release points. A cumulative impact in the form of greenhouse gas emissions, mainly carbon dioxide (CO_2) and methane (CH_4), has however been identified. Figure 9.11 illustrates the predicted cumulative GHG emissions for EOP, ACG FFD and Shah Deniz operations.

Figure 9.11 Estimated Annual GHG Emissions for EOP, ACG FFD and Shah Deniz (offshore and onshore) (tonnes CO_2 equivalent)



There is a concern that increased atmospheric concentrations of GHG emissions from the burning of fossil fuels for energy contribute to global warming and climate change[1]. The following sections provide context on the international framework and Azerbaijan's position regarding climate change. In addition, it provides an overview of gas management arrangements for ACG as a full field development.

9.9.2.2 International Conventions and Agreements

The principal basis for international discussion on GHG emissions and negotiation among countries is the UN Framework Convention on Climate Change (UNFCCC), signed in 1992. The convention contains a series of provisions with the long-term goal to achieve stabilization of greenhouse gas concentrations in the atmosphere at a level that would avoid dangerous anthropogenic interference with the climate system.

In 1997, the Third Conference of the Parties to the UNFCCC adopted the Kyoto Protocol to the Convention. This Protocol commits industrialised nations (Annex 1 countries) to reduce their greenhouse gas emissions by an average of 5.2% of 1990 levels, by the 5-year commitment period 2008-2012. It is relevant in terms of potential opportunities to use market-based mechanisms to meet the commitments, with specific reference to participation by the

[1] GHG inventories are often reported in terms of CO_2 equivalents (CO_2 eq), in which all of the GHG are converted to an equivalent basis relative to their predicted Global Warming Potential (GWP). CO_2 eq assumes the GWP of one tonne of CO_2 is 1. GWP of one tonne of CH_4 is 21 (i.e. equivalent to 21 tonnes of CO_2).

private sector. The Republic of Azerbaijan acceded to the Convention on 28 September, 2000.

9.9.2.3 Azerbaijan's GHG Forecasts and National Initiatives

It has been forecast that the main source of GHG emissions in Azerbaijan in the immediate future will be from fuel combusted in the energy industry. In addition, forecasts indicate that GHG emissions in Azerbaijan could potentially double by 2025, versus a 1990 baseline year (see Table 9.36). A high priority objective of the National Environmental Action Plan is expansion of the area under forests and plantations. Forestry is a natural regulator of CO_2 in the atmosphere and, depending on forestry development scenarios, Azerbaijan could increase its sink of CO_2 by between 42% and 112% by 2025 versus 1990 baseline.

Table 9.35 Predicted Emissions and Sinks of GHG in Azerbaijan (Kilotonnes)

Indicators	Year							
	1990	**1995**	**2000**	**2005**	**2010**	**2015**	**2020**	**2025**
Baseline Scenario								
CO_2	44703	30124	24689	41544	52322	59844	65729	68735
CH_4	723	587	730	1253	1837	1946	2050	2177
N_2O	2.90	2,60	2.80	3.10	3.30	3.50	3.60	3.80
Total CO_2 equivalent	60785	43257	40887	68818	91922	101795	109895	115630
Sink of CO_2								
Baseline Scenario	1847	253	681	2367	2424	2488	2556	2627
Optimistic Scenario	1847	253	681	2383	2550	2865	3329	3922

Source: First National Communication of Azerbaijan on Climate Change, May 23, 2000; available at www.unfccc.int/resource/natcom/nctable.html.
Optimistic Scenario assumes that all of the initiatives outlined in the National Environmental Action Plan are implemented and achieve the predicted sinks of CO_2.

The Republic of Azerbaijan has begun the process of identifying ways in which it can address its greenhouse gas emissions. An Azerbaijan national strategy to abate GHG has been developed based on a number of general and industrial development programmes for the country.

A State Commission on Problems of Climate Change was established in 1997 by Decree of the then President of Azerbaijan Republic, G.A. Aliyev to implement commitments under the Convention. According to the resolution of the Government of Azerbaijan, the State Committee on Hydrometeorology has been appointed as the main coordinating institution in association with the UNFCCC. Within the National Climate Change Center of the Azerbaijan, the State Committee on Hydrometeorology, a group of experts has been established for the purposes of preparing national inventories of GHG, to study of the climatic system and vulnerability and to develop climate change mitigation measures.

9.9.3 ACG FFD GHG Management

9.9.3.1 ACG Initiatives

With reference to Section 5.10, the principal sources of GHG emissions within ACG FFD operations are generally associated with power generation, gas compression and water injection, process heating at the terminal and non-routine flaring of gas required for safety reasons. A key opportunity for managing project contributions to GHG emissions is during the design phase. The ACG project partners are committed to assessing, and where practical, reducing the projects GHG emissions. This is reinforced in the HSE Design Standards for the Phase 3 project (Appendix 2), which include:

- Evaluation of options to reduce flaring, combined with the development of operational flare policy, aligned with ACG FFD;
- Maximization of energy efficiency in line with BPEO;
- Challenge and justification of well testing requirements;

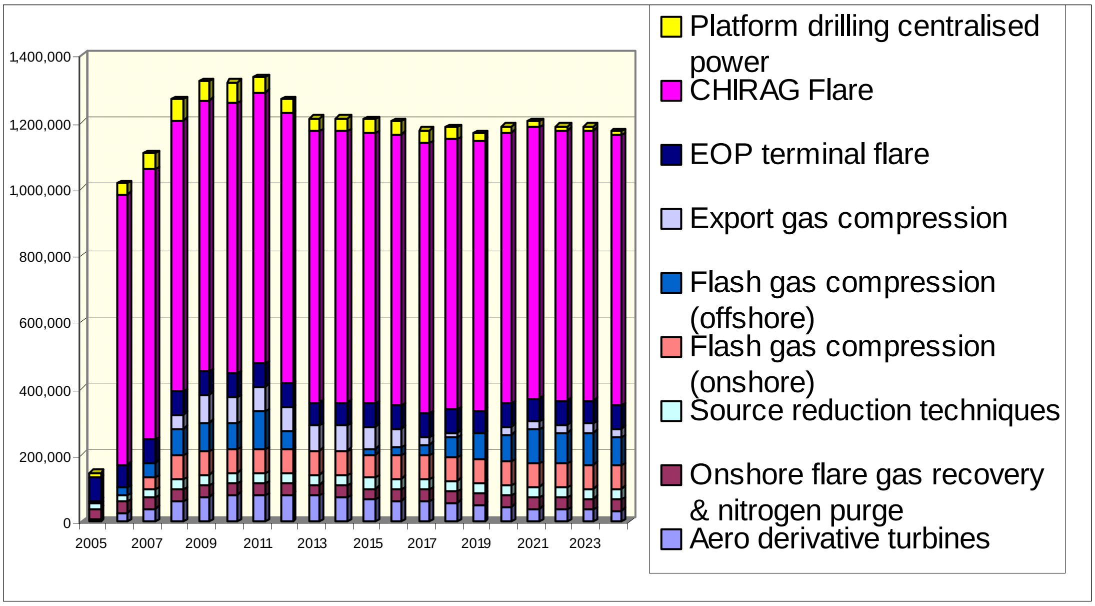
- Minimisation of combustion and fugitive emissions; and
- Prevention of hydrocarbon gas disposal by continuous venting.

As a result of this commitment, the ACG FFD project (including Phase 3) has included a number of design measures to minimise emissions, including GHG contributions. These are detailed in the ACG Phase 1 and Phase 2 ESIAs and Supplementary Lenders Information Package (SLIP) (www.caspiandevelopmentandexport.com) and readers are directed to those documents for detailed descriptions of the benefits provided. In summary, design measures that contribute to these savings include:

- The cessation of routine flaring from the Chirag-1 platform (as part of EOP);
- Onshore flare gas recovery;
- Onshore inert purge gas;
- Centralised power offshore for the Azeri Field;
- No continuous flaring for production;
- Gas re-injection (as opposed to flaring) at the Azeri Field;
- External floating roof tanks at terminal;
- Use of Aero-derivative turbines;
- Electric motor driven export compression on Phase 3; and
- Gas management

It is estimated, based on design information available, that these measures will reduce GHG emissions by approximately 23 million tonnes prevented over the life of the PSA. See figure 9.12.

Figure 9.12 ACG FFD Gas Savings Through Design (tonnes CO_2 Eq)



9.9.3.2 ACG Gas Utilisation and Management

In addition to the measures mentioned above, the ACG FFD Project will also participate in a gas management strategy for the overall development. Figure 9.12 illustrates the gas utilisation balance for ACG FFD. This highlights that the majority of associated gas produced by the FFD development is routinely re-injected into the subsurface Azeri Field reservoir, as part of the Phase 1 and 2 ACG project. On start up of Phase 1 gas compression and water injection platform (CWP), the majority of associated gas from Chirag-1 (EOP) will be directed to this platform for re-injection, thus negating the need to routinely flare gas from the Chirag platform. Associated gas that will routinely be transported to Sangachal Terminal via the 28" Gas export pipeline will be the remaining gas from the Azeri Field development (ACG Phases 1 and 2), plus all associated gas from ACG Phase 3 that is not required offshore as fuel gas. This is required because the Phase 3 DWG field does not lend itself to gas injection.

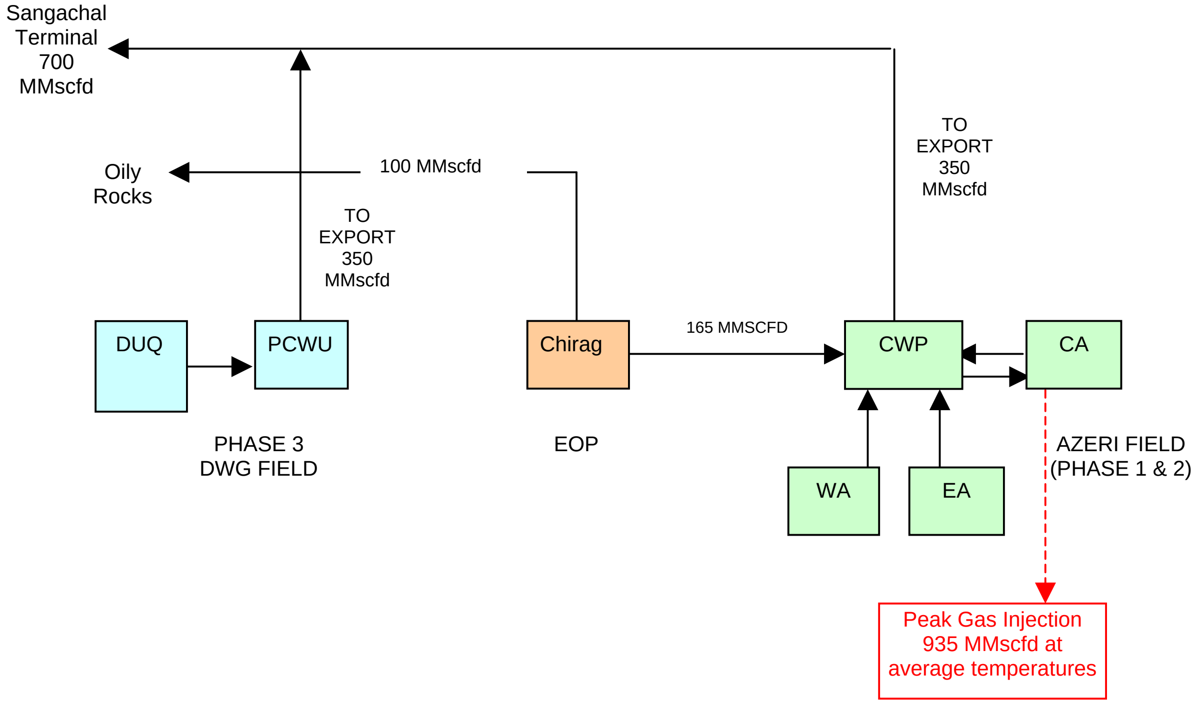
A key element of ACG FFD gas management is providing the gas to SOCAR (via the Sangachal Terminal) for use in the national grid in Azerbaijan. This not only eliminates the need to flare the associated gas but also provides Azerbaijan with a clean fuel source. Most recent information indicates that the predicted demand for gas in Azerbaijan exceeds that which will be supplied by ACG FFD.

To provide the necessary assurance that SOCAR will provide facilities at Sangachal to take the gas available, AIOC has funded these facilities under the Azeri Project. In addition, a gas protocol has been signed between AIOC and SOCAR. The gas protocol addresses the following key points:

- Defines the delivery pressure and gas specification that AIOC must meet at Sangachal;
- Provides estimates of gas deliveries to SOCAR from ACG FFD to the end of the PSA;
- Defines where SOCAR will redeliver the gas to for use by consumers in Azerbaijan;
- Confirms that gas will be first be used to optimise oil recovery and surplus gas will be delivered to SOCAR;
- Confirms that if Chirag-1 (EOP) gas cannot be delivered to the Phase 1 gas compression platform for re-injection, then Chirag-1 gas can continue to be delivered to SOCAR at Oil Rocks; and
- Gives priority of delivery to associated gas over non-associated gas produced within or imported into Azerbaijan.

AIOC has worked closely with SOCAR to define the delivery requirements of the gas, agree the facilities required, and to define an operational protocol. Construction of a pipeline to provide the gas from Sangachal Terminal gas delivery point to existing SOCAR facilities has already commenced in readiness to distribute gas to the local Azerbaijan grid following Phase 1 start up. A flaring policy will be developed and agreed by AIOC prior to the start up of Phase 1 operations. This will stipulate an annual flaring cap with year on year reductions being sought within the boundaries of safety and integrity, operational capability, reservoir management and production of the day. Both Phase 2 and 3 will align with the flaring policy, once operational.

Figure 9.13 Gas Management for the ACG FFD Project, showing gas export and re-injection capacities (MMcsfd)



9.9.3.3 Additional Management Initiatives

Despite the savings discussed in the above sections, it is appropriate for AIOC to continue to examine ways in which GHG emissions can be reduced or mitigated. As a minimum, this should include the following measures:

- Operational mechanisms, such as optimisation of energy efficiency, leak detection programmes, monitoring and maintenance programmes;
- Investigation of opportunities to integrate broader GHG reduction considerations into the projects' environmental and community investment programmes; and
- Monitor developments within the UNFCCC for ideas that could have applicability to Azerbaijan.

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9.10 Socio-economic Impacts

9.10.1 Introduction

The results of the socio-economic impact assessment are summarised in Table 9.37 and discussed further below. Socio-economic impacts and associated mitigation measures were assessed for routine and planned non-routine activities associated with all stages of the ACG Phase 3 project i.e. construction, pre-commissioning, installation, hook-up, drilling, commissioning and operations. Impacts were assessed in accordance with the methodology used for the environmental impact assessment.

The construction programme during Phase 3 will be carried within the same mitigation and management regime currently being implemented by ACG Phases 1 and 2. In undertaking the necessary research for this ESIA, consideration was given to the current management system being implemented by Phase 1 to identify any lessons learnt which could be borne in mind for Phase 3. It should be stated that consideration was only given to the management regimes of Phase 1 as at the time of undertaking the research Phase 2 was only in its early stages of construction and as such there were limited experiences to draw from.

With the exception of demanning, socio-economic impacts resulting from the ACG Phase 3 project are predicted to be low and any residual impacts will not be significant. Demanning following completion of construction work is predicted to result in a significant impact as a result of the large numbers of personnel that will no longer be employed. This impact is partially mitigated by the measures described in Table 9.37.

Although all activities and aspects were considered during the scoring of impacts (Appendix 7), a number of activities and aspects identified during the impact assessment were assessed to result in minimal socio-economic interactions and have been removed from the following table to allow key activities to be emphasised.

Table 9.36 Summary of Socio-economic Impact Assessment for ACG Phase 3

ID	Activity	Socio-economic Aspects	Socio-economic Mitigation	Cumulative Contribution	Socio-economic Impact Significance	Justification / Comments	Residual Socio-economic Issues to be Addressed
S	**Offshore Platform Facility Construction / Fabrication, Assembly and Commissioning in Azerbaijan Construction Yards**						
S1	Mobilisation of workforce.	Employment, training, income, inward migration, nuisance, communicable disease.	Community information centres. Community Liaison Adviser. Community complaint and dispute resolution procedures. Public consultation and disclosure. Workforce code of conduct. Workforce training. Medical screening and immunisation of workforce. Medical clinics. Communicable diseases CCP Contractor selection. Recruitment commitments. Information dissemination. Employment strategy including a preference for local residents. Training strategy Pre-work training.	▲	P	Potential for interaction with the local community is effectively managed through the mitigation measures currently in place. Positive: An extension of construction activities leading to extended employment for existing employees. Employment opportunities were raised as an issue during consultation	Employment & information dissemination Refer to Section 9.10.2
S2	Procurement of materials.	Income, indirect employment Positive national income generation	Maximise procurement of materials from local/regional/national vendors. Procurement and Supply Management Plan. Effective communication of procurement requirements.	▲	P	Positive: Large quantities of goods and services will be purchased within Azerbaijan. Low but the issue of procurement outside Azerbaijan was raised during consultation	Maximising national procurement Refer to Section 9.10.3
S3	Road transportation (equipment, materials and workforce)	Nuisance, atmospheric emissions, noise, congestion.	Transport management plan. Community complaint and dispute resolution procedure. Onsite accommodation		L	Low as environmental mitigation will ensure air quality not affected detrimentally Transport management plan of importance to AIOC as implemented through Contractors.	Refer to Section 9.10.4
S4	Sea transportation (modules, equipment and materials)	Interference to other users of the sea.	Route selection planning and scheduling to minimise disturbance Notification to other sea-users through the Azerbaijan		L	Environmental mitigation will ensure air quality not affected detrimentally and interference with sea users will be minimised through management.	Refer to Section 9.10.4

ID	Activity	Socio-economic Aspects	Socio-economic Mitigation	Cumulative Contribution	Socio-economic Impact Significance	Justification / Comments	Residual Socio-economic Issues to be Addressed
			Hydrographer of the Navy.			Transport management plan of importance to AIOC as implemented through Contractors.	
S5	Rail transportation (equipment and materials)	Atmospheric emissions, noise, congestion.	Schedule selection to minimise congestion and minimising the number of train journeys by maximising loading capacity.		L	Environmental mitigation will ensure that air quality is not affected detrimentally and that potential interference with sea users is minimised through management.	Refer to Section 9.10.4
S6	Onshore construction activities and power generation	Noise and atmospheric emissions. Potential disturbance to individuals/ communities in the vicinity	Identification of human receptors. Monitoring.	▲	L	Environmental mitigation will ensure that air quality is not affected detrimentally. Atmospheric emissions were raised as a concern affecting local inhabitants during consultation.	Atmospheric emissions Refer to Section 9.10.6
S7	Support facilities (including construction camp accommodation and catering)	Nuisance to local communities through interaction with workforce.	Camp Management Plan Provision of entertainment, sports and canteen facilities etc. at construction camp. Security. Housekeeping. Workforce code of conduct. Measures for the transportation of the construction workforce. Workforce training. Management of complaints from the local community.	▲	L	Low due to appropriate management through the mitigation currently in place thereby minimising the potential for interaction with the community local to the camp but important part of Corporate policy. Existing Azerbaijan company contracted. No additional workforce required.	Social and cultural interaction Refer to Section 9.10.5
S8	Demobilisation of workforce	Employment, income.	Information provided to workforce detailing contractual details and specifically end of contracts. Other appropriate management measures to be introduced to offset the demanning process, including inter-project liaison to ensure sharing of resources and a timely, open and transparent communication process.	▲	M	High levels of personnel will no longer be employed by the project. Concern over demanning raised as an issue during consultation	Demanning Refer to Section 10
	Installation of Offshore Facilities[1], Hook-up and Commissioning						

[1] Offshore facilities includes: Jackets; topsides; drilling templates, subsea manifolds; bridge link
[2] There will be eight tow out/transportation activities – template x 1, jacket x 2, topsides x 2, bridge link x 1, subsea manifolds x 2 – each of these activities will occur at a different time

ID	Activity	Socio-economic Aspects	Socio-economic Mitigation	Cumulative Contribution	Socio-economic Impact Significance	Justification / Comments	Residual Socio-economic Issues to be Addressed
S9	Mobilisation of workforce.	Employment, training, income, nuisance.	Specialised workforce in place.	▲	L	Existing Azerbaijan company contracted. No additional workforce required.	None
S10	Procurement of materials.	As S2	As S2	▲	P	As S2	As S2
S11	Vessel operations including facility tow out, transportation and positioning[2]	As S4	As S4		L	As S4	As S4
S12	Installation of template and jackets (including piling)	Interference to other sea users, physical seabed disturbance.	As S4 Exclusion zone established to ensure visibility and manage risks of interaction with other sea users. Installation location notified with Azerbaijan Hydrographer of the Navy and plotted on maritime charts		L	As S4 No identified fishing banks, exclusion zones will be small in comparison to the total sea area, activities will be localised and of, short duration.	Exclusion zones justification Refer to Section 9.10.9
S13	Floatover and installation of topsides and bridge link	As S12	As S12		L	As S12	As S12
S14	Installation of sub-sea facilities	As S12	As S12 Safety zone will be established over subsea facilities after installation to reduce the possibility of interference from current or potential future socio-economic activity		L	As S12	As S12
S15	Demobilisation of workforce	Employment, income.	Information provided to workforce including contractual details and when contract will end.		L	Low as small number s of specialised contractors used for offshore installation, no large-scale employment of national staff from areas around the terminal or fabrication yards.	None
	MODU Drilling – template and sub-sea injection wells						
S16	Tow out and positioning of MODU	As S4	As S12		L	As S12	As S12

ID	Activity	Socio-economic Aspects	Socio-economic Mitigation	Cumulative Contribution	Socio-economic Impact Significance	Justification / Comments	Residual Socio-economic Issues to be Addressed
S17	Helicopter operations	Potential disturbance to individuals/ communities in the vicinity of airstrip and flight path from noise. Atmospheric emissions.	Route selection, planning and scheduling		L	Environmental mitigation will minimise disturbance to local people near airbases.	None
S18	Vessel support including standby, supply to MODU and back load to shore.	As S4	As S4		L	As S4	As S4
S19	MODU removal	As S16	As S16		L	As S16	As S16
	Offshore Facilities – Platform Drilling, Production, Facilities Operations and Maintenance						
S20	Mobilisation of workforce.	Employment, training, income.	Specialised recruitment procedures and training underway.		P	Small number of long-term jobs will be created. Employment opportunities were raised as an issue during consultation	Employment opportunities Refer to Section 9.10.2.4
S21	Procurement of materials.	As S2	As S2	▲	P	As S2	As S2
S22	Helicopter operations	Atmospheric emissions, noise.	None required.		L	Environmental mitigation will minimise disturbance to population in vicinity of airbases.	None
S23	Vessel support	Interference with other sea users, atmospheric emissions, noise.	Route and schedule selection to minimise congestion, notification of other sea-users.		L	Environmental mitigation will ensure disturbance to sea users is limited and any interference that may result will be minimised through management.	None
S24	Demobilisation of workforce	Employment, income.	Contactor communication management		L	Personnel will be unemployed, however training, skills and experience gained will improve likelihood of future employment.	None

ID	Activity	Socio-economic Aspects	Socio-economic Mitigation	Cumulative Contribution	Socio-economic Impact Significance	Justification / Comments	Residual Socio-economic Issues to be Addressed
	Infield Pipeline Installation and Commissioning						
S25	Mobilisation of workforce.	Employment, training, income.	Specialised recruitment procedures in place.		P	Local contracts	None
S26	Procurement of materials.	As s2	As S2		P	As S2	As S2
S27	Installation and commissioning of pipelines, flowlines and umbilicals	As S12	As S12		L	As S12	As S12
S28	Demobilisation of workforce.	Employment, income.	Information provided to workforce including contractual details and when contract will end.		L	Contractors employed are active in the Caspian region and have a permanent associated workforce.	None
	Terminal Engineering, Construction and Commissioning						
S29	Mobilisation of workforce	As S1	As S1	▲	L	As S1	As Si
S30	Procurement of materials.	As S2	As S2	▲	P	As S2	As S2
S31	Road and onsite transportation (equipment, materials and workforce)	As S3	As S3		L	As S3	As S3
S32	Foundation laying	Noise, dust and atmospheric emissions. Potential disturbance to individuals/ communities in the vicinity	Use cleared and graded area already established within terminal fence line. Noise monitoring. Dust suppression through watering down.		L	Environmental mitigation measures will ensure air quality and ambient noise levels are not affected detrimentally. Atmospheric emissions were raised as a concern affecting local inhabitants during consultation.	Atmospheric emissions Refer to Section 9.10.6 and 9.10.7
S33	Construction, of structures, pipe racks, pipework, electrical, tanks, equipment interconnections.	As S32	As S32 Vehicle maintenance as per pollution prevention procedures.		L	As S32	As S32

ID	Activity	Socio-economic Aspects	Socio-economic Mitigation	Cumulative Contribution	Socio-economic Impact Significance	Justification / Comments	Residual Socio-economic Issues to be Addressed
S34	Power generation	Noise, dust and atmospheric emissions.	Maintenance of turbines. Optimisation of power requirements.		L	Environmental mitigation measures will ensure that air quality is not affected detrimentally.	Non.
S35	Support facilities (including construction camp accommodation and catering)	As S7	As S7		L	As S7	As S7
S36	Demobilisation of workforce	As S8	As S8		M	As S8	As S8
	Terminal Operation and Maintenance						
S37	Mobilisation of workforce	Employment, training, income, inward migration.	Specialised recruitment procedures and training underway.		L	Low: Potential for interaction with the local community is low due to low levels of workforce, use of Azeri workers. Positive: Long-term employment created. Employment opportunities raised as an issue during consultation.	Employment & information dissemination Refer to Section 9.10.2
S38	Procurement of materials.	As S2	As S2		P	As S2	As S2
S39	Transportation of goods, materials and personnel	As S3	As S3		L	As S3	As S3
S40	Processing including heating and cooling crude oil.	Atmospheric emissions.	Temperature monitoring and regulation. Regular maintenance of turbines.		L	Environmental mitigation will ensure air quality is not affected detrimentally. Atmospheric emissions were raised during consultation as a concern affecting local inhabitants.	Atmospheric and noise emissions Refer to Section 9.10.6
S41	Gas compression and refrigeration/Dew point control and export.	Atmospheric emissions	None required.		L	As S40	As S40

ID	Activity	Socio-economic Aspects	Socio-economic Mitigation	Cumulative Contribution	Socio-economic Impact Significance	Justification / Comments	Residual Socio-economic Issues to be Addressed
S42	Flaring	Atmospheric emissions, light, heat, noise.	No routine flaring to produce, only lit pilot. Flare gas recovery and nitrogen purge. Flare gas metering.		L	As S40	As S40
S43	Power generation	Atmospheric emissions, noise.	Regular maintenance of turbines. Optimisation of operating range. Gas consumption monitoring. Flue gas monitoring. DLE unit retrofit. Air emission dispersion modelling.		L	As S40	As S40
S44	Demobilisation of workforce	Employment, income.	Information provided to workforce including contractual details and when contract will end.		L	Personnel will be unemployed, however number unemployed will be low and training, skills and experience gained will improve likelihood of future employment	None

9.10.2 Employment

9.10.2.1 Overview

The Phase 1 and 2 workforce will supply the manpower required for Phase 3 construction. Although no additional employment will be created, the extension to current employment contracts will continue to provide benefits through income and skills enhancement. To maximise the positive impact from Phase 3 employment, Phase 3 will adopt the following measures already in place for Phases 1 and 2:

- Targets for employment of Azerbaijani nationals – Phase 1 and 2 contractors are contractually committed to employing a 70% national workforce. In September 2003 (at the time of ESIA research) 85% of the Phase 1 construction workforce at Sangachal Terminal was Azerbaijani. It is planned to have similar contractual commitments for Phase 3 contractors.
- Preference for recruiting from local communities – a number of settlements surround the Sangachal Terminal. To ensure the people living nearest to the facility see benefits from it, a Phase 1 and 2 recruitment policy has been to employ local residents in priority to those outside of the area. In September 2003 53% of the Phase 1 construction workforce at Sangachal Terminal were from the Garadagh Region.
- Information Centres - the use of information centres within local communities as places where people can register for employment has contributed to the high rate of local recruitment, and it is proposed to use this approach during Phase 3. The centres are in Sangachal, Umid and Sahil. Notice boards at the centres have been used to explain the recruitment process and detail the specific positions available. As a result of the interest received from potential employees the information centres have developed a database of approximately 18,000 potential employees (as of September 2003). This database has been utilised for recruitment undertaken by the construction contractors at Sangachal terminal. The recruitment process is non discriminatory – the importance for this was highlighted by NGOs during the consultation phase of the ESIA.
- Training - there is a substantial skilled workforce currently working on the construction programme for the Phase 1 project. This skill base reflects the extensive training programmes that have been implemented both prior to and during employment of the construction workforce for Phases 1 and 2. This training focuses on skills relevant to construction work, for example, training is conducted by the terminal construction contractor at a dedicated training centre at the terminal and courses cover HSE, language and computer skills, driving and certified courses including painting, electronics, slinging and lifting, scaffolding and pipe coating and welding.

Some contractors have however been constrained in the workforce from which they can source employees. Specifically, a number of the yards used during the Phase 1 construction process required contractors to access employees through their existing pool of labour. This has in some instances resulted in temporary, short-term skills shortages, particularly during peak times of employment. These shortages have since been rectified through training programmes.

9.10.2.2 Construction

Figure 9.14 illustrates the planned manpower requirements for the construction of onshore facilities. As illustrated below, construction employment for Phase 3 will peak during 2006 and steadily decline thereafter. Phase 3 is the last of several major construction projects that have taken place in the region since 2002. The impacts of demobilisation on employment and income levels will be unavoidable and consequently demobilisation has been allocated an impact significance ranking of medium (See Table 9.38). The permanent loss of employment resulting from demobilisation following completion of the project's construction phase was raised as an issue by NGOs during ESIA consultation. As this issue is common across the BP/AIOC construction projects it is dealt with in Chapter 10 – Wider Issues.

Figure 9.14 **Planned Workforce for Onshore Terminal Construction**

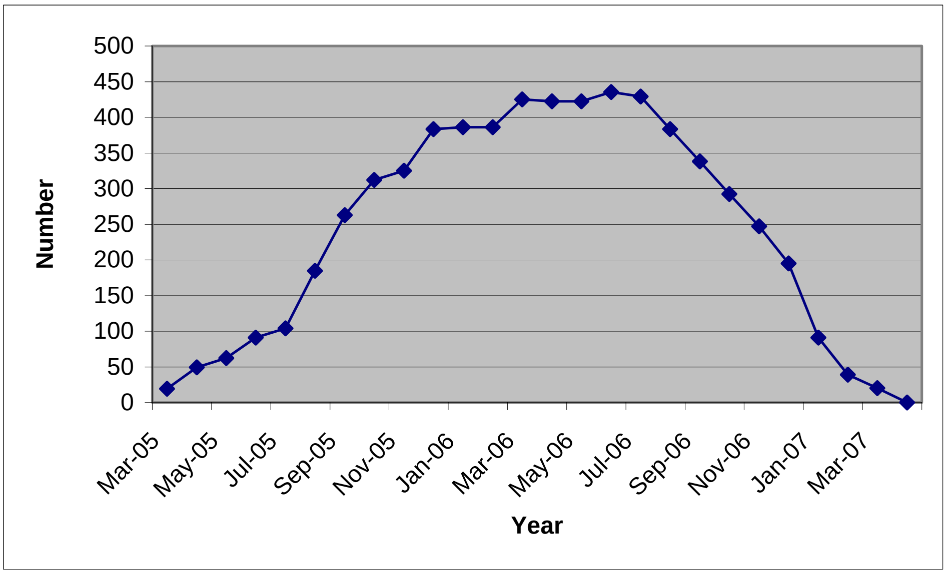


Figure 9.15 illustrates the planned manpower requirements for the construction of offshore facilities, including installation, commissioning and hook-up.

Figure 9.15 **Planned Workforce for Offshore Construction (including hook-up, and installation)**

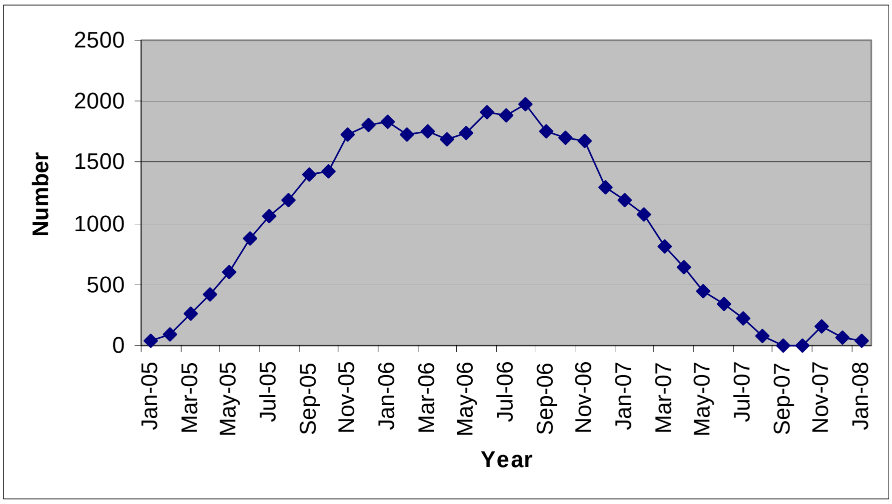
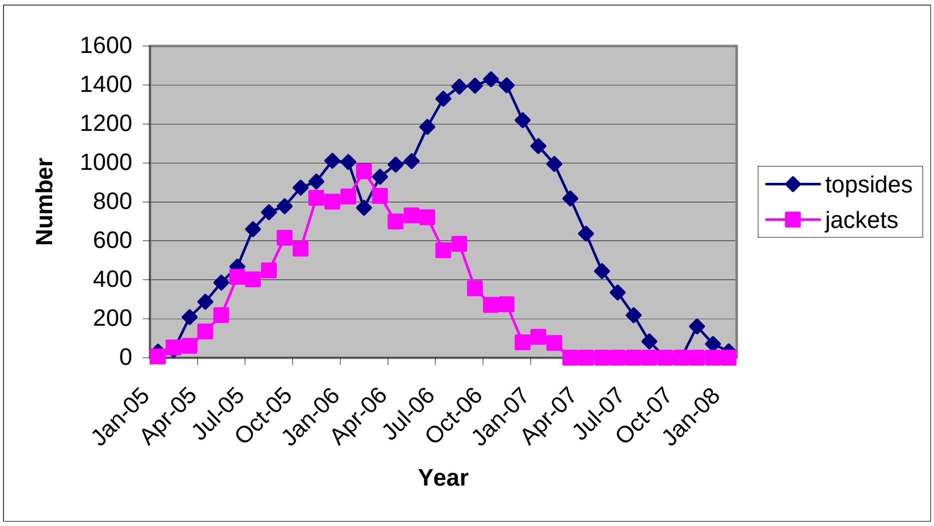


Figure 9.16 compares the manpower requirements for the construction of jackets and topsides.

Figure 9.16 Planned Workforce for Offshore Construction of Jackets and Topsides



9.10.2.3 Drilling

There is an established workforce of approximately 120 individuals on the MODU and there is no separate or additional requirement for employment associated with Phase 3. This workforce is part of the permanent crew and will therefore remain employed following completion of drilling operations.

9.10.2.4 Operations

As part of the PSA (Article VI (vi)) AIOC made a commitment to achieve target levels of manning for Azeri nationals of 90% for professional staff and 95% for non-professional staff at five years after first oil.

Under the ACG Phase 1 project BP recruited Azerbaijani University graduates from Azerbaijan's universities into the BP Challenge Graduate programme. This programme provides operational, engineering and other onshore support training over a three-year period. Phase 3 will take a similar approach and, following completion of the Challenge Graduate Programme, will seek to deploy Azerbaijani personnel into the operations workforce. Other similar initiatives that will ultimately achieve the overall goal of attracting qualified and talented graduates for the Company's needs include:

- Scholarship schemes with national and international universities; and
- Creating and maintaining close relations with local universities and working with them to modify program content and student development eg. through summer placements with BP.

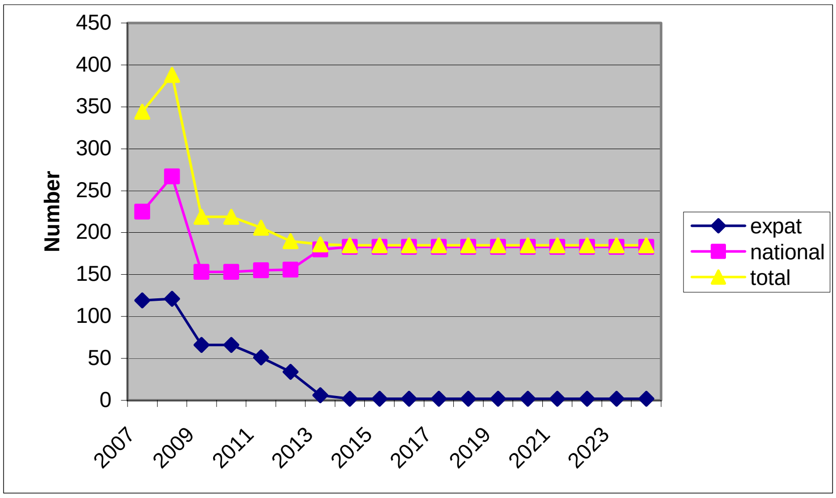
Training centres have been established, including the National Training School in Baku and a $12 million world-class technical training centre at Sangachal Terminal. The facility has been developed as part of BP's and its partners plans for technical and professional development of the national staff working for these projects. Both BP operations technicians as well as BP's drilling contractor KCA Deutag's drilling technicians working on BP's platforms will utilise the training facilities. The centre has the capacity to train 400 operations and drilling technicians a year in its main facilities. The facilities include:

- An experiential learning simulator, which is a Drilling Control room facility installed to train KCA Deutag drillers to safely and efficiently operate the modern drilling equipment existing on the new platforms in the Caspian Sea;
- A unique Operations Training Plant, which was designed and manufactured in the UK, assembled and commissioned at the Training Centre to offer technicians a complete experience of starting up and operating the plant in a safe environment; and
- A large and fully equipped workshop with specific equipment extensively used within the oil and gas industry, which will provide the foundations for underpinning knowledge and practical experience. The workshop facility is complimented by approximately 24 classrooms and offices and both physical and virtual equipment for production and drilling training.

The training and experience programmes outlined above will ensure a high level of employee competency and this will ensure safe and productive operations, a concern that was raised during consultation.

Figure 9.17 illustrates the proposed offshore employment levels during operations. The target employment levels are those cited in the Production Sharing Agreement under article 6(vi). The project will aim to ensure that after five years from first oil, Azeri nationals will fill 90% of the offshore professional positions and 95% of the offshore non-professional positions. Meanwhile, onshore operations will create eight positions at the terminal between 2007 and 2024. It is proposed that Azerbaijani nationals will fill all of these positions at the terminal.

Figure 9.17 Offshore Operations Employment



9.10.3 Procurement

Phase 3 will need to procure a great variety of goods and services, especially during the construction phase. Table 9.37 illustrates the estimated cost of constructing Phase 3 onshore and offshore facilities.

Table 9.37 Estimated Construction Costs

Item	Cost ($ million)
Topsides	1,110
Jackets	387
Sub total	1,497
Pipelines	54
Subsea	108
Sub total	162
Terminal	271
Grand total	1,930
Note: The cost information above includes design, materials, fabrication and HUC but not BP project management	

Whilst it is not possible at present to provide the in country and out-of-country spending allocation for construction work as the project is currently finalising its contracting strategy, it is the commitment of AIOC/BP to maximise the procurement of goods from Azerbaijani companies when all technical and other requirements are met. As a result, positive benefits are envisaged to flow to the Azerbaijan economy and this impact has been assessed as positive. To maximize the benefits, Phase 3 will adopt the following measures already in place for the Azeri Project:

- Contractual requirements to source goods and materials locally - during Phase 1 and 2, AIOC/BP contractually required contractors to locally source goods and materials that meet the appropriate specifications. As a result, significant levels of materials and services have been procured locally by the Phase 1 project.
- The skills and experience of Azerbaijani based companies gained during Phase 1 and 2 will result in Phase 3 having a developing supplier network within Azerbaijan from which it can source supplies, goods and services as appropriate. For example, three of the main construction contractors for Phase 1 are partnering with Azeri companies (e.g. Azfen-Tekfen, Amec-Azfen-Tekfen, Bos Shelf).
- The management of procurement activities during Phase 1 included the requirement for each construction contractor to develop a procurement strategy detailing their policy, approach and mechanisms for sourcing goods and services for the Project. Phase 3 will continue with this approach.
- Support to local businesses - the Business Enterprise Centre in Baku provides a focal point for supporting local companies by improving supplier competence through capacity building, and by providing information on business opportunities. It is proposed that a similar procurement policy will be adopted for the Phase 3 project. This is discussed further in Section 11 Mitigation and Monitoring.

Despite the efforts during Phase 1 and proposed during Phase 3 to maximise benefits for Azerbaijani companies during the procurement process concerns were still raised during Phase 3 consultation that tender conditions were working against local companies.

Discussions with the main Phase 1 construction contractors indicated that they have an established network of companies upon which to draw for the purposes of procuring materials and services. Consequently there is limited use being made of the Azerbaijan Supplier Database developed by the Business Enterprise Centre. Contractors who have developed their own approved supplier lists do not share this information with other contractors. Although it is recognised that contractors have a competitive relationship with one another, where feasible, sharing of information between contractors and the Business Enterprise Centre would assist in improving the efficiency of the procurement process.

The project's demand for goods and services may contribute to a "boomtown" effect through the growth of local industry, particularly construction. The project will also generate or sustain, a number of permanent employment opportunities directly associated with the new businesses attracted to the area. It needs to be recognised however that the development of a supplier network to support any industry does not happen in the short term. However, there is evidence that the offshore oil and gas industry in Azerbaijan is growing already. Where previously only a small number of local companies were involved in this sector, there is now potential for increased local involvement leading to increased job opportunities and wealth creation in Azerbaijan.

The long-term impact of in-country spending depends upon oil and gas sector development attracting other investments. Where this does not occur, and communities have become dependent on the presence of oil and gas developments, the decline of this industry will have a detrimental impact on livelihoods. However, the loss of income and/or employment in the community may be offset should other economically valuable resources be found in the region, or if the region is in a position to service other industrial sectors.

The social and community investment programmes supported by the various phases of ACG in part seek to encourage economic diversification to help avoid any such impacts. The AzBU intends to establish a Regional Development Initiative (RDI) in the form of an initial 10 year programme of sustainable economic and social capacity building activities in Azerbaijan, Georgia and Turkey. This will become the single, integrated programme for BP's social initiatives in the region, embracing all of the AzBU current Community Investment Programmes, Environmental Investment Programmes, BP's 100% Social Investment Programme, and a new regional element. The RDI will address a key need to deliver an appropriate level of ongoing social spend in the region in a holistic and integrated manner. It will provide a vehicle to address the challenges of economic capacity building and social and institutional capacity building.

9.10.4 Transportation

Phase 3 will require large amounts of specialist materials and equipment to be transported not only into Azerbaijan (primarily through the Volga-Don canal) but also to, from and between the various construction yards within the country (by road and rail). The movement of goods and materials does have the potential to place demands on the transportation network. Until the additional traffic load is fully defined it is difficult to predict accurately the impacts related to transportation. However, the impact on the local transportation system is predicted to be low based on the following:

- Logistical studies have been conducted for the ACG FFD project to ensure the timely delivery into Azerbaijan of facility components and materials sourced internationally, through a detailed process of scheduling and co-ordination. These studies take into account the existing utilisation of transportation infrastructure in the region. For example, the availability of railway wagons and existing rail movements have been assessed in order to ensure that project materials and components can be delivered in a timely manner, thereby minimising the impact of transportation activities. The timing of international vessel and rail movements is scheduled to avoid the period when transportation infrastructure will be required for the other phases of the ACG project.
- Based on current information the railway system is operating well below maximum carrying capacity and any increase in rail traffic is unlikely to cause significant impacts unless current timetables and frequencies are disrupted in order to accommodate Phase 3 transport needs, although it is not anticipated that this will occur. Any potential disruption to rail services is unlikely to be lengthy or sustained and the impact of the project on the railway system is therefore predicted to be low.
- The continued application of the Phase 1 management regime during Phase 3, including the consideration of community traffic safety needs and also the transportation of Phase 3 employees to worksites utilising designated transport (for example, ensuring traffic is

not routed through local villages and using project specific buses to transport workers, thus ensuring that additional demand is not placed on local transport infrastructure).

- Not all of the large workforce requires public transport to access their place of work, with some of the workforce housed on site at the construction camp and a lot of the workforce living locally.
- An effective complaints procedure for the local community helps to deal with an issue that does occur. For example a complaint was made about construction traffic taking a short cut through a local settlement. This route was stopped and repairs made to the road.
- The Government recently upgraded the main roads providing access to the project fabrication yards located near Baku. Road users, including members of the local community, have benefited from this work.

During operations it is not expected that there will be a significant increase and thus impact on the road or rail network in Azerbaijan, as volumes and frequency of movements will be limited.

9.10.5 Social and Cultural Interaction

Impacts on the population in the vicinity of the proposed construction activities for both on and offshore facilities were identified as being of low significance (See Table 9.38). This conclusion is based on the following:

- Employment will be sourced primarily from the workforce that is currently contracted for Phase 1 construction. Consequently, requirements for any additional personnel will be limited and few people are expected to be attracted to the area;
- There have been no known incidences of adverse social interaction between workers and the communities local to the facilities being used for the Phase 1 construction programme. This may be partially attributed to the induction training provided to the workforce that includes guidance regarding community interaction. This training will also be continued as required for Phase 3;
- Since the inception of the community complaints procedure in Sangachal, Umid and Sahil there have been no complaints have been recorded from the local community regarding the workforce;
- A worker Code of Conduct was developed for Phase 1, which applies to all workers on the construction programme and includes behavioural aspects and access to nearby communities. It is intended that the Code of Conduct will be used during the Phase 3 construction programme;
- The main construction contractors developed recruitment and employment strategies during Phase 1 that favoured those based locally to the facilities. A similar stance on recruitment and employment will be taken during Phase 3;
- The use of a construction camp to house non-local personnel during Phase 1. Family members will not accompany workers thereby minimising pressure on local community infrastructure. The construction camps erected during Phase 1 will be used to house non-local workers. It is an open camp with workers permitted to leave the camp at regulated times. The camp also provides dedicated medical facilities and personnel, and if hospitalisation is necessary, workers will be transported to Baku. These construction camps will also be used for the Phase 3 construction programme and will be managed in accordance with current practice; and,
- The Phase 1 construction camps at both Sangachal Terminal and the ATA Yard provide entertainment facilities, medical care and transport to/from Baku. This reduces contacts between the workforce and local community. It is intended to continue these services during Phase 3 construction.

During the socio-economic assessment for Phase 1 it was predicted that there was a potential for migration of people to communities local to the facilities in search of jobs. However, as illustrated in Section 7: Socio-Economic Baseline, population levels in areas close to the Phase 1 construction facilities i.e. Sangachal, Umid and Sahil near the SPS Yard have actually decreased. The current employment strategy that focuses on employing as many workers local to the project area as possible has been in force since 2001 and it is considered that this has deterred people planning to migrate to the area in search of project related work. Although the migration of jobseekers to the project area was raised during stakeholder consultation, it is highly unlikely that this will occur for the reasons discussed; consequently no additional pressure is predicted on community facilities, the local transport network or other utilities and facilities.

Based on interviews with BP's central health team, it is considered that the health management measures implemented during Phase 1 construction have successfully limited health impacts associated with communicable diseases. These measures included:

- Pre-employment health screening to identify health problems of potential employees thereby checking that those recruited to the workforce are healthy;
- Pre-employment training and awareness campaigns focussing on disease prevention and mitigation; and
- Vaccination programmes as appropriate.

Phase 3 will continue to implement these management measures and consequently the impact of the construction workforce on the spread of communicable diseases is predicted to be low.

Concern has been raised regarding the provision of standing water around the terminal and the possible implications for the spread of malaria. However, construction works at Sangachal will not increase the amount of standing water in the terminal area. Although there is no risk of the project contributing to the spread of malaria the Phase 1 project has been sensitive to local concerns and an anti-malaria campaign was initiated by the Human Development Forum in conjunction with World Vision between May and September of 2003. Further information is available in Appendix 5 – Social and Community Investment.

Following community concern being expressed over the perceived use of herbicides during vegetation clearance for terminal construction work, BP/AIOC and construction contractors working at the terminal have confirmed that vegetation has been and will be cleared mechanically and that no herbicides will be used.

9.10.6 Atmospheric emissions

Atmospheric emissions were identified as a concern during stakeholder consultation. Mitigation and monitoring measures have been designed to address these concerns and this is discussed further in Section 9.8 Terminal Operations. These measures focus primarily on ensuring compliance with appropriate environmental standards. However, the potential ultimate receptor is the human population and local residents have voiced their concerns over the potential effects of atmospheric emissions. Although formal compliance with emissions standards is an effective and sufficient strategy to avoid adverse effects on the local community, it is recognised that the community would benefit from some additional reassurance.

Since the Terminal employs a significant number of local residents, representing (via family associations) a substantial fraction of the local population, it will be possible (to a modest but useful extent) to monitor local health trends via the routine employee health assessments carried out by the Terminal medical services.

Compilation and analysis of Terminal employee health data will enable significant health issues to be identified and handled in an appropriate manner. Particular attention will be paid to the incidence of apparent respiratory disease, and to the identification of causes where possible, keeping in mind that respiratory disease is prevalent throughout Azerbaijan. AIOC is committed to ensuring that Terminal operations do not have adverse health effects on the local community.

9.10.7 Noise

The assembly of offshore facilities and the construction of Sangachal terminal will result in temporary noise pollution.

Although the yards to be used for assembly of offshore facilities remains to be determined and hence the proximity of nearest receptors is unknown, the predominant noise sources associated with platform assembly have been identified as follows:

- The operation of heavy plant, hand tools and site vehicles;
- Delivery vehicles using local access routes; and
- Power generation at the assembly yard.

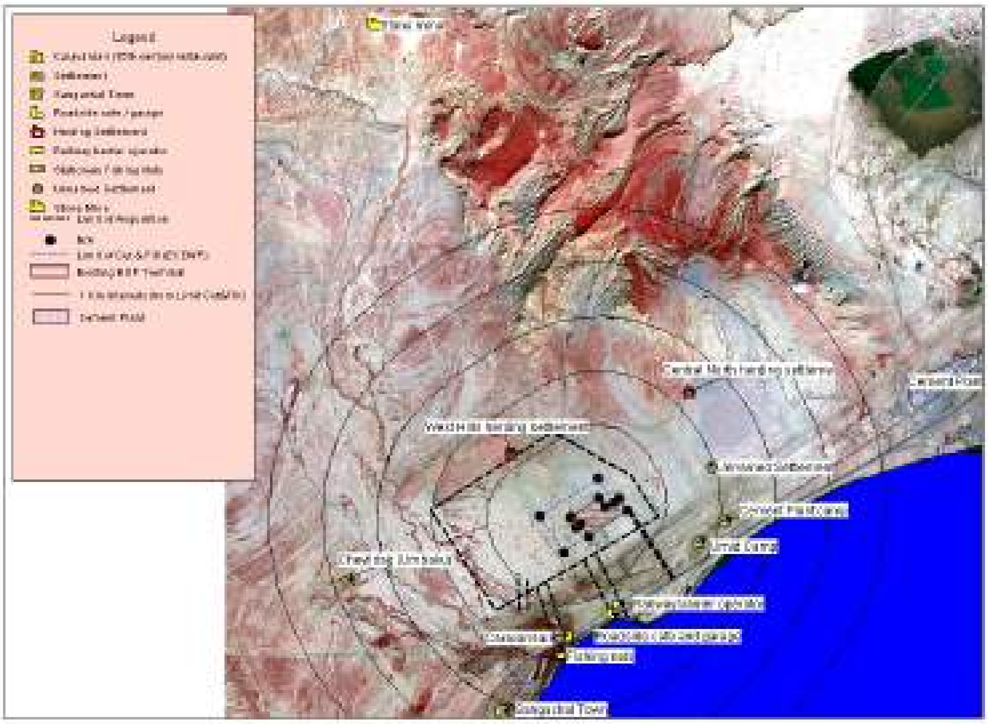
Although it is not anticipated that significant noise emissions will result from platform assembly there will be regular noise monitoring at identified sensitive receptors such as the ATA yard (Section 11.7.2.1) to identify nuisance and this impact has therefore been rated as low.

The construction and operation of the proposed Phase 3 terminal facilities, located adjacent to the existing facilities, is likely to increase the ambient noise level. Receptors potentially impacted by the construction and operation of the proposed Phase 3 Terminal facilities, are:

- Umid IDP Camp;
- Cheyildag (Umbaku); and,
- Sangachal town.

Figure 9.18 presents a satellite image of the terminal facility depicting the location of the receptors. The concentric lines on the figure represent increments of 1 km.

Figure 9.18 Location of existing EOP terminal, boundary of proposed land acquisition area and nearby sensitive receptors



A noise survey conducted in 1996 to establish background noise levels in the vicinity of the existing EOP terminal demonstrated that noise levels were generally high. This is considered to be a result of the heavy traffic on the Baku-Tbilisi-Iran Highway, exacerbated by the prevailing windy conditions.

During facility construction a variety of activities will result in additional noise at the terminal; including:

- Excavation of foundations and the installation of underground services; and
- Building construction.

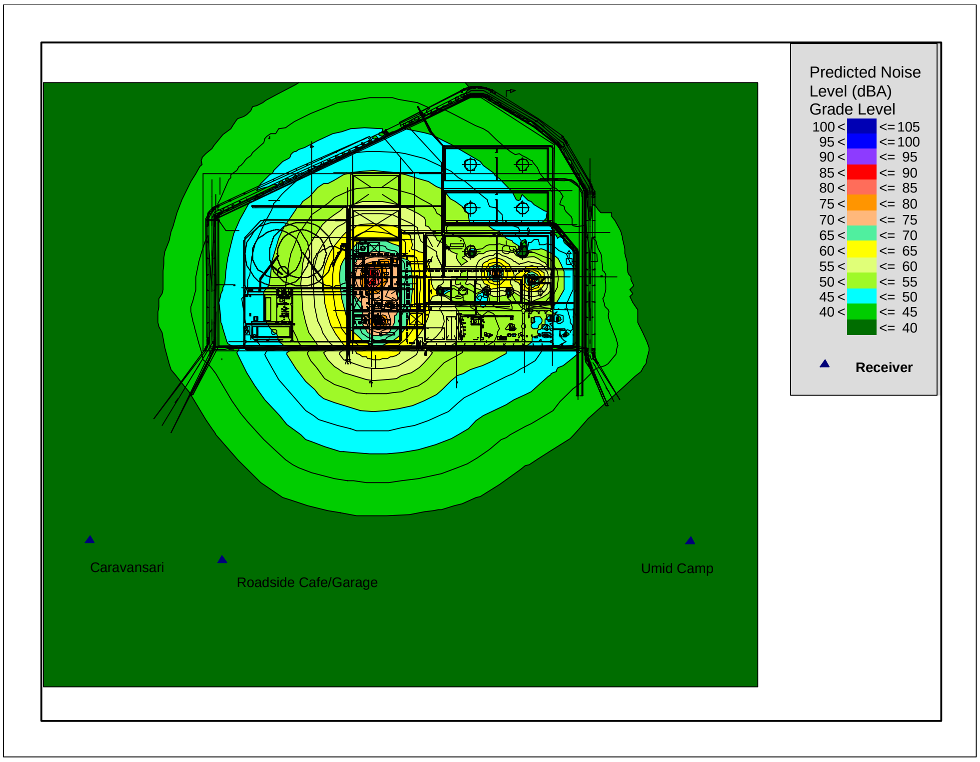
It is anticipated that short term-impacts will result on receptors within 850 m of the construction site. However, due to the limited number of receptors, and the temporary nature of construction work, this impact has been rated as low. Phase 3 construction work will be comparable with Phase 1 in terms of the nature and extent of activities and it is therefore expected that noise levels will be similar to those generated during Phase 1. Currently noise measurements are recorded on a regular basis at potential receptors. The noise levels recorded are generally within World Bank Guidelines. Short term exceedences have occurred, in part due to third party activities (including passing trains and road traffic) and the prevailing windy conditions. Current construction activities have not resulted in any noise-related complaints from the surrounding communities. During Phase 3 consultation stakeholders did not identify noise as an issue of concern.

Terminal operation will result in noise from the following sources:

- Two gas turbine driven generators with a diesel driven emergency back-up system;
- Fuel gas system;
- Instrument/utility air supply; and
- Emergency flaring.

Noise emission modelling has been undertaken for the above sources to characterise the propagation of noise during terminal operation. Modelled data is illustrated in Figure 9.19, which depicts sound emission contours up to a distance of 2 km from the site boundary. Modelling confirmed that receptors located more than 100 m from the proposed facility are unlikely to be impacted by noise during normal operations.

Figure 9.19 Propagated noise Sound Impression Contours (SIC) to a distance of 2 km from the terminal land-take area boundary



9.10.8 Utilities

All work potentially impacting on utility supplies was conducted during Phase 1 construction. Phase 3 construction will therefore not result in any disruption to utilities (including electricity, gas, sewage facilities and water supplies). Phase 3 construction activities will not require any road or rail crossings.

No disruption of local utilities is anticipated during Phase 3 terminal operation. In the unlikely event that the supply of utilities is disrupted, appropriate mitigation measures will be immediately instituted.

9.10.9 Sea Users

Some offshore activities require exclusion zones to be enforced around them as a safety measure to prevent third parties colliding with facilities or snagging on equipment. This will result in some areas of the sea being unavailable for vessels to enter which could result in traffic having to re-route around, and will prevent activities such as fishing taking place within the excluded zone.

The MODU, when drilling, will require an exclusion zone of 500 m around it. A stand-by vessel will, as part of its duties, act to alert vessels should they be heading into the exclusion zone, in addition support vessels have radar fitted to aid detection of ships in the area. Given the temporary nature and short duration of MODU drilling resulting impacts are predicted to be low.

The interfield pipeline installation will take place over a 30-day period and will be a continuous exercise, with the barge and associated vessels moving progressively along the pipeline route. In view of the short installation period, this activity is not predicted to result in a significant impact on other sea users although there will be a 2 km (2 km radius) exclusion zone in force. During operations, vessels will be free to move through the interfield pipeline area and there will be no disruption to shipping.

During installation of the platforms a permanent 2 km exclusion zone (2 km in radius) will surround the installation areas to minimise the risk of vessel collisions. The majority of vessels required for installation will operate within this exclusion zone. All vessels not involved in the installation programme will be excluded from this area and vessels will patrol the marker buoy perimeter to prevent other sea users from entering the exclusion zone. All vessels required for installation will use standard maritime safety procedures and will be equipped with radio equipment and appropriate navigation beacons and lights.

A mandatory 500 m exclusion zone will be established around the offshore platforms immediately following installation. All vessels, other than those specifically associated with the offshore development, will be prohibited from entering or passing through the exclusion zone. There are however no shipping routes currently through the Contract Area and thus shipping routes will not be affected as a result of the exclusion zones around the offshore platforms. The exclusion zone will however be continually policed using radar located on the platform, at BP headquarters in Baku, and on a standby vessel, which will be continually present at the platform location. The location of all installations and their associated exclusion and safety zones will also be marked on BP marine charts.

During operations there will be approximately 10 supply boats servicing all the platforms within the ACG Contract Area. Of these, around 6 will be at sea at any one time, and they will bus-stop between the platforms to reduce the number of journeys required. All vessels will route out of the SPS Supply Base. As a result, given the small numbers involved compared to the overall traffic in the area the impact on shipping is estimated to be negligible.

The Naval Hydrographer of Azerbaijan[2] will be notified in advance of activities to be carried out at sea, including the location and duration of these activities and activity exclusion zones. The Naval Hydrographer will be responsible for notifying other sea going vessels that may travel through areas where project activities are being conducted and will be responsible for updating Admiralty Charts as required.

The Azerbaijan Ministry of Ecology and Natural Resources (MENR) in its capacity as the head office for the state fishing entity and all other official fisheries representatives will be notified of relevant offshore activities in sufficient time to allow them to notify the commercial fishing fleet. Discussion with the MENR has indicated that there are no fishing banks in the contract area and no fishing permits have been issued in the area. Impacts on fisheries are therefore not anticipated during installation, commissioning and hook-up of offshore facilities.

9.10.10 Macro-Economic Impact[3]

Under the provisions of the PSA, payments are made to SOCAR as the Azerbaijani Government's representative. Regulations were promulgated in the Azerbaijan Oil Fund in 2001, which calls for transfer of signature bonuses into the Oil Fund.

The PSA requires the ACG partners to pay a $300 million bonus to SOCAR. The bonus is payable in three instalments. The first instalment of $150 million was paid on the effective date of the PSA in December 1994. The second instalment of $75 million was paid in 1998 after average daily production had been sustained at a level of 40,000 bpd. Though the remaining $75 million is payable when BTC becomes operational, the ACG partners agreed

[2] The Azerbaijan Navy Hydrographic Service Department of the Ministry of Defence
[3] The information contained in this section was sourced from the Regional Review: Economic, Social and Environmental Overview of the Southern Caspian Oil and Gas Projects, February 2003

that the third instalment would be paid when production exceeds 300,000 bpd (expected in 2006).

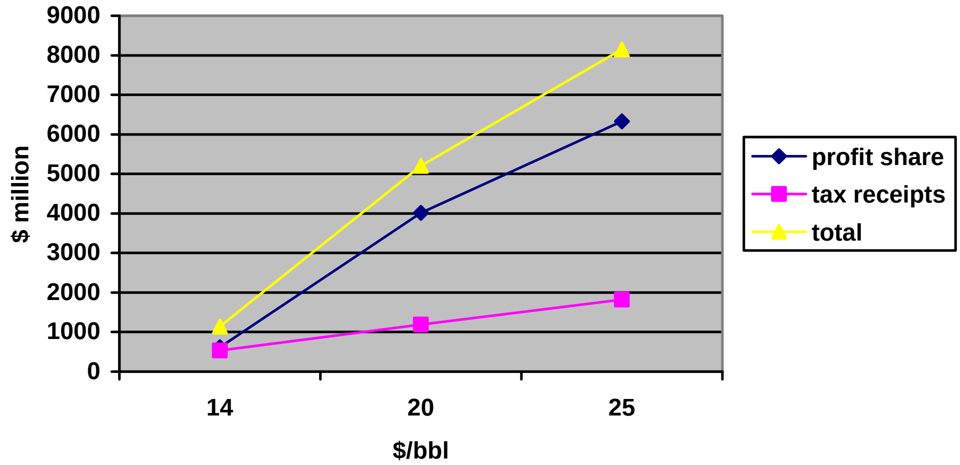
In additional the EOP has already delivered some $500 million of profit petroleum to Azerbaijan. Beyond 2005, oil and gas revenues from ACG and also BTC and Shah Deniz/SCP projects are expected to rise rapidly and represent a considerable proportion of GDP. By 2024 the cumulative revenues that could accrue to the Azerbaijani Government from ACG alone are forecast within a range of approximately $21 billion to $39 billion to $59 billion, depending on oil price assumptions. The forecast revenue that will be passed to the Government of Azerbaijan as a result of the ACG Full Field Development Project is summarised in Table 9.38 below.

Table 9.38 Forecast Revenue Range to the Government of Azerbaijan

$/bbl	state take
16	$21 billion
20	$39 billion
25	$58 billion
Source: Regional Review, February 2003 Note: figures include SOCAR profit, Azerbaijan profit oil and Azeri profit tax.	

Figure 9.20 below illustrates the profit share and tax receipts that will flow to the Government of Azerbaijan during Phase 3.

Figure 9.20 Estimated Revenues to the Government of Azerbaijan During Phase 3



As illustrated above, total share of profit oil varies from $613 million under the $14/bbl case to $6.3 billion under the $25/bbl case. Meanwhile tax receipts vary between $532million under the $14/bbl case to $1.8 billion under the $25/bbl case. All of this data is in 2004 prices.

The most obvious potential benefits to the economy and the people of Azerbaijan from the development of the oil will arise from the expected revenue flows generated as well as multiplier effects on the local economies. Following the collapse of the command economy with the dissolution of the Soviet Union and the associated dramatic fall in production from all other sectors of the economy, these revenue flows are potentially very significant in comparison to other sources of income flowing to the Government.

The revenues, if effectively used, have the potential to result in real and sustained economic progress in Azerbaijan. They could act as a springboard for regeneration of infrastructure, reinvestment in education and development of technology, which could further lead to improvements in the well being of the people of Azerbaijan. Apart from direct revenues there are indirect benefits to the Azerbaijan economy from a thriving oil and gas sector by way of its many linkages to other sectors of the economy. A successful oil sector could provide an example and encouragement to both domestic and foreign sources to invest further in the economy. However the magnitude of these revenues flows is such that they could present some significant challenges as well as be the key to the successful development of the Azerbaijani economy.

Experience in some countries has suggested that poor economic management of government energy and natural resource revenues can result in the actual lowering of long-term growth prospects. To manage these concerns over the application of revenues accruing from the oil and gas projects in the Caspian, the State Oil Fund of the Azerbaijan Republic was established in 2000. The Fund's primary purposes are to manage the macro-economic impacts of oil revenues and to save for future generations. In order to overcome both the potential impact of resource price volatility, it is intended that expenditure will be based on income generated form the investment of the oil and gas revenues until the capacity for more effective spend has been established. The Government plans to prepare a Public Investment Programme giving details of planned major investments, whether financed through the State Budget or the Oil Fund.

The Fund's regulations specify close cooperation with the State budget to allow coordination of the preparation of the State budget and the Government's spending plans of the Oil Fund within the framework of its macroeconomic targets. Expenditure is to be executed only within the approved annual budget of the Fund and through the Treasury and by Presidential Decree. The Executive Director and Supervisory Council are responsible for managing and controlling the activities of the Fund.

9.11 Accidental Events

Accidental events can occur as a result of a number of factors, such as human error, technical failure, natural events (e.g. seismic activities), or a combination of these. The following subsections present the finding of the accidental events impact assessment for the Phase 3 project. All offshore and onshore activities potentially leading to accidental events have been considered, together with the mitigation measures that have been incorporated into the project design to reduce these risks. Mitigation considered includes both steps taken to prevent an event occurring, and measures in place to minimise the environmental/socio-economic consequences.

9.11.1 Offshore Environmental and Socio-Economic Impact Assessment

The results of the environmental and socio-economic impact assessment for offshore activities are summarised in Table 9.39. The assessment of potential onshore accidental events arising from the ACG Phase 3 development predicted that, except for one medium impact as a result of a Tier III[1] oil spill event (well blow-out or full pipeline rupture), all other impacts would be of low. Each event is considered in more detail below, together with the supporting information behind the impact assessment.

[1] For a definition of a Tier III oil spill event refer to Page 9/105

Table 9.39 Summary of Environmental and Socio-Economic Impact Assessment for Offshore Accidental Events from ACG Phase 3

ID	Activity	Environmental / Socio-Economic Aspects	Environmental / Socio-Economic Mitigation	Cumulative Contribution	Impact Significance	Justification / Comments	Residual Environmental / Socio-Economic Issues to be Addressed
H	Potential Accidental Events Offshore						
H1.	Tier 1 Minor spill (small operation spills) including: Refuelling spills, valve and flange leaks etc	Surface water contamination, atmospheric emissions, hazardous wastes, sea users, revenue	Facility design; Pollution prevention management; Staff training in standard operating procedures; Spill risk assessment and control; Hazardous material management and storage procedures; Plan preventative maintenance (PPM) Spill preparedness and response plan; Spill clean up; Incident reporting; Waste management; Notification.		L	Low significance due to small volume. Atmospheric emissions raised during consultation as a concern affecting air quality on local inhabitants. Issue of waste management raised during consultation. Concern over oil spills raised during consultation.	None.
H2.	Tier 2 Major spill including: Large hydrocarbon/inventory losses, loading hose failures, small to medium pipe failures (hole size up to 50 mm)	Water contamination, atmospheric emissions, hazardous wastes, health, fire/explosion, uncontrolled flow, toxicity, sea users, revenue	As H1 and pipeline inspection along the pipeline route. Pipeline impact protection/corrosion protection Pipeline trenching in water depths <8m Notification		L	Low significance due to low probability of occurrence. Atmospheric emissions raised during consultation as a concern affecting air quality on local inhabitants. Issue of waste management raised during consultation. Concern over oil spills raised during consultation. Reputation issue.	None
H3.	Tier 3 Crisis event including: Well blowout, full diameter pipe rupture etc	Water contamination, atmospheric emissions, hazardous wastes, health, fire/explosion, uncontrolled flow, toxicity, sea users, revenue	As H2 and international assistance in event of a spill; Blowout - BOP equipment design; Mud logging; Relief well contingency plans; Well control specialist contractors; Notification		M	Medium/\low possibility but represents the 'worst-case scenario' and such an event would have wide ranging and trans-boundary environmental impacts, reputation issues and financial implications. Atmospheric emissions raised during consultation as a concern affecting air quality on local inhabitants. Government revenue due to loss of production Issue of waste management raised during consultation. Concern over oil spills raised during consultation.	Oil Spill Contingency Plan Refer to Section 9.11.6

ID	Activity	Environmental / Socio-Economic Aspects	Environmental / Socio-Economic Mitigation	Cumulative Contribution	Impact Significance	Justification / Comments	Residual Environmental / Socio-Economic Issues to be Addressed
H4.	Gas leak from pipeline	Atmospheric emissions; uncontrolled gas release,	Pipeline inspection along the pipeline route Notification		L	Low significance due to low probability of occurrence. Atmospheric emissions raised during consultation as a concern affecting air quality on local inhabitants. Concern over hydrocarbon spills raised during consultation.	None.
H5.	Failure of MODU mooring	Physical presence, collision risk	Routine maintenance of mooring system; Appropriate design on mooring system.		L	None.	None.
H6.	Vessel collision and damage to facilities	Atmospheric emissions; fire/explosion uncontrolled liquid release	Marine management procedures including navigation charts, navigation lights, radar; Presence of standby vessel and exclusion zone to prohibit vessel access. Notification.		L	Low probability of occurrence.	None.
H7.	Loss of facilities during tow-out or installation	Seabed disturbance, interference with other sea users, reputation	Towing sea trials; Trained operators; Standard operating procedures; Mooring checks; Bad weather policy; Installation Management Plan; Additional floatation tanks; Trained operators; Standard operating procedures; Bad weather policy; Control from support vessels; Notification.		L	Low probability of occurrence.	None.
H8.	Subsea umbilical rupture	Uncontrolled liquid release	Correct design; Umbilical inspection; Careful fluid selection through chemical management system; Low toxicity fluid used.		L	Low significance due to low probability of occurrence and low toxicity hydraulic fluids.	None.

ID	Activity	Environmental / Socio-Economic Aspects	Environmental / Socio-Economic Mitigation	Cumulative Contribution	Impact Significance	Justification / Comments	Residual Environmental / Socio-Economic Issues to be Addressed
H9.	Fire	Atmospheric emissions; uncontrolled release of oil.	Firewater pumps designed to deliver water at a rate of 2,000m^3/hr; Platform designed to minimise the spread of fire; Platform staff have been provided with fire safety training.		L	Low significance due to low probability of occurrence, and fire control measures.	None.
H10.	Dropped objects	Seabed disturbance.	Training of personnel Correct design Risk assessment; Standard operating procedures		L	Low significance due to low consequence.	None.
H11.	Loss of cuttings out of CRI wells	Uncontrolled release of waste outside of cuttings target zone or even seabed; Potential hazard to drilling in other locations.	Extensive subsurface modelling to identify a contained repository zone; Analysis of data to confirm deposition of cuttings in target zone.		L	Low significance due to low probability of occurrence. Issue of waste management raised during consultation.	None.
H12.	Encounter shallow gas during drilling	Atmospheric emissions; rig stability; loss of containment	Geophysical surveys Drilling shallow gas pilot holes (3x sites) at DUQ and subsea drill centres.		L	Low significance due to low probability of occurrence. Atmospheric emissions raised during consultation as a concern affecting air quality on local inhabitants.	None.
H13.	Seismic event	Spill, leak, fire/explosion	Seismic analysis and modelling to determine facilities locations and design; Design for 1-in-500 year event and continue producing, 1-in-3,000 year event and retain structural integrity.		L	Low significance due to high design standards, ranking due to loss of well control (worst-case scenario) in the event of for example an earthquake.	None.

9.11.2 Oil Spill

Based on a review of the potential causes of oil spills the following oil spill scenarios were identified for the Phase 3 project:

- The loss of contents of a diesel storage tank.
- A small process equipment leak/spillage.
- Catastrophic rupture of one of the 30” oil export pipelines.
- A small leak in one of the 30” oil export pipelines.
- Catastrophic blow-out at platform location.

In order to facilitate impact assessment, and emergency preparedness and response planning, oil spill dispersion modelling has been conducted for the above scenarios. Modelling used the methodology developed during the Phase 1 and Phase 2 ESIAs. In common with these earlier studies, the OSIS model was used to predict the movement and behaviour of oil simulated releases to the marine environment. The Phase 3 model has improved on earlier work by utilising Caspian specific data; specifically, the unique characteristics of Azeri crude have been recorded and inputted into the model (a sample of crude was not previously available). The model operates on the unrealistic assumption that any oil releases are left to move uninhibited through the environment, whereas in reality response to spills would not permit this scenario to occur. This provides a worst-case spill scenario to facilitate response planning.

The oil spill modelling conducted was of two types – stochastic and deterministic. Stochastic modelling considered environmental factors such as wind and temperature to calculate the probability that an oil spill would impact specific sites/receptors. Deterministic modelling simulates a point source spill and assumes a worse case scenario (e.g. the fastest travel speed towards the coastline). Deterministic and stochastic modelling are used in combination to predict the weathered state of the oil for each of the stochastic modelling scenarios. Modelling scenarios included simulating summer and winter conditions in order to account for seasonal variation in oil spill impact.

Each of the oil spill scenarios is considered below, together with likelihood of the event occurring, and the results of the modelling for the event.

The loss of contents of a diesel storage tank / small process equipment leak/spillage

Minor spills of oil (and chemicals) on platforms and vessels have been mitigated by a variety of operational and design measures, the former are detailed in the Pollution Prevention Plan developed for offshore operations. Specific mitigation measures include;

- Chemical selection procedures limiting chemical use and restricting use to low toxicity chemicals whenever possible.
- Bunding and segregated drainage for fuels and chemicals
- Refueling procedures
- Regular preventative maintenance to detect, repair or replace equipment such as hoses and tanks
- Staff training in hazardous materials management, refueling and waste management procedures
- Reporting of minor spills to detect underlying trends, and task risk assessment

The worst case scenario was modelled for a small process equipment leak resulting in oil potentially reaching the Absheron Peninsula 56 hours after release, with 375 m^3 of oil reaching the shoreline.

The assessment of loss of diesel from a storage tank (100 m^3) shows that the diesel rapidly disperses and evaporates and the amount of oil on the sea surface becomes insignificant (1 m^3) 8 hours after release shoreline.

Catastrophic rupture of one of the 30" oil export pipelines

As discussed in Section 5.7 Pipelines, the Phase 3 development will not involve the installation of additional export pipelines from the offshore facilities to shore. The Phase 3 oil and gas will be transferred via tie-in lines to the Phase 1 and 2 export lines. As such, the Phase 3 project will result in a cumulative contribution to the oil and gas inventory exported to shore via these pipelines and as such, the risk of an accidental event along these lines has been considered.

A catastrophic failure of the main export pipeline due to damage to the pipeline by commercial shipping, was considered to be of low probability during oil spill risk assessment for Phase 1 (Table 40).

Table 9.40 Probability of One or More Pipeline Spills by Size (%). Phase 1 Lifetime (2001 through 2024). (URS, 2001)

Spill Source, Pipeline Spills	Spill probability (%)	
	1-100 tonnes	>300 tonnes
Corrosion and Fittings	6.95	5.45
Pipe Damage/Anchors	2.18	1.59

These probabilities were calculated on the basis of statistically expected pipeline spills with the risk exposure calculated as 4000 km-years for the single Phase 1 pipeline (URS, 2001). The probability of a pipeline spill from the single Phase 2 pipeline is similar because it is of similar length and lifetime. Since Phase 3 will not use an additional export pipeline, but will use both of the two 30" Phase 1 and Phase 2 export pipelines to transport the oil to the Sangachal terminal, the statistical risk and therefore statistical probability of a pipeline spill for Phase 3 is greater that of either of the individual pipelines. The probabilities of either one of the two pipelines being the source of a spill during the 17-year lifetime of Phase 3 are as follows:

Table 9.41 Probability of One or More Pipeline Spills by Size (%) for combined Phase 1 and Phase 2 pipelines during the 17-year lifetime of Phase 3. (URS, 2001)

Spill Source, Pipeline Spills	Spill probability (%)	
	1-100 tonnes	>300 tonnes
Corrosion and Fittings	10.3	8.07
Pipe Damage/Anchors	3.23	2.35

The pipeline is protected with a concrete coating to protect from the mechanical impact of a dropped object or dragged anchor. The concrete coating also provides the pipelines with weight to ensure stability on the seabed. Furthermore, the pipeline is on two major gradients as it dips down from the platform and then steadily rises again as the pipeline heads towards the shore. This means that there is a low point at some distance from the platform. For oil to leak from the pipeline it would have to overcome the hydrostatic head of water in the surrounding waters and thus it is unlikely that all oil in the pipeline to be discharged.

The possibility of a pipeline rupture or leak from external damage is further managed through a number of protection measures; all pipelines are corrosion protected by a polypropylene/polyethylene coating together with additional cathodic protection. In addition there is a corrosion inhibitor program whereby corrosion-inhibiting chemicals are added to the product before passing it through the pipeline.

Pipeline route selection also minimises possible interference from anchoring boats and the risk of damage due to dropped objects. In the nearshore zone where the water depth is less than 8m the pipelines will be buried to a depth of 1 m. Where a pipeline crosses existing pipelines, crossing structures have and will be constructed to permit sufficient spacing between the pipelines (See Chapter 5, Section 5.7.2.1).

Once constructed, possible leaks of hydraulic fluid from the operation of the subsea water injection facilities (i.e. umbilicals and manifolds) will be detected through regular operational integrity checks and occasional Remote Operated Vehicle (ROV) surveys. The main export pipelines will also be monitored, details of which are provided in Phase 1 ESIA Section 5.6.8.

Modelling was based on a release of oil from the point in the pipeline that was deemed most vulnerable, i.e a shipping route in shallow water. Modelling predicts that should either export pipeline rupture, 12,000m^3 of oil could be released in 2 hours. It should be noted that a simultaneous rupture of both pipelines was not considered due to the extreme rarity that this event could occur during the operational lifetime of the projects.

The model predicts that oil would beach within Sangachal Bay. There is a 5% probability that oil would beach within the first hour and an 85% probability of beaching within 40 hours of release. Under continuous westerly winds, and in winter, there is a very small probability (2%) that oil could reach coastal sites at Turkmenistan. This probability is greater than that estimated for Phases 1 and 2 due to the additional volume of oil contributed by Phase 3 (50%) and the use of Azeri crude in the model, which displays a higher persistence when compared to the crude modelled for the ACG Phase 1 and 2 ESIAs.

The impact of pipeline rupture on the open Caspian is greatest during winter; with an area of 120 km^2 deemed to have a 5% chance of being impacted.

The deterministic models for a large-scale pipeline spill were run until the slick volume became insignificant (1 m^3). The worst-case scenario is an onshore wind resulting in oil beaching within 2hrs in Sangachal bay.

A small leak in one of the 30” oil export pipelines

As stochastic modelling was conducted for a large pipeline spill, only deterministic modelling was conducted for the small pipeline spill to determine the risk of oil reaching the Azerbaijan coastline.

The model indicates that with an onshore wind (worst case scenario), oil from a small pipeline leak could reach the Azerbaijan coastline within 3 hours of release, with 741 m^3 reaching the shore. Slick volumes are greatest during offshore winds (258 m^3 compared to 6 m^3 with an onshore wind) but beached volumes are substantially less than during onshore winds (only 283 m^3 deposited 188 hours after release).

The measures to prevent a small leak in the export pipelines and the probabilities of a small spill are described above (corrosion protection, concrete coating, inspection programmes).

Catastrophic blow-out at platform location.

In terms of oil spill risk from a blow-out, using the methodology described in the ACG Phase 1 ESIA (URS, 2001) and calculating the risk specific to the drilling programme for Phase 3, the risks of a blowout during ACG Phase 3 alone are 2.1% during development drilling and 1.15% during production. This equates to a risk of 1 in 47 and 1 in 90 respectively that an individual well will suffer a blowout during the 17-year life of Phase 3.

The risk of a blow-out is reduced through the incorporation of a variety of protective measures including:

- Prior to production, drilling geophysical surveys will be conducted and shallow gas pilot holes drilled to enable potentially dangerous gas pockets to be avoided.

- Blow Out Preventers (BOPs) will be utilised in all wells drilled and can be rapidly closed following an influx of formation fluids into the well bore. In an emergency situation, gas will be vented at the surface and any oil will be contained in the drilling rig's mud system.
- Mud logging to assess the characteristics (such as pressure changes) of the formation being drilled and assist in identifying dangerous conditions potentially leading to a blow out.

Whilst extremely unlikely, the consequences of a blow out represent the worst-case oil spill scenario. The duration of a blow-out is based on the time taken for a drilling facility to reach the spill site and drill a relief well; this was conservatively estimated at 42 days. Furthermore, the model was allowed to run for a total of 1008 hours to assess the fate of oil released over a longer timescale.

If a blow out were to occur in summer there would be an area of approximately 101,000 km^2 with a 15% chance of being affected. The surface oiling contour for a 50% probability level covers an area of approximately 1700 km^2. During winter, the 15% probability of oiling contour covers a reduced area, however, due to the more viscous nature of the oil in winter, the 50% probability contour covers an area of approximately 4,700 km^2.

Under a blow-out scenario, there is also a risk of oil reaching the shore ('beaching'). Much of the Iranian coast and areas of Turkmenistan have a 10-15% probability of oil being beached. The volumes of oil beached based on extrapolated volumes after 1008 hours, are shown in Table 9.42

Table 9.42 "Worst Case Scenario" Oil Beached on International Shores in the Case of a blowout involving 200,000m^3 of Azeri Crude Oil.

Country	Volume of Oil Beached in Worst Case Scenario (m^3)	Minimum time taken for oil to beach (days)
Turkmenistan	400,000	6
Northern Iran	500,000	11

Deterministic blowout oil spill scenario modelling was conducted to assess the volumes of oil potentially beaching on the Apsheron Peninsula, Turkmenistan and Iran (based on modelling three different wind directions) and the time required to do so. Full details of the model results based on extrapolated volumes after 1008 hours are summarised in Table 9.43.

Table 9.43 Summary of the deterministic model results for a blow-out at the Phase 3 platform facilities.

Model volumes	Location of beaching		
	Aspheron peninsula	Turkmenistan	Iran
Summer conditions:			
Time to initial beaching	59 hrs	90 hrs	185 hrs
Beached Volume (over 1008 hours)	381,330 m^3	339,339 m^3	162,418 m^3
Total Volume	595,729 m^3	564,371 m^3	405,390 m^3
Winter conditions:			
Time to initial beaching	56 hrs	90 hrs	185 hrs
Beached Volume (over 1008 hours)	498,497 m^3	419,499 m^3	270,406 m^3
Total Volume[1]	699,915 m^3	640,367 m^3	528,963 m^3

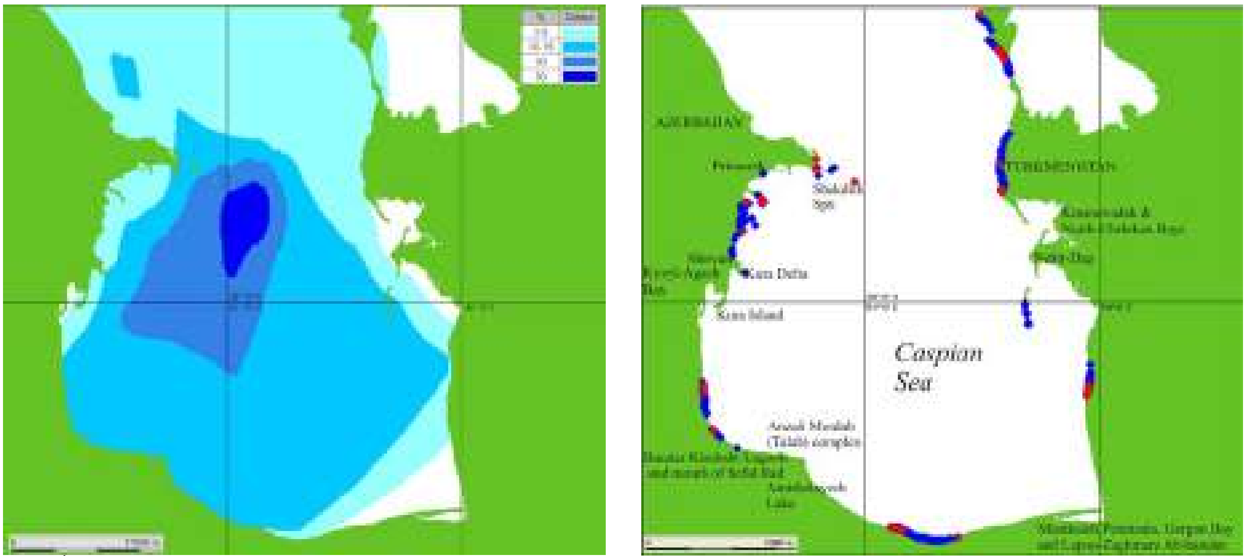
[1]Representing the extrapolated volumes after 1,008 hours, the largest volume of oil occurring during the spill scenario.

From Table 9.43 it is evident that while a blow out occurring at any time could result in the beaching of substantial quantities of oil, a blow out in winter would be most damaging if left to disperse without implementing any response measures.

9.11.2.1 Impacts of an offshore oil spill from the ACG Phase 3 project

The environmental impacts of spilled oil are dependent upon the potential for oil to contact sensitive resources. The impacts will be greatest with a Tier III event. Under the no-response modelled scenario, the probability of areas being affected is illustrated in Figure 9.21. For example, the probability of Bandar Kiashahr Lagoon being affected in the event of a spill is 10-15%. Sensitive resources with potential to be impacted by a major spill are described in Table 9.44.

Figure 9.21 Stochastic modelling (winter scenario) and beaching locations[1] of an accidental release of Azeri Crude resulting from a well blow-out, showing the locations of sensitive receptors identified in Table 9.44



[1] The red dots indicate sites of initial beaching, the blue dots represent subsequent beaching sites

Table 9.44 Sensitive Sites Identified Along The Caspian Coast potentially vulnerable to a Transboundary Oil Spill Incident

Area	Sensitivity
Azerbaijan	
Kyzyl-Agach region (Kyzyl-Agach Bay, Kura spit and Kura River Delta)	Ramsar site1 and State reserve. Supports significant bird populations year round and is an important nearshore fish feeding ground. Oil spill clean-up operations likely to cause significant damage.
	Kura River Delta is an important site for wintering and migratory wader s, some of which are of global conservation importance
Shakdilli Spit, Yuznaya Kosa Cape on Zhiloy Island and the Dardanelli Reef System around the Absheron Peninsula	Main haul-out sites for the Caspian Seal. Highest numbers of seals are present at these locations in spring
Shirvan area	State reserve. Some bird species of global importance. Although inland, birds may fly to the coast to feed.
Islands of Garasu and Gliniyaniy	The offshore islands support large numbers of breeding seabirds
The coastline from Primorsk to the Kura Delta	Important fishing area
Coastline and coastal waters of the Absheron Peninsula south to Kyzyl-Agach	Seagrass communities- important fish feeding and nursery areas.
Iran	
Miankaleh Peninsula, Gorgan Bay and Lapoo-Zaghmarz Ab-bandan	Ramsar site1 and state reserve.
Anzali Mordab (Talab) complex	Ramsar site1 and state reserve.
Bandar Kiashahr Lagoon and mouth of Sefid Rad	Ramsar site1 and state reserve.
Amirkelayeh Lake	Ramsar site1 and state reserve. Although inland, birds may fly to the coast to feed.
Turkmenistan	
Krasnovodsk & North-Cheleken Bays	Ramsar site1 and State Nature Reserve (Zapovednik). The site is a very important staging and wintering area for migratory waterbirds. Also supports a limited commercial fishery.

[1]The Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar Convention) - Azerbaijan became a Contracting Party during 2000.

Comprehensive information on the generic potential effects of an oil spill on the offshore environment of the Caspian has been provided in the ACG Phase 1 Chapter 10 and Phase 2 ESIAs Chapter 8, and is not reproduced here. The following sub-sections summarise the impacts of a potential oil spill from the Phase 3 project.

Seabirds

Seabirds represent the most sensitive faunal population in the ACG Phase 3 offshore location. As discussed in Chapter 6, the most abundant populations in the offshore development location are gulls, terns and cormorants. Terns and gulls are at a relatively low risk from oil spills as they do not spend long periods of time on the sea surface. Cormorants (together with ducks and grebes) are more sensitive to oil given their feeding habits, often spending considerable periods of time on the water. Even minimal oil contamination can be fatal due to hypothermia from loss of insulation, toxic poisoning and an inability to feed. Given the potential area covered by a large-scale spill, all species of seabird would be at risk from an accidental event such a blow-out.

Nearshore and coastal birds

Nearshore and coastal bird populations are sensitive throughout the year, although the degree of vulnerability will change due to natural seasonal variation in the number of birds present.

Azerbaijan is a known migration route for many bird species. Particularly during March to August (breeding period) and October to March (overwintering), internationally significant numbers of birds may be found in the Azerbaijan waters of the Caspian. A large spill reaching the shore during these times would pose a significant risk of impact. Information on coastal sites of ornithological importance is given in Chapter 6 (See Section 6.3.2.8, Figure 6.12 and Table 6.9).

Caspian Seal

The Caspian Seal is listed by the IUCN as Vulnerable and is the only aquatic mammal in the study area, as discussed in Section 6. Seals may be impacted by oil spills, either by direct physical effects on their skin, eyes and nose, or by toxicity resulting from ingestion of oil or contaminated prey. Oil contamination may render the animals more susceptible to other diseases, e.g. CDV (Canine Distemper Virus). The summer is the most vulnerable period for the seal population as they are expected to occur in higher numbers at this time of year in the middle and south Caspian, either feeding or hauling out on islands. Although seal pups are potentially very vulnerable to an oil spill, most pupping sites are outside the potential zone of impact from an oil spill as 90% of the population migrate to the pack ice in the North Caspian to pup on the pack ice.

Fish

Due to their mobility, impacts on fish populations tend to be limited to the immediate area of a spill or to coastal environments where avoidance is difficult. Rapid evaporation and dilution of spilled crude will reduce the effective toxicity to fish and any significant long term changes to fish populations are not anticipated.

Plankton populations

Plankton populations are generally subject to high levels of natural variability. In the open sea, rapid dilution of naturally dispersed oil and its soluble components, as well as the wide distribution of plankton eggs and larvae, reduces the possibility of significant effects from an oil spill.

Benthos

Impacts on benthos from an oil spill are likely to be most evident in shallow coastal waters. Impacts include smothering (affecting all species) and toxicity, affecting deposit, suspension and filter feeders. Filter feeders such as mussels are likely to be particularly vulnerable given their relatively slow rate of reproduction. Significant indirect impacts may also result on species such as sturgeon that feed on benthos.

Coastal environments

Oil contamination of coastal habitats has the potential to affect a wide range of species, not only during the spill, but also subsequently due to physical damage caused by clean up operations. AIOC has conducted studies to assess the sensitivity of the coastal environment of Azerbaijan using internationally accepted methods to assign vulnerability status (See ACG Phase 1 ESIA, Chapter 10 and the Phase 2 ESIA, Chapter 8). The vulnerability classifications are shown below in Table 9.45.

Table 9.45 Coastal Vulnerability Index, with 9 representing the most vulnerable shoreline habitat type.

Index	Shoreline Type	Comments
1	Exposed rocky headland	Wave reflection keeps most of the oil offshore.
2	Eroded wave-cut platforms	Wave swept. Most oil removed by natural processes within weeks.
3	Fine-grained sand beaches	Oil with limited penetration into the sediments, facilitating mechanical removal. Otherwise oil may persist for several months.
4	Coarse-grained sand beaches	Oil may sink and/or be buried rapidly making clean up difficult. Under moderate to high-energy conditions, oil will be removed naturally within months.
5	Mixed sand and gravel beaches	Oil may undergo rapid penetration and burial. Under moderate to low energy conditions, oil may persist for years.
6	Gravel beaches	As above.
7	Sheltered rocky coasts	Areas of reduced wave action. Oil may persist for years.
8	Sheltered inundated flats	Areas of great biological activity and low wave activity. Oil may persist for years.
9	Salt marshes	Highly productive aquatic environments. Oil may persist for years.

Of the oil spill scenarios modelled, the nearshore pipeline rupture represents the worst immediate risk to the coastal environment, with a 5% probability of oil reaching the shoreline one hour after release.

The most sensitive shoreline areas identified along the Azerbaijan coast are the coastal wetlands, particularly the Kyzyl-Agach region (Chapter 6, Figure 6.12), which supports bird species of international importance and provides valuable fish feeding grounds. In addition, the shallow waters and seagrass habitat identified along the Sangachal Bay and Aspheron Peninsula are also vulnerable year round.

As the toxic volatile components of an oil spill rapidly evaporate on entering the marine environment, the most likely impact of an oil spill will be physical smothering and coating of biological receptors. However, oil dispersed in the water column may result in toxic effects on seagrass and associated communities. For the largest spills, resulting from a blow out, oil could potentially reach coastal wetlands in Iran and Turkmenistan, some of which are of international importance for wildlife.

The Caspian Sea supports a range of commercial and recreational activities, with a high concentration of vessel movements in support of trade and industry and passenger services. The oil spill resulting from a Tier III event, and the associated spill response activities, will interfere with vessel movements during clean-up. Additionally, there will be a loss of government revenue as a result of the reduction in the delivery of produced product.

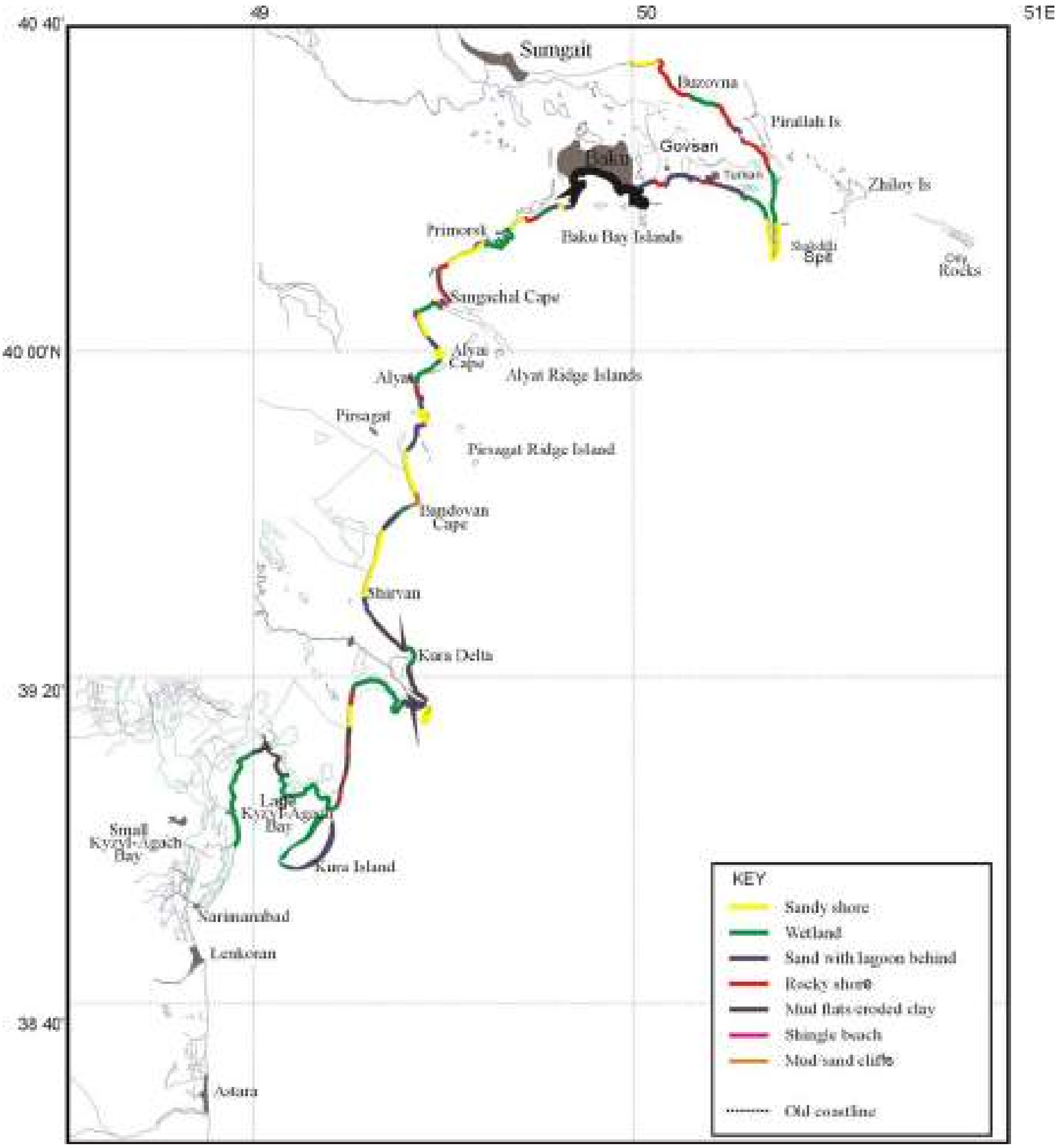
Commercial and recreational amenities located on the coastline of the Caspian Sea will also be impacted. The physical presence of oil and the visual impact will interrupt and/or deter usage of the coastal amenities leading to a potential loss of income. The effect of these impacts will be long-term.

It is expected that the marine environment will be impacted with the potential knock-on effect of bans on the fishing and harvesting of marine products following a spill. The purpose of these bans being to maintain market confidence and to protect fishing gear and catches from contamination. Loss of market confidence may arise where the public is unwilling to purchase marine products from the region due to the perception that the products are tainted. Floating equipment and fixed traps extending above the sea surface are more likely to become contaminated by floating oil. Submerged nets, pots, lines and bottom trawls are usually well protected, provided they are not lifted through an oily sea surface.

Remediation activities can potentially have an impact upon natural and man-made structures where heavy plant and pressure hoses are used, however this will be mitigated during design and planning.

Small operation spills e.g. resulting from refuelling activities or valve and flange leaks will have little, if any, adverse impacts due to the limited potential for interaction with receptors due to the volume of the spill.

Figure 9.22 Coastal classifications and clean-up strategies for the Azerbaijan coastline (adapted from Gundlach and Hayes, 1989 and AIOC, 2001).



9.11.3 Oil Spill Response Planning

BP as operator of AIOC has an approved Oil Spill Response Plan in place for its offshore and onshore operations. These plans establish the notification, response and follow up actions that must be implemented should an accidental event occur. A comprehensive description of the elements to be included in the OSRP is provided in Section 13 of the ACG Phase 1 ESIA and the ACG Oil Spill Framework Document (www.caspiandevelopmentandexport.com) and is not repeated here. This plan will be used as a basis for the development of an integrated ACG OSRP that will encompass all Phases of the ACG Development, including Phase 3.

BP has adopted the internationally recognised Tiered response concept to oil spill response, which allows the company to plan for any realistic spill that may occur, and put in place an effective response system to deal with it. Oil spill provide a variety of complexities, and the Tiered response concept gives BP the means to escalate their response in line with that level of complexity. There are three Tier levels as described below:

Tier 1 (Minor Spill)

Tier 1 spills are defined as small operational spills that can be can be handled immediately by on-site personnel. Tier 1 spills may result from normal operations such as well control problems, refuelling and pig launching and receiving, valve and flange leaks, and routine operation and maintenance activities. In most cases, the response will be to clean up using on site resources or monitor the spill with a view to it dispersing naturally.

Tier 2 spill (Major Spills)

Tier 2 spills are defined as spills that require additional local (in-country) resources and manpower. Tier 2 spills are likely to result from large fuel losses, loading hose failure or small to medium pipe failures (hole size up to 50 mm). The site response team will carry out cleanup, aided by the dedicated Tier 2 oil spill contractor.

The following scenarios are associated with a Tier 2 spill:

- Environmental damage which may affect a nearby community for a short period of time;
- Any operational oil spill that may require additional resources and manpower;
- Significant media coverage or potential damage or costs to the company;
- Significant resources are needed to deal with the emergency and which may not be available at the facility.

Tier 3 spill (Crisis Event)

Tier 3 spills are very large, possibly ongoing spills, which will require additional resources from outside the country of spill origin. Such spills are very rare and would only occur through events such as a well blowout, full diameter pipe rupture, or an uncontrolled tank failure. All available spill contractors (from within and outside Azerbaijan) would carry out the physical response, with extensive support from the Incident Management Team and the Business Support Team.

The following scenarios are associated with a Tier 3 spill:

- Significant environmental damage (e.g. large geographic area, or sensitive environmental resources);
- Impacts the community for an extended period;
- National interest, or will attract international media attention;
- Threatens the financial resources of the company.

Three approved plans are currently in place, which address offshore and onshore operations. These three plans cover all potential spills for the following areas:

- All offshore platforms within the Chirag and Azeri fields
- In-field sub sea pipelines
- 1 x 24” from Chirag & 2 x 30” oil export pipelines from Central Azeri, all going to the Sangachal Terminal.
- Sangachal Terminal.
- Marine maintenance, construction (during operation phase), repair, survey and supply traffic in field.

The OSCP represents the project level control for oil spill response and coordination of personnel. At the national level, BP is working very closely with the Azerbaijan government to help develop national systems. Once the national plan for the country of Azerbaijan is in place, the relevant BU plans will be updated to reflect any impacts this change may have. Despite the absence of a formal national plan, BP has a process for notifying the Azerbaijan government in the event of an incident such as a spill occurring.

As oil spill modeling scenarios presented in the previous subsections have identified the remote possibility of a transboundary spill from a Tier 3 event, there is the need for a framework to provide international action in response to such a rare event. The littoral states (Azerbaijan, Kazakhstan, IR Iran, Russian Federation, and Turkmenistan) are developing regional co-operation arrangements, to facilitate mutual support in the cases of major oil spill incidents. A Framework Convention was signed by Azerbaijan and a number of these Littoral States on the 4th November 2003, at the Conference of Plenipotentiaries. This convention promotes co-operation within the littoral states in the context of pollution. In the event that the convention is ratified by Azerbaijan government, this OSCP plan will need to be updated.

At present, in the event of a transboundary spill, the defined procedure is for BP to notify the MENR and consult with them on the best strategy to use. Once a national plan is developed, management of transboundary spills will be further defined and formalised. At this point in time, BP will notify MENR and they will notify the relevant transboundary states.

Failure of MODU mooring

The risk of a failure in the mooring of the MODU is very low given the routine maintenance that is carried out on the mooring system, and its appropriate design. Therefore the impact of such an event is considered of low significance.

Vessel collision with project vessels or facilities

Collisions between vessels and the offshore facilities will have a negligible potential for impact due to the provision of mitigation measures that include:

- Exclusion zones around offshore platform facilities, thereby limiting the possible receptors of most offshore accidental events considerably.
- A 500 m safety zone, effective on either side of the pipelines, to prohibit anchoring and snagging.
- There will be radar on vessels and platforms.
- The Naval Hydrographer of Azerbaijan will be informed of the locations of the facilities (platforms and pipelines), including exclusion and safety zones and is responsible for transferring this information to Admiralty Charts.
- The Naval Hydrographer will inform other sea users of the exclusion zones and the movement of project related vessels.
- Navigational lights to vessels and structures involved with the project.
- Radio communications through which sea vessels may be contacted should they enter the exclusion zones.
- Supply/support vessels (on standby) to intercept vessels entering the exclusion zone and ward them away from a collision.

Loss of Facilities During Tow-Out / Installation

Offshore construction will include the installation of major infrastructure, requiring transportation of a jacket, topside and piles to the offshore construction site. In order to avoid possible loss or damage to infrastructure, towing operations will only be conducted as permitted by the bad weather policy. Towing operation trials, operator training, mooring checks and controls provided by support vessels will further minimise the likelihood of damage to or loss of infrastructure. An installation management plan will be developed for jacket and topside installation and measures are included to minimise seabed impacts and interference with other sea users. Therefore the impact is considered of low significance.

Subsea umbilical rupture

A rupture in a subsea umbilical could result in an uncontrolled release of hydraulic fluid. However the likelihood of a rupture is extremely small as the umbilicals will undergo a regular integrity-monitoring schedule and be replaced should any sign of damage occur. The consequence of a release of hydraulic fluid will be low as only hydraulic fluid of a low toxicity will be used. Therefore the residual impact of a subsea umbilical rupture is considered of low significance.

Fire

In the unlikely event of fire occurring on an offshore facility, fire protection equipment has been strategically located to enable a rapid and effective response. Firewater pumps are designed to deliver water at a rate of 2,000m^3/hr, thereby ensuring adequate quantities are available for fire fighting purposes. The platform is designed to minimise the spread of fire, all staff have been provided with fire safety training, and regular monitoring and maintenance of fire fighting equipment is conducted to ensure that it is functioning correctly. Therefore the residual impact is considered low.

Loss of cuttings out of CRI well

The CRI wells are subject to extensive subsurface modelling to ensure that the repository zone is a contained geological zone that will not allow breakout of fractures that could affect other zones, allow movement of cuttings into other zones (where they could pose a drilling hazard), or even return of cuttings to the surface. The modelling also ensures that pressurizing the repository zone will not increase the propensity for seismic events. During re-injection well pressures and the injection volumes will be constantly monitored. The data will be analysed to verify that the cuttings are remaining in the target repository zone. The impact of a loss of cuttings from one of the CRI wells is therefore considered a very low probability and therefore of low impact significance.

Other accidental events

The impact of dropped objects is considered of low significance because of the low probability of occurrence when considering operating procedures and training of personnel, and the low consequence. The possibility of encountering shallow gas will be mitigated through the drilling of pilot wells and conducting geophysical surveys and so the impact is considered of low significance. Finally, the impact of a seismic event is also considered low because of high design standards to withstand a 1-500 year seismic event.

9.11.4 Onshore Environmental and Socio-Economic Impacts

The results of the environmental and socio-economic impact assessment are summarised in Table 9.46. The assessment of potential onshore accidental events predicted that, except for one medium impact (emergency flaring), all other impacts would be of low significance.

Table 9.46 Summary of Environmental Impact Assessment for Onshore Accidental Events from ACG Phase 3

ID	Activity	Environmental / Socio-Economic Aspects	Environmental / Socio-Economic Mitigation	Cumulative Contribution	Impact Significance	Justification / Comments	Residual Environmental / Socio-Economic Issues to be Addressed
J	**Potential Accidental Events Onshore**						
J1.	Tier 1 Minor spill (small operation spills) including: Refuelling spills, Valve and flange leaks, transportation spills etc	Ground contamination, atmospheric emissions, hazardous wastes, fire	Facility design; Pollution prevention management; Staff training in standard operating procedures; Spill risk assessment and control; Hazardous material management and storage procedures; Plan preventative maintenance (PPM) Spill preparedness and response plan; Spill clean up; Incident reporting; Waste management. Notification, community liaison		L	Low significance due to small volume. Concern over oil spills raised during consultation. Atmospheric emissions raised during consultation as a concern affecting air quality on local inhabitants. Issue of waste management raised during consultation.	None required.
J2.	Tier 2 Major spill including: Large fuel losses, loading hose failures, small to medium pipe failures (hole size up to 50 mm)	Ground contamination, atmospheric emissions, hazardous wastes.	As J1; Bunding of tanks to at least 110% of the volume of the tanks (the crude oil storage tanks sit within a bund of compacted clay soil with a concrete facing, built to contain 150% of the volume of the tank).		L	Low significance due to low probability of occurrence. Atmospheric emissions raised during consultation as a concern affecting air quality on local inhabitants. Issue of waste management raised during consultation. Concern over oil spills raised during consultation. Reputation issue.	None

ID	Activity	Environmental / Socio-Economic Aspects	Environmental / Socio-Economic Mitigation	Cumulative Contribution	Impact Significance	Justification / Comments	Residual Environmental / Socio-Economic Issues to be Addressed
J3.	Tier 3 Crisis event including: Loss of oil storage inventory through an uncontrolled tank failure, full diameter pipe rupture etc	Ground contamination, atmospheric emissions, hazardous wastes.	As J1 and international assistance in event of a spill. Bunding of tanks to at least 110% of the volume of the tanks (the crude oil storage tanks sit within a bund of compacted clay soil with a concrete facing, built to contain 150% of the volume of the tank).		L	Low significance due to low probability of occurrence. Atmospheric emissions raised during consultation as a concern affecting air quality on local inhabitants. Issue of waste management raised during consultation. Concern over oil spills raised during consultation. Reputation and liability issue.	None
J4.	Fire at the terminal	Atmospheric emissions; loss of containment.	Bunding of tanks to at least 110% of the volume of the tanks (the crude oil storage tanks sit within a bund of compacted clay soil with a concrete facing, built to contain 150% of the volume of the tank); Fire and gas detection systems; Fixed Foam fire systems on tanks (for the crude oil storage and offspec tanks) eg for the crude oil tanks in the event of a fire by a fire wire which circles the tank and triggers an early warning alarm when melted by heat. A foam system can be activated to disperse foam over the tank and extinguish any fire before it escalates; Water deluge protection system for the Dew Point Control Units (DPCU); Fire Pumps; Portable fire extinguishers throughout terminal; On site mobile fire response vehicle.		L	Low significance due to low probability of occurrence and controls in place to respond to a fire should it occur.	None
J5.	Emergency flaring	Atmospheric emissions, light, heat, noise.	Correct process design; PPM and inspection; Staff training in standard operating procedures; Control mechanisms. Notification, community liaison		M	Medium due to large volume of emissions over a short period of time. Atmospheric emissions raised during consultation as a concern affecting air quality on local inhabitants.	Refer to Section 9.11.4

ID	Activity	Environmental / Socio-Economic Aspects	Environmental / Socio-Economic Mitigation	Cumulative Contribution	Impact Significance	Justification / Comments	Residual Environmental / Socio-Economic Issues to be Addressed
J6.	Extinguishing flare/flare failure	Air emissions, health	Correct design; Control; PPM and inspection Notification, community liaison		L	Low due to continuous pilot. Atmospheric emissions raised during consultation as a concern affecting air quality on local inhabitants.	None.
J7.	Road accident	Impact on other road users; Ground and surface water contamination; Air emissions.	Vehicle maintenance programmes; Transport Management Plan; Emergency Response Plan.		L	Vehicle maintenance and the Transport Management Plans reduce the likelihood of an accident and the Emergency Response Plan will limit the extent and duration of impacts should an accident occur.	None.
J8.	Seismic event	Spill, fire/explosion	Safety standard 30% above Factor of Safety to safeguard against seismic. Notification, community liaison		L	Low significance due to high design standards.	None.

Emergency Flaring

It has been assessed that the most significant environmental impact from potential accidental events onshore will result from emergency flaring. Emergency flaring may have to be conducted for safety reasons should plant upsets occur. However, the incidence of flaring will be managed by designing equipment with spare capacity and regular equipment maintenance. A flaring policy will also be developed to manage flaring quantities. Flaring quantities will be measured to verify that the flaring policy is being effectively implemented.

In the case of an emergency flaring the atmospheric emissions or heat will not impact the surrounding communities. Although the level of light and noise emissions during emergency flaring will increase, emergency flaring for full blowdown of the facilities will only take place for a maximum of 15 minutes. During this period there will be peak flaring for about 3 – 4 minutes, after which the light and noise emissions will exponentially decline as a result of pressure reduction. The modelled noise at the peak emergency flare rate of 100 MMSCF, predicted to last 4 minutes, was 107.7 dB(A) at 125 metre radius from the flare base and between 60 and 70 dB(A) at the sensitive community receptors between 2 and 3 km away. The exact predicted noise levels in the event of emergency flaring are shown in Table 47.

Table 9.47 Predicted Noise Levels at Sensitive Community Receptors Due to ACG FFD HP Flare at 107.7 dB(A) at 125m from Flare.

Predicted Community Noise Level (dB(A))	
Caravansari	68.6
Roadside Café	68.3
Umid Camp	60.4
Umbaki	64.3
Sangachal Town	61.4

The Azeri Project will supply gas to the national grid (refer to Section 7: Socio-Economic Baseline) and emergency flaring will lead to a decrease in the volume of gas supplied to the national grid. The volumetric decrease will be negligible compared to the overall supply and the frequency of emergency flaring is expected to be low. Consequently, the potential impact of this activity is assessed as low.

Oil Spill

Given the potential for onshore oil spills to impact soil and water resources should they occur, the potential for spills has been reduced through the development of a range of mitigation measures. Design measures include minimising potential sources of leaks by the installation of valves and flanges. Should leakage and spills occur, secondary containment systems around storage tanks and processing areas will reduce the impact, e.g. bunds around oil storage vessels that will contain 110% of the vessel storage capacity in the event of a spill. The potential for storage tanks to be overfilled has been reduced through good tank design, including level gauges, warning alarms and automatic shut-down valves.

As described above for offshore operations, operational plans and procedures (e.g. fluid transfer, inspection of transfer hoses and joints, plan preventative maintenance, including inspection, testing and calibration of monitoring and pollution control equipment) have been developed and pertinent staff training will be conducted to facilitate the implementation of these procedures. Regular monitoring and auditing will also take place to verify that procedures are being followed. Spill response equipment is strategically located in the terminal area to allow a rapid response in the unlikely event that containment systems fail.

Fire

The fire water system developed for terminal facilities associated with Phase 1 and 2 will be extended to cover additional Phase 3 facilities. As described for spill response, fire-fighting equipment will be located and regularly maintained in accordance with established procedures. In addition the following controls will mitigate the impact of a fire should it occur:

- Bunding of tanks (the crude oil storage tanks sit within a bund of compacted clay soil with a concrete facing, built to contain 150% of the volume of the tank);
- Fire and gas detection systems;
- Fixed Foam fire systems on tanks (for the crude oil storage and offspec tanks) eg for the crude oil tanks in the event of a fire by a fire wire which circles the tank and triggers an early warning alarm when melted by heat.
- A foam system can be activated to disperse foam over the tank and extinguish any fire before it escalates;
- Water deluge protection system for the Dew Point Control Units (DPCU);
- Fire Pumps;
- Portable fire extinguishers throughout terminal;
- On site mobile fire response vehicle.

Given the low probability of a fire occurring and controls in place to quickly manage a fire situation, the environmental impact is considered of low significance.

Extinguishing flare/flare failure

The possibility of the flare system failing is very small but the consequence would be the release of unburned hydrocarbons constituting GHG emissions as well as posing a fire/explosion hazard. Because of this risk the flare system is designed to self re-ignite almost instantaneously in the event of the pilot light extinguishing. Therefore the consequences of a flare failure are considered of low impact significance.

Road Accident

The vehicles that transfer fuel and/or hazardous materials to and from the terminal represent the most significant risk to other road users, in the specific event of an accident. This risk will be managed through the application of strict vehicle maintenance programmes and transport management systems, as utilized in Phase 1 and 2 construction activities. A road accident involving a project-associated vehicle carrying fuel or hazardous materials is also expected to impact on the normal flow of traffic. However, the probability of such an event occurring is small and implementation of the Emergency Response Procedures developed for Phase 1 will limit the duration of the impact. As such, the significance of the impact is low.

Seismic Event

The terminal has been designed to withstand seismic events of the type and size characteristic for the region. Project structural design safety factors for the Phase 3 terminal expansion, used in the calculation of seismic loads, have been set at 30% greater than those prescribed by international design codes. Therefore the potential environmental impact is considered of low significance.

Potential for socio-economic impacts from onshore accidental events

Accidental ground contamination, atmospheric emissions, hazardous wastes, fires and explosions and uncontrolled flows, resulting from spillages are not expected to have any major socio-economic impacts for reasons that include, but are not limited to, the following:

- No project related activities occur in areas of agricultural or commercial significance, or in areas that are frequently used by the general public.
- Most of the identified accidental events will occur within the terminal boundary.

10 Wider issues

Contents

Figures

Tables

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10.1 Introduction

As discussed in previous sections, ACG Phase 3 activities may contribute to the challenge of meeting a number of further operational issues relating to ACG projects or other BP AzBU activities in the region. Although the majority of these issues do not register as significant issues for ACG Phase 3 as a single project, when considered that it will follow behind a number of other BP operated projects in the region and integrate into their management of these issues, they warrant further discussion. Furthermore, some issues relate to stakeholder concerns raised via the ACG Phase 3 consultations and therefore this section aims at providing transparency on them and any work conducted by BP AzBU and/or the ACG project team to address them. These issues are identified below and discussed in the following subsections:

- Waste Treatment and Disposal – Low residual significant impact specific to ACG Phase 3 is predicted from the generation, reception, transportation and onshore treatment and/or disposal of project wastes, but waste management is a key issue of stakeholder concern and ACG Phase 3 will ultimately align with AzBU waste management strategy.
- Construction Workforce Demobilisation – Identified as of low significance impact for ACG Phase 3 project. However, recognising that the project is the last in a series major construction projects currently active in the area and as such will also need to demobilise the construction workforce, the impact of workforce demobilisation on local employment is of concern to stakeholders.
- Decommissioning – Under the ACG PSA, an abandonment plan for ACG Phase 3 and all facilities will be required one year prior to recovery of 70% of reserves. Whilst environmental and social impacts will be fully considered at the time of developing the plan, decommissioning of offshore facilities was raised as a stakeholder concern.

10.2 Waste treatment and disposal

10.2.1 Introduction

As discussed in Section 9 Impact Assessment, a range of non-hazardous and hazardous wastes will be generated during the different stages of the Phase 3 development, from construction through to installation and operation of the offshore and onshore facilities.

BP's waste production is predicted to peak at 18,000 MT around 2004, declining rapidly to around 4,000 MT by the end of 2007 as projects move from construction to operation resulting in a decrease in the amount of waste generation. From 2008, waste production will become relatively constant until 2024.

It is recognised that internationally acceptable waste management infrastructure is at an early stage of development in Azerbaijan and Georgia. Until the appropriate waste storage/treatment/disposal facilities are available, BP will store its hazardous wastes in a safe and secure manner.

BP has invested considerable effort in assessing national waste disposal sites for suitability as long-term disposal solutions for AzBU waste. The results indicate that the available waste infrastructure currently does not provide the range of internationally acceptable facilities for the reuse and recycling of generated wastes. Clearly this together with stakeholder concern makes waste disposal a priority issue and hence its inclusion within this discussion of wider issues.

This section sets out AzBU's current approach to waste management together with its strategy for the future.

10.2.2 Current BU Approach to Waste Management

BP as the operator of AIOC, currently manages waste around a commitment that the Company provides:

"…an environmentally acceptable strategy for the management and disposal of wastes arising from the Company's own activities and those of its Contractors" (AzBU Waste Management Expectations' ref: UNIF-HSE-ENV-REP-001-Rev 0).

The AzBU is responsible for sourcing suitable waste disposal routes on behalf of Phase 3 and the other BU projects/operations. The current primary disposal routes for wastes are shown in Table 10.1 below:

Table 10.1 AzBU Identified Primary Waste Disposal Routes

Category	Description	Disposal Location
Hazardous waste	Storage under controlled conditions	Serenja Hazardous Waste Facility
Non-hazardous waste	Re-use/recycling and where not possible, landfill	Various recycling routes (steel, paper, wood) or Balakhany Municipal Landfill

Section 5.10 provides detail on the classification and quantification of wastes under the above cateogries.

With respect to the Serenja hazardous waste storage facility, this provides a controlled and managed interim step until a final disposal solution can be provided. Similarly, the use of the Balakhany Municipal Landfill is not a preferred solution for BP as landfill creates a long-term responsibility and occupies valuable land resources and as such alternatives are being sought.

AzBU is currently working in conjunction with local agencies and authorities and with individual BP project teams to identify compliant interim and long-term waste management solutions for hazardous storage, reuse/recycling options, landfill sites and operations.

10.2.3 BU Waste Management Strategy

The AzBu aspiration is to achieve international standards of waste management in Azerbaijan and Georgia. To ensure that this process is transparent to all stakeholders, BU guidelines have been developed that are consistent with international waste management practices. These include:

- Compliance (as a minimum expectation) with BP Policy and local legislation and regulations;
- Experienced, reputable contractors will be accountable for managing waste from the agreed point of deposit to the final destination;
- Innovative approaches to waste management, seeking assistance from and interaction with local institutions and industry;
- Development of disposal options in partnership with the relevant Environmental Authorities;
- Working internally and with Contractors to minimise waste generation;
- Working with local infrastructure and industry to re-use and recycle waste in accordance with principles of the waste reduction hierarchy;
- Setting Annual Work Activity Plans, Budget Plans and Performance Measures with regular reporting to key stakeholders.

Any external company that manages BP wastes must demonstrate that it meets these standards, or has an agreed improvement plan for achieving them within a realistic timeframe. This standard applies to wastes generated at all BP sites and those of its contractors. BP will regularly audit its waste treatment facilities and contractors to provide assurance that continuous improvement in performance is achieved.

There are two main activity sets for the achievement of international standards of waste management in Azerbaijan:

1. Implementation of the AzBu plan for the delivery of suitable waste management infrastructure. The waste treatment facilities for hazardous and non-hazardous wastes include a waste transfer station, hazardous waste landfill and other potential facilities e.g. an incinerator.
2. Engagement/encouragement of continuous improvements in new and existing waste management facilities/options via:

- Auditing of local waste management companies and implementation of suitable and sufficient improvement plans;
- Working transparently with local companies to understand current practice and future capabilities;
- Working with international organisations (as appropriate) to maximise any benefits/synergies for waste management improvements;
- Limited investment in new local facilities, or upgrading existing facilities (where relevant).

10.2.4 Solutions to Waste Management

As discussed, there is a lack of suitable infrastructure in Azerbaijan for the reuse / recycling and disposal of wastes. The following section discusses the activities that are being pursued by the AzBU in the management of waste.

10.2.4.1 Waste prevention/minimisation/re-use

The first step in the waste management hierarchy is to prevent the generation of large quantities of waste through prevention, minimisation or re-use. In accordance with the AzBU Waste Expectations, methods of waste prevention and minimisation will be investigated for implementation, including:

- The development and implementation of a “sustainable supply chain” philosophy to activities and operations;
- Justification of waste management decisions through the AzBU waste management hierarchy;
- Training of personnel on waste prevention/minimisation/re-use opportunities on site;
- Continual review of site activities to identify new and/or additional waste prevention/minimisation/re-use opportunities;
- Review of chemicals used on site and, where practicable, replace toxic chemicals used with non-toxic chemicals; and
- Audits to verify workforce compliance with approved waste reduction strategies.

10.2.4.2 Waste recovery/recycling

A significant amount of scrap steel is currently being generated from the construction stage of the ACG Phase 1 project, and this is expected to continue through the construction of ACG Phases 2 and 3. Scrap steel, largely resulting from ongoing template and jacket construction at SPS is currently taken through Sofaz to the Baku Steel Company for recycling. Whilst further study is required to provide the assurance that the facility operates in line with AzBU expectations, the scrap steel is untreated, inert and of a high marine grade quality that can be efficiently recycled with a minimum of residual waste. As such, scrap steel does not pose a significant risk to the environment. Thread protectors are also currently recycled through an approved contractor and scrap electrical cables are being sent for recycling where possible.

With respect to other recyclable materials, a number of routes for recycling have been identified for waste wood. Wood from the terminal construction programme is made safe (by removing nails, removing and labelling any treated timber to control re-use) and distributed to carpentry and agricultural centres. The use of untreated recycled wood from the Phase 1 terminal expansion has also been used to construct beehives to support honey production in the region. In addition waste paper is also being collected and sent to the Baku Sun newspaper for recycling and egg cartons are being returned for re-use.

The AzBu is currently in the process of identifying additional disposal routes for inert non-hazardous wastes that may be suitable for recycling. For example, paint wastes present one opportunity for recycling.

10.2.4.3 Waste removal/segregation/storage

The waste management hierarchy and control procedures that are in place for the construction stage of the ACG Project are discussed in Section 9.2.1 *Offshore Platform Facility Construction and Commissioning in Azerbaijan Construction Yards*. The implementation of ACG project waste management practices to reduce the total amount of wastes generated, together with controls over the segregation, storage and transport of wastes, has resulted in a significant improvement and standardization in the way project contractors currently handle wastes. The development of Central Waste Accumulation Areas (CWAA), together with training at construction sites, waste tracking and waste recording documentation, represents a substantial investment into the management of project wastes.

10.2.4.4 Waste treatment/disposal

In terms of its long term strategy for waste treatment/disposal, BP is currently considering two treatment/disposal options: incineration and landfilling. These are discussed in turn below. Separate consideration is then given to the final disposal options for drilling cuttings, which has been the subject of a BPEO study.

Incineration

The incineration of hazardous and non-hazardous wastes represents an accepted international solution in waste management as it reduces the volume and nature of wastes through combustion. The system uses high temperature incineration to maximise the combustion efficiency of wastes and reduce the atmospheric release of gaseous products that can result from partial combustion at lower temperatures. In addition, vapour/particulate recovery technology further reduces gaseous emissions and the appropriate design of chimney stack heights promotes the effective dispersion of atmospheric emissions.

The use of incineration presents a viable solution for long-term waste disposal but would need to be used in conjunction with an alternative solution for non-combustible wastes.

Currently there is only one known incinerator in Azerbaijan which is specified to work to international standards. This is currently being used on another BP project and future use of this plant by the BU is being investigated. AzBU is currently working to influence third party providers to offer incineration to internationally acceptable standards.

The Garadagh Cement Plant operates on a similar principal to an incinerator, as the facility uses a high temperature kiln in cement production. It is currently used to dispose of small volumes of process water from the Sangachal terminal. However it has the potential to dispose of wastes such as pigging wax, oily rags and tyres. The use of the cement plant as a disposal route for further wastes would be subject to environmental assessment and MENR approval.

Landfill

Balakhany Municipal Landfill is used at present to dispose of non-hazardous waste that cannot be reused or recycled. This will continue to be the case although when incineration becomes available combustible wastes will be redirected away from landfill in line with the waste hierarchy principles.

Hazardous wastes are currently stored at the Serenja Hazardous Waste Facility. A National Hazardous Waste Landfill has recently been constructed as part of a World Bank funded project. It is located at Sumgait approximately 45 km north of Baku. The facility has the capacity to receive all hazardous wastes from BP's operations. Whilst landfilling does not represent a preferred option for BP, in the absence of any alternative those waste streams not suitable for treatment/elimination will be taken there once it becomes operational (at the time of writing this is scheduled for third quarter, 2004).

Drill cuttings

Currently non-water based mud (NWBM) cuttings received onshore are stored under controlled conditions in dedicated cuttings storage pits at Serenja hazardous waste storage facility. During stakeholder consultation, communities raised concerns about atmospheric emissions from the storage of hazardous cuttings potentially affecting the health of local residents. Current storage at the Serenja facility is through a combination of open and closed containment for the cuttings. BP currently conducts atmospheric monitoring at the site in order to assess and manage potential emissions from the storage of cuttings at Serenja.

A number of alternative potential solutions for cuttings treatment and disposal have been subject to trials by BP. These comprise:

- Incineration in the high temperature kiln at the Garadagh Cement Plant.
- The use of microbiological organisms to reduce the oil on cuttings through bioremediation.
- Use of the cuttings in asphalt.

Whilst the trial results have shown some success, the ability of these methods to form long-term onshore management solutions for treatment/re-use of the cuttings waste is limited in consideration of the predicted volume of cuttings that will be brought to shore.

Three additional treatment solutions have therefore been identified as proven technology currently in use in the international market. These have been subject to a BPEO by BP in order to assess their suitability for use in Azerbaijan and are summarised below.

- Indirect thermal desorption (ITD). This method of treatment relies on indirect heating of the cuttings to vaporise the oil contamination. The products of the process are recovered oil, water and residual solids. The recovered oil can be recycled and passed on to drilling mud contractors for re-use in the industry and the water can also be of a standard that could safely be used in dust suppression at the site. At the time of writing, an ITD unit was operating at the Serenja site under a temporary approval from the MENR with a view to defining a final preferred re-use or disposal route for the recovered solids. In many countries where this treatment method has been adopted, a number of re-use options have been found, from road construction to infill material, and these options are included in those currently being investigated by AzBU.
- Fixation. Fixation is a process that uses stabilising agents (lime and cement) to fix the hydrocarbons present in the drill cuttings within a stabilised medium so that they cannot readily be mobilised and interact with their immediate environmental surroundings. The process is currently being used by Azeri MI in a number of small-scale operations in the processing of barite. In addition, small scale trials have been conducted to process

cuttings for other oil companies and the treated cuttings have been disposed of to a third party supply base for land infill as part of a warehouse development.

- Landfill. The potential landfilling of untreated oily drill cuttings is seen as a least preferred option for the long-term management of cuttings wastes transported to shore, primarily due to unsustainability of the permanent use of land resources, potential release of gases and risk of leaching hazardous components. In additional BP Environmental Expectations state, with regard to mud and cuttings that 'disposal to land must be justified by demonstrating that recovery and recycling is not reasonably practicable'.

As discussed, BP has conducted a BPEO of these three options. On consideration of all options in line with Corporate Environmental Expectations, BP is committed to the recycling of the treated cuttings as a preferred option, with landfill being a last resort. Of the potential recycling solutions for drill cuttings management, ITD is considered as the recommended approach, based on a review of cost, logistical requirements and environmental impact criteria. The use of ITD is subject to a separate EIA within the public domain[1], and use of an ITD unit at the Serenja site has been granted temporary approval by the MENR. The ITD EIA also discusses the other options assessed, and these are not repeated within this ESIA.

Produced water

The issue of cumulative generation of produced water from AzBU projects has been discussed in Section 9.8 and is summarised here. Produced water is a key issue for consideration in the generation and management of wastes from terminal operations and has been an area of considerable investigation by AIOC as it applies equally to the Consortium's current and planned operations for EOP, ACG Phase 1and 2. At the time of writing, produced water is only being generated from EOP operations.

As discussed in the previous subsections, the current disposal of produced water from EOP is being managed by sending the waste to the Garadagh Cement Plant where it is used in the cement manufacturing process. A produced water management strategy is presently being formulated to address the higher volumes of produced water that are predicted from the ACG and Shah Deniz fields in 2007 and the subsequent lower volumes of water that are predicted from ACG Phase 3 (Section 9.8)

The future disposal of produced water is being evaluated through the assessment of a number of long-term disposal options. As discussed in Section 9.8, there are at present three potential long-term disposal options under evaluation by AIOC and AzBU:

- Disposal to a dedicated injection well at the Lokbatan onshore oilfield;
- Subsea pipeline back to ACG Field and re-injection via existing offshore facilities
- Treatment and disposal to the marine environment at a suitable distance offshore.

Evaluation of the above options is continuing to assess the equipment, design, cost and potential environmental impacts to determine a preferred final option to pursue. The final decision will be subject to a separate Environmental and Social Impact Assessment, and will require review and approval by the Ministry of Ecology and Natural Resources.

10.3 Workforce Demobilisation

10.3.1 Introduction

As discussed in Section 9, the employment that ACG has created has had a positive effect on the Azerbaijan economy and in particular on the local area. However, the completion of ACG Phase 3 construction will result in a significant impact on the local employment base within

[1] Indirect Thermal Desorption Environmental Statement - Addendum to EIA for Integrated Waste treatment and Disposal Facilities, 2003

the Garadag region. Whilst Phase 3 extends the manpower requirements associated with the ACG FFD project, it is the last in the series of major construction projects within the oil and gas sector that have been on-going in the Garadag region since 2002 (i.e. ACG Phases 1 and 2, Shah Deniz Stage 1). As a result, whilst a high number of those employed in earlier projects have been able to move onto subsequent construction programmes, after the construction period of Phase 3 there are currently no known major construction programmes in the region to which the workforce can transfer. The resultant impacts on employment and income levels will therefore be unavoidable and because of this, demanning or workforce demobilisation has been identified as a medium significant impact for the Phase 3 project. It must be recognised though that demanning is not just an issue for Phase 3, but across all projects within the region and as such is also relevant at a BP AzBU level.

As such the consequences of workforce demobilisation and the effects on employment and income levels must be considered. This section sets out AzBU's current approach to this issue together with discussion on the way forward.

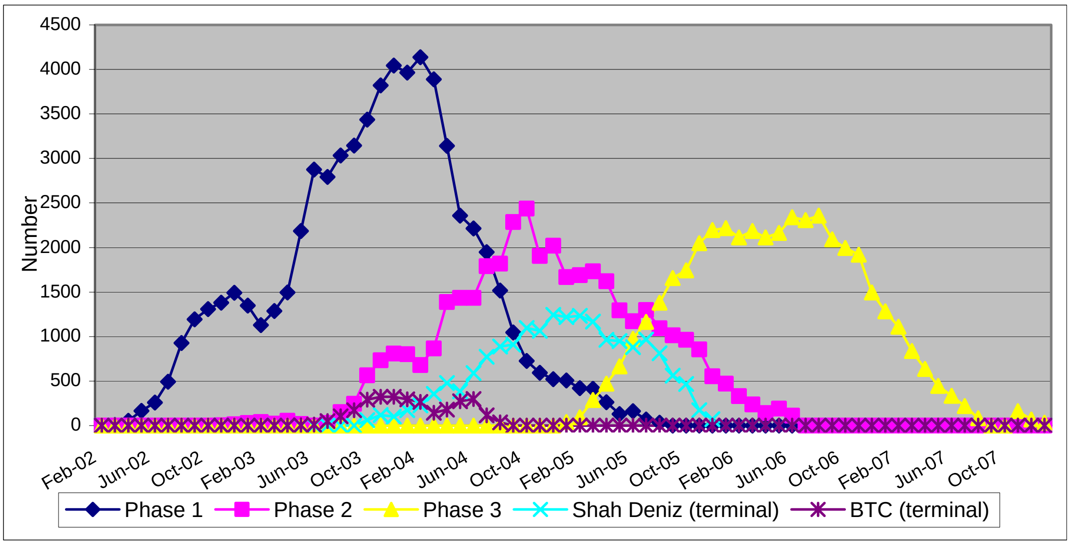
10.3.2 Current Situation

Figure 10.2 below illustrates the projected onshore construction employment profile associated with the various projects since 2002 through until 2008. Total employment from the combined BP projects is projected to peak at approximately 5,500 workers in mid-2004, with successive phases extending the total period of employment but for a decreasing workforce size. As illustrated, Phase 3 employment levels during construction will peak during 2006 and then fall steadily. The impact of this decrease in employment will be especially felt within the local communities, as they have benefited greatly from the project philosophy of employing local personnel wherever possible. Specifically, the Sangachal Terminal main construction contractor developed recruitment and employment strategies during Phase 1 that favoured employing those based locally to the facilities in order for these people to receive benefits through having facilities constructed next to their communities. This also brings local advantages from technology transfer and capacity building, in addition to providing a comprehensive range of training opportunities and thus a more diverse range of skilled employees in the vicinity of these projects.

Within Phase 1, contractors are committed to include 70% Azerbaijan nationals into their workforces and recent project data indicates that some contractors have workforces that consist of between 70% and 85% Azerbaijani personnel. A similar stance on recruitment and employment is currently being taken by Phase 2 and will also be taken during Phase 3.

As a result of the commitment to national employment where possible, a level of interdependency has developed in the past few years between the national employment base and the oil and gas construction activities. It must be stressed though in hiring workers the ACG projects ensures that those being hired are made aware of the length of their contract and more specifically, the short-term nature of the employment is made clear with every appointment.

Figure 10.2 Planned Construction Manpower Requirements (Sangachal Terminal and In-country Fabrication Yards)



In terms of future workforce demobilisation, the main affected areas will be around Sangachal Terminal and the fabrication yards, and specifically the communities of Sangachal, Umid and Sahil. Prior to the commencement of AIOC/BP projects there was minimal employment within these communities. However, this situation has been improved as a result of the employment created either directly by the projects, or indirectly through the supplier network that has developed as a consequence. Reference should be made to Section 7: Socio-Economic Baseline, which details changes in employment and also unemployment levels in the areas near to the Phase 1 facilities since construction works started.

A number of actions currently in place for the existing ACG construction projects will help to some degree to lessen the impact of demobilisation to the local community, and the Phase 3 project will integrate into these management measures. Transparency with the local communities on the expected levels of employment opportunities available was a key consideration made during Phase 1, and the establishment of local information centres and the community liaison process has provided a framework to enable this to happen. Furthermore, as indicated above, clear communication with workers on the terms and length of contracts is practiced by the projects to ensure workers have clarity on the short-term nature of the project works.

Collaboration between ACG projects and other projects in the local area is also important to ensure that alternative employment opportunities can be maximised. As reflected in Figure 10.2 above, the construction programmes of the different projects require a workforce of varying size at different times. The transferral of national workers between projects is currently undertaken, based on the skills, abilities and availability of each employee. This creates the possibility for short-term jobs to be extended by moving temporary employees between different projects. To assist this process, an Industrial Relations Forum has been established, whereby representatives from the different projects and contractors meet once per month to discuss the skills and size of workforce required for each project currently working in the region.

A further existing mechanism that will help to offset potential impacts associated with workforce demobilisation is the AIOC ACG Community Investment Programme. This has been active in the Garadag region since 2002 with a key objective to improve livelihoods and business opportunities for project affected areas. As highlighted in Appendix 5, the programme objectives are to support ways to increase income opportunities, and the development and/or establishment of new businesses. As such, this programme provides a framework to continue to support social development projects that are sustainable, and which bring long-term benefits to the affected areas. In addition, a community investment programme is under development in the Bibi Heybat area, recognising the construction and fabrication works currently being undertaken in the ATA yard, and this could be used by Phase 3 if appropriate.

10.3.3 The Way Forward

As stated above, the actions already in place in terms of community liaison and investment and workforce transfer between projects will be carried forward into Phase 3. However, as the total workforce number declines, the potential impacts associated with demobilisation will increase. Beyond the unemployment that will ensue, other impacts may also occur. Households may send additional household members, who otherwise would not have worked, to look for work, for fear the main income earner may lose his job. This is known as the "added worker effect". In view of the knowledge that the employment is short-term it is expected that this may already be happening in the affected households of the area.

As a result of the skills and experience gained through working on ACG FFD, some of the national workforce may subsequently be able to access employment opportunities that may take them out of Azerbaijan. Whilst the income gained from such employment will be of benefit, it may result in head of households being absent for long period of time.

In order to assess whether additional mitigation measures are required, Phase 3 undertook background research into accepted approaches to workforce demobilisation, including lessons learnt. The results of this research provided some key principles for consideration of any further mitigation by ACG and other AzBU projects, as follows:

- Ensure that any measures introduced enhance and augment existing ACG project and AzBU social management systems and process;
- Constructive action is undertaken to ensure a legacy of positive social impacts and enhanced reputation;
- Proactive management and involvement by relevant parties; and
- Enhanced skills and experience to assist in securing additional employment.

There will be a continuous utilisation of existing initiatives and enhancement of these systems as follows:

- Transparency and Communication – a timely, open and transparent communication and information disclosure process regarding employment, contract terms and demobilisation.
- Inter Project Management – continuation of efforts to collaborate with other projects to maximise use of available workforce. Utilise readily available resource databases that provide details of employees and skills.
- Training and Guidance – seek to diversify training that has already been provided so as to increase the employability of the workforce. Continuation of training centres to diversify skills.
- Community investment – via existing community investment initiatives and programmes, with an increased focus on sustainable social development projects such as micro enterprise projects.
- External Bodies – maintain linkages to and support, where appropriate other government, NGO or IFI economic development strategies within the area.

Whilst the employment requirements shrink as the projects move from construction to operation, it is important that social investment and community development continues through into operations. Recognising this, BP plans to continue these schemes under the umbrella of a Regional Development Initiative, a ten-year programme of sustainable economic and social capacity building activities more fully described in Section 11.

10.4 Decommissioning

The commercial production of hydrocarbons from Azerbaijan's offshore oil and gas reserves is in an early stage of development and considerable effort has been placed in assessing and supporting the enhancement of offshore infrastructure and technology available in the region to support this industry. However, in parallel with this development and in view of international and national legislation, it is also necessary to consider the potential decommissioning of projects such as ACG Phase 3, to ensure that appropriate management measures are incorporated into project design to mitigate against potential environmental impacts in the long-term.

According to the terms of the ACG PSA, AIOC is required to produce a field abandonment plan one year prior to completion of 70% production of identified reserves. SOCAR will assume ownership for all ACG facilities at the end of the PSA agreement in 2024. To address the financial burden associated with decommissioning and abandonment, all partners involved in the ACG projects are required under the PSA to contribute a proportionate share of the revenue raised from the projects to cover decommissioning costs. These funds will be used to establish an "Abandonment Fund" such that the funds can be accrued against the decommissioning costs. Under the terms of the PSA, SOCAR as future operators of the ACG development will inherit the Abandonment fund set aside for this purpose.

The PSA does not state specific requirements on the methodology of decommissioning and in view of the operational lifetime of the ACG project, it is not possible at this time to provide finalised details for the method or extent to which the facilities will be decommissioned. A review of generic decommissioning options and methodologies for offshore and onshore facility decommissioning and consideration of associated environmental impacts, are presented in the ACG Phase 1 ESIA (Chapter 10.7). It is recognised that technology, facilities and infrastructure will change over the lifetime of the project within the Caspian region, as will international experience in decommissioning oil and gas installations. The current international approach to decommissioning is to conduct a BPEO to provide a comparative assessment of available options. The purpose of the BPEO will be to consider both the potential alternative uses for facilities to extend their operational life and detailed options for field abandonment assessed in terms of environmental impact, health and safety, technical feasibility and cost effectiveness.

Local scientists raised the future decommissioning of ACG offshore facilities during stakeholder consultation (Section 8). The consideration of decommissioning, and more specifically the concern over the potential hazard to shipping posed by installations if not completely removed from the seafloor, has therefore been considered in the ESIA process.

10.4.1 Standards and Guidelines

Azerbaijan is a member state of the International Maritime Organisation (IMO). The ACG Phase 3 HSE design standards require that '*the design ensures that the facilities can be safely decommissioned in compliance with OSPAR and IMO regulations, without long term impact on the environment.'* Consideration of design compliance is therefore required regarding the IMO 'Guidelines and Standards for the Removal of Offshore Installations and Structures on the Continental Shelf and in the Exclusive Economic Zone', 1989 (Resolution A.672 (16)), and regarding the requirements under the Convention on the protection of Marine Environment of the North East Atlantic (OSPAR Decision 98/3). The IMO guideline states that structures in waters deeper than 100m must be removed to give a clear water column of 55m for safety of navigation. In addition, it includes the following clause:

"*On or after 1 January 1998, no installation or structure should be placed on any continental shelf or in any exclusive economic zone unless the design and construction of the installation or structure is such that entire removal upon abandonment or permanent disuse would be feasible*."

Under OSPAR Decision 98/3, there is a prohibition on the dumping and leaving wholly or partly in place of offshore installations. The decision however does recognise that there may be difficulty in removing footings of large steel jackets weighing >10,000 tonnes. All jackets installed under the ACG development are >10,000 tonnes.

It is considered that the ACG offshore facilities covered under the IMO regulations have been designed so as to enable complete removal. The following section provides a summary as to how complete removal of the main offshore facilities could be achieved (using ACG Phase 3 as a basis), assuming existing infrastructure and technology within the Caspian Region. However as previously discussed, the actual extent to which the facilities will be removed and by what methods cannot be defined until the time the Field Abandonment Plan is developed.

10.4.2 Offshore Facility Decommissioning Process

10.4.2.1 Platform Topsides

Following well abandonment and facility cleaning and decommissioning, the removal of the topsides is expected to be a reverse of the installation. Removal of the bridge can be achieved using the Derrick Barge Azerbaijan (DBA) and each of the topsides can be re-floated with STB-01 barge. Assuming there are no significant changes to the weight or centre of gravity of the platforms and bridge link, it is predicted that this operation is within the capability of existing lifting equipment in the region.

10.4.3 Platform Jackets

During the decommissioning process, the area around the jackets would be subject to pre- and post-removal inspection. These inspections would identify debris to be removed that may cause a hazard and assure the integrity of the jacket and seabed following decommissioning using ROV surveys. The jacket configurations for DUQ and PCWU are almost identical and are secured to the seabed by an arrangement of piles. The installation weight of each jacket is approximately 18,000 tonnes, which is predicted to rise to a cumulative total of approximately 23,000 tonnes, if account is taken of the added piles and grouting, plus the potential for future installation of additional equipment, and marine growth on the structure over the operational lifetime. In view of the weight of the structure it would not be possible to remove the jackets as a single unit using current vessels in the Caspian. Therefore the current approach to removing the jacket would be to cut the structures into sections, starting at the sea surface and progressing to the seabed.

The DBA has a maximum crane capacity of 2,500 tonnes, although this reduces to a maximum load capacity of 1200 tonnes when lifting structures from water depths of approximately 150 m. Current estimates indicate that it would require in the order of 40–50 lifts to remove a single jacket, taking into account stability of the remaining structure, transportation and sea fastening issues. During cutting operations the emphasis will be on safety and therefore the use of remote cutting techniques will be encouraged. It will not be possible to completely retrieve the subsea piles using current technology. Under the IMO Guidelines it is stated that any piles should be cut below the natural seabed level at such a depth to ensure that any remains are unlikely to become uncovered. This depth will depend upon the prevailing seabed conditions and currents at the site of the ACG platform jackets but indications suggest that a depth of 3m is required below the seabed for the ACG development. A combination of Diamond Wire Cutting Machines (DWCM) and Abrasive Water Jetting could be utilised, the latter of which could be deployed in lower sections. Tools such as the DWCM are available to cut the jacket piles below the mudline.

10.4.3.1 Subsea Pipelines

There are currently no international guidelines on the decommissioning of disused pipelines. The pipelines are designed for complete removal, however in many cases the best environmental option for long sections of pipelines is to clean and close the lines and bury them to allow them to decay naturally. The following options could be considered to support decommissioning plans:

- Leave the pipeline in situ with no remedial work carried out
- Leave in situ but bury or rock dump areas that present a snagging risk
- Remove sections of pipelines that are considered to be a snagging risk or;
- Bury part, or all, of the pipeline

In the event of removal, the lines would be cleaned and purged and can be completely removed by reverse laying using the pipe-lay barge Israfil Guseinov. Alternatively, the pipelines could be cut at a number of locations by ROV using diamond wire technology, and then retrieved using a DSV and crane.

10.4.3.2 Subsea Installations (e.g. drilling template, wellheads, injection manifolds)

Although not separately addressed under the IMO guidelines, the subsea facilities at the water injection sites are self-contained units. Once detached from the flowlines, these may be lifted from the seabed in a simple reverse-installation operation.

11 Environmental and Socio-economic Mitigation and Monitoring

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11.1 Introduction

The impact assessment for the ACG Phase 3 project presented in Section 9, considers existing mitigation measures that have been designed into the project, in order to eliminate or reduce the potential for impacts from these activities. These measures include mitigation through engineering design, through existing environmental and social management plans and procedures currently in use as part of the Azeri project and through the existing EMS developed as part of EOP operations. In terms of the different stages of Phase 3, construction will be managed within the Azeri Project Environmental and Social Management System (ESMS), and operation will be managed under the AzBU Environmental Management System (EMS). Details of these systems are presented below, and further information can be found on the website www.caspiandevelopmentandexport.com, within the document 'ACG Environmental and Social Action Plan'.

Based on these assumptions, it has been found that the majority of activities proposed for the ACG Phase 3 project will not result in a significant residual environmental or social impact.

The residual significant environment and social impacts and mitigation measures specific to the Phase 3 project are described below, together with details of the monitoring measures that will be conducted to assess the success of these in minimising identified potential residual environmental and social impacts of the project.

11.2 Responsibilities

The BP Azerbaijan Business Unit (AzBU) has overall responsibility for the Company's projects in the region and for coordinating and standardising the management measures adopted in the Company's activities, in fulfilment of Corporate goals, objectives and policy. In terms of environmental performance, AzBU is responsible for the development, alignment and adoption of common environmental policy across all projects, including commitment to legislative compliance, continual improvement and pollution prevention. The AzBu achieves this through the following measures:

- Alignment between BP Corporate, the Business Unit and individual project standards and expectations;
- Development of common environmental strategies for projects (e.g. for produced water handling and disposal, waste compliance monitoring, onshore cuttings treatment and disposal); and
- Ongoing review and advice on environmental improvement and performance throughout all BP operated projects.

Under the ACG PSA, BP as operator for AIOC is responsible for the environmental and social management of the project, implementing project commitments checking and that the project's environmental and social performance complies with applicable legal, regulatory and policy standards in all material respects. Commitments related to mitigating environmental or social impacts may be the direct responsibility of BP, or may be the contractual responsibility of the Phase 3 contractors. This is more fully explained in Section 11.5.

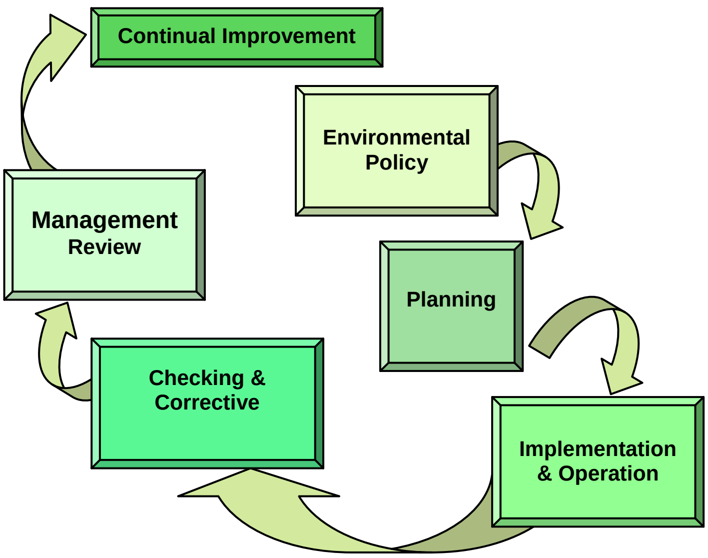
11.3 Environmental Management System

An Environmental Management System provides a structured framework to manage the environmental performance of an organisation. Both the construction ESMS and the operations EMS will be aligned with ISO 14001, the international standard for EMS, which contains the following key elements:

- Establishing objectives and targets;
- Defining organisation and responsibilities;
- Identifying legal and other requirements;
- Identification of significant environmental impacts;
- Establishing environmental management programmes;
- Establishing environmental improvement plans;
- Operational control;
- Control of contractors and suppliers;
- Document control and records;
- Monitoring and measurement;
- Emergency preparedness and response;
- Training, awareness and competence;
- Communication;
- Non-conformances, corrective and preventative actions;
- Audit; and,
- Continuous improvement.

The management system includes continuous environmental improvement as an integral part of the philosophy (illustrated in Figure 11.1).

Figure 11.1 Continuous Improvement Philosophy of the Environmental Management System (EMS)



As discussed in Section 11.1, for the ACG Phase 3 project, construction will be managed within the Azeri Project Environmental and Social Management System (ESMS), and operations will be managed under the existing AzBU Environmental Management System (EMS). The Azeri Project ESMS ensures:

- the project is constructed in accordance with relevant legal and regulatory standards; and
- there is a focus on complying with the environmental and social commitments and objectives identified in this ESIA.

The ESMS provides a sound context for mitigation and monitoring of environmental and social management matters within the construction phase.

The AzBU EMS will cover the commercial life of the Phase 3 project so that:

- the project is operated in accordance with relevant legal and regulatory standards; and
- the commitments made relating to operations are implemented.

Each phase of ACG has the target to be certified under ISO 14001 within 9 months of operations. It is intended that this will be done through extending the scope of the facilities within the AzBU EMS certificate.

11.4 Commitments to Action

11.4.1 Commitments Register

This ESIA represents the culmination of an extensive and rigorous process to identify the potential environmental and social impacts associated with the project, assess their significance and recommend mitigation action where applicable. As discussed in Section 3 and 9, the ESIA process ran parallel to the project design phase to ensure that significant environmental and social aspects were taken into account prior to the design freeze.

Significant impacts requiring additional mitigation and management in the project construction and operation phases (Section 9) will be formalised in the ACG Phase 3 Commitments Register. The Commitments Register serves as the linking mechanism between the ESIA and the ESMS. The Commitments Register aids:

- Transparency in translating commitments to action;
- Clear assignation of responsibilities for commitments;
- Resourcing and allocation of budget to achieve commitments; and
- Definition of timeline for action.

11.5 ACG Phase 3 Environmental and Social Management

As discussed in Section 11.2, the responsibility for achieving ESIA commitments will lie with both BP and Phase 3 contractors (with BP maintaining overall responsibility). For the construction stage, this is achieved through Operator Management Plans and Contractor Control Plans. For operations, the responsibility for meeting commitments primarily rests with BP. This section first describes the management and control plans that will be in place for the construction stage of Phase 3, and then outlines the system that will be established for the operational stage of the project.

11.5.1 Project Control under the Construction ESMS

11.5.1.1 Operator Management Plans

The Operator Management Plans contain certain mitigation measures that are the responsibility of BP. For ACG Phase 3, these plans include the following:

- The Community Relations Plan; outlines procedures for the management of community relations and provision of information on the project including:
  - Establishment of a permanent Community Liaison Office at the Sangachal terminal;
  - Establishment of Information Centres at the Sahil, Sangachal and Umid; and
  - Establishment of Information Centres at the Construction Camps and Enterprise Centre in Baku.
- The Cultural Heritage Management Plan detailing the measures implemented to protect cultural heritage sites (including archaeological deposits and remains, historical monuments, sites and buildings, historical and culturally significant landscapes, places of worship, cemeteries and graveyards, places associated with local folklore, mythology and traditions and the location of historical and cultural festivals, events and rituals) near to the development area.
- The Landscape Management Plan, including:
  - Pre-work planning to account for and document landscape management requirements in regards habitat preservation and protection during construction/installation works;
  - Site management during works to ensure that landscape and habitat values are protected as far as possible; and
  - Site reinstatement/rehabilitation following construction/installation works including any measures to mitigate visual intrusions and that assist achieving the community expectation for a “green terminal”.
- Construction Health and Safety Management Principles, namely measures established to ensure that activities are conducted in a safe manner with no adverse effects on the health of the workforce or community.

These plans contain instructions on how ESIA commitments will be implemented by the Operator.

As well as mitigation of direct project impacts, AIOC will make an additionality commitment in the form of continued social investment during the construction stage as described in Appendix 5. Additionality commitments relate to measures over and above any mitigation undertaken, which provide benefits to local communities and environment. The aim of additionality programmes is to contribute to long-term sustainability in the areas in which the Operator is active.

11.5.1.2 Contractor Control Plans

The Contractor Control Plans (CCPs) contain instructions on which environmental or socio-economic commitments that must be implemented by the Contractors working on the ACG Phase 3 project, and form part of their contractual commitments. CCPs have been developed as part of the construction stage of ACG Phase 1, and these will be modified to incorporate lessons learned from ACG Phase 1 (and subsequently Phase 2) in order to form part of the continual improvement process for ACG Phase 3.

In summary, the CCPs fulfill the following purposes:

- They translate ESIA commitments into implementation by the contractor (the construction contract is integral to this process);

- They serve as a key tool by which the Operator can verify that the Contractor Implementation Plans and Procedures that specify how the activities specific to a contract will be carried out to ensure compliance with project commitments; and
- They provide transparency and assurance that relevant commitments made through the ESIA process are being translated through to the contractor responsible for implementation.

The contractor management process is illustrated in Figure 11.2.

As discussed, CCPs have been developed as part of the construction stage of the ACG Phase 1 project. The construction CCPs applicable to Phase 3 consist of:

Contractor Control Plan Title	
Environmental focus	**Social focus**
Pollution Prevention - requirements and minimum standards for measures required for the prevention of pollution to land, air and water during implementation of the Project.	Construction Camp - requirements and minimum standards for construction camp management during the construction programme.
Waste Management – requirements and minimum standards for waste management during the Project that will ensure that all wastes are minimised, handled, recycled and disposed of in accordance with Project requirements.	Communicable Diseases Awareness and Prevention - requirements and minimum standards for communicable disease awareness and prevention for all workforce personnel associated with the construction programme and communities near to the project workforce.
Fauna Management - requirements and minimum standards against which potential impacts vulnerable fauna in the area of Phase 1 construction activity may be managed and hence reduced or eliminated.	Recruitment, Employment and Training - requirements and minimum standards for recruitment, employment and training during the construction programme.
Aggregates Management - approach and procedures to be followed by Contractors for aggregate management.	Procurement and Supply Chain - requirements and minimum standards for the purchasing and supply of materials, goods, and services during the construction programme.
Transport Management - requirements and minimum standards for transport and traffic management during implementation of the Project with particular emphasis on construction activities.	
Spill Response (construction) - requirements for response to land-based spills during implementation of the Project.	

The contractor will be responsible for the development and implementation of these commitments and will details these measures in Contractor Implementation Plans and Procedures (CIPPs) (described below).

11.5.1.3 Contractor Implementation Plans and Procedures (CIPPs)

Each contractor is required to develop Contractor Implementation Plans and Procedures describing the how they will implement measures to fulfil the commitments assigned in the Commitments Register (and documented in the CCPs).

The ESMS objectives and targets are used by the contractors to develop key performance indicators (KPIs) for environmental and social management within each of their Contractor Implementation Plans and Procedures. BP will have an audit programme to check the contractor's performance against the Contractor Control Plans and KPIs to ensure that the project's environmental and social commitments are carried out.

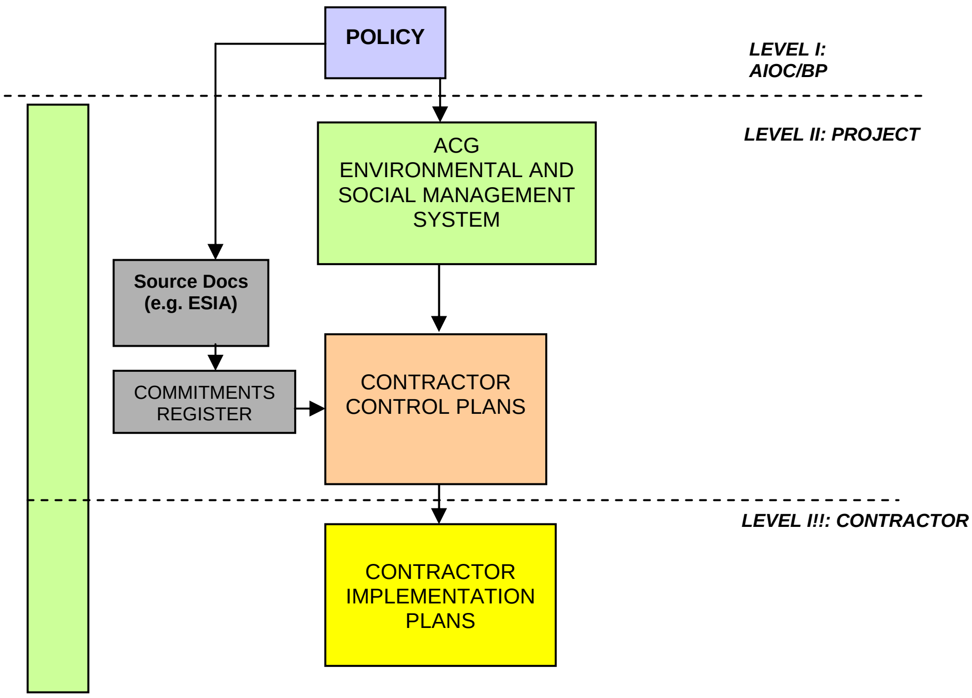
As the project progresses through final design and engineering to construction, changes in the scope of the plans will be necessary to take account of any additional commitments

This inherently flexible approach is essential to accommodating each individual contractor's preferences and experience, and in recognizing the critical importance of accounting for local conditions in the design and implementation of the mitigation measures.

The Contractor is also responsible for:

- Workforce training and ensuring that all personnel are aware of their responsibilities;
- Ensuring the performance of all subcontractors is in accordance with the requirements of the Contractor Implementation Plans and Procedures;
- Complying with all project standards, statutory requirements, permit and license conditions;
- Implementing an appropriate inspection and monitoring program; and
- Implementing and maintaining a reporting and action tracking system.

Figure 11.2 Contractor Management System Development



11.5.2 Project Control under the Operations EMS

As ACG projects roll from construction into operations they will pass from the construction ESMS into the AzBU EMS for operations. The EMS that is currently used to manage AzBU operations (incorporating Chirag 1, Sangachal terminal and Northern and Western Route Export Pipelines) is certified to ISO 14001. Currently there is a team looking at where the existing EMS requires enhancement to meet the needs of this future organisation.

Broadly it is envisaged that the AzBU environmental policy will be realized through an umbrella document for the AzBU operations. This will set out how the EMS will work, for example, how objectives and targets will be set, how monitoring will be conducted, and how auditing will be carried out. The EMS will contain an impacts register, operational procedures, monitoring programme and so forth. A cross-check will also be made with the commitments register to verify that commitments relating to the operational phase are incorporated into the operations EMS.

Whilst the construction EMS also includes management of social issues, at the time of writing it had not been determined whether management of social impacts arising from operations will fall within the operations EMS, or within a separate part of the organization. Social and community investment will continue under the umbrella of the Regional Development Initiative, described below.

11.5.2.1 Regional Development Initiative

The AzBU intends to establish a Regional Development Initiative (RDI) in the form of an initial 10 year programme of sustainable economic and social capacity building activities in Azerbaijan, Georgia and Turkey. This will become the single, integrated programme for BP's social initiatives in the region, embracing the AzBU current Community Investment Programmes, Environmental Investment Programmes, BP's 100% Social Investment Programme, and a new regional element. A description of the current social and community investment programmes and their management is provided in Appendix 5. The RDI will address a key need to deliver an appropriate level of ongoing social spend in the region in a holistic and integrated manner. It will provide a vehicle to address two challenges:

Economic capacity building, in particular:

- Utilising and enhancing indigenous economic enterprise associated with hydrocarbon development
- Stimulating development of the non-oil sector and encourage other foreign direct investment
- Encouraging infrastructure development

Social and institutional capacity building, including:

- Championing and strengthening institutional transparency and the rule of law
- Strengthening structures to ensure the effective use of oil and gas revenues
- Providing opportunities to enhance skills and education in key areas of public and private enterprise

The RDI will aim to provide a material, long-term commitment to the region, delivering visible benefits to the people in the countries in which the projects are being undertaken, and contributing to the longer-term economic development and stability of the region.

11.6 ACG Phase 3 Mitigation

When considered in isolation for the project, the majority of activities proposed for the ACG Phase 3 project will not result in a significant residual environmental or social impact, either due to the small scale of the activity, the distance of the activity from receptors or through the effective mitigation of impacts through careful design and management developed and implemented by the earlier Phases 1 and 2 projects.

The residual impacts shown in Table 11.1 were identified in Chapter 10 as being of medium or high significance, and the mitigation measures proposed to address these impacts are discussed here. It should be noted that the assessment of residual impact took into account any existing control measures already identified by the project. These control measures are captured in the Commitments Register. Verification that they are implemented and effective will be provided by the EMS. The monitoring that will be conducted as part of this verification is described in Section 11.7 below.

Table 11.1 Summary and Classification of Residual Impacts and Issues from ACG Phase 3

ACG Phase 3 Stand-alone Project	ACG Cumulative Impact	Wider AzBU Project Issues
Discharge of WBM drill cuttings from surface hole sections Medium ranking	Offshore and onshore atmospheric emissions Medium ranking (onshore emergency flaring). Cumulative issue	Final disposal of wastes Low ranking but AzBU issue
Oil Spills Medium ranking (blow-out)		Workforce Demobilisation Low ranking but AzBU issue
-	-	Decommissioning Low ranking but AzBU issue

11.6.1.1 Mitigation of Impacts From ACG Phase 3 as a Stand-Alone Project

Discharge of WBM drill cuttings from surface hole sections

The potential impacts of discharge of WBM cuttings from the surface hole sections is discussed in Section 9.5 Platform Operations. The impact is ranked as being of medium significance due to the recovery time taken for the main impacted receptor, the benthic environment. In view of the fact that drilling will occur for a period of 10 years over the project, the intermittent discharge of WBM cuttings and physical settlement on the seabed represents a re-occurring impact over this period. For this reason, the impact is ranked as 2 and the frequency of occurrence 4, resulting in a residual significance of 8 (or medium) due to the repeated disturbance and physical impact.

The measures already identified to mitigate the impacts from the discharge of WBM cuttings are as follows:

- The selection of low toxicity chemicals for use in the drilling muds. Mud systems used will be tested to meet US EPA 96 Hour LC 50 toxicity tests (i.e., > 30,000 ppm) or Caspian Specific Ecotoxicity Tests, should these be agreed;
- Sampling and analysis of the WBM cuttings. There will be no discharge of drill cuttings or fluids unless the maximum chloride concentration is less than four times the ambient concentration in the receiving water.. An API chloride test will provide the check required to manage residual chloride levels in the cuttings and minimise environmental impact to a low significance level.
- Discharge of WBM cuttings from a 138 m caisson, i.e. below the productive zone.

Following the WBM drilling programme and discharge of cuttings, BP will assess the need to conduct a post well drilling survey under the Integrated Monitoring Plan (refer to Section 11.7.3). The data from the survey will be used to compare actual cuttings dispersion and deposition on the seabed with the predictions from the cuttings model, and to assess the impacts of cuttings deposition and settlement on the benthic environment.

Oil Spills

Although unlikely, industry statistics show that there is a theoretical possibility of a single blow out event occurring from the ACG Phase 3 offshore facilities during the lifetime of the project. Measures taken to minimise the consequences of a blow out comprise the use of Blow Out Preventors (BOP) to keep the well under control and the preparation of an Oil Spill Contingency Plan (OSCP) as discussed in Section 9.11. In addition, the risk of a pipeline rupture is similarly unlikely and has been mitigated through correct project design (structural protection) and burial of pipelines in shallower waters depths (less than 8 m). However, these two events, when combined with the potential impact of such an event on environmental and socio-economic receptors, are considered to be of medium residual significance.

The prime measure that will be in place during the drilling programme to mitigate the consequences of a major oil spill is the development of an ACG specific spill contingency plan (integrating all Phases of ACG including Phase 3) detailing notification procedures, responsibility and contacts; response measures according to a tiered structure of spill size; emergency response contacts and location of equipment, as discussed in Chapter 9.11.

11.6.1.2 Mitigation of Impacts from the Cumulative Contribution of ACG Phase 3

The following measures will be in place to mitigate against those impacts deemed to be significant when considering the cumulative contribution ACG Phase 3 will all AzBU projects in the region.

Offshore and onshore atmospheric emissions as contributing to the cumulative emissions of GHG

As a single project, the atmospheric emissions from the ACG Phase 3 development are not considered to result in a significant residual impact. However as a cumulative contributor to all AzBU activities in the Caspian, the emissions from ACG Phase 3 are considered potentially significant.

The mitigation measures for atmospheric emissions from the ACG Phase 3 project (and therefore for the project's contribution to the cumulative emissions from all AzBU activities) are:

- The verification of onshore and offshore mitigation measures assumed to be in place during the impact assessment; specifically no routine offshore or onshore flaring during production (only purge and pilot), gas and diesel consumption monitoring, regular maintenance and operating efficiency of gas and fuel operated equipment and atmospheric emissions monitoring around the terminal location; and
- Operational mechanisms, such as optimisation of energy efficiency, leak detection programmes, monitoring and maintenance programmes;
- Investigation of opportunities to integrate broader GHG reduction considerations into the projects' environmental and community investment programmes; and
- Monitoring of developments within the UNFCCC for ideas that could have applicability to Azerbaijan.

11.6.1.3 Mitigation of Impacts from Wider Operational Issues

A number of aspects of the Phase 3 development have been ranked as having a significant residual impact as relating to common wider operational issues associated with FFD or other AzBU activities in the region. These wider issues will be managed at a BU level as described in Ch 10. The mitigation measures discussed in Chapter 10 are summarised below.

Final disposal of wastes

- Compliance (as a minimum expectation) with BP Policy and local legislation and regulations;
- Experienced, reputable contractors will be accountable for managing waste from the agreed point of deposit to the final destination;
- Use of the CWAA for accumulation and temporary storage prior to removal by approved contractors.
- Innovative approaches to waste management, seeking assistance from and interaction with local institutions and industry;

- Development of disposal options in partnership with the relevant Environmental Authorities;
- Working internally and with Contractors to minimise waste generation;
- Working with local infrastructure and industry to re-use and recycle waste in accordance with principles of the waste reduction hierarchy;
- Setting Annual Work Activity Plans, Budget Plans and Performance Measures with regular reporting to key stakeholders.

Decommissioning

- The verification of facility design to enable total removal at the end of their operational lifetime;
- The production of a Field Abandonment Plan one year prior to completion of 70% production of identified reserves. The Field Abandonment Plan will present recommendations for project decommissioning based on a best practicable environmental options (BPEO) study of all available options.
- The contribution of a proportionate share of the revenue raised from the project by each of the AIOC partners to meet the future financial aspects of Phase 3 decommissioning.

11.6.2 Socio-economic Mitigation

As discussed in Section 9.10 Socio-economic Impacts, two impacts of residual significance were identified, as follows:

- Construction workforce demobilisation; and
- A largescale oil spill event caused by a well blow-out or catastrophic failure of the pipeline.

The mitigation of an oil spill event is discussed in Section 11.5.1.1 and is not repeated here.

The Phase 3 mitigation that will be implemented to minimise the impacts of construction workforce demobilisation are as follows:

- The verification of socio-economic management measures assumed to be in place during the impact assessment; specifically the implementation of appropriate recruitment, employment and training procedures; contractor alignment and coordination in workforce management across the project;
- The alignment and integration of ACG Phase 3 into the framework of the BP AzBU established social management system and social investment programme, which includes the following key components:
  - Transparency & Communication: Clear communication to workers on terms and conditions of contracts at start of work, including notification process, so that workers are aware of the length of their employment. Clear expectations outlined for contractors that they will do the same for their employees.
  - Inter-Project Management: Focus on planning and collaboration between projects to maximise alternative employment opportunities, and the transfer of skilled and non-skilled workers between existing and any new projects that arise.
  - Contribution and communication within the established Industrial Forum (IF) mechanism between the projects main contractors on behalf of ACG Phase 3.
  - Provision of Training & Guidance: Training will be established to supplement existing training and diversify skills, such as business development, computer and life skills. These will be available to workers and other locals as appropriate.
  - Social Development: Existing social investment (SI) programmes will be used as a platform to launch capacity building, sustainable income generation and micro-

enterprise projects to enhance the opportunity for individuals, or groups close to BP-operated projects to generate their own income.
  – Linkages to External Activities: Engaging into and supporting where appropriate other NGO, IFI or Government strategies aimed at supporting economic development within the country and region.

- Development and proposal to AzBU of additional measures based on project experience to augment existing programmes.

11.7 Monitoring

During the ACG Phase 3 project AIOC will use monitoring to assess the effectiveness of identified control measures in mitigating the environmental and social impacts identified. Monitoring will indicate performance against standards and objectives/targets, and will highlight any trends so that underlying issues can be picked up and addressed. It can be used to verify predictions made in the ESIA, and prompt the development of further control measures if necessary. Monitoring can also highlight impacts or consequences of operations that were unknown at the time of writing the ESIA, or that have developed from a change in operations or the receiving environment.

11.7.1 Environmental Monitoring

Monitoring consists of two main types:

Project activity monitoring e.g.

- Liquid waste discharges (sewage, grey water, hydrotest water, process water)
- Atmospheric emissions – primarily stack emissions from engines and generators
- Noise

Operational monitoring provides data on the activities of the project and ecological modelling enables the assessment of the interaction of these activities on environmental components.

Ecological and ambient monitoring e.g.

- Terrestrial habitats
- Ornithological studies
- Marine habitats
- Marine benthos
- Marine water column and plankton

By assessing operational and ecological parameters, an understanding of 'cause and effect' relationships can be established and be used to assess whether desired beneficial effects of the project are being achieved, or the degree of success in avoiding or reducing predicted undesired impacts. This information can then be used to target specific activities of the project through changes in the management system.

11.7.2 Project Activity Monitoring

Specifically for ACG Phase 3 a number monitoring commitments have been made through the mitigation detailed in Section 11.6. These have been developed to assess whether desired standards are being achieved, either as a result of legislative compliance requirements under the PSA, HSE Design Standards, or through corporate policy, aims and objectives. These are summarised in the following subsections:

11.7.2.1 Onshore Construction Activities

Table 11.2 below provides the monitoring that will be conducted at the Sangachal Terminal and the yards used to assemble offshore facilities. Monitoring of noise and air quality at the yards will be conducted only if there are sensitive receptors within the vicinity of the yards selected.

Table 11.2 Construction monitoring programme

Parameter	Content	Frequency
Air Emissions	Fuel use (diesel and gas) converted to emissions using standard conversion factors	Weekly
Air Quality Refer to Table 11.3	Visibility, particulates (PM_{10} $PM_{2.5}$), primary chemical species (NOx, SOx, CO, H_2S, VOCs), secondary species (ozone)	Once during FFD construction programme
Noise emissions Refer to Table 11.4	Noise levels at project fenceline as well as at identified sensitive receptors	Twice monthly
Sanitary wastewater (for re-use) Refer to Table 11.5	Flow proportional or time-based 24-hour sampling at a point on the outlet of the wastewater treatment plant.	Weekly

Standards for air emissions, sanitary wastewaters, and noise are from the World Bank Group General Environmental Guidelines, July 1998, and are provided below.

Air Emissions

Table 11.3 Ambient Air Conditions at Property Boundary, for General Application

Parameter	Concentration ($\mu g/m^3$)
Particulate Matter (<10um) Annual Arithmetic Mean Maximum 24-hr Average	 50 70
Nitrogen Oxides, as NO_2 Maximum 24-hr Average	 150
Sulphur Dioxide (SO_2) Annual Arithmetic Mean Maximum 24-hr Average	 50 125

Noise

The noise levels given in Table 11.4 must be met at identified noise receptors outside the Project property boundary or alternatively must not exceed a maximum increase in background levels of 3 decibels (on the dB (A) scale).

Table 11.4 Noise Limits

Receptor	Maximum Allowable Log equivalent (hourly measurements) in dB(A)	
	Day (0700-2200)	Night (2200-0700)
Residential, institutional, educational	55	45
Industrial, commercial	70	70

Sanitary Wastewater

Table 11.5 Limits for Sanitary Wastewater

Parameter	WBG guidelines
BOD	50 mg/l
COD	250 mg/l
pH	6-9
Residual Chlorine	0.2 mg/l
Total Suspended Solids	50 mg/l
Coliform Bacteria	<400 MPN/100 ml
Oil and Grease	10 mg/l
Heavy metals, total	10 mg/l
Arsenic	0.1 mg/l
Cadmium	0.1 mg/l
Chromium Hexavalent Total	0.1 mg/l 0.5 mg/l
Copper	0.5 mg/l
Iron	3.5 mg/l
Lead	0.1 mg/l
Mercury	0.01 mg/l
Nickel	0.5 mg/l
Selenium	0.1 mg/l
Silver	0.5 mg/l
Zinc	2.0 mg/l
Cyanide Free Total	 0.1 mg/l 1.0 mg/l
Ammonia	10 mg/l
Fluoride	20 mg/l
Phenols	0.5 mg/l
Phosphorus	2.0 mg/l
Sulfide	1.0 mg/l
Temperature increase	<3ºC*

* The effluent should result in a temperature increase of no more than 3ºC at the edge of the zone where initial mixing and dilution take place. Where the zone is not defined, use 100 meters from the point of discharge.

11.7.2.2 Drilling Monitoring

Table 11.6 provides the monitoring that will be undertaken for drilling from the MODU.

Table 11.6 MODU monitoring programme

Discharge	Monitored Parameter	Discharge Limitation	Monitoring Frequency	Sampling & Testing
DRILLING MUD SYSTEM (WBM only to be discharged to sea)	1. Toxicity prior to drilling programme start 2. Toxicity during drilling 3.Drilling fluid additives 4. Discharge volume 5. Chlorides content	1. LC50 in concentrations >30000 ppm 2. Low toxicity 3 Not applicable 4. Not applicable 5. 4 x ambient concentration	1. Prior to drilling only 2. Periodically 3. Daily inventory of mud additives 4. Record daily, report monthly 5. Record daily, report monthly	1.Toxicity US EPA 96hr acute toxicity test 2.Caspian specific procedures (if agreed) 3. Record either mass or volume 4. Estimate volume 5. API chloride test
WBM DRILL CUTTINGS	1. Volume	1. Not applicable	1.Record daily; report monthly	1.Estimate volume, visual checks
SEWAGE (SANITARY WASTE)	1. Discharge volume 2. Residual chlorine	1. No floating solids 2. >0.5 mg/l <2.0 mg/l, average of 1 mg/l	1.Record daily; report monthly 2. Record daily; report monthly	1.Estimate volume 2. Hach CN-66-DPD
GREY WATER (DOMESTIC)	1.Discharge volume	1.No floating solids	1.Record daily; report monthly	1. Estimate volume
DECK DRAINAGE AND WASH WATER	1. Volume	1. No visible sheen	1.Record daily; report monthly	1. Estimate volume; record days sheen is observed
AIR EMISSION FROM IC ENGINES/ TURBINES LARGER THAN 500 HP	1. NO_X and CO	1. Manufacturers specification	1. Annually	1. Portable analyser - calibrated before each test using a known reference gas
POINT SOURCE EMISSIONS	1. SOx and NOx	1. Maximum concentration of 400 mg/Nm^3 and 1000 mg/Nm^3 respectively	1. Annually	1. Portable analyser
MANIFESTED WASTE	1.Volume	1. Not applicable	1. Record daily, report monthly	1. Not applicable
RADIOACTIVITY (refer to Appendix 10)	1. Presence and level	1. No discharge allowed	1. Regular risk assessments for opened production equipment. If a possibility that NORM may be encountered, then measurements will be made	1. Direct measurement

A monitoring programme for Phase 3 operations will be defined closer to Phase 3 start-up, but will be designed to verify compliance with PSA, Phase 3 HSE Design Standards, and World Bank/IFC standards as defined in Chapter 2, Policy, Regulatory, and Administrative Framework.

11.7.3 Ecological and Ambient Monitoring

As a result of approval conditions and as part of the AzBU EMS, AIOC conducts a number of ecological monitoring programmes specific to each project. The increase in projects currently underway or proposed has resulted in a substantial amount of environmental data that represents a comprehensive data source for the evaluation and management of the Company’s activities.

BP is currently in the process of developing an Integrated Monitoring Programme (IMP). Initially, the integrated programme will focus on areas in which ACG Project, Shah Deniz Project, EOP and future upstream operations are (or will be) active. Terrestrial pipeline projects and operations will be included at a later date. The IMP will align all required ecological monitoring and ensure that there is a coordinated and common approach between projects.

The main objective of the IMP is to develop a consistent long-term environmental monitoring program, which will serve the overall needs of the AzBU and will recognise and accommodate the legal commitments and practical requirements of all projects. This will be achieved by the development of a practical approach to ensure the generation of holistic and interpretable environmental data, which can be utilised by AzBU to detect potential environmental damage and target these activities (actual or proposed) for mitigation in order to provide assurance that BP is achieving the Company's environmental aims. The IMP will become an integral part of the AzBU EMS, will contribute to the AzBU report on environmental performance for the Company and provide outputs that can be used within the EMS for the avoidance, mitigation or remediation of impacts.

For the organisation and implementation of the IMP, the ACG Project will form the primary Technical Authority for co-ordination and implementation of the annual integrated monitoring programme. In addition, an AzBU Environmental Monitoring Steering Committee will be created to provide verification on the implementation of the IMP. Independent verification, challenge and peer review of the monitoring program will be provided by an External Environmental Monitoring Review Panel.

For all areas, a key medium-term objective is to gather sufficient data to identify the most relevant and useful monitoring criteria. Both terrestrial and marine surveys to date have been largely descriptive in nature, and have not attempted to identify specific parameters or features that could be used as indicators of ecological status or trends. By developing trend-based data sets, and by reviewing these regularly, it will be easier to identify the most robust and relevant indicators.

Currently, the following ecological areas of interest have been identified for the ecological monitoring programme:

Sangachal

- Terrestrial environment
  - Semi-desert habitat: flora, fauna, soil, water, air quality
  - Wetlands
  - Birds
  - Beach profile changes
- Marine environment
  - Benthic faunal and sediment habitat (including seagrass communities and fisheries)
  - Water column and plankton

ACG contract area

- Chirag 1, Phase 1, 2 and 3 locations, pipeline corridor, regional context
  - Benthic faunal and sediment habitat
  - Water column and plankton

Shah Deniz contract area

- SD1 and future production locations, pipeline corridor, regional context
  - Benthic faunal and sediment habitat
  - Water column and plankton

ACG and Shah Deniz marine pipeline corridors

- Benthic faunal and sediment habitat

These studies have been agreed with the Research and Monitoring Group (RMG) and the environmental sub committee in line with the PSA requirements.

11.8 Socio-economic Monitoring

The impact assessment considered the mitigation and management regime currently in place as part of Phase 1 and has assumed that the system is working effectively and is subject to regular assessment, reporting and auditing. Phase 3 will integrate monitoring arrangements already in place e.g. monitoring of information centres, workforce training and human development projects.

As discussed in previous sections, a review of the social management measures was conducted during the ESIA process. The monitoring programme for Phase 3 will build on such assessments in order to evaluate the effectiveness of these mitigation measures and the management of potential social issues.

Specifically in terms of the stakeholder and wider issues that was identified for Phase 3, e.g. perceived health effects from project operations, procurement issues and the demobilisation of the construction workforce, the following key areas will be monitored for Phase 3.

- Recruitment and employment of workers. Monitoring will focus largely on the effective transfer of workers from Phase 1 and 2, to Phase 3. Through the training and skills development conducted as part of Phase 1 and will continue as part of Phase 2, there will be a large trained workforce available for Phase 3. The project will provide the opportunity for a portion of the workforce involved in Phases 1 and 2 to have continuous employment for an extended period as part of Phase 3. It is expected that contractors will have a networking system in place to provide each other with information about workers who will become available for employment. It will then be possible for contractors to fill vacancies with current project-related workers, thereby providing continuous employment to these individuals or groups. Monitoring of this system will assess how effectively employment is being extended through the effective use of internal mechanisms such as databases.

- Procurement and Supply Chain Management. The procurement policy is designed to maximise the number of local contracts and to build the local capacity to provide services and resources. This policy will be monitored through a periodic audit to confirm it is being implemented. In addition, figures will be collected in terms of size and number of contracts awarded to local firms and the success of an available databases to ensure that local suppliers and contractors receive as much opportunities as possible.

- Community liaison. Community Liaison will be monitored periodically through an audit of how issues and complaints raised by the communities where addressed by the community liaison advisor. Other measures will also include assessments of the information centres and discussions with the support staff to ascertain how the community liaison advisors function within the communities.

- Atmospheric emissions were identified as a concern during stakeholder consultation. A number of studies have been conducted. Mitigation and monitoring measures have been designed to address these concerns, and this is discussed further in Section 9.8 Terminal Operations. These measures focus primarily on ensuring compliance with appropriate environmental standards. However, the potential ultimate receptor is the human population, and local residents have voiced their concerns over the potential effects of atmospheric emissions. Although formal compliance with emissions standards is an effective and sufficient strategy to avoid adverse effects on the local community, it is recognised that the community would benefit from some additional reassurance. Since the Terminal employs a significant number of local residents, representing (via family associations) a substantial fraction of the local population, it will be possible (to a modest but useful extent) to monitor local health trends via the routine employee health assessments carried out by the Terminal medical services. Compilation and analysis of Terminal employee health data will enable any significant health issues to be identified and handled in an appropriate manner. Particular attention will be paid to the incidence of apparent respiratory disease, and to the identification of causes where possible, keeping in mind that respiratory disease is prevalent throughout Azerbaijan. AIOC is committed to ensuring that Terminal operations do not have adverse health effects on the local community.

- Monitoring of construction workforce demobilisation. Systems are currently being developed to manage workforce demobilisation at the completion of contracts. The process will be transparent and will be managed by specified support personnel. It will include a communication system to inform employees exactly when their contracts will be completed and this process will be regularly monitored. Additional mitigation measures will also include community development projects that will aim to improve employment and income generation opportunities. Part of this will involve the training of individuals so that their skills may be diversified, thereby improving their marketability. These projects will be monitored at regular intervals and measured against existing best practices.

12 Conclusion

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12.1 Introduction

This chapter summarises the main conclusions and recommendations of the Environmental and Socio-Economic Impact Assessment of the ACG Phase 3 Project.

The ESIA has considered the environmental and socio-economic impacts of the ACG Phase 3 Project, as well as the cumulative impacts from all three phases of FDD. This document described the options assessed in the concept development of Phase 3 and gave a full technical description of the selected option. The baseline environmental and socio-economic conditions were documented. All aspects of the project that have the potential for impacting the environment, including the socio-economic environment have been assessed, together with the mitigation and control measures already defined.

Phase 3 is the final phase of FFD, and the development has many activities in common with Phases 1 and 2. As a result many of the potential impacts are similar, and can be mitigated by a common set of measures. The ESIA for Phase 3, took into consideration the considerable amount of work carried out in developing mitigation and management measures for Phases 1 and 2. As part of the ESIA process advantage was taken of the fact that Phases 1 and 2 are under construction, and the effectiveness of some of those mitigation measures could be assessed. This ESIA found that the majority of impacts were of low residual significance due to the mitigation and management measures already in place.

Mitigation of direct impacts is either made through project design or through procedural controls applied to the activity. Phase 3 has adopted a number of design measures to reduce or eliminate impacts. These include:

- Onshore flare gas recovery to minimise emissions to air;
- Use of existing pipeline infrastructure thus avoiding the need to build a new pipeline;
- Use of existing facilities at Sangachal minimising the footprint for Phase 3 and minimising the construction of new facilities;
- NWBM cuttings reinjection negating the need to discharge these cuttings to sea;
- Offshore produced water and cooling water reinjection, so that these waste streams will not routinely be discharged to sea; and
- Offshore produced water coalescers to achieve better separation of water from oil whilst offshore, and thus reducing the amount of water requiring disposal onshore.

Procedural controls for construction sit within the Azeri Project ESMS. They specify the set of measures that must be taken by either BP or the construction contractors to control activities such as the running of the construction camp, interaction with local communities, management of waste, and transport management. Compliance with these procedures is subject to regular audit, and their effectiveness is monitored through use of a set of KPIs. These procedural controls will be adopted for Phase 3 construction.

When Phase 3 enters its operational phase it will fall under the AzBU EMS, currently being expanded to incorporate Phase 1 and 2. The EMS is aligned with ISO 14001, and Phase 3 has a target to achieve certification under this standard within 9 months of operations.

As well as mitigation of direct project impacts, AIOC will make an additionality commitment in the form of continued social investment during Phase 3 construction. Additionality commitments relate to measures over and above any mitigation undertaken, which provide benefits to local communities and environment. The aim of additionality programmes is to contribute to long term sustainability in the areas in which the Operator is active.

12.2 Impact Assessment Results

The following sections present a summary of the environmental and socio-economic impact assessment and the additional mitigation measures that will need to be implemented in order to address identified significant residual impacts.

The impact assessment methodology adopted for this assessment denotes any residual impact that was ranked as “medium”, “high” or “critical” as significant. Significant residual impacts will require the development and implementation of additional mitigation measures.

When considered in isolation for the project, the majority of activities proposed for the ACG Phase 3 project will not result in significant residual environmental or social impacts, either due to the small scale of the activity, the distance of the activity from receptors or through the effective mitigation of impacts through careful design and procedural control.

No impacts were identified with a high residual significance. Over the project, six impacts were identified as having a medium residual significance. Two impacts are directly related to the ACG Phase 3 development as a single project (i.e. the project occurs on its own with no consideration of other projects in the region). The remainder arise as a result of either the project in a cumulative context with other AzBU activities such as ACG Phase 1 and 2, or relate to wider issues associated with FFD or other AzBU activities in the region. These are summarised in Table 12.1 and discussed below.

Table 12.1 Summary and Source of Residual Significant Impacts for ACG Phase 3

Type of Residual Impact	Impacts
ACG Phase 3 Specific Impacts	Discharge of WBM drill cuttings from surface hole sections Oil Spills
ACG FFD Cumulative Impact	Offshore and onshore atmospheric emissions
Wider AzBU Issues	Final disposal of wastes Demanning Decommissioning

12.2.1 ACG Phase 3 Specific Impacts

12.2.1.1 Discharge of WBM drill cuttings from surface hole sections

The length of time over which the drilling programme will run (10 years) and the total volume of cuttings that will be discharged (14,706 m^3 from the MODU and 10,526 m^3) from platform drilling) will result in a physical impact to the seabed at and near to the drilling locations. Importantly, there will be no opportunity for the marine organisms to recolonise the impacted area until the drilling stops. It should also be noted that concerns over discharge of drill cuttings and the resultant disturbance of the benthic habitat was raised during consultation.

A BPEO study into drill cuttings management was performed for the Phase 1 ESIA. Several issues were highlighted with shipping cuttings to shore:

- Containerising the volume of cuttings that would be generated during drilling of the surface and top-hole sections would be technically difficult as storing large volumes of cuttings on the topsides has inherent safety risks.
- The cuttings would be generated at a high rate thereby necessitating frequent vessel operations and quick off-loading of the cuttings from the topsides.
- Shipping to shore results in atmospheric emissions from vessel operations.

The study concluded that while not desirable, release of WBM drill cuttings to the seabed is, on balance, the best environmental option.

Deposition of the cuttings may extend for up to 1.4 km from the platform and lead to a predicted biomass loss of 3,300kg.

The impact of the release of WBM drill cuttings will be mitigated via a number of measures:

- Selection of low toxicity WBM;
- Sampling and analysis of the cuttings to ensure chloride levels are kept within operating standards;
- Discharge from the platform will be from a caisson at –138m, well below the productive zone.

12.2.1.2 Oil Spills

The accidental events of greatest environmental significance are a well blow out or pipeline rupture, both of which would result in a large-scale oil spill. Both scenarios are extremely unlikely due to the incorporation of a variety of protective measures during project design, which include:

- Prior to production, drilling geophysical surveys will be conducted and shallow gas pilot holes drilled to enable potentially dangerous gas pockets to be avoided.
- Blow Out Preventors (BOP). BOPs will be utilised in all wells drilled and can be rapidly closed following an influx of formation fluids into the well bore. In an emergency situation, gas will be vented at the surface and any oil will be contained in the drilling rig's mud system.
- Mud logging to assess the characteristics of the formation being drilled and assist in identifying dangerous conditions potentially leading to a blow out.
- External protection of pipelines with concrete to provide the weight required to ensure stability on the seabed and mechanical protection against impact (mitigated as part of the ACG Phase 1 and Phase 2 projects).
- Pipeline route selection also minimises possible interference from anchoring boats and the risk of damage due to dropped objects. In the nearshore zone where the pipeline is potentially vulnerable to passing ships it will be buried under the seabed (mitigated as part of the ACG Phase 1 and Phase 2 projects).
- Regular pipeline inspection - side scan sonar and visual inspection surveys by ROV with onboard camera, internal intelligent pig surveys, and flow rate monitoring
- Pipeline corrosion protection measures (sacrificial anodes and protective coating) and corrosion monitoring

The environmental impacts of spilled oil are dependent upon the potential for oil to contact sensitive resources. Under a no-response modelled scenario, the potential distribution of a worst-case oil spill (a large-scale blow-out) could extend throughout the middle and south Caspian, with oil reaching the shorelines of Azerbaijan, Turkmenistan and Iran. In practice, AIOC has developed an ACG specific Oil Spill Contingency Plan (OSCP) and Phase 3 will integrate into this plan. The Caspian littoral states are also developing National Oil Spill Contingency Plans. Although Azerbaijan has yet to prepare a plan, AIOC is working with industry and government to support spill response preparedness.

12.2.2 ACG FFD Cumulative Impacts

12.2.2.1 Offshore and onshore atmospheric emissions

The ACG project partners are committed to assessing, and where practical, reducing the projects GHG emissions. The Phase 3 HSE Design Standards, which included the following standards relating to the control of GHGs:

- Evaluation of options to reduce flaring, combined with the development of operational flare policy, aligned with ACG FFD;
- Maximization of energy efficiency in line with BPEO;
- Challenge and justification of well testing requirements;
- Minimisation of combustion and fugitive emissions; and
- Prevention of hydrocarbon gas disposal by continuous venting.

As a result of these Design Standards the ACG FFD project (including Phase 3) has included a number of design measures to minimise emissions, including GHG contributions and are as follows:

- The cessation of routine flaring from the Chirag-1 platform (as part of EOP);
- Onshore flare gas recovery;
- Onshore inert purge gas;
- Centralised power offshore for the Azeri Field;
- No continuous flaring for production;
- Gas re-injection (as opposed to flaring) at the Azeri Field;
- External floating roof tanks at terminal;
- Use of Aero-derivative turbines;
- Electric motor driven export compression on Phase 3; and
- Gas management.

Considerable savings in GHG emissions have been made through the implementation of these measures and it is estimated that the Phase 3 Project will generate 15,170,364 tonnes of GHG. In addition to the measures outlined above the following further measures will be implemented in order to ensure the minimisation of GHG emissions from the Phase 3 project:

- Operational mechanisms, such as optimisation of energy efficiency, leak detection programmes, monitoring and maintenance programmes;
- Investigation of opportunities to integrate broader GHG reduction considerations into the projects' environmental and community investment programmes; and
- Monitoring of developments within the UNFCCC for ideas that could have applicability to Azerbaijan.

12.2.3 Wider AzBU Project Issues

12.2.3.1 Final disposal of wastes

The management of waste is an issue for all BP activities due to the lack of available facilities for the reception, treatment (where required) and disposal of wastes in Azerbaijan. This problem is compounded by the fact that some types of wastes have not been produced in Azerbaijan to the scale that will result from the ACG and other BP operated developments, and therefore there has not been a requirement to develop disposal routes for them. Work is underway by the AzBU to define disposal routes for these wastes and ACG Phase 3 will align with and integrate into final disposal solutions.

BP's waste production is predicted to peak at 18,000 MT around 2004, declining rapidly to around 4,000 MT by the end of 2007 as projects move from construction to operation resulting in a decrease in the amount of waste generation. From 2008, waste production will become relatively constant until 2024. Current waste management practices are shown in Table 12.2.

Table 12.2 AzBU Identified Primary Waste Disposal Routes

Category	Description	Disposal Location
Hazardous waste	Storage under controlled conditions	Serenja Hazardous Waste Facility
Non-hazardous waste	Re-use/recycling and where not possible, landfill	Various recycling routes (steel, paper, wood) or Balakhany Municipal Landfill

AzBU is currently working in conjunction with local agencies and authorities and with individual BP project teams to identify compliant interim and long-term waste management solutions for hazardous storage, reuse/recycling options, landfill sites and operations.

12.2.3.2 Demanning

The demobilisation of the workforce that will occur at the completion of the construction programme remains of medium residual significance due to the number of people that will be directly affected and the consequent socio-economic impact. Whilst those employed in earlier projects have been able to move onto subsequent BP construction programmes, after the construction period of Phase 3 there will be no further BP construction programmes to which the workforce can transfer. It must be recognised though that demanning is not an issue for Phase 3 in isolation, but relevant to all BP projects within the region and as such is also relevant at a AzBU level.

The Phase 3 mitigations that will be implemented to minimise the impacts of construction workforce demobilisation are as follows:

- The verification of socio-economic management measures assumed to be in place during the impact assessment; specifically the implementation of appropriate recruitment, employment and training procedures; contractor alignment and coordination in workforce management across the project;
- The alignment and integration of ACG Phase 3 into the framework of the BP AzBU established social management system and social investment programme, which includes the following key components:
    - Transparency & Communication: Clear communication to all workers on terms and conditions of contracts at start of work, including notification process, so that workers are aware of the length of their employment.

  - Inter-Project Management: Focus on planning and collaboration between projects to maximise alternative employment opportunities, and the transfer of skilled and non-skilled workers between existing and any new projects that arise.
  - Contribution and communication within the established Industrial Forum (IF) mechanism between the projects main contractors on behalf of ACG Phase 3.
  - Provision of Training & Guidance: Training will be establishment to supplement existing training and diversify skills, such as business development, computer and life skills. These will be available to workers and other locals.
  - Social Development: Existing social investment (SI) programmes will be used as a platform to launch capacity building, sustainable income generation and micro-enterprise projects to enhance the opportunity for individuals, or groups close to BP-operated projects to generate their own income.
  - Linkages to External Activities: Engaging into and supporting where appropriate other NGO, IFI or Government strategies aimed at supporting economic development within the country and region.
- Development and proposal to AzBU of additional measures based on project experience to augment existing programmes.

12.2.3.3 Decommissioning

Local scientists raised the future decommissioning of ACG offshore facilities during stakeholder consultation (Section 8). The consideration of decommissioning, and more specifically the concern over the potential hazard to shipping posed by installations not completely removed from the seafloor, has therefore been considered in the ESIA process.

The ACG Phase 3 facilities have been designed so as to enable complete removal. According to the terms of the PSA, AIOC is required to produce a field abandonment plan for the ACG facilities one year prior to completion of 70% production of identified reserves. Whilst the PSA sates that ownership of these facilities will pass to SOCAR at on completion of the term of the PSA, AIOC will develop a Field Abandonment Plan which will present recommendations for project decommissioning based on a best practicable environmental options (BPEO) study of all available options. The financial aspects of Phase 3 decommissioning will be addressed by the contribution of a proportionate share of the revenue raised from the project by each of the AIOC partners, as defined by the PSA.

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