Chapter 19: Unplanned Events

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19.1 Introduction

Unplanned events are episodes that are not expected to occur during the Project's normal Construction and Operational Phase activities, such as accidents. The Project follows safety and engineering design criteria that aim to avoid unplanned events that could lead to adverse environmental, socio-economic or health and safety impacts.

This chapter provides an assessment of the potential environmental and socio-economic risks and impacts from onshore and offshore unplanned events, that could occur during the Construction and Pre-Commissioning, Operational (including Commissioning) Phases of the Project so that design controls and mitigation measures can be put in place. The approach to unplanned event management during the Decommissioning Phase is also presented herein. Project risks and impacts associated with worker occupational health and safety (OH&S) are considered in Appendix 15.1: Occupational Health and Safety.

The assessment considers both the likelihood of unplanned event occurrence as well as the potential consequences of such events.

19.2 Scope and Approach

The overall Project Area (the geographical area within which all proposed Project Activities will occur as defined in **Chapter 1 Introduction**) has been split into three main areas of activity for the purpose of the assessment of unplanned events, namely:

- Onshore Landfall: Area covers all Project onshore landfall facilities and activities (from the landfall facilities of the Project to the shoreline); and
- Offshore: Area includes the nearshore and offshore sections as defined in the previous chapters of this ESIA Report. This area commences at the shoreline and extends out to the border of the Russian and Turkish Exclusive Economic Zones (EEZ) in the Black Sea.

Locations in the wider surrounding area and/or between these main areas of activity that could be affected by unplanned events are also considered. For example, onshore access roads / routes and shipping routes.

This chapter focuses on those unplanned events considered to be of most relevance to the Project given the nature of the construction activities, the operational requirements of the pipelines and the geographic location of the Project. In order to assist the unplanned event identification process, South Stream Transport has undertaken an Emergency Threat Analysis[1] for the Project that determines the risks posed by potential emergencies and the need for an Emergency Preparedness and Response Plan and related procedures as a contingency for

[1] Involves use of an emergency risk analysis spreadsheet that assigns risk ratings against potential unplanned events taking account of event likelihood and consequences. In August 2013 South Stream Transport undertook an internal Emergency Threat Analysis workshop involving relevant specialists.

emergency events. The unplanned events considered within this chapter have been identified via the Emergency Threat Analysis.

Where available, information on the likelihood of occurrence of unplanned events has been drawn from statistics from industry organisations. Data on the frequency of shipping incidents has been taken from statistics published by recognised industry bodies, including the International Association of Oil & Gas Producers and the European Maritime Safety Agency.

Given the inherent uncertain nature of potential unplanned events, the potential variability of such events in terms of geographic location and coverage, and limitations of directly relevant event statistics, a qualitative assessment methodology has been adopted herein. This methodology has entailed the following tasks:

- Screening of unplanned events to identify those which are carried forward for further consideration;
- Identifying the range of activities that could lead to the occurrence of a potential unplanned event during Construction and Pre-Commissioning and the Operational (including Commissioning) Phases of the Project;
- If possible, determining the likelihood of occurrence of such events;
- Defining and describing the geographic range of occurrence of potential unplanned events;
- For each unplanned event, definition of the potential resultant impacts in relation to potentially affected receptors; and
- Definition of appropriate risk management measures to reduce the likelihood of occurrence of each unplanned event and minimise the residual significance of any resulting impacts.

When determining the potential consequences of unplanned events, the resultant impacts have been assessed in relation to categories of receptors as follows:

- Environmental receptors; and
- Socio-economic receptors (including impacts upon community health).

OH & S impacts associated with unplanned events are not considered in this chapter. However, South Stream Transport will implement internationally recognised procedures to assure the OH&S of the workforce (including during unplanned events) along with the necessary equipment and training to make these effective. OH&S measures will be included in a Health, Safety, Security and Environmental Integrated Management System (HSSE-IMS) which will form an important part of the corporate management system (**Chapter 22 Environmental and Social Management**).

In order to support the unplanned events assessment as reported herein, the following additional assessments have been undertaken:

- Quantitative Risk Assessment (QRA) (Ref. 19.1 and Appendix 19.1: Quantitative Risk Assessment) which considers the risks to the public as associated with the operation and maintenance of the onshore pipeline and landfall infrastructure and facilities;

- Maritime Risk Assessment (Appendix 19.2: Maritime Risk Assessment and Oil Spill Modelling) which considers the risks of marine vessel accidents occurring and the potential for consequential oil spillages;
- Oil spill modelling (Appendix 19.2) to investigate the fate and behaviour of various oil spill scenarios that may occur following an unplanned marine event (as identified by the maritime risk assessment); and
- Terrestrial and marine geohazard evaluation (Appendix 19.3: Unplanned Events - Marine Geohazards) which highlights the potential geohazards present along the pipeline alignment, and the actions that have been undertaken to manage risks to pipeline integrity.

19.3 Legal Context

A range of legislation has been passed in Russia that requires plans and actions to be developed should unplanned events have the potential to impact on workers, the local community and the environment. Much of the legislation applies to private organisations as well as public authorities and local government bodies. This legislation reinforces the prevention and elimination of accidents and promulgates the need for emergency and management plans and thus the legislation needs to be taken into account as part of the Project's unplanned event risk minimisation and management process. A summary of the relevant legislation is outlined below:

- Russian Federation Law "On protection of population and territories from natural and man-made emergency situations", No. 68-FZ, 21 December 1994: The law sets forth institutional and legal provisions for the protection of people, land, water and air space from emergency situations. This Federal Law extends to public authorities, local government bodies, as well as to private companies and organizations;
- Russian Federation Law "On fire safety", No. 69-FZ, 21 December 1994: The law determines legal, economic and social basis for provision of fire safety in the Russian Federation, regulates relations between the state authorities, self-government bodies, institutions, private organizations, other legal entities and also between public organisations, officials, citizens of the Russian Federation, foreign citizens, and stateless persons;
- Russian Federation Government Enactment "On procedure for organising measures for emergency oil spills' prevention and response in the territory of the Russian Federation", No. 240, 21 August 2000: The resolution determines the main requirements for developing plans for emergency oil spill prevention and response. The requirements define the principles for formulation of the plans for emergency oil spill prevention and response, which apply to emergency situations of onsite, local, territorial, regional and federal importance, and coordination of response measures;
- Russian Federation Government Enactment "On urgent measures for emergency oil spills' prevention and response", No. 643, 15 April 2002: The related rules establish requirements for organising measures for emergency oil spill prevention and response aimed at reducing adverse impacts on humans and the natural environment. The measures are organised by the federal bodies of executive power of the Russian Federation, self-government bodies and companies who carry out field exploration, oil production, refining, transportation and storage of oil and related products; and

- Russian Federation Requirements "On adoption of requirements for prevention of emergency situations at potentially hazardous facilities and vital infrastructure", No. 105, 28 February 2003: The requirements provide a set of measures on reduction of risk of emergency situations of technogenic character at potentially hazardous facilities, which use, produce, process, store and transport fire-explosion-hazardous substances, hazardous chemical and biological substances, including the provision of publicly vital activities (water supply and wastewater discharge, waste water treatment, heat and power supply utilities, hydro-engineering facilities). The specified requirements are as follows:
    - Identification of emergency situations for population and territories, coordination and planning for monitoring, forecasting and modelling, zoning of Russian territories by location of hazardous production facilities;
    - Classification of potentially hazardous facilities and vital infrastructure by risk of emergency situation occurrence at these facilities;
    - Design, construction, operation and decommissioning of facilities, which are hazardous to the population and Russian territories;
    - Management of actions for emergency situation prevention and protection of population and territories from hazardous impacts; and
    - Assessment of potentially hazardous facilities preparedness to emergency situation prevention and sufficiency of measures for protection of population and territories.

19.4 IFC Requirements and Guidance

International Finance Corporation (IFC) Performance Standard (PS) 1 Assessment and Management of Environmental and Social Risks and Impacts (January 1, 2012) (Ref. 19.11) states that:

"The client, in coordination with other responsible government agencies and third parties as appropriate will conduct a process of environmental and social assessment, and establish and maintain an ESMS appropriate to the nature and scale of the project and commensurate with the level of its environmental and social risks and impacts. The ESMS will incorporate the following elements: (i) policy; (ii) identification of risks and impacts; (iii) management programs; (iv) organizational capacity and competency; (v) emergency preparedness and response; (vi) stakeholder engagement; and (vii) monitoring and review."

PS1 goes on to highlight the need for the Environmental and Social Management System (ESMS) to establish and maintain an emergency preparedness and response system:

"…so that the client, in collaboration with appropriate and relevant third parties, will be prepared to respond to accidental and emergency situations associated with the project in a manner appropriate to prevent and mitigate any harm to people and/or the environment. This preparation will include the identification of areas where accidents and emergency situations may occur, communities and individuals that may be impacted, response procedures, provision of equipment and resources, designation of responsibilities, communication, including that with potentially Affected Communities and periodic training to ensure effective response. The emergency preparedness and response activities will be periodically reviewed and revised, as necessary, to reflect changing conditions".

Guidance on the content and coverage of Emergency Preparedness and Response Plans is provided in the IFC Environmental, Health and Safety (EHS) Guidelines (IFC, 2012) (Ref. 19.12). Also of relevance is PS4 Community Health, Safety, and Security (Ref. 19.15) which addresses the client's responsibility to avoid or minimise the risks and impacts to community health, safety, and security that may arise from project related-activities, with particular attention to vulnerable groups. PS4 states that:

"In addition to the emergency preparedness and response requirements described in Performance Standard 1, the client will also assist and collaborate with the Affected Communities, local government agencies, and other relevant parties, in their preparations to respond effectively to emergency situations, especially when their participation and collaboration are necessary to respond to such emergency situations. If local government agencies have little or no capacity to respond effectively, the client will play an active role in preparing for and responding to emergencies associated with the project. The client will document its emergency preparedness and response activities, resources, and responsibilities, and will disclose appropriate information to Affected Communities, relevant government agencies, or other relevant parties."

19.5 Emergency Preparedness and Response Plan

Chapter 22 Environmental and Social Management highlights that South Stream Transport will prepare an over-arching Emergency Preparedness and Response Plan for the overall project (covering Russian, Turkish and Bulgarian sectors) in line with IFC EHS Guidelines. The plan will be part of the HSSE-IMS as defined in **Chapter 22 Environmental and Social Management**.

This plan will define response actions for material unplanned events / risks that have been identified by the Emergency Threat Analysis. The overarching plan will cover all project phases and will include details as suggested by the IFC EHS Guidelines as follows:

- Purpose and scope;
- Emergency response management strategy;
- Emergency risk analysis, Emergency Preparedness and Response Plan and definition of the relationships with Contractors' Emergency Response Plans;
- Roles and responsibilities;
- Communication requirements;
- Emergency drill requirements (including examinations, inspections and testing); and
- Review processes.

South Stream Transport's Construction Contractors will be responsible for preparing their own Emergency Response Plans for their work activities, and specifically those events identified by the Emergency Threat Analysis. Contractors are expected to apply Good International Industry Practices (GIIP) and applicable recognized industry standards when preparing their Emergency Response Plans.

The preparation of contractors' Emergency Response Plans will be a requirement of the applicable works Contract, and will be available prior to the start of construction activities and will be subject to South Stream Transport review and acceptance. South Stream Transport will ensure that Contractors' plans are integrated with other Project response plans, including South Stream Transport 's overarching Emergency Preparedness and Response Plan.

Similarly, South Stream Transport will ensure that contractor Emergency Response Plans appropriately integrate with the Emergency Prevention and Response Plan for Anapa municipality and the National Disaster Management Plan with regard to command and control systems, points of first contact during emergencies, local capabilities and capacity.

South Stream Transport will also prepare a Security Plan which will include the following:

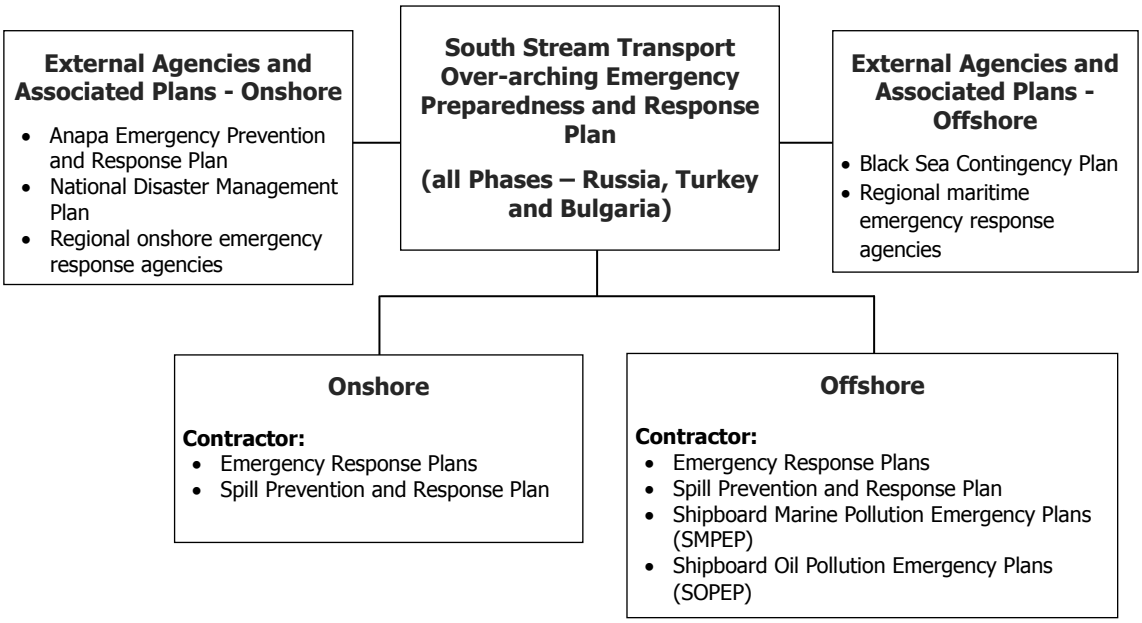
- Systematic identification of security threats;
- Monitoring of social and other conditions related to security threats;
- Security screening of employees and other persons, as appropriate;
- Security measures to protect the property, assets, employees and intellectual capital of South Stream Transport;
- Information, instruction and training on security practices and requirements;
- Promotion of personal and corporate security;
- Security surveillance, including CCTV, security guards etc.;
- Emergency response plan and crisis management plan in case of serious security incidents; and
- Analysis of security incidents to facilitate lessons learned.

The Security Plan will be coordinated with the contractors who will be required to demonstrate how they will ensure compliance with the plan through the development of their own contract-specific Security Plan and procedures.

As detailed in Section 14.8.6 Security Provision (**Chapter 14 Socio-Economics**), in order to ensure there are no risks of human rights abuses against local communities by security forces, whether these be directly employed by the Project, contractors or state security forces, South Stream Transport will ensure training for security forces on escalation of force and protection of human rights. Furthermore, South Stream Transport will use its contractual process to ensure that provisions are in place for the conducting of background checks on security staff, as well as monitoring of performance.

The security provisions for the Project will follow the guidance as set forth in the Voluntary Principles on Security and Human Rights (Ref. 19.14). Policies, plans and procedures to protect the safety and security of the workforce, community and other Project stakeholders will be documented in the HSSE-IMS (**Chapter 22 Environmental and Social Management**). Figure 19.1 illustrates the relationship between South Stream Transport's over-arching Emergency Preparedness and Response Plan and the contractor Emergency Response Plans for the onshore and offshore areas, as well as external agencies and associated emergency plans.

Figure 19.1 Relationship between South Stream Transport's Over-arching Emergency Preparedness and Response Plan and the Contractor Emergency Response Plans (Onshore and Offshore)



19.6 Onshore Landfall Section

19.6.1 Construction and Pre-Commissioning Phase – Landfall Section

19.6.1.1 Events Identification

During the Construction and Pre-Commissioning Phase of the Project, unplanned events in the onshore landfall section may occur as a result of the use of construction plant, power generation equipment and from vehicular traffic in conjunction with equipment malfunction or human error.

Table 19.1 lists the activities that could result in an unplanned event, a description of the unplanned event, and the receptors which could be affected.

Table 19.1 Landfall Activities Potentially Resulting in an Unplanned Event (Construction and Pre-Commissioning Phase)

Activity	Event	Receptors	
		Environmental	Socio-Economic and Community Health
Use of construction equipment and power generation equipment	Fuel and oil spillages	✓	
	Damage to third party property or utilities		✓
	Fires	✓	✓
Vehicular traffic	Traffic accidents		✓
	Fuel and oil spillages	✓	
	Damage to third party property or utilities		✓
Third party activity	Major forest fire during construction caused either by public or nature e.g. lightning strike requiring evacuation of the site	✓	✓
	Protests and communal violence		✓

The design controls that will be put in place to reduce the likelihood of occurrence of the above potential unplanned events, as well as the mitigation / response measures that will be enforced to minimise the consequences associated with these events, are discussed below.

19.6.1.2 Potential Impacts to Environmental Receptors

Fuel and Oil Spillages

Construction activities will require many large mobile plant items (e.g. excavators, dozers), power generation equipment and vehicles that will be powered by diesel oil and which will contain relatively small reservoirs of lubricant oil and hydraulic oil. There is the potential for environmental damage if such materials are spilled depending on the volume and location of the spill / loss of containment.

Oil spilled to unpaved areas could potentially seep into the soil if the spill is not responded to immediately. Small oil spillages to paved and contained areas can generally be responded to in a manner that does not impact upon environmental receptors (unless spillages to paved areas subsequently discharge onto unpaved areas). In the case of a relatively large spillage of fuel,

associated for example with a fuel tank rupture as a result of vehicular accidents, the spilled fuel could also discharge directly into any nearby drainage ditches or watercourses.

Such a spill of diesel fuel, lubricants or hydraulic oil impacting upon surface water could be harmful to aquatic organisms and may cause long-term adverse effects in the aquatic environment. Spillages to soil could also result in localised soil contamination.

Most onshore construction related oil spillage incidents are likely to be relatively small (e.g. less than 100 litres) given the nature of the vehicles / mobile plant being used. The control measures to be adopted by the Project will be defined within a Spill Prevention and Response Plan which will be developed and maintained by each Project contractor. The Spill Prevention and Response Plan will include aspects such as the following:

- Introduction and objectives;
- Roles and responsibilities;
- Oil spillage risk analysis;
- Response equipment details;
- Response actions;
- Communication requirements;
- Drill and training requirements; and
- Review processes.

The application of the Spill Prevention and Response Plan will reduce the risks of any long-term significant adverse impacts on the aquatic environment as a result of such events. In the case of soil contamination from a small scale spillage, in accordance with the Spill Prevention and Response Plan, any contaminated soil would be promptly removed and disposed of at an appropriately licenced waste management facility. Such actions taken will reduce the risks of any long-term significant adverse impacts on soil quality. Given the small quantity of any accidental hydrocarbon spillages and implementation of the Spill Prevention and Response Plan, the potential for adverse impacts upon groundwater resources will also be reduced. Any residual groundwater contamination will only be locally affected and is expected to gradually recover through natural attenuation (Section 8.6.2).

Accidents during the bulk transportation of fuel to the landfall section and spillages from bulk fuel storage tanks (e.g. tank rupture or as a result of human error or equipment malfunction during tank loading and unloading operations) could result in a large spillage of hydrocarbon (greater than 100 litres) into the environment. The design controls that will be implemented to minimise the risks of such events occurring and to prevent adverse environmental impacts will be included in the Spill Prevention and Response Plan. Measures include:

- Appropriate driver training;
- The use of designated routes for transporting fuel to the landfall site (avoiding where possible environmental sensitive areas and built up areas);
- Definition of spillage containment equipment and clean-up actions following such events; and

- Provision of on-site secondary containment facilities for all hydrocarbon storage tanks (including loading and unloading bays) to enable any spillages of hydrocarbons to be contained, thus preventing significant environmental impacts.

Fires

Fires during construction could occur, for example, as a result of the accidental ignition of dry vegetation during certain operations that involve the use of gas torches (hot works), such as heat wrapping of the coating that is applied to the pipe welds or during torch welding of mechanical components. Fires could also be caused by inappropriate human behaviour, such as construction worker smoking, as well as actions by third party activities and via lightning strikes.

Fires could spread to the forest environment that surrounds the landfall section and cause significant environmental impacts. **Chapter 11 Terrestrial Ecology** describes the habitats that occur within the Project Area that could be adversely affected by fire. In view of the sensitivity of some of the habitats and their protection status, it is important that stringent measures are enforced to minimise fire risks and the associated potential significant adverse impacts.

Fire risks will be minimised through the definition and enforcement of strict control measures, which will include the adoption of a "permit to work" system for hot works and a smoking ban for all construction personnel whilst undertaking construction activities. Other ignition sources, such as open fires along the pipeline Right of Way (RoW) will also be prohibited, whilst dry vegetation will be removed from the RoW and from areas of hot works.

Section 19.5 indicates that South Stream Transport will prepare an overarching Emergency Preparedness and Response Plan – this plan will include details of fire prevention, fire detection and fire-fighting systems which will be developed and maintained by each construction contractor. Contractors' Emergency Response Plans will be tailored to work to be carried out under their contracts. These Emergency Response Plans will include specific measures to prevent ignition and subsequent spread of any fires to natural habitats and well as fire-fighting procedures (including interactions with local competent fire-fighting authorities). Contractor Emergency Response Plans will thus make reference to, and be aligned with, South Stream Transport's overarching Emergency Preparedness and Response Plan.

19.6.1.3 Potential Impacts to Socio-Economic Receptors and Community Health

Damage to Third Party Properties or Utilities

Large mobile construction plant items, such as excavators, dozers and construction vehicles etc. have the potential to cause damage to third party property, whilst the excavation of pipeline trenches could result in damage to buried utilities.

Existing third-party services will be located, marked, and either safeguarded or diverted in accordance with owners agreements, and as further described in **Chapter 5 Project Description**.

As noted in **Chapter 5 Project Description,** Section 5.3 Construction Phase Description, two existing third-party utility infrastructure installations crossing the landfall section of the Project Area have been identified, namely:

- An existing underground communication cable; and
- A 10 kV overhead power line suspended on poles located approximately 850 m downstream from the landfall facilities.

If utilities such as the communication cable or overhead power line were damaged, in addition to causing damage to the relevant utility operator's assets, it could also lead to economic impacts on local businesses e.g. potential interruption to communication services and energy supply, as well as potential lost production time. Householders could also experience inconvenience and could potentially make alternative provisions, at personal expense, to cope with a loss of communication services or electricity.

For buried services, at the time of setting out the works, each contractor will locate such services and record depth, type and size through the use of hand excavation. All services will be adequately protected from damage by the laying of excavator mats, or geotextile membrane and hard-core and by maintaining an appropriate safe distance between the pipeline and existing services. Alternatively, in agreement with the service owners (including the underground communication cable), it may be decided to cut and reroute service lines. The final decision will be subject to consultation with the utility owner and detailed design studies.

Due to the height of the overhead power line which is suspended over the access road and construction corridor, it is possible that it may restrict certain types of vehicles from accessing the route. In order to overcome this and to maintain a safe working environment, the power will need to be cut temporarily and either an alternative power system provided or the power lines rerouted so that the construction equipment can travel safely along the route. A decision on which option will be selected will be based on consultation and agreement with the power line owners, local authorities and any other effected parties. South Stream Transport will put in place measures to ensure that disruptions to power supply as a result of accidental damage to services are kept to a minimum.

It is considered that the risks of accidentally damaging either the communication cable or the overhead power line are low taking into account the aforementioned preventative measures.

All reasonable efforts have been made to ensure that all utilities crossing the landfall section of the Project Area have been identified. However, in the event that unknown services are encountered during construction, the potential for damage to that infrastructure will be minimised through the implementation of procedures to stop work in the immediate area until the nature of the services can be established. Project construction activities could restart following the definition of appropriate working methods which would avoid impacting upon the integrity of the subject services and/or the health and safety of the construction personnel. Ownership of the services will be established where possible, and the owners consulted if service diversions are deemed necessary. Additionally, appropriate signage, working practices and worker training will be given should any other overhead cables be encountered.

Fires

As identified in Section 19.6.1.2, fires during the Construction and Pre-Commissioning Phase could occur either as a result of construction activities or as a result of inappropriate human behaviour. Such fires have the ability to impact upon local community assets and the health of local community residents.

Chapter 14 Socio-Economic describes the land uses that occur within the Project Area and within adjacent areas that could be adversely affected by a fire. Sections of the Project Area are forested, interspersed with pockets of open land used primarily for agriculture (including vineyards). The agricultural land is a mixture of shrubby and fallow land and productive agricultural land, mainly vineyards. While fires could spread to neighbouring vineyards and other agricultural land, causing the loss of established productive vineyards, it would be easier to fight and contain a fire spreading through agricultural land compared to forests. Consequently, the potential for economic losses would be limited.

The amount of residential accommodation within the vicinity of the Project Area (as defined in **Chapter 1 Introduction**) is limited. There are no residential properties, either permanently occupied or holiday accommodation, within the Project Area. However, there are the Shingari and Don holiday complexes (tourist resorts) (approximately 1.3 km south of the microtunnel entry points), a group of residential dwellings situated approximately 1.5 km south of the landfall facilities, as well as more concentrated residential developments in Gai Kodzor (approximately 4.5 km northeast of the landfall facilities), Sukko (approximately 3 km south of the microtunnel entry points), Supsekh (approximately 4 km north of the nearest point of the pipelines) and Varvarovka (approximately 1.5 km northwest of the landfall facilities) plus two log cabins that have been built approximately 1.1 km south of the landfall facilities (see **Chapter 9 Air Quality** – Section 9.6.1.5). The nearest identified buildings are thus located near the Varvarovka community approximately 1 km northwest of the landfall section with the intervening land being agricultural in nature with some woodland. The risk from fire to the Varvarovka community is minimal given the distance to Project activities and given the sparse nature of the vegetation between the Project Area and that settlement. Nevertheless, the enforcement of strict fire control measures and the fire detection and fire fighting enactments of the Contractors' Emergency Response Plan (see Section 19.6.1.2) will limit the potential for fire impacts upon residential property.

Protests and Communal Violence

Local residents in the vicinity of the Project Area could potentially be impacted by unplanned events involving construction workforce unrest, civil unrest and worker-community conflict.

Measures will be undertaken to prevent unplanned events caused by the construction workforce protests and disturbances. The construction contractors have the responsibility to provide for the well-being of their workers – this includes compliance with applicable employment laws and regulations, adherence to appropriate OH&S management systems, and the availability of a worker consultation and grievance process. Grievances raised by workers, including South Stream Transport employees and contractors / suppliers' workers, will be handled according to the Worker Grievance Procedure. This procedure is part of the HSSE-IMS and will be implemented via the Environmental and Social Management Plan (ESMP) (see **Chapter 22**

Environmental and Social Management). It will function through all Project phases. The Worker Grievance Procedure will be implemented by South Stream Transport in partnership with its contractors and will ensure that grievances are brought to the attention of the appropriate Project staff and addressed in an appropriate and timely way.

In addition, the well-being of workers will also be assisted through the adoption of the policies and practices including the following (see **Chapter 14 Socio-Economics**):

- Human health resources;
- Working relationships;
- Working conditions and terms of employment;
- Workers' organisations; and
- Non-discrimination and equal opportunities.

In order to minimise the risks associated with workforce conflicts and civil unrest caused by Project activities, South Stream Transport will ensure that the construction contractors adhere to considerate construction practices, including the measures detailed in this ESIA. South Stream Transport will also ensure that security personnel adhere to internationally recognized human rights principles in the provision of Project security services.

As detailed in Section 19.5, South Stream Transport will develop a Security Plan that sits within the broader HSSE-IMS (see **Chapter 22 Environmental and Social Management**) and is integrated with the other South Stream emergency plans discussed in this chapter. Contractors are required to align their own security plans and procedures with the requirements specified in the South Stream Transport Security Plan and in doing so demonstrate due consideration of both applicable law and the Voluntary Principles on Security and Human Rights (the 'Voluntary Principles'). Further detail concerning the Project's implementation of the Voluntary Principles is provided in **Chapter 14 Socio-Economics**.

To further mitigate against civil unrest, South Stream Transport will prepare and implement the Stakeholder Engagement Plan. The Stakeholder Engagement Plan will define community engagement activities that will be undertaken and adhered to, including ensuring access to a suitable community grievance procedure, and undertaking an appropriate community engagement and awareness programme.

In the event of construction workforce / community unrest or conflict there could be human injuries. Therefore, the Emergency Response Plans that will be prepared and maintained by each construction contractor will include measures that aim to protect the workforce and members of the public. These plans will define measures that aim to initially stabilize medical cases (which would be carried out by an on-site first aider, nurse or physician) and then enable evacuation carried out by ambulance or helicopter. The injured party would be evacuated to the nearest designated hospital or accident and emergency centre. Each contractor will ensure that sufficient first-aid or medical staff and equipment are located at the construction site to meet the identified occupational health risks. The location and capability of local ambulance stations (public and private) will be identified (and mapped) together with contact details, times of operation, distance and travel times. A qualified occupational physician will inspect and report on the capacity and capability of these services. A designated hospital or accident and

emergency centre will also be identified (including contact details, times of operation, distance and expected travel times).

Traffic Accidents

Pipe sections and other materials will be delivered to the landfall section of the Project from the Novorossiysk port by road using designated access routes. Stakeholder engagement consultation has identified public and community safety concerns as related to traffic accidents when construction vehicles pass through residential settlements (**Chapter 6 Stakeholder Engagement**). Such traffic accidents could be caused by equipment malfunction or by human error.

South Stream Transport will ensure a range of measures will be implemented prior to construction works to address transportation related risks and impacts, including:

- Preparation and implementation of a Logistics Plan to manage and coordinate the transport and logistics requirements of the Project. The Logistics Plan will identify agreed access routes, as well as measures and safeguards to minimise interference with local transportation and routes;
- Preparation and implementation by the contractor of a Construction Traffic Management Plan (CTMP). The CTMP will:
    - Be consistent with, and take into consideration, the Construction Traffic Management Plan (or equivalent) developed for the Russkaya Compressor Station Project;
    - Be aligned with the Logistics Plan and ensure that access to the pipeline landfall and associated above ground installations will be restricted to the agreed access routes and the construction corridor;
    - Ensure that movement of 'outsize' or 'large / long' vehicles, or convoys, will be timed, where practicable, to avoid busy traffic periods and routed to avoid minor roads and villages; and
    - Include strict enforcement of speed limits for employees driving company vehicles and adherence to driving and health and safety guidelines during both work and non-work hours.
- The implementation of safe driving procedure protocols. These protocols will include the following measures:
    - Drivers will be briefed to maintain vehicular access to all existing properties and relevant safety measures to be applied along the designated construction access routes;
    - Training and enforcement to ensure that all South Stream Transport / contractor drivers adhere to all applicable national legislative requirements and driving conditions as specified by South Stream Transport;
    - All drivers will be trained in 'well driven' principles and guidance (Ref. 19.7); and
    - Driving performance will be assessed and monitored with additional training provided if necessary.

Contractors will also be required to regularly inspect and maintain their construction fleet in order to minimise accident risks as associated with mechanical failures. In addition to these risk reduction measures, contractor's Emergency Response Plans will include specific measures to be

undertaken in the event of vehicle accidents, including those involving third parties. Any traffic induced oil spillages will be handled in accordance with the contractors Spill Prevention and Response Plan (Section 19.6.1.2).

19.6.2 Commissioning and Operational Phase – Landfall Section

19.6.2.1 Events Identification

During the Operational (including Commissioning) Phase of the Project, unplanned events in the onshore landfall section may occur as a result of accidental leakages of natural gas from the pipeline or from landfall facilities which have the potential to result in fires and explosions.

Table 19.2 lists the activities that could result in an unplanned event, a description of the unplanned event, and the receptors which could be affected.

Table 19.2 Landfall Activities Potentially Resulting in an Unplanned Event (Commissioning and Operational Phase)

Activity	Event	Receptors	
		Environmental	Socio-Economic and Community Health
Operation of the pipelines and landfall facilities	Accidental release of natural gas into the atmosphere	✓	✓
	Fires and explosions	✓	✓
	Protests and communal violence		✓

Some unplanned events have been excluded from the assessment undertaken in this section as they are not expected to lead to significant environmental or socio-economic impacts. Unplanned events that have been excluded from discussion are:

- **Spills of liquid hydrocarbon:** these events could occur during maintenance operations at the onshore landfall facilities, but the frequency of such operations and the volumes of hydrocarbon involved are sufficiently small enough not to warrant a detailed discussion of these events. Such events can be readily accommodated through applicable Emergency Response Plan and Spill Prevention and Response Plan;
- **Vehicular traffic accidents:** considering that no significant vehicular traffic will be associated with the Operational (including Commissioning) Phase of the Project, this aspect has been excluded from the assessment; and
- **Operational worker protests and / or disturbances:** As there will be no full time workers employed for the Project during the Operational Phase of the Project, issues associated with potential worker protests and / or disturbances are thus excluded from the assessment.

19.6.2.2 Potential Impacts to Environmental Receptors

Gas Leakages

The only possible source of a large scale release of gas into the atmosphere would be the result of a pipeline rupture or a planned release of gas from the landfall facilities or pipelines to allow maintenance or repairs to take place. Pipeline ruptures could be caused by factors such as external interference, internal or external corrosion, material and construction defects or ground movement / geohazards. Statistically, a pipeline rupture is a very rare event and the likelihood of such an extreme situation is very low (refer to failure frequencies as detailed in Table 19.3). Table 19.4 also provides calculated failure frequencies for the landfall facilities.

Table 19.3 Calculated Failure Frequencies for One and Four Pipelines (Ref. 19.1)

One Pipeline			
Failure Mode	*Failure Frequency (/1,000 km year)*	*Rupture (%)*	*Leak (%)*
External interference	0.000046	70	30
Internal corrosion	negligible	-	-
External corrosion	negligible	-	-
Material and construction defects	0.001	0	100
Ground movement	0.00001	22	78

Four Pipelines				
	Failure Frequency (/1,000 km year)			
	Buried pipeline sections		*Trenchless pipeline sections*	
	Leak	*Rupture*	*Leak*	*Rupture*
External interference	0.0000554	0.00012935	0	0
Other (Material and construction defects; Ground Movement)	0.040312	0.0000088	0	0.0000022

Table 19.4 Calculated Failure Frequencies for the Landfall Facilities (Ref. 19.1)

Leak Frequency (/year)	Above Ground Equipment		Underground Equipment
	Normal Operation	*Pigging Operation*	
Medium Leak (25 mm)			
1 pipeline	1.42×10^{-3}	1.25×10^{-3}	7.10×10^{-4}
4 pipelines	5.67×10^{-3}	5.02×10^{-3}	2.84×10^{-3}
Large Leak (100 mm)			
1 pipeline	1.11×10^{-4}	1.48×10^{-4}	1.14×10^{-4}
4 pipelines	4.44×10^{-4}	5.92×10^{-4}	4.57×10^{-4}
Very Large Leak (300 mm)			
1 pipeline	1.70×10^{-6}	2.08×10^{-5}	0
4 pipelines	6.80×10^{-6}	8.32×10^{-5}	0

The Project pipelines and the landfall facilities will be designed in compliance with national and internationally recognised standards (Section 5.2.6.1). The Project has developed specific design criteria taking into account Russian legislation and international pipeline industry standards, notably those of Det Norske Veritas[2], and European Standards that apply to the Project overall that aim to minimise the risk associated with gas leakages (and subsequent fires / explosions) and thus protect the environment, the operational workforce, as well as members of the public in surrounding areas. Of note is that the Project design takes account of potential terrestrial geohazards as described in Appendix 19.3.

Such measures aim to minimise the risks of pipeline failures which could result in large scale gas releases. Consistent with GIIP, the landfall facilities in Russia will have local Emergency Shutdown (ESD) valves and safety systems (e.g. alarms and trip systems) installed for each pipeline (Section 5.2.5.2). An ESD valve is a hydraulic actuated and spring return valve designed to stop the flow of a hazardous substance (i.e. the gas) upon the detection of a potentially dangerous unplanned event or non-standard operating conditions. In the unlikely event of rupture of one of the Project pipelines the ESD system will be triggered and the pipelines will isolate themselves. The gas volume in the pipelines will then be automatically isolated from the

[2] As per Section 5.2.6.1, the Project Specific Design Code (PSDC) will be developed during the detailed design stage and which will be primarily based on Det Norske Veritas (DNV) Offshore Standard DNV OS-F101 code 'Submarine Pipeline Systems, 2010' (DNV-OS-F101, 2010). DNV will certify that the offshore gas pipeline is compliant with DNV-OS-F101.

landfall facilities, by closing the landfall facilities inlet and outlet ESD valves, thereby stopping the flow of gas to the pipelines.

The landfall facilities will be equipped with a vent stack. The venting system is designed for venting the gaseous inventory of the pipework within the landfall facilities to the atmosphere (to depressurise) in cases of planned shutdown or maintenance of the pipelines. During normal operations, the vent stack will not emit any gas. Venting will only take place during planned maintenance or shutdown activities that may require gas within certain areas of the landfall facilities to be released to atmosphere (Section 5.6.2.1).

For safety purposes, the location of the vent stack structure is chosen such that the prevailing wind blows gas away from the landfall facilities. The vent stack height has been pre-determined based on safety requirements in the workplace in order to protect workers at the facility from asphyxiation, to ensure adequate dispersion in the atmosphere, and to ensure that an explosive mixture is not present at ground level.

Fires

If leaked gas is ignited, significant acute environmental impacts could be caused by the resulting fire, potentially at large distances from the Pipeline itself in the case of a full bore rupture event (especially if there are dry conditions at the time of such a fire event). In many instances, the area would recover relatively quickly from the effects of a fire (e.g. areas of grassland). However, if the fire was within or adjacent to a woodland area, there may be longer-term environmental damage.

Consistent with GIIP, the likelihood of occurrence of fires will be minimised through the use of a Fire & Gas (F&G) detection system that aims to protect and alert personnel and assets from the consequences of a fire and / or gas release. The F&G detection system is a safeguarding system which acts completely autonomously from other safety systems (Section 5.2.5.7). The landfall facilities F&G detection system will include a number of strategically placed gas, flame and smoke detectors. In addition, the containers housing the electrical and instrumentation (E&I) equipment will be fitted with gas, flame and smoke detection systems as appropriate. The main piping will also be installed underground as much as possible, whilst ESD valves will be installed in pits to minimise exposure to fire and explosion events. Such measures will further reduce the potential occurrence and magnitude of fire events.

In an emergency the landfall facilities will be isolated from the offshore pipeline and the Russkaya CS in Russia and the Receiving Terminal in Bulgaria. There is no requirement for emergency venting (i.e. venting is not part of the ESD logic). However, provisions exist to enable a manual depressurisation of the landfall facilities, if required.

In case of a gas-fuelled fire at the landfall facilities, rapid isolation of the leak will be undertaken as quickly as possible which will reduce the magnitude of any gas leak and limit the duration and intensity of possible fires. The rapid initiation of the isolation provisions will occur following detection of a gas leak or fire by the installed alarm systems. The quantity of gas within the landfall facilities (between the inlet and outlet valves) depends on the operating conditions at the time the valves are closed. The maximum quantity of gas that could be present within the landfall facilities is 42,830 kg.

Additional measures will include the development of an Emergency Response Plan, inclusive of fire prevention and suppression measures (see Section 19.6.1.2). The fire prevention and response measures will include specific actions to prevent the spread of any fires to the surrounding environment. However, provisions for active fire fighting are not foreseen for fire protection of the equipment within the landfall facilities as water based extinguishing systems are not considered an effective measure to extinguish or mitigate the effects of gas fires on gas containing equipment.

19.6.2.3 Socio-Economic Receptors and Community Health

Gas Leakages and Fires

Gas leakages have the potential to impact upon human health receptors. Short term exposure to low concentrations of natural gas may cause headaches, dizziness, drowsiness, nausea and vomiting. High gas vapour concentrations may lead to unconsciousness due to the absence of oxygen. Natural gas is extremely flammable, forming a flammable mixture at a concentration of approximately 5% gas in air (by volume). Therefore, in the unlikely event of a gas leakage, the main risk of concern to community facilities and health is associated with fire and explosion rather than gas exposure.

As identified in Section 19.6.1.3, in the event of a fire, it could spread to the environment that surrounds the landfall section, although fires are unlikely to reach private and residential properties located in the Shingari and Don holiday complexes and Gai Kodzor, Sukko, Supsekh and Varvarovka residential areas.

Section 19.6.2.2 indicates that the Project Pipeline has been designed in a manner that aims to minimise the risks associated with gas leakages and subsequent fires or explosions and thus risks posed to members of the public in surrounding areas. Notwithstanding the stringent standards of design and construction that have been adopted by the Project, it is acknowledged there is a small residual risk that leakages of gas could occur from the pipeline and landfall facilities which could result in a fire / explosion. In developing the Project design, potential third party interference has been taken into account such that the pipeline design includes measures to reduce accidental damage, whilst the landfall facilities will be secured by security fencing, intruder alarms and the surveillance of the real time Closed-Circuit Television (CCTV) by staff based in the Central Control Room (CCR) in accordance with a Security Plan that is being developed by South Stream Transport for the Project.

As indicated in Section 19.6.2.2 during operation, a vent stack located just outside the landfall facilities will be used to depressurise the landfall facilities during a planned shutdown. Given that the vent stack has been designed in order to provide for the safe venting of gas, it is not expected that this venting would pose a risk to the health of residents at nearby receptors given their distance from the vent stack (a minimum 1.1 km). Due to the presence of hydrogen sulphide and mercaptans in the gas, perceptible odour impacts may be expected to occur on a short-term infrequent basis during venting, but this would not be expected to represent a risk to health.

Whilst the risks of a pipeline gas leakages are inherently very low, it is essential to determine what the consequences of any gas leakage could be (ignition and explosion, for example) upon

surrounding receptors, and assess the measures that can be implemented to reduce the effects of any such event, regardless of how small the likelihood of occurrence. Such information can then be used to define exclusion zones around Project facilities, within which activities and land uses are restricted. Definition of exclusion zones for the Project has been assisted through the completion of a Quantitative Risk Assessment (QRA) study that has analysed all components of the landfall section of the Project and, based on historical data on components failure and accidents' occurrence, determine the probability of possible leakages, quantify the leakages and determine the associated potential impacts on the public (Ref. 19.1) (Appendix 19.1).

The QRA undertaken has considered the risks to the public associated with the operation of the landfall sections by taking into account the hazards due to the release and dispersion of:

- Toxic substances either contained in the hydrocarbon gasses or used in the processing of these substances, if present; and
- Gaseous and liquid hydrocarbons as well as subsequent fires and explosions.

The QRA was performed following a pipeline specific approach with pipeline specific data. This approach was also applied for the landfall facilities. The risks have been calculated and expressed in terms of Individual Risk (IR) and Societal or Group Risk (GR). As detailed in Appendix 19.1, the QRA considered the risks to the offsite population expressed as the fatality risk per year.

The QRA study has assessed whether the risk to people resulting from the onshore pipeline section (and the landfall facilities) falls within the risk acceptance criteria of the international pipeline industry standards adopted by the Project, and it has enabled a clear and consistent set of exclusion zones to be defined for the Project. Details of the QRA methodology, acceptance criteria and scenarios tested are presented in Appendix 19.1.

The QRA shows that the highest IR is at the ground surface directly over the buried pipeline (maximum 1.8 x 10^{-7} per year) – this is below the acceptance criteria of 1 x 10^{-5} and 1 x 10^{-6} per year.

The population density in the surrounding areas of the planned pipeline route is such that the group risk criteria is not exceeded. No residential buildings are located in the range of the maximum effect distance of 680 m to 690 m (i.e. the maximum distance away from an event that would be adversely affected).

The QRA also shows that for the landfall facilities the distance from the facility fencing to the 1 x 10^{-5} per year, 1 x 10^{-6} per year and 1 x 10^{-7} fatality risk per year contours occur at distances of approximately 20 m, 150 m and 370 m respectively.

Table 19.5 presents the proposed exclusion zones that have been defined for the landfall section of the Project for the protection of public health and infrastructure. These are in accordance with the requirements of Gazprom Standard STO 2-2.1-249 – 2008 for Main Gas Pipelines, the regulatory requirements set out for the Proekt (the Russian Project Design Documentation), and informed by the results of the QRA (Ref. 19.1).

Table 19.5 Exclusion Zones Established for the Russian Landfall Section (Including Landfall Facilities)

Distance from the centreline of outermost pipelines and landfall facilities	Exclusion Conditions
0 to 19 m	Easement zone intended for construction, maintenance and repair of pipeline
19 to 260 m	C- and E-class: no isolated buildings (1-2 levels), dachas, agricultural farms
260 to 345 m	B-class: no cities, settlements, apartments of three levels or more, no developments / buildings with less than 100 people
345 to 410 m	A-class: no airports, railways station, no developments / buildings with population of more than 100 persons

The defined exclusion zones are sufficient to meet the risk acceptance criteria on individual and societal risk for the Project, as defined by industry standards, and to meet the requirements on exclusion zones from local Russian legislation and regulations.

Protests and Communal Violence

Local residents in the vicinity of the Project Area could potentially be impacted by unplanned events involving local civil unrest as associated with Project activities. Such events may occur because of misperceptions or lack of knowledge about the Project.

In order to minimise the likelihood of any civil unrest triggered by the Project's activities, South Stream Transport will prepare and implement the Stakeholder Engagement Plan which will define community engagement activities to be undertaken and adhered to, including public access to a suitable community grievance procedure, and a community consultation and awareness programme. During the Operational (including Commissioning) Phase it will be important to manage the community perception of gas leakage (and fire) risks through the provision of clear information about the Project and its risks during the community consultation and awareness programme.

19.6.3 Decommissioning

The decommissioning programme will be developed during the Operational Phase of the Project (expected service lifetime of the South Stream Offshore Pipeline is 50 years). It is likely that the technological options and preferred methods for decommissioning of such gas transportation systems as the South Stream Offshore Pipeline will be different in 50 years' time.

Consequently, unplanned events associated with the Decommissioning Phase are unknown at this stage; however, it is anticipated that some of the potential unplanned events will be similar in nature to some of those that may arise during the Construction and Pre-Commissioning

Phase. As such, the mitigation actions as defined in Sections 19.5.1 are also likely to be applicable to the Decommissioning Phase.

Under all circumstances, decommissioning activities will be undertaken in accordance with GIIP and with the applicable international and national legislation and regulations prevailing at that time, and in liaison with the relevant regulatory authorities. As part of the decommissioning planning programme, the potential for unplanned events will be considered and appropriate mitigation and management measures put in place to reduce risks and consequences to the surrounding environmental and local community receptors.

19.7 Nearshore and Offshore Section

19.7.1 Construction and Pre-Commissioning Phase – Marine Section

19.7.1.1 Events Identification

During the Construction and Pre-Commissioning Phase of the Project, unplanned events in the nearshore and offshore sections may occur as a result of offshore construction activities, use of maritime vessels and as a result of maritime vessel accidents.

Table 19.6 lists the main activities that could result in an unplanned event, a description of the unplanned event, and the receptors which could be affected.

Table 19.6 Marine Activities Potentially Resulting in an Unplanned Event (Construction and Pre-Commissioning Phase)

Activity	Event	Receptors	
		Environmental	Socio-Economic and Community Health
Offshore construction activities and associated use of maritime vessels	Introduction of invasive species by marine vessels	✓	✓
	Maritime accidents or collisions leading to oil spills (including during bunkering)	✓	✓

Table 19.6 indicates that during the Construction and Pre-Commissioning Phase, there is a risk of maritime vessel accidents and collisions. These events have the potential to impact upon socio-economic and human health receptors. Such maritime vessel accidents and collisions can also result in oil spillages which can have resultant impacts upon environmental, as well as socio-economic receptors. Table 19.6 also indicates the risks associated with the introduction of invasive species by maritime vessels.

In order to assist in defining the risks and potential knock-on environmental impacts associated with maritime accidents and associated oil spills, a maritime risk assessment has been undertaken which has included modelling of marine oil spills that are considered most likely to occur (due to accidental collisions / grounding of marine vessels or during vessel bunkering (refuelling) at both nearshore and offshore locations). The risk assessment assists in defining risk management activities. Details of the maritime risk assessment are presented in Appendix 19.2 which highlights the potential likelihood of accidents occurring. Appendix 19.2 also presents results from the oil spill modelling which has been used to assess the implications and risk management activities as related to environmental, socio-economic and human health receptors as detailed below.

Some unplanned events have been excluded from the assessment as they are not expected to lead to significant environmental or socio-economic impacts. Unplanned events that have been excluded from discussion are:

- **Spillages and discharge of potentially hazardous materials other than fuel / oil spillage:** Spillage of relatively small quantities of potentially hazardous chemicals (discharges of grey / black waste, sewage, garbage, bilge and oily water) from marine plant / vessels can be readily managed through ensuring that vessels operate in accordance with the Marine Pollution (MARPOL) Convention, the Black Sea Contingency Plan and national regulations. All contractors and operators of vessels working on behalf of South Stream Transport will be required to prepare Shipboard Marine Pollution Emergency Plans (SMPEP) as applicable for each vessel. Effective implementation of the SMPEP will mean that the implications of any such events will be sufficiently small enough not to warrant a detailed discussion of these events herein;
- **UXO Clearance:** Pipelay will be preceded by an unexploded ordnance (UXO) survey on part of the route, which will establish the need, and provide guidance for, the removal of boulders, rocks or potential UXO. A UXO clearance plan (if required) will take into consideration the presence of sensitive cultural heritage, marine biological and physical receptors, and will aim to avoid or reduce adverse impacts on these receptors. This process will be managed through the management of change process described in **Chapter 5 Project Description**. The UXO Clearance Plan (if required) will be developed by the Contractor subject to review and acceptance by South Stream Transport in close conjunction with the relevant authorities at the appropriate time. In the event that UXO requires clearance (controlled detonation) in close proximity to an as yet unidentified Cultural Heritage Object (CHO), the possibility that the CHO might be damaged or lost cannot be discounted. **Chapter 16 Cultural Heritage** discusses this issue further noting that the likelihood of such an event is considered remote. UXO clearance via a controlled detonation also has the potential to result in behavioural disturbances to fish / mammals over several kilometres; and
- **Impacts of unplanned pipeline construction events:** During the Construction and Pre-Commissioning Phase a range of unplanned construction events may be encountered, including wet buckle events (whereby the submerged pipeline buckles under pressure and floods with water) or failed hydrotest. Such events have the potential to result in significant construction delays and associated costs. It is considered that the environmental implications of such events (such as pipeline recovery, disposal, relaying) would be similar

to the environmental impacts as associated with routine construction activities as reported within this ESIA. Under such circumstances, remedial activities will be undertaken in accordance with GIIP which will limit the potential for significant environmental impacts.

19.7.1.2 Potential Impacts to Environmental Receptors

Invasive Species

Vessel operations have the potential to inadvertently introduce invasive alien species, either in ballast water, on the biofilm inside ballast tanks or carried as fouling organisms on the vessel hulls. Historically, some introductions of alien species have had extreme ecological consequences, either directly through the introduction of benthic predators such as *Rapana venosa* or through system wide perturbations as exemplified by the invasion of the planktonic ctenophore *Mnemiopsis leidyi.* In other instances, such as the introduction of the bivalve *Anadara inaequivalvis*, the effects have been less severe and in the case of *Beroe ovata*, have in fact served to redress some of the ecological perturbations caused by *M.leidyi*. See **Chapter 12 Marine Ecology** for more information.

Despite its low likelihood of occurrence, there is the possibility of population or community-wide effects on the entire ecology of the Black Sea should invasive alien species be inadvertently introduced. Introduced invasive planktonic species can out-compete native plankton species and cause changes to the marine food web. As such, introduction of invasive species can lead to the decrease in populations of pelagic fish that are the main food of most cetaceans or seabirds. Introduction of benthic predators such as *Rapana venosa* can cause changes to benthic species diversity which in turn can impact larger species (fish, birds or mammals) which feed on these species.

Given the above, the introduction of invasive species, although a rare event, could potentially have significant adverse environmental consequences. It is therefore a key objective of the Project to minimise the likelihood of occurrence of the introduction of invasive species and to develop measures that would effectively minimise the adverse impacts on potentially impacted marine habitats and associated species. Mitigation measures to be applied include the following:

- Where relevant and practical the IPIECA (Global Oil and Gas Industry Association for Environmental and Social Issues) document Alien Invasive Species (Ref. 19.13) and the Oil and Gas Industry, Guidance for Prevention and Management and the International Maritime Organisation (IMO) Ballast Water Management Convention and Guidelines. They will be applied to all marine plant and equipment that is used on the Project and which has the potential to be a vector of live organisms, spores, larvae and young and will include ballast water management, use of antifouling coatings, cleaning of equipment prior to deployment and the change of cooling water. The Contractor HSSE Plan will contain a detailed description of the actions to be taken to implement these requirements, where possible and practicable, including:
    - Vessels entering the Black Sea will have on-board, and implement, a Ballast Water and Sediment Management Plan;

- Vessels entering the Black Sea will have a Ballast Water Record Book to record when ballast water is taken on board; circulated or treated for ballast water management purposes; and discharged into the sea or reception facilities;
- Vessels entering the Black Sea using ballast water exchange will conduct ballast water exchange as far from the nearest land as possible, and in all cases at least 50 nautical miles (nm) from the nearest land and in water at least 200 m in depth;
- Vessels entering the Black Sea will conduct ballast water management in accordance with their year of construction and ballast water capacity and with either the ballast water exchange standards or ballast water performance standards;
- Careful cleaning of hulls and tanks before use and prior to entering the Black Sea; and
- Use of anti-fouling coatings (non-TBT) or sealing coatings to minimise inadvertent transport of organisms.

Maritime Vessel Collisions and Oil Spillages

A maritime vessel collision could conceivably occur at any location along the offshore section of the pipeline route, although the likelihood of such a collision occurring is considered to be very low. The likelihood that such an incident would result in an oil spill is even lower, as a high-energy collision would be required to damage a vessel to such an extent that marine diesel was spilled into the sea.

Appendix 19.1 presents details of maritime risk assessment which has entailed the following:

- Estimate the likelihood of an oil spill occurring following a maritime collision (based on available historical information), and rank these into categories;
- Estimate the severity of the potential consequences of any oil spill that could occur and rank these severities into categories;
- Construct a risk matrix of likelihood and consequence severity; and
- Assess various oil spill scenarios and determine their overall risk rating.

Following an evaluation of potential unplanned collision events, the oil spill scenarios (involving marine diesel oil - MDO) as detailed in Table 19.7 were defined, together with details of potential resultant oil spillages. The maritime risk assessment (Appendix 19.1) goes on to indicate that such unplanned collision events do not present a major risk of oil spills and that overall risk ratings are considered to be acceptable.

Table 19.7 Potential Oil Spill Scenarios in the Marine Area

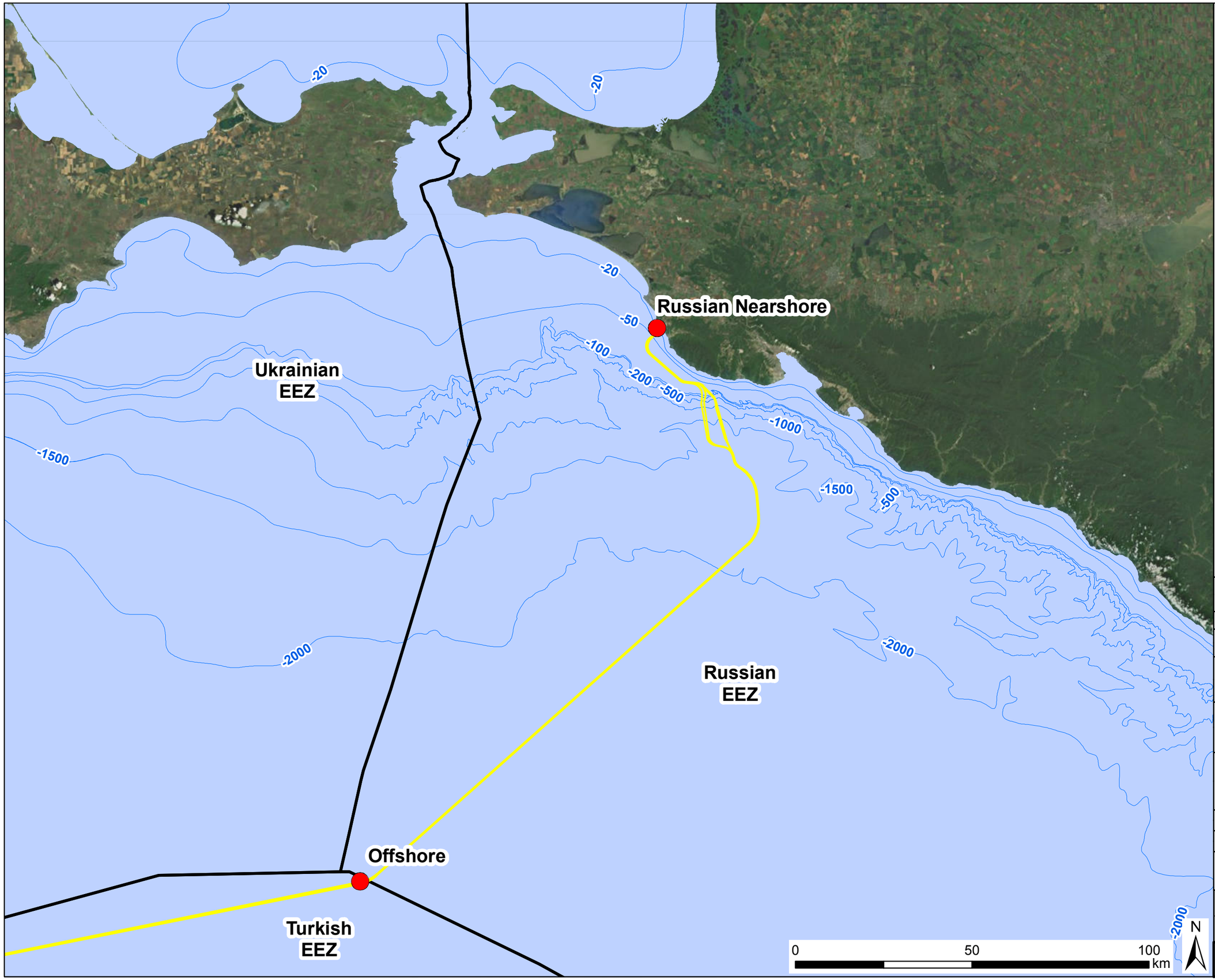
Location	Activities	Event Description	Assumption
Black Sea Nearshore	Dredging and Delivery	Grounding	MDO spillage @750 m^3 (loss of fuel over four hours), grounding on rocky shore.
		Collision with third party	MDO spillage of 1,200 m^3 (loss of fuel over six hours).

Continued…

Location	Activities	Event Description	Assumption
Black Sea Nearshore	Dredging and Delivery	Collision with Project vessel	MDO spillage of 1,200 m^3 (loss of fuel over six hours).
		Sinking	MDO spillage of 1,200 m^3 (loss of fuel over six hours).
		Bunkering at sea	MDO spillage of 10 m^3.
		Refuelling at port	MDO spillage of 10 m^3.
	Pipelay	Grounding	MDO spillage of 1,500 m^3 (loss of fuel over six hours). Grounding on rocky shore.
		Collision with third party	Collision with fully laden oil tanker, MDO spillage of 10,000 m^3, released from 2 wing tanks of tanker vessel (loss of fuel over six hours).
		Collision with Project vessel	MDO spillage of 1,500 m^3 (loss of fuel over six hours).
		Sinking	MDO spillage of 1,500 m^3 (loss of fuel over six hours).
		Bunkering	MDO spillage of 10 m^3.
Black Sea Offshore	Pipe Delivery	Grounding	Not possible.
		Collision with third party	MDO spillage of 2,000 m^3 (loss of fuel over six hours).
		Collision with Project vessel	MDO spillage of @750 m^3 (loss of fuel over six hours).
		Bunkering	MDO spillage of 10 m^3.
		Sinking	MDO spillage of 2,000 m^3 (loss of fuel over six hours).

Complete.

On the basis of the scenarios above, oil spill modelling has been undertaken for selected highest risk scenarios (details are included in Appendix 19.2) and include a nearshore spillage of 1,200 m^3 of MDO and an offshore spillage of 2,000 m^3 of MDO. Figure 19.2 illustrates the oil spillage locations that have been modelled.



LEGEND

Oil spill modelling locations

Russian Sector of South Stream Offshore Pipeline

Proposed offshore pipelines

Exclusive Economic Zone boundary

Isobaths

Projection: Lambert Conformal Conic

Revision Details	By / Check	Check Date	Suffix

Purpose of Issue: For Information

Client: South Stream Offshore Pipeline — ENERGISING EUROPE

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Oil Spillage Risk Factors

The severity of the consequences of an oil spill depends on several factors including (a) type of oil spilled, (b) the amount of oil spilled and, perhaps most importantly, (c) the proximity of the oil spill to oil-sensitive resources. These issues are considered in the sections below.

a) Type of Oil Spilled

Maritime vessels typically use the following types of fuel oil:

- Marine gas oil (MGO): consisting of only distillates from oil-refining. This fuel is used in the small diesel engines of boats and smaller ships and can be used in auxiliary equipment such as generators and compressors;
- Marine diesel oil (MDO): A blend of heavy gas oil that may contain small amounts of black refinery feed stocks. This is used as fuel by the medium-speed diesel engines of smaller ships and can also be used in auxiliary equipment such as generators and compressors; and
- Intermediate Fuel Oils (IFO): Blends in varying proportion of gas oil and residues from crude oil distillation. This includes IFO-380 or Heavy Fuel Oil (HFO) consisting almost entirely of residues. HFO is used to power the slow-speed cross-head diesel engines used in most large ships and requires heating and purification when stored and used.

Oils have been classified by the International Oil Pollution Compensation Funds, the body involved with compensation for oil spills from tankers, into two groups; 'persistent' oils and 'non-persistent' oils:

- Persistent oils include most crude oils and HFO. When spilled on the open sea these oils progressively 'weather' to produce high-viscosity, water-in-oil emulsions that are very persistent on the sea surface and which contaminate shorelines when they drift ashore; and
- Non-persistent oils are mainly distillate fuels such as gasoline and diesel fuel. When spilled in the open sea these oils evaporate to some degree and are rapidly dispersed and dissipated by the prevailing wave action. MGO and MDO are classified as being non-persistent.

Taking into account the above, where practical, Project vessels deployed in the Project Area will use MGO or MDO, commonly referred to as 'marine diesel' and conforming to ISO-8217:2010 Marine Distillate Fuel Grades DMA, DMB or DMZ (rather than persistent oils such as most crude oils and Heavy Fuel Oil (HFO). As such, the oil spill modelling undertaken as detailed in Appendix 19.1 only considers oil spill scenarios that involve marine diesel.

b) Amount of Oil Spilled

The amount of oil spilled from an incident influences the area which is potentially affected. A large volume oil spillage has the ability to impact a wider area than a lower volume spillage given the ability of wind, waves and marine currents to disperse oil spillages.

c) Proximity of the Oil Spill to Oil-Sensitive Resources

Oil spills in the open ocean appear to be dispersed and dissipated by the effects of wind, waves and currents which reduces their ability to reach coastal sites. Some scattered tar balls can be found along coastlines which are evidence of past oil spills of crude oil and HFO, or caused by operational activities such as tank-washing.

Potential Impacts Upon Marine Ecology Sensitive Receptors

Typically ecological impacts are more severe when oil spills occur in shallower nearshore waters where spilled oil can affect the shoreline or be naturally dispersed into shallow water by wave action. Different organisms have different sensitivities and vulnerabilities to the toxic and physical effects of spilled oils. A spill of a relatively small amount of oil close to particularly sensitive coastal sites such as mud-flats and salt marshes can cause more ecological damage than a larger oil spill further from such sensitive sites. Spilled oil that becomes naturally dispersed by wave action in shallow water can cause adverse effects to habitats such as fish nurseries.

The principal areas of ecological concern with respect to oil spills are:

- Impacts on organisms in the water column; such as marine mammals, plankton and fish in open water, caused by the potentially toxic components in oils;
- Impacts on seabirds on the sea surface caused by oil contaminating the plumage of seabirds leading to the loss of insulation and subsequent hypothermia; and
- Impacts on coastal habitats (including bird populations) should the spilled oil at sea subsequently drift ashore where damage may be caused by the physical nature of the emulsified oil that smothers small organisms.

Section 12.4 of this ESIA Report (Baseline Marine Ecology) describes the marine habitats within and in proximity of the Project Area. This section indicates that along the eastern Black Sea coast, faunal groups of particular interest, either due to their value or vulnerability, include a variety of commercial fish species (e.g. anchovy, turbot, sprat etc.), endangered species (e.g. sturgeon), marine mammals and seabirds. Marine flora is also important, particularly red and brown macroalgae.

Oil Spill Mitigation Measures

Given the presence of the sensitive marine ecological species as indicated in the section above, an oil spill would potentially have significant adverse consequences. It is therefore a key objective of the Project to minimise the likelihood of occurrence of an oil spill and to develop Oil Spill Prevention and Response Plans that would effectively minimise the potential for adverse impacts on potentially impacted marine species and habitats.

Mitigation measures to be applied include the following:

- Where practical, vessels deployed in the Project Area will use MGO or MDO and, therefore, any accidental spill of fuel will have less adverse consequences than a spill that involves heavier fuels;
- All contractors and operators of vessels working on behalf of South Stream Transport will be required to develop and implement an Oil Spill Prevention and Response Plan. South Stream

Transport will ensure that contractor Oil Spill Prevention and Response Plans are appropriately aligned with the Black Sea Contingency Plan (Ref. 19.2). The Oil Spill Prevention and Response Plans will specifically target the prevention of potential oil spillage incidents as detailed in Table 19.7;

- The contractor will develop and implement Standard Operational Procedures (SOPs) which will define procedures that involve the handling of fuels / oils that aim to minimise the potential for spillages;
- Contractors and operators of vessels working on behalf of South Stream Transport will operate in compliance with MARPOL regulations on oil spill prevention and response and are required to prepare Shipboard Oil Pollution Emergency Plans (SOPEP) and Shipboard Marine Pollution Emergency Plans (SMPEP) as applicable for each vessel (Ref. 19.3; Ref. 19.5). The SOPEPs will specify the control and response measures that have to be available on board every vessel to respond to a spill that does not require external intervention; and
- Marine vessel crews will have the appropriate training, qualification and certification to undertake the tasks required during the construction of the pipelines.

The mitigation measures indicated above will minimise the likelihood of an oil spill occurring, and thus reduce the potential adverse impacts to marine habitats in the event of a spill.

19.7.1.3 Potential Impacts to Socio-Economic Receptors and Community Health

Invasive Species

As detailed in Section 19.7.1.2, vessel operations have the potential to inadvertently introduce invasive alien species, either in ballast water, on the biofilm inside ballast tanks or carried as fouling organisms on the vessel hulls. As the introduction of invasive species can have knock-on effects for larger species higher up the food chain; commercially important fish populations could be impacted through a decrease in the availability of their food source. A collapse or reduction in the fish stocks would cause a reduction in the fish available to local fishers.

The mitigation measures as detailed in Section 19.7.1.2 aim to minimise the likelihood of occurrence of the introduction of invasive species which thus minimise the potential for adverse socio-economic impacts as related to fish stock levels.

Maritime Vessel Collisions and Oil Spillages

Beach Users and Tourism

The mitigation measures as highlighted in Section 19.7.1.2 minimise the risk of an oil spill occurring. In addition, the maritime risk assessment and oil spill modelling results as included in Appendix 19.2 has established that the construction of the sub-sea natural gas pipelines across Russian waters does not present a major risk of oil spills and that the fuels used by Project vessels, if spilt, would evaporate to a significant degree with the remainder being naturally dispersed in the water column by wave action within a few days of being spilled.

Nevertheless an oil spill could, in theory, give rise to adverse impacts on the tourism industry in the Anapa Region. **Chapter 14 Socio-Economics**, Section 14.4.10 Baseline has identified that the Anapa Region is a focal point for coastal-related tourism and that the industry is a major employer in the region. The baseline has also identified that the tourism industry in the Anapa Region, particularly that which is focused on beaches and coastal activities, is heavily concentrated to the south of the Project Area (e.g. Sukko Beach).

An oil spill could potentially spread beyond the immediate area and could reach the coastal areas to the south of the Project Area, thereby potentially impacting the key coastal tourism precinct in the Anapa Region. If there was an oil spill that prevented tourists from using the beaches, swimming in the sea, or pursuing other Black Sea based or related recreational activities, the tourism industry in the Region could suffer economically (including long term tourist cancellations). However, as for beach users themselves, the severity of the impact would depend on the extent of the spill, its distribution and whether or not it occurred just prior to or during the peak summer season. Considering that any disruption due to oil spillages would be limited to a few days indicates that the economic impact on the tourism industry would be limited, even if the spill did occur just prior to or during the peak summer season.

Potentially, the greatest risk associated with an oil spillage would be to the reputation of the Region's beaches, and associated tourism industry, as an attractive and pristine seaside holiday destination. This could lead to a drop off in bookings over the remainder of the season and, possibly even in subsequent years. The relatively short duration of any visible oil in the water would limit the opportunity for adverse publicity, especially of a visual nature. However, the possibility of reputation damage for the area cannot be discounted. As described in Section 19.7.1.2, Project marine construction activities do not present a major risk of oil spills whilst construction-related activities in the marine environment that could give rise to an accidental oil spill will be undertaken in line with the Oil Spill Prevention and Response Plans to be prepared by contractors and operators of vessels working on behalf of South Stream Transport. Such measures thus minimise the risks of an oil spill and subsequent adverse impacts upon beach users and tourism.

Fisheries

Oil spills have the potential to affect fishery resources in a number of ways as described in the sections below.

Fish or Other Seafood Products - Mortality

Despite the susceptibility of juvenile stages of fish to relatively low concentrations of oil in the water column, adult free swimming fish and wild stocks of commercially important species will tend to swim away after detecting oil in the water column and thus it is unlikely that a spill will cause serious mortalities in any wild stocks. In general, juvenile fish and eggs are significantly more susceptible to oil pollutants than adults, and thus oil spillages can result in localised mortalities. Following a spillage, the reproductive success of unaffected fish, as well as the influx of eggs, juveniles and adults from unaffected areas leads the recovery of stock numbers. Given that many marine species produce vast numbers of eggs and larvae that are widely distributed by tidal currents means that species can recover from any mortality events as a result of short-term unfavourable conditions. Thus, the depletion of adult stocks is very rarely

recorded following spillages as marine organisms can generally adapt to high mortalities though production of large numbers of eggs and replacement from outside the affected area.

Oil concentrations in the water column decline rapidly and are normally confined within the area of the spill so the impacts will be potentially more significant nearshore on more sessile animals, such as mussels. As well as mortality, there may be other effects such as changes in behaviour, feeding, growth or reproduction.

The impacts of an oil spill will depend upon the type of oil used - Section 19.7.1.1 details that spillages of non-persistent oils such as MGO and MDO when spilled in the open sea evaporate to some degree and are rapidly dispersed and dissipated by wave action. The effects of an oil spill are also dependent upon the duration of the exposure to the components in the oil. Bivalves and crustaceans located in intertidal or shallow sub tidal areas are particularly vulnerable to contamination from some of the lighter, more aromatic, compounds in oil.

Fish or Other Seafood Products – Sub lethal Effects

Fish or other seafood products can become tainted, defined as giving the product a petroleum taste or smell. Although it is essentially non-harmful to consumers, it can affect the marketability of the product and is most common in bi-valve molluscs and other filter feeding, sedentary animals (marine bottom-dwelling animals attached to the substrate). There are no set threshold values to determine if a product is tainted, subsequently it cannot be determined through chemical analysis, but only through taste (organoleptic testing). In the event of an oil spill, if there are signs of shellfish / fish oil tainting or contamination, any resultant imposed authority restrictions on fishing activities could result in detrimental impacts upon local fishers.

Damage to Fishing Gear

It is considered that the risks of damage and contamination to fishing gear is very low, given that following a spillage, any affected areas would be avoided by fishing vessels, whilst MGO or MDO spillages are expected to be rapidly dispersed.

Fisheries - Mitigation

The maritime risk assessment and oil spill modelling as presented in Appendix 19.2 has established that Project construction activities do not present a major risk of oil spills and that the fuels in question, if spilt, would evaporate to a significant degree with the remainder being naturally dispersed in the water column by wave action within a few days of being spilled. This reduces the potential for adverse impacts upon local fisheries and the local and regional fisheries industry. In addition, as indicated in Section 19.7.1.2, contractors and operators of vessels working on behalf of South Stream Transport will be required to develop and implement an Oil Spill Prevention and Response Plan. Vessels will also need to operate in compliance with MARPOL regulations on oil spill prevention and response and are required to prepare SOPEP and SMPEP as applicable for each vessel (Ref. 19.3; Ref. 19.4). The SOPEPs will specify the control and response measures that have to be available on board every vessel to respond to a spill that does not require external intervention. Such measures will further limit the potential for adverse impacts upon local fisheries and the local and regional fisheries industry.

South Stream Transport will ensure that contracts with vessel owners include appropriate oil spill compensation provisions to cover such potential socio-economic oil spill consequences.

19.7.2 Commissioning and Operational Phase – Marine Sections

19.7.2.1 Events Identification

During the Operational Phase (including Commissioning) of the Project unplanned events at sea may occur as a result of accidental leakages of natural gas from the subsea pipeline, as well as the introduction of invasive species by maintenance vessels.

Table 19.8 below lists the activities that are discussed in this section that could result in an unplanned event, describes the events, and the receptors that could be affected.

Table 19.8 Marine Activities Potentially Resulting in an Unplanned Event (Commissioning and Operational Phase)

Activity	Event	Receptors	
		Environmental	Socio-Economic and Community Health
Operation of the pipelines	Failure / damage to the pipeline which may result in gas releases and fire / explosions	✓	✓
	Introduction of invasive species by marine vessels	✓	✓

In order to assist in the risk assessment process, a Shipping Risk Report was prepared for the Project (Ref. 19.5). The report considers the risks to the marine pipelines posed by shipping in the Black Sea. The following shipping hazards were identified as posing a potential risk to the integrity of the pipelines:

- **Ship sinking onto and damaging the pipeline:** The risks of ship sinking damaging the pipelines can occur along the entire pipeline route, although there is only a risk when the ship is large enough to cause damage to the pipeline;
- **Ship grounding onto the pipeline:** Ship grounding becomes a risk when the ship is large or heavy enough to cause damage to the pipeline. In addition, grounding can only occur in shallow water. Based on the main characteristics of ships, ships are generally at risk from grounding when navigating in water with a depth of less than 18 m. Given that the pipeline at the Russian nearshore will be buried in such water depths, the risks of pipeline damage by ship grounding is considered to be negligible (Ref. 19.5);
- **Ship anchoring damaging the pipeline:** Risks associated with anchoring in the vicinity of the pipeline are two-fold:

- **Anchor drop:** An anchor, with impact energy sufficient to create significant damage, can be dropped directly on the pipeline; or
- **Anchor drag:** An anchor dropped in the vicinity of the pipeline can subsequently be dragged interacting with the pipeline; and

- **Ships dropping objects (such as containers) onto the pipeline:** The risks of ships dropping objects into the pipeline can occur along the entire pipeline route. When a container hits the top of a pipeline, the result can be a dent in a bare steel pipeline or, when the pipeline has concrete weight coating, a cracked coating possibly combined with a dent in the steel pipeline.

The hazards as detailed above have the potential to result in pipeline damage / failure, which could result in the release of gas (and potential subsequent fire) from the sub-sea pipeline which has the potential to impact upon the environment and human health receptors. However, due to the pipeline engineering design standards being applied which aim to minimise the potential for pipeline rupture and associated gas leakages (see Section 19.6.2.2), and the use of exclusion zones along the offshore pipeline (see Section 5.6.7), the potential for such a safety incident from an offshore pipeline is remote.

It is noted that there is a risk of encountering geohazards along the offshore pipeline route. Geohazards associated with the offshore environment include seismic activity, soft sediments, shallow gas and gas seeps. Appendix 19.3 presents details of potential marine geohazards and the resultant pipeline design responses.

For a fire incident following a gas leakage to impact upon human health receptors, it would require a pipeline failure and gas leakage, followed by ignition at the sea surface in conjunction with a passing vessel. The most likely occurrence of this type of event would be where an object such as a container or the vessel itself, causes an impact failure by sinking on the pipeline as detailed above. The potential resultant impacts associated with environmental and human health receptors are discussed below.

Some unplanned events have been excluded from the assessment undertaken in this section as they are not expected to lead to significant environmental and socio-economic impacts. Unplanned events that have been excluded from discussion are:

- **Pipeline repairs / salvage as associated with unplanned events:** following unplanned events there may be the need for pipeline salvage / repair works. It is considered that such activities would be similar to pipeline construction activities. Under such circumstances, salvage / remedial works would be undertaken in accordance with GIIP which would limit the potential for significant environmental impacts; and
- **Maritime vessel collisions and resultant oil spillages:** given the low volume of survey and maintenance vessels anticipated to be used during the Operational Phase, it is considered that the risks of collisions and oil spillages is so remote that is can be scoped out of the assessment. Maritime vessels operated on behalf of South Stream Transport will be operated in accordance with GIIP which would limit the potential for spillages and associated significant environmental impacts, whilst Oil Spill Prevention and Response Plans will still be required to limit the potential for oil spills and resultant impacts.

19.7.2.2 Potential Impacts to Environmental Receptors

Invasive Species

Maritime vessel operations during the Operational Phase will be limited to the periodic use of maintenance and monitoring vessels (see **Chapter 5 Project Description**). During routine monitoring or in the event that repairs are necessary, there is potential for vessels to be used from outside of the Black Sea. As such, there is the potential for such vessels to inadvertently introduce invasive alien species to the marine environment in the same manner as described in Section 19.7.1.2 for the Construction Phase.

The potential environmental consequences of introducing invasive species are considered in Section 19.7.1.2. Given the limited maritime vessel use required during the Operational Phase, it is considered that the risks of such events occurring is less than during the Construction Phase.

The mitigation measures as detailed in Section 19.7.1.2 will be applied during the Operational Phase in order to minimise risks to the marine environment from the inadvertent introduction of invasive species from maritime vessels.

Gas Leakages

Any gas released from a damaged sub-sea pipeline would rise through the water column as a plume of gas bubbles. On reaching the sea surface, the gas would disperse into the air.

As detailed in Section 19.6.2.2, gas releases into the atmosphere would not result in acute environmental impacts. The impacts would be chronic through the addition of greenhouse gases to the atmosphere. Such gas releases would not be significant in terms of increasing overall Russian Federation greenhouse gas emissions, although methane levels at the release site would be temporarily elevated which could locally impact upon any present marine ecology, including seabirds.

Gas passage through the water column could also impact upon marine organisms (such as fish and marine benthos), resulting in potential acute or chronic impacts depending upon exposure levels and environmental conditions (e.g. water temperature, dissolved oxygen) (Ref. 19.6). Gas is able to rapidly penetrate into marine organisms (especially through the gills) and disturb the main functional systems (respiration, nervous system, blood formation, enzyme activity, and others). Initially, organisms such as fish may exhibit behavioural symptoms such as fish excitement, increased activity, scattering in the water. Thereafter, further exposure can lead to symptoms of poisoning. As with most toxicants, early life stages are most vulnerable to effects.

Section 19.6.2.2 provides details of the measures included in the pipeline design that aim to minimise the potential for uncontrolled gas releases from the pipeline, and the actions that would be taken in the event of an unplanned gas release (to be defined in the contractor Emergency Response Plans).

Of note is that a number of Project design control measures have been identified to reduce the risk of geohazards impacting upon the integrity of the offshore pipeline which could result in gas leakages (refer to Appendix 19.3). During the Development Phase, geohazard mapping was undertaken to facilitate the pipeline route alignment as based on marine survey findings and

associated engineering assessments (Ref. 19.9 and 19.10). In addition, the occurrence of mass movements triggered by events such as earthquakes was taken into account during the pipeline design process (Ref. 19.8). As detailed in Section 5.2.6.1, the pipelines will be designed in accordance with DNV-OS-F101 which considers standards for geohazard risk analyses. The pipeline design thus aims to minimise the occurrence of the unplanned gas releases following pipeline damage by unplanned events, whilst the Emergency Preparedness and Response Plan will further minimize the potential risks and environmental consequences of such events.

19.7.2.3 Potential Impacts to Socio-Economic Receptors and Community Health

Invasive Species

As detailed in Section 19.7.2.1, during the Operational Phase, there remains a low level risk that vessels from outside of the Black Sea will be used for pipeline repairs. In order to minimise risks to commercially important fish populations from the inadvertent introduction of invasive species from maritime vessels (as described in Section 19.7.1.3), the mitigation measures as detailed in Section 19.7.1.2 will be applied during the Operational Phase.

Gas Leakages and Fire

Should the marine pipeline rupture via the unplanned events as detailed in Section 19.7.2.1, gas would rise through the water column and disperse into the air.

Short-term human exposure to low concentrations of natural gas may cause headaches, dizziness, drowsiness, nausea and vomiting. High vapour concentration may lead to unconsciousness due to the absence of oxygen. Asphyxiation of any person present on a ship within the gas cloud was assumed to be a very unlikely scenario by the Shipping Risk Report (Ref. 19.5) as the gas concentration in the air would rapidly decrease to below harmful levels.

Natural gas is extremely flammable, forming a flammable mixture at a concentration of approximately 5% gas in air (by volume). In the unlikely event of a gas leakage, the risk to community facilities and health is associated with fire and explosion rather than gas exposure. Ignition of the gas cloud by an ignition source present on a ship in the gas cloud could result in a flash fire and harm, including potential ship's crew fatalities as well as result in vessel damage. For this risk analysis it was assumed that:

- Ships having performed anchoring operations that interact with the pipelines will be present in the gas cloud as they will have stopped or be close by; and
- Ships sinking or dropping containers on the pipelines would not be present in the gas cloud.

In order to minimise such risks to ships, the pipeline design standards as detailed in Section 5.2.6.1 aim to minimise the potential for pipeline rupture and associated gas leakages, and thus minimise the potential socio-economic implications. In addition, in order to minimise potential damage to the subsea pipelines (e.g. dragged anchors, fishing gear etc.), as well as minimise the risks to third party vessel occupants, exclusion zones will be put in place along the pipeline route during the Operational Phase. As detailed in Section 5.6.7, it is anticipated that the exclusion zone will extend to 0.5 km either side of the outermost pipelines from the microtunnel

exit pit until the Russian / Turkish EEZ boundary (except for a section on the Russian continental slope where the pipelines diverge into two groups of two) (refer to Figure 5.41).

Section 19.7.2.2 also indicates that gas leakages can impact upon marine fish, although any such events are unlikely to result in widespread impacts upon fisheries. Following a gas leakage, the main impact may be the temporary exclusion of fishing vessels from potentially affected areas.

19.7.3 Decommissioning

The approach presented in Section 19.6.3 as related to the potential for unplanned events during the decommissioning of onshore pipelines are also applicable to the decommissioning of the marine pipeline. Thus as part of the decommissioning planning programme, the potential for unplanned events will be considered and appropriate mitigation and management measures put in place to reduce risks and consequences to the surrounding environmental and local community receptors.

References

Number	Reference
Ref. 19.1	Quantitative Risk Assessment - Onshore Sections. Intecsea Report 10-00050-10-SR-REP-0040-0010 dated October 2013.
Ref. 19.2	Black Sea Contingency Plan 2002. To the Protocol on Cooperation in Combating Pollution of the Black Sea by Oil and Other Harmful Substances in Emergency Situations – Volume 1 Response to Oil Spills. AG ESAS 8.4d.
Ref. 19.3	"Guidelines for the development of the Shipboard Oil Pollution Emergency Plans", [IMO Resolution MEPC.54(32); adopted on March 6, 1992; and Resolution MEPC.86(44), adopted on 13 March 2000].
Ref. 19.4	IMO IB586E – Shipboard Oil Pollution Emergency Plans (SOPEP), 2010 Edition.
Ref. 19.5	South Stream Offshore Pipeline FEED - Shipping Risk Analysis Report. Intecsea Report 10-00050-10-SR-REP-0040-0011 dated February 2013.
Ref. 19.6	Patin, Stanislav 1999 Environmental Impacts of the Offshore Oil and Gas Industry, Ecomonitor Publishing 425 p.
Ref. 19.7	International Road Transport Union (IRU) Agenda for Sustainable Development – the Road Transport Industry Takes the Lead. http://www.iru.org/cms-filesystem-action?file=en_Priority%20Issues/GuideIRUsustain.E.pdf
Ref. 19.8	Intecsea Worley Parsons Group (2013) South Stream Offshore Pipeline FEED Pipeline Geohazard Summary Report 10-00050-10-SS-REP-0050-0003, 19-April-13, Rev B1.
Ref. 19.9	Intecsea Worley Parsons Group (2013) South Stream Offshore Pipeline FEED Pipeline Geohazard Impact Assessment Report 10-00050-10-MX-REP-0060-0013, 19-April-13, Rev 0.
Ref. 19.10	Intecsea Worley Parsons Group (2013) South Stream Offshore Pipeline FEED Pipeline Geohazard Study Review Report 10-00050-10-GE-REP-00520-0002, 27-Feb-13, Rev 0.
Ref. 19.11	IFC (2012) Performance Standard 1 - Assessment and Management of Environmental and Social Risks and Impacts. Accessed at: http://www.ifc.org/wps/wcm/connect/3be1a68049a78dc8b7e4f7a8c6a8312a/PS1_English_2012.pdf?MOD=AJPERES Accessed on 20 September 2013.
Ref. 19.12	IFC General EHS Guidelines (2012): Environmental – Section 3.7 Emergency Preparedness and Response. Accessed at: http://www.ifc.org/wps/wcm/connect/554e8d80488658e4b76af76a6515bb18/Final%2B-%2BGeneral%2BEHS%2BGuidelines.pdf?MOD=AJPERES&bcsi_scan_AB11CAA0E2721250=mF5SovapK11f8yGYcBV4zim8GWQYAQAA8Hbz+w==&bcsi_scan_filename=Final%2B-%2BGeneral%2BEHS%2BGuidelines.pdf Accessed on 25 November 2013.

Number	Reference
Ref. 19.13	Alien Invasive Species and the Oil and Gas Industry - Guidance for Prevention and Management. IPIECA. 2010.
Ref. 19.14	Voluntary Principles on Security and Human Rights, 2000, retrieved from http://www.voluntaryprinciples.org/files/voluntary_principles_english.pdf on 20 August 2013.
Ref. 19.15	IFC (2012) Performance Standard 4 - Community Health, Safety, and Security. Accessed at: http://www.ifc.org/wps/wcm/connect/a40bc60049a78f49b80efaa8c6a8312a/PS4_English_2012.pdf?MOD=AJPERES Accessed on 25 November 2013.