Environmental Impact Assessment

Liza Phase 2 Development Project

Esso Exploration and Production Guyana Limited

Volume III

ERM

GSEC GROUND STRUCTURES ENGINEERING CONSULTANTS INC.

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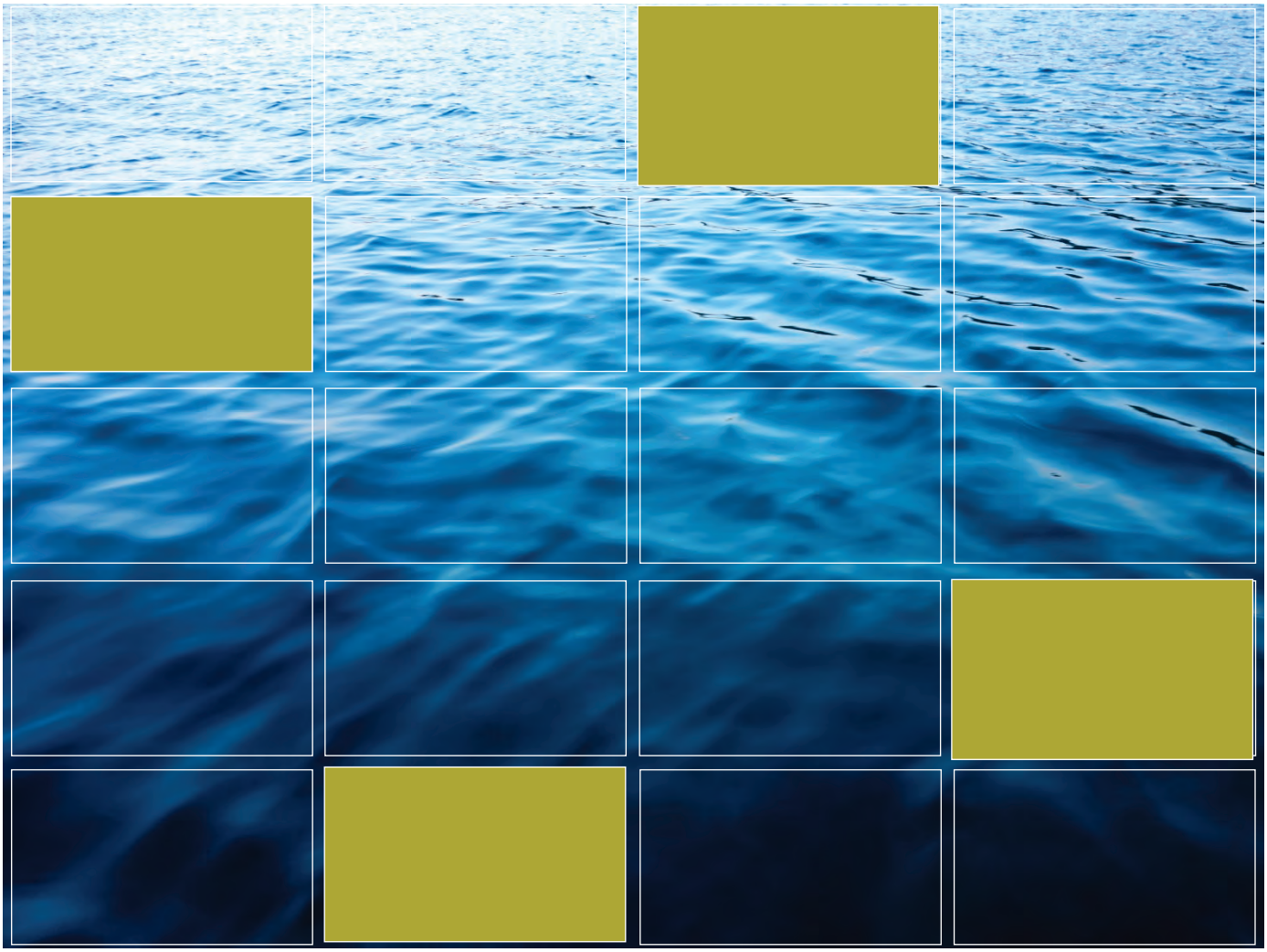

Environmental and Socioeconomic Management Plan

Liza Phase 2 Development Project

Esso Exploration and Production Guyana Limited

June 2018

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Todd H. Hall

ERM Partner

The business of sustainability

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Approved by:

EEPGL Country Manager

Rod Henson — Date: 31 MAY 2018

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LIST OF ACRONYMS

AUV ..... Automated Underwater Vehicle
BFROC ..... base fluid retained on cuttings
BOD ..... Biological Oxygen Demand
BOEM ..... U.S. Bureau of Ocean Energy Management
CHS ..... Cultural Heritage Specialist
CITES ..... Convention on International Trade in Endangered Species of Wild Fauna and Flora
CO ..... carbon monoxide
COD ..... Chemical Oxygen Demand
COLREG ..... Convention on the International Regulations for Preventing Collisions at Sea
CSC ..... International Convention for Safe Containers
EEPGL ..... Esso Exploration and Production Guyana Limited
EHS ..... Environmental Health and Safety
EIA ..... Environmental Impact Assessment
EPA ..... Guyana Environmental Protection Agency
EPI ..... Environmental Performance Indicator
ESMP ..... Environmental and Socioeconomic Management Plan
FAO ..... Food and Agriculture Organization
FPSO ..... Floating Production, Storage, and Offloading (Vessel)
GGMC ..... Guyana Geology and Mines Commission
GPS ..... Global Positioning System
GRA ..... Guyana Revenue Authority
IFC ..... International Finance Corporation
IMO ..... International Maritime Organization
IOGP ..... International Oil and Gas Producers
JNCC ..... Joint Nature Conservation Committee
MARAD ..... Maritime Administration Department
MARPOL 73/78 ..... International Convention for the Prevention of Pollution by Ships, 1973, as modified by the Protocol of 1978
mg/L ..... milligrams per liter
MPN ..... most probable number
NABF ..... non-aqueous base fluid
NADF ..... non-aqueous drilling fluid
NEAP ..... National Environmental Action Plan
OAS ..... Organization of American States
OGP ..... Oil and Gas Producers
OI ..... Operations Integrity
OIMS ..... Operations Integrity Management System
PDA ..... Project Development Area
ROV ..... remotely operated vehicle
SEP ..... Stakeholder Engagement Plan
SSLT ..... Site Safety Leadership Team
USEPA ..... U.S. Environmental Protection Agency
VSP ..... Vertical Seismic Profile
WBDF ..... Water-Based Drilling Fluid

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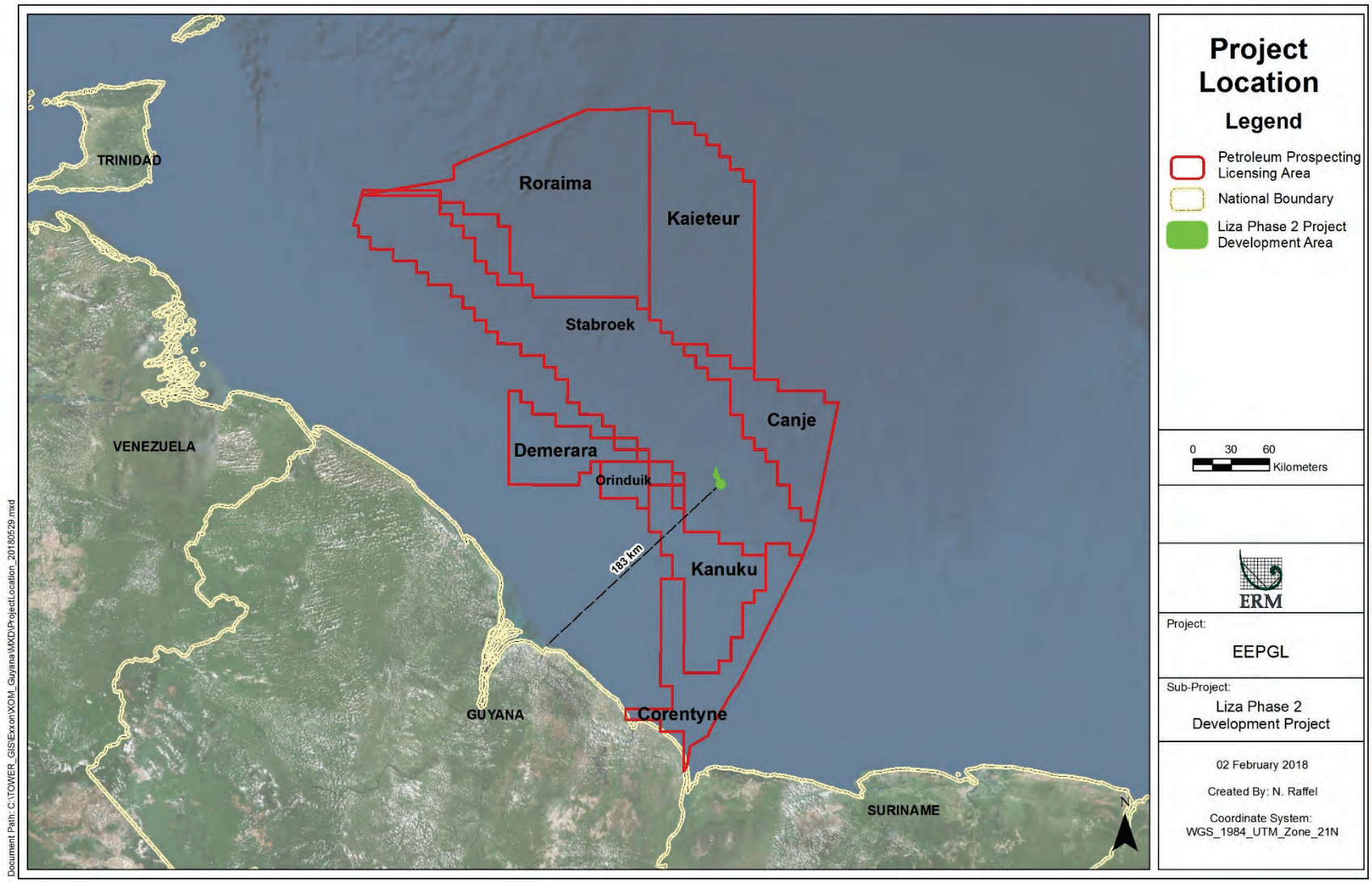
1.0 INTRODUCTION AND SCOPE

Esso Exploration and Production Guyana, Limited (EEPGL) is the Operator of the Stabroek Block, the largest petroleum prospecting license area offshore Guyana. EEPGL operates the Stabroek Block on behalf of EEPGL, Hess Guyana Exploration Limited, and CNOOC Nexen Petroleum Guyana Limited. In 2015, oil was discovered in the Liza field within the Stabroek Block offshore Guyana, in waters approximately 1,500 to 1,900 meters (m) deep. Subsequent surveys and exploratory drilling have identified a reservoir of oil in a sandstone formation approximately 3,600 m below the seabed (approximately 5,400 m below sea level). EEPGL and its co-venturers Hess Guyana Exploration Limited and CNOOC Nexen Petroleum Guyana Limited are parties to a Petroleum Agreement with the Government of Guyana. Under this agreement, and in light of the Liza field discovery, in 2017, EEPGL obtained a Petroleum Production Licence from the Ministry of Natural Resources and an Environmental Authorisation (also commonly referred to as an Environmental Permit) from the Guyana Environmental Protection Agency (EPA) to construct and operate the first phase of development within the Liza Field (i.e., the Liza Phase 1 Development Project), which is planned to occur approximately 190 kilometers offshore from the Georgetown coastline. EEPGL is currently applying to the EPA for an Environmental Permit to conduct the second phase of the Liza development (i.e., the Liza Phase 2 Development Project), which is planned to occur approximately 183 kilometers offshore from the Georgetown coastline, and about 8.5 km east of the Liza Phase 1 development.

The scope of this Environmental and Socioeconomic Management Plan (ESMP) is intended to cover the Liza Phase 2 development (hereinafter, "the Project"), which will include up to 33 development wells (including production wells, water injection wells, and gas re-injection wells); installation and operation of subsea umbilicals, risers, and flowlines (SURF); and installation and operation of a Floating Production Storage and Offloading (FPSO) vessel to process the produced fluids from the production wells, store the processed crude oil until offloading, and offload the processed crude oil to conventional tankers for export. The Project's drilling and production operations activities will occur in what is referred to as the Project Development Area (PDA), which is comprised of a subsea area of approximately 77 km^2 where work may be performed and a sea surface area of approximately 45 to 50 km^2 where work may be performed. Figure 1-1 illustrates the location of the PDA. The Project will also involve shorebase facilities and marine/aviation services to support development drilling, FPSO and subsea equipment installation, and production operations.

Figure 1-1. Location of the Liza Phase 2 Project Development Area within the Stabroek Block



EEPGL has prepared a separate Environmental Impact Assessment (EIA) that:

- Describes the local and regional environmental and socioeconomic existing conditions within the Project's Area of Influence;
- Describes all components of the Project activities;
- Identifies the potential environmental and socioeconomic impacts associated with the Project activities; and
- Describes a strategy to manage the potential adverse impacts of the Project and explain why the Project activities should be considered environmentally and socioeconomically acceptable.

This ESMP covers regulatory compliance requirements as well as environmental and socioeconomic management requirements for the Project-related activities described in the EIA. It provides the basis of EEPGL's environmental and socioeconomic management program, which is the mechanism through which EEPGL will manage the environmental and socioeconomic impacts potentially resulting from the Project activities, including potential cumulative impacts. Where appropriate, it contains objectives and targets which EEPGL seeks to accomplish in order to avoid, reduce, or remedy potential negative impacts.

The following are not considered within the scope of this ESMP:

- Regulatory compliance associated with employment visas and taxes associated with the Project;
- Employment, commercial, and financial laws and regulations;
- Environmental and socioeconomic management and regulatory compliance activities for exploration-related activities in the Stabroek Block or other nearby blocks where no interfaces are required to be maintained with the Project; and
- Provisions for local content, which are addressed in the Project Development Plan and the associated Local Content Plan as covered in the Project's Petroleum Production Licence.

It is important to note that the ESMP will be used throughout the Project life cycle. However, the document will be regularly updated in an effort to remain aligned with the Project as it progresses from drilling to installation to production operations. As production activities progress, it is envisioned that the ESMP will be periodically revised as appropriate during the planned 20-year production operations stage and through to decommissioning.

2.0 ENVIRONMENTAL AND SOCIOECONOMIC MANAGEMENT FRAMEWORK

2.1 Objectives of the ESMP

The objectives of this ESMP are to:

- Demonstrate commitment to compliance with applicable laws, regulations, and executed Project agreements through documented plans and procedures;
- Describe the process the Project will use to identify, evaluate, communicate, and comply with applicable regulatory requirements and obligations and EEPGL policies and procedures, and to maintain a current list of Project-applicable requirements and obligations;
- Establish clear roles and responsibilities and describe how the Project will interface in relation to environmental, socioeconomic and regulatory matters;
- Utilize regulatory compliance management systems, processes, and procedures;
- List the types of reports that will be used to communicate environmental, socioeconomic and regulatory compliance and overall status updates; and
- Identify environmental, socioeconomic, and regulatory training and awareness requirements for the Project and contractors.

2.2 Environmental Policy and Legal Framework

The legal framework for this ESMP consists of the key general and resource-specific environmental and socioeconomic laws that have either a direct or indirect relevance to the management of potential impacts from the Project. Statutes described in this section impose specific legal obligations on EEPGL under Guyana law and include:

- The National Constitution of Guyana
- The Environmental Protection Act
- The Guyana Geology and Mines Commission Act

2.2.1 National Constitution of Guyana

Guyana is governed according to the Constitution of the Co-operative Republic of Guyana, as amended. The constitution took effect in 1980 and expressly provides for protection of the environment. Article 25 establishes “improvement of the environment” as a general duty of the citizenry.

2.2.2 The Environmental Protection Act

In 1996, the Environmental Protection Act Cap 20:05 1996 (hereinafter referred to as the Act) was enacted to implement the environmental provisions of the Constitution. The Act is Guyana’s single most significant piece of environmental legislation because it articulates

national policy on important environmental topics such as pollution control, the requirements for environmental review of projects that could potentially impact the environment, and the penalties for environmental infractions. It also provides for the establishment of an environmental trust fund. Most importantly, the Act authorized the formation of the EPA, and establishes the EPA as the lead agency on environmental matters in Guyana (FAO, 2013). The Act further mandates the EPA to oversee the effective management, conservation, protection and improvement of the environment (EPA, 2018). It also requires the EPA to take the necessary measures to ensure the prevention and control of pollution, assessment of the impacts of economic development on the environment, and sustainable use of natural resources.

2.2.3 The Guyana Geology and Mines Commission Act

The Guyana Geology and Mines Commission Act was enacted in 1979, and authorized the government to establish the Guyana Geology and Mines Commission (GGMC), which is within the Ministry of Natural Resources. The GGMC promotes and regulates the exploration and development of the country's mineral resources. The GGMC has a dedicated Petroleum Unit charged specifically with regulatory supervision of the oil and gas sector; however, petroleum-related activities also occur in other divisions, such as the Geological Services division and the Environment Division. The GGMC's most important role with respect to the Project is related to EEPGL's Petroleum Production Licence, under which production would be conducted.

2.2.4 Protected Areas Act

The Protected Areas Act was enacted in 2011. It provides for protection and conservation of Guyana's natural heritage and natural capital through a national network of protected areas, and creates a Protected Areas Commission to oversee the management of this network. It also highlights the importance of maintaining ecosystem services of national and global importance and public participation in protected areas and conservation, and it establishes a protected areas trust fund to ensure adequate financial support for maintenance of the network. Other functions of this act include promoting national pride in and encouraging stewardship of Guyana's natural heritage, recognizing the conservation efforts and achievements of Amerindian Villages and Amerindian Communities, and promoting the recovery and rehabilitation of vulnerable, threatened, and endangered species.

2.2.5 The Petroleum Act

The Petroleum (Exploration and Production) Act was enacted in 1986 to regulate the prospecting for and production of petroleum in Guyana, including the territorial sea, continental shelf, and exclusive economic zone. This act identifies persons allowed to hold prospecting licenses, establishes the process for obtaining prospecting licenses, and specifies requirements for further resource development in the event petroleum resources are discovered.

2.3 Resource-specific Legal Requirements for the Project

2.3.1 National Laws and Regulations

In additional to the legal framework described in Section 2.2, several Guyanese environmental laws with more narrowly defined scopes are relevant with respect to management of potential impacts to specific physical, biological or socioeconomic resources. Other laws which are potentially relevant have a public health-related focus.

Guyana has several national laws that regulate impacts on physical environmental media, biological resources including wildlife and fisheries, and socioeconomic aspects with potential to be impacted by the Project. In addition to these laws, Guyana also has national laws governing waste management and noise. These laws and regulations are described in greater detail in Table 2-1.

Table 2-1. Resource-Specific Environmental and Social Laws

Title	Objective	Relevance to the Project
Biological Resources		
Fisheries Act, 2002	Regulates fishing and related activities in Guyana territorial waters.	Section 33(1) of the Fisheries Act authorizes the prohibition and/or regulation of deposition or discharge of substances harmful to fish. Would primarily affect the contents of routine discharges from Project vessels and the FPSO.
Wild Birds Protection Act, 1987	Protects listed wild birds in Guyana.	Sections 3 and 6 prohibit knowingly wounding or killing wild birds listed in the First and Second Schedule of the Act and establishes penalties.
Species Protection Regulations, 1999	Provides for the establishment of a Management Authority and a Scientific Authority in compliance with the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).	Provides for wildlife protection, conservation, and management.
Wildlife Management and Conservation Regulations, 2013 (recently supplemented by passing of Wildlife Conservation and Management Act, 2016)	Provides for the establishment of a Management Authority and the management of the country's flora and fauna. Provides for classification of some species as vulnerable, endangered, or critically endangered; 2016 Act specifies that the Act applies to all species in CITES Appendices I, II and III unless otherwise reserved by Guyana.	Provides a supportive mechanism cognizant of the national goals for wildlife protection, conservation, management and sustainable use.

Title	Objective	Relevance to the Project
Physical Resources		
Environmental Protection Water Quality Regulations, 2000	Establishes that the EPA shall, at any time after the commencement of the Regulation, establish parameter limits of effluent that may be discharged into any inland or coastal waters or land of Guyana. Includes reporting requirements, penalties for violations of standards, and permitting requirements for discharges.	Regulates discharges of listed substances, which could include substances used as part of the Project.
Environmental Protection Air Quality Regulations, 2000	Establishes that the EPA shall, at any time after the commencement of the Regulation, establish limits for any of the contaminants specified in the Regulation. Sets ambient air quality standards, reporting requirements, penalties for violations of standards, and permitting requirements for stationary and mobile sources of air emissions.	Applicable to Project sources of air emissions (although no limits have yet been established by EPA).
Environmental Protection Hazardous Waste Regulations (2000)	Establishes requirements for generating, handling, and disposing of hazardous waste as well as penalties for violations of these requirements.	Identifies wastes subject to regulation, including several types of waste that could be generated as part of the Project.
Pesticides and Toxic Chemicals Control Act Cap. 68:09 (2000, as amended in 2007)	Provides for the formation of a Pesticides and Toxic Chemicals Control Board; establishes requirements for registration, licensure, and trade in pesticides and toxic chemicals. Amended in 2007 to provide rules for the exportation of pesticides and toxic chemicals.	Establishes regulations pertaining to the use of toxic chemicals and pesticides. Pesticides will not be required for this Project, but small amounts of chemicals may be used. Will regulate the importation, registration, and use of these chemicals.
Environmental Protection Noise Management Regulations, 2000	Establishes general provisions for noise avoidance and restrictions from multiple commercial and industrial sources including sound making devices, night clubs, equipment, tools, and construction activities. Authorizes EPA to set specific permissible noise levels in the future. Includes reporting requirements, penalties for violations of standards, and permitting requirements for operations that emit noise.	Regulated facilities include any offshore installation and any other installation, whether floating or resting on the seabed.

Title	Objective	Relevance to the Project
Guyana Standard, Requirements for Noise Emission into the Environment, 2010	Establishes standard used for monitoring of noise emission into the environment; sets permissible noise levels for residential, commercial, and industrial areas (day and night).	Relevant to Project-related noise levels that could be perceived in commercial, residential or industrial districts (i.e., onshore or nearshore activities)
Public Health		
Occupational Safety and Health Act (1997) Cap. 99:06	Legally defines the responsibilities of workers and management with respect to keeping workplaces safe.	Generally applies to Project workers and Project-related activities.
Food & Drug Regulations (Food and Drug Act, 1971) Cap. 34:03	Regulates the sale, advertisement, preparation, and handling of food products; regulates the manufacture, advertisement, trade, and administration of pharmaceuticals; provides the Ministry of Health authority to facilities to establish compliance with sanitation standards.	Governs the preparation of food and provision of medications at Project facilities.
Ministry of Health Act (2005)	Sets out the functions of the Ministry of Public Health (previously the Ministry of Health) and the duties of the Minister. Among the responsibilities conferred to the Ministry by the Act are to provide oversight of health care services including mental health; provide advice to government and establish policies on health; develop and ensure the implementation of the National Health Plan and other action plans and directives including human and all other resource requirements; enter into service agreements with the Regional Health Authority (RHA) and review and approve their health plans and budgets; and facilitate the accreditation and regulation of the health care professionals, hospitals, and other health facilities in the public and private sectors.	Generally applies to health care services supplied to Project workers.
Regional Health Authority Act (2005)	Provides the RHA with the responsibility for providing for the delivery and administration of health services and health programs in specified geographic areas and for matters incidental thereto or connected therewith.	Establishes the regional regulations under which health services would be provided to Project workers.

Title	Objective	Relevance to the Project
Health Facilities Licensing Act (2007)	Under the act, all health facilities must be licensed by the Minister of Public Health. The Act also provides for inspectors who are authorized to enter any facility and conduct inspections. Offenses are outlined with fines and imprisonment upon summary conviction. Importantly, the act also provides for the Minister to make regulations related to licenses, renewals, standards for health facilities, record keeping, prescribing and governing the construction, establishment, location, equipment, maintenance, and repair of, additions and alterations to, and operations of health facilities.	Sets the requirements for health facilities at which services would be available to Project workers.
Social / Cultural Resources		
National Trust Act (1972) Cap. 20:03.	Stewardship of historic resources and places of cultural significance.	Governs the management of any building, structure, object, or other manmade or natural feature that is of historic or national cultural significance that could be impacted by the Project. Includes shipwrecks and other marine features. Would only apply to the Project in the event of a chance find, in which case the Act would require EEPGL to work cooperatively with the National Trust to manage any resources discovered.
Prevention of Discrimination Act (1997) Cap. 99:08.	Provides for the elimination of discrimination in employment, training, recruitment, and membership in professional bodies and the promotion or equal remuneration to men and women in employment who perform work of equal value.	Prevents discrimination in employment practices.
National Insurance and Social Security Act (1969) Cap. 36:01.	Establishes a system of national insurance and social security providing pecuniary payments by way of old age benefit, invalidity benefit, survivor's benefit, sickness benefit, maternity benefit, and funeral benefit, and to substitute for compensation system of insurance against injury or death caused by	Provides the overarching framework for workers' insurance and other benefits.

Title	Objective	Relevance to the Project
	accident arising in the course of employment or resulting from disease due to the nature of employment; establishes a National Insurance Fund.	
Employment of Young Persons and Children Act. Cap. 99:01.	Seeks to implement certain conventions relating to the employment of young persons and children.	Restricts the ages of young persons who may be employed by the Project.
Termination of Employment and Severance Pay Act (1997, 1999) Cap. 96:01.	Makes provision for the conditions governing termination of employment and grant of redundancy or severance payment to employees.	Governs payments to employees or the termination of employment. This could be relevant to contractors and sub-contractors to the Project.
Amerindian Act (2006) Cap. 29:01.	Provides for the recognition and protection of the collective rights of Amerindian villages and communities, the granting of lands to Amerindian villages and communities, and the promotion of good governance with Amerindian villages and communities.	Within the broad context of protection of the collective rights of Amerindian villages, this could include the right of use of coastal resources for traditional and subsistence activities, which could be affected in the event of an oil spill from the Project.
Social Infrastructure and Services		
Sea Defence Act (1953, 1988, 1992) Cap. 64:03.	Aims to make better provision for the maintenance and construction of sea defenses in Guyana.	Covers the protection of mangroves, which serve as a natural sea defense mechanism; there are fines and penalties for the unpermitted destruction of mangroves. Relevant to the Project in the event of an oil spill reaching the shore and causing mangrove damage.
Town and Country Planning Act (1996) Cap. 20:01.	Provides for the orderly and progressive development of urban and rural lands and the preservation and improvement of amenities pertaining to such development. Development under the Act is restricted to buildings and roadworks incidental to buildings.	Could be relevant if the Project builds commercial, industrial or residential structures. It would also be relevant for the land use clearance process (within the building permit process) within the Central Housing and Planning Authority.
Water and Sewerage Act (2002) Cap. 30:01.	Provides for the ownership, management, control, protection and conservation of water resources, the provision of safe water, sewerage and advisory services and the regulation thereof.	Has no direct applicability to the Project, as water resources are defined as water systems, conservancies, canals and water from rainfall or runoff from the land.

Title	Objective	Relevance to the Project
Maritime Use and Transportation		
Guyana Shipping Act (1998) Cap. 49:01.	Establishes the framework for the regulation of vessels and sets out the Maritime Administration Department (MARAD) and its functions.	MARAD is the principal regulator for vessels operating in the marine environment and all vessels associated with the Project will fall under the purview of MARAD.
Maritime Zones Act (2010) Cap. 63:01.	Incorporates certain provisions of the United Nations Convention on the Law of the Sea and the United Nations Educational, Scientific and Cultural Organization (UNESCO) Convention on the Protection of the Underwater Cultural Heritage, to provide for marine scientific research, maritime cultural area, eco-tourism, marine parks and reserves and mariculture, the protection and preservation of the marine environment and for related matters.	Relevant to the Project as it makes provisions for passage in the territorial sea, and the discharge of harmful substances and hazardous waste. In addition, relevant when specific maritime zones are established for the protection and preservation of the marine environment and also for mariculture activities, for which one project is currently being pursued by others.
Ecosystem Services		
Forests Act (2009) Act. No. 6 of 2009.	Consolidates the law relating to forests and makes provisions for sustainable forest management and forest conservation.	Covers mangroves, which are classified as a forest type and subject to protection measures under the Act. Mangrove ecosystem makes up a significant portion of Guyana's coastal zone, and could potentially be affected in the event of an oil spill event which reaches the shore.

2.3.2 National Policy Framework

Guyana's National Development Strategy (NDS), National Environmental Action Plan (NEAP), and Integrated Coastal Zone Management (ICZM) Action Plan relate to environmental protection and natural resource management goals. The NDS identifies several distinct natural "features" of Guyana that could be affected by the Project, including the coastal zone and fisheries. Guyana's NEAP articulates the Government's approach to managing the environment, with particular emphasis on environmental management and pollution control. The ICZM Action Plan articulates the Government's strategy for managing coastal environmental resources, several of which could be impacted by the Project. These same documents are also relevant to the Project from a socioeconomic perspective because they outline priorities for the country's economic and social development in the context of environmental protection and natural resource management goals.

2.3.3 International Conventions and Protocols

Guyana is signatory to a number of international and regional conventions and protocols that are relevant to environmental management aspects including air quality/climate change, pollution prevention, and conservation of biodiversity and wildlife habitat. These agreements include several prominent conventions concerning pollution control and waste management such as the International Convention for the Prevention of Pollution from Ships (MARPOL 73/78), the Basel Convention on the Transboundary Movement of Hazardous Wastes and Their Disposal, and the Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade, and reflect a particular focus on control of pollution and environmental contamination.

Guyana is also a signatory to several international and regional conventions and protocols that are relevant to environmental and socioeconomic aspects, although not all of these agreements have been translated into national legislation. Examples include climate change agreements such as the Kyoto Protocol and the United Nations Framework Convention on Climate Change (UNFCCC), the UNESCO Convention on the Protection of Underwater Cultural Heritage, and maritime safety conventions such as the International Convention for the Safety of Life at Sea. These international conventions and protocols are described in greater detail in the EIA.

2.4 Safety, Security, Health, and Environmental Management

ExxonMobil (EEPGL's parent organization) and its affiliates (including EEPGL) are committed to conducting business in a manner that is compatible with the environmental and socioeconomic needs of the communities in which it operates, and that protects the safety, security, and health of its employees, those involved with its operations, its customers, and the public. These commitments are documented in its Safety, Security, Health, Environmental (SSHE), and Product Safety policies. These policies are put into practice through a disciplined management framework called the Operations Integrity Management System (OIMS). Effective and consistent application of these policies will constitute the primary safeguards against occupational hazards for Project workers, and all Project workers and contractors will receive training on implementation of these principles and will be required to adhere to them in the daily execution of their duties.

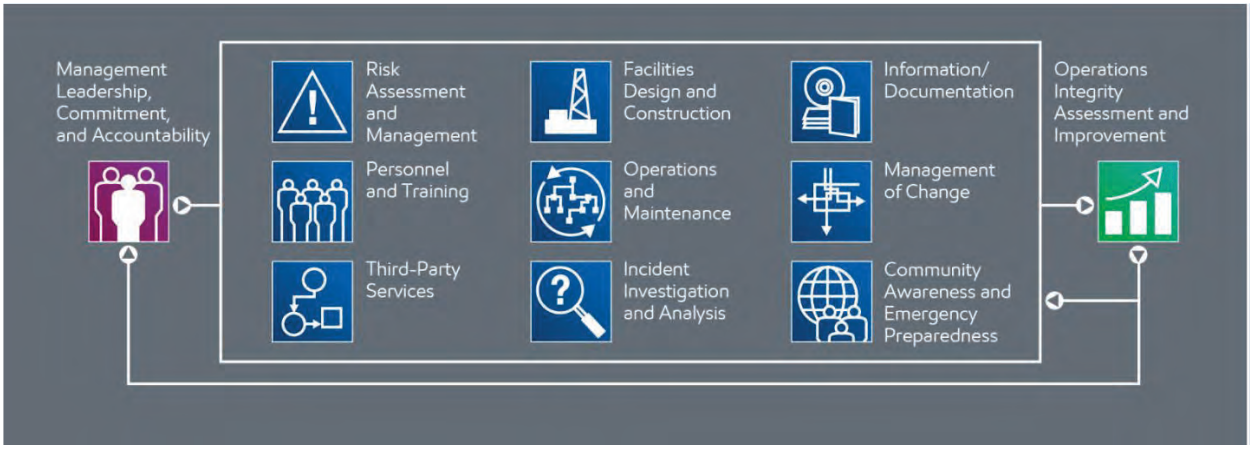
ExxonMobil's OIMS Framework[1] establishes common expectations used by ExxonMobil affiliates worldwide for addressing risks inherent in its business. The term Operations Integrity (OI) is used to address all aspects of its business that can impact personnel and process safety, occupational safety, security, occupational health, and environmental performance.

Application of the OIMS Framework is required across all ExxonMobil affiliates, with particular emphasis on design, construction and operations. Management is responsible for ensuring that management systems satisfying the OIMS Framework are in place. Implementation is consistent

[1] http://corporate.exxonmobil.com/company/about-us/safety-and-health/operations-integrity-management-system

with the risks associated with the business activities being planned and performed. Figure 2-1 provides a high level description of the OIMS Framework and its 11 essential elements.

Figure 2-1. The OIMS Framework



2.4.1 Occupational Safety & Health Management

OIMS establishes expectations and requirements for identifying and managing occupational safety and health risks associated with its operations. Examples of the key elements of EEPGL's occupational safety and health programs that will be utilized during the Project life cycle are discussed in Table 2-2. The occupational safety and health program elements in Table 2-2 are focused on personnel safety and health risks associated with the offshore drilling, installation, production operations, and decommissioning stages of the Project; design considerations are not included.

Table 2-2. Key Occupational Safety & Health Management Elements

Program Element	Description
Safety	
Personal Protective Equipment (PPE)	Used to reduce personal exposure to hazards when engineering and administrative controls are not feasible or are not effective in reducing exposure to an acceptable level. A PPE program addresses the hazards to be encountered; the selection, maintenance, and use of PPE; the training of personnel; and monitoring of the program to ensure ongoing effectiveness. Includes basic and specialty PPE.
Confined Space Entry	Controls hazards associated with personnel entering spaces not designed for human occupancy, where egress is limited and where hazards pose a risk to injury or illness from hazardous substances or conditions (e.g., hazardous atmosphere, fire, exposure to hazardous substance, temperature, physical hazards, etc.). Includes controls such as atmospheric testing, forced air ventilation, attendants, signage, entry permits, etc.
Energy Isolation	Utilizes controls to prevent the unexpected energizing, start-up, or release of stored energy (e.g., hydraulic, pneumatic, thermal, chemical, gravity, mechanical) while working with plant and equipment which have one or more energy sources. Also known as Lockout/Tagout (LOTO).

Program Element	Description
Electrical	Controls hazards encountered by personnel who install, use, maintain, repair, or test various types of permanent and temporary plant and equipment, as well as other personnel who work in the proximity of such plant and equipment. Includes controls such as electrical codes, classified areas, qualified persons, signage, specialty PPE, grounding, guarding, etc.
Hot Work	Utilizes controls necessary to safely perform Hot Work (work methods which produce ignition sources; sparks, flame, heat) in the proximity of flammable gases, liquids, or materials. Includes controls such as safe welding areas, gas testing, fire watch, firefighting equipment, permits, etc.
Fall Protection	Manages the risk of personnel working above 1.8 meters (6 feet) and includes use of personal fall arrest systems and safe anchoring points.
Scaffolding, Work Platforms, Ladders, and Personnel Lifting Equipment	Scaffolding, work platforms, and ladders are utilized to elevate workers performing work at heights. Scaffolding and work platforms require controls for use of competent scaffold builders, standards for erection, safe work loads, and inspection/tagging systems. Includes safe work practices for ladders. Includes controls and safe work practices for mechanized personnel lifting (e.g., aerial lifting equipment, work baskets).
Dropped Objects Management	Uses control to prevent dropped objects such as tools, materials, and debris from falling onto work areas below, which could cause injury to personnel or damage to equipment. Includes controls such as overhead protection, hard barricades, soft barricades, tool tethering, etc.
Mechanized Lifting and Rigging	Includes the utilization of various types of mechanized lifting equipment (e.g., stationary cranes, mobile cranes, overhead cranes) by equipment operators and rigging personnel, as well as rigging apparatus (e.g., spreader bars, slings, straps, hooks). Utilizes controls related to operator and equipment certification, inspection and maintenance, load ratings, general safe work practices for routine lifts, and procedures for non-routine lifts.
Tools and Equipment	Identifies controls and safe work practices for managing the risks associated with various types of hand tools and portable equipment (e.g., hammering, chipping, welding, burning, cutting, cleaning, smoothing, breaking, shaping, torqueing). Includes inspection, maintenance, safety devices, etc.
Marine Transportation and Personnel Transfers	Includes controls and safe work practices associated with marine transportation of personnel by crew boat. Also includes controls and safe work practices for infield personnel movements between vessels or facilities (e.g., collapsible rope man-baskets, gangways).
Aviation Transportation	Includes controls and safe work practices associated with rotary wing aviation aspects (e.g., refueling operations, aircraft inspection and maintenance, design of helidecks, pilot training and credentials, weather criteria) and personnel transportation considerations (e.g., water survival training, helicopter egress training, in-flight aviation procedures).
Housekeeping	Utilizes controls and monitoring processes to eliminate various types of incidents, including fires, exposure to hazardous chemicals, dropped objects, and slips, trips, and falls.

Program Element	Description
Driving	Utilizes controls to manage ground transportation hazards in an urban environmental, including general driving rules, licensing, defensive driving training, fatigue management, alcohol and drug avoidance, inspection and maintenance, journey management, etc.
Health	
Hazard Communication	Includes controls to verify that materials are reviewed for hazards prior to use, are communicated to potentially affected persons, and the necessary controls are implemented to provide safety and health protections. Includes making Safety Data Sheets (SDS) available to personnel.
Respiratory Protection Program	Provides controls to ensure personnel select the appropriate respiratory protective equipment for certain activities. Certain respirators require training, fit testing, and use by medically qualified personnel.
Noise and Hearing Conservation Program	Identifies high noise areas (exposures above 85 decibels), evaluates personnel exposure, provides protective equipment, and implements appropriate engineering and administrative control measures to prevent occupational hearing loss.
Exposure Monitoring	Includes exposure monitoring to identify, analyze, and manage occupational health risks. Results of monitoring against defined criteria (e.g., threshold limit values) are communicated to personnel and effective control measures are established to mitigate worker risks.
Radiation Management	Establishes controls to safely manage use of radioactive sources, source materials, radiation producing devices, and naturally occurring radioactive materials (NORM).
Heat Stress Management	Utilizes controls and safe work practices to assess the work environment in order to reduce potential injury or illness where temperature extremes may result in significant health impacts to personnel.
Medical Screening and Fitness for Work	Includes controls to ensure personnel are fit for work, including general medical fitness for duty, job-specific fitness-for-duty, vaccinations, pre-screening for contagious diseases, alcohol and drug testing, etc.
Tuberculosis Control Program and Other Communicable Disease Concerns	Provides Tuberculosis (TB) controls to promote early detection, isolations, and prompt treatment of TB cases at sites where TB transmission may exist and where personnel live together in congregate settings (e.g., offshore vessels). Includes other controls for other relevant communicable diseases of concern (e.g., Dengue, Zika, Lymphatic Filariasis) based on risk of exposure in the work location.
Water Safety	Includes controls to ensure potable water sources are safe for consumption on offshore vessels. Includes standards and periodic verification testing by qualified personnel.
Administrative Processes	
Contractor and Subcontractor Management	Includes a structured evaluation and selection process that addresses safety and health considerations, identifies the minimum safety and health requirements through contract language, provides performance monitoring during execution/operations, and provides a feedback mechanism to contractor/subcontractor management.

Program Element	Description
Orientation and Training	Training program includes a systematic means of providing, enhancing, and/or sustaining the safety and health knowledge and skills of personnel. Includes a training matrix, competency assessment, documentation of training, etc. Orientation program includes a structured induction process to ensure that personnel arriving at a work location for the first time understand the applicable safety and health expectations and requirements. Orientation program also includes an abridged version for visitors.
Simultaneous Operations	Includes a structured process to verify that incompatible activities between different offshore teams (Drilling, Installation, Production, Logistics) are safely managed.
Work Management System	A work management system (also known as a permit to work system) is a systematic process for planning, executing, and controlling critical and/or non-routine tasks at a work location. Includes processes for work authorization and permit validity (duration, suspension, cancellation). Includes coordination meetings, pre-task planning, and assessment. Defines when certain types of work permits are required (e.g., hot work, confined space entry, energy isolation, critical mechanized lifts).
Worker Hazard Management Processes	Includes a suite of programs aimed at engaging workforce personnel in hazard management; including: pre-shift safety meetings, job safety analysis, personal risk assessment, near miss and hazard condition reporting, behavioral observations, stop work authority, etc.
Inspections	Provides a systematic process for designated work site personnel to identify and resolve safety and health issues at a work location. Typically focuses on both physical conditions and personnel behaviors.
Audits	Includes structured verification processes to periodically evaluate the effectiveness of various types of safety and health policies, processes, procedures, and work practices, in order to identify opportunities for improvement and develop and steward action plans to drive improvement.

2.5 International Environmental and Socioeconomic Performance Criteria

A number of environmental and socioeconomic performance criteria will be utilized by the Project. These performance criteria are consistent with good international industry practice. Table 2-3 presents a summary of key environmental and socioeconomic performance criteria the Project will utilize.

Table 2-3. Summary of Key Environmental and Socioeconomic Performance Criteria to be used by the Project

Aspect	Performance Criteria to be Applied	International Standard Which References Applied Performance Criteria
Air Quality	Modeled concentrations of air pollutants at potential onshore receptor locations have been compared to guideline concentrations from the World Health Organization.	World Health Organization's Air Quality Guidelines for Particulate Matter, Ozone, Nitrogen Dioxide and Sulfur Dioxide; Air Quality Guidelines for Europe
Ballast Water	Comply with requirements.	International Convention for the Prevention of Pollution from Ships (MARPOL 73/78)
Bilge Water	Comply with requirements.	MARPOL 73/78
Cooling Water	Avoid increases in ambient water temperature of more than 3°C at 100 meters (~328 feet) from the point of discharge.	World Bank Group Environmental Health and Safety (EHS) Guidelines for Offshore Oil and Gas Development
Cooling Water	Although not technically applicable to a cooling water discharge, the modeled concentrations of residual chlorine in the receiving water at the edge of the mixing zone have been compared to the International Maritime Organization (IMO) recommended level of 0.5 milligrams per liter (mg/L).	IMO's 2012 Guidelines on Implementation of Effluent Standards and Performance Tests for Sewage Treatment Plants
Cumulative Impacts	The cumulative impact assessment for the Project has been conducted in general accordance with international best practice guidance of the International Finance Corporation (IFC).	IFC's Good Practice Handbook - Cumulative Impact Assessment and Management: Guidance for Private Sector in Emerging Markets
Deck Drainage	Comply with requirements.	MARPOL 73/78
Drill Cuttings	Modeled deposition of drill cuttings has been compared to the literature-based threshold rate for potential impact to benthic organisms from smothering (5 centimeters per month).	Ellis D. V. and C. Heim. 1985. Submersible surveys of benthos near a turbidity cloud. Mar Poll Bull, 16(5): 197–203.; MarLIN (Marine Life Information Network). 2011. Benchmarks for the Assessment of Sensitivity and Recoverability. The Marine Biological Association of the UK, Citadel Hill, Plymouth, Devon, U.K. Retrieved from: http://www.marlin.ac.uk/habitats/SNCB-benchmarks#toc_physical-pressure-other-

Aspect	Performance Criteria to be Applied	International Standard Which References Applied Performance Criteria
Drill Cuttings	Modeled Total Suspended Solids (TSS) concentrations from discharge of drill cuttings have been compared to the MARPOL recommended TSS threshold of 35 mg/L.	MARPOL 73/78
Drilling Fluids and Cuttings – Non-Aqueous Drilling Fluid (NADF)	Use low-toxicity International Oil and Gas Producers Group 3 Non-Aqueous Base Fluid (NABF).	World Bank Group EHS Guidelines for Offshore Oil and Gas Development
Drilling Fluids and Cuttings – NADF	Use solids control and cuttings dryer systems to treat cuttings, such that, for discharged cuttings, end of well maximum weighted mass ratio averaged over all well sections drilled using NABF does not exceed 6.9 percent wet weight base fluid retained on cuttings.	World Bank Group EHS Guidelines for Offshore Oil and Gas Development
Ecosystem Services	An ecosystem services baseline has been established in general accordance with the Millennium Ecosystem Assessment 2005 methodology. An ecosystem services prioritization has been conducted in general accordance with international best practice described in the 2012 IFC Performance Standards.	Millennium Ecosystem Assessment's Ecosystems and Human Well-being: A Framework for Assessment; IFC Performance Standards 2012
Food Waste	Comminuted to 25 millimeters diameter particle size or less and comply with requirements.	MARPOL 73/78
Greenhouse Gas Emissions	Quantification of GHG emissions will be conducted annually in accordance with internationally recognized methodologies and good practice.	International Petroleum Industry Environmental Conservation Association's (IPIECA's) Petroleum Industry Guidelines for Reporting Greenhouse Gas Emissions
Produced Water	Treat to achieve an oil in water content of 29 mg/L (monthly average) and 42 mg/L (daily maximum).	World Bank Group EHS Guidelines for Offshore Oil and Gas Development
Sediment Quality	Existing concentrations of constituents in sediment samples have been compared to U.S. National Oceanic and Atmospheric Administration (NOAA) "Effects Ranges".	NOAA (Macdonald, D. D., R. S. Carr, and F. D. Calder. 1996. Development and evaluation of sediment quality guidelines for Florida coastal waters. Ecotoxicology, 5(1996): 253.)
Sewage	Treat sewage with a marine sanitation device and comply with requirements.	MARPOL 73/78 IMO's 2012 Guidelines on Implementation of Effluent Standards and Performance Tests for Sewage Treatment Plants

Aspect	Performance Criteria to be Applied	International Standard Which References Applied Performance Criteria
Underwater Noise	Observations by Marine Mammal Observers and operational protocols (e.g., soft starts, initiate during daylight hours) to be conducted for certain noise producing activities (e.g. Vertical Seismic Profile).	Joint Nature Conservation Committee guidelines
Water Quality	Existing concentrations of constituents in water samples have been compared to guideline concentrations in the U.S. Environmental Protection Agency (USEPA) water quality guidelines.	USEPA Water Quality Guidelines (Burgess, R.M., W.J. Berry, D.R. Mount, and D.M. Ditoro. 2013. Mechanistic Sediment Quality Guidelines Based on Contaminant Bioavailability; Equilibrium Partitioning Sediment Benchmarks. Environmental Toxicology and Chemistry, 32, No. 1, pp. 102–114.); USEPA Saltwater Quality Standards

2.6 Organizational Structure

As part of design and implementation for the Liza Phase 1 Development, EEPGL established an organizational structure within the affiliate which is responsible for managing the Project activities over the life cycle of the Project. EEPGL will use this same structure to manage activities associated with the Liza Phase 2 Development. A dedicated in-country organization will be in place throughout each Project stage. The organizational size and makeup will evolve over time to accommodate the business needs associated with drilling development wells, installation of FPSO and SURF components, production operations, logistical support, and ultimately decommissioning.

The in-country organization will be led by a Lead Country Manager, and supported by various discipline managers such as Operations, Engineering, Human Resources, Public & Government Affairs, Business Services (e.g., Procurement, Controllers, Information Technology), Law, and SSH&E. The in-country organization will also be supported by a number of technical, business, and administrative specialists located inside and outside of Guyana. The in-country organization is responsible for all in-country Project activities, and will be the organization which interfaces with government and stakeholders.

The EEPGL management team will be supported by a SSH&E team which provides technical expertise, training, and administrative support for OIMS implementation, which addresses disciplines such as safety, security, health, environmental, regulatory, and socioeconomics.

The in-country organization will also be supported by several teams which are responsible for managing certain types of Project activities. Examples of such teams include a Drilling Team which manages the drilling and completion of the development wells; a Logistics Team which manages logistical support (e.g., shorebase, aviation, marine vessels); and a Project Team which manages the engineering, procurement, construction, and installation of the FPSO and SURF components. Each of these teams has a suite of discipline managers to support the planning and

execution of the Project activities for which they are responsible, including SSH&E. These teams interface with the EEPGL in-country organization in a seamless manner to deliver their scopes of work for the Project. EEPGL will ultimately manage production operations.

Figures 2-2 and 2-3- illustrate the preliminary organizational structure which is planned to be utilized at the commencement of the production operations state. Key roles and responsibilities as it relates to the ESMP are outlined in Table 2-4. This organizational structure and the organizational roles and responsibilities will be further defined in future revisions of this document once the Project achieves a Final Investment Decision.

The management team of EEPGL is accountable for managing the Project activities in alignment with OIMS and EEPGL's established SSH&E policies, in compliance with the laws and regulations of Guyana, and in line with the commitments and obligations associated with the EIA and ESMP.

EEPGL defines SSH&E roles and responsibilities for its organizations and individuals to ensure they understand expectations.

Figure 2-2. Preliminary Organizational Structure – Production Operations

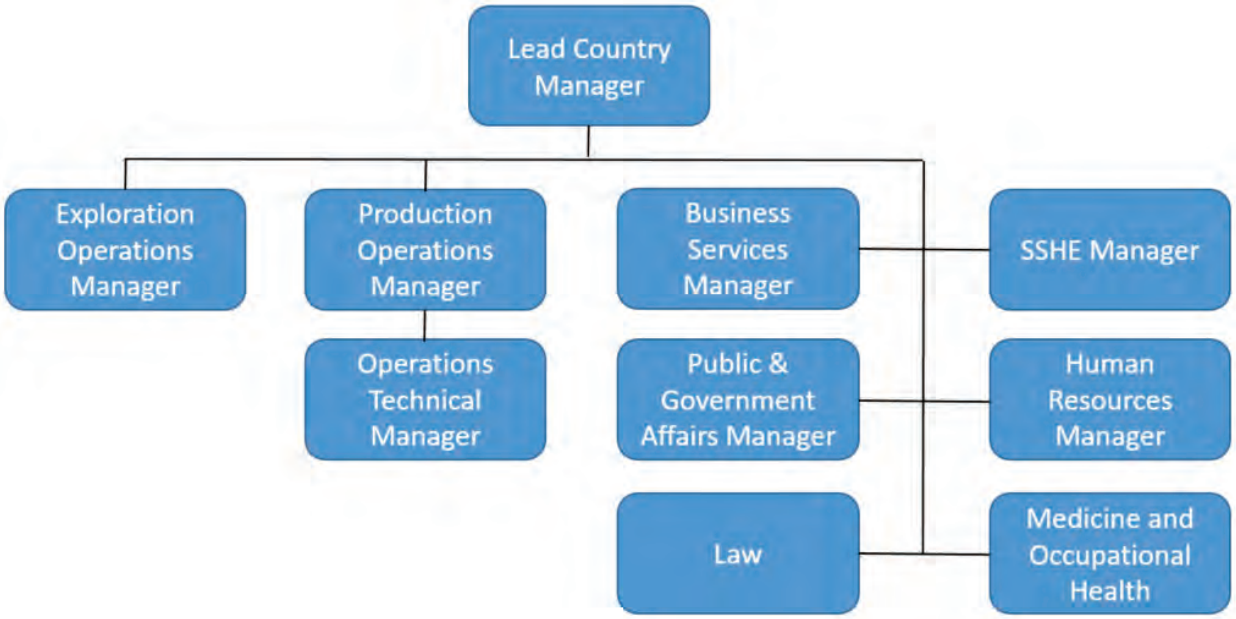


Figure 2-3. Preliminary Organizational Structure – Safety, Security, Health, and Environment

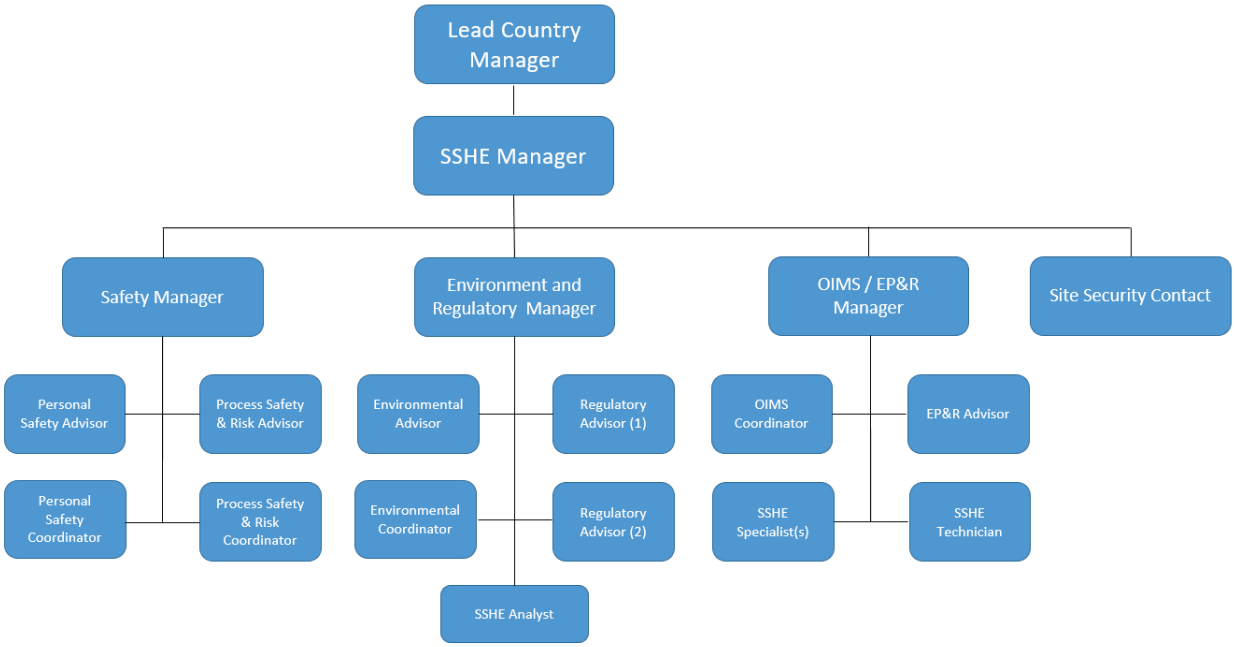


Table 2-4. ESMP Roles and Responsibilities

Role	Responsibilities
Lead Country Manager	• Approves the ESMP • Sets the expectation for the Production Organization to comply with the requirements of the ESMP
Operations Manager(s) / Operations Technical Manager	• Maintains awareness of the requirements in the ESMP with the Operations Organizations • Accountable for implementing the operational requirements of the ESMP • Provides resources to implement the operational requirements of the ESMP • Verifies the Operations Organization complies with ESMP
Operational Staff	• Responsible for implementing the operational requirements of the ESMP • Responsible for performing internal ESMP related reporting to SSHE
P&GA Manager	• Endorses the ESMP • Jointly accountable with Operations Management for implementation of the Socioeconomic Management Plan within the ESMP • Provides technical support to operational staff for socioeconomic related ESMP requirements • Coordinates interfaces with Government agencies and external stakeholders with regards to public and government affairs matters

Role	Responsibilities
SSHE Manager	• Endorses the ESMP • Administrative owner of the ESMP documentation • Jointly accountable with Operations Management for implementation of the ESMP • Provides technical support to operational staff for safety, health, environmental, and regulatory compliance related ESMP requirements • Coordinates interfaces with Government agencies and external stakeholders on safety, health, environmental, regulatory compliance matters • Manages OIMS implementation and execution such that EEPGL meets the Corporate OIMS expectations • Responsible for EEPGL SSHE stewardship and performance reporting
Environmental & Regulatory Staff	• Support implementation of the ESMP • Facilitate the development and submission of regulatory submittals for EEPGL • Collect and consolidate environmental data for reporting, including waste, discharge, and emissions to air • Provide training and guidance to EEPGL operational staff as needed to facilitate awareness and implementation of the ESMP

2.7 Competency, Training, and Awareness

EEPGL will assign suitably competent personnel to manage and support the Project activities in alignment with OIMS, which provides guidelines for personnel selection, placement, and competency verification. EEPGL will provide/validate that its personnel have been provided the appropriate SSH&E training, in alignment with OIMS.

EEPGL will verify that its contractors have competency, training, and awareness programs in place which are consistent with EEPGL's programs, in alignment with OIMS.

EEPGL and its contractors will provide SSH&E training and awareness programs which include:

- Country/site-specific inductions for new personnel and visitors;
- General training covering broad SSH&E roles and responsibilities for all personnel;
- Management training directed at management and supervisory level personnel;
- Operational training for operational and engineering personnel; and
- Project- and job-specific training specific to those with direct duties and roles in SSH&E, commensurate with their level of responsibility.

EEPGL will include ESMP-related training and awareness in the above programs, as appropriate to ensure that personnel with ESMP roles and responsibilities understand expectations related to commitments and obligations, mitigation measures, monitoring programs, and reporting. Table 2-5 provides a conceptual overview of roles and responsibilities for EEPGL's competency, training, and awareness program.

Table 2-5. Training Roles and Responsibilities

Position	Responsibilities
Management	• Endorse overall training processes and procedures • Verify competent and trained personnel are available to support Project activities
Site Supervision	• Ensure their personnel have the required knowledge and skills to perform job tasks • Review and approve training plans for their personnel • Provide time/resources required for their personnel to complete/maintain training • Review training progress for their personnel on an annual basis • Consult with management on actions to take when a person does not meet the requisite knowledge/skills after training has occurred
Personnel	• Complete training requirements • Provide feedback on training received
SSH&E Personnel	• Provide SSH&E training programs with support from training resources
Training Resources	• Provide SSH&E training programs with support from SSH&E personnel • Assist with delivery of training (where appropriate) and evaluate training results

2.7.1 Training Programs and Delivery

EEPGL will develop competency, training, and awareness program appropriate to the Project's needs. Training may be provided through a variety of means, which may include but is not limited to: briefings, toolbox talks, coaching/mentoring, on-the-job training in specific elements or tasks, self-study, instructor-led training, seminars, workshops, computer-based training, or the provision of specific skills, as necessary. These and other means (such as posters, signs, site newsletters, etc.) may be used to promote environmental, socioeconomic, and regulatory compliance awareness. Training programs may be delivered by both EEPGL, contractor, and third party training resources.

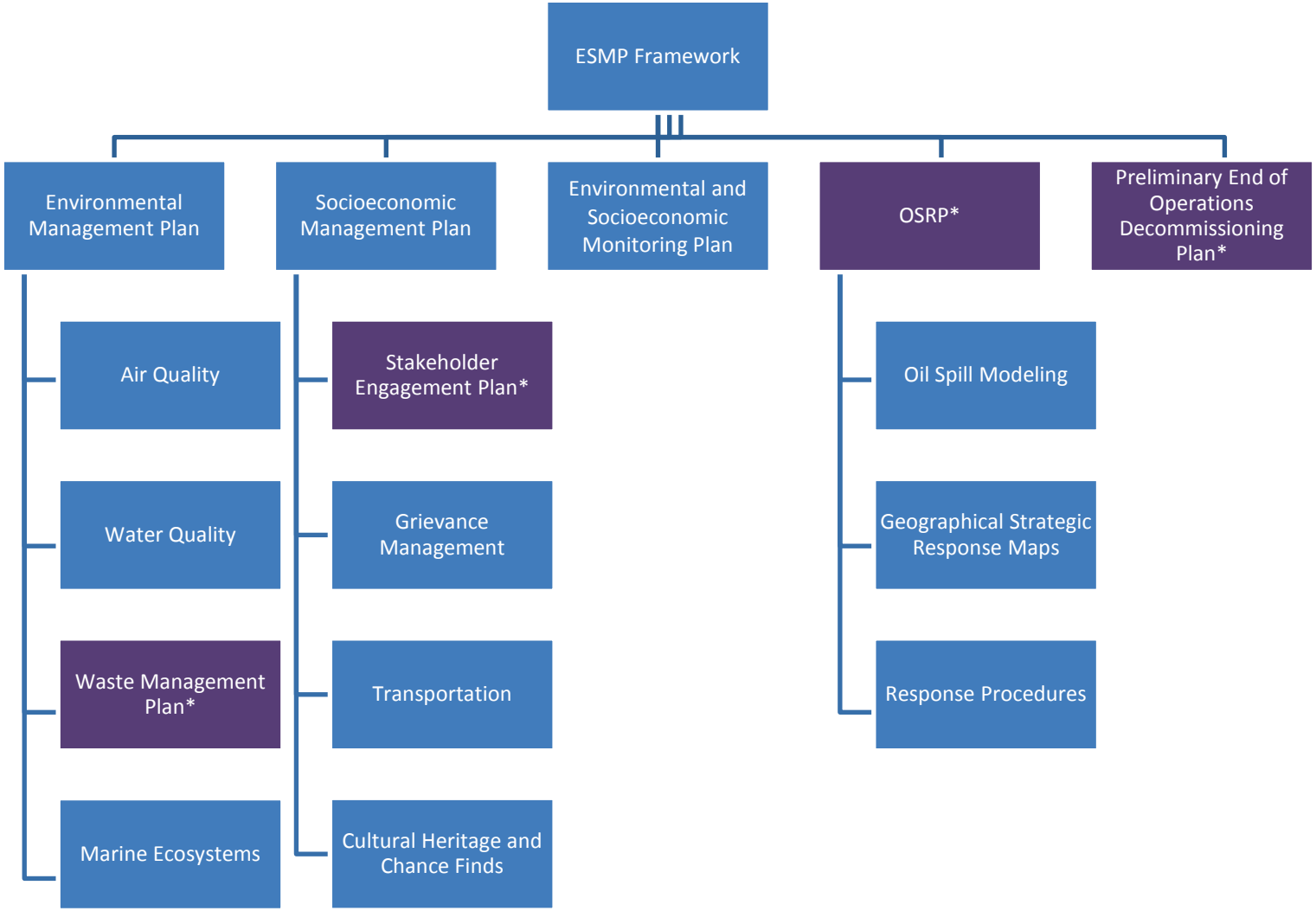
3.0 PROJECT SPECIFIC MANAGEMENT PLANS

In accordance with the structure of the ESMP as described in Section 11.3 of the Liza Phase 2 EIA, the ESMP includes several specific management plans that are organized into five categories:

- Environmental Management;
- Socioeconomic Management;
- Environmental and Socioeconomic (E&S) Monitoring;
- Oil Spill Response; and
- Preliminary End of Operations Decommissioning

Each of the above categories includes one or more specific management plans, which are included within the body of this document unless otherwise noted, as shown in Figure 3-1.

Figure 3-1. ESMP Structure



** Due to the size and/or complexity of these documents, these are standalone plans, and are provided either as an appendix to the ESMP or as a separate volume to the regulatory submittal for the Liza Phase 2 Project (i.e., OSRP).*

3.1 Environmental Management Plan

3.1.1 Introduction and Scope

The purpose of the Environmental Management Plan (EMP) is to identify specific measures that EEPGL or its contractors would implement to avoid or minimize potential adverse environmental impacts of the Project, and enhance positive benefits. The scope of this plan includes environmental impacts that could potentially result directly or indirectly from the Project, and over which EEPGL exercises control.

3.1.2 Management Measures

This section summarizes the potential impacts of the Project that require management actions as identified in the EIA. The following sub-sections identify the source of impact, the affected receptor, a description of the management measure, and the specific Project facilities for which the control/measure will be implemented. The sub-sections are organized by primary receptor, but many of the measures listed in the following subsections would address potential induced or indirect impacts on other receptors as well as the primary receptor.

3.1.2.1 Air Quality Management

EEPGL will implement measures to manage potential impacts on air quality as listed in Table 3-1.

3.1.2.2 Water Quality Management Measures

EEPGL will implement measures to manage potential impacts on marine water quality as listed in Table 3-2.

3.1.2.3 Waste Management

The Project will evaluate waste generation volumes associated with Project activities. Locations and capacities of acceptable waste handling, treatment, storage, and disposal facilities will be further assessed in relation to Project waste generation. The EEPGL Waste Management Plan is located in Appendix 1 of the ESMP.

3.1.2.4 Marine Ecosystems

EEPGL will implement measures to manage potential impacts on marine ecosystems as listed in Table 3-3.

In addition to the measures listed in Table 3-3, most if not all of the water quality management measures listed in Table 3-2 and several of the waste management measures listed in the Waste Management Plan will also contribute to management of Project-related impacts on marine ecosystems.

Table 3-1. Air Quality Management Measures

SOURCE OF IMPACT	RECEPTOR	MANAGEMENT MEASURE	INVOLVED FACILITY
Emissions to Atmosphere	Air Quality	Re-inject produced gas which is not utilized as fuel gas on the FPSO to avoid routine flaring. In cases where non-routine flaring is required, the following measures will be implemented: • Monitor flare performance to maximize efficiency of flaring operation; • Ensure flare equipment is appropriately inspected and function tested prior to production operations; and • Ensure flare equipment is appropriately maintained and monitored during production operations	FPSO
Emissions to Atmosphere	Air Quality	Maintain equipment and marine vessels in good working order and operate in accordance with manufacturer's specifications.	Drill Ships, FPSO, Installation / Decommissioning Vessels, Other Marine Vessels, Shorebase
Emissions to Atmosphere	Air Quality	Shut down (or throttle down) sources of combustion equipment in intermittent use where reasonably practicable in order to reduce air emissions (e.g., vehicles, portable equipment).	Drill Ships, FPSO, Installation / Decommissioning Vessels, Other Marine Vessels, Shorebase
Emissions to Atmosphere	Air Quality	Utilize low-sulfur fuels for major vessels, where available and commercially viable.	Drill Ships, Installation / Decommissioning Vessels, Other Marine Vessels
Emissions to Atmosphere	Air Quality	Utilize dust suppression measures to reduce impacts on air quality.	Shorebase

SOURCE OF IMPACT	RECEPTOR	MANAGEMENT MEASURE	INVOLVED FACILITY
Emissions to Atmosphere	Air Quality	Notify regulator when process upset events or unplanned maintenance occur, resulting in a flaring event sustaining at least 10 MMSCFD and lasting 5 days or longer.	FPSO
Emissions to Atmosphere	Air Quality	Avoid routine venting (excludes tank flashing emissions, standing/working/breathing losses) except during safety and emergency conditions.	FPSO
Emissions to Atmosphere	Air Quality	Avoid use of chlorofluorocarbons (CFCs) and polychlorinated biphenyls (PCBs).	FPSO
Emissions to Atmosphere	Air Quality	Implement inspection, maintenance and surveillance programs to identify and prevent leaks.	FPSO
Emissions to Atmosphere	Air Quality	Operate incinerator in accordance with Waste Management Plan and avoid incineration of restricted materials.	FPSO, Drill Ships

Table 3-2. Water Quality Management Measures

SOURCE OF IMPACT	RECEPTOR	MANAGEMENT MEASURE	INVOLVED FACILITY
Operational Discharges	Marine Water Quality	Produced water discharge will be treated to comply with an oil in water content of 29 mg/L (monthly average) and 42 mg/L (daily maximum).	FPSO
Operational Discharges	Marine Water Quality	Produced water and cooling water discharge will be designed to avoid increases in ambient water temperature of more than 3°C at 100 m (~328 feet) from the point of discharge.	FPSO
Wastewater Discharge to Sea	Marine Water Quality	Bilge water will be treated and tested per MARPOL requirements to ensure compliance with an oil in water content of <15 ppm.	Drill Ships, FPSO, Installation / Decommissioning Vessels, Other Marine Vessels
Wastewater Discharge to Sea	Marine Water Quality	Sewage and food waste will be treated in accordance with MARPOL (e.g., food comminuted to 25 mm diameter particle size or less, sewage goes through a marine sanitation device).	Drill Ships, FPSO, Installation / Decommissioning Vessels, Other Marine Vessels
Discharge of Cuttings to Sea	Marine Water Quality	Utilize WBDF to the extent reasonably practicable (upper sections of the wells) and in other cases use low-toxicity International Oil and Gas Producers (IOGP) Group III NABF.	Drill Ships
Discharge of Cuttings to Sea	Marine Water Quality	Use low-toxicity IOGP Group 3 Non-Aqueous Base Fluid (NABF) as well as utilization of solids control and cuttings dryer systems to treat cuttings, such that, for discharged cuttings, end of well maximum weighted mass ratio averaged over all well sections drilled using NABF does not exceed 6.9 percent wet weight base fluid retained on cuttings.	Drill Ships
Discharge of Cuttings to Sea	Marine Water Quality	There shall be no discharge of free oil as a result of the discharge of NADF cuttings.	Drill Ships
Commissioning Discharges	Marine Water Quality	There shall be no visible oil sheen on receiving water as a result of any discharges.	All Marine Vessels, SURF

SOURCE OF IMPACT	RECEPTOR	MANAGEMENT MEASURE	INVOLVED FACILITY
Drilling and Operational Discharges	Marine Water Quality	All vessel wastewater discharges (e.g. storage displacement water, ballast water, bilge water, deck drainage) must comply with IMO/MARPOL requirements.	Drill Ships, FPSO, Installation / Decommissioning Vessels, Other Marine Vessels
Hydrocarbon Spills	Marine Water Quality	Utilize a marine bonded, double-carcass floating hose system certified by Class or other certifying agency that complies with the recommendations of OCIMF Guide to Manufacturing and Purchasing Hoses for Offshore Moorings (GMPHOM) 2009 Edition or later during offloading operations.	FPSO
Hydrocarbon Spills	Marine Water Quality	Change liquid hydrocarbon transfer hoses periodically	Drill Ships
Hydrocarbon Spills	Marine Water Quality	Utilize dry-break connections on liquid hydrocarbon bulk transfer hoses	Drill Ships
Hydrocarbon Spills	Marine Water Quality	Utilize a liquid hydrocarbon checklist before every bulk transfer	Drill Ships
Hydrocarbon Spills	Marine Water Quality	Regularly test certified blowout preventer (BOP) equipment and other spill prevention equipment	Drill Ships
Hydrocarbon Spills	Marine Water Quality	Utilize overbalanced drilling fluids to control wells while drilling	Drill Ships
Hydrocarbon Spills	Marine Water Quality	Utilize breakaway couplers on offloading hose that would stop the flow of oil from FPSO during an emergency disconnect scenario.	FPSO
Hydrocarbon Spills	Marine Water Quality	Utilize leak detection controls during FPSO offloading (e.g., for breach of floating hose, instrumentation / procedures to perform volumetric checks).	FPSO
Hydrocarbon Spills	Marine Water Quality	Utilize leak detection controls during installation and operation of SURF equipment (e.g., pigging and pressure testing of lines, periodic ROV surveys of subsea trees, manifolds, flowlines and risers).	FPSO, SURF

SOURCE OF IMPACT	RECEPTOR	MANAGEMENT MEASURE	INVOLVED FACILITY
Hydrocarbon Spills	Marine Water Quality	Utilize secondary containment for storage of bulk fuel, drilling fluids, and hazardous materials, where practical.	Drill Ships, FPSO, Installation / Decommissioning Vessels, Other Marine Vessels, Shorebase
Hydrocarbon Spills	Marine Water Quality	• Regularly check pipes, storage tanks, and other equipment associated with storage or transfer of hydrocarbons/chemicals for leaks • Inspect and service, as appropriate, shorebase cranes and construction equipment in order to mitigate the potential for spills.	Shorebase
Hydrocarbon Spills	Marine Water Quality	Implement and maintain OSRP (see EIA).	Drill Ships, FPSO, Installation / Decommissioning Vessels, Other Marine Vessels, Shorebase
Hydrocarbon Spills	Marine Water Quality	Perform operational training (including well control training) for drill ship supervisors and engineers	Drill Ships

Table 3-3. Marine Ecosystem Management Measures

SOURCE OF IMPACT	RECEPTOR	MANAGEMENT MEASURE	INVOLVED FACILITY
Collision Between Vessels and Marine Species	Marine Mammals, Marine Turtles, Seabirds	• Provide awareness training to Project-dedicated marine personnel to recognize signs of marine mammals at the sea surface. • Issue standing instruction to Project-dedicated vessel masters to avoid marine mammals and marine turtles while underway and reduce speed or deviate from course, when possible, to reduce probability of collisions. • Provide standing instruction to Project-dedicated vessel masters to avoid any identified rafting seabirds, when possible, when transiting to and from PDA.	Drill Ships, FPSO, Installation / Decommissioning Vessels, Other Marine Vessels
Auditory Impacts on Marine Species	Marine Mammals, Marine Turtles, Marine Fish	• Initiate VSP activities during daylight hours after a suitable pre-watch by Marine Mammal Observers (MMOs) is performed; • Gradually increase intensity of seismic impulses and hammer energy (during pile driving) to allow sensitive species to vacate area before injury occurs (i.e., soft starts); • Utilize MMOs during VSP (although use of MMOs is more effective for identification of marine mammals, these individuals can also detect marine turtles depending on weather conditions, and they will be tasked with observing for marine turtles as well) and implementation of other measures recommended by the Joint Nature Conservation Committee (JNCC, 2017), as applicable; and • Maintain equipment (including marine vessels) in good working order and operate them in accordance with manufacturers' specifications so as to limit sound levels to the extent reasonably practicable.	Drill Ships, FPSO, Installation/ Decommissioning Vessels, Other Marine Vessels

SOURCE OF IMPACT	RECEPTOR	MANAGEMENT MEASURE	INVOLVED FACILITY
Entrainment or Impingement of Marine Fish	Marine Fish	Provide screening for cooling water and ballast water intakes on FPSO and Drill Ships to minimize the entrainment of aquatic life, where practical.	FPSO, Drill Ships
Visual Disturbance of Marine Species	Marine Turtles, Seabirds	Where practicable, direct lighting on FPSO and major vessels to required operational areas rather than at the sea surface or skyward.	FPSO, Drill Ships

3.2 Socioeconomic Management Plan

Under planned operations, the Project is expected to have few adverse socioeconomic impacts, and likely an overall positive impact due to increased revenues to the Guyanese government, as well as increased local business activity as a result of Project procurement and employment. Nevertheless, EEPGL is committed to minimizing any anticipated adverse socioeconomic impacts, as well as enhancing positive benefits associated with the Project, through the implementation of a Project-specific Socioeconomic Management Plan (SMP).

3.2.1 Introduction and Scope

The purpose of the SMP is to identify actions that EEPGL or its contractors would implement to avoid, minimize, or mitigate potential adverse socioeconomic impacts from the Project, or to enhance benefits of the Project.

The scope of this plan includes socioeconomic impacts that could potentially result directly or indirectly from the Project, due to activities over which EEPGL exercises control. In addition, specific actions and goals related to local workforce development are addressed separately under a Project-specific Local Content Plan, which is outside the scope of the EIA and ESMP.

3.2.2 Management Measures

3.2.2.1 Stakeholder Engagement

EEPGL has developed a Stakeholder Engagement Plan (SEP) aimed at fostering ongoing communication with stakeholders, toward the objectives of 1) identifying, understanding, and addressing community/stakeholder priorities and concerns, and 2) improving Project decision-making and transparency. The SEP is considered a key component of the SMP and is an evergreen document subject to update throughout the Project as EEPGL conducts more engagement activities and gains further insight and understanding about different stakeholders and their concerns. The full SEP is included as Appendix 2 in the ESMP.

3.2.2.2 Grievance Management

EEPGL has developed a mechanism by which stakeholders (including employees) can provide feedback in the form of issues, concerns, comments, grievances, and which will allow the Project to respond to or address such feedback in a consistent, transparent, and timely manner. The implementation of such a mechanism complements proactive or preventative management policies or procedures already in place, ensuring that when administrative controls do not adequately address an issue, there is recourse for resolution. EEPGL has a Community Grievance Mechanism (CGM), which allows EEPGL and its contractors to receive and respond to stakeholders regarding a range of potential Project activities and impacts. The CGM will apply to all aspects of the Project and will be open to any affected stakeholder. As such, it will play a role in monitoring the effectiveness of other socioeconomic management measures (see Section 3.5, Monitoring Program). EEPGL has the responsibility for day-to-day functioning of the CGM.

Objectives of the CGM are to:

- Provide stakeholders with a mechanism to communicate feedback, issues, or concerns requests and/or complaints to EEPGL in a timely manner so that they can be addressed quickly and proactively;
- Process grievances so they are acknowledged, tracked, and addressed by EEPGL in a timely and confidential manner;
- Continuously improve Project performance in key areas as a result of stakeholder feedback provided through the CGM; and
- Demonstrate EEPGL's commitment to meaningful stakeholder engagement and respect for local opinions and concerns.

Guiding Principles of the CGM

The CGM has been developed in line with the following core principles:

- Ensure communities face no barriers to accessing and using the mechanism;
- Establish the mechanism early on;
- Base the mechanism on a transparent, predictable process and ensure it is well publicized and understood;
- Build trust in the legitimacy and fairness of the mechanism; and
- Create an organizational structure and mind-set that support the mechanism.

Definition of Grievances

Inquiries received by EEPGL will fall into one of five categories defined as follows:

1. Complaint – An expression of discontent, regret, pain, censure, resentment, or grief. A direct, tangible incident along with its alleged damage, impact or dissatisfaction that occurred as a result of company or contractor actions, perceived or actual. Complaints are typically accompanied by a request for resolution and rectification.
2. Concern – A matter that engages a person's attention, interest, or care, or that affects a person's welfare or happiness. Related to questions or requests for information or general perceptions unrelated to a specific impact or incident and/or recorded in an individual grievance. Concerns are good indicators of where stakeholders lack or misunderstand information.
3. Issue – A point in question or a matter that is in dispute, as between contending parties in an action at law. A pre-existing complaint or concern between two non-Project entities, one of which may attempt to use the company's activities as the leverage to achieve resolution. Issues should be transmitted to the entities directly involved along with an explanation as to how they can affect the company. Issues may evolve into loss of the Project's social license to operate if not handled properly.

4. Request – The act of asking for something to be given or done, especially as a favor or courtesy; a solicitation or petition. A communication from a stakeholder asking for something – donation, community project, job, contract, or some other benefit for a group or individual. Requests may evolve into loss of the Project's social license to operate if not handled properly.
5. Guidance – A piece of advice or information aimed at resolving a problem or difficulty, especially as given by someone in authority.

Implementation of the CGM

Project contractors and EEPGL will coordinate in the process of addressing issues on a regular basis. It is the responsibility of Project contractors to report all grievances received, along with the required information for entry into the CGM, and it is the responsibility of EEPGL to investigate each grievance and ensure the grievance is addressed in a timely manner. Contractors will be provided a Project-specific CGM log (consistent with EEPGL's log) to ensure the consistent collection of grievance information, which will be completed and submitted to EEPGL on a periodic basis. This will include:

- Type of grievance - issue, concern, compliant (e.g., property damage, work conditions, noise, traffic);
- Brief description of grievance;
- Status of grievance (registered, assessed, under investigation, in resolution, closed);
- Date grievance was received; and
- Date the incident occurred, if applicable.

The CGM procedure is depicted in Figure 3-2.

As shown in Figure 3-2, stakeholder feedback can be received by EEPGL or its contractors in the following five ways:

1. In person, either to an EEPGL employee, representative or contractor;
2. Via EEPGL telephone - (592) 231 2866, extension 12400
3. Via EEPGL email – Guyanastaff@exxonmobil.com
4. Via EM Guyana Facebook – https://www.facebook.com/exxonmobilguyana
5. Via EEPGL website – www.exxonmobil.com/guyana

Figure 3-2. EEPGL's Five-Step Grievance Management Procedure

Responsible parties must be identified to manage receipt of the grievances at each feedback avenue, and these individuals must be trained in proper documentation of information and timely input of the data into the database. Upon receipt, EEPGL will register the grievance in a CGM database, determine the appropriate responsible party, and forward the grievance to that party for resolution. As is required by the type of grievance, the responsible party will then undergo investigation activities as appropriate for resolution and appropriate response to the grievant. Once resolved, a summary of the grievance resolution will be entered into the CGM database to allow for tracking and reporting. This consolidated database will also allow for the monitoring of Project-wide trends and for identification of potential recurring issues associated with specific contractors or Project activities.

Receipt, registration, prioritization, and resolution of grievances using the CGM should adhere to the following guidelines:

a. Established forms to be filled in with all necessary information – clarify that if a grievance is submitted verbally, it must be transcribed as soon as practicable thereafter.

b. Details should be compiled – electronically if possible, and registers of chain of custody and communication must be established.

c. When a grievance is received with a name attached, the grievant must be notified within a specific timeline that their grievance has been registered, as well as provided with a timeline for future activities, including the timeline by when the Project should have a proposed resolution.

d. When a grievance is received without a name attached, the grievance must be addressed and documented within a pre-specified timeframe. If relevant and practicable (for example in the case of worker grievances), information on the grievance and how it has been addressed should be disseminated publicly. This should in no way infringe on the confidentiality of any grievant.

e. Where necessary/relevant an interview with the grievant could be helpful to obtain further details.

f. Specified timeframes should be established for confirming receipt of the grievance, completing the investigation, and providing a resolution.

g. Options for resolution should include: unilateral response; bilateral response (the aggrieved party and EEPGL developing a solution together); third party response (though a mediator); or through a judicial process as appropriate, outside of the CGM. Given that the purpose of the mechanism is to proactively address concerns before they escalate, it is important to maximize the opportunities for bilateral response wherever practicable.

CGM Mechanism Monitoring

In addition to monitoring the effectiveness of the CGM itself, data from the CGM can be a useful tool in monitoring the effectiveness of management measures for a range of EEPGL and Project aspects, in combination with other resource-specific monitoring indicators. CGM indicators that should be monitored include:

- Number and type of grievances registered within the reporting period (e.g., monthly, quarterly, or annually);
- Number of grievances closed during the reporting period; and
- Average time for processing and resolution of grievances.

Monitoring of these indicators will allow EEPGL to identify trends across the Project phases, activities and facilities, allowing for adjustment of the CGM or other management plans and procedures.

It should be understood that receipt of a large number of grievances does not necessarily indicate poor Project performance; a large number could in fact be indicative of high quality engagement and dialogue between the Project and the community. The goal of the CGM mechanism process should therefore not be to reduce the number of grievances received, but rather to develop and maintain trust and confidence on the part of the community that, when valid grievances arise, EEPGL will respond appropriately. Ensuring the same types of grievances are not raised repeatedly, and maintaining a reasonable average time to achieve closure of grievances, are key indicators of good performance.

3.2.2.3 Socioeconomic Management Measures

EEPGL will implement measures to manage potential socioeconomic impacts as listed in Table 3-4.

3.2.2.4 Marine Transportation

EEPGL will implement measures to manage potential impacts on marine transportation, inclusive of marine safety risks, as listed in Table 3-5.

3.2.2.5 Air and Road Transportation

EEPGL will implement measures to manage potential impacts on air and road transportation, inclusive of road safety risks, as listed in Table 3-6.

Table 3-4. Socioeconomic Management Measures

SOURCE OF IMPACT	RECEPTOR	MANAGEMENT MEASURE	INVOLVED FACILITY
Project Employment	Guyanese Population	Utilize Guyanese nationals where reasonably practical. Partner with select local institutions and agencies to support workforce development programs and proactively message Project-related employment opportunities.	N/A
Project Procurement	Guyanese Population	Procure Project goods and services locally when available, and when they meet minimum standards and when commercially competitive. Engage with local area agricultural development co-ops to identify potential supply contract opportunities.	N/A
Project Workforce	Guyanese Population	Develop a Worker Code of Conduct that includes requirements for interaction with local communities while on shore-leave. Ensure that contract agreements require strict adherence to the Code of Conduct.	N/A
Waste Generation	Land Use Waste Management	Perform onboard waste incineration for certain categories of waste, thereby reducing demand on landfill capacity.	FPSO
Project Workforce	Guyanese Population	Provide trained medical personnel onboard both the FPSO and major installation vessels to minimize reliance on medical infrastructure and facilities in Guyana	FPSO, Drill Ships, Installation Vessels
Various	Guyanese Population	Implement a transparent, accessible, and consistent CGM mechanism early on, prior to onset of Project activities. Ensure CGM mechanism is well publicized and understood by the public.	N/A
Various	Guyanese Population	Develop and implement a Stakeholder Engagement Plan.	N/A
Various	Guyanese Population	Monitor grievances received and resolved by the CGM mechanism; adjust CGM mechanism, and other management measures, as appropriate (see Section 3.5: Monitoring Program).	N/A

Table 3-5. Marine Transportation Management Measures

SOURCE OF IMPACT	RECEPTOR	MANAGEMENT MEASURE	INVOLVED FACILITY
Marine Casualty Event (Collision)	Non-Project Marine Vessels	• Use a Class 3 Dynamic Positioning (DP) system, which includes numerous redundancies; • Ensure rigorous personnel qualifications and training; • Use seatrials and acceptance criteria; • Continuous DP proving trials; • Conduct a System Failure Mode and Effects Analysis; • Conduct a continuous DP failure consequence analysis; and; • Establish well-specific operations guidelines.	Drill Ships
Marine Casualty Event (Collision)	Non-Project Marine Vessels	• Utilize a Mooring Master from the FPSO located onboard the offloading tanker to support safe tanker approach/departure and offloading operations.	FPSO, Offloading Tankers
Marine Casualty Event (Collision)	Non-Project related Marine Vessel Traffic	• Utilize support tugs to aid tankers in maintaining station during approach/departure from FPSO and during offloading operations	FPSO, Offloading Tankers
Increased Vessel Traffic; Marine Casualty Event (Collision, Grounding); Reduced Ocean Surface Area Available for Non-Project Activities	Commercial Cargo and Fishing Vessels; Subsistence Fishing Vessels	• Observe standard international and local navigation procedures in and around the Georgetown Harbour and Demerara River, as well as best ship-keeping and navigation practices while at sea, shall be implemented. This includes Notice to Mariners, Trawlers Association, and Co-ops. • Inform relevant authorities regarding planned major vessel movements. • Provide Notices to Mariners and other communication materials regarding major vessel movements and ensure marine safety exclusion zones are issued through MARAD to alert mariners of the installation/drilling activities. • Conduct an augmented stakeholder engagement process (along with relevant authorities) to identify and communicate with maritime users who might not ordinarily receive Notices to Mariners.	Shorebase, FPSO, Drill Ships, Installation / Decommissioning Vessels, Other Support Vessels

SOURCE OF IMPACT	RECEPTOR	MANAGEMENT MEASURE	INVOLVED FACILITY
		• Ensure Project-related vessels have radar systems and communication mechanisms to communicate with third party mariners. • Maintain marine safety exclusion zones around the Drill Ships, FPSO, and major installation vessels. • Implement a Stakeholder Engagement Plan that includes a Community Grievance Mechanism (CGM) process for stakeholders, including local fishing interests. • Monitor engagement with fishing communities to record locations of fisheries activities and to check for adherence to communications protocol and grievances follow up.	

Table 3-6. Air and Road Transportation Management Measures

SOURCE OF IMPACT	RECEPTOR	MANAGEMENT MEASURE	INVOLVED FACILITY
Increased Aviation Traffic	Other Aircraft and Users of Ogle Airport	• Coordinate with relevant aviation authorities and stakeholders to understand peak Project-related utilization rates.	FPSO, Drill Ships
Increased Vehicular Traffic	Road Users (e.g. Drivers, Cyclists, and Pedestrians)	• Develop an onshore logistics/journey management program to reduce potential conflicts with local road traffic when transporting goods to/from onshore support facilities.	Shorebase, Waste Management Facility, Other Onshore Support Infrastructure
Increased Vehicular Traffic	Road Users (e.g., Drivers, Cyclists, Pedestrians)	Define typical, primary travel routes.	Shorebase and Onshore Support Infrastructure
Vehicular Incidents	Road Users (e.g., Drivers, Cyclists, Pedestrians)	Define required driver training for Project-dedicated drivers, including (but not limited to) defensive driving, loading/ unloading procedures, and safe transport of passengers, as applicable.	Shorebase and Onshore Support Infrastructure
Vehicular Accidents	Road Users (e.g., Drivers, Cyclists, Pedestrians)	Designate and enforce speed limits, through speed governors, GPS, or other monitoring systems for Project-dedicated vehicles.	Shorebase and Onshore Support Infrastructure
Increased Vehicular Traffic	Road Users (e.g., Drivers, Cyclists, Pedestrians)	Avoid deliveries during typical peak traffic hours or scheduled closure of the Demerara Harbour Bridge to road traffic, to the extent reasonably practicable.	Shorebase and Onshore Support Infrastructure
Vehicular Breakdowns; Traffic Congestion	Road Users (e.g., Drivers, Cyclists, Pedestrians); Project Drivers	Define vehicle inspection and maintenance protocols that include all applicable safety equipment for Project-dedicated vehicles.	Shorebase and Onshore Support Infrastructure
Vehicular Accidents	Local Communities	Implement a community safety program for potentially impacted schools and neighborhoods to improve traffic safety.	Shorebase and Onshore Support Infrastructure

3.2.2.6 *Cultural Heritage Management and Chance Finds*

Cultural Heritage Management Plan

EEPGL will implement a Cultural Heritage Management Plan (CHMP) aligned with international best practice and the National Trust's "¨Guidelines for the protection of Monuments and Sites"2 to protect cultural heritage that is inadvertently discovered during drilling and installation activities. The CHMP includes a Cultural Heritage Monitoring Plan, Chance Find Procedure, and Cultural Heritage Training Program, as described below.

Cultural Heritage Monitoring Program

In consultation with the Guyana National Trust (GNT) and other relevant cultural heritage stakeholders, EEPGL will implement a Cultural Heritage Monitoring Program for all activities that disturb the seafloor. The purpose of this monitoring is to identify, record, and protect cultural heritage that was not identified during pre-drilling or pre-installation cultural heritage investigations. Monitoring will be conducted by Project staff supported by a remote professional cultural heritage specialist (CHS) who will be on call to assess any potential chance finds that are identified. Cultural heritage monitoring will be conducted by any EEPGL or contractor staff with the potential to discover underwater cultural heritage, which would generally be limited to AUV/ROV operators. These staff will be responsible for reporting any potential chance finds to Project management, who would then notify the CHS.

Chance Find Procedure

The following types of underwater cultural heritage, while not likely present based on studies conducted to date, could potentially be encountered during the drilling or installation stages:

- Shipwrecks or parts thereof; and
- Artifacts from debris fields associated with shipwrecks.

The Chance Find Procedure will use a two-tiered approach for identifying, assessing, and resolving potential chance finds. The purpose of this approach is to utilize an on-call CHS to resolve minor chance finds without necessitating consultations with the GNT, and to minimize Project delays by allowing for the quick resolution of non-significant finds. The defining characteristics of each chance find tier and the processes for assessing them and determining if consultation is required will be developed in consultation with the GNT and other cultural heritage stakeholders prior to the drilling and installation programs, as appropriate.

All potential chance finds identified will be reported as soon as practicable (i.e., within approximately 24 hours) to EEPGL and the designated CHS, using the Chance Find Reporting Form in Figure 3-3. The CHS will determine if the potential chance find is cultural heritage and, if so, assign it to a chance finds tier. Figure 3-4 provides a detailed flow diagram of the Chance

[2] Guyana National Trust. "Guidelines for the Protection of Monuments and Sites." Revised 2017.

Find Procedure. All chance finds will follow the two-tiered hierarchy that is presented in Table 3-7.

Since little to no material from the seafloor is expected to be brought to the surface, the collection of artifacts is not anticipated. In the unlikely event underwater chance finds are accidentally brought to the surface, they should be immediately placed in a container filled with sea water from the area of the find and maintained indefinitely, as exposure to the air can cause artifacts that have been underwater to decompose or oxidize very rapidly. Documentation of the find, including photographs of the artifact(s) with a scale included in the frame, should be made immediately. Artifacts and associated documentation and photographs taken by Project personnel should be given to the designated CHS.

Although recovery of underwater artifacts to the surface is not anticipated, any recovered artifacts would belong to the Guyanese government. All recovered artifacts would be handled in accordance with the guidance provided by the Guidelines and EEPGL would be responsible for providing recovered artifacts to the GNT. For underwater chance finds not brought to the surface, such as shipwrecks or associated debris fields, avoidance is the preferred approach, as excavation of underwater archaeological sites is costly and time consuming. Specific management guidance will be provided by the Project for each cultural heritage site identified and documented.

The Project will maintain records on chance finds and the implementation of treatment plans. These may include:

- Reports that describe chance finds identified, the results of chance find assessments, internal and external communications and instructions, and supporting documentation (or other reference materials as appropriate); and
- Any additional reports prepared to fulfill specific requirements of the GNT.

Cultural Heritage Training Program

Project and Project contractor personnel with the potential to identify underwater chance finds (e.g., AUV/ROV operators) will receive awareness training in the identification of chance finds and the Chance Find Procedure as described above. The Project will develop training materials, such as a quick reference hand-out, which will be provided to applicable Project personnel. The Project will maintain records of all chance find training provided to Project personnel.

EEPGL and its contractors will establish the communication and engagement protocols for the on-call CHS. The Project contractors will designate personnel that require cultural heritage awareness training. The training will provide the necessary information on how to identify and respond to chance finds.

All Project personnel who may have contact with cultural heritage objects will be made aware that it is illegal and forbidden to disturb or remove cultural heritage objects offsite for personal gain.

Figure 3-3. Chance Find Reporting From

Chance Find Reporting Form

Date of find:

Location of find (description and GPS):

Project person making the find:

Project person notified of the find:

Date notified:

Time notified:

Cultural Heritage Specialist notified of the find:

Date notified:

Time notified:

Description of the find:

Description of the initial response to the find:

Prescribed treatment methodology for the find and any needed modifications to Project execution:

Date of handover of the artifact(s), if recovered to surface:

Recipient of the artifact(s), if recovered to surface:

Date of closure of the chance find:

Figure 3-4. Chance Find Procedure Flow Chart

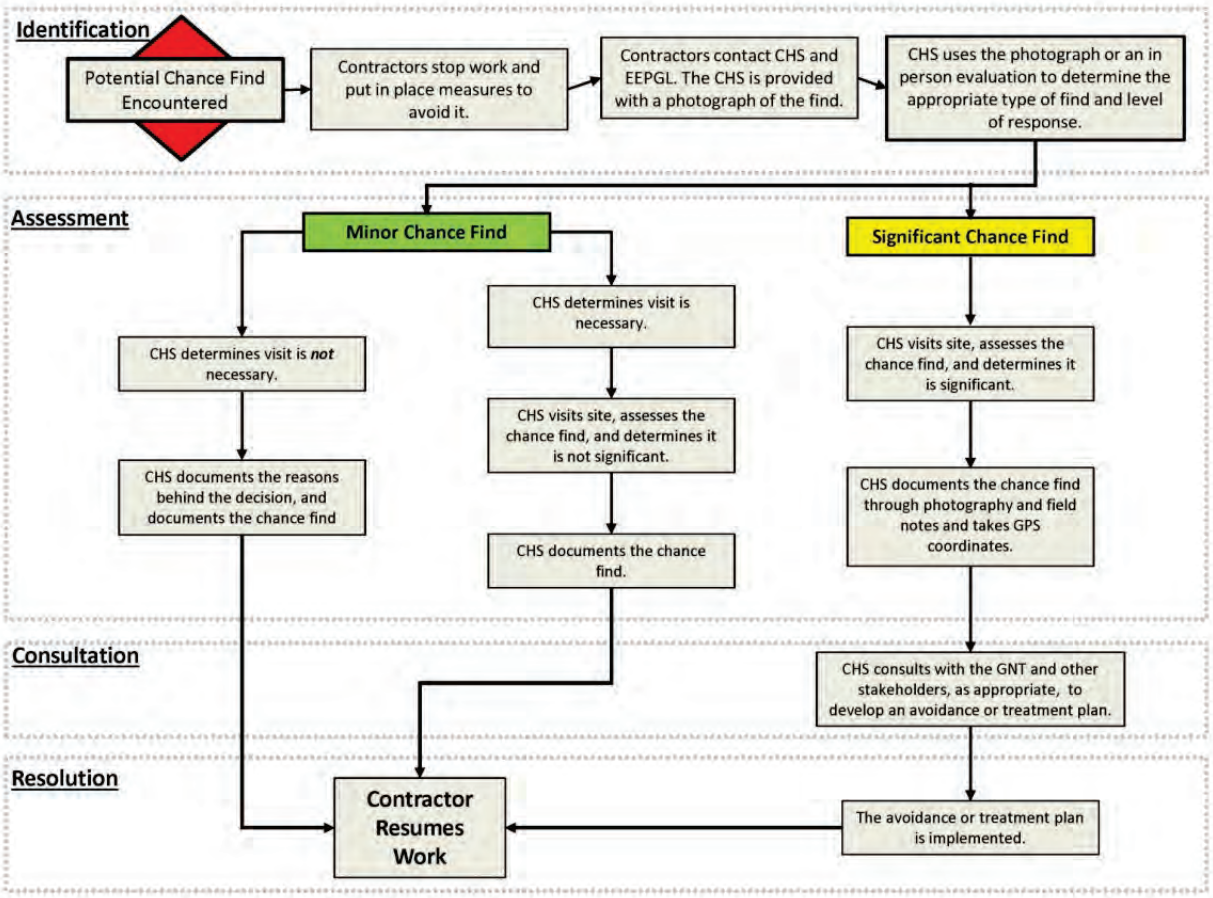


Table 3-7. Two-tiered Chance Find Hierarchy

Chance Find Type	Characteristics	Evaluation Process
Minor Chance Finds	Modern features or objects that do not meet the criteria for cultural heritage under Guyana laws and regulations.	Drilling and installation activities will stop in the area of the find as soon as safely possible, where appropriate and where practical. The potential chance find will be reported to EEPGL (if found by a contractor) and the CHS within approximately 24 hours. In the unlikely event an artifact is brought to the surface, the CHS will determine if a site visit is necessary to examine the artifact. If the potential chance find is discovered in situ, the CHS will examine images collected from the ROV. If the CHS determines that it is a minor chance find, drilling and installation activities will resume in the area. Drilling and installation activities will not be stopped if there is no reasonable expectation that the potential chance find would not be disturbed/damaged.
Significant Chance Finds	Significant historic features (e.g., shipwrecks), objects (i.e., artifacts), or human remains that meet the criteria for cultural heritage under Guyana laws and regulations.	Drilling and installation activities will stop in the area of the find as soon as safely possible, where appropriate and where practical. The potential chance find will be reported to EEPGL (if found by a contractor) and a CHS within approximately 24 hours. In the unlikely event an artifact is brought to the surface, the CHS will determine if a site visit is necessary to examine the artifact. If the potential chance find is discovered in situ, the CHS will examine images collected from the ROV. If the CHS determines that it is a significant chance find, the CHS will develop an avoidance or treatment plan in consultation with the GNT. Installation activities will resume in the area upon acceptance of the avoidance plan or completion of the treatment plan. Drilling and installation activities will not be stopped if there is no reasonable expectation that the potential chance find would not be disturbed/damaged.

3.3 Oil Spill Response Plan

The Project's Oil Spill Response Plan has been submitted separately as a supporting document to the Project EIA.

3.4 Preliminary End of Operations Decommissioning Plan

The Preliminary End of Operations and Decommissioning Plan can be found in Appendix 3 of the ESMP.

3.5 Environmental and Socioeconomic Monitoring Plan

EEPGL will implement an Environmental and Socioeconomic Monitoring Plan to assess the accuracy of the residual impact predictions in the EIA and to assess the effectiveness of the management measures described in this ESMP and other supporting plans. This section provides a monitoring framework that describes the specific monitoring activities EEPGL will undertake upon commencement of development drilling to validate the findings of the EIA, ensure the effective implementation of the management measures described in Section 3.1 through 3.4, track environmental and socioeconomic performance, and adjust Project operations or mitigations, if necessary, through the life of the Project.

Monitoring activities for environmental and socioeconomic resources in Table 3-8 are generally organized by resource / receptor. The table also identifies the specific Project components each monitoring activity is intended to monitor. The specific monitoring activities included in Table 3-8 were selected based on the findings of the EIA; level of stakeholder interest in specific impacts and receptors, as assessed through the stakeholder engagement process; and the EPA's prior monitoring requirements for exploration activities in the Stabroek Block.

At the time this ESMP was prepared, the contracts for key components of the Project had not been finalized, so it was not possible to assign responsibility for implementing specific components of the monitoring program. EEPGL will ultimately be responsible for all monitoring, but may delegate some responsibility to contractors. The ESMP is intended to be a "living" document and will be updated to assign these responsibilities as contracts are finalized and responsible parties can be identified. The ESMP will also be updated as necessary throughout the operational stage of the Project to maximize the value of the data collected, capture lessons learned, achieve continuous improvement, and ensure cost-effective tracking of the Project's environmental and socioeconomic performance over time.

Table 3-8. Environmental and Socioeconomic Monitoring Measures

SOURCE OF POTENTIAL IMPACT	ACTIVITY	INVOLVED FACILITIES	HOW MONITORING IS PERFORMED	FREQUENCY OF MONITORING	RESPONSIBLE PARTY	REPORTING
VARIOUS RECEPTORS						
Various	Perform regular audits of field operations on the drill ships, FPSO, and shorebase to ensure application of designed safeguards.	FPSO, Drill Ships, Shorebase	Periodic audits of field operations	Annual	EEPGL	None.
AIR QUALITY						
GHG Emissions	Quantify direct Project GHG emissions from the Project facilities and equipment utilized.	FPSO, Drill Ships, Installation/ Decommissioning Vessels and Support Vessels, Shorebase	1.) Fuel usage and specifications (see vessel and helicopter-related procedures in following 2 rows) will be collected from each vessel and from the shorebase (includes helicopter fuel use). 2.) Greenhouse gas emissions (e.g., CO_2 and Methane) will be calculated based on mass balance considerations, taking into account the volume and composition of the gas and diesel consumed, which reflects directly the total emissions of CO_2-equivalents that would be generated through combustion. This method is consistent with industry standard practices. a.) For combustion sources aside from the flare, combustion is assumed to be complete, and methane and VOC are calculated using standard emissions factors.	GHG emissions will be calculated annually for the previous year.	EEPGL	Annual Compliance Report

SOURCE OF POTENTIAL IMPACT	ACTIVITY	INVOLVED FACILITIES	HOW MONITORING IS PERFORMED	FREQUENCY OF MONITORING	RESPONSIBLE PARTY	REPORTING
			b.) For the flare (FPSO only), combustion is assumed to be at 98%, with the remaining gas passing through uncombusted. CO_2 emissions are calculated by mass balance on carbon in the combusted (98%) volume. Methane and VOC emissions are calculated using the uncombusted (2%) volume and gas composition.			
Combustion Emissions	Monitor on an ongoing basis the volume of fuel used by all combustion sources and equipment on FPSO and other marine vessels.	FPSO, Drill Ships, Installation/ Decommissioning Vessels and Support Vessels	On the FPSO, fuel usage for each combustion source will either be directly metered or estimated based on run hours, engine size, or other appropriate methodology. a.) Total FPSO fuel gas usage will be metered and allocated to the various combustion equipment based on run hours, equipment type and specifications (e.g., engine size), or other relevant factors. b.) Diesel fuel usage will be estimated based on diesel run hours. In some cases, this will be tracked automatically using computer systems. In other cases, run hours will be recorded and tracked manually in a log book. For the drill ships and other vessels, each vessel has the technical means to measure the consumption of fuel on a daily manner using flow meters, gauges, etc. Fuel consumption information will be included in daily reports and provided to EEPGL on a monthly basis.	Data will be collected monthly from each vessel.	EEPGL	Fuel usage and specifications will be the basis for air emission calculations, which will be provided in the Annual Compliance Report

SOURCE OF POTENTIAL IMPACT	ACTIVITY	INVOLVED FACILITIES	HOW MONITORING IS PERFORMED	FREQUENCY OF MONITORING	RESPONSIBLE PARTY	REPORTING
Combustion Emissions	Monitor volume of fuel used for helicopter operation.	Helicopters	The aviation contractor will provide a summary of helicopter trips to FPSO, Drill Rig, and any large Installation vessels (with helidecks) and the fuel usage for each trip.	Data will be collected monthly from the aviation contractor.	EEPGL	Fuel usage and specifications will be the basis for air emission calculations which will be provided in the Annual Compliance Report Additionally, fuel usage for helicopters will be provided in a monthly summary.
Combustion Emissions	Keep records of non-routine flaring of produced gas.	FPSO	To accommodate measurement of non-routine flaring, flow meters will be installed at the High Pressure and Low Pressure piping that lead to the flare in order to directly measure the total amount of gas flared. Flare gas volume is stored in plant digital computer system.	Continuous	EEPGL	Total amount of gas flared, composition and corresponding dates will be provided to EPA in the Annual Compliance Report Reporting and recordkeeping of Annual Air Emissions will be performed as required for New and Existing Operations utilizing the approved form.
FPSO Emissions	An air emissions inventory report will be prepared annually.	FPSO	An air emissions inventory will include PM, SO_2, NO_x, CO, VOCs and GHGs.	Annually	EEPGL	Annual Compliance Report

SOURCE OF POTENTIAL IMPACT	ACTIVITY	INVOLVED FACILITIES	HOW MONITORING IS PERFORMED	FREQUENCY OF MONITORING	RESPONSIBLE PARTY	REPORTING
FPSO Emissions	Monitor flare performance to maximize efficiency of flaring operation.	FPSO	The flare system is designed to maximize efficiency. The volume of pilot gas can be adjusted as needed to optimize efficiency. The pilot will be maintained to ensure safety of the facility.	Continuous	EEPGL	None.
WATER QUALITY						
Drilling Discharges	Prior to and post-drilling, an ROV will take pictures of the area immediately surrounding the well location to monitor for marine water quality impacts.	Drill Ships	Before and after photos will be provided in End of Well Report for each well.	Before and after drilling at each well	EEPGL	End of Well Reports will be submitted within 90 days following the completion of drilling operations for each well.
Drilling Discharges	Monitor daily during drilling to ensure that end of well maximum weighted mass ratio averaged over all well sections drilled using non-aqueous fluids (NAF) shall not exceed 6.9 percent wet weight base fluid retained on cuttings.	Drill Ships	1.) Measurement is taken in the field daily following industry standard procedures. 2.) The percentage of fluids retained on cuttings is documented daily in a log. 3.) Once the well is complete, an average retained NAF on cuttings (%) is documented.	Daily	EEPGL	The averaged retained NAF on cuttings (%) will be supplied to EPA in the End of Well Report for each well. End of Well Reports will be submitted within 90 days following the completion of drilling operations for each well.
Operational Discharges	Monitor daily produced water discharge volume.	FPSO	The volume of the produced water discharge will be metered and recorded in the FPSO digital computer system.	Continuous	EEPGL	The total volume of produced water discharged will be documented in the Annual Compliance Report.

SOURCE OF POTENTIAL IMPACT	ACTIVITY	INVOLVED FACILITIES	HOW MONITORING IS PERFORMED	FREQUENCY OF MONITORING	RESPONSIBLE PARTY	REPORTING
Operational Discharges	Measure oil and grease content of produced water (grab sample once per day).	FPSO	A minimum of one grab sample will be taken each day to ensure compliance with the daily maximum oil in water content of 42 mg/L. Samples will be analyzed for oil and grease content using an industry standard method in the lab on board the FPSO. Results will be documented in a log. A monthly average will be recorded to ensure compliance with the monthly average oil in water content of 29 mg/L.	Daily	EEPGL	Daily maximums and monthly averages will be documented and provided in the Annual Compliance Report.
Operational Discharges	Perform daily inspections to verify no visible sheen from discharge of cooling water.	FPSO	Routine overboard observations are part of overall surveillance program.	Daily	EEPGL	Confirmation that no visual sheens observed from cooling water discharge will be documented and provided in the Annual Compliance Report.
Operational Discharges	Monitor discharge temperature of cooling water and produced water to avoid increases in ambient water temperature of more than 3°C at 100 m (~328 feet).	FPSO	Thermal dynamic modeling of cooling water discharge and produced water discharge has been completed. Modeling results depict that as long as temperature of cooling water discharge or produced water discharge does not exceed 50°C, ambient water temperature will not rise by more than 3°C at 100m. Temperature transmitter on cooling water system and produced water system upstream of discharge point will provide an instantaneous measurement.	Continuous	EEPGL	The maximum and average daily temperature of cooling water and produced water discharge will be documented in the Annual Compliance Report.
Operational Discharges	Utilize load monitoring system in the FPSO control room to support FPSO offloading.	FPSO	A load monitoring system will consist of fixed and portable equipment that allows for continuous monitoring of the hawser tension between the FPSO and Export Tanker. In addition, offloading activities	Continuous during offloading	EEPGL	None.

SOURCE OF POTENTIAL IMPACT	ACTIVITY	INVOLVED FACILITIES	HOW MONITORING IS PERFORMED	FREQUENCY OF MONITORING	RESPONSIBLE PARTY	REPORTING
			will be actively monitored by FPSO personnel to visually identify leaks, and volumetric checks will be performed on FPSO and Export Tanker during offloading.			
Operational Discharges	Monitor pressure and temperature of subsea wells and manifolds by a control system on the FPSO to detect and prevent leaks.	FPSO	Temperature and pressure are continuously monitored by operators and surveillance engineers utilizing temperature and pressure transducers located on the subsea equipment. Alarms built in to the control system will notify the operators of temperatures or pressures outside the normal operating range. The system will be designed to automatically shut-in any wells should the transducers detect anything outside of the operating ranges.	Continuous	EEPGL	None.
Operational Discharges	Monitor chlorine concentration of treated sewage discharges.	FPSO, Drill Ships, Installation/ Decommissioning Vessels, and Support Vessels	On the FPSO, a minimum of one grab sample will be taken each week. Samples will be analyzed for chlorine concentration using an industry standard method on board vessels. Results will be documented in a log. Other Project vessels, including the drill ship, will be fitted with a MARPOL Annex IV approved sewage treatment system to comminute and disinfect the sewage.	Weekly (FPSO)	EEPGL	Weekly sampling results will be documented and provided in the Annual Compliance Report.
Operational Discharges	Perform daily visual inspection of discharge points to ensure absence of floating solids on the water.	FPSO, Drill Ships, Installation/ Decommissioning Vessels, and Support Vessels	Routine overboard observations will be part of the overall surveillance program.	Daily	EEPGL	Confirmation that no floating solids were observed will be documented and provided in the Annual Compliance Report.

SOURCE OF POTENTIAL IMPACT	ACTIVITY	INVOLVED FACILITIES	HOW MONITORING IS PERFORMED	FREQUENCY OF MONITORING	RESPONSIBLE PARTY	REPORTING
Operational Discharges	Record estimated quantities of grey water, black water, and comminuted food waste discharged (based on number of persons on board [POB] and water consumption) in Garbage Record Book.	FPSO, Drill Ships, Installation/ Decommissioning Vessels, and Support Vessels	Grey Water/Black Water/Food Waste discharges will be based on POB per MARPOL.	Daily	EEPGL	Discharge summaries of Grey Water/Black Water/Food Waste will be documented and provided in the Annual Compliance Report. Additionally, discharge summaries of Grey Water/Black Water/Food Waste for marine support vessels will be provided in a monthly summary.
Operational Discharges	Perform oil in water content (automatic) monitoring of Bilge Water to ensure compliance with 15 ppm MARPOL limit and record in Oil Record Book;	FPSO, Drill Ships, Installation/ Decommissioning Vessels, and Support Vessels	The FPSO, Drill Ship and Installation/ Decommissioning/ Support vessels will be required to have a water treatment system per MARPOL. Discharges will be recorded in MARPOL Annex I Oil Record Book.	Continuous	EEPGL	Confirmation that bilge water discharge was < 15 mg/L will be documented in the Annual Compliance Report.
Operational Discharges	Record estimated volume of ballast water discharged and location (per ballasting operation).	FPSO, Drill Ships, Installation/ Decommissioning Vessels, and Support Vessels	Ballast Water discharge measurement will be described in the vessel's Ballast Water Management Plan. All ballast water discharges and associated volumes will be recorded in a log book. Specifically for the FPSO, ballast water discharge will be estimated using level gauges (sounding pipe) that are installed in the tanks and conversion tables.	Per ballasting operation	EEPGL	Ballast Water Management Plans for each vessel will be submitted to the EPA. Ballast Water discharge volumes will be documented and provided in the Annual Compliance Report.

SOURCE OF POTENTIAL IMPACT	ACTIVITY	INVOLVED FACILITIES	HOW MONITORING IS PERFORMED	FREQUENCY OF MONITORING	RESPONSIBLE PARTY	REPORTING
WASTE						
Waste	Record type and quantity of each individual waste stream on board any time a new waste is generated.	FPSO, Drill Ships, Installation/ Decommissioning Vessels, and Support Vessels	FPSO and Drill Ship will maintain an inventory of wastes per Environmental Permit condition 5.8. A log (i.e., IMO MARPOL Annex V Garbage Record Book) is kept on Project vessels to track wastes generated and discharged (e.g., food waste), incinerated (e.g., paper/wood, waste oils), and sent to shore (e.g., domestic, operational wastes).	Ongoing	EEPGL and its contractors	Annual types and quantities of wastes including hazardous waste generated, treatment, and disposal (both onshore and offshore) will be provided to the EPA in the Annual Compliance Report.
Waste	Daily inspect waste storage area and containers; log inspections.	FPSO, Drill Ships, Installation/ Decommissioning Vessels, and Support Vessels	Visual inspections of waste storage areas on board Project vessels will occur daily. Inspections will verify proper labelling of wastes, proper segregation, and container integrity.	Daily	EEPGL and its contractors	None.
Waste	Document marine waste transfer.	FPSO, Drill Ships, Installation/ Decommissioning Vessels, and Support Vessels, Shorebase	Waste transfers from sea to shore will be documented via logs (i.e., IMO MARPOL Annex V Garbage Record Book) on board the Project vessels and via garbage disposal receipts from onshore facilities.	As required	EEPGL and its contractors	None.
Waste	Sample and perform analytical testing as needed to properly classify waste.	Waste Management Facility	Sampling and analytical testing will generally be performed by the waste contractor at the waste contractor's onshore Waste Management Facility in order to verify that all wastes are classified and disposed of properly.	As needed	EEPGL and its Waste Contractor	Records will be kept by the onshore waste contractor.
Waste	Complete Recoverable Material and Waste Summaries.	FPSO, Drill Ships, Installation/ Decommissioning Vessels, and Support Vessels	FPSO and Drill Ship will maintain an inventory of wastes per Environmental Permit Condition 5.8. A log (i.e., IMO MARPOL Annex V Garbage Record Book) is kept on Project vessels to track wastes	Ongoing	EEPGL	Annual types and quantities of wastes including hazardous waste generated, treatment, and

SOURCE OF POTENTIAL IMPACT	ACTIVITY	INVOLVED FACILITIES	HOW MONITORING IS PERFORMED	FREQUENCY OF MONITORING	RESPONSIBLE PARTY	REPORTING
			generated and discharged (e.g., food waste), incinerated (e.g., paper/wood, waste oils), and sent to shore (e.g., domestic, operational wastes).			disposal (both onshore and offshore) will be provided to the EPA in the Annual Compliance Report.
Waste	Complete and submit reports required per the Environmental Permit.	FPSO, Drill Ships, Installation/ Decommissioning Vessels, and Support Vessels	Logs (i.e., IMO MARPOL Annex V Garbage Record Book), receipts, and manifests will be gathered from all Project vessels from the previous calendar year.	Annually	EEPGL	Annual types and quantities of wastes including hazardous waste generated, treatment, and disposal (both onshore and offshore) will be provided to the EPA in the Annual Compliance Report.
Waste	Conduct waste facility audits and inspections periodically.	Waste Management Facility	Inspections of contractor onshore waste management facility will occur periodically, at least annually. Comprehensive audits will be performed at a minimum of every 3 years with more frequent audits performed based on performance. Waste facility audits will be documented and made available upon request.	Annually	EEPGL	Inspections and audits will be documented and kept on file and provided upon request.
MARINE ECOSYSTEMS						
Marine Mammals and Turtles	Monitor on an ongoing basis visual detections of Marine Mammals and Marine Turtles	FPSO, Drill Ships, Installation/ Decommissioning Vessels, and Support Vessels	Training on known marine mammals and turtles in the project vicinity will be provided to workers on offshore vessels. Workers will be trained to report any marine mammal or turtle sightings to a designated person on board. The designated person will keep a log of all marine mammal and turtle sightings.	As sighted	EEPGL and its contractors	The inventory of marine mammals and turtles observed will be provided to EPA in the Annual Compliance report.

SOURCE OF POTENTIAL IMPACT	ACTIVITY	INVOLVED FACILITIES	HOW MONITORING IS PERFORMED	FREQUENCY OF MONITORING	RESPONSIBLE PARTY	REPORTING
SOCIOECONOMIC RECEPTORS						
Project Employment	Monitor percentage of Project Workforce made up of Guyanese nationals.	N/A	Project contractors and suppliers are required to report workforce details to EEPGL on a quarterly basis.	Quarterly	EEPGL and its contractors and suppliers	Reporting will be on a semi-annual basis 30 days after the end of the six month period to the Ministry of Natural Resources.
Project Procurement	Monitor percentage of Project goods and services expenditures procured locally on a calendar year basis.	N/A	Project contractors and suppliers are required to report amount of local spend and number of local vendors utilized on a quarterly basis.	Quarterly	EEPGL and its contractors and suppliers	Reporting will be on a semi-annual basis 30 days after the end of the six month period to the Ministry of Natural Resources.
Various	Track number and types of complaints received via the Project Community Grievance Mechanism (CGM).	N/A	Complaints/grievances will be reported and documented in the EEPGL Stakeholder Database.	As required	EEPGL	None.
Various	Monitor average time for processing and resolution of grievances.	N/A	Grievances will be formally tracked in a database and stewarded to resolution. The average time for processing and resolving grievances will be continually monitored as a key performance metric.	Continuously	EEPGL	None.
Various	Track percentage of grievances resolved.	N/A	Grievances will be formally tracked in a database and stewarded to resolution. The percentage of grievances resolved will be continually monitored as a key performance metric.	Continuously	EEPGL	None.
Hearing Impairment	Monitor Project workers' occupational exposure to sound.	All	Worker hearing protection program with exposure limits will be in place. Areas requiring double or single hearing protection will be clearly marked.	Continuously	EEPGL	None.

SOURCE OF POTENTIAL IMPACT	ACTIVITY	INVOLVED FACILITIES	HOW MONITORING IS PERFORMED	FREQUENCY OF MONITORING	RESPONSIBLE PARTY	REPORTING
Communicable Disease	Subject project workers to health screening procedures to minimize risks of communicable diseases	All	Tests for diseases that are communicable through normal medical screening/ surveillance.	Upon mobilization and periodically thereafter	EEPGL	None.
VEHICLE AND VESSEL TRAFFIC						
Onshore Vehicular Traffic	Monitor vehicular speed for Project-dedicated vehicles through speed governors, GPS, or other monitoring systems.	Onshore Travel Routes	Project-dedicated vehicles will be monitored through speed monitoring, GPS, and a web based tool for vehicle tracking.	Continuously	EEPGL	None.
Onshore Vehicular Traffic	Monitor driver fatigue (e.g., supervision, administrative constraints for work and rest periods, etc.) for Project-dedicated drivers.	Onshore Travel Routes	Drivers dedicated to the Project will be monitored for fatigue and will follow administrative controls (e.g. defined work and rest periods) to reduce risk.	Annual reviews of contractor performance	EEPGL and its contractors	None.
Marine Vessel Traffic	Record instances of marine vessels entering marine safety exclusion zones.	FPSO, Drill Ships, Installation/ Decommissioning Vessels	A 500 m marine safety exclusion zone will be maintained around the Drill Ship, major installation vessels, and the FPSO. In addition, during offloading, a 2 nm marine safety exclusion zone will be maintained around the FPSO. Procedures will be in place so that only authorized vessels enter the exclusion zone (i.e., they have sought and obtained approval via radio communication to enter the marine safety exclusion zone). Communication will be attempted with any unauthorized vessels prior to them entering the marine safety exclusion zone. Any unauthorized vessels that enter the marine safety exclusion zone will be documented in the daily report.	Continuously	Vessel Operators	None.

3.6 Documentation, Reporting, and Record Keeping

The requirement for monitoring stems from the need to verify Project activities are being conducted in accordance with commitments made and to provide performance information to regulators and other relevant stakeholders. As such, the results of monitoring will be reported internally and externally.

Reporting requirements include those stipulated in the following:

1. Applicable regulations required by Guyana and related to the Petroleum Production Licence; and
2. Project commitments, regulatory filings, and Project agreements.

Reporting is summarized in Table 3-9

Table 3-9. Summary of Reporting

Reporting Requirement	Description
Project SSH&E Status Report	EEPGL will provide a high level Project SSH&E Status Report on a semi-annual basis that includes a summary of the Project activities completed during the period, key SSH&E-related performance metrics, and highlights of SSH&E accomplishments, improvement initiatives, and lessons learned. The content and structure of the Project SSH&E Status Report will be developed in collaboration with the EPA.
Monthly Reports	Monthly Shared Environmental Logistics Report: Helicopter and Marine Vessel Fuel Consumption and Effluent Discharge Summary
End of Well Reports	End of Well Reports will be submitted within 90 days following the completion of drilling operations for each well.
Compliance Report	EEPGL will provide a report on the progress of Project activities and compliance with conditions in the Project's Environmental Permit within two months of completion of the following Project stages: Drilling, Installation, Commissioning/Start-up, Production Operations, and Decommissioning.
Annual SSH&E Report	EEPGL will annually provide a report summarizing statutory SSH&E metrics, in line with the reporting requirements as stipulated in the Project's Environmental Permit. These reports may include, but are not limited to: • Air emissions (including GHGs); • Waste types/volumes, disposal methods/locations; • Discharges types/volumes (e.g., wastewater, drill cuttings/fluids, etc.); • Fuel consumption; • Marine species observations; • Spills (e.g., hydrocarbons, chemicals) and non-compliances that may have occurred.
Emergency/incident notification and reporting	All environmental incidents and excursions will be appropriately documented and reported to the relevant authorities, in line with regulations.
Other reporting requirements as stipulated in the Project's Environmental Permit	EEPGL will comply with all other reporting requirements as stipulated in the Project's Environmental Permit.

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APPENDIX 1

Waste Management Plan

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Waste Management Plan (WMP)

Guyana Development Projects

Esso Exploration and Production Guyana Limited (EEPGL)

May 2018

Review and Approval

Reviewed by:

E&R Advisor	Prepared by J. Raun	5/7/2018
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Approved by:

EEPGL Country Manager _____ 31 MAY 2018

Date

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1 INTRODUCTION

The objective of this Waste Management Plan (WMP) is to manage the waste management activities associated with Esso Exploration and Production Guyana Limited's (EEPGL's) operations in Guyana (collectively "Projects"), consistent with applicable regulatory requirements. This WMP has been prepared in conjunction with the Environmental and Socioeconomic Management Plan (ESMP) developed for use in executing the Projects and outlines EEPGL's approach for the handling, storage, and disposal of hazardous and non-hazardous wastes. The WMP may be updated from time to time by EEPGL as needed. EEPGL is the designated Operator for the Stabroek project and is acting on behalf of itself and Hess Guyana Exploration Limited and CNOOC Nexen Petroleum Guyana Limited.

This document:

- Defines and categorizes the different types of waste that may be generated in the performance of the Projects;
- Specifies and documents the management and disposal practices that apply to each category of waste; and
- Specifies and documents the monitoring and reporting guidelines that apply to each category of waste.

This WMP is applicable to the management of wastes generated in the performance of the Projects, including: drilling, installation, commissioning, production operations, and decommissioning. Descriptions of the individual projects covered under this WMP and estimated annual waste quantities are included in Attachment 1. The scope of this document covers waste management procedures and practices from the points of generation - both offshore and onshore - through storage, treatment, transportation, recycling, reuse and disposal. Planned discharges (e.g., produced water, cooling water) are managed under the ESMP and under individual vessel-specific Garbage Management Plans, and are therefore outside the scope of this document. Other non-effluent wastes that cannot be managed at the point of generation (e.g., via onboard vessel incineration) will be transported to onshore waste management facilities operated by a qualified permitted third-party waste management service providers for further segregation, consolidation, treatment, transportation and/or disposal or directly (for non-hazardous wastes) to the final approved recycling, reuse or disposal facilities.

2 SCOPE AND OBJECTIVES

The scope of the WMP includes the following:

- Identifying the sources and processes that generate recoverable materials and wastes;
- Identifying opportunities to avoid waste generation and minimize both the quantities and associated hazards of waste generated;
- Identifying those recoverable materials eligible for recycling, reclaiming, and reuse;
- Identifying the hazards associated with each waste type;

- Estimating the annual quantities for each recoverable material and expected waste type over the various Project stages;
- Selecting approved containers and ensuring proper segregation of materials and wastes;
- Identifying preferred management, storage, treatment, and disposal methods for all wastes;
- Identifying and assessing acceptable waste management facilities;
- Identifying and assessing acceptable waste management service providers for transporting recoverable materials received at the shorebases from points of origin such as the FPSOs; Drill Ships; and Installation, Supply, and Support Vessels that cannot be managed offshore to the final recycling, reclaiming, handling, storage, treatment, and disposal facilities approved by EEPGL;
- Providing the process knowledge and Safety Data Sheets (SDSs) to ensure safe handling of all materials and wastes, including the use of personal protective equipment (PPE).
- Ensuring the proper reporting and recordkeeping is performed through the utilization of multiple log books and records to document the generation, storage, transportation, and final disposition of all recoverable materials and wastes, including an annual waste summary report and incorporation of waste summary information in the end of activity reports (i.e. End of Well, End of Survey, or End of Stage Reports).

The objectives of this WMP are as follows:

- Monitor that recoverable materials and wastes generated are managed in accordance with applicable standards and regulations;
- Monitor that contractors, including Drill Ship; FPSO; and installation, supply and support vessel contractors manage their recoverable materials and waste in accordance with their individual vessel-specific Garbage Management Plans, applicable standards and regulations.
- Provide practical methods for handling, storing, transporting, recycling, and disposing of wastes generated during all stages of the Projects.

3 EEPGL ROLES AND RESPONSIBILITIES

EEPGL will monitor the implementation, maintenance, and periodic update of this WMP, as necessary.

EEPGL will:

- Monitor that project drilling, installation, hook-up and commissioning, production operations, and decommissioning activities conform to the requirements of this WMP;
- Monitor that that recoverable materials and wastes are properly characterized and profiled based on process knowledge and the sampling and analysis of hazardous wastes as required per the WMP;
- Perform routine inspections and periodic self-assessments to verify compliance with applicable regulations;
- Identify qualified third-party waste service providers capability of the storage, transportation, treatment, recycling, reuse, and disposal of wastes;

- Perform periodic audits/assessments of third-party waste service providers utilized by EEPGL to monitor that they are properly permitted and have similar processes and procedures in place in their own individual WMPs or vessel-specific Garbage Management Plans;
- Monitor that vessel owners and operators properly track and manage waste from the point of generation offshore through storage, treatment, reuse, and, if needed, transportation to shore for further handling.
- Confirm chain of custody and manifest records are kept, documenting the subsequent transfer of recoverable materials and wastes at the shorebase to the third-party waste service providers who will perform the final transport, storage, segregation, consolidation, recycle, reuse, treatment, and disposal of materials and wastes in accordance with their WMPs; and
- Ensure that its recoverable materials and waste records are kept and required annual reports are prepared, reviewed, and submitted to the Guyana Environmental Protection Agency (EPA) as required, and copies are retained by EEPGL for its records.

3.1 EEPGL Specific Responsibilities:

- Will ensure there are reasonable resources (e.g., people, time, expertise and finances) to manage and monitor waste issues;
- Will update the WMP from time to time, as needed;
- Will identify the permits required and ensure timely applications to the appropriate authorities;
- Will ensure that required permits/licenses are in place prior to carrying out applicable work;
- Will ensure that EEPGL's management is informed of waste management issues;
- Will prepare procedures for area-specific issues per this WMP;
- Will monitor that its contractor's activities where waste is generated (e.g., Drill Ships; FPSO Vessels; installation, supply, and support vessels); onshore logistics; and waste service providers are aligned and are implementing or overseeing their WMP-specified duties;
- Will review the WMP procedures developed by contractors and subcontractors;
- Will undertake and carry out internal audits on waste management in line with this WMP;
- Will ensure that contractors maintain all necessary permits associated with their waste management activities;
- Will ensure all waste management contractors maintain proper documentation in accordance with Guyana requirements for generation, transportation, and disposal of wastes;
- Will ensure that waste records are maintained.

3.2 Marine Vessel Owner/Operator-Specific Responsibilities (Supply, Support, and Installation Vessels; Drill Ships; and FPSOs):

- Will ensure that required equipment and containers are on site/vessel, as required;

- Will ensure that required equipment and recoverable material/waste storage areas are well maintained and inspected;
- Will ensure that contractors complete and maintain waste manifests as they are progressed through the chain of custody process;
- Will carry out inspections as necessary to ensure waste issues are identified and managed accordingly. This includes ensuring all wastes are correctly segregated;
- Will carry out or supervise waste monitoring ensuring that waste records are completed and correctly stored and filed. This includes ensuring waste is manifested separate from cargo with all details are recorded as to type of waste, volume of waste, characteristics of waste, and final destination.
- Will coordinate with waste contractors that required labels and placards are in use and are correct;
- Will have designated personnel to coordinate with shorebase operators;
- Will maintain an up-to-date recoverable material/waste inventory;
- Will maintain and inspect recoverable material/waste storage areas;
- Will ensure all remedial actions identified by monitoring and inspections offshore and/or at the shorebase are closed out;
- Will keep copies of necessary permits associated with waste management activities; and
- Will notify EEPGL Logistics Representative of recoverable materials/wastes to be transported to shore.

3.3 Waste Service Provider-Specific Responsibilities

- Will spot-check and inspect loads (e.g., bags, containers, skips, totes, and tanks) to verify they conform to the paperwork, bill of ladings, and trip tickets prepared by the generator of the recoverable materials and wastes for transport to the shorebase;
- Will ensure loads are properly labeled by the generator and identify the hazards of such materials and wastes;
- Will oversee the safe offloading and transfer of recoverable materials and waste to vehicles for final transport, storage, recycling, recovery, treatment, or disposal;
- Will ensure that any transfers times are recorded;
- Will manage the completion of all manifests and other documents to record the final disposition of all materials and wastes, with copies to EEPGL and regulatory authorities, and will maintain the original records as required;
- Will perform periodic self-assessments of waste management activities;
- Will provide guidance, training, and local capacity building on waste management issues, as requested by EEPGL;
- Will ensure all waste transport vehicles are thoroughly inspected and placarded before they leave the shorebase or other Project locations for disposal facilities;
- Will supervise all waste transfer operations to ensure they are correctly implemented;
- Will provide a point of contact to the EEPGL Logistics Supervisor; and
- Will ensure proper inspection, maintenance, and use of its equipment.

Supplementing the detailed responsibilities above, Table 1 summarizes the overall roles in the waste management process.

Table 1: Summary Roles – Waste Management

Task	Waste Service Providers	Operators*	EEPGL
Implement WMP	R	R	A
Designate waste storage areas	R/A	R/A	C
Minimize waste	R/A	R/A	C
Ensure: correct equipment and containers on site; all wastes are correctly segregated; all required labels and placards are used	R/A	R/A	C
Designate personnel to coordinate with shorebase operators and waste contractor	I	R/A	C
Properly utilize all required waste transfer and disposal forms	R	R	A
Keep up to date with waste laws and requirements	R/A	I	R/A
Maintain waste inventory	R	I	A
Document date waste is removed from site	R	A	I
Coordinate contractor procedures	I	R	R/A
Provide periodic waste training	R	R	A

Responsible (R), Accountable (A), Consulted (C), Informed (I)

**Includes operators o Drill Ships; FPSOs; Installation, Supply, and Support Vessels*

4 REGULATORY REQUIREMENTS AND GUIDELINES

This document supports the ESMP prepared for the Liza Projects. The WMP has been developed to comply with the requirements of applicable laws and regulations, including:

- Environmental Protection Act of 1996;
- Regulations made under the Environmental Protection Act 1996 (No. 11 of 1996) of 2000;
- Environmental Guidelines for the Transportation, Storage and Occupational Handling of Chemical/Industrial Hazardous Waste of 2011 (as appropriate);
- Environmental Guidelines for Removal, Treatment and Disposal of Oily Sludge of 2011 (as applicable) (as appropriate);
- Environmental Guidelines for the Storage, Transportation and Occupational Handling of Biomedical Waste of 2011 (as appropriate and as applicable to medical waste that may be generated);
- MARPOL 73/78 - International Convention for the Prevention of Pollution from Ships, Revised Annex V, Ship Garbage Management Plans and Record Books;

- Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal (if applicable, no such shipments are currently planned); and

Further details on these laws and conventions are contained in the following sections.

4.1 Local Regulatory Requirements and Waste Definitions

This WMP deals with recoverable materials and wastes that will be generated from the drilling, installation, hook-up and commissioning, production and decommissioning activities for the Projects. Limited recoverable materials and wastes will also be generated by support operations conducted at the shorebase, offices, and warehouses utilized to support offshore operations, and this WMP applies to those support operations as well.

The definition of a hazardous waste per the Guyana Hazardous Waste Regulation, 2000 Part I, 2(e) is "A hazardous waste means a waste or combination of wastes which, because of its quantity, concentration or physical, chemical or infectious characteristics, may pose a substantial hazard to human health and belong to any category contained in Schedule I unless they do not contain any of characteristics contained in Schedule II and includes waste that is:

(i) Hazardous industrial waste;
(ii) Acute hazardous waste chemical;
(iii) Hazardous waste chemical;
(iv) Severely toxic waste;
(v) Flammable waste;
(vi) Corrosive waste;
(vii) Reactive waste;
(viii) Radioactive waste;
(ix) Clinical waste; or
(x) Leachate toxic waste or polychlorinated biphenyl waste,

and includes a mixture of acute hazardous waste chemical, hazardous waste chemical, pathological waste, radioactive waste, or severely toxic waste and any other waste or hazardous material."

Further descriptions of such wastes can be found in Schedule I of this regulation.

- A "liquid industrial waste" means a waste that is both liquid and industrial waste but does not include:
  (i) Hauled sewage;
  (ii) Waste from the operation of sewage works;
  (iii) Waste from the operation of water works;
  (iv) Waste that is produced in any month in an amount less than twenty-five litres or otherwise accumulated in an amount less than twenty-five litres;
  (v) Waste directly discharged by a generator from a waste generation facility into a sewage works or sewage system;

(vi) Waste that results directly from food processing and preparation operations, including food packaging, food preserving and restaurants;

(vii) Drilling fluids and produced waters associated with the exploration or production of crude oil or natural gas;

(viii) Processed organic waste; or

(ix) Asbestos waste.

- A "clinical waste" means:

  (i) Any part of the human body including tissues and bodily fluids, but excluding fluids, extracted teeth, hair, nail clippings, and the like that are not infectious;

  (ii) Any part of the carcass of an animal infected with a communicable disease;

  (iii) Non-anatomical waste infected with communicable disease; or

  (iv) Any waste that is generated in the diagnostic, treatment, or immunization of human beings or animals and related activities that include research or autopsies;

- A "flammable waste" means a waste that is either solid, liquid, an oxidizing substance, or an ignitable compressed gas, which, under certain conditions may be readily combustible or may cause or contribute to fire through friction, absorption of moisture or spontaneous chemical changes and when ignited, burns so vigorously and persistently that it creates a danger; and
- An "incinerator waste" means the residue from incineration, other than incinerator ash and fly-ash.

Additional regulations and guidelines govern specific wastes, including chemical, industrial, and biomedical wastes. EEPGL and its contractors may generate, as a result of offshore clinic operations and associated medical treatment, small quantities of sharps or other biological material or biomedical waste (also referred to as "Red Bag Waste" due to the color of the containers used and special labeling to denote such a potential biohazard). Such wastes could be incinerated offshore or brought to shore for proper treatment and disposal per the Guyana biomedical waste guidelines.

As noted above, sewage and other planned discharges are excluded from these chemical/industrial hazardous waste guidelines. All planned discharges from EEPGL offshore operations have been described in and will be managed under the ESMP for Liza Development Projects and under individual vessel-specific Garbage Management Plans.

4.2 National Environmental Legislation

In 1996 the Environmental Protection Act (hereinafter referred to as the Act) was enacted to implement the environmental provisions of the Guyana Constitution. The Act authorized the formation of the Environmental Protection Agency (EPA), as the lead agency on environmental matters in Guyana (FAO, 2013).

Environmental compliance of the Projects will be regulated under several statutes. These statutes contain measures that must be implemented to ensure compliance with applicable policies,

guidelines, and legislation in Guyana. They include the Maritime Zone Act of 2010 No 18: 2010 and the Act of 1996 (as amended in 2005).

4.3 Guyana Permits and Licenses

The Projects will be governed under the provisions of the Petroleum Agreement, Joint Operating Agreement (JOA), Liza Production License for the Stabroek Block, and Environmental Authorisations that have been or will be issued by the Guyana Environmental Protection Agency (EPA) upon review and approval of the Project-specific EIAs and supporting plans, including this WMP. All of these documents may contain general and specific waste management commitments, obligations, and conditions. The WMP will be updated as needed upon issuance of the Environmental Authorisations to reflect any additional requirements contained in those documents.

4.4 International Conventions

4.4.1 MARPOL 73/78

EEPGL will operate its offshore activities consistent with the provisions of the MARPOL 73/78 Convention.

The MARPOL 73/78 Convention places restraints on the contamination of the sea, land, and air by ships. The Convention includes two protocols dealing with reports on incidents involving harmful substances and arbitration, and six annexes which contain regulations for the prevention of various forms of pollution. Table 2 provides short descriptions of each MARPOL 73/78 annex.

Table 2: MARPOL 73/78 Annexes[1]

MARPOL Annex	Description
Annex I: Regulations for the Prevention of Pollution by Oil	Prevention of pollution by oil from operational measures as well as from accidental releases.
Annex II: Control of Pollution by Noxious Substances	Details the criteria and measures for the control of pollution by noxious liquid substances carried in bulk.
Annex III: Prevention of Pollution by harmful Substances Carried by Sea in Packaged Form	Contains general requirements for the issuing of detailed standards on packing, marking, labelling, documentation, stowage, quantity limitation, exception, and notifications.
Annex IV: Prevention of Pollution by Sewage from Ships	Requirements to control pollution of the sea by sewage and grey water.
Annex V: Prevention of Pollution by Garbage from Ships	Deals with different types of garbage and specifies the distances from land and the manner in which they may be disposed of.
Annex VI: Prevention of Air Pollution from Ships	Sets limits on certain air pollutants and prohibits deliberate emissions of ozone depleting substances.

[1] *International Maritime Organization (IMO). (2015). International Convention for the Prevention of Pollution of Ships (MARPOL). Accessed 9 December 2015 at http://www.imo.org/en/About/Conventions/ListOfConventions/Pages/International-Convention-for-the-Prevention-of-Pollution-from-Ships-(MARPOL).aspx.*

All solid combustible waste (except for food waste) suitable for incineration will be managed on the Drill Ships and FPSO Vessels as the first preference; the remainder will be stored on board and sent back to shore for treatment or disposal in accordance with local regulations. Food waste will be comminuted or ground prior to discharge. Black water / sewage will be treated, including chlorination, per MARPOL standards and discharged overboard. Management and monitoring measures implemented to ensure treatment standards for these discharges are described in the ESMP.

The primary provisions of MARPOL 73/78 relevant to waste management for the Projects are those applicable to offshore vessels, as follows:

- Waste Management Plan: A formal WMP shall be developed and enforced by the Unit owner;
- Waste Record Book: All wastes generated should be recorded in the Waste Record Book;
- Plastic Waste and General Waste (except Food Waste): The disposal to the sea of all plastics, including but not limited to synthetic ropes, synthetic fishing nets, and plastic garbage bags, and all other general waste, including paper products, rags, glass, metal, bottles, crockery, dunnage, lining and packing materials, is prohibited;
- Food Waste: The disposal to the sea of food wastes that have been passed through a comminuter or grinder shall be made not less than 12 nautical miles from the nearest land. Such comminuted or ground food waste shall be capable of passing through a screen with openings no greater than 25 mm; and
- When waste to be disposed of is a mix of waste types having different disposal requirements, the more stringent requirements shall apply.

4.4.2 Basel Convention

The objective of the Basel Convention is to control the transboundary movements of hazardous waste and their disposal and by such protect human health and the environment against the adverse effects of hazardous waste if not managed correctly. Its scope covers a wide range of wastes defined as “hazardous wastes” based on their origin and/or composition and their characteristics, as well as two types of wastes defined as “other wastes” – household waste and incinerator ash.

The primary provisions of the Convention center around the following principles:

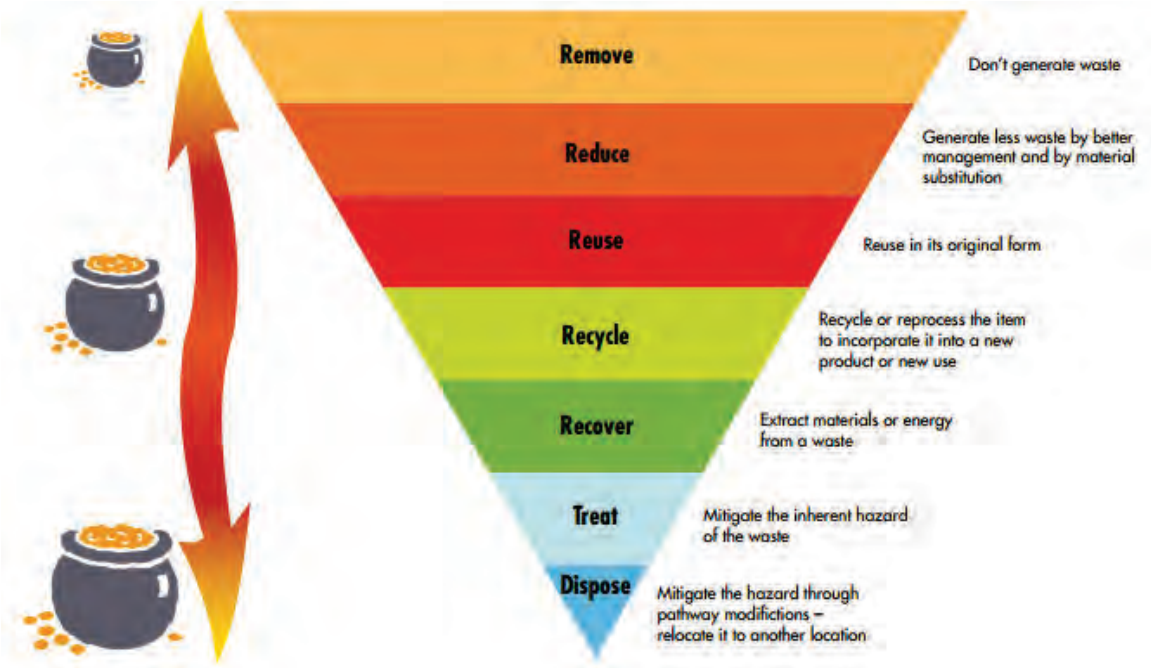
- The reduction of hazardous waste generation and the promotion of environmentally sound management of hazardous wastes, wherever the place of disposal;
- The restriction of transboundary movements of hazardous wastes except where it is perceived to be in accordance with the principles of environmentally sound management; and
- A regulatory system applying to cases where transboundary movements are permissible.

Guyana became a signatory to the Basel Convention on March 7, 2001.

5 WASTE MANAGEMENT STRATEGY

The WMP is underpinned by EEPGL's waste management hierarchy, which is described below.

1. Generation of waste should be Avoided, Prevented, or Reduced at the source whenever feasible;
2. Wastes that are not Prevented should be Reused or Recycled in an environmentally safe manner, whenever feasible;
3. Wastes that are not Prevented or Recycled should be Treated in an environmentally safe manner, whenever feasible; and
4. Finally, Disposal should be employed as a last option and when employed, should be conducted in an environmental responsible manner.



Source: OGP. (2009). Guidelines for waste management with special focus on areas with limited infrastructure. Accessed 21 November 2015 at http://www.ogp.org.uk/pubs/413.pdf.

Figure 1: Waste Management Hierarchy

EEPGL prefers that its contractors and suppliers (e.g., of equipment, materials, goods and services) to minimize packaging on products wherever possible, or to package products in recyclable materials, to limit waste generation at each stage of the Projects. Whenever practicable, surplus and unused materials will be returned to a vendor or recycled as the means of management (i.e., reused for the same or a new purpose, converted into a new product), enabling reduction in the consumption of a new product or raw material.

Where possible, measures will be implemented to minimize contractor waste generation. These include:

- Avoiding single use items where reusable items could be used (e.g., using washable plates rather than paper plates);
- Purchasing supplies with minimal or recyclable packaging;
- Using reusable and/or biodegradable materials;
- Ordering only what is needed;
- Storing products properly to prevent spillage or contamination;
- Keeping all product containers in good condition, clearly labeled; and
- Maintaining good housekeeping and maintenance of facilities.

5.1 Waste Categories

Descriptions of the recoverable materials, common waste types, and categories expected to be generated by the Projects have been summarized in Table 3.

Table 3: Recoverable Materials, Waste Types and Categories

#	Waste Category	Waste Types
1	Non-hazardous wastes	General and domestic trash, incinerator ash and residue (must be tested), production solids (e.g. scale, sand), dry filters, abrasive blast media, filter media, desiccant/drying agents
2	Recyclable materials	Wood, paper, cardboard, glass, aluminum cans, plastic, scrap metal including metal packaging, clean empty steel drums, empty/punctured aerosol cans
3	Hazardous waste liquids	Used lube/motor oil, contaminated hydrocarbons (crude, diesel, etc.), oily water, contaminated water-based drilling fluid, non-aqueous drilling fluid, drilling slops, well treatment and completion fluids, waste brines, treatment chemicals, liquid paint waste, drum/container rinse, acid and caustic solutions, hydraulic fluid
4	Hazardous waste solids	Production solids and sludges, oily trash/debris, oily/wet filters, drums/containers with chemical residues, dried paint waste, consumables (e.g. non-empty aerosol cans, oil filters, grease tubes, dope brushes)
5	Special hazardous wastes	Medical/biological waste, batteries (including alkaline, lead-acid, nickel-cadmium), fluorescent light bulbs and ballasts, mercury and mercury-containing equipment, radioactive waste including Naturally Occurring Radioactive Material (NORM), electronic waste

5.2 Waste Management Practices

The key waste management practices covered by this WMP include:

- Proper waste classification and identification;
- Proper handling, segregation and storage;
- Proper recycling, reclaiming or recovery; and
- Proper treatment and disposal.

Each of the categories and individual types of wastes listed above has been summarized, with the preferred waste management practices to be used, in Table 4.

Table 4: Preferred Waste Management Practices

Preferred Waste Management Practices	Recoverable Materials and Waste Streams
Recycle	Plastic, glass, scrap metal including empty steel drums and empty/punctured aerosol cans
Landfill	General trash, used PPE, dessicant and other drying agents, filter media, abrasive blast media, uncontaminated cement, incinerator ash and other hazardous waste treatment residues that have been tested to ensure they are safe for land disposal
Recycle into FPSO Process	When possible, the following will be recycled into the FPSO production/separation process: used lube/motor oil, used glycol, oily water, *de minimis* quantities of off-spec product/materials, by-products, oil slops
Offshore Incineration (non-hazardous wastes) / Onshore recycling, incineration	Wood, paper, cardboard, general trash
Offshore / onshore incineration (hazardous wastes)	Used lube/motor oil (when not possible to recycle into FPSO process), contaminated hydrocarbons (crude, diesel, etc.), oil filters and oily debris (rags, gloves, wood, vegetation, sorbent pads, paper, etc.), paint waste, medical waste
Onshore Treatment	Drilling slops (mixture of used drilling muds, water, cement spacer, additives), oil-contaminated cement and completion brines, used drilling muds not discharged w/ cuttings, production sludges and solids, tank bottom sludge, pigging waste, used and unused chemicals/solvents, hazardous drum rinse, oily water, contaminated drums, containers, packaging, non-empty aerosol cans, batteries (lead acid, nickel-cadmium, lithium, mercury cell), electrical/electronic waste, mercury-containing equipment (e.g. thermometers and other instruments; should be very little), radioactive/NORM waste (only in case that it is produced)

5.3 Waste Classification

Proper waste management begins with an accurate classification of each waste, which is critical for safe storage, transportation, and treatment/disposal planning. This will be based on generator processes and process knowledge, review of manufacturer's SDSs, product specifications, and select laboratory testing and analysis, as required to ensure the hazards are known for each waste including whether they are flammable, corrosive (acid or base), reactive (oxidizer, pyrophoric, reducer), and/or toxic.

Whenever supporting analytical results are necessary to initially profile and characterize a waste stream, the following analytical tests will commonly be performed:

- Flashpoint;
- pH;
- Toxicity (Toxicity Characteristic Leaching Procedure [TCLP] metals, and in some cases volatiles); and
- Reactivity (reactive sulfides, reactive cyanides).

The disposal contractor will be consulted to ensure appropriate analytical methods and tests are performed. EEPGL will audit and approve labs used to analyze EEPGL's waste and other materials.

Waste sampling will be performed by properly trained personnel using the appropriate PPE. Samples will be packaged in appropriate containers and properly labeled. A chain of custody form (sample provided in Attachment 5) must accompany all samples during transport.

5.4 Handling of Wastes

Personnel involved in the handling of hazardous, scheduled wastes must recognize and understand the associated potential hazards and will be trained to a level commensurate with their job duties.

Standard PPE for hazardous/scheduled waste-handling activities includes the following:

- Gloves: leather or chemically resistant (depending on the type of waste);
- Safety glasses, goggles or face shield;
- Hard hat;
- Steel-toed shoes or boots; and
- Coveralls or other suitable work clothes.

Additional PPE may be required for specific hazardous/scheduled wastes (e.g., latex boot covers, respirator). Further information is also contained in the SDSs.

5.5 Handling of Hazardous Materials

All hazardous materials will be stored in designated areas where the potential for damage to containers is minimized (e.g., paint stored in paint locker, acids stored in enclosed areas, etc.). Additionally, hazardous materials will be stored in areas with adequate containment.

Any hazardous materials transported for use will not be accepted by the Drill Ships; FPSO Vessels; installation, supply and support vessels, or other user unless the following requirements are met:

- Appropriate SDSs must accompany the materials;
- Materials have been accounted for under the Guyana Revenue Authority Investment Development Agreement (IDA);
- Applicable requirements have been met for materials import, customs clearance and use; and
- Materials have been approved under the Guyana Pesticides and Toxic Chemicals Control Act of 2000 (if applicable).

Hazardous materials will be transported in proper containers affixed with a hazardous waste label and placard(s) indicating the applicable hazard class(es). Placards containing internationally recognized symbols exist for the following hazard classes (see Attachment 9):

1. Explosives
2. Flammable liquids
3. Flammable solids or waste solids other than explosives which may be readily combustible
4. Oxidizing substances
5. Organic peroxides
6. Poisonous substances
7. Infectious substances
8. Corrosives
9. Toxic gases
10. Toxic substances which if inhaled or ingested may cause delayed or chronic effects
11. Ecotoxic substances which if released may present immediate or delayed adverse impacts to the environment by means of bioaccumulation and/or toxic effects upon systems; and
12. Materials capable, after disposal, of yielding another material which possesses any of the characteristics specified in items 1 – 11.

All containers with hazardous materials transferred to and from the Drill Ships; FPSO Vessels; installation, supply and support vessels, and onshore work locations must be clearly identified on the cargo manifest, properly placarded per the hazard classes listed above, and accompanied by SDSs, as applicable.

5.6 Waste Segregation and Storage

Waste generated will be collected in appropriately labeled bin collectors, tanks, bottles, drums, or other designated receptacle. Proper containers will be used for each recoverable material and waste. Secondary containment will be provided for all liquid and hazardous wastes.

Non-hazardous waste, including recyclables, will be physically separated from Hazardous Waste (HW) and segregated by type in order to:

- Maximize the possibilities for waste recycling or reuse;
- Minimize the possibility of contamination of non-hazardous wastes by HW;
- Ensure that waste storage is contained; and
- Ensure the proper management of each specific waste;

Additionally, the following segregation and storages practices will be utilized:

- Wastes will be stored in containers that are in good condition and compatible with characteristics of the materials in question;
- Sealable containers will be provided for hazardous/scheduled wastes;
- Incompatible wastes will be segregated to minimize potential chemical reactions;
- Containers bearing wastes will be labeled in accordance with regulatory requirements; and
- Different types of HW will be stored separately from each other and from non-hazardous waste.

Containers bearing wastes will be labeled with the following information:

- Classification (i.e., hazardous or non-hazardous);
- Name/description of the waste
- Applicable hazardous waste characteristics (see list in Section 6.5);
- Physical state of the waste (i.e., solid or liquid).

In addition to the requirements stated above, HW containers will be labeled with the following information:

- Name and address of EEPGL or designated contractor;
- Placard(s) corresponding to the applicable hazard class(s) (during transport only); and
- Packaging or start of accumulation date.

HWs will be labelled in the specified format as follows:

- The size of the label should not be less than 20 centimeters (cm) x 30 cm [7.9 inches (in) x 11.8 in];
- Labels should have a yellow background with black lettering conspicuously marked in paint or another permanent form of marking;
- The material of the label should be scratch proof, resistant to tampering and able to withstand open weather exposure;
- Generally, the label should be attached to the side of the vessel, container, tank or containment building. In case of a vessel, container, tank or containment building that is used repeatedly, the label should ideally be a plate that is hung on the side of it. For containment buildings, all hazardous wastes types contained in the building should be included on the plate;
- The label should identify the hazardous characteristic(s) of the waste (e.g., flammable, corrosive, toxic)

The basic label form is provided below in Table 5. Labelling procedures should be completed at the location where the waste was generated and should be retained at the destination treatment, storage, and disposal facilities.

Table 5: Basic Label Form

Hazardous Waste		
Waste Information	Waste type / description	Name and/or description of the waste/material
	Waste Classification	Hazardous or non-hazardous
	Hazard Class	Name of the hazard class (see placards in Attachment 9; e.g. Toxic, Corrosive, Flammable, Explosive, Reactive, Infectious)
	Physical Form	Liquid, Solid, or Sludge
	Quantity	Quantity of the hazardous waste contained in the vessel, container or tank
	Packaging date	Date the hazardous waste is packed in the vessel, container or tank
	Shipping date	Date the hazardous waste must be removed from the storage area and transported off site if applicable
	Waste transport record number	Manifest number if transported off site
Container Information	Capacity	Maximum capacity or volume of the container
	Material	Material that a vessel, container or tank is made of
Generator Information	Name	Name of the waste generator (company name)
	Address	Address of the waste generator
	Telephone #	Telephone number of the waste generator

5.7 Waste Tracking Process

A Marine Transport Manifest (see Attachment 6) will be used for all vessel shipments of hazardous and non-hazardous wastes and must contain the types and quantities of hazardous and non-hazardous wastes being transported.

Additionally, a waste manifest (sample included in Attachment 7) and waste information data sheet (sample included in Attachment 8) will be completed and must accompany all shipments of hazardous and non-hazardous wastes. This includes over-water shipments as well as land shipments. The purpose of this manifest is to track each shipment of waste from the point of generation to the point of final treatment, recycling or disposal. EEPGL is responsible for completing waste manifests prior to shipment.

In compliance with MARPOL 73/78, marine vessels, including the supply, support, and installation vessels, as well as the Drill Ships, and FPSO Vessels, will maintain a Garbage Record Book and record of used oil generated (See Attachments 3 and 4). The Garbage Record Book can be modified to allow tracking of Project-related wastes outside the scope of the categories specified in MARPOL 73/78; therefore, this will be referred to as a Waste/Garbage Record Book in the remainder of this document.

Vessels must retain copies of all Marine Transport Manifests and waste manifests with the Waste/Garbage Record Book for a minimum of two years.

5.8 Waste Transfer to Shore

Marine vessels used to transport waste will be required to have necessary licenses and approval from the Guyana authorities. Crews on vessels that transport hazardous waste will have training in basic emergency response, and knowledge of labeling and placarding requirements.

Vessels transporting waste will carry both a completed Marine Transport Manifest (see Attachment 6), a completed waste manifest (see example in Attachment 7), and a waste information data sheet (see Attachment 8). These documents will contain the name, description and quantity of all wastes being transported.

All waste containers will be labeled per the requirements described in Section 6.6. Hazardous waste containers will be affixed with the appropriate placard(s) corresponding to the hazard class(es) of the waste being transported.

EEPGL will monitor that vessel waste transporters and shipments meet the requirements above and that vessel crews have completed and documented conformance with the minimum training requirements.

5.9 Waste Transfer from Shore to Offsite Waste Management Facility

Vehicles used to transport waste from the shore to offsite waste management facilities will be required to have necessary licenses and approval from the Guyana authorities. Crews that

transport hazardous waste will have training in basic emergency response and knowledge of labeling and placarding requirements. Vehicles transporting waste will carry a completed waste manifest (see example in Attachment 7). This document will contain the names, descriptions and quantities of all wastes being transported.

All waste containers will be labeled per the requirements described in Section 6.6. Hazardous waste containers will be affixed with the appropriate placard(s) corresponding to the hazard class(es) of the waste being transported.

EEPGL will confirm vehicle waste transporters and shipments meet the requirements above and that crews have completed and documented compliance with the minimum training requirements.

6 WASTE MANAGEMENT METHODS

The following treatment and disposal methods may be employed to manage Project waste:

- **Offshore:**
  - Incineration;
  - Discharge (macerated food);
  - Other methods allowed by Environmental Permit.
- **Onshore:**
  - Incineration;
  - Other thermal treatment (e.g., thermal desorption);
  - Neutralization;
  - Stabilization (e.g., solidification);
  - Bioremediation;
  - Liquid waste treatment;
  - Burial disposal (landfill);
  - Beneficial reuse.

EEPGL's contracted waste service providers will be expected to furnish all required equipment and facilities for the storage, handling, transportation, treatment, and disposal of hazardous and non-hazardous waste brought onshore. In some cases (e.g., special hazardous wastes), waste may need to be shipped to other approved facilities owned and/or operated by a different service provider.

6.1 Incineration/Thermal Treatment

Thermal treatment, including incineration, is a preferred technology for the management of combustible solid wastes and liquid wastes. It can be performed utilizing a variety of incinerators (single and dual chamber), thermal desorption units, or other thermal treatment technologies. Incinerators will be considered during engineering design and contracting for the Drill Ships and

FPSOs to handle the types and quantities of combustible wastes specified in this WMP and capable of destroying hazardous constituents in those waste streams. Where onboard incinerators are not specified, onboard waste otherwise suitable for incineration would be transported to shore. EEPGL's contracted waste service providers may also utilize incineration or other forms of thermal treatment for hazardous and non-hazardous wastes that cannot be managed offshore. Incinerator ash and residue will be analyzed as described in Section 6.3 of this WMP to assess suitability for land disposal prior to shipment to the landfill. There can be an expected 75% - 85% reduction by volume for incinerated solid wastes, and a significantly higher percent reduction for incinerated liquid wastes.

6.2 Neutralization

Neutralization is an effective treatment method for certain waste acids and caustics; it involves mixing of the waste with other materials to raise or lower the pH to a more neutral level. Appropriate health and safety considerations must be taken and specific controls put in place when performing neutralization. It is important to verify that waste liquids can be safely neutralized prior to mixing with materials, which can often result in an exothermic reaction. Commonly used chemicals for neutralization are 98% sulfuric acid (to neutralize a base) and 50% sodium hydroxide or calcium hydroxide (lime) (to neutralize an acid).

6.3 Stabilization

Stabilization can be any process used to alter the physical or chemical properties of a waste to render it more amenable for land disposal or further treatment. One form of stabilization is solidification, in which waste is physically or chemically bound or encapsulated in a stabilizing material to form a hardened block that will reduce the tendency of constituents of concern (e.g., metals) to be released or leached into the environment. Common binding agents or stabilizing materials are cement, clay, fly ash or asphalt. Stabilization/solidification is sometimes used as a secondary treatment following incineration for wastes that may have residual leachable constituents after all volatiles and hydrocarbons have been removed through thermal treatment.

6.4 Bioremediation

Bioremediation can be an effective form of treatment for organic wastes, such as hydrocarbon or hydrocarbon-contaminated wastes (e.g., hydrocarbon-impacted soil). Bioremediation is often performed in open pits or other open spaces where naturally occurring or added organisms are used to break down the organic material in the waste until biodegradable constituents are reduced to a level suitable for land disposal. A synthetic liner is one example of a potential barrier to protect groundwater sources beneath the bioremediation area, and other engineering controls are often considered during facility design as measures to reduce potential runoff or other migration of potential contaminants outside of the designated bioremediation area. EEPGL has specific criteria for which wastes are eligible for bioremediation (generally only exploration and production (E&P) wastes in which hydrocarbons are demonstrated through analytical testing to be the only

hazardous constituent present). Once the hydrocarbon content of bioremediated waste is reduced to 5% or less, it can become eligible for beneficial reuse.

6.5 Liquid Waste Treatment

There are a variety of forms of industrial liquid waste treatment that can be used to remove hazardous constituents from liquid wastes, making them more amenable to land disposal. A properly designed treatment plant is the preferred management method for large volume liquid wastes, such as slops, oily water, or washwater from vessel tank cleanouts.

6.6 Burial Disposal (Landfill)

Non-hazardous solid wastes that are not recycled, reclaimed or reused will be transported for disposal in an approved and permitted landfill. Wastes must be demonstrated to meet standards for land disposal through generator knowledge or analytical testing prior to landfilling. In Guyana, the Haags Bosch Landfill has been permitted by the Guyana EPA and is managed by the Ministry of Communities. Should additional engineered landfills become available in Guyana, those will be assessed and reviewed for use.

6.7 Beneficial Reuse

It may be possible to use exploration and production (E&P) wastes for beneficial purposes. EEPGL has strict standards for when a waste is eligible for beneficial reuse. Untreated wastes that are demonstrated through analytical testing to meet certain criteria (e.g., hydrocarbon content less than 5%, all other constituents of concern below levels that could cause harm to the environment) can be eligible for beneficial reuse. Wastes that do not initially meet these criteria may be treated to meet the standard. Such reuse can offer important environmental benefits such as waste minimization (avoids unnecessarily using up landfill space), dust suppression, and improved road maintenance.

7 SPILL AND EMERGENCY RESPONSE

EEPGL, other waste generators (e.g., marine vessel operators), waste transporters, and waste service providers will all have Emergency Response Plans (ERPs) to address possible emergency contingencies such as spills, fires, and explosions. These plans include specific and actionable steps for multiple risk scenarios. The action steps and the resources applied increase as the seriousness of the emergency or release increases. Tier I (lowest level) emergencies will be handled by local resources. In the case of scenarios outside the local capability (e.g., Tiers II and III), EEPGL will activate its Regional Response Team (RRT). The RRT is a large group of responders that have been trained for response actions around the world. The ERPs also include all required internal and external incident communications processes and contact numbers.

7.1 Oil Spill Cleanup – Waste Management

All waste generated as a result of oil spill cleanup activities will be managed in accordance with this WMP, EEPGL's Oil Spill Response Plan (OSRP), and Guyana laws and local regulations. The typical waste streams associated with a cleanup could include recovered product not able to be reintroduced into the system, oily water, absorbent materials, decontamination materials, contaminated trash and debris, general trash and debris, and affected vegetation/foliage, among others. Should a significant oil spill occur, an incident-specific WMP may be developed as part of the response.

Additional waste management provisions can be found in Section 6.9 of the EEPGL OSRP, which is found in Appendix 3 of the ESMP. Procedures for the disposition of deceased wildlife are included in the Wildlife Response Plan (Appendix E of the OSRP).

8 WASTE MONITORING AND REPORTING GUIDELINES

Monitoring and reporting of those recoverable materials and wastes and their final management are critical components to the successful implementation of this WMP.

8.1 Waste Monitoring

The waste monitoring program will be facilitated by regular inspections conducted by EEPGL. A summary of monitoring guidelines is provided in Table 6.

Table 6: Waste Monitoring Guidelines

Monitoring Activity	Frequency	Originator	Documentation
Record type and quantity of each new individual waste stream onboard	Any time new waste is generated	Dedicated personnel on all vessels	Waste/Garbage Record Book; Oil Record Book; Incinerator Log (where applicable)
Inspect waste storage area and containers; log inspections	Daily	Dedicated personnel on all vessels, at shore base, and Waste Management Service Provider's facility	Daily inspection log
Document marine waste transfer	Each instance waste is transported	Dedicated personnel on all vessels and at shorebase	Marine Transport Manifest and Waste Manifest
Sample and perform analytical testing	As needed to properly classify waste	Waste Management Service Provider / EEPGL	Chain of Custody; Laboratory analysis results
Complete Recoverable Material and Waste Summaries	Monthly; Annual	Waste Management Service Provider / EEPGL	Monthly Waste Inventory and Annual Waste Summary Report

Monitoring Activity	Frequency	Originator	Documentation
Complete and submit reports required per the Environmental Permit	Dependent on final permit conditions	EEPGL	End of Survey, End of Well, End of Stage Reports, EPA Recording and Reporting Form, any other reports required by Environmental Permit
Waste facility audits and inspections	Periodic	EEPGL	Inspection logs and reports

8.2 Waste Recordkeeping and Reporting

Waste management performance will be measured against agreed-upon reporting and recordkeeping requirements including:

- Types and volumes of wastes (hazardous and non-hazardous) generated;
- Maintenance of required vessel Waste/Garbage Record Book and Oil Record Books;
- Maintenance of required incinerator logs;
- Maintenance of Marine Transport Manifests and waste manifests to document custody transfer and the final means of disposition for each recyclable material and waste;
- Preparation of waste reports required per the Environmental Permit, such as the Guyana EPA Recording and Reporting Form shown in Attachment 2;
- Maintenance of monthly waste inventories;
- Preparation of annual waste management summary reports;
- Routine inspections and periodic assessments of Waste Management Service Provider's facilities; and
- Maintenance of hazardous substances / chemical inventory register and transboundary shipment forms, if required. These forms should be kept by EEPGL personnel at either the shore base or venture office.

Any issue of non-compliance will be tracked and documented in a monthly report.

9 WASTE TRAINING

General training will be conducted for applicable EEPGL personnel, contractors, and any others that will be involved with recoverable material and waste generation and management during the life of the Projects. This training will cover:

- EEPGL Waste Management Practices;
- Environmental Permit requirements;
- Typical waste streams;
- Identification, classification, and labelling of hazardous and non-hazardous waste;
- Handling, segregation, storage, and treatment/disposal options;

- PPE requirements; and
- Waste management during normal operating conditions, as well as emergencies.

In addition to the general waste management training, additional offshore- and onshore-specific waste training will be provided to the appropriate personnel.

9.1 Offshore Waste Management Training

EEPGL personnel and contractors working offshore will attend a training focused on waste management in the offshore environment. This training will support compliance with both Guyana regulations as well as EEPGL's responsible waste management practices. Topics to be covered in these trainings will include, but not be limited to:

- Opportunities to minimize waste generation;
- Waste generation offshore and potential impacts on marine life;
- Specific types of hazardous and non-hazardous waste that can be generated offshore and associated risks;
- Handling, storing, and transporting wastes, with particular focus on hazardous waste to ensure safety of personnel and environment; and
- Waste tracking, monitoring, and auditing standards and practices.

9.2 Onshore Waste Management Training

Onshore waste management training will be conducted for EEPGL personnel and contractors as appropriate. The waste management service provider will also provide training for all its waste personnel and verify training has been performed for waste transporters. This training will cover more specific topics, including:

- Application of Guyana laws and guidelines;
- Opportunities to minimize onshore waste generation;
- Waste generation onshore and potential risks to health, safety, and the environment;
- Specific types of hazardous and non-hazardous wastes that can be generated offshore and sent to shore for treatment/disposal, as well as potential waste generated from onshore activities;
- Handling, storing, and transporting wastes onshore, with particular focus on hazardous waste to ensure safety of personnel and the environment; and
- Waste tracking, monitoring, and auditing standards and practices.

Attachment 1: PROJECT DESCRIPTIONS, WASTES, MANAGEMENT METHODS, AND ESTIMATED ANNUAL QUANTITIES

Annex A: Liza Phase 1 Project

Project Description

The Liza Phase 1 Project proposes to develop the offshore resource by drilling approximately 17 subsea development wells and using a FPSO vessel to process, store, and offload recovered oil. The FPSO will be connected to the wells via associated equipment, collectively referred to as subsea umbilicals, risers, and flowlines (SURF), to transmit produced fluids (i.e., oil, gas, produced water) from production wells to the FPSO, as well as treated gas and water from the FPSO to the injection wells.

The Project consists of five primary stages: drilling, installation, hook-up and commissioning, production operations and decommissioning. The Project will generate a variety of recoverable materials as well as solid, semi-solid, and liquid wastes that are both hazardous and non-hazardous, which will vary over time by Project stage. Estimated recoverable materials and waste types and volumes to be generated during each stage of the project has been provided in Attachment 1.

Coincident with the start of development drilling, waste generation started in May 2018. Waste volumes generated will increase early in the project as concurrent drilling and SURF installation activities occur from 2018 - 2020, which are then followed by the hookup and commissioning of the FPSO. Waste volumes will then begin to decrease as drilling activities conclude in 2020-2021 and significantly decrease thereafter during the stage of production operations alone in 2022 to approximately 2040. When production operations cease, some waste will be generated during the decommissioning stage.[2]

[2] *Any dates specified in this document are based on the current project schedule which is subject to change. They are provided to help conceptualize anticipated duration of each Project stage.*

Liza Phase 1 Project Waste Estimates: Hazardous Wastes

Waste Information: Hazardous Wastes				Volume By Year / Metric Tonnes					
Waste Stream	Waste Source	Primary Disposal Method	Alternate Disposal Methods	2018	2019	2020	2021	2022–2039	2040
Used lube oil / motor oil	Equipment and vehicle maintenance and repair (of internal-combustion engines, pumps, and compressors)	When practicable, recycle into FPSO process	Offshore or Onshore Incineration, Onshore Recycling	76	175	236	94	9	4
Contaminated hydrocarbons (contaminated crude, diesel, etc.)	General maintenance activities and spill response	Offshore incineration	Onshore treatment	4	13	18	10	5	8
Oily Debris (rags, gloves, wood, vegetation, sorbent pads, paper, etc.)	Routine operations and maintenance, rags and oil spill clean-up activities	Offshore incineration	Onshore treatment	6	21	26	12	5	12
Oily Filters and Oil Filter Sludge	Vehicle and equipment engines during all project phases	Offshore incineration	Onshore treatment	6	21	30	17	10	15
Paint waste	Equipment and facilities activities and maintenance during all phases	Onshore Treatment		2	7	8	3	1	3
Medical waste	First aid and routine clinical procedures	Offshore incineration	Onshore treatment	1	3	4	2	1	1
Drum rinse	Drum and container rinsing	Onshore treatment		2	7	7	2	0	5
Pigging waste	General maintenance activities	Onshore treatment		0	4	6	5	5	3
Slops containing used drilling muds (NAF), cement spacer, chemical additives, washwater	Drilling operations	Onshore treatment		1210	2720	3626	1360	0	0
Oil contaminated completion brines	Well completion activities	Onshore treatment	Offshore incineration	18	40	54	20	0	0
Oily water	Tank and operating equipment cleaning	When practicable, recycle into FPSO process	Onshore treatment	24	58	81	37	10	5
Unused or contaminated solvents/chemicals	Operations, wastewater or water treatment systems, laboratories	Onshore treatment		4	13	56	61	57	57
Glycol	Operations and vessel equipment maintenance	When practicable, recycle into FPSO process	Onshore treatment	2	7	15	12	10	5
Oil sludge/Tank bottom sludge	Operations and vessel equipment maintenance	Onshore treatment		25	80	94	38	10	30
Oil contaminated cement		Onshore treatment		370	830	1110	415	0	0
Fluorescent bulbs	Replacement of light tubes	Stabilize and landfill		0	1	1	0	0	1
Non-punctured Aerosol / pressurized spray cans	General maintenance activities	Onshore treatment		2	5	6	3	1	1
Batteries (Lead Acid, Nickel-Cadmium, Lithium, Mercury Cell)	Instruments and small equipment	Onshore treatment / send to approved battery recycler		5	15	46	45	39	22
Electrical/electronic waste	Instruments and computer related equipment	Onshore treatment / send to an approved E-waste recycler		0	2	2	1	1	6

Waste Information: Hazardous Wastes				Volume By Year / Metric Tonnes					
Waste Stream	Waste Source	Primary Disposal Method	Alternate Disposal Methods	2018	2019	2020	2021	2022–2039	2040
Contaminated drums, containers, packaging (metal or plastic)	Operations and general maintenance	Onshore treatment	Landfill (plastic drums)	8	26	44	31	22	16
Radioactive waste		Send to facility permitted to manage NORM		<1	<1	<1	<1	<1	<1
Mercury-containing equipment		Onshore treatment		<1	<1	<1	<1	<1	<1

Liza Phase 1 Project Waste Estimates: Non-Hazardous Wastes

Waste Information: Non-Hazardous Wastes				Volume By Year / Metric Tonnes					
Waste Stream	**Waste Source**	**Primary Disposal Method**	**Alternate Disposal Methods**	**2018**	**2019**	**2020**	**2021**	**2022–2039**	**2040**
Recyclable domestic trash (plastic and glass)	Discarded items from, kitchen, living quarters, bathroom, laundry, warehouse, offices	Recycle	Landfill	39	100	136	62	19	24
Incinerator Ash	Incinerator	Landfill		17	40	55	24	5	7
General/domestic trash: non-recyclable	Discarded items from kitchen, living quarters, bathroom, laundry, warehouse, offices	Incinerate offshore or landfill		96	269	495	335	200	216
Desiccant	Air drying equipment (i.e. instrument air, air filtration systems)	Landfill		0	0	4	5	5	3
Production solids (e.g. sand, scale)	Operational maintenance from wells and producing equipment	Landfill		0	0	<1	<1	<1	15
Abrasive blast media (uncontaminated)	Construction and general maintenance	Landfill		0	0	2	3	3	2
Dry Filters	General Maintenance	Offshore incineration, recycle carcasses with scrap metal when possible	Landfill	4	10	20	15	10	8
Paper, Cardboard and Wood	Wooden pallets, construction, general maintenance	Offshore incineration	Recycle, landfill	154	360	503	218	45	45
Scrap metal	Equipment maintenance, metal packaging	Recycle	Landfill	24	61	110	72	45	25
Empty aerosol / pressurized spray cans	General maintenance	Recycle	Landfill	1	2	3	1	1	1
Empty steel drums	Construction and Operations	Recycle	Landfill	22	53	71	29	4	4

Annex B: Liza Phase 2 Project

Project Description

The Liza Phase 2 Project proposes to develop the offshore resource by drilling approximately 33 subsea development wells and using a FPSO vessel to process, store, and offload recovered oil. The FPSO will be connected to the wells via associated equipment, collectively referred to as subsea umbilicals, risers, and flowlines (SURF), to transmit produced fluids (i.e., oil, gas, produced water) from production wells to the FPSO, as well as treated gas and water from the FPSO to the injection wells.

The Project consists of five primary stages: drilling, installation, hook-up and commissioning, production operations and decommissioning. The Project will generate a variety of recoverable materials as well as solid, semi-solid, and liquid wastes that are both hazardous and non-hazardous, which will vary over time by Project stage. Estimated recoverable materials and waste types and volumes to be generated during each stage of the project has been provided in Attachment 1.

As per the current project schedule, waste could be generated as early as 2020. Waste volumes generated will increase early in the project as concurrent drilling and SURF installation activities occur from 2020 - 2022, which are then followed by the hookup and commissioning of the FPSO. Waste volumes will then begin to decrease as drilling activities conclude in 2023 and significantly decrease thereafter during the stage of production operations alone in 2024 to approximately 2040. When production operations cease, some waste will be generated during the decommissioning stage.[3]

[3] *Any dates specified in this document are based on the current Project schedule which is subject to change. They are provided to help conceptualize anticipated duration of each Project stage.*

Liza Phase 2 Project Waste Estimates: Hazardous Wastes

Waste Information: Hazardous Wastes				Volume By Year / Metric Tonnes					
Waste Stream	Waste Source	Primary Disposal Method	Alternate Disposal Methods	2020	2021	2022	2023	2024-2039	2040
Used lube oil / motor oil	Equipment and vehicle maintenance and repair (of internal-combustion engines, pumps, and compressors)	When practicable, recycle into FPSO process	Offshore or Onshore Incineration, Onshore Recycling	143	234	228	114	22	40
Contaminated hydrocarbons (contaminated crude, diesel, etc.)	General maintenance activities and spill response	Onshore treatment		8	20	20	20	8	16
Oily Debris (rags, gloves, wood, vegetation, sorbent pads, paper, etc.)	Routine operations and maintenance, rags and oil spill clean-up activities	Onshore treatment		12	31	27	27	8	24
Oily Filters and Oil Filter Sludge	Vehicle and equipment engines during all Project phases	Onshore treatment		12	33	35	35	16	32
Paint waste	Equipment and facilities activities and maintenance during all phases	Onshore Treatment		4	10	8	8	2	6
Medical waste	First aid and routine clinical procedures	Onshore treatment		2	5	4	4	1	1
Drum rinse	Drum and container rinsing	Onshore treatment		4	11	14	14	8	16
Tank sludges, production solids/sludges (pigging waste, etc)	General maintenance activities	Onshore treatment		46	119	98	98	24	64
Slops containing used drilling muds (NAF), cement spacer, chemical additives, washwater	Drilling operations	Onshore treatment		676	1082	1082	1082	0	0
Vessel tank cleanout liquids	Drilling operations, general maintentance activities	Onshore treatment		4222	4811	4324	4324	160	160
Oil contaminated completion brines	Well completion activities	Onshore treatment		34	54	54	54	0	0
Oily water	Tank and operating equipment cleaning	When practicable, recycle into FPSO process	Onshore treatment	45	78	72	72	20	16
Unused or contaminated solvents/chemicals	Operations, wastewater or water treatment systems, laboratories	Onshore treatment		10	45	106	106	93	101
Glycol	Operations and vessel equipment maintenance	When practicable, recycle into FPSO process	Onshore treatment	4	9	6	6	16	8
Oil contaminated cement	Drilling operations	Onshore treatment		692	1107	1107	1107	0	0
Fluorescent bulbs	Replacement of light tubes	Stabilize and landfill		<1	1	1	1	<1	1
Non-punctured Aerosol / pressurized spray cans	General maintenance activities	Onshore treatment		2	5	6	3	1	1
Batteries (Lead Acid, Nickel-Cadmium, Lithium, Mercury Cell)	Instruments and small equipment	Onshore treatment / send to approved battery recycler		9	37	77	77	63	67
Electrical/electronic waste	Instruments and computer related equipment	Onshore treatment / send to an approved E-waste recycler		1	4	2	2	2	10

Waste Information: Hazardous Wastes				Volume By Year / Metric Tonnes					
Waste Stream	**Waste Source**	**Primary Disposal Method**	**Alternate Disposal Methods**	**2020**	**2021**	**2022**	**2023**	**2024-2039**	**2040**
Contaminated drums, containers, packaging (metal or plastic)	Operations and general maintenance	Onshore treatment	Landfill (plastic drums)	15	46	59	59	35	43
Radioactive waste		Send to facility permitted to manage NORM		<1	<1	1	1	1	3
Mercury-containing equipment		Onshore treatment		<1	<1	<1	<1	<1	<1

Liza Phase 2 Project Waste Estimates: Non-Hazardous Wastes

Waste Information: Non-Hazardous Wastes				Volume By Year / Metric Tonnes					
Waste Stream	**Waste Source**	**Primary Disposal Method**	**Alternate Disposal Methods**	**2020**	**2021**	**2022**	**2023**	**2024-2039**	**2040**
Recyclable domestic trash (plastic and glass)	Discarded items from, kitchen, living quarters, bathroom, laundry, warehouse, offices	Recycle	Landfill	72	142	134	76	19	33
Incinerator Ash	Incinerator	Landfill		31	56	58	33	8	15
General/domestic trash: non-recyclable	Discarded items from kitchen, living quarters, bathroom, laundry, warehouse, offices	Incinerate onshore and/or landfill		180	369	489	344	200	140
Desiccant	Air drying equipment (i.e. instrument air, air filtration systems)	Landfill		0	2	8	8	8	9
Production solids (e.g. sand, scale)	Operational maintenance from wells and producing equipment	Landfill		0	<1	<1	<1	<1	24
Abrasive blast media (uncontaminated)	Construction and general maintenance	Landfill		0	1	4	4	4	5
Dry Filters	General maintenance	Recycle carcasses with scrap metal when possible; Onshore incineration	Landfill	8	17	28	22	16	20
Paper and Cardboard	General maintenance	Recycle, landfill		18	52	45	31	16	17
Wood	Wooden pallets, construction, general maintenance	Onshore incineration, landfill		270	444	462	245	29	27
Scrap metal (punctured aerosol cans, empty steel drums)	Equipment maintenance, metal packaging	Recycle	Landfill	88	169	190	120	49	33

Attachment 2: GUYANA HAZARDOUS WASTE RECORDING AND REPORTING FORM

EPA-EMD2012HWRRF1R1

RECORDING AND REPORTING FORM OF HAZARDOUS WASTES (*for* New and Existing Operations)

General Instructions/Requirements/Information

The Recording and Reporting Form must be completed by the holder of an Environmental Authorization no later than forty-five days after the end of the operating year.

Note: The report should be prepared on activities relating to the previous calendar year.

1. This Form must be completed in BLOCK LETTERS (preferably completed electronically) and a hard copy along with any additional information requested submitted to:

   The Executive Director
   Environmental Protection Agency
   Ganges Street
   Sophia, Georgetown, Guyana
   Telephone: (592) 225-2062 / 1218 / 0506 / 6917
   Fax: (592) 225-5481
   Email: epa@epaguyana.org **Website:** www.epaguyana.org

2. The information provided in this form must be kept by the holder of the authorization for a period of not less than three years or for such other extended time as the Agency may determine.

Specific Instructions for Completing Form

3. **Block A:** Provide the Permit Reference number, the name of the Company, Project address, mailing address (if different). In this section also provide the name, designation, telephone number, email/fax of a contact person.

4. **Block B:** Provide a description of the operation process. Identify all hazardous materials/chemicals used within the operation process. Also provide the number of years the project has been operational.

5. **Block C:** Provide information on **hazardous materials/chemicals used** in the life cycle of the project. Provide the type of hazardous material/chemicals used (see attached list), its hazardous, physical and chemical characteristics (see attached list), the quantity and the type of storage e.g. containers, bags etc.

6. **Block D**: Provides information on the **hazardous wastes generated.** Provide the type of hazardous material/chemicals used (see attached list), its hazardous, physical and chemical characteristics (see attached list), the quantity and the type of storage e.g. containers, bags etc.

7. **Block E**: Once authorized all spills must be reported. Provide information on the date of incident, type and amount of waste spilled, measures taken to mitigate incident.

EPA-EMD2012HWRRF1R1

A. IDENTIFICATION INFORMATION			
Generator's Permit Reference Number:			
Company Name:			
Project Address:		Region	
Mailing Address (if Different):		Region	
Contact Personnel			
Name :			
Designation:			
Telephone number:			
FAX:			
Email:			

B. OPERATION DETAIL
Brief description of operating process and raw materials (specifically hazardous materials and quantity) used:
No. of Years of Operation: 1-4 years ☐ 5-19 years ☐ over 20 years ☐

C. HAZARDOUS MATERIALS/ CHEMICALS (All Parts of This Section Must Be Completed)

Types of Hazardous Materials/ Chemical	**Hazardous Characteristics**	**Quantity of Hazardous Materials/Chemical**		**Physical Characteristics**	**Chemical Characteristics**	**Type of Storage**
		Mass (kg/gallons)	**Volume (m^3)**			

EPA-EMD2012HWRRF1R1

D. HAZARDOUS WASTES (All Parts of this Section Must Be Completed)						
Type of Hazardous Wastes generated	**Hazardous Characteristics**	**Quantity of Hazardous Waste Generated**		**Physical Characteristics**	**Chemical Characteristics**	**Type of Storage**
		Mass (kg/gallons)	**Volume (m^3)**			

E. SPILLS/CHEMICALS RELEASE		
Date/s of Incident	**Type and Approximate Amount of Waste Lost (kg/gallons)**	**Measures Taken to Resolve the Incident**

OTHER	
Data for off-site Shipment of Waste (transporter and receiver details, location of the off-site facility, etc.)	
Treatment Standard for Waste (if applicable)	
Waste Minimization Efforts (different ways used by the company to reduce the waste generated)	
Details on any Pollution Prevention Plan by the company	

EPA-EMD2012HWRRF1R1

Other Information (e.g. Emergency Response Plan, Occupational Handling Measures)	

Attachment 3: SAMPLE WASTE/GARBAGE RECORD BOOK

Ship's Name:

Official No:

IMO No:

Garbage Categories:

- Category 1: Plastics
- Category 2: Floating dunnage, lining, or packing material
- Category 3: Ground-down paper products, rags, glass, metal, bottles, crockery, etc.
- Category 4: Cargo residues, paper products, rags, glass, metal, bottles, crockery, etc.
- Category 5: Food waste
- Category 6: Incinerator ash except from plastic products which may contain toxic or heavy metal residues
- Other Releases - Treated sanitary wastewater, grey water, ballast

NOTE: The discharge of any garbage other than food waste is prohibited in special areas. . Garbage other than Category 1 transferred to reception facilities need only be listed as a total estimated amount.

Waste Type	Date/ Time	Position of the Ship	Estimated Amount of Waste Generated Solid (m3); Liquid (L)	Category 1-6	Estimated Amount of Food Waste Comminuted and Discharged (m3)	Estimated Amount Transferred to Reception Facilities or to Other Ship Solid (m3); Liquid (L)	Estimated Amount Incinerated Solid (m3); Liquid (L)	Certification / Signature
Food Waste	1/1/17; 13:00		2 m3	5	2 m3	NA	NA	
Paper Products	1/15/17; 07:30		15 m3	3	NA	NA	15 m3	
Used Oil	2/20/17; 15:20		50 L	4	NA	50 L		

Master's Signature:

Date:

Attachment 4: SAMPLE OIL RECORD BOOK

Ship's Name: _____

Distinctive Number or Letters: _____

Gross Tonnage: _____

Period From: _____ To: _____

Machinery Space Operations (All Ships) or Cargo / Ballast Operations (Oil Tankers)

(*Delete that operation above which does not apply*)

Date	Code Letter	Item Number	Record of Operations / Signature of Officer in Charge

Master's Signature:

Date:

Attachment 5: SAMPLE CHAIN OF CUSTODY FORM FOR SAMPLES

CHAIN-OF-CUSTODY RECORD

1. Facility Information:

   Facility Name_____

2. Sample Information:

   Time Sample Collected _____:_____ [ ] AM or [ ] PM (Check One)

   Date Sample Collected _____/____/_____ (Month/Day/Year)

   Name of Sampler (Print) _____

   Signature of Sampler _____

   Sampler's Company Name _____

   Analysis Information: _____

3. Chain-of-Custody: (To be completed by each person relinquishing sample)

Name (Please Print)	Signature	Facility	Relinquished To (Name / Facility)	Date mm/dd/yr	Time

4. Laboratory Shipping Information:

   Laboratory Name: _____

   Laboratory Address: _____

   _____

   Date Shipped: ____/____/____ (Month/Day/Year)

   Estimated Arrival Date: ____/____/____ (Month/Day/Year)

   Estimated Arrival Time: Collected _____:_____ [ ] AM or [ ] PM (Check One)

Attachment 6: SAMPLE MARINE TRANSPORT MANIFEST

Generator:		From	MANIFEST Nr: GUY-18-XXX
Prepared Date:	Day- Month - Year	Well Nr/Ref:	OPERATOR REF: Vessel Owner-Operator
Shipped Date:	Day- Month - Year	VESSEL:	OTHER REF:
Lease Holder:	EEPGL		DESTINATION: Georgetown Supply Base

ITEM	QTY	WASTE CAT	DG REF	UN CODE	PACKING	S/N ID/REF	OTHER REF	DESCRIPTION	OWNER
1	1	n/a	n/a	n/a	n/a	13220		Containers o/w:	
	6	6	n/a	n/a	Bags			Old Grout Bag. Non Hazardous. Non Recyclable	
	6	6	n/a	n/a	Big Bags			Sack Room Waste. Non Hazardous. Non Rec	
2	1	n/a	n/a	n/a	n/a	13150		Containers o/w:	
	6	1	n/a	n/a	Big Bags			General - Non Hazardous - Non Recyclable	
3	1	n/a	n/a	n/a	n/a	13253		Containers o/w:	
	1	3	n/a	n/a	Skip			Wood - Non Hazardous - Non Recyclable	
4	1	n/a	n/a	n/a	n/a	13262		Containers o/w:	
	1	3	n/a	n/a	Skip			Wood - Non Hazardous - Non Recyclable	
5	1	n/a	n/a	n/a	n/a	13195		Containers o/w:	
	6	3	n/a	n/a	Big Bags			Sack Room Waste. Non Hazardous. Non Rec	
									Sub Totals

1st Transporter	2nd Transporter	Final Destination	
DATE:	VEHICLE REG/ID:	DATE	VEHICLE REG/ID:
NAME:		NAME	
SIGN:		SIGN	

Totals

Grand Totals

Final destination receiver to return a completed signed copy to originator.

Waste Categories

Glass	8 Chemical Waste	Oily Effluents	Tetra Pack
d - Aluminium	9 Hospital Waste	Hydraulic / Lube Oil / Fuel	Vegetable Oil
		14 Mud	Others
		15 Waste Water Mud	

Declaration: I hereby declare that the information contained herein, is true and correct, to the best of my knowledge:

Vessel Name: _____ ***Signature:*** _____

Name: (Print) _____

Attachment 7: SAMPLE WASTE MANIFEST

WASTE GENERATOR INFORMATION

Generator: _____
Address: _____
Contact Information: Office _____ Mobile _____ email _____
Contact Person: _____ Position _____
Manifest Number: _____

WASTE INFORMATION (To be completed by waste generator)

Waste Description: ☐ Hazardous ☐ Non Hazardous

(Provide a brief description) _____
Process Generating Waste: _____
_____
Physical State ☐ Solid ☐ Liquid ☐ Sludge ☐ Other _____
Physical Properties Colour _____
Odour _____
MSDS ☐ Yes ☐ No
Special Handling Requirements ☐ Yes ☐ No
Waste Volume ☐ _____ Barrels (42 Gal.) ☐ _____ Drum (55 Gal.) ☐ _____ Gallons
☐ _____ Cubic Meters ☐ _____ Pounds

DISPOSAL INFORMATION (To be completed by TTTU)

Disposal Option ☐ Recycling ☐ Thermal Desorption
☐ Incineration ☐ Landfill
Disposal Facility ☐ Tiger Tanks ☐ Haag Bosch
☐ Other (Recycling) _____
Haulage /Storage ☐ Truck ☐ HWS Skip ☐ Cuttings Box ☐ Other

WASTE RECEIPT AT GENERATORS FACILITY

Physical State ☐ Solid ☐ Liquid ☐ Sludge ☐ Other _____
Physical Properties Colour _____
Odour _____
MSDS ☐ Yes ☐ No
Waste Volume ☐ _____ Barrels (42 Gal.) ☐ _____ Drum (55 Gal.) ☐ _____ Gallons
☐ _____ Cubic Meters ☐ _____ Pounds

Dispatched By: _____ Signature _____ Date _____
Received By: _____ Signature _____ Date _____

Attachment 8: SAMPLE WASTE INFORMATION DATA SHEET

GENERATOR INFORMATION

Generator: _____ Date _____

Address: _____

Contact Information: Office _____ Mobile _____ email _____

Contact Person: _____ Position _____

Waste Manifest Number : _____

WASTE INFORMATION

MSDS to be provided for all chemical drums, buckets and tote tanks for disposal.

Waste Description		*WMF*	*DN*	*Volume*			*Comments*
				lbs	*units*	*m^3*	
Hazardous Waste Liquids							
Oil contaminated water based drilling fluid							
Liquid oil residue / slops							
Oil contaminated completion brines							
Oil contaminated produce water or water							
Non-aqueous drilling fluid							
Contaminated deck drainage or other oily water							
Liquid treatment/ chemicals							
Solvents /paints/ Glycols							
Acid/ caustic solutions							
Used lube oil/motor oil/ grease							
Surplus fuels Heli, contaminated diesel							
Oil sludge							
Hydrocarbon contaminated sand							
SOBM / cement slops							
Hazardous waste solid/ other							
Contaminated solid products with oil or grease	*Rags*						
	Clothing						
	Absorbent pads						
	Wood						
	Used oil						
	Grease tubes						
	Dope brushes						
	Filter						
	Other						
Storage mediums contaminated	*Metal drums/ container*						
	Plastic drums/ container						

with hazardous waste such as chemicals, oils, paints	*Cardboard drums/ container*						
	Totes						
	Buckets						
	Threaded protectors						
	Biohazard/ Medical waste						
	Aerosol cans						
	Chemical drums						
Batteries	*Alkaline/ Lead acid batteries*						
	Ni-Cd/ Lithium Batteries						
Bulbs/ White Fluorescent tubes							
Light Ballast electronic equipment							
Recyclables	*Paper/ cardboard*						
	Scrap metal						
	Plastic bottles						
	Glass bottles						
	Aluminum can						
	Plastic packaging and wood						
Non- hazardous General waste/ other							
Water base drilling fluid							
Non- contaminated cement							
Other non-hazardous liquids							
Non-hazardous waste	*Food / Sanitary waste*						
	Sewage						
	Non- hazardous sludge/slops						
	Non hazardous solid industrial waste/ general trash						

Attachment 9: HAZARD CLASS SYMBOLS FOR HAZARDOUS WASTES AND MATERIALS

APPENDIX 2

Stakeholder Engagement Plan

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Esso Exploration and Production Guyana Limited

Stakeholder Engagement Plan for Guyana Operations

(Updated to include Liza Phase 2)

Stabroek License Area
Offshore Guyana

[For Public Disclosure]

May 2018

Contents

Figures

Glossary

Terms	Description
Stakeholder	Any individual or group who is affected by a project or may have an interest in, or influence over it
Consultation	The process of sharing information, ideas and concerns in a two-way dialogue between project proponents and stakeholders, allowing stakeholders to express their views and for these to be considered in the decisions about project planning and implementation
Disclosure	The process of publishing and making available information in various ways (such as on the internet, in paper form or in press announcements)
Engagement	General term for activity including disclosure and consultation
Environmental Impact Assessment (EIA)	A systematic process for identifying and managing the potential environmental, social and health aspects, impacts and related risks associated with major projects
Environmental Management Plan (EMP)	A project-specific plan developed to identify and implement measures to protect the environment and comply with environmental legislation
Environmental and Social Management Plan (ESMP)	A system to manage the environmental and social risks and impacts of a project's activities
Esso Exploration and Production Guyana Limited (EEPGL)	A subsidiary of ExxonMobil in Guyana
Feedback	Formally issued inquiry, comment, concern or complaint about the Project or associated activities by individuals or organizations
Feedback Mechanism	Process by which inquiries, comments, concerns or grievances are formally submitted by interested parties, and tracked and addressed by the Project proponent
Strategic Environmental Assessment (SEA)	A systematic decision support process to consider environmental and possibly other sustainability aspects during the planning phases of a project
Terms of Reference (TOR)	Document that describes the purpose, scope, limitations and structure of a project or process

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1 INTRODUCTION

The Esso Exploration and Production Guyana Limited (EEPGL) Stakeholder Engagement Plan (SEP) is designed for an ongoing exchange of information that allows the Company to 1) identify, understand and address community/stakeholders priorities and concerns, and 2) improve decision-making and transparency. This is an evergreen document that will evolve according to EEPGL activities. For example, Annex B is the Synopsis of Liza Stakeholder Engagement Activities, which will be updated at various stages of each major project or EEPGL activity.

Environmental Resources Management (ERM) been contracted by EEPGL to support the company's environmental permitting processes, including completion of a Strategic Environmental Assessment (SEA), Environmental Impact Assessments (EIAs) and associated stakeholder engagement activities. All efforts occur on behalf of EEPGL. ERM has subcontracted with local environmental consultancies Ground Structures Engineering Consultants (GSEC) and Environmental Management Consultants (EMC) who also regularly assist in stakeholder engagement activities.

1.1 Objectives

This SEP has been developed to meet the expectations of the company, regulators and the communities. The SEP describes the stakeholder identification process and outlines an engagement program to promote meaningful, timely and effective engagement with stakeholders. It builds on previous engagement efforts, including those documented in the SEA and the Liza Phase 1 and Liza Phase 2 EIA processes.
Engaging stakeholders is an important aspect of managing ongoing social and environmental performance and non-technical risks.
The objectives of stakeholder engagement are to:

- Promote the development of respectful and open relationships between stakeholders and EEPGL;
- Identify stakeholders and understand their interests, concerns and influence in relation to ongoing activities;
- Provide stakeholders with timely information about Company activities, in ways that are appropriate to their interests and needs;
- Support alignment with the Government of Guyana requirements and corporate standards and guidelines for stakeholder engagement;
- Record feedback and resolve any grievances that may arise through a formal feedback mechanism.

2 ADMINISTRATIVE FRAMEWORK

Socioeconomic and stakeholder components are considered in a number of laws, including the Environmental Protection Act. Additionally, Guyana is a signatory to a number of international and regional conventions and protocols aimed at addressing socioeconomic and stakeholder concerns. EEPGL proposes to conduct stakeholder engagement to comply with the spirit and intent of these laws, Guyana National Plans, and international agreements, including those outlined in the environmental authorizations for major project developments and other operational activities.

2.1 The Environmental Protection Act

In 1996, the Environmental Protection Act (hereinafter referred to as the Act) was enacted to implement the environmental protection provisions of the Constitution. The Act is Guyana's single most significant environmental legislation because it articulates national policy on important environmental topics such as pollution control, the requirements for environmental review of projects that could potentially impact the environment, and the penalties for environmental infractions. Most importantly, the Act authorized the formation of the Environmental Protection Agency (EPA), and establishes the EPA as the lead agency on environmental matters in Guyana (FAO, 2013). The Act further mandates the EPA to oversee the effective management, conservation, protection and improvement of the environment (EPA, 2012). It also requires the EPA to take the necessary measures for the prevention and control of pollution, assessment of the impact of economic development on the environment, and the sustainable use of natural resources.

The Act outlines the process for conducting an EIA with timeframes for some steps. It specifically regulates stakeholder involvement. The stakeholder engagement process describes how a project proponent should undertake consultation to provide stakeholders with opportunities to express their views on project risks, impacts and mitigation measures, and to allow the project to consider and respond to them. There is a 28-day public consultation period for the scoping phase in which a Project Summary is submitted and the 60-day public consultation period after the entire Draft EIA is submitted.

Outside of and in addition to these EIA public consultation periods, EEPGL is committed to promoting and providing means for adequate engagement with stakeholders throughout the project lifecycle on issues that could potentially affect them and so that relevant environmental and social information is disclosed and disseminated. EEPGL's ongoing and planned engagement activities are complementary to EIA-regulated disclosure periods.

3 STAKEHOLDER ENGAGEMENT STRATEGY

3.1 Overview

The stakeholder engagement strategy is one component of managing project risk by familiarizing stakeholders with EEPGL's activities and efforts to protect safety, health and the environment, incorporate stakeholder input into business decisions, and build a positive relationship between EEPGL and the community.

EEPGL's engagement strategy:

- Proactively identifies and engages stakeholders to provide an overview and understanding of activities;
- Collects stakeholder input for the identification of potential impacts and associated management plans;
- Facilitates the consideration of stakeholder input when making business decisions;
- Outlines a mechanism to address concerns/grievances in a timely manner;
- Monitors and reports trends.

The stakeholder engagement strategy integrates the following elements:

- Identification and assessment of stakeholders;
- Mechanisms, methods, and tools for engagement;
- Engagement activities that have been undertaken to date;
- Planned engagement activities;
- A formal stakeholder feedback mechanism;
- Monitoring and reporting of engagement activities.

3.2 Stakeholder Identification Methodology

One of the first steps in stakeholder engagement planning is the identification of stakeholders. Stakeholders typically include government officials, regulators, co-venturers, members of the community and public at large, non-governmental organizations (NGOs) and civic leaders, media, employees and contractors, and industry associations. Stakeholders can be individuals working on a project, groups of people or organizations, or even segments of a population. A stakeholder may be actively involved in a project's work, affected by the project's outcome, or in a position to affect the project's success.

To develop an effective SEP, it is necessary to identify stakeholders and to understand their needs and expectations for engagement, and their priorities and objectives in relation to the Project.

As part of this process it is particularly important to identify individuals and groups who may find it more difficult to participate and those who may be differentially or disproportionately affected by the project because of their marginalized or vulnerable status. It is also important to

understand how stakeholders may be affected – or perceive they may be affected – so that ongoing engagement can be tailored to inform them in an appropriate manner and address their views and concerns.

One way to characterize stakeholders is by their relationship to the effort in question, for example:

- *Primary stakeholders* are the people or groups that stand to be directly affected, either positively or negatively, by an effort or the actions of an agency, institution, or organization;
- *Secondary stakeholders* are people or groups that are indirectly affected, either positively or negatively, by an effort or the actions of an agency, institution, or organization;
- *Key stakeholders*, who might belong to either or neither of the first two groups, are those who can have a positive or negative effect on an effort, or who are important within or to an organization, agency, or institution engaged in an effort.

While an interest in an effort or organization could be just that – intellectually, academically, philosophically, or politically motivated attention – stakeholders are generally said to have an interest in an effort or organization based on whether they can affect or be affected by it. The more they stand to benefit or lose by it, the stronger their interest is likely to be; and the more heavily involved they are in the effort or organization, the stronger their interest is as well. Stakeholders' interests can be many and varied. A few of the more common include:

- Economics;
- Social Change;
- Labor;
- Environment;
- Safety and Security.

3.3 Stakeholders

Stakeholders are identified at the beginning of new activities. Once identified, stakeholders are assessed based on their anticipated degree and topics of interest, as well as their role in processes which may affect activities. (Figure 1) The information is input into a stakeholder log. The SEP is an evergreen document, so additional stakeholders will be added to the stakeholder log as they are identified. Potential stakeholders, including those identified through the EIA baseline data collection process, are listed in Annex A. This table is not exhaustive.

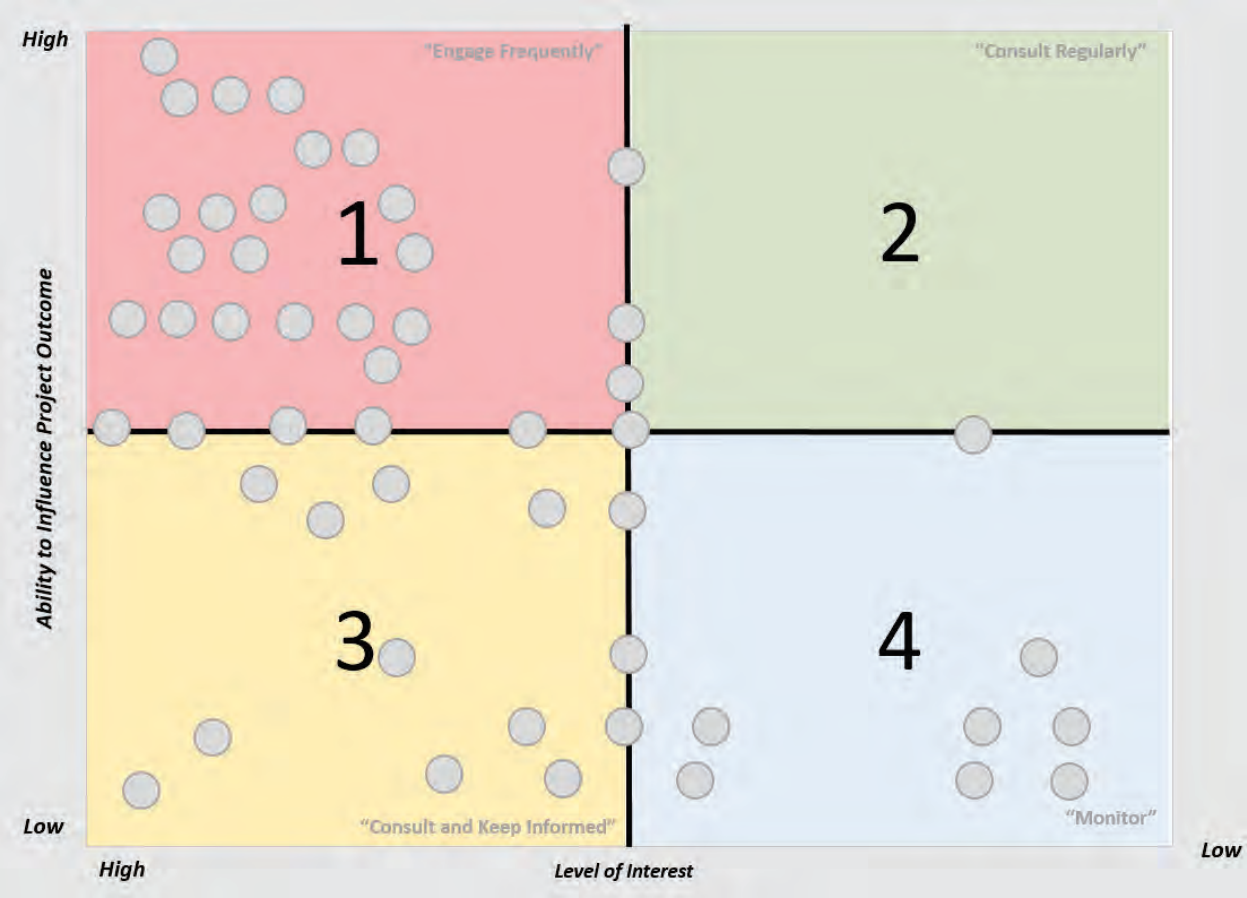

Figure 1: Example Stakeholder Map

Methods and Tools

EEPGL's stakeholder engagement strategy includes methods and tools to facilitate stakeholder communication and dissemination of public information. As shown in Figure 2, the different types of methods employed interact to allow informed engagement. The first method is information provision, which offers stakeholders information to support their understanding of the proposed activities. The other methods are consultation, which supports dialogue and active receipt of stakeholder feedback/input based on the information provided, and incorporation of input. These methods capture opinions, concerns and knowledge on how activities may interact with a stakeholder's natural and social environment, allowing EEPGL to gather information concerning topics that are important to its stakeholders. These activities provide stakeholders an opportunity to ensure their comments and opinions are heard and concerns addressed. The tools and mechanisms listed in italics in Figure 2 describe how EEPGL intends to provide information to stakeholders, consult with and solicit information from stakeholders, and report back on how stakeholder input has been incorporated into key documents such as project plans.

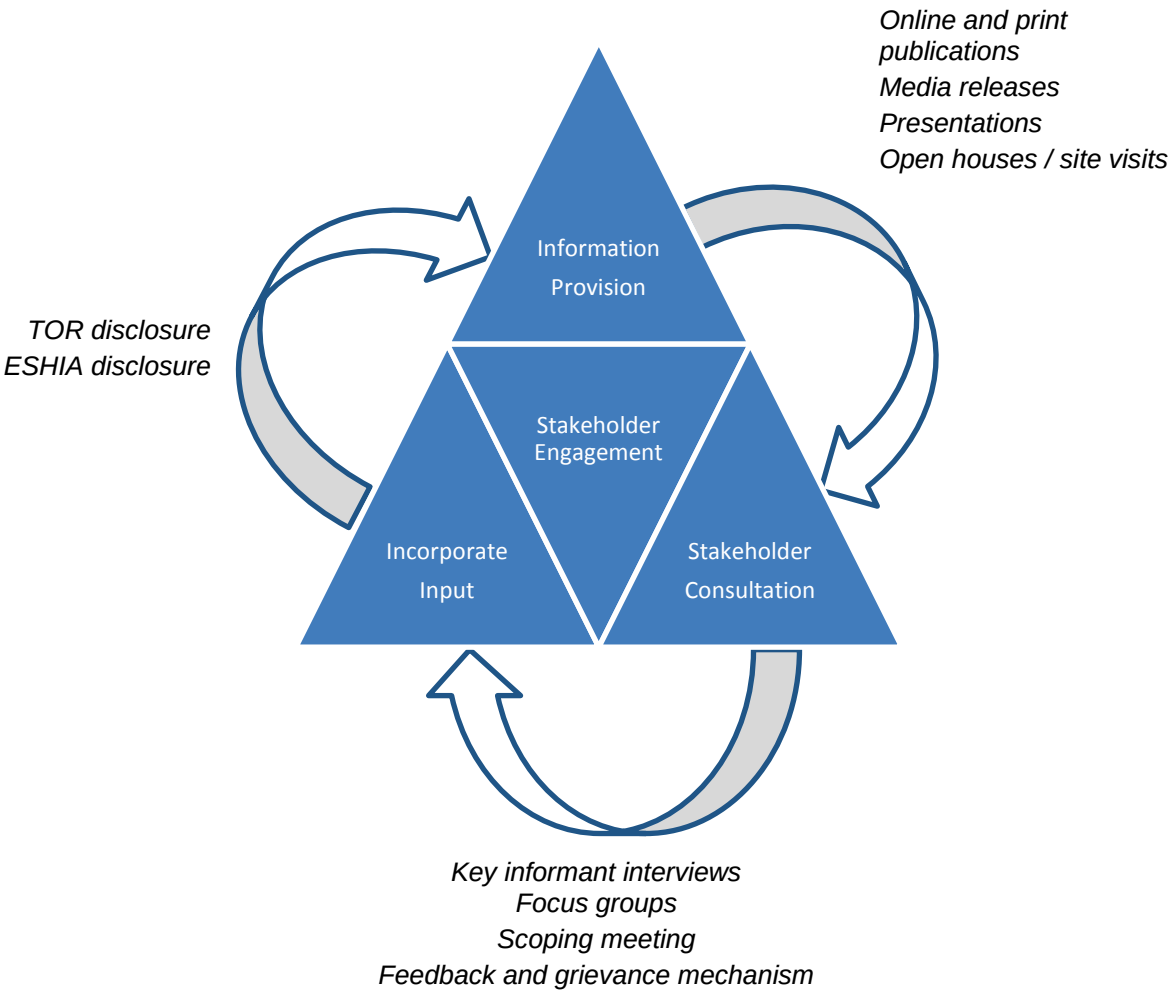

Figure 2: Example Stakeholder Engagement Strategy for EIA Development

Information Provision activities provide information to a broad audience or group of stakeholders as efficiently as possible. Activities include dissemination of online material and print publications, media releases, presentations and open houses.

Stakeholder Consultation activities involve a two-way flow or exchange of information between stakeholders and the Project. Activities include one-on-one and small group meetings, public meetings including a question and answer session, town hall meetings, feedback mechanism such as a webpage, email address or dedicated phone line.

Incorporate Input activities include TOR disclosure and ESHIA disclosure, which includes making the documents available for review and comment.

Stakeholder Grievance Mechanism

EEPGL has a community grievance mechanism (CGM) for stakeholders to provide feedback related to any issues or concerns, guidance, requests and/or complaints (considered grievances) associated with activities. The Project will address these in good faith through a transparent and impartial process.

Objectives of the CGM are:

- Provide stakeholders with a mechanism to communicate feedback, issues or concerns requests and/or complaints to EEPGL in a timely manner so that they can be addressed quickly and proactively
- Process so they are acknowledged, tracked and addressed by EEPGL in a timely and confidential manner
- Continuously improve Project performance in all areas
- Demonstrate EEPGL's commitment to meaningful stakeholder engagement and respect for local opinions and concerns

For a full description of the CVM please refer to the Environmental and Socioeconomic Management Plan (ESMP).

EEPGL will consider any feedback that it receives as a critical component of the broader stakeholder engagement activities, including monitoring and reporting.

Stakeholders can contact EEPGL to submit feedback in three ways:

1. In person, either to an EEPGL employee or representative;
2. Via telephone – (592) 231 2866, extension 12400; or
3. Via email – Guyanastaff@exxonmobil.com

NOTE: The EPA prescribes that stakeholder feedback and comments related to SEA/EIA should be addressed to:

The Environmental Protection Agency
c/o Director – Environmental Management Permitting Division
Ganges Street, Sophia, Georgetown
Phone: 225-0506 / 225-5467-8 / 225-5471-2
Fax: 225-5481
E-mail epa@epaguyana.org
Website: www.epaguyana.org

Monitoring and Reporting

Monitoring is an important part of determining the effectiveness of the activities undertaken, and revising them, as required, to ensure effective engagement. A tool is used to log all engagements with stakeholders, and capture feedback received from stakeholders. This tool allows for an analysis of trends in stakeholder interest and concern, which will help EEPGL design further engagement programs and activities.

As part of EEPGL's management systems, performance indicators are assigned to the monitoring process and will be tracked for completion. A number of key performance indicators will be monitored by EEPGL on a regular basis in relation to stakeholder engagement measures. These may involve the following parameters:

- Number of consultation meetings and other public discussions /forums conducted within a period (e.g. monthly, quarterly, or annually)
- Number of grievances received within a period (e.g. monthly, quarterly, or annually)
- Number of those closed within the prescribed timeline and the reason for aged grievances within the prescribed timeline and trends
- Type of public grievances received and trends

3.4 Roles and Responsibilities

In order for a SEP to be implemented successfully, adequate resources and responsibilities need to be designated. Please note that this does not include roles assigned to the Government of Guyana and the EPA.

Role	Responsibilities
EEPGL	
Lead Country Manager	• Review and approve SEP • Assist in implementation of the SEP
Public and Government Affairs Manager	• Review and approve SEP to ensure alignment with current affiliate stakeholder engagement information, philosophies, activities, and relationships • Own and steward the affiliate's feedback mechanism, including the management of grievances • Assist in the development and implementation of the SEP • Assist in documentation of engagements conducted • Help maintain a comprehensive archive on captured data
SSH&E Manager	• Review and approve the SEP • Review and authorise any financial provisions for stakeholder engagement (tied to SEA/EIA Stakeholder engagement)
ER&S Lead	• Review, approve and steward the SEP to ensure it meets permitting requirements • Assist in the definition, development and implementation of the SEP, ensuring correct application of the EEPGL internal requirements • Periodically review progress in the development and implementation of stakeholder engagement activities

Role	Responsibilities
	• Periodically review SEP, monitoring outcomes, and elaborate where necessary
Service Department and Business Leads/Advisors and Contractors	• Conduct engagements as directed by the affiliate and/or ER&S Lead • Complete all reporting including outcomes and stakeholder input for all engagements
Houston based ExxonMobil Management	
Project Leadership	• Provide adequate resources to implement the SEP • Ensure that the SEP is designed, developed and implemented as per legal requirements and ExxonMobil requirements for all operations
ERM	
Environmental and Social Consultant	• Engage with stakeholder to explain EIA process and collect information required to complete a robust EIA • Document all engagements conducted • Maintain a comprehensive archive on all items captured / generated during / related to the conduct of the EIA (lists of concerns / issues / comments, newspaper articles, handouts / posters developed, fact sheets, etc.).

4 SUMMARY OF STAKEHOLDER ENGAGEMENT ACTIVITIES

Ongoing positive stakeholder relationships throughout the entire lifecycle of a project are critical to its success. Stakeholder engagements are ongoing throughout EEPGL's activities in Guyana, and will continue specifically through the environmental authorization application and the corresponding EIA processes.

4.1 Overview of Engagement Activities to Date

EEPGL began pro-active communication regarding the company's activities in 2013 to lay the groundwork for establishing and maintaining stakeholder relations. Informational meetings and exchanges of information were conducted between the Project team members and key external audiences, including government officials, stakeholders within the general public, and representative non-governmental organizations. In addition to being a good business practice, these early engagements helped to inform the Strategic Environmental Assessment that was submitted to the EPA in March 2014.

Stakeholder engagements have been ongoing since then and have included meetings with individual stakeholders, public forums and training for local agencies and officials in the form of workshops on topics such as oil spill response and waste management. Newspaper notifications have been printed at various points in time throughout the regulatory process to increase public awareness.

A schedule of the larger and more structured stakeholder engagement activities conducted to date is presented in Annex B (Synopsis of Liza Engagements). Not all stakeholder engagement activities are included, for example, face-to-face meetings which are part of the normal course of business for EEPGL.

4.1.1 Regular government engagement

Continuous engagements with government and agencies that have oversight of the Projects, such as the Ministry of Natural Resources, Guyana Geology and Mines Commission and Environmental Protection Agency, will take place throughout EEPGL's operations.

4.1.2 Environmental Application and Public Comment Period

During all environmental authorization application processes, stakeholders have had the opportunity through a 28-day public review period to provide input on EPA's determination on whether an EIA is required. For both the Liza Phase 1 and Liza Phase 2 developments, the EPA determined an EIA is required.

4.1.3 TOR and Public Comment Period

For the EIA processes conducted to date, EEPGL held face-to-face meetings with select members of civil society to provide specific Project information prior to the TOR submittals. Stakeholders had the opportunity through a series of sector and public scoping meetings to provide input into the issues and concerns they wish to be considered within the EIAs. The dates and locations of the sector and public scoping meetings held to date are summarized in the table below. Once the TORs were submitted, EEPGL held regular meetings with the EPA and other relevant government agencies to discuss the submittals.

Meeting Type	Meeting Date	Meeting Location
Liza Phase 1		
Sector Agencies	5 and 6 October 2016	Region 4
Public Meeting	24 October 2016	Region 3
Public Meeting	26 October 2016	Region 2
Public Meeting	8 November 2016	Region 6
Public Meeting	14 November 2016	Region 1
Public Meeting	2 December 2016	Region 5
Public Meeting	3 December 2016	Region 4

Meeting Type	Meeting Date	Meeting Location
Liza Phase 2		
Sector Agencies	16 January 2018	Region 4
Public Meeting	17 January 2018	Region 5
Public Meeting	18 January 2018	Region 6
Public Meeting	24 January 2018	Region 2
Public Meeting	25 January 2018	Region 2
Public Meeting	25 January 2018	Region 3
Public Meeting	2 February 2018	Region 1
Public Meeting	5 February 2018	Region 4

More information on the attendees and issues raised at the scoping meetings is summarized in Annex B (Synopsis of Liza Engagements).

4.1.4 EIA Baseline Data Collection

As part of the EIA preparation process, EEPGL's EIA environmental consultants ERM, EMC and GSEC conduct engagement sessions with select key informants who hold specialist knowledge about topics of relevance for the EIA. These engagements often involve key informant interviews to gather specific information, as well as requests for data such as annual reports and plans. Key informant stakeholders that have been engaged to date include:

- Ministry of Agriculture, including the Department of Fisheries;
- Ministry of Communities;
- Ministry of Public Health;
- Department of Tourism;
- Ministry of Social Protection;
- Ministry of Indigenous Peoples Affairs;
- Ministry of Public Infrastructure ;
- Maritime Administration Department;
- Guyana Land and Surveys Commission;
- Bureau of Statistics;
- National Trust of Guyana;
- Private Sector Commission;
- Protected Areas Commission;
- University of Guyana Centre for the Study of Biological Diversity;
- Guyana Marine Conservation Society;
- Conservation International;

- World Wildlife Fund;
- Association of Trawler Owners and Seafood Processors;
- National Aquaculture Association of Guyana;
- Guyana Rice Producers' Association;
- Supenaam-Parika Speedboat Owners' Association;
- Mainstay Amerindian Village;
- Vilvordeen-Fairfield Women's Association;
- Pomeroon Women's Agro-Processors Association;
- West End Agricultural Development Society;
- Big Bird & Sons Fishing Complex (Charity);
- Lima Fishermen's Development Co-op;
- Georgetown Fishermen's Co-op Society Ltd.;
- Parika Fishermen's Development Co-op;
- Ogle International Airport;
- African Culture Development Association;
- Guyana Hindu Dharmic Sabha;
- Region 2 Development Council.

Information on key informant engagements aimed at obtaining baseline information for EIA development is summarized in Annex B (Synopsis of Liza Engagements).

4.1.5 Draft EIA Submittal and Public Comment Period

Under the Guyana EPA's EIA process, a 60-day public comment period begins upon submittal of the draft EIA. Per the Environmental Protection Act, during the course of the environmental impact assessment, the developer and the person carrying out the environmental impact assessment shall consult members of the public and interested bodies and organizations to discuss the results of the EIA. Public consultation meetings held to date in accordance with these requirements are shown in the table below.

Meeting Type	Meeting Date	Meeting Location
Liza Phase 1		
Stakeholder meeting – Guyana Marine Conservation Society	28 February 2017	Georgetown
Stakeholder meeting – EPA	2 March 2017, 15 March 2017 23 March 2017	Georgetown
Stakeholder meeting – Ministry of Natural Resources	2 March 2017	Georgetown

Meeting Type	Meeting Date	Meeting Location
Stakeholder meeting – CDC	3 March 2017	Georgetown
Stakeholder meeting – Ministry of Indigenous Peoples Affairs	8 March 2017	Georgetown
Stakeholder meeting – National Trust of Guyana	16 March 2017	Georgetown
Stakeholder meeting – Ministry of Communities	22 March 2017	Georgetown
Stakeholder meeting – Guyana Hindu Dharmic Sabha	5 April 2017	Georgetown
Stakeholder meeting – Ministry of Public Health	6 April 2017	Georgetown
Stakeholder meeting – EPA, MNR, CDC, GGMC, MARAD	13 April 2017	Georgetown
Public Meeting	21 April 2017	Region 1
Public Meeting	24 April 2016	Region 6
Liza Phase 2		
Anticipated for mid-2018	TBD	TBD

In addition to public consultation meetings led by ERM, EEPGL also conducts round-table meetings with groups of stakeholders (NGOs; members of interest groups, etc.) to discuss the preliminary EIA impacts and proposed mitigating measures, to seek feedback on progress and to help identify gaps/issues which may need to be addressed in more detail or new concerns/issues that need to be further investigated.

Meetings, round-tables and other engagements conducted in accordance with EIA disclosure requirements are summarized in Annex B (Synopsis of Liza Engagements).

4.1.6 Post-EIA Engagements

Conditions such as requirements for additional engagements may be included as part of the EPA's environmental authorization. Information on these and other engagements conducted as part of Post-EIA requirements is summarized in Annex B (Synopsis of Liza Engagements).

4.1.7 Other Engagements

The Project is committed to providing stakeholders with regular access to information about the activities as well as access to a feedback mechanism through which stakeholders may provide input and receive response to feedback.

5 Conclusion

This SEP will be periodically revised and updated as necessary according to EEPGL ongoing activities. This will help to maintain the validity and adequacy of the information presented, and that the identified methods of engagement remain appropriate in relation to the legislative requirements and specific phases of the Project development. Any major changes to the Project activities and to its schedule will be duly reflected in the SEP.

Annex A: Sample of Identified Potential Stakeholders

Stakeholder Category	Interest in Project	Potential Stakeholders
Regulatory /Government	National authorities have an interest in the EIA and permitting procedures and Guyanese resources. Local and regional authorities have a general interest in potential impacts and benefits to their respective communities, and may facilitate engagement with local communities. Provides permits for Project activities and business licenses for onshore and offshore facilities.	President of Guyana; Ministry of Natural Resources; Sectoral Committee on Natural Resources; Members of Cabinet; Opposition Government leaders, Guyana Geology and Mines Commission; Environmental Protection Agency; Protected Areas Commission; Government Information Agency; Civil Defense Commission; Guyana Maritime Administration Department; leadership of Regions 1-10; Attorney General; Civil Aviation Authority; Guyana Defence Force; Transportation and Harbors Department; Pesticides and Toxic Chemicals Board; Hydrometeorological Service; Guyana Forestry Commission; Guyana Tourism Authority; Bureau of Statistics; National Trust of Guyana; National Toashao's Council
Community	Communities who may potentially be impacted positively or negatively by Project activities, or are concerned that they may be impacted.	Georgetown residents; coastal beach users/residents; indigenous people; commercial fishermen
Civil Society, Interest Groups, NGOs	Non-governmental or other organizations and entities that may be interested in a diverse set of issues including environmental protection, socioeconomic development and human rights.	NGOs focused on indigenous peoples' issues; Conservation International; World Wildlife Fund; Religious organizations; Guyana Marine Conservation Society; Mangrove Restoration Project; ECO1
Private Sector	Businesses of any scale that could be affected positively or negatively by the Project.	Fuel and Waste; SURF, Drilling, FPSO Shorebase Contractors
Media	News media outlets that may range from local to international in distribution.	Stabroek News, Kaieteur News, Guyana Chronicle, Guyana Times, www.demerarawaves.com, www.inewsguyana.com, www.newsroom.gy, www.newsourcegy.com, www.newsnow.gy, www.citizensreportgy.com, www.gnnonline.com, National Communications Network TV and others TV and radio networks
Academic Institutions	Academic institutions or foundations that provide research on specific topics of interest.	National Agricultural Research and Extension Institute; Caribbean Agricultural Research and Development Institute; Universities and technical institutes
Professional, Business and Workers' Associations	General or industry-specific associations with interest in how Project activities may represent opportunities for the members or impacts to them.	Private Sector Commission; Guyana Oil & Gas Association, Guyana Manufacturing and Services Association; Guyana Association of Trawler Owners and Seafood Processors; Shipping Association of Guyana; Chambers of Commerce; African Business Roundtable; Rotary Clubs; National Aquaculture Association of Guyana; Tourism and Hospitality Association of Guyana

Annex B: Synopsis of Liza Stakeholder Engagement Activities

SYNOPSIS OF PREVIOUS STAKEHOLDER ENGAGEMENT ACTIVITIES			
Project Activity	**Objective / Desired Outcome**	**Stakeholders / Audience**	**Potential Concerns, Issues & Sensitivities**
Liza-1 Well Drilling Program [August 2011 to November 2013]	Liza-1 well SEA and Environmental Permit	Ministry of Natural Resources	Available skilled/unskilled labor in oil and gas operations
		GGMC	Meeting or exceeding GOM standards Education and communication on Project and Deepwater OSRP
		EPA	• First Deepwater well in Guyana • Resource-or constituency – related concerns
		Natural Resource Management Division of EPA	Potential impact on fisheries resources and supporting coastal ecosystems
		Environmental Assessment Board	First Deepwater well in Guyana
		Ministry of Labor, Human Services and Social Security, and Special Department of Occupational, Safety and Health Department	Local employment
		• Ministry of Labor, Human Services and Social Security • Special Department of Occupational, Safety and Health Department	Occupational, Health and Safety requirements
		Ministry of Local Government and Regional Development	Potential effect on communities
		Guyana Defense Forces and Guyana Police Forces	• Port Security issues • Road Safety through Town
		Ministry of Local Government – Solid Waste Management Department	Capacity and stability of waste management facility
		Ministry of Public Works, and Maritime Administration Department (MARAD)	• Maritime issues, maritime traffic • Security issues, incidents
		Transportation and Harbors Division, and Harbour Master	Wharf/Port access and development
		National Trust Department	• Cultural heritage issues • Archaeological finds
		Mangrove Restoration Project – National Agriculture Research and Extension Institute (NARI)	• Risk and impact to Mangrove ecosystem • Impacts on coastal livelihood artisan fishing, beekeeping and sea defense protection

SYNOPSIS OF PREVIOUS STAKEHOLDER ENGAGEMENT ACTIVITIES			
Project Activity	**Objective / Desired Outcome**	**Stakeholders / Audience**	**Potential Concerns, Issues & Sensitivities**
		Guyana Marine Turtle Conservation Society (GMTCS) and Volunteer Youth Corp (Math and Science Initiative)	• Potential disturbance to sea coastline and transboundary movement • Community and social benefits from Project • Impacts of sound and noise from exploration on sea turtles and other sensitive biodiversity • Blowout Prevention and emergency response
Six-Well Drilling Program (Liza-2 and Liza-3 wells) [mid-December 2015 to February 2016]	Six-well Drilling Program EMP and Environmental Permit(s) and present out comes of Multi-well EMPA Process	EPA, GGMC, CI, WWF and other external stakeholders	• Marine sound • Waste management • Effluent discharge standards • Oil spill preparedness and response
	Ongoing dialogues with agencies	EPA/GGMC	Ongoing clarity of EMP and permit status. Discussing document comments and revisions
Liza Phase 1 Development EIA [July 2016 to present]	• Presidential briefing • Continue to build public support for the Project and confidence EEPGL capability. • Identify potential roadblocks/issues before they cause project risk.	President of Guyana	• Legislative requirements, policy requirements, general compliance and project support. • Economic development and local workforce and supplier participation in the project
	• General briefing • Ensure timelines and process is well understood. • Identify potential roadblocks/ issues before they cause project risk.	EPA/GGMC	• Legislative requirements, policy requirements, general compliance and project support. • Capacity concerns due to increasing activities in sector • Evolving regulations and legislation that can affect the agency • Pressure to evolve regulations to meet international standards
	EIA information sharing and baseline data collection interviews	Ministry of Agriculture, Department of Fisheries	• Potential overlap of Project activity with new deep-sea tuna fishery • Potential security concerns related to illegal fishing vessels entering FPSO exclusion zone
		Ministry of Communities	No Project-specific concerns/issues identified
		Ministry of Public Health	• Potential for added burden on Guyanese health system • Potential for social investment in the health sector
		Department of Tourism	• Possible changes to Guyana's image as a "green" nation
		Ministry of Social Protection	• Proper fulfilment of OHS requirements for contractors; ensure contracts are clear on who is responsible • Proper payment and documentation for worker insurance coverage • Potential for informal communities to arise, with potential for prostitution or other exploitation
		Ministry of Indigenous Peoples Affairs	Need for consultation with indigenous communities in Region 1

SYNOPSIS OF PREVIOUS STAKEHOLDER ENGAGEMENT ACTIVITIES			
Project Activity	**Objective / Desired Outcome**	**Stakeholders / Audience**	**Potential Concerns, Issues & Sensitivities**
		Ministry of Public Infrastructure	Possible traffic disruption if offsite storage facilities are used
		Maritime Administration Department	Maintenance of maritime safety and security in Project area
		Guyana Land and Surveys Commission	• Current land speculation in relation to the Project • GLSC vetting of any new data produced
		Bureau of Statistics	Project information required to develop economic indicators for the country's new petroleum sector
		National Trust of Guyana	• No Project-specific concerns or issues identified • Interest in CSR support
		Private Sector Commission	• Ensure appropriate local content targets • Accountability and involvement in proper management and investment of the country's revenues from the Project • EPA capacity • Retention of institutional knowledge and experience from this Project
		Protected Areas Commission	Potential impacts of an oil spill on Shell Beach; recommendation for consultation with the 18 communities living on or adjacent to Shell Beach
		University of Guyana Centre for the Study of Biological Diversity	Lack of data regarding pelagic species beyond the continental fish
		Guyana Marine Conservation Society	• EPA/EEPGL transparency; availability of data and studies conducted to date for the Project • Recommendation for consultation with indigenous communities
		Conservation International	• Short timeline of the EIA and lack of EPA capacity • Appropriate use of mitigation hierarchy • Participation of ExxonMobil in the sustainable development of the country
		World Wildlife Fund	No Project-specific issues or concerns identified
		Association of Trawler Owners and Seafood Processors	No Project-specific concerns identified; the Project will be well seaward of trawling activity
		National Aquaculture Association of Guyana	No Project-specific concerns or issues identified; fish farms are segregated from seawater intrusion using the same irrigation and drainage systems as rice fields.
		Guyana Rice Producers' Association	• Main concern for rice industry is improved access to lower cost fuel, which is a significant industry input. • No other concerns or issues identified; rice fields are protected from potential seawater intrusion (and thus oil spills) by elaborate drainage and irrigation systems whereby fields are always upgradient of tidally influenced drainage canals

SYNOPSIS OF PREVIOUS STAKEHOLDER ENGAGEMENT ACTIVITIES			
Project Activity	**Objective / Desired Outcome**	**Stakeholders / Audience**	**Potential Concerns, Issues & Sensitivities**
		Supenaam-Parika Speedboat Owners' Association	No Project-specific issues or concerns identified
		Mainstay Amerindian Village	Reliance of Amerindian communities on natural resources
		Vilvordeen-Fairfield Women's Association	No Project-specific issues or concerns identified
		Pomeroon Women's Agro-Processors Association	• Interested in whether fuel costs will go down • Potential for damage to livelihoods in event of a spill for those residing near the mouth of the Pomeroon River
		West End Agricultural Development Society	No Project-specific issues or concerns identified
		Big Bird and Sons Fishing Complex	No Project-specific issues or concerns identified
		Lima Fishermen's Development Co-op	No Project-specific issues or concerns identified
		Georgetown Fishermen's Co-op Society Ltd.	• Potential for oil spills and their impact on those directly and indirectly employed by fishing • Expected communication from EEPGL sooner, given that exploration has been ongoing
		Parika Fishermen's Development Co-op	No Project-specific issues or concerns identified
		Ogle International Airport	No Project-specific issues or concerns identified
		African Culture Development Association	• Use of Kingston seawall area for festivals and religious ceremonies • Local employment, including skills and technology transfer
		Guyana Hindu Dharmic Sabha	• Use of seashore for religious ceremonies, including funerals • Community investment
		Region 2 Development Council	• Importance of face to face consultation with Region 1 and 2 local stakeholders • Potential for spills • EPA capacity • Community investment
	Two (2) Agency EIA scoping meetings led by EPA	Multiple public and private agencies and NGOS including EPA, GGMC, Ministry of Public Health, Ministry of the Presidency, PAC, GMCS, WWF, CI, others.	• Oil spill response procedures and capabilities • Process for updating TOR to reflect scoping comments • Other potential uses of produced gas • Government revenues from Project • Local employment
	Six (6) Public EIA scoping meetings (Regions 1-6) led by EPA	Various national, regional and local agency representatives as well as private citizens.	• National and local benefits, proper management/oversight of revenues • Local employment • Oil spill response procedures and capability • Impacts to fishing

SYNOPSIS OF PREVIOUS STAKEHOLDER ENGAGEMENT ACTIVITIES			
Project Activity	**Objective / Desired Outcome**	**Stakeholders / Audience**	**Potential Concerns, Issues & Sensitivities**
			• MMO data availability • Impact of potential natural disaster on Project infrastructure and development area • Recommendations to increase public participation at scoping meetings • Other potential uses for produced gas
	Agency-specific EIA disclosure meetings	Guyana Marine Conservation Society	• Coastal sensitivity mapping process, and ways to improve quality of maps
		EPA	• Air monitoring equipment and methodology • Rationale for EIA conclusions on air emissions impact on public health • Economic impacts of cooling water discharges to fish e.g. yellowfin tuna • Details of water modeling assumptions and limits
		Ministry of Natural Resources	• Factors considered in oil spill modeling • Possibility of piping gas to shore or locating a refinery in Guyana
		CDC and MARAD	• Definition of routine discharges • Engagement with neighboring countries that could be impacted by spills (T&T, Venezuela) • Liability for cleanup/restoration in event of a spill
		Ministry of Indigenous Peoples' Affairs	• Possibility of piping gas to shore or locating a refinery in Guyana • Likelihood of oil spills reaching the coast • Capacity-building needs to allow proper use of government revenues: Engineering, IT, infrastructure, environmental protection • How to use Project benefits to optimize and protect Guyana's natural riches
		National Trust of Guyana	No Project-specific issues or concerns identified
		Ministry of Communities	• Oil spill impacts on fish and commercial fisheries • Waste management – request for guidance on influencing cultural and behavioral changes with respect to waste management practices in the country
		Guyana Hindu Dharmic Sabha	• Estimate of local employment • Request info on local opportunities • Procedure for removing fishing boats from exclusion zone • Frequency/duration of disruption to fishing during Project vessel transits • Publicizing of Grievance Mechanism
		Ministry of Public Health	• Estimate of local employment • Why is a refinery not considered for Guyana • Clarification about potential health impacts of air emissions

SYNOPSIS OF PREVIOUS STAKEHOLDER ENGAGEMENT ACTIVITIES			
Project Activity	**Objective / Desired Outcome**	**Stakeholders / Audience**	**Potential Concerns, Issues & Sensitivities**
	One (1) multi-agency EIA disclosure meeting	MARAD, GGMC, MNR, CDC, Ministry of Agriculture (Dept of Fisheries)	• Time required for recovery of benthic species • Request to see ROV images • Chemical discharges and their toxicity • Species that could be introduced by ballast water • Potential for impacts within the mixing zone
	Two (2) Public EIA disclosure meetings led by ERM		• Potential oil spills - how would they be responded to/compensated. • Benefit sharing – how would this be distributed among regions • Timeframe in which Guyanese will experience socioeconomic benefits • Request for social scholarships, jobs, job training, and extra help to better plan for the environment • Wastes generated and their potential impacts • Management of drill cuttings • Seismic survey impacts on whales • Approach if impacts are found to be greater than predicted – would operations be stopped • Potential impacts to fishing livelihoods, sustainaibility of fisheries for future generations. • Process for monitoring air pollution • Liability in the event of an oil spill moving to another country's coast • Rationale for low spill potential • Consider use of fishermen and other citizens in environmental monitoring efforts • Transparency regarding revenue sharing agreement
Liza Phase 1 EIA Post-Permit Studies [June 2017 to May 2018]	Coordination and Planning Workshop	EPA, PAC, GMCS, CI, NTC, University of Guyana	Development of methdologies for the coastal mapping studies, including ecosystem servies and biodiversity, and turtle telemetry
	Consultations for planning and execution of post-permit studies	EPA	Coordination and approvals of Post-Permit Studies methodologies and timelines, including paricipation from EPA staff
		Ministry of Agriculture (Department of Fisheries)	Representative from Department of Fisheries to participate in Coastal Fishing Study consultations and execution
		Various fishing associations, boat owners, and equipment suppliers	Provision of information regarding potential boat rentals and equipment procurement.
		39 coastal regional, democratic and village council meetings in Regions 1-4 More than 369 neighborhood and village council leaders and community members engaged	• Ecosystem Services Basline data collection and field verification • Requests for more information and updates on EEPGL's activities and the O&G sector in general • Requests for copies of the coastal sensitivity map once completed

SYNOPSIS OF PREVIOUS STAKEHOLDER ENGAGEMENT ACTIVITIES			
Project Activity	**Objective / Desired Outcome**	**Stakeholders / Audience**	**Potential Concerns, Issues & Sensitivities**
		Protected Areas Commission	Coordination and approvals of Turtle Telemetry Study conducted on Shell Beach Protected Area
		Fisherfolk througout Regions 2-6	Participatory fishing study survey to determine
Liza Phase 1 Development Drilling [April 2018]		Fisheries Department, fishing associations, boat owners, fisherfolk througout Regions 2-6	• Discuss Notice to Mariners pertaining to Development Drilling start date of 1 May 2018 • Identify and communicate with maritime users who might not ordinarily receive Notices to Mariners • Record locations of fisheries activities and to check for adherence to communications protocol and grievances follow up
Liza Phase 2 Development EIA [January 2018 to present]	One Agency TOR scoping meeting led by EPA	Multiple public and private agencies and NGOS including EPA, GGMC, Ministry of Public Health, Ministry of the Presidency, GMCS, WWF, CI, others.	• Status of Phase 1 Post-Permit studies • Cumulative Impacts • Timelines for the TOR and EIA study • Public benefits as a result of oil wealth and how that influences their behavior • How EIA studies will account for cycles on an annual and multi-year basis
	Seven (7) Public EIA scoping meetings (Regions 1-6) led by EPA	Various national, regional and local agency representatives as well as private citizens.	• Production schedule and drilling locations • National and local benefits, proper management/oversight of revenues • Local employment and training • Oil spill response procedures and capability including compensation and insurance • Impacts to coastal zones, mammals, fishing and other livelihoods • Waste management procedures including independent monitors • Impact of potential seismicity and natural disasters • Recommendations to increase public participation at scoping meetings • Considerations given to socioeonomic resources • Responsibility of regulatory agencies and dissemination of information • Regional and other country concerns
	Scoping and baseline data collection interviews [Ongoing]	24 coastal regional, democratic and village council meetings in Regions 5 and 6 More than 167 neighborhood and village council leaders and community members engaged	• Ecosystem Services Basline data collection and field verification • Requests for more information and updates on EEPGL's activities and the O&G sector in general • Requests for copies of the coastal sensitivity map once completed
		Protected Areas Commission	• Details pertaining to Phase 1 post-permit studies • Potential impacts to Shell Beach • Participation of Amerindian villages surrounding SBPA, including updates on previous exercises conducted

SYNOPSIS OF PREVIOUS STAKEHOLDER ENGAGEMENT ACTIVITIES			
Project Activity	**Objective / Desired Outcome**	**Stakeholders / Audience**	**Potential Concerns, Issues & Sensitivities**
			• Access to turtle tracking information
		GMCS	• Expansion of marine mammal observation over larger geographic area • How will Phase 1 post-permit studies be utilized in the EIA and shared • Oil spill modeling should take into consideration seasons and cumulative effects • EEPGL insurance and protocols in the event of a disaster
		GGMC	• Details on exclusion zones for workovers • Changes in boundary/area for harvesting of certain fish species • Oil spill modeling should take nto consideration cumualtive effects • Environmental studies should consider monitoring • Worker health and safety and emergency response • Hazardous waste handling
		Conservation International	• Synergy between Liza Phase 1 post-permit studies and a CI Mangrove Study planned for area from Guyana coast to North of Brazil. • Potential involvement of UG students in future studies to allow for UG capacity-building • Availability of data resulting from current and ongoing studies
		Ministry of Agriculture, Fisheries Department	• Need for Notice to Mariners to be supplemented by targeted information sharing through engagement • Protocols for encroachment on safety exclusion zones
		Fishing associations, boat owners, fisherfolk througout Regions 2-6	• Oil spill response protocols and compensation • Protocols for encroachment on safety exclusion zones
		National Trust of Guyana	• Chance Find Procedure and Cultural Heritage Monitoring Programme previously shared was reviewed and is acceptable • Indicated that its own procedures have been published although guidelines are subject to change during revisions • Queried what mechanism will be in place to detect cultural heritage offshore if encountered • Clarified point of contact for further engagements is the CEO
		World Wildlife Fund (WWF)	• Questions about methodology and data for coastal mapping • Expect EIA to be more rigid in terms of analysis (modelling and extrapolation) • Recommended that the Post Permit Studies be annexed to the EIA so that the reader can have a better view/understanding of reporting / would also serve to address the difficulty in obtaining data from EPA • Results of the sea turtle telemetry will be useful to the for PAC's sea turtle conservation plan

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APPENDIX 3

End of Operations Decommissioning Plan

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Esso Exploration and Production Guyana Limited

Liza Phase 2 Preliminary End of Operations Decommissioning Plan

May 2018

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Contents

Figures

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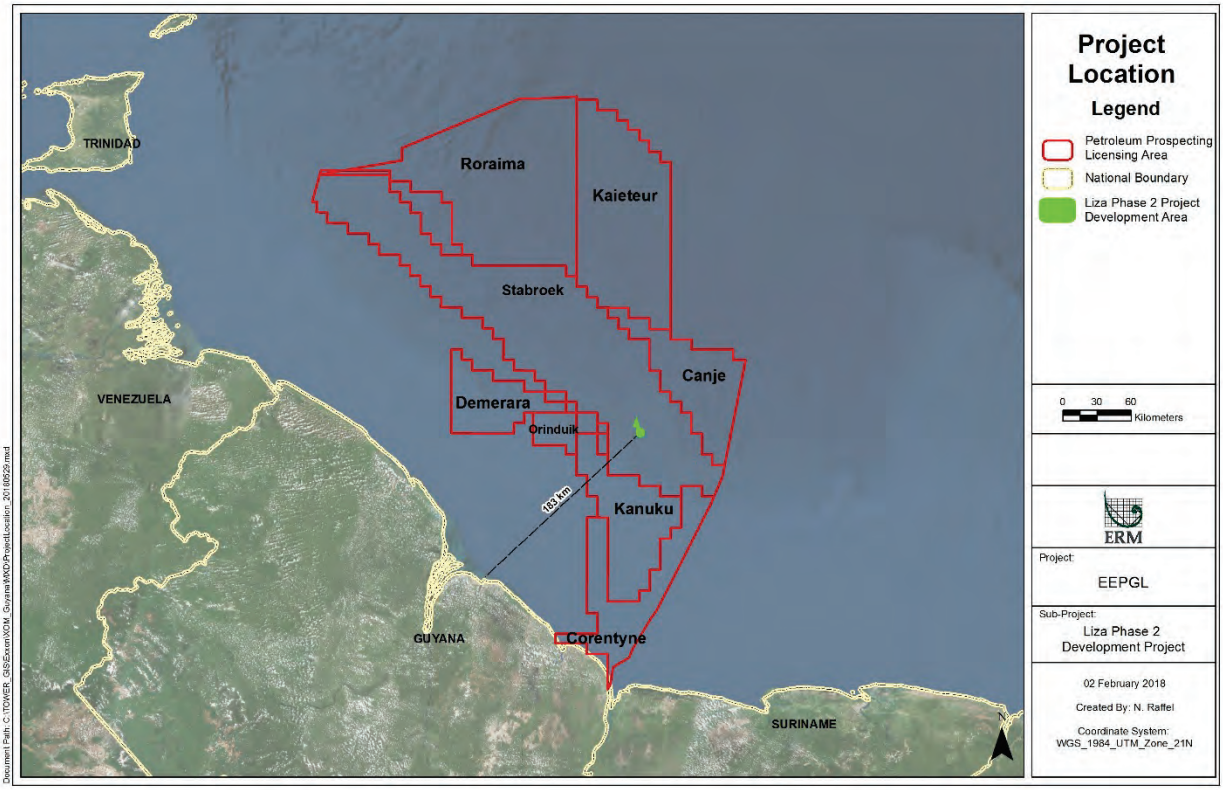
1 INTRODUCTION

Esso Exploration and Production Guyana Limited (EEPGL)[1], together with its co-venturers Hess Guyana Exploration Limited and CNOOC Nexen Petroleum Guyana Limited, is the operator for the second phase of development of the Liza field in the eastern half of the Stabroek Block (hereafter referred to as the Liza Phase 2 Development Project, or the Project); the area that will be developed as part of the Project is located approximately 183 kilometers (114 miles) northeast of the coastline of Georgetown, Guyana (Figure 1).



Note: Map does not represent a depiction of the maritime boundary lines of Guyana

Figure 1: Location of the Liza Phase 2 Project Development Area within Stabroek Block

[1] *EEPGL will be the operator of the Project, and is used in this Environmental Impact Assessment to represent the joint venture.*

1.1 Purpose and Objectives

The purpose of this Preliminary End of Operations Decommissioning Plan (Plan) is to provide a preliminary plan for the proposed abandonment and decommissioning of Project wells and facilities at the end of operations, and to describe the anticipated work required to confirm that the abandoned facilities will be left in a condition that avoids harm to the environment.

The objectives of this Plan are to:

- Describe the proposed methods for the safe abandonment, removal, disposal, and/or decommissioning of the Project assets; and
- Describe the plans for managing potential impacts as a result of decommissioning activities through mitigation measures and monitoring.

1.2 Project Overview

The Project will consist of the drilling of up to 33 development wells (including production, water injection, and gas re-injection wells); installation and operation of SURF equipment; and installation and operation of a FPSO vessel in the eastern half of the Stabroek Block (Figure 2). Onshore logistical support facilities and marine/aviation services will be utilized to support each stage of the Project. The facility layout will continue to evolve during the design development process. The various components shown on Figure 1 are further described in the relevant Drilling, SURF, and FPSO sections in Chapter 2 of the Liza Phase 2 Development Project Environmental Impact Assessment (EIA).

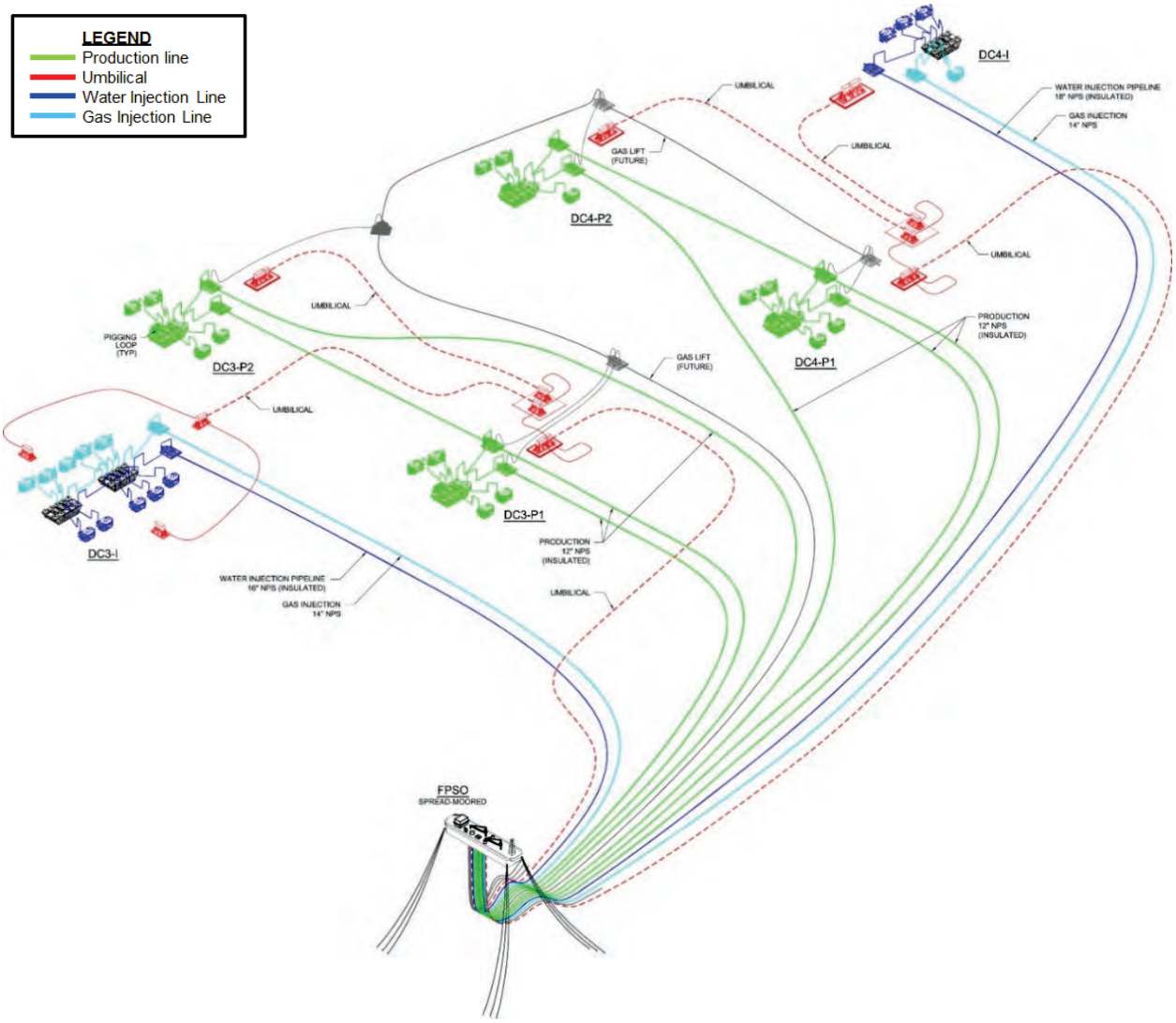


Figure 2: Preliminary Liza Phase 2 Field Layout

1.3 Scope

The scope of this Plan covers the preliminary plans for the plugging and abandonment of the development wells and the decommissioning of Project production facilities. As the Project approaches the end of field life (e.g., several years prior to commencement of decommissioning), it is envisioned that this Plan will be revised to cover the ultimate decommissioning of the facility in compliance with the laws and regulations in effect at that time, while also considering the technology available at that time. This Plan was developed as part of the Project's Environmental and Social Management Plan (ESMP), and as described in the Project EIA. The current scope of abandonment and decommissioning activities includes:

- Subsurface – approximately 33 development wells;
- Subsea – trees, manifolds, jumpers, flowlines, umbilical, risers, and other subsea equipment;
- FPSO vessel – marine vessel, topsides facilities, and the vessel mooring system; and
- End of operations-related waste.

2 LEGAL FRAMEWORK

The offshore decommissioning process is regulated by a framework of international conventions and guidelines, regional seas conventions, and national legislation. Guyana is currently a party to some of these international conventions and guidelines that pertain to offshore decommissioning, such as:

- United Nations Convention on the Law of the Sea (UNCLOS);
- Basel Convention on the Transboundary Movement of Hazardous Wastes and their Disposal;
- IMO Guidelines for the Removal of Offshore Installations and Structures (1989).

The decommissioning plan and strategy will be based on a notice of the intent for plugging and abandonment of the development wells and decommissioning the production facilities, which will be provided to the appropriate Guyanese agencies, (e.g. GGMC, EPA) to obtain approval in accordance with the following requirements, or with future applicable legislation:

- Environmental Protection Act (1996);
- Guyana Petroleum (Exploration and Production) Act (1998).

Section 2 of the ESMP further identifies these international conventions, guidelines, and laws; summarizes their relevance to the Project; and articulates the environmental performance criteria they impose.

3 MAJOR DECOMMISSIONING COMPONENTS AND ACTIVITIES

3.1 Prior to Decommissioning

EEPGL will perform inspections, surveys, and testing to assess current conditions that will provide the basis and required information to prepare a plan for decommissioning. All risers, pipelines, umbilicals, subsea equipment, and topside equipment will be safely and properly isolated, de-energized, and cleaned to remove hydrocarbons and other hazardous materials to a suitable level prior to being taken out of service.

Near the time of decommissioning, EEPGL will select, in consultation with the appropriate Guyanese agencies, the final decommissioning strategy based on a comparative assessment, which is designed to evaluate the potential safety, environmental, technical, and economic impacts and associated mitigation measures in order to finalize the decommissioning plan. Consultation with stakeholders would also be conducted by EEPGL during decommissioning planning. A revised Plan will be submitted to the appropriate Guyanese agencies in advance of commencing field work.

3.2 Development Wells

Wells will be permanently plugged and abandoned (P&A) by restoring suitable cap rock to prevent escape of hydrocarbons to the environment. P&A barriers will be installed in the wellbore, of adequate length to contain reservoir fluids, and deep enough to resist being bypassed by fracturing. The number of barriers required will depend on the distribution of hydrocarbon-bearing permeable zones within the wellbore.

3.3 Subsea Equipment

It is expected that the risers, pipelines, umbilicals, subsea equipment, and anchor piles will be disconnected and abandoned in place on the seafloor at the production location, consistent with current standard industry practice, unless an alternative strategy is selected based on the results of the comparative assessment.

3.4 FPSO

The FPSO will be disconnected from its mooring system, removed from the production location, and towed to a new location for re-use or decommissioning. The FPSO anchor piles and mooring lines are expected to be disconnected and abandoned in place on the seafloor at the production location, unless an alternative strategy is selected based on the results of the comparative assessment, consistent with current standard industry practice.

3.5 Decommissioning Waste

Waste streams associated with decommissioning activities, including hazardous and non-hazardous wastes, will be managed and disposed of in accordance with applicable Guyanese regulations, applicable international conventions and guidelines, and standard industry practice. Methods may include injection downhole into the reservoir for certain types of wastes, separation and incineration offshore for certain types of wastes, or transport to onshore waste management facilities for management and disposal for certain types of wastes. Further details on waste management can be found in the EEPGL Waste Management Plan.

4 MITIGATION AND MONITORING

There will be areas of disturbance at the sea surface and the seafloor associated with the end of operations activities, as noted in the EIA. The Project Development Area (PDA) will be the site of marine vessel activity for the duration of the decommissioning program as support vessels transfer supplies and personnel to and from the PDA. All disturbances at the sea surface will be temporary in nature.

Disturbances at the seafloor will be associated with the decommissioning of the development wells, FPSO mooring lines, and SURF equipment.

EEPGL will implement measures to manage potential decommissioning-related impacts as listed in Sections 4.1 and 4.2.

4.1 Description of Embedded Controls for Decommissioning

This section of the Plan identifies the embedded controls that EEPGL will implement to reduce potential environmental and socioeconomic impacts related to decommissioning activities. Additional embedded controls that are specific to the decommissioning stage may be identified during the future comparative assessment performed by EEPGL.

- Maintain marine safety exclusion zones with a 500 m (~1,640 ft) radius around major decommissioning vessels to prevent unauthorized vessels from entering potentially hazardous areas;
- Provide trained medical personnel on board major decommissioning vessels to minimize reliance on medical infrastructure and facilities in Guyana;
- Maintain equipment and marine vessels in good working order and operate in accordance with manufacturer's specifications in order to reduce atmospheric emissions and sound levels to the extent reasonably practicable;
- Shut down (or throttle down) sources of portable combustion equipment in intermittent use where reasonably practicable in order to reduce air emissions;
- Utilize secondary containment for bulk fuel storage and hazardous materials, where practical;
- Regularly check pipes, storage tanks, and other equipment associated with storage or transfer of hydrocarbons/chemicals for leaks;
- Treat sewage and marine discharges to applicable standards under MARPOL;
- For those wastes that cannot be reused, treated, or discharged/disposed on the major decommissioning vessels, manifest and safely transfer them to appropriate onshore facilities for management. Onshore waste management contractors facilities will have an EPA approval to operate.
- Utilize oil/water separators to limit oil in water content in bilge water to <15 parts per million (ppm; per MARPOL);

- Provide standing instruction to Project dedicated vessel masters to avoid marine mammals and turtles while underway and reduce speed or deviate from course, when possible, to reduce probability of collisions;
- Provide standing instruction to Project dedicated vessel masters to avoid any identified rafting seabirds, when possible, when transiting to and from PDA;
- Observe standard international and local navigation procedures in and around the Georgetown Harbour and Demerara River, as well as best ship-keeping and navigation practices while at sea;
- Subject Project workers to health screening procedures to minimize risks of communicable diseases;
- Procure Project goods and services locally when available on a timely basis, and when they meet the minimum standards and are commercially competitive;
- Employ Guyanese citizens having the appropriate qualifications and experience when reasonably practicable, in alignment with the approved Liza Local Content Plan;
- Utilize an established Safety, Security, Health, and Environmental (SSHE) program to which all Project workers and contractors will be required to mitigate against risk of injury/illness to workers; and all workers and contractors will receive training and orientation on implementation and will be required to adhere to its principles;
- Maintain an Oil Spill Response Plan (OSRP) to ensure an effective response to an oil spill, including maintaining the equipment and other resources specified in the OSRP and conducting periodic training and drills;
- Where practicable, direct lighting on major vessels to required operational areas rather than at the sea surface or skyward.

4.2 Description of Mitigation Measures for Decommissioning

This section of the Plan identifies the mitigation measures that EEPGL will employ to mitigate potential environmental and socioeconomic impacts related to decommissioning activities. Additional mitigation measures that are specific to the decommissioning stage may be identified during the future comparative assessments performed by EEPGL.

- Report direct GHG emissions from the facilities owned or controlled by the Project to the EPA on an annual basis in accordance with internationally recognized methodologies and good practice;
- Issue Notices to Mariners via MARAD, the Trawler's Association, and fishing co-ops for movements of major marine vessels to aid them in avoiding areas with concentrations of Project vessels and/or where marine safety exclusion zones are active;
- Augment ongoing stakeholder engagement process (along with relevant authorities) to identify commercial cargo, commercial fishing, and subsistence fishing vessel operators who might not ordinarily receive Notices to Mariners and, where possible, communicate regarding major vessel movements and marine safety exclusion zones;
- Promptly remove damaged vessels (associated with any vessel incidents) to minimize impacts on marine use, transportation, and safety;

- Proactively communicate the Project's limited staffing requirements for decommissioning as a measure to reduce the magnitude of potential population influx to Georgetown from job-seekers;
- Adopt and implement as needed a Chance Find Procedure that describes the requirements in the event of a potential chance find of heritage or cultural resources during decommissioning activities;
- Require Project workers to adhere to a Worker Code of Conduct, which will address shore-leave considerations.

4.3 Description of Monitoring Program

The Project will implement an Environmental and Social Monitoring Plan to ensure that Project activities, including decommissioning, are undertaken in an environmentally responsible manner, and in a manner that is compliant with applicable laws and regulations, as highlighted in Section 2 of this Plan and in the EIA.

5 SCHEDULE

End of operations / decommissioning activities are expected to begin around 2042. A comparative assessment will be performed in accordance with IMO guidelines in effect at the time, which considers environmental and socioeconomic aspects. A revised Plan will be submitted to the appropriate Guyanese agencies in advance (e.g., several years ahead) of commencing field work. The Plan would be approved prior to the commencement of abandonment and decommissioning activities in the PDA.

6 INFORMATION MANAGEMENT AND REPORTING

Reporting requirements for decommissioning activities include those stipulated in the following:

- Applicable laws and regulations in Guyana; and
- Project commitments contained in regulatory filings and Project agreements.

Decommissioning-related reporting to be provided may include, but is not limited to:

- SSHE reports;
- Emergency/incident reporting;
- Summary of waste volumes/types disposed;
- Air emissions;
- Wastewater discharges;
- Fuel consumption (e.g., supply/support vessels, helicopters, etc.);
- Close-out reporting at the conclusion of decommissioning activities.

7 TRAINING AND ENVIRONMENTAL AWARENESS

EEPGL will appoint suitably competent staff and develop and implement training and orientation programs so that requirements are well understood and systematically applied.

EEPGL personnel will be provided with training appropriate to their level of responsibilities on key environmental, regulatory, and socioeconomic issues and on the required mitigation, monitoring, and reporting measures.

Training may be provided in a variety of means, including formal training as well as informal training such as briefings, toolbox talks, and coaching. Other training may take the form of on-the-job training in specific elements or tasks or the provision of specific skills as necessary. These and other means (such as posters, signs, site newsletter, etc.) may be used to promote SSHE awareness. Orientations will be provided to verify that personnel understand expectations and requirements on arrival to a particular work location or vessel.

EEPGL will verify that its contractors supporting the decommissioning activities have implemented a training and orientation program that is consistent with EEPGL competency requirements.

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Esso Exploration and Production Guyana Limited (EEPGL) Oil Spill Response Plan for Guyana Operations

May 2018

Review and Approval

Approved by:

EEPGL Country Manager

For Rod Henwan

5 June 2018
Date

Contents

Tables

Figures

Amendment Record

For each revision of EEPGL's Oil Spill Response Plan (OSRP), EEPGL will insert approval signatures and details in Table 1. Include details on the revision number, description, and indication of the revised pages or paragraphs and amendment approval date.

Table 1: Amendment Record

Revision Number	Date	Summary of Amendment	Page Number	Approved by (Signature)
Rev 0	February 8, 2016	Initial issue for use.		J. Simons
Rev 1	February 27, 2017	EEPGL OSRP Amendment Amended to reflect further spill scenarios associated with Liza Phase 1 FPSO Development Project and addition of Wildlife Response Plan.	Multiple	J. Simons
Rev 2	May 10, 2017	Final edits/revisions based on comments received to Liza Phase 1 FPSO Development Project EIA and OSRP.	Multiple	R. Henson
Rev 3	May 2018	Transitioned OSRP to a single plan covering all Guyana operations. This version supersedes all previous versions. Amended to reflect further oil spill modeling associated with Liza Phase 2 FPSO Development Project, updates to align with the Guyana National Contingency Plan, and EEPGL tactical response maps and equipment).	Multiple	R. Henson

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1 INTRODUCTION

This Oil Spill Response Plan (OSRP) outlines plans and procedures, in the event of an oil spill incident, for engagement between the Operator (Esso Exploration and Production Guyana Limited [EEPGL]), the Guyana Authorities (e.g., Environmental Protection Agency [EPA], Civil Defense Commission [CDC], and Guyana Coast Guard [GCG]), ExxonMobil Corporate support teams, and third party support organizations.

This document has been transitioned into a country-wide OSRP which covers all of EEPGL's operations in Guyana, including exploration activities and development projects. This OSRP describes the equipment and facilities to be used to support oil spill response, and how EEPGL will work together with the appropriate Guyana agencies to respond to oil spills of differing severity levels. This document supersedes previously published OSRPs.

2 SCOPE

2.1 Covered Operations

This document covers all of EEPGL's business operations in Guyana, and is focused on those operations where there is a risk of an oil spill to the environment. As such, this document covers operations related to:

- Exploration operations (e.g., drilling, seismic)
- Liza Phase 1 Development Project (inclusive of all phases, e.g., installation, production operations, decommissioning)
- Liza Phase 2 Development Project (inclusive of all phases, e.g., installation, production operations, decommissioning)
- Other supporting field operations (e.g., marine logistics, aviation logistics, and ancillary survey programs such as geotechnical, geophysical, environmental)

This OSRP will be updated periodically to cover other EEPGL operations and development projects as they are planned and executed.

2.2 Geographic Response Area

Oil spill modeling has determined the geographic areas that could be potentially impacted by the various types of oil spill scenarios that could be encountered in EEPGL's operations. Based on this modeling, the geographic response area generally covers Guyana's territorial waters North/Northwest of Georgetown where a full operational response is implemented. Although it is unlikely that a fully mitigated oil spill would reach outside of Guyana's territorial waters, EEPGL's

geographic response area includes other regional territories including Venezuela, Trinidad and Tobago, and the Lessor Antilles. EEPGL has the capability to broaden its geographic response area as needed. See Appendices A and B for the results of modeling efforts for the Liza Phase 1 and Phase 2 Development Projects.

EEPGL will manage and coordinate an oil spill response from Georgetown, Guyana. EEPGL has the capability to setup support operations from multiple countries in the region, where it is safe to operate and where the authorities allow such support within their jurisdictions.

2.3 Incident Management

The response management overview graphic (Figure 1) and supporting information provides guidance for an appropriate field and issues management response. This model depicts the interaction of both the field (tactical) response levels and Headquarters (strategic) support structure.

ExxonMobil tactical response teams include the Emergency Response Team (ERT), Incident Management Team (IMT) and Regional Response Team (RRT). Strategic response teams include the Region Emergency Support Group (ESG) and Business Unit ESG. Additional information is available in the EEPGL Emergency Response Plan (ERP).

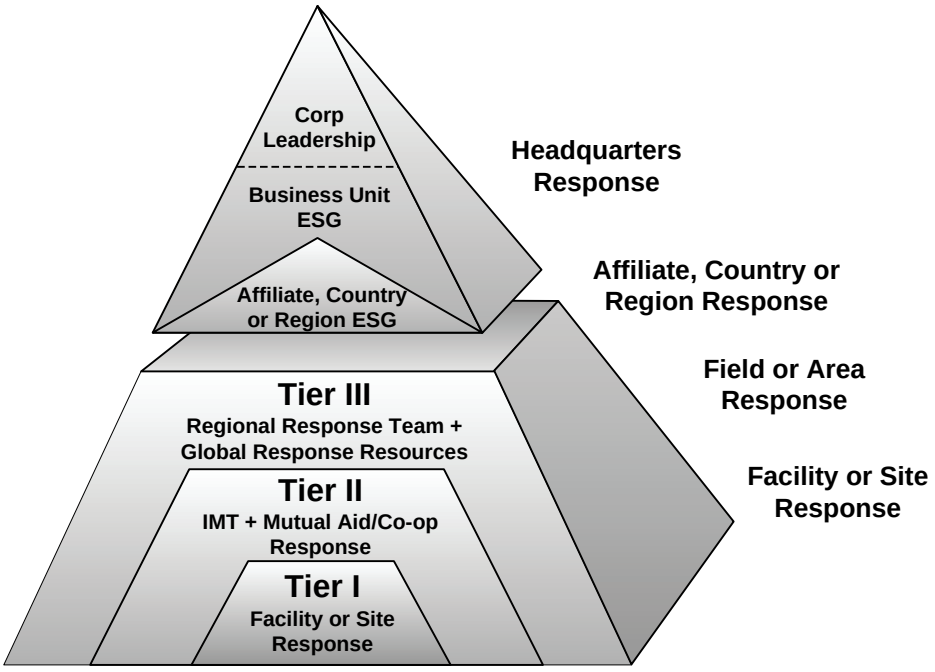

Figure 1: Emergency Management Overview

ExxonMobil has a tiered response approach to oil spill planning globally. Table 2 summarizes the tiered response approach adopted by EEPGL.

Table 2: Tiered Oil Spill Response Approach

Tier	Description
I	Incident is small, under control, and may involve a local company-managed resource response.
II	Incident is large, under control, or spill source not immediately under control, and involves mutual aid cooperative response.
III	Incident is large, is not under control, and requires response by the appropriate RRT and specialized resources.

The on-site ERT will manage Tier I incidents in accordance with the site-specific ERP.

Figure 2 depicts the emergency response escalation model. EEPGL will proactively obtain additional support and resources to reduce the impact of a spill in the unlikely event it has the potential to exceed Tier I capabilities.

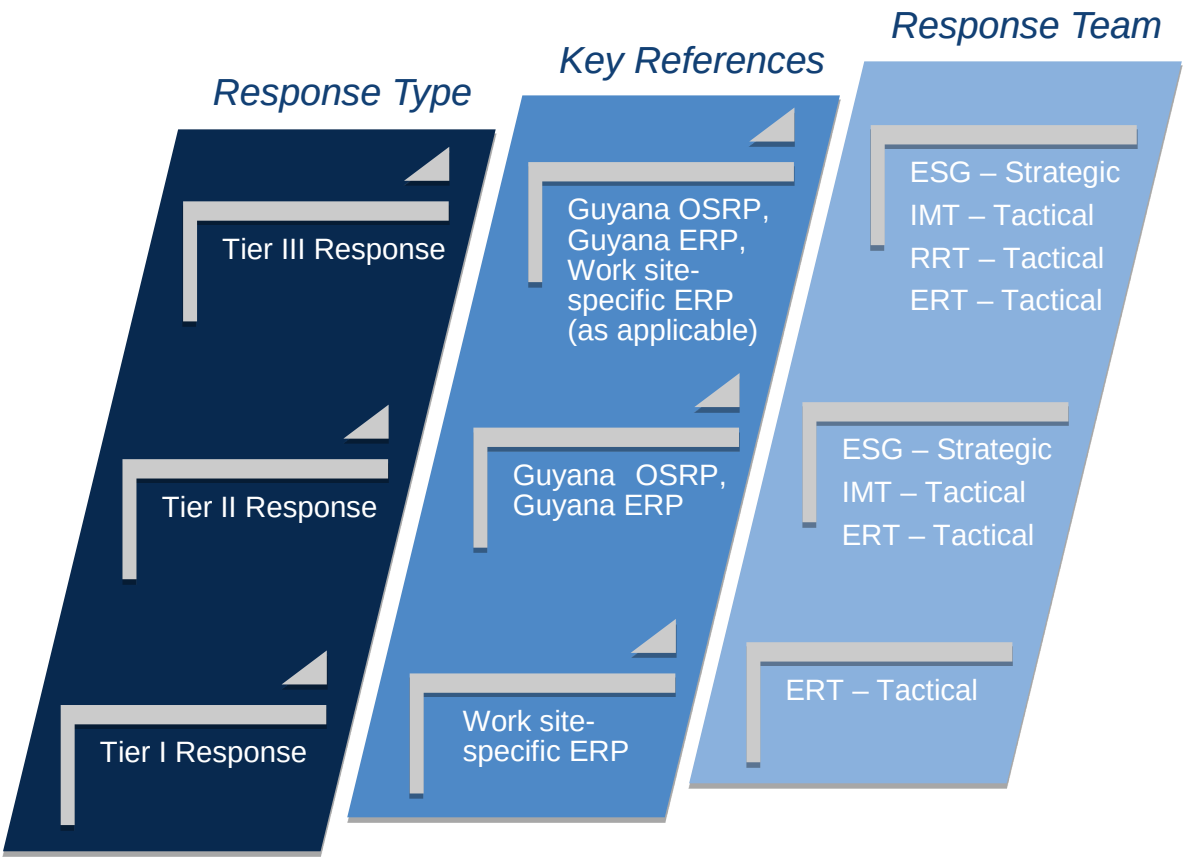

Figure 2: Emergency Response Escalation Model

The ERT will manage Tier I spill responses using the site-specific ERP and resources located on vessels and in port facilities in Guyana and (as appropriate) in Trinidad. Such resources as well as dispersant application from vessels will also be used for larger Tier II spills until supplemental OSR resources arrive on-scene.

For incidents that may exceed Tier I capabilities, EEPGL would notify its contractor Oil Spill Response Ltd (OSRL) in Southampton, UK[1] (Refer to forms in Appendices C.3 and C.4), to provide immediate incident management support as well as access to OSRL's global oil spill technical response teams and equipment.

At all stages of the response operation, EEPGL will work with the appropriate authorities in Guyana and any other affected countries, which will include rapid development of a plan to identify and engage potentially affected stakeholders and communities. EEPGL continues to work cooperatively with the CDC, GGMC and other local agencies and interested stakeholders on a routine basis to ensure open lines of communication are maintained and clear roles and responsibilities are understood and consistent with the agreed emergency response planning for offshore petroleum operations. In recognition of the CDC recently preparing a national oil spill response plan (still in draft stage at the time of issue of this document), updates to this OSRP will be performed periodically by EEPGL to verify alignment.

To supplement its in-country oil spill response resources, EEPGL will consider setting up a cooperative with a regional OSRO to support Tier II+ oil spill response, should an OSRO with appropriate capabilities be identified. Whether using a direct agreement or a cooperative, Tier II+ oil spill response readiness in-country is critical as such spills could potentially have transboundary impacts to neighboring countries.

This OSRP is supported by the EEPGL ERP which provides a structured and systematic process for responding to incidents. The ERP outlines plans and procedures for engagement between the incident site, EEPGL, and ExxonMobil management and the relevant authorities in Guyana. The ERP covers incidents associated with the shorebases utilized by EEPGL as well as the offshore operations in the geographic response area, including the possibility of hydrocarbon and chemical releases, search and rescue, offshore medical evacuation, medical emergency, fatality, fire or explosion at a work site, natural disaster, and security or civil disturbance. While the ERP is the primary document for use in all emergencies, it is supplemented by this OSRP in the specific case of an oil spill.

[1] Oil Spill Response Ltd (OSRL) merged with the Clean Caribbean & Americas (CCA) co-operative in 2013. The hertitage CCA equipment base and personnel located in Ft. Lauderdale, FL are now an integral part of a larger global response co-operative under the name OSRL.

2.4 Response Plan Relationships

2.4.1 Esso Exploration and Production Guyana Ltd (EEPGL) Emergency Response Plan (ERP)

The EEPGL ERP establishes a structured process for responding to events that pose, or could pose, a threat to the people, environment, assets, or reputation impacted by EEPGL activities.

The ERP provides guidelines to assist project, drilling, exploration, and facilities management in effectively responding to an emergency such as an oil spill. This plan is a country-level plan that is mainly focused on emergency response activities conducted at the EEPGL Emergency Response Center(s) (ERC). The EEPGL ERP also references work site-specific Emergency Response Plans (e.g., Drillship ERP, Installation Vessel ERP, FPSO ERP).

2.4.2 Country National Plan

A draft national contingency plan identifies the Guyana Civil Defence Commission (CDC) as the lead agency for oil spill response operations. However the draft has not yet been formally adopted. Responsibilities in the maritime sector are split between several departments and ministries. The Lands and Surveys Department of the Ministry of Agriculture has jurisdiction in river waters. The Transport and Harbors Department of the Ministry of Public Works, Communications and Regional Development is responsible for port areas and territorial waters. However, the Coast Guard enforces all maritime regulations and is a key operational organization in any marine incident, investigating reports of pollution in navigable waters on behalf of the relevant ministry and department. In addition, the Guyana Defense Force and the Fire Service also assume some operational responsibility for pollution response.

By developing a national strategy for disaster risk reduction and management the CDC aims to be compliant with global and regional systems such as United Nation International Strategy for Disaster Reduction and the Caribbean Disaster Emergency Response Agency's Comprehensive Disaster Management Framework.

2.4.3 Legal Framework

National laws, regulations, and conventions are applicable to EEPGL's activities in Guyana territorial waters in the case of marine pollution.

Applicable National laws and regulations include:

- National Constitution of Guyana;
- The Environmental Protection Act 1996;
- The Guyana Geology and Mines Commission Act 1979.

Specific regulatory reporting requirements are covered in EEPGL's ERP.

2.5 OSRP Owner Responsibility

Owner and Administrator: The EEPGL Country Manager is the Owner of the EEPGL OSRP and the EEPGL OIMS/SSH&E Manager is the Plan Administrator.

Plan Review: The OSRP Administrator and Owner review this plan on an annual basis and/or if there is a significant change to EEPGL in-country operations.

Site Specific Plans: Other Activity or Site-specific ER Plans for shorebases and those individual vessels owned and operated by others are the responsibility of the site-specific Emergency Response (ER) owners and administrators for those companies. These include the following planned vessel Shipboard Oil Pollution Emergency Plans (SOPEPs).

ONSHORE

- Fuel Storage Terminal Owner/Operator Emergency Response Plan; and
- Shorebase(s) Owner/Operator Emergency Response Plan.

OFFSHORE

- FPSO(s) Owner/Operator SOPEPs;
- Conventional Crude Oil Tanker Owners/Operators SOPEP;
- Drillship Owners/Operators SOPEPs; and
- Other Installation, Supply, Support Vessel Owners/Operators SOPEPs.

EEPGL's On-Scene Incident Commander will communicate and coordinate with the owners/operators of such assets to ensure they have effectively implemented their ERP/SOPEP in the event of a spill or release. Further discussion of such duties and responsibilities are outlined in Section 3. Hard copies of such site specific ERP's and SOPEP's will be maintained at the physical asset's location or onboard the vessels with a copy of the FPSO(s) and Drillship(s) SOPEP's also maintained at EEPGL's Office.

3 INITIAL RESPONSE ACTIONS

3.1 On-Scene Initial Response Actions

Figure 3 describes the immediate actions of on-scene personnel upon discovery of a spill, including a quick situation analysis and identification of actual or potential health and safety hazards. More detailed site-specific procedures can be found in the appropriate ERP.

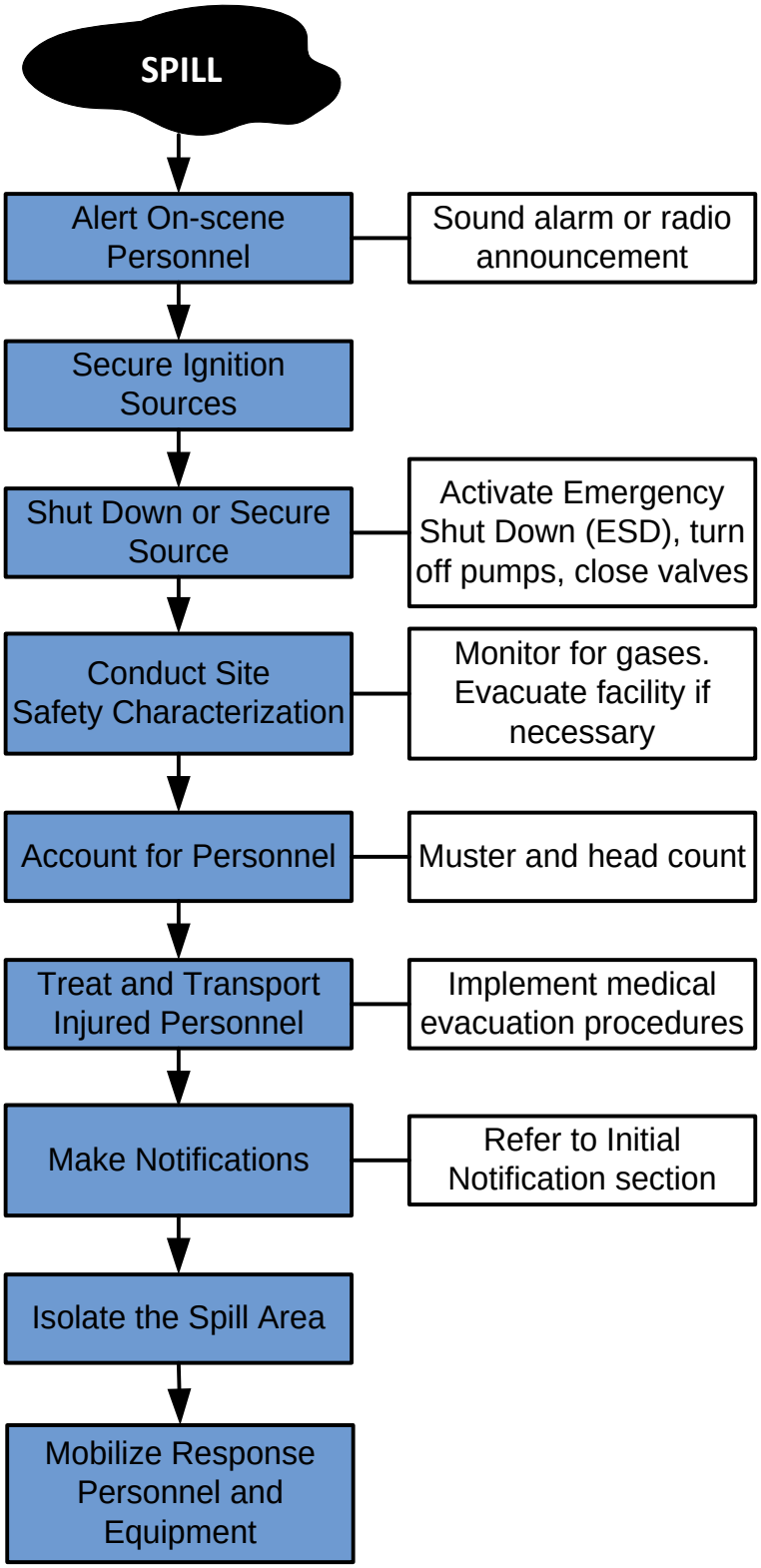

Figure 3: On-Scene Response Actions (Sample)

3.2 On Scene Incident Commander Initial Actions

The On-Scene Incident Commander is responsible for implementing the appropriate initial oil spill response actions including, but not limited to, those in Table 3.

Table 3: Incident Commander Initial Checklist

✓	Action
	Notify EEPGL Duty Manager immediately (use Initial Spill Report Form D.1, Appendix D).
	Request resources required to carry out spill response activities.
	Activate personnel and equipment maintained by EEPGL.
	Activate required external oil spill response organizations.
	Act as liaison with the lead government organization.
	Authorize notification of applicable external organizations (Table 4).

For site-specific actions refer to the appropriate plans and the ExxonMobil Incident Management Handbook (IMH).

3.3 Initial Notifications

The notifications matrix details which organizations to notify for each incident Tier, once initial on-scene response actions have been addressed (Table 3). The EEPGL ERP provides specific internal and external incident reporting requirements.

Table 4: Notifications Matrix

Organization / Regulatory Body	Spill Criteria	Timing / Responsible Person	Tel number	Form	Email address / Fax number
Guyana Government Agencies					
Coast Guard Guyana Defence Force Ruimveldt Georgetown	All Tier Levels	Within 24 hours / Initial On- scene IC	+592-226-8488 (24 hrs)	N/A	
Harbor Master Transport and Harbors Department Stabroek Georgetown	All Tier Levels	Within 24 hours / Initial On- scene IC	+592-226-7842	N/A	
Guyana EPA Ganges Street, Sophia Georgetown, Guyana	All Tier Levels (subject to permit language)	Within 24 hours / ERT Incident Commander	+592 225-5467 +592 225-5469	N/A	
Maritime Administration Department (MARAD)	Tier II and III	Within 24 hours / ERT Incident Commander	+592 226 3356	N/A	
Guyana Geology and Mines Commission	All Tier Levels	Within 24 hours	+592 225-6691 +592 225-2862	N/A	
ExxonMobil					
EEPGL Duty Manager	All Tier levels	Immediately / Initial On Scene IC	TBD	Internal Notification Form	
Americas Regional Response Team	Tier II and III	Immediately / Initial On-scene IC	+1 866 285 8895 +1 703 677 2852	Internal Notification Form	
Key 3rd Party Operators					
FPSO Owner/Operator [Upon arrival at the Liza Direct Area of Influence (AOI)]	All Tier Levels	For all FPSO based incidents Immediately / Source Control / Branch Director	TBD	Internal Notification Form	
Crude Oil Tanker Owner/Operator (While offloading or within the Stabroek Block)	All Tier Levels	For all Tanker based incidents Immediately / Source Control / Branch Director	TBD	Internal Notification Form	

Organization / Regulatory Body	Spill Criteria	Timing / Responsible Person	Tel number	Form	Email address / Fax number
Drill Ship Owner/Contractor (While drilling or on standby)	All Tier Levels	For all Drill Ship based incidents Immediately / Source Control / Branch Director	Noble Bob Douglas Rig +1 713 422-5970 Stena Carron Rig +1 713 948-1401	Internal Notification Form	
Installation/ PSV/FSV Contractors	All Tier Levels	For all Vessel based incidents Immediately / Source Control / Branch Director	Paradise Island +1 985 377 0628 Horn Island +1 985 377 0853 Sanibel Island +1 985 377 0880	N/A	
Shorebase(s)	All Tier Levels	Immediately / Initial On Scene IC	GYSBI +592 697 8643 +592 608 2605 +592 608 2606	Internal Notification Form	
Fuel Storage Terminal	All Tier Levels	Immediately / Initial On Scene IC	GYSBI + 592 600 1321	Internal Notification Form	
Response Contractors					
Oil Spill Response Ltd (Fort Lauderdale, USA)	Tier II and III	Immediately / Initial On-scene IC	+1 954 983 9880	OSRL notification OSRL mobilization	+1 954 987 30001
NRC Trinidad	All Tier Levels	Immediately / Initial On-scene IC	+44 (0) 1908 467 800	N/A	
Wild Well Control	Loss of well control	Immediately if loss of well control / Initial On-scene IC	+1 281 784 4700	N/A	N/A
ROV contractor	Loss of well control	Immediately if loss of well control / Initial On-scene IC	TBD	N/A	TBD

Organization / Regulatory Body	Spill Criteria	Timing / Responsible Person	Tel number	Form	Email address / Fax number
Trendsetter Engineering Inc.	Loss of well control	Immediately if loss of well control / Initial On-scene IC	+1 281 465 8858	N/A	N/A
Relief Well: Halliburton Boots & Coots	Loss of well control	Immediately if loss of well control / Initial On-scene IC	+1 281 931 8884 +234 1271 5020	N/A	N/A

3.4 Initial Source Control Actions

Initial source control actions and resources to control the source of operational spills, including the initial actions to a loss of well control incident, are described in site specific response plans. Sustained source control response operations will be managed and coordinated by the IMT including the Source Control Branch under the Operations Section. See Figure 4 for an example IMT with Source Control Branch.

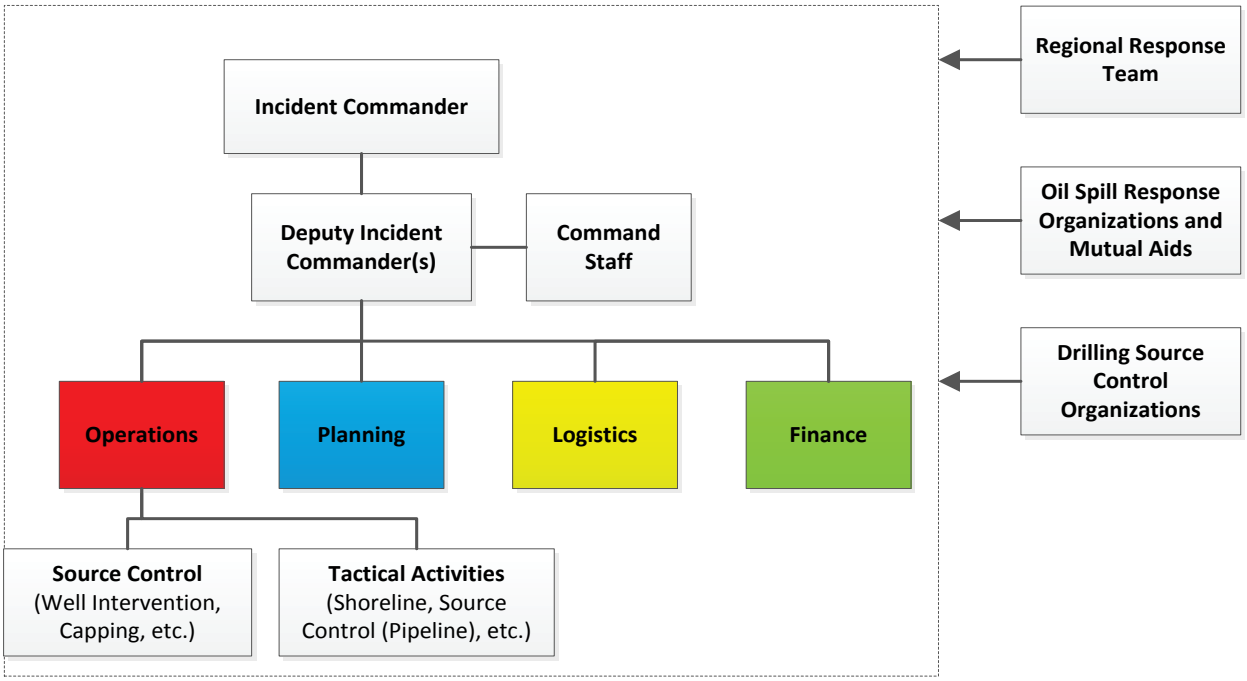

Figure 4: Example Incident Management Team (IMT) with Source Control Branch

3.5 Spill Assessment

An accurate estimation of total spill volume, location, and movement is essential to determine the required response Tier, and to plan for and initiate spill response and cleanup operations. Quick estimation will aid in determining the:

- Equipment and personnel required;
- Potential threat to shorelines and/or sensitive areas, including ecological impact; and
- Waste storage and disposal requirements.

EEPGL will initiate a systematic search with vessels and aircraft (weather permitting) to locate the spill and determine its coordinates.

EEPGL will estimate spill size and movement using coordinates, photographs, drawings, and other information received from vessels, aircraft, and satellite imagery. Spotters will photograph the spill from aircraft as often as necessary for operational purposes, and determine its movement based on existing reference points, such as vessels and familiar shoreline features. Modeling of the oil release may be utilized to predict the oil slick's surface movement or trajectory. Modeling will help to identify shorelines that may be at risk from oil stranding, predict the probable timing of that stranding, and provide information regarding how the oil is changing with time.

The Source Control Branch will estimate the volume and rate of a subsea well release.

4 OIL SPILL SCENARIOS

The following tables describe potential hydrocarbon release scenarios in terms of location, hydrocarbon type, volume, and potential environmental impact. The fourteen spill release scenarios are taken from the EIA of the Liza Phase 2 Development Project, and these scenarios are generally representative of FPSO Development Projects.

The following are examples of locations that could experience a hydrocarbon release during EEPGL operations in Guyana:

- Guyana fuel terminal;
- Guyana shorebase(s);
- Trinidad shorebase;
- Drillship(s);
- FPSO(s);
- Installation vessel(s);
- Marine support vessel(s); and
- Survey vessel(s).

Section 6, Response Strategy Implementation, provides details of potentially appropriate response actions for each identified scenario. Section 8, Response Resources, details resources available to EEPGL.

Hydrocarbons that could potentially be released during development drilling and production operations include crude oil, marine diesel, fuel oil, aviation fuel, lubricating oil, and non-aqueous drilling fluid. These scenarios are outlined in Table 5. The most appropriate response strategy to a given incident will depend, in part, on the properties of the hydrocarbon spilled. For example, heavy oils tend to persist in the environment longer than lighter hydrocarbons. A significant fraction of spilled diesel fuel, however, may be expected to evaporate and naturally disperse.

The properties of the crude oil are provided in the modeling results included in Appendices A and B. These modeling results, along with previous spill experience of different oil types, were used to complete the predicted impacts of each spill scenario.

Table 5: Possible Hydrocarbon Release Scenarios by Tier

Potential Response Strategies					
#	Tier	Location	Possible scenario	Potential Impact	Potential Response Strategies
1	I	Shorebase	Onshore spill of less than 10 bbl (e.g., partial loss of diesel storage tank contents)	Contained onshore; no shoreline impact	6.4 Onshore/Near Shore Response 6.9 Waste Management 6.11 Decontamination 6.12 Demobilization
2	II	Shorebase	On-water spill of less than 100 bbl (e.g., shore to vessel bunkering spill)	Diesel enters water; possible minor shoreline impact	6.4 Onshore/Near Shore Response 6.1 Surveillance and Monitoring 6.2 Assisted Natural Dispersion 6.9 Waste Management 6.11 Decontamination 6.12 Demobilization
3	II	Supply vessel at shorebase	On-water release of less than 500 bbl of diesel (e.g., shore to vessel bunkering)	Diesel enters water; possible shoreline impact	6.4 Onshore/Near Shore Response 6.1 Surveillance and Monitoring 6.2 Assisted Natural Dispersion 6.9 Waste Management 6.11 Decontamination 6.12 Demobilization
4	II	Supply vessel at shorebase or nearshore	On-water spill of less than 100 bbl (e.g., resulting from grounding or collision with a non-Project vessel or structure)	Diesel enters water; possible minor shoreline impact	6.4 Onshore/Near Shore Response 6.1 Surveillance and Monitoring 6.2 Assisted Natural Dispersion 6.9 Waste Management 6.11 Decontamination 6.12 Demobilization
5	I	Supply vessel offshore	Offshore spill of less than 50 bbl of fuel	Hydrocarbons enter water, creating sheen on the water surface; no shoreline impact likely	6.4 Onshore/Near Shore Response 6.1 Surveillance and Monitoring 6.2 Assisted Natural Dispersion 6.9 Waste Management 6.11 Decontamination 6.12 Demobilization

Table 5 Continued Next Page

#	Tier	Location	Possible scenario	Potential Impact	Potential Response Strategies
6	I	Drill ship or FPSO offshore	Offshore spill of less than 50 bbl of fuel (e.g., leak or release due to human error or failure of equipment)	Contained on deck of vessel or enters offshore Atlantic Ocean; no shoreline impact likely	6.1 Surveillance and Monitoring 6.2 Assisted Natural Dispersion 6.6 Offshore Containment and Recovery 6.7 Wildlife Response 6.9 Waste Management 6.11 Decontamination 6.12 Demobilization
7	II	Drill ship or FPSO offshore	Offshore spill of less than 250 bbl of fuel (e.g., leak or release due to human error or failure of equipment)	Contained on deck of vessel or enters offshore Atlantic Ocean; no shoreline impact likely	6.1 Surveillance and Monitoring 6.2 Assisted Natural Dispersion 6.6 Offshore Containment and Recovery 6.7 Wildlife Response 6.9 Waste Management 6.11 Decontamination 6.12 Demobilization
8	I	Helicopter offshore	Offshore spill of less than 50 bbl of fuel resulting from helicopter ditching and resultant release of fuel tank contents	Enters offshore Atlantic Ocean; no shoreline impact likely	6.1 Surveillance and Monitoring 6.2 Assisted Natural Dispersion
9	I	FPSO offshore	Offshore spill of less than 50 bbl of fuel resulting from discharge of hydrocarbons along with washover of firewater	Contained on deck of vessel or enters offshore Atlantic Ocean; no shoreline impact likely	6.1 Surveillance and Monitoring 6.2 Assisted Natural Dispersion 6.6 Offshore Containment and Recovery 6.7 Wildlife Response 6.9 Waste Management 6.11 Decontamination 6.12 Demobilization
10	I	FPSO offshore	Offshore spill of less than 50 bbl of crude oil from FPSO topsides (e.g., leak or release due to human error or failure of equipment)	Contained on deck of vessel or enters offshore Atlantic Ocean; no shoreline impact likely	6.1 Surveillance and Monitoring 6.2 Assisted Natural Dispersion 6.6 Offshore Containment and Recovery 6.7 Wildlife Response 6.9 Waste Management 6.11 Decontamination 6.12 Demobilization

Table 5 Continued Next Page

#	Tier	Location	Possible scenario	Potential Impact	Potential Response Strategies
11	II	Drill ship/well offshore	Well control release of less than 250 bbl (e.g., well becomes unbalanced during the drilling process and begins flowing at a prior to containment)	Hydrocarbons enter Atlantic Ocean; no shoreline impact likely	6.1 Surveillance and Monitoring 6.2 Assisted Natural Dispersion 6.6 Offshore Containment and Recovery 6.5 Dispersant Application 6.7 Wildlife Response 6.9 Waste Management 6.11 Decontamination 6.12 Demobilization
12	II	FPSO, offloading tanker offshore	Offshore release of 2,500 bbl of oil (e.g., failure of offloading hose during offloading from FPSO to tanker)	Oil enters Atlantic Ocean; no shoreline impact likely	6.1 Surveillance and Monitoring 6.2 Assisted Natural Dispersion 6.6 Offshore Containment and Recovery 6.5 Dispersant Application 6.7 Wildlife Response 6.9 Waste Management 6.11 Decontamination 6.12 Demobilization
13	III	Drill ship /well offshore	Offshore release of oil from well control event (30 day duration at 20,000 BOPD)	Oil enters Atlantic Ocean; possible shoreline impact	6.1 Surveillance and Monitoring 6.2 Assisted Natural Dispersion 6.6 Offshore Containment and Recovery 6.5 Dispersant Application 6.7 Wildlife Response 6.9 Waste Management 6.11 Decontamination 6.12 Demobilization
14	II	Drill ship / well offshore	Offshore release of up to 2,200 bbl of NADF due to loss of riser contents after emergency disconnect due to DP station keeping failure	NADF enters water near the seafloor; no shoreline impact likely	6.1 Surveillance and Monitoring 6.2 Assisted Natural Dispersion
End of Table 5					

With regards to Table 5, hydrocarbon releases of less than 100 bbl (Scenarios 1, 2, 4, 5, 6, 8, 9, and 10) would be expected to be quickly brought under control, and would be managed with locally available spill control equipment. A temporary, visible sheen on the water surface may occur, water quality would be temporarily impaired in a localized area, and sensitive receptors (e.g., plankton and possibly some seabirds or shorebirds) may be locally affected. However, there is not considered to be potential for any long-term or ecosystem level impacts on ecologically important or protected species.

A hydrocarbon release under Scenario 14 would involve a spill of up to approximately 2,200 bbl of NADF into the ocean near the seafloor. Under this scenario, the spill is limited to the capacity of the drilling riser. The potential impacts of a release of this nature would primarily occur at or near the seabed, and may include localized smothering and toxicity that would affect benthic species, although this disturbance would occur in the same area where disturbance from drilling and cuttings discharges have already occurred. Any dispersion of the NADF would also result in localized impacts on water quality and sensitive planktonic or fish species. Other than a localized area where the material has deposited, any water quality or other effects would be short-term, as the product would disperse within the water column.

A hydrocarbon release under Scenario 3 would involve a spill of approximately 500 bbl of diesel into an adjacent river or water body where a shorebase is located. Due to the rapid natural dispersion and evaporation of diesel, combined with dilution by water movement and tidal exchange, impacts would be limited in duration and would reduce with distance from the spill site.

Hydrocarbon releases under Scenarios 11 (minor well control release during drilling), 12 (release during offloading from FPSO to tanker), and 13 (a larger well control incident) would all involve an oil spill requiring the implementation of both local and regional response resources as well as OSRL's global oil spill technical response teams and equipment, which are further described in Section's 5 - 7. Oil spill modeling was performed for scenarios involving offshore release of 50 bbl (Scenarios 5, 6 or 9) and 250 bbl of marine diesel (Scenario 7), 50 bbl of crude oil (Scenario 10), and 2,500 bbl release of crude oil during offloading from FPSO to tank (Scenario 12), and a larger well control incident (Scenario 13).

Oil spill modeling for selected scenarios of the Liza Phase 1 and Phase 2 Development Projects are provided in Appendices B and A, respectively.

5 RESPONSE STRATEGIES

5.1 Response Strategy Overview

An oil spill response includes a range of response tools and techniques, response strategies, and tactics. It can be constrained by physical conditions, prevailing weather and sea conditions, and safety considerations. EEPGL will evaluate each deployment in terms of feasibility, effectiveness, and potential to reduce negative environmental impact (i.e., net environmental benefit). EEPGL will respond with the intent of minimizing the negative impacts of the response and cleanup, as determined by a Net Environmental Benefit Analysis (NEBA, see Section 5.2), which is an evaluation tool that supports decision making. In the event of a release, EEPGL and ExxonMobil technical experts will complete the NEBA for submission for a specific spill to the Guyana EPA as soon as practical.

During EEPGL's operations, the on-site ERT will endeavor to contain any spill at the source, whether it be onshore (shorebase or port) or onboard a vessel (i.e. PSV, FSV, installation, drillship, tug, tanker, or FPSO) and minimize any impacts to the environment, using the equipment available at the worksite. In the event of an on-water release, EEPGL will ensure the required notifications are made, initial response actions are implemented, and monitor the incident and consider all appropriate response strategies, including containment and recovery as well as dispersants to appropriately respond to the incident.

If released oil is predicted to reach a shoreline, EEPGL will continue to leverage all available resources to stop the release at the source, utilizing provided containment, mechanical recovery, open burning, and surface/subsurface dispersant application. EEPGL will also consider and evaluate shoreline protection measures (based on consultation with the appropriate government authorities) and outcomes from the NEBA to identify the combination of key response strategies that would be appropriate, given the specific situation, fate, and trajectory of the oil spill and weather conditions. Local regulatory authorization and the ExxonMobil Oil Spill Dispersant Guidelines will govern the application of dispersants.

The following flowchart (Figure 5) provides an overview of actions taken by the EEPGL ERT and IMT in the event of an emergency. A final decision on all necessary actions to be implemented will be determined on a case by case basis tailored to the particular incident and individual circumstances.

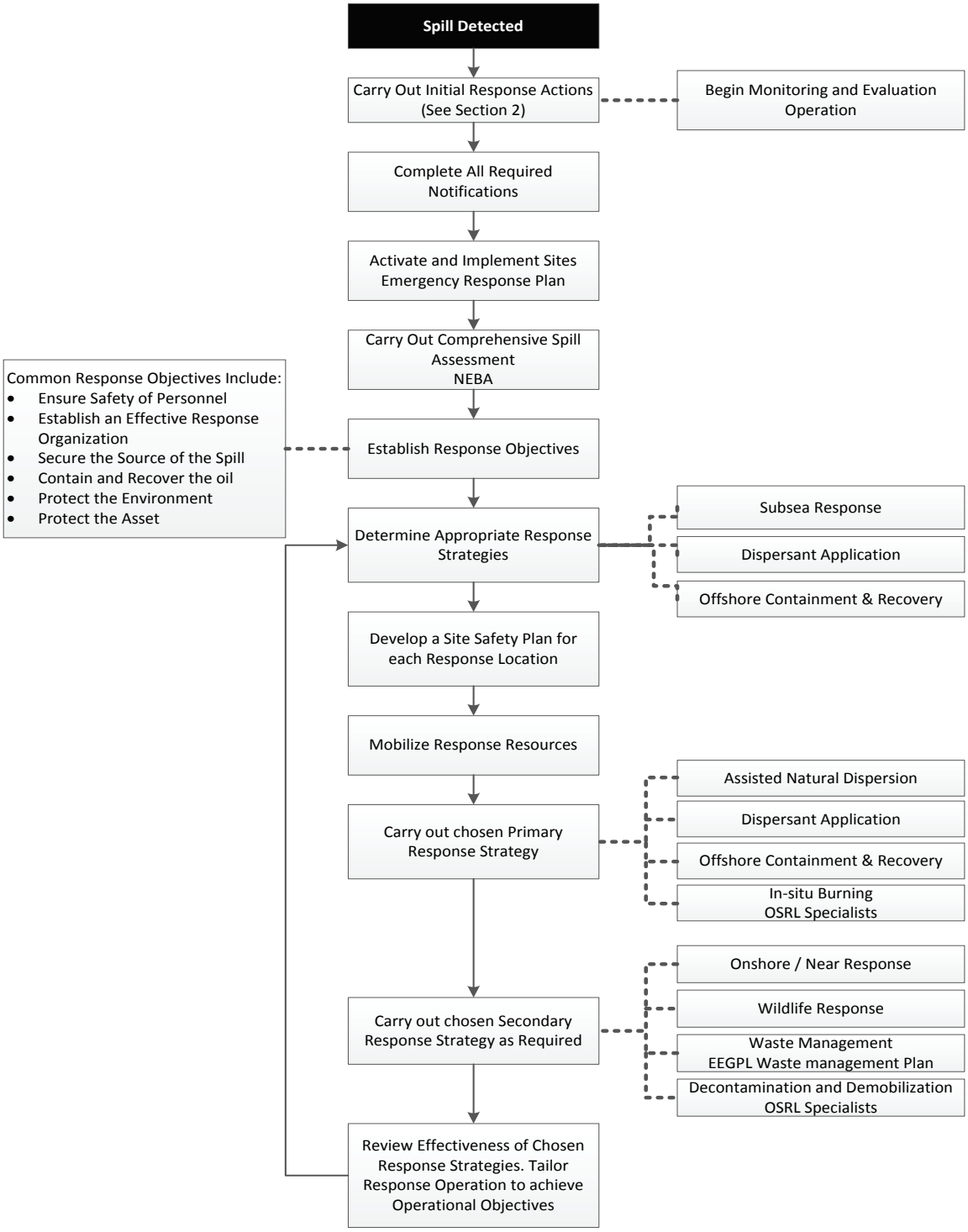

Figure 5: Emergency Response Generic Actions Flowchart

5.2 Net Environment Benefit Analysis

EEPGL has completed a Net Environment Benefit Analysis (NEBA) for a Tier III scenario resulting from a loss of well control during the drilling of a production well as well as a Tier II scenario resulting from a crude oil spill associated with an FPSO loading hose malfunction. These releases are designed to account for the response to smaller spills and are a key input to the overall Incident Response Planning and in preparation of this OSRP.

NEBA is a process that compares the impacts of oil in the environment when applying different available response options. These options would include removing the oil from the environment utilizing burning and mechanical recovery. They also include the use of oil dispersants that make oil available to natural biodegradation processes, and may include, in some cases, leaving the oil to degrade naturally. The NEBA process helps identify and select the option or combination of options that minimizes overall harm to environmental and socioeconomic resources (including cultural sensitivities). One of the key aspects of the NEBA is to determine the combination of response strategies that will encounter the highest amount of oil entering the environment. In many cases, this drives the location of the response close to the source of the release because that is where oil is most concentrated.

The encounter rate of different response alternatives is the highest with dispersant strategies. Dispersant application at the well head, with aircraft, and by vessel spraying at the water surface is far more effective in preventing shoreline stranding and effects on birds and marine mammals than mechanical recovery or burning, which both require the utilization of booms which typically exhibit low encounter rates with oil in the environment. The process requires that the performance of the spill response options are weighed against shoreline impacts and potential persistent environmental effects that would result in lieu of those offshore response strategies. The recovery time of nearshore and on-shore habitats and species must be considered against the recovery time of near-surface plankton and invertebrate communities. The loss of fish eggs and larvae need to be assessed with respect to the potential population level effects that might result from exposure to surface oil vs exposure to a spike of dispersed oil. All of these factors should be weighed by experts with an understanding of the species and habitat recovery times, socio-economic, and cultural impacts associated with the oil spill response alternatives.

The use of NEBA will ensure EEPGL selects the most appropriate response techniques available to minimize overall environmental impact based on the conditions and sensitivities of an actual incident. In select situations, the NEBA may be updated and performed again at the time of a significant spill (Tier III) to further refine and optimize the response strategies to be used given the specific conditions and circumstances existing at the time of the event.

Refer to Section 8 for a list of available resources and Appendix H for the NEBA Report.

5.3 Appropriate Response Strategies

EEPGL will respond to a release as far offshore and as expeditiously as possible, using all appropriate tools and tactics to minimize shoreline impact. In consultation with the Guyana EPA, EEPGL will develop Incident Response Plans that could include the following response strategies for an offshore release:

- Respond with aerially applied dispersants, which can be quickly deployed and treat large surface areas rapidly and efficiently.

The safety of responders also needs to be considered in the evaluation of response strategies. Response tactics depend upon a variety of environmental conditions.

- For subsea releases, implement subsea dispersant application as soon as possible, if warranted, to treat most if not all oil spilled at the source before it encounters surface water resources;
- Deploy in-situ burning equipment to burn thick oil near the source;
- Continue to use aerially applied dispersant as a primary response tool for oil further from the source where mechanical recovery/in-situ burn operations are less effective;
- Utilize aerial dispersant application during calm seas on emulsified oil;
- Outfit vessels of opportunity (VOO) with dispersant delivery and mechanical containment and recovery systems to provide a fleet of vessels that can be a line of defense against surface oil approaching shorelines.

Shoreline protection and/or cleanup may be needed for some scenarios, in which case, sensitive shorelines will receive prioritization for protective booming.

Depending on the volume, mechanical recovery at sea is possible due to the anticipated oil thicknesses, but can typically be difficult due to the active metocean conditions.

There is a health and safety hazard posed by high atmospheric concentrations of hydrocarbons. Air quality should be monitored at all times and personnel should be evacuated immediately if an exclusion zone is required. Consideration for air quality monitoring is included in the Site Safety Plan.

Figure 6 below shows the cone of response when responding to a loss of well control event with loss of containment using all the available response strategies at once.

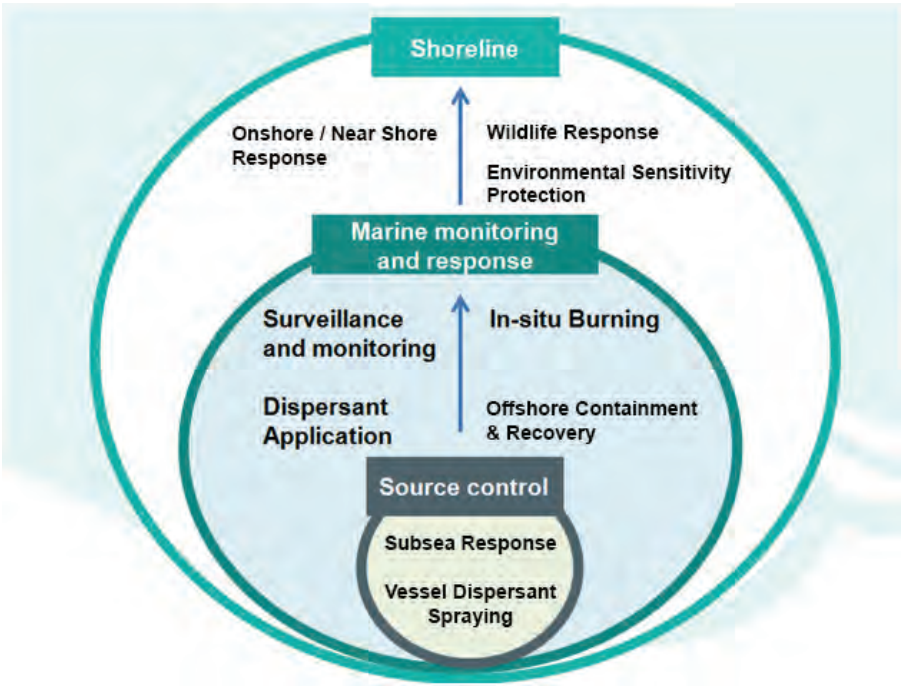

Figure 6: Cone of Response Diagram

5.4 Transboundary Impacts

EEPGL will work with the appropriate governments of potentially impacted jurisdictions to support bi-lateral response agreements, in alignment with the protocols of the Guyana national contingency plan. In the event that there is an incident that impacts areas outside the Guyana Exclusive Economic Zone (EEZ), EEPGL will work with representatives for the respective locations to:

- Coordinate operations and communication between different command posts;
- Create a transboundary workgroup to manage waste from a product release – including identifying waste-handling locations in the impacted regions and managing commercial and legal issues;
- Identify places of refuge in the impacted regions where vessels could go for repairs and assistance;
- Determine how EEPGL and the impacted regional stakeholders can work together to allow equipment and personnel to move to assist in a spill response outside the region while still retaining a core level of response readiness within the jurisdictions;
- Determine financial liability during a response to a transboundary event; and
- Work with local communities within the impacted areas to raise awareness of oil spill planning and preparations.

6 RESPONSE STRATEGY IMPLEMENTATION

The following sections describe the implementation of each response strategy available to EEPGL.

6.1 Surveillance and Monitoring

Surveillance and monitoring is a key strategy relevant to all oil spills that enter the marine environment. Surveillance and monitoring teams can fulfill the following response objectives:

- Verify oil spill scale and location;
- Monitor effectiveness of applied response strategies;
- Visually quantify spill volume (iterative as needed);
- Direct operations – dispersant application, containment and recovery, shoreline assessment, in-situ burning; and
- Monitor wildlife.

The resources mobilized will vary depending on the scale of the incident. At a minimum, personnel will take visual observations, and vessel owners/operators will implement their ERP/SOPEP's, deploying the Tier I response equipment they have onboard or at location. Depending on the type of operation involved in the spill this could include: FPSOs, drillships, tankers, tugs, installation vessels, marine support vessels, etc. EEPGL will request updated oil spill modeling from response and/or organizations or support organizations. For Tier II or Tier III incidents, EEPGL will scale up to a full surveillance plan using helicopters, fixed wing aircraft, and satellite imagery.

The IMT will assign an Air Operations Branch as part of the Operations Section for large or complex incidents. The Air Operations Branch will coordinate aerial support according to operational needs and document operational assignments in an ICS-220 Air Operations Summary form, which will be included in the Incident Action Plan (IAP).

The Air Operations Branch Director is responsible for addressing response considerations including flight authorizations and restrictions, air clearances, government support, aerial logistics, and operational constraints (e.g. weather, visibility). All aviation operations must follow the Site Safety Plan and additional emergency procedures specific to the operation.

Figure 7 illustrates the key steps involved in surveillance and monitoring; refer to the ExxonMobil IMH and the OSRL Field Guides for further details. Refer to Section 8, for a list of available resources.

Figure 7: Surveillance and Monitoring Key Steps

6.2 Assisted Natural Dispersion

Assisted natural dispersion is the process of speeding up the natural breakdown of hydrocarbons without the use of chemicals. This strategy is suitable for smaller spills or in combination with other strategies for larger spills.

To assist the natural dispersion process, techniques such as prop washing or water hoses can be implemented to introduce energy and agitate the hydrocarbons, thereby assisting with the breakup of a surface slick and promoting biodegradation.

6.3 Operational Spill Cleanup

Operational spills are small in volume and easily contained on land, on deck or in very close proximity to a vessel. These spills can originate from shore facilities, vessels or the drill rig. Equipment used for operational spills include sorbent pads, booms, shovels and PPE. This equipment is stored close to the work site for ease of deployment.

- Shore bases in Guyana and Trinidad have site specific ER Plans and are equipped with Tier I spill response kits;
- Vessels maintain a Shipboard Oil Pollution Emergency Plan (SOPEP) and associated equipment onboard the vessel.

For further details on operational spill cleanup, refer to the Incident Management Handbook and Field Response Guide.

6.4 Onshore/Near Shore Response

6.4.1 Harbor Containment and Recovery

EEPGL will use harbor containment and recovery should a marine support vessel (e.g., PSV or FSV) release hydrocarbons in port. The harbor response team will employ a strategy that considers tides, currents, wind, vessel traffic, and local infrastructure with stakeholder input. EEPGL will deploy equipment available on site and in the port (such as or similar to the equipment and trained personnel at the Guyana Fuel Terminals and resources held by NRC for Trinidad) immediately following a release.

Figure 8 illustrates the key steps involved in harbor containment and recovery; refer to the ExxonMobil IMH and OSRL Field Guide for detailed information. Refer to Section 8, for a list of available resources.

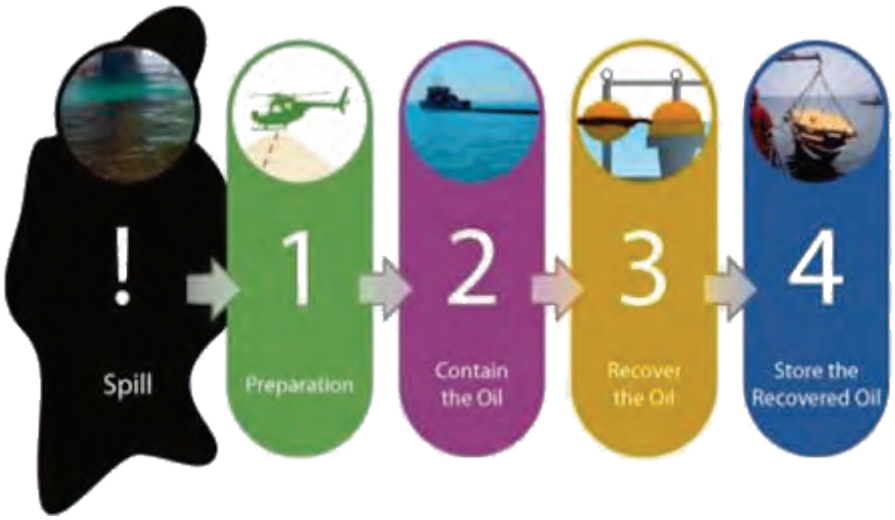

Figure 8: Harbor Containment and Recovery Key Steps

6.4.2 Shoreline Response

EEPGL will implement a shoreline response if released hydrocarbons show the potential to affect a shoreline, prioritizing environmentally or socio-economically sensitive areas (ESAs). These are ranked using an Environmental Sensitivity Index (ESI) and corresponding resource/receptor ratings to identify those projected areas, special status species, fish, and other marine life on which these local coastal communities and indigenous peoples depend and live, as assessed in the Environmental Impact Assessments (EIA) for the FPSO Development Projects (Phases 1 and 2).

Shoreline response will consist of using vessel dispersant application on the surface to prevent approaching slick(s) from impacting ESAs and using shoreline booming to protect sensitive areas and provide collection points for hydrocarbon recovery. Initial equipment (e.g., dispersant,

mechanical recovery) will come from in-country and/or regional sources and will be supplemented as necessary via OSRL from Ft. Lauderdale, FL and other bases.

EEPGL has pre-identified the environmental and socio-economical sensitive areas that could be impacted by a major oil spill. Coastal Sensitivity Maps have been developed which identify sensitive habitats/wildlife areas/features associated with the coastlines in the geographic response area. The Coastal Sensitivity Maps are included as an appendix to the EIA for the Liza Phase 2 Development Project. Strategic Geographical Response Maps have also been developed to define the equipment needs in specific coastline areas of portions of the geographic response area, considering sensitive areas, access points, and likely response actions. See Section 7.2 and Appendix E. The IMT will use this information for response planning, including development of protection strategies.

Figure 9 illustrates the key steps involved in a shoreline response; refer to the ExxonMobil IMH and the OSRL Field Guide for detailed information. Refer to Section 8 for a list of available resources.

Figure 9: Shoreline Response Key Steps

6.5 Dispersant Application

Dispersants have been used successfully to reduce shoreline and surface impact during many oil spill incidents in industry. When used properly, dispersants can rapidly reduce the volume of oil on the sea surface and accelerate the natural biodegradation process. Dispersants can reduce or eliminate the potential for oil to impact shorelines. EEPGL will only apply dispersants if there is a direct advantage to protecting environmental or socio-economical sensitivities (determined using NEBA, Section 5.2 and Appendix H) and where authorized by the EPA.

Vessel mounted systems will generally be used to apply dispersant on the surface in small-scale incidents, and aircraft will generally apply dispersant on the surface for large oil slicks. A small supply of dispersant (and associated vessel spray equipment) will be kept at the shorebase or other easily

accessible location where it can be easily loaded on marine support vessels for application in small-scale spills. OSRL will conduct aerial dispersant application on the surface for larger-scale spills and will likely base the operation out of the Georgetown airport. In the unlikely event of a Tier III well blowout, dispersant is injected subsea at the wellhead location near the seafloor using specialized equipment and Remotely Operated Vehicles (ROVs).

In Guyana, dispersant usage is subject to permission from the Guyana EPA. EEPGL and Guyana EPA both recognize that pre-planning and operational readiness is essential for selecting the best strategy and achieving an effective and timely response. The EPA's acceptance of response strategies for scenarios identified in this plan (via EPA acceptance of the OSRP as part of the environmental authorization process for the Liza Phase 2 Development Project) serves as pre-approval. However, in the event of an incident, all relevant agencies will be notified and consulted, as appropriate, prior to dispersant application. Pre-approval from the EPA is related to the potential use of the four primary (i.e., most broadly approved and studied) dispersants: Corexit 9500, Corexit 9527A, Finasol OSR 52, and Dasic Slickgone NS. These dispersants have been found to be of low toxicity, are effective across a broad range of oil types and environmental conditions, and are readily available globally. For reference, in a 2010 study conducted by the US EPA, Corexit 9500A was found to be of lower toxicity during standard aquatic toxicity tests than several other commercially available products, i.e., slightly toxic to practically non-toxic (Comparative Toxicity of Eight Oil Dispersant Products on Two Gulf of Mexico Aquatic Test Species, U.S. Environmental Protection Agency; Office of Research and Development, June 30, 2010). Safety Data Sheets (SDS) for each of the above mentioned products have been provided in Appendix D – Form D.2.

Requesting approval at the time of an incident can delay the response, and may result in a missed window of opportunity to apply dispersants, potentially increasing environmental damage. EEPGL will use the Dispersant Spraying Considerations Flowchart (Appendix C) as a guide for whether to use dispersants. Dispersant will be applied according to manufacturers' guidelines and the operating procedures of the spray applicators.

EEPGL will work with the EPA to develop a dispersant application, monitoring, and evaluation strategy as part of the spill response strategy. The following dispersant use application forms capture all relevant information to assist in this process. Appendix D includes the Dispersant Use Planning Form - Initial Incident Information (Form D.3), Dispersant Use Planning Form – Application Tactics (Form D.4) and the Dispersant Use Request Form (Form D.4).

Figure 10 illustrates the key steps involved in dispersant operations; refer to the ExxonMobil IMH and the OSRL Field Guides for further details. Refer to Section 8, for a list of available resources.

Figure 10: Dispersant Application Key Steps

6.5.1 Toxicity

Toxicity is a parameter associated with all materials. Every substance exhibits toxic effects at some concentration, so it is not a binary (i.e., yes or no) parameter. The essential element of toxicology is that the magnitude of the effect on an organism caused by a chemical compound is dependent on the exposure of the organism to the chemical compound. Highly toxic materials require exposure to only very small concentrations of the substance, e.g. low part per billion levels, while low toxicity materials require exposure to much higher concentrations, e.g. 100's of parts per million. Exposure is the concentration of the chemical to which the organism is in contact, the route of that exposure (e.g., gills, lungs, skin, stomach), and the duration of exposure. Sections 6.5.2 through 6.5.5 discuss the potential toxic effects of dispersants. Additional analysis on the potential impacts of dispersant use are described in EIA for the Liza Phase 2 Development Project.

6.5.2 Potentially Toxic Chemical Compounds in Oil

Most alkanes and cycloalkanes have a limited potential to cause toxic effects on marine organisms due to their low water solubility. Aromatic hydrocarbons are the components of crude and fuel oils that are generally considered to be toxic to aquatic organisms (Anderson *et al.,* 1974; Di Toro *et al.,* 2007).

6.5.3 Exposure to Oil, Dispersed Oil, and Water-Soluble Compounds from Oil

Once an oil spill has occurred, it is inevitable that some marine organisms will be exposed to elevated concentrations of naturally dispersed oil droplets and water-soluble compounds from the oil in the upper water column (González *et al.,* 2006). The one-ring aromatic compounds (or BTEX) will rapidly evaporate from floating oil into the air. There remains potential for toxic effects to be caused by the remaining oil (Neff *et al.,* 2000).

The main cause of acute (short term [48 to 96 hour], high concentration exposure) toxic effects in marine organisms is exposure to 2-ring PAHs (substituted naphthalenes) in the water through absorption across the gills and other organs. The dispersion of oil as small droplets, either naturally or enhanced by dispersants, may increase the exposure of some marine life to these and other partly water-soluble compounds from the oil due to the increased oil/water surface area. However the dispersion process does not increase the oil's toxicity. Modern dispersants were designed for low toxicity and the dispersant and dispersed oil are not more toxic than the oil alone.

The uppermost water layer typically contains high densities of planktonic organisms, including the developing spawn (embryos and larvae) of some fish species. These early life stages are known to be sensitive to low concentrations of 2- and 3-ring PAHs in the water (Carls *et al.,* 2008). Plankton drift with the currents in the water and cannot avoid exposure to the compounds from the oil, but any effects on plankton would be localized, and recovery by recruitment from outside of the affected area is rapid. Most oil spills are of limited area and short duration, and the resulting impact, if any, would be limited and localized (Kingston, 1999). Furthermore, the recovery of plankton occurs on the order of several weeks.

In water more than 10 metres deep, the concentration of naturally dispersed oil and water-soluble compounds from the oil will be rapidly diluted to low levels in the underlying water. Adult fish can detect oil compounds in the water and are likely to avoid the contaminated area (Weber *et al.,* 1981). There is no recorded case of any massive fish-kill being caused by an oil spill in the sea.

Fish swimming through water containing oil can absorb some of the water-soluble compounds (most usually the 2-ring aromatic compounds) from the oil into their tissues, but these compounds are quickly lost ('depurated') by normal metabolic processes when the fish passes into clean water. Fishing bans or restrictions are often put in place as a precautionary measure to prevent fishing boats and their equipment being oiled, and to reassure the public and protect the reputation/viability of the seafood markets. These bans often benefit regional fish populations because greater numbers of the adult fish spawn to reproduce and remain in the population until fishing bans are eliminated.

6.5.4 Effect of Using Dispersants

Dispersing more of the oil as small droplets in the water column by the use of dispersant will temporarily increase the exposure of all marine organisms in the upper water column (Singer et al., 1998). The increase in oil/water surface area will enable more of the partially water-soluble chemical compounds to transfer into the water. They will also be rapidly diluted, as long as sufficient water depth is available (Law and Kelly, 1999; Bejarano et al., 2013). The elevated concentrations of these compounds (the 2- and 3-ring aromatic compounds) in the water column have the potential to cause toxic effects, with the magnitude of the effect depending on the duration of exposure (Kelly and Law, 1998; Sterling et al., 2003; Bejarano, 2014). If dispersants are used on spilled oil over water deeper than 10 or 20 metres the concentrations of dispersed oil droplets and water-soluble chemical compounds from the oil will initially increase, but then rapidly decrease as they are diluted into the surrounding water. Marine organisms will therefore be exposed to a brief 'spike' of elevated concentration of these compounds (Singer et al., 1991; Bragin et al., 1994; Clark et al., 2001), typically reaching a concentration around 50 ppm and rarely exceeding 100–200 ppm in the top few metres and falling to about 1 ppm within a few hours. The overall levels of exposure in the marine environment are much lower than those used in standard laboratory toxicity testing procedures (Pace et al., 1995; Coelho et al., 2013).

6.5.5 Exposure of Marine Organisms by Ingestion of Dispersed Oil Droplets

Marine organisms may also be exposed to the higher molecular weight PAHs through ingestion of food. Filter-feeding organisms that prey on plankton can ingest naturally or chemically dispersed oil droplets when they are of similar size to some plankton. Relatively simple organisms, such as bivalves, cannot biochemically process the higher molecular weight PAHs in the oil, and these PAHs can build up ('bio-accumulate') in some organs (Neff and Burns, 1996). These compounds will subsequently be lost by depuration into clean water. Predators that consume oil-contaminated bivalves can therefore be exposed to elevated concentrations of the higher molecular PAHs by this ingestion route. Organisms that possess livers, such as fish, can metabolize PAH, and some of these metabolites are harmful, causing lesions and other effects. The magnitude of toxic effects caused by this exposure route in most circumstances is likely to be low with only some individuals affected.

In summary, the assessment of environmental effects from dispersing accidentally spill oil requires that the effects be compared to that of oil alone. Crude oils are materials that contain toxic constituents. When they enter a nearshore area or strand on a shoreline they can potentially produce negative physical (smothering) and chemical environmental effects. The effects have the likelihood of being persistent because bulk oil does not readily degrade. Dispersing these oils into very small droplets will greatly reduce the persistence of the spilled oil and provide the ability of naturally occurring oil-degrading bacterial to remove it from the environment.

6.6 Offshore Containment and Recovery

EEPGL is likely to use containment and recovery operations for spills that enter the marine environment.

EEPGL and its contractors including OSRL will provide containment and recovery resources for an offshore response. EEPGL will source Vessels of Opportunity (VOOs) to provide platforms for the containment and recovery systems. Barges will store and transport recovered waste in accordance with the Waste Management Plan (Refer to Section 6.9).

Figure 11 illustrates the key steps involved in containment and recovery operations; refer to the ExxonMobil IMH and OSRL Field Guide for detailed information. Refer to Section 8, for a list of available resources.

Figure 11: Containment and Recovery Key Steps

6.7 Wildlife Response

In the event of an oil spill, there is potential for wildlife to either become oiled or require protection from the oil. Both require specialist knowledge and regulatory authorization.

A Wildlife Response Plan (WRP) specific to Guyana has been developed and provided as Appendix F to allow for a timely, coordinated, and effective protection, rescue, and rehabilitation of wildlife to minimize any negative impacts of a spill. The WRP outlines the measures to avoid and mitigate impacts to wildlife, as well as rescue and rehabilitation of affected or injured wildlife should such measures be required.

Details of the wildlife that could be impacted are provided in the Environmental Impact Assessments (EIA) for the FPSO Development Projects (Phases 1 and 2).

Should a wildlife response be required, EEPGL will call upon the Sea Alarm Foundation via OSRL to provide specialist advice and assistance with carrying out a response. Opportunities to engage and train further members of the local oil spill response contractor(s) as well as potential members of the potentially affected communities will be evaluated to expand such local resources.

6.8 In-Situ Burning

In-situ burning is a technique for burning spilled hydrocarbons on the water's surface. EEPGL is only likely to use in-situ burning for large-scale Tier III incidents. OSRL will provide the resources required.

Hydrocarbons must be contained within fire retardant boom with sufficient thickness to achieve a successful burn. Other factors that influence burn success include:

- Weather and sea state;
- Volatility of the hydrocarbons;
- Suitable vessel availability; and
- Regulatory approval.

Figure 12 illustrates the key steps involved in burning operations; refer to the ExxonMobil IMH and OSRL Field Guide for detailed information. Refer to Section 8, for a list of available resources.

Figure 12: In Situ Burning Key Steps

6.9 Waste Management

EEPGL will manage hazardous wastes resulting from cleanup activities and ensure appropriate disposal. Large spills can typically result in significant quantities of waste in various forms:

- Recovered oil;
- Oily water mixed with recovered oil;
- Sorbent materials;
- Oiled containment boom;
- Oiled PPE;
- Oiled sediment;
- Oiled vegetation;
- Oiled debris;
- Deceased wildlife.

Effective waste management will minimize secondary contamination, thereby minimizing waste volume. EEPGL have developed a Waste Management Plan (WMP) (refer to Appendix 1 of the Environmental and Socioeconomic Management Plan), which may be adapted as required if a spill is likely to produce more waste than can be handled by their regular waste contractor. Additional waste management provisions including those associated with the disposition of any deceased wildlife is found in Appendix F, the Wildlife Response Plan.

Figure 13 illustrates the key steps involved in waste management; refer to the ExxonMobil IMH and OSRL Field Guide for detailed information. Refer to Section 8, for a list of available resources.

Figure 13: Waste Management Key Steps

6.10 Subsea Response

The Drilling ERP contains managerial and logistical details on debris clearance, subsea dispersant injection, well capping, and relief well drilling. The FPSO ERP will be implemented on the surface and subsea for a spill from either the FPSO, during tanker offloading, or SURF (Subsea Umbilical, Riser, Flowline) equipment during production operations. Tankers (owned/operated by others) will have similar ERPs that would be implemented complementary to the FPSO ERP, for spills during offloading.

If a Tier III well control incident occurs involving the release of wellbore fluids into the sea, EEPGL will be responsible for containing the source. This team is responsible for performing site survey, conducting debris removal operations (as required), evaluating and executing well intervention options, installing subsea dispersant application hardware, and mobilizing and installing a capping device/auxiliary equipment as required. Initially, the team will attempt to operate the existing subsea well control equipment through intervention. If required, the team will mobilize and install a capping device to shut-in the well at the sea floor. Once under control, the forward plan will be designed and executed according to the details of the incident itself. If a relief well is required, it will be drilled to intersect the original well and address specific issues encountered in the original wellbore.

OSRL's Subsea Well Intervention Service (SWIS) provides EEPGL with access to a Subsea Incident Response Toolkit (SIRT), the Global Dispersant Stockpile (GDS), and multiple Capping Stack Systems (CSS). The CSS and SIRT includes equipment that can be mobilized directly to the well site:

- Survey & debris clearance equipment;
- Intervention equipment;
- Dispersant hardware application system*; and
- Capping stack systems and auxiliary equipment.

* Dispersant will be mobilized simultaneously through the OSRL GDS service via the EEPGL IMT. For detailed information on the implementation of a subsea response, refer to the Drilling ERP.

The key steps involved with a subsea response are:

Figure 14: Subsea Response Key Steps

6.11 Decontamination

In the event of a spill, an incident-specific Decontamination Plan will be developed by EEPGL relevant to the nature and extent of the spill to prevent further oiling through secondary contamination. Decontamination is the process of removing or neutralizing contaminants on personnel and any equipment that has come into contact with the oil or oily wastes. To ensure the safety of the responders and the public, and to prevent further potential impact to the environment, a Decontamination Plan and dedicated area with clearly delineated hot (exclusion), warm (contamination reduction), and cold (clean support) zones will be developed and established. Decontamination procedures are supplemental to the Site Safety Plan. The Planning Section of the Regional Response Team will support development of the Decontamination Plan with input from Operations and Logistics.

The decontamination procedures will depend on the type and volume of oil that has been spilled, and the type of equipment used during the clean-up operation. Regular decontamination during the response is necessary for the personnel involved with direct clean-up efforts, the vessels involved in the response, and a wide range of spill-related equipment. Any spill response contractor will follow established guidelines for decontamination operations in order to facilitate proper decontamination through the duration of the cleanup effort.

Establishing a field decontamination process is a priority. Regular decontamination will occur in the field, particularly during a large-scale response, so all personnel must be briefed on the decontamination requirements at the beginning of the spill response in order to ensure functioning decontamination operations.

Supervisory personnel are responsible for ensuring that all decontamination activities are occurring according to the guidelines. At the end of the response effort, all the vessels and equipment that have been used at the site will undergo a more thorough cleaning in order to ensure their suitability for future use, including normal operations.

For detailed information on the implementation techniques involved with decontamination, refer to the relevant Field Guide and IMH.

6.12 Demobilization

Once an incident has stabilized and response operations are being completed, a decision will be made to commence demobilization of resources (personnel and equipment) as appropriate. An incident-specific Demobilization Plan will be developed incorporating guidance from the Resource Unit Lead, Operations, Logistics, and Legal.

The Resource Unit will then coordinate demobilization of resources in accordance with the approved Demobilization Plan.

There are a number of tools available to assist in the determination of cleanup endpoints, including:

- Shoreline Assessment Manual, Third Edition, NOAA, 2000;
- Shoreline Assessment Job Aid, NOAA, 2007;
- Marine Oil Spill Response Options for Minimizing Environmental Impacts, NOAA, API and USCG, 1998; and
- Options for Minimizing Environmental Impacts of Freshwater Spill Response, NOAA and API, 1995.

7 RESPONSE STRATEGIES

7.1 Methodology

EEPGL, supported by the Response Group (TRG), will utilize a Geographic Response Plan (GRP) for the coastlines of Guyana and Trinidad & Tobago to support EEPGL operations in Guyana. The geographical footprint of the GRP was based on projected impacts from the stochastic modeling of the 20,000 barrel per day scenario and the initially impacted shorelines as outlined in this OSRP. Once the scope of coverage was defined, TRG conducted a full desktop review in detail at a scale of 1:5,000 to determine any potentially impacted sensitivities along the entire coastline of Guyana. As TRG had previously developed a Tactical Response Plan (TRP) for Trinidad & Tobago during 2007 and 2008, these developed strategies were reviewed and updated based on the changes in the coastlines over that time period.

Once the data from the FPSO Development Projects (Phase 1 and 2) Environmental Impact Assessments (EIA) data was received in Geographical Information Systems (GIS) format, the data was overlaid to confirm the response actions by location. By combining the environmental GIS data into the GRP, responding organizations can review locations of sensitivities, access points, and response actions, as well as resource requirements in one document. The GRP also defines the equipment needs (totals) for each division to support efficient resource ordering practices upon implementation of the plan. To further support response activities, the GRP also provides an appendix to response methods by shoreline type to support response activities and decision-making on impacted areas which might be outside the scope of the GRP.

7.2 Divisions and Maps

The GRP is a comprehensive document (500+ pages) which is managed outside of the OSRP for efficiency purposes. However, several example maps and tables included in Appendix E to provide users with a conceptual overview. As shown in Appendix E, each country (Guyana, Trinidad & Tobago) is broken up into multiple divisions, based on geopolitical boundaries in Guyana, and cities, or points of interest in Trinidad & Tobago. Each of these divisions contain detailed strategies for spill response and shoreline protection. These strategies were developed to support three primary functions (1) enhance the safety of the public, (2) protect the environment, and (3) provide responders with a planning tool to support the initial response actions in the event of a spill.

8 RESPONSE RESOURCES

Table 6 lists or otherwise describes the international, regional, and local resources available to EEPGL for each potential response strategy. Table 7 provides a further summary of the representative oil spill response equipment to be provided on the FPSOs.

Table 6: Oil Spill Response Resources*

Response Strategy	Resources Available	Quantity	Location
Surveillance and Monitoring	Heliport / Shorebase	2	Guyana Airport / Shorebase (Examples: Correia International Airport / GYSBI Shorebase or similar, Guyana)
	Helicopters	3	Infield helicopter provider
	Helicopters	As required	National Helicopter Services Limited or similar, Trinidad
	Tracking Buoy	As required	Horizon Marine or similar
	OSRL Trained personnel Fluorometry Satellite Imagery Tracking buoys	Refer: Section 8.3.2, Oil Spill Response Limited (OSRL)	
Assisted Natural Dispersion	PSV's / FSV marine support vessels (mounted dispersant application monitors)	6	Infield
Operational Spill clean-up	SOPEP material Spill Equipment at shoreside facilites	As required	Onboard all vessel's, at shorebases in Guyana and Trinidad, Fuel Terminals [Examples: SOL Terminal (Guyana), NRC base (Trinidad)]
Onshore/near shore	Onshore/near shore package Fence Boom Skimmers Temporary storage	TBD	Guyana Fuel Terminal (SOL Terminal or similar, Guyana)
			Trinidad Shorebase (NRC base or similar)

Response Strategy	Resources Available	Quantity	Location
Onshore/near shore, continued	OSRL	Refer: Section 8.3.2, Oil Spill Response Limited (OSRL)	
	1,200 ft. 8" x 16" Solid Float Containment Boom (24 ea. 50ft. Sections)	2	Georgetown Shorebase
	1,200 ft 6" x 12" TC Solid Float Containment Boom (12 ea 100ft Sections)	2	Georgetown Shorebase
	CRUCIAL Drum Skimmer Package (Including Skimmer Head , Diesel Hydraulic Power Pack, PD75 Oil Transfer Pump, Hose Package, and Spares)	2	Georgetown Shorebase
	Weir Skimmer Head	2	Georgetown Shorebase
	Tow Bridles	8	Georgetown Shorebase
	Boom Repair Kit	4	Georgetown Shorebase
	20 lb. Anchor	40	Georgetown Shorebase
	40 lb. Anchor	8	Georgetown Shorebase
	Buoys	50	Georgetown Shorebase
	Spools of Rope	16	Georgetown Shorebase
	Box of Shackles, Fittings, etc.)	2	Georgetown Shorebase
	End Opening Container	4	Georgetown Shorebase
	Dispersant Spray Package 4000 liters chemical dispersant Afedo Spray nozzles	2	Guyana Shorebase (GYSBI Shorebase or similar), Guyana
	OSRL Vessel mounted spray equipment Aerial spray platform Trained personnel	Refer: Section 8.3.2, Oil Spill Response Limited (OSRL)	

Response Strategy	Resources Available	Quantity	Location
Onshore/near shore, continued	Global Dispersant Stockpile	Refer to: Section 8.3.3, Global Dispersant Stockpile	
	OSRL Offshore boom Offshore skimmers Temporary storage Trained personnel	Refer: Section 8.3.2, Oil Spill Response Limited (OSRL)	
	Inflatable Offshore Boom (43in Inflatable Boom, 100 ft. Sections)	1,400 ft	Georgetown Shorebase
	Hydraulic Boom Reel	2	Georgetown Shorebase
	Tow Bridles with Tow Line	4	Georgetown Shorebase
Dispersant Application	Inflation Blower with Hoses	2	Georgetown Shorebase
	Diesel Hydraulic Powerpack	2	Georgetown Shorebase
	Hydraulic Hoses (Pair)	2	Georgetown Shorebase
Offshore containment and recovery Wildlife In-Situ Burning Waste Management Subsea Response	Boom Spares Kit	2	Georgetown Shorebase
	Double door 20ft Container (Opens both ends)	2	Georgetown Shorebase
	CRUCIAL Model C-Disc 13/24 skimmer	2	Georgetown Shorebase
	Diesel hydraulic power pack (Lamor model LPP-6 with Hatz diesel engine)	2	Georgetown Shorebase
	Spate PD75 oil transfer pump coupled on two wheel cart	2	Georgetown Shorebase
	Hose package	2	Georgetown Shorebase
	Towable bladders (approx. 5000-6000 gal. total combined capacity of both bladders)	4	Georgetown Shorebase
	Spool rope	2	Georgetown Shorebase

Response Strategy	Resources Available		Quantity	Location
	Spares package		2	Georgetown Shorebase
	Hose floats		16	Georgetown Shorebase
	20ft. Standard shipping container (with doors on one end)		1	Georgetown Shorebase
	OSRL		Wildlife response equipment	Refer: Section 8.3.2, Oil Spill Response Limited (OSRL)
	Sea Alarm Foundation (SAF)		Technical expertise	Georgetown Shorebase
	ExxonMobil Biomedical Sciences, Inc. (EMBSI)		Wildlife expertise	Refer: Wildlife Response Plan (Appendix F)
	OSRL Fire resistant boom Ignition equipment Trained personnel		Refer: Section 8.3.2, Oil Spill Response Limited (OSRL)	
	Waste contractor		N/A	Guyana
	OSRL		Refer: Section 8.3.2, Oil Spill Response Limited (OSRL)	
	OSRL Subsea Well Intervention Services (SWIS)		Refer: Section 8.3.4, Global Dispersant Stockpile (GDS) Well Response	
Subsea Response	ROV contractor ROVs onboard Technicians 8 (4 man crew per Drill Ship)	4 (2 per Drill Ship)	TBD Houston, TX	
	Trendsetter Engineering Inc.	N/A		

Response Strategy	Resources Available		Quantity	Location
	Engineers / Technicians to support mobilization and installation of capping equipment			
	Relief Well: Halliburton Boots & Coots active ranging technology	N/A	Houston, TX	
In-Situ Burning	Additional available equipment: Wild Well Control Well CONTAINED BOP Intervention Subsea Dispersant application kit Debris removal kit Capping Stack system		See WellCONTAINED (TM)	
Multi strategy use	Drillship		Up to 2	Infield
	FPSO*		1	Infield (See Table 7 for a list of the common spill response equipment kept onboard)
Subsea Response	Crude Oil Tanker		1	Infield (During scheduled tanker offloading)
	PSV's / FSV		PSV (Similar in class to the Hornbeck Commander, 320 ft class)	4
	Trendsetter Engineering Inc. Engineers / Technicians to support mobilization and installation of capping equipment		FSV (Similar in class to Chouest Fast Hauler)	1
	Installation Vessels		MPV (Multi-Purpose Support vessel)	1

Response Strategy	Resources Available	Quantity	Location
	Tugs	1x 120 MT Azimuth Stern Driven (ASD) Tug 2 x 80 MT ASD Tugs	3
	Vessel's of Opportunity (VOO's)	Various	N/A
Multi strategy use * Note: All equipment and vessels specified are reflective of the peak resources needed during concurrent drilling and production operations.			

Table 7: FPSO Sample List of Common Onboard Oil Spill Response Equipment*

FPSO	Detailed List	Quantity
Container # 1	25 m sections of RO Boom 1500 Offshore Boom with ASTM Connectors	2
	Ro Skim Weir Skimmer	1
	15 m Outrigger float arm 3 PARTS with connector BOAT	1
	DOP 250 Dual Screw Pump (Interchangeable with Terminator Skimmer)	1
	Hydraulic Hose Set 40 m	1
	Hose reel for 40 m Hose Set with Hydraulic Winch	1
	Hydraulic Winder for RO Boom Swwep System in 20,ISO Container	1
	Towing set for Ro Sweep System	1
	Repair Kit For Ro Boom 1500 and skimmer	1
	1 Box Plugs BOON and 3 Key	1
	Box PAD Absorbent	1
	Gloves	5
	Disposal coveralls	5
	Ropes	2
	Board	1
Container # 2	Ro Boom 1500with ASTM Conectors	200 m
	Towing set for Ro Boom 1500	1
	Winder Hydraulic for 200m Ro Boom 1500	1
	Powerpack 10kW for Hydraulic Winder with Onboard Boom, inflator, Spark Arrestor & Automatic Shutdown valve	1
	Hose set for 10kW Powerpack	1
	Repair kit for Ro Boom 1500	1
	Spares kit for 10kW Powerpack	1
	Box PAD Absorbent	1
	Gloves	5
	Disposal coveralls	5
	Ropes	2
	Board	1
	Terminator Self Adjusting Weir Skimmer Head with Radio Controlled Thrusters	2

FPSO	Detailed List	Quantity
Container # 3	Desmi Helix Brush Skimmer Adaptor for Terminator skimmer	1
	DOP 250Dual Screw Pump (Interchangeable with Ro Sweep system)	1
	Hose set 40m for Terminator with Thrusters	1
	Hose reel For 40m Hose Set for Terminator with Thrusters & Brush Skimmer Adaptor	1
	Spares kit for Terminator	1
	For use with Ro Sweep Hydraulic Winder, onboard Boom, Inflator for Ro Sweep, Operation of DOP 250 Dual Screw Pump with Ro Sweep & Terminator Skimmer	1
Container # 4	Spares kit for 50kW Powerpack	1
	Oil Spill Kit Box in Process Area: 5 pack plastic bags 200 L 2 Buckets, 4 pair of hand gloves, 4 packers, 2 disposal coveralls 2 CARTON BOXES OF LUBETECH ROLLS 2 BAGS OF HYDROCARBON ABSORBENT PAD OR ROLL PAD 10 OIL SPILL TAG + 2 rolls BARRIER TAPE	1
Container # 5	AFT Oil Spill Reserve Equipment: 3 Plastic Drums; 2 Boxes (Empty); 1 Box with 8 Chemical Absorbant Pads and Industrial Spillage Absorbent.	1
Container #6	10’ containerized system with 300m Hi-Sprint Boom, boom reel with integral power pack; air pack (for inflation)	1
Container #7	Vikoma Komara 50 (or equivalent) disk skimmer system (with lifting sling)	1
	GP 35 Diesel hydraulic power pack (with lifting sling and shackle)	1
	Rotary Lobe Transfer Pump	1
	Hose Kit	1
	Floating Recovered Oil Storage Tank (FROST) – $18m^{3;}$	2
	FROST Inflator / Deflator unit	1
	Vikospray 1000 (or equivalent) with Hose Kit	1
	55 Gallon Drums of Oil Dispersant	10

8.1 Tier I Resources

8.1.1 Mobilization

The EEPGL onsite ERT is responsible for mobilizing Tier I resources. In some cases, the onsite ERT may be contractor managed (e.g., Drillship).

The Tier I equipment held at EEPGL's onshore and offshore operations, including shorebases, fueling terminal, support vessels, drillships, tankers, and FPSOs will be available for rapid onsite deployment in the event of an incident. See site specific ERPs for onshore facilities and individual vessel SOPEPs.

8.2 Tier II Resources

Equipment and trained personnel are available through the Guyanese terminals and shorebases supporting EEPGL operations to initiate a response to a Tier II incident.

Vessel dispersant spray operations will be initiated from the PSVs and supported from the shorebases or other accessible locations as needed to supplement other Tier II response actions.

Given the type and quantity of hydrocarbons identified in the EIA impact analyses, the distance of the FPSOs and drill ships from the coastline, and the likelihood that oil from a marine oil spill offshore is unlikely to impact a shoreline in less than approximately 5-10 days; it is estimated that regional and international resources can be cascaded into a response in sufficient time to be effective. Therefore, in the event country/regional resources are insufficient, EEPGL would immediately activate additional resources such as ExxonMobil's RRT and OSRL (see Tier III Arrangements Section 2) early in an incident response operation.

In addition, EEPGL could call upon their in-country contracted companies to provide specific technical or logistical assistance (e.g., aircraft, road transportation, waste management, equipment providers, deployment assistance) for Tier II incidents, as well as Vessels of Opportunity located in Guyana and Trinidad, as needed.

EEPGL may also request Tier II assistance with the provision of equipment (e.g., boom, skimmers) and deployment assistance from the organizations/contractors supporting the Guyana national response plan, some of which have recently procured oil spill response equipment.

8.3 Tier III Resources

8.3.1 ExxonMobil's Regional Response Teams

The ExxonMobil RRT is comprised of two geographically-based units:

- Europe-Africa-Middle East / Asia-Pacific RRT; and
- Americas RRT.

The first point of contact for EEPGL is the Emergency Preparedness and Response Coordinator for Americas RRT, who can initiate activation following instructions from the EEPGL Country Manager. Although organized geographically, resources from all RRT units can be mobilized.

The RRT is organized in accordance with the Incident Command System (Figure 15). The organization is led and the incident managed by the Incident Commander and the Command Section, supported by Operations, Planning, Logistics and Finance Sections. The support sections are further sub-divided into branches and units depending on the scale and type of incident.

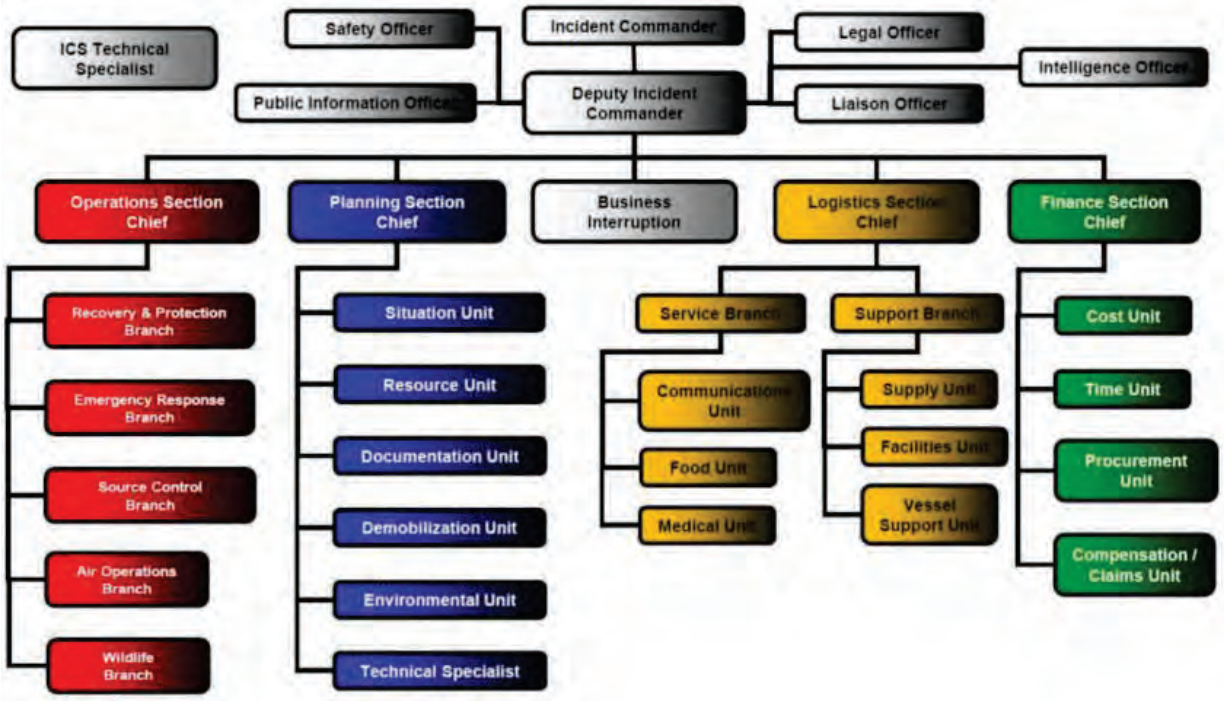

Figure 15: Sample Incident Command System Organization

The RRT includes trained individuals and specialists, with assigned roles and responsibilities, who can be deployed at short notice to address a broad range of emergency situations.

The RRT can be partially or fully activated. Partial activation may be implemented when functional support is required by ERTs at incident sites. Should this occur, RRT members will typically be deployed within the existing on-site ERT structure. For larger incidents, that require an extensive amount of tactical work, an intermediate group called the IMT may be established to provide tactical management support for the ERT. Additional company support can be called upon independent of RRT activation, if required.

For large emergencies and incidents in remote locations, full activation may be implemented. In Guyana, partial or full activation of the RRT is likely for all Tier II and Tier III incidents, to help manage a major tactical response. In the event that the RRT is activated, an RRT Command Center will be established by the Americas RRT.

8.3.2 Oil Spill Response Limited (OSRL)

EEPGL is a Participant member with OSRL, and therefore has immediate access to Tier III technical advice, resources, and expertise 365 days a year on a 24 hour basis. Table 8 summarizes the OSRL service level agreement (SLA) available to EEPGL.

Table 8: OSRL Service Level Agreement (SLA) Summary

Service	Service Standard			
Response notification, mobilization, service and advice	Notification of a spill should be placed to one of the following locations:			
	OSRL BASE	Fort Lauderdale, USA		
	TELEPHONE	+1 954 983 9880		
	FAX	+1 954 987 3001		
	EMAIL	dutymanagers@oilspillresponse.com		
	FORMS	Refer to Appendix D: OSRL Notification Form D.6		
	The Duty Manager will speak and advise EEPGL immediately, or call EEPGL back within 10 minutes.			
Nominated Contact	OSRL must receive an official mobilization authorization from one of EEPGL's Nominated Call-Out Authorities (anyone can notify OSRL).		EEPGL's Nominated Authority: Greg DeMarco Arthur Powers	
Spill response equipment	SLA response equipment is housed in secure facilities in Southampton, Fort Lauderdale, Bahrain, and Singapore. Response equipment is customs cleared response ready. Refer to: OSRL Yearbook for a complete list of equipment available, www.oilspillresponse.com and refer to the equipment stockpile status report http://www.oilspillresponse.com/activate-us/equipment-stockpile-status-report			
	As per the SLA, EEPGL can mobilize up to 50% of the global stockpile. If there is more than one spill EEPGL can mobilize 50% of what remains.			
Dispersant stockpile	If there was an incident, the spiller is entitled to 50% of the ~680m^3 of dispersant located in Southampton, Singapore, Fort Lauderdale, and Bahrain. OSRL may be able to obtain further dispersant through the Global Response Network (GRN) and other organizations, if required.			
World-wide transportation of equipment	Aircraft Type	Location	Dispersant Capacity	Range
	C-130 Hercules	Singapore, Seletar	13,000 liters	2,000 nm in 8 hours
	Boeing 727	UK, Doncaster	17,500 liters	2,400 nm in 6 hours
	Aerial dispersant coverage is provided within a six hour notice period. 24 hour access to global network of cargo and passenger charter services through a dedicated broker.			
Oil spill trajectory and tracking	Trajectory and stochastic services for surface or subsurface oil spills on request, and backtrack services for surface oil spills using commercial modeling software:			
	OILMAP		Oil Spill Contingency and Response Model (OSCAR)	
	Satellite imagery services can be provided on request.			
Response Personnel	OSRL will provide the following response personnel on a first come, first served basis: 1 x Senior oil spill response manager			

Service	Service Standard	EEPGL Membership Type: Participant
	1 x Oil spill response manager 15 x Spill response specialists / responders 1 x Logistics Service branch coordinators	
	A Technical Advisor can be dispatched to offer support to EEPGL when they have an oil spill incident or the potential for an incident to occur. This is provided free of charge for the initial assessment period of up to 48 hours. If a full response team is then mobilized, the technical advisor will form part of the available team headcount.	

8.3.3 Global Dispersant Stockpile (GDS)

The GDS is an additional 5,000 m³ of dispersant located across the OSRL bases (Table 8) and in France. The dispersant types are those with the largest worldwide approval. Copies of the Safety Data Sheets (SDS's) (Form D.2 in Appendix D) for all three of these products have been furnished as part of Appendix D.

Table 9: OSRL GDS Quantities and Locations

Dispersant	Quantity	Storage Location
Slickgone NS	350 m^3	Singapore
	500 m^3	Southampton, UK
	800 m^3	Saldanha, South Africa
Finasol OSR52	350 m^3	Singapore
	500 m^3	Southampton, UK
	1,500 m^3	Vatry, France
Corexit 9500	500 m^3	Rio de Janeiro, Brazil
	500 m^3	Fort Lauderdale, USA
Corexit 9527A	TBD	TBD

OSRL and EEPGL mobilization responsibilities depend on the location of the stockpile (16). For all GDS dispersant located in Southampton, Singapore, and Fort Lauderdale, normal SLA logistics and mobilization agreements apply. OSRL will mobilize the GDS alongside all other Tier III equipment.

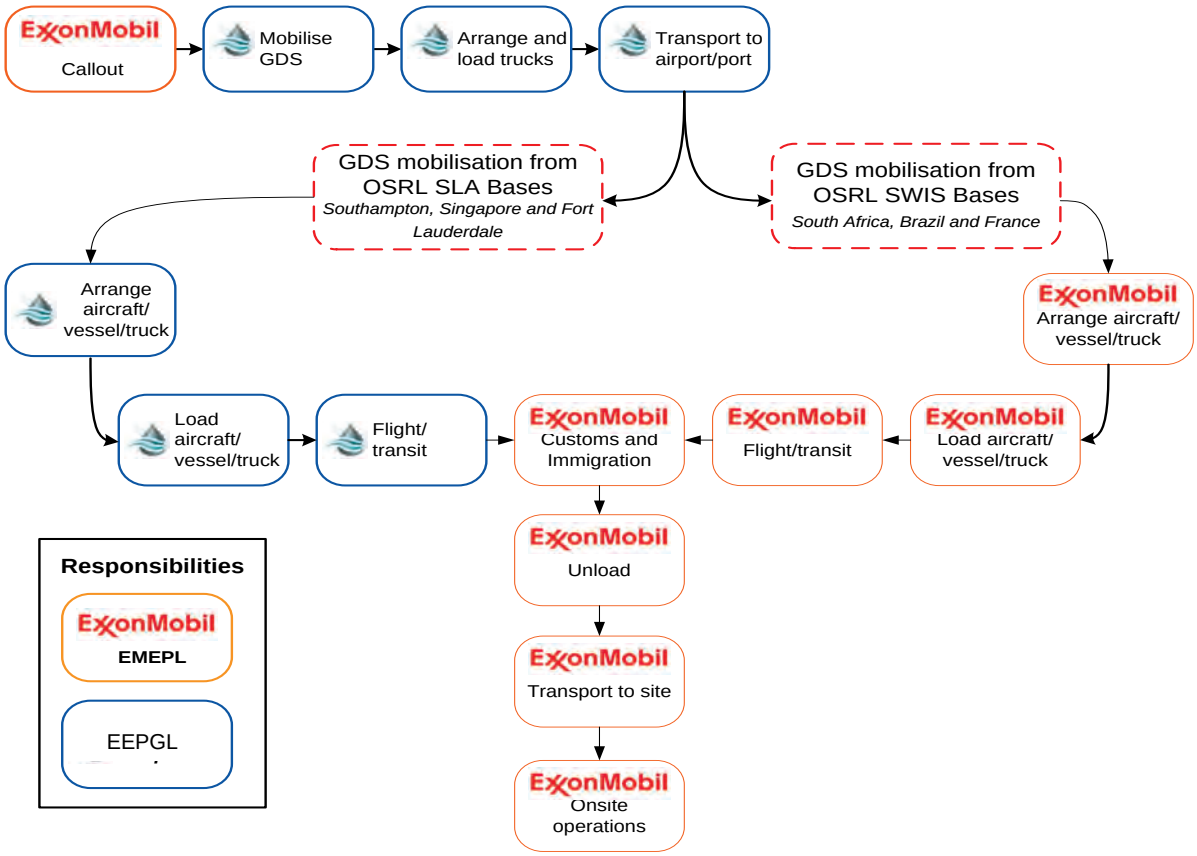

Figure 16: GDS Mobilization Responsibilities

EEPGL would mobilize the GDS through the OSRL Duty Manager. Unlike the SLA, EEPGL can mobilize 100% of the GDS for a single incident; 5,000 m³ has been estimated to support both a subsea and/or surface response for 30 days, which is consistent with data collected from the 2010 Macondo incident.

Arrival of Tier III equipment and the SLA dispersant is expected in Cheddi Jagan International Airport within 3 days of callout. The re-supply to EEPGL response operations will be arranged between EEPGL and the dispersant's manufacturer.

EEPGL will be responsible for designating the preferred port, arranging the airplane/vessel (in the case of a subsea well response), accepting the dispersant at the port, coordinating customs clearance, in-country logistics, and confirming the authorized use of dispersant for the specific incident application with the EPA. The OSRL Duty Manager will advise the operator of the logistical requirements of the GDS.

8.3.4 Subsea Well Response

EEPGL has access to the OSRL Subsea Well Intervention Service (SWIS), Oceaneering, Wild Well Control, Trendsetter Engineering, and Halliburton Boots & Coots Services.

The OSRL SWIS provides EEPGL with access to a Subsea Incident Response Toolkit (SIRT) and multiple subsea well Capping Stack Systems (CSS), as required. The CSS and SIRT include equipment that can be mobilized directly to the well site:

- Survey and debris clearance equipment;
- Intervention equipment;
- Dispersant hardware application system*; and
- Capping stack systems and auxiliary equipment.

*Dispersant must be mobilized simultaneously through the OSRL GDS service via EEPGL IMT.

SWIS holds and maintains four CSSs and two SIRTS globally:

- 15k PSI Subsea Well Capping Stack – Norway and Brazil;
- 10k PSI Subsea Well Capping Stack – South Africa and Singapore; and
- Subsea Incident Response Toolkit – Norway and Brazil.

In the event of activation, the capping stack providing the fastest response time would be mobilized to the operational area. Further details are outlined in the Drilling specific ERP.

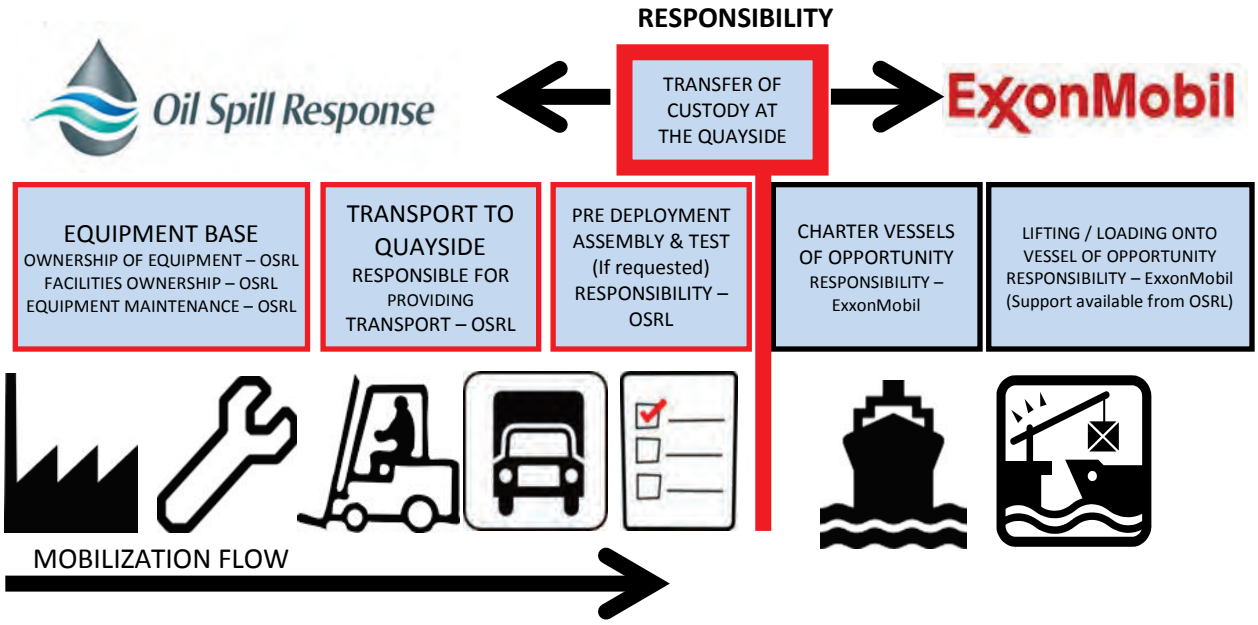

Figure 17: CSS Mobilization Responsibilities for OSRL and ExxonMobil

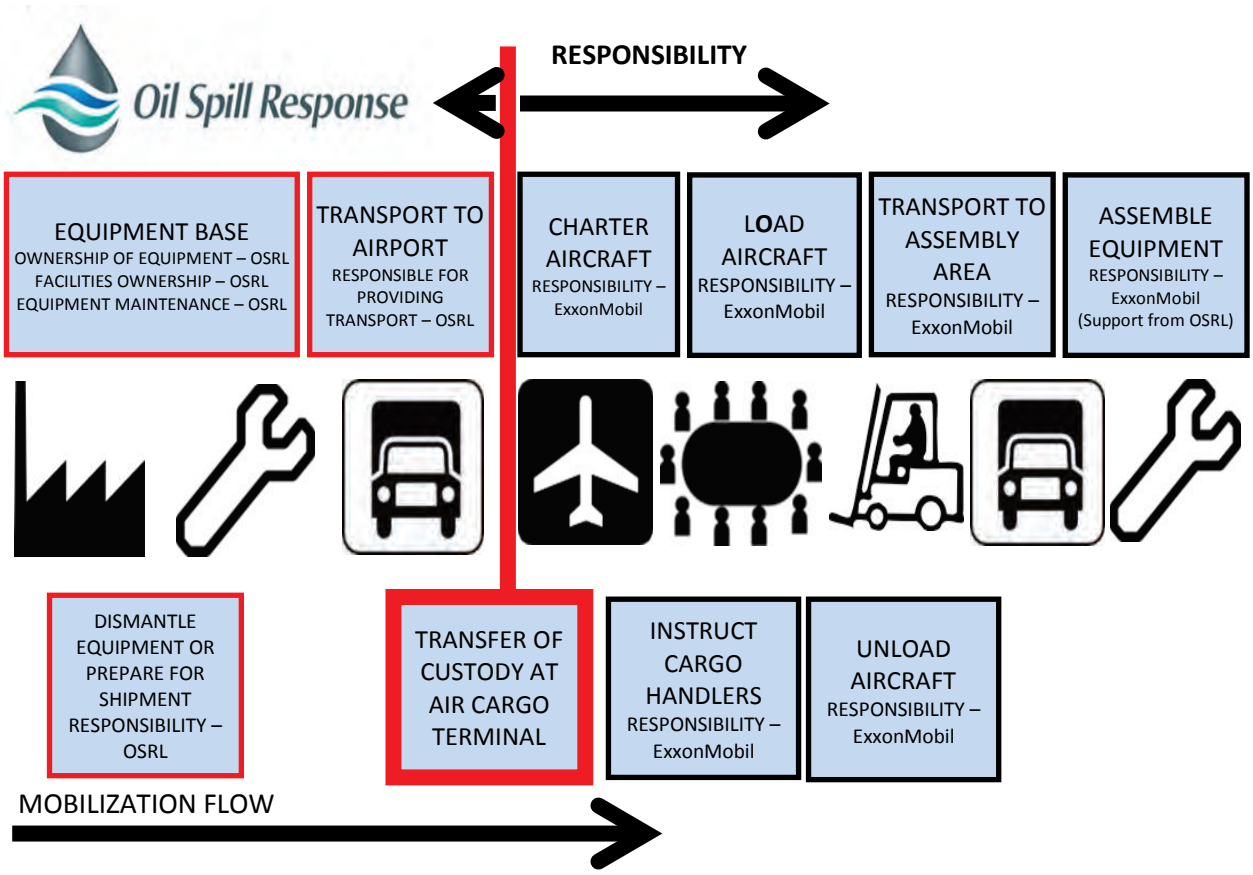

Figure 18: SIRT Mobilization Responsibilities for OSRL and ExxonMobil

In order to mobilize this equipment the following flow chart (Figure 19) should be considered.

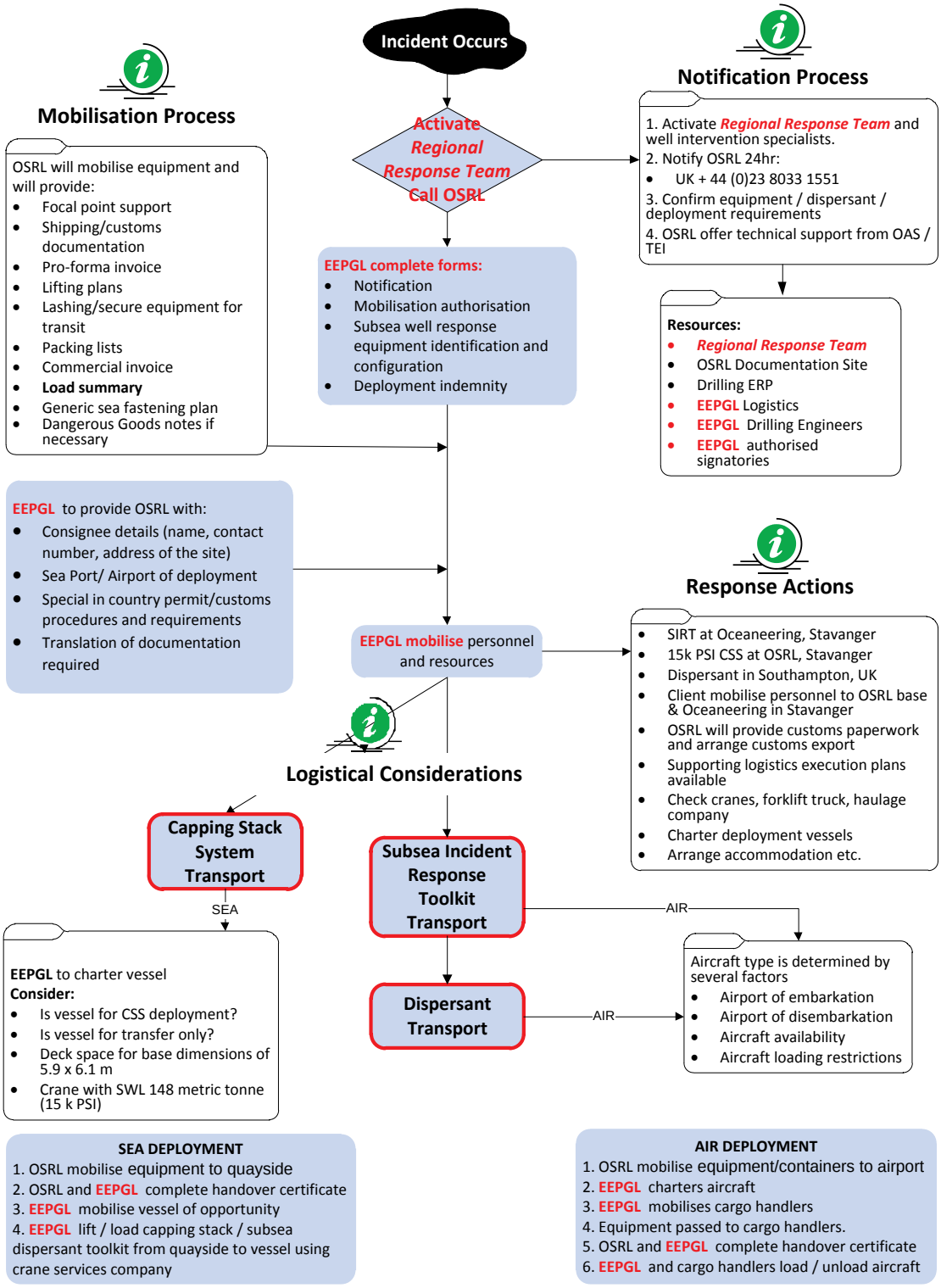

Figure 19: SWIS Mobilization

9 EXERCISES AND TRAINING

EEPGL conducts oil spill training courses and exercises (desktop and in-field) for its operations in Guyana. The training, drills, and exercises familiarize response personnel with their duties and responsibilities in an oil spill.

9.1 Oil Spill Training

Training requirements depend on an individual's role and experience. There is some overlap between the IMT and the ERT training. This is beneficial since, for example, this provides the IMT with a clear appreciation of the factors likely to affect the performance of a particular technique or piece of equipment, and at the same time gives the ERT a better understanding of the overall strategy.

EEPGL ERT and IMT members, which includes the Regional Response Team, will receive oil spill response training listed in Table 10 (or equivalent training such as XOM ICS 100/200 CBT and University of Spill Management) based on their response position.

Table 10: OSR Training Course Information

IMO Course Level	Oil Spill Incident Response Personnel	Course Outline
Level 1	ERT members	Provides training on practical aspects of oil properties, response techniques, health and safety, boom and skimmer deployment, dispersant application, use of sorbents, shoreline cleanup, debris/waste handling and disposal and wildlife casualties.
Level 2	On-Scene Commanders and ERT Leaders	Provides detailed training in oil spill behavior, fate and effects, spill assessment, operations planning, containment, protection and recovery, dispersant use, shoreline cleanup, site safety, storage and disposal of waste, media relations, record keeping, command and control management, communications and information, liability and compensation, response termination and post incident review/briefing.
Level 3	IMT members	Provides an overview of the roles and responsibilities of senior personnel in the management of oil spill incidents, cause and effect of oil spills, response policy and strategies, contingency planning, crisis management, public affairs and media relations, administration and finance and liability and compensation.

9.2 Incident Command System Training

ERT and IMT members will receive appropriate ICS Training listed in Table 11 based on their roles and responsibilities.

Table 11: ICS Training Course Information

ICS Course Level	Oil Spill Incident Response Personnel	Course Outline
100	Tactical Response Team Members	This course is a web based course aimed at introducing the ICS, basic terminology, common responsibilities, ICS principles and features. A foundation is set that will allow personnel to function appropriately in an ICS. Completing ICS 100 is prerequisite to completing ICS 200.
200		This course is also web based that builds on the foundation information from ICS 100. ICS 200 is required for first level supervisors involved in responding to the incident at the site, Site Response Team. Completing ICS 200 is prerequisite to completing higher level ICS training. Topics covered should include: principles and features, organizational overview, incident facilities, incident resources and common responsibilities.
300	On-Scene Commanders, ERT Leaders and IMT	This course provides description and detail of the ICS organization and operations in supervisory roles on expanding incidents. Topics covered should include: organization and staffing, resource management, Unified Command, transfer of Command, event and incident planning, air operations and establishing incident objectives.
400		This course is designed for more Senior personnel who are expected to perform in a management capacity in the Incident Command Team or IMT. Topics covered should include: General and Command staff, major incident management, multi-agency coordination and ICS for executives.

9.3 Oil Spill Exercises

Oil spill response exercises test incident response personnel function and responsibilities. They improve oil spill incident response teams skills and awareness, and provide management with an opportunity to assess equipment, measure performance, obtain feedback from participants, update and correct the contingency plans, and give a clear message about the company's commitment to oil spill prevention and response.

An exercise schedule is determined based upon local needs annually by the EEPGL OIMS/SSH&E Manager, which is approved by the EEPGL Country Manager. A suggested guideline including schedule and type of oil spill exercise is outlined in Table 12.

Table 12: Oil Spill Exercise Overview and Schedule

Exercise Type	Description and Purpose	Frequency
OSRP Orientation	A contingency plan orientation exercise is a workshop which focuses on familiarizing the ERT and IMT with their roles, procedures and responsibilities in an oil spill. The aim is to review each section of the plan, encourage discussion, and by using local knowledge and expertise, make useful and practical improvements to the plan where required.	As required or directed
Notification and Callout Exercise	A notification exercise practices the procedures to alert and call out the ERT and IMT. They are normally conducted over the telephone or radio, depending on the source of initial oil spill report. They test communications systems, the availability of personnel, travel options and the ability to transmit information quickly and accurately. This type of exercise will typically last 1-2 hours and can be held at any time of the day or night.	Quarterly
Practical Oil Spill Equipment Deployment Exercise	Simple deployment exercises give personnel a chance to become familiar with equipment, or they may be a part of a detailed emergency response scenario, where maps, messages, real-time weather and other factors are included. The exercise is designed to test or evaluate the capability of equipment, personnel, or functional teams within the oil spill response. In deployment exercises, the level of difficulty can be varied by increasing the pace of the simulation or by increasing the complexity of the decision-making and coordination needs. A deployment exercise would typically last from 4-8 hours.	Semi-annually
IMT Tabletop Exercise	A tabletop exercise uses a simulated oil spill to test teamwork, decision-making and procedures. The exercise needs to be properly planned with a realistic scenario, clearly defined objectives for participants, exercise inputs, and a well briefed team in control of the running and debriefing of the exercise. A tabletop exercise will typically last from 2-8 hours.	Annually
Full-scale Incident Management Exercises	Full-scale exercises provide a realistic simulation by combining all of the elements of the tabletop exercise (maps, communications, etc.) and the deployment of related personnel and equipment. This complexity requires the response to be more coordinated than in basic tabletop or deployment exercises. The effort and expense in organizing a realistic full scale exercise means that it is recommended that they be run only once every two years or so. It may also be cost effective to run full-scale exercises in partnership with other organizations within the region and the ESG. Full-scale exercises can create a very intense learning environment that tests cooperation, communications, decision making, resource allocation and documentation. People involved in full-scale incident management exercises should have attended earlier tabletop exercises. Organizing a realistic full-scale exercise could take many months, requires an experienced planner and a large support team to run the exercise. The full scale exercise will generally last at least one day and often carry on overnight into a second or third day.	Every 3 Years during Production Operations
Joint Exercises (e.g., with other	Joint exercises provide a realistic simulation by combining the full scale oil spill response equipment deployment and tabletop incident management to handle a major spill scenario.	Every 3 Years during

Exercise Type	Description and Purpose	Frequency
Operators or Regulators)	The spill scenario involves major consequences to a very wide range of resources, threatening national interests and requiring national and regional cooperation and coordination. Joint exercise involves very wide range of personnel from many different organizations, possibly in various locations, together with a range of equipment deployment opportunity. This exercise is designed to build confidence in EEPGL's preparedness to effectively and efficiently deal with oil spills at all scales. This will also enhance the cooperation among the government and industry at national and regional level in responding to major and/or trans-boundary spills. A joint exercise will generally last at least one day and often carry on overnight into a second or third day.	Production Operations

APPENDIX A – LIZA PHASE 2 MODELING RESULTS

A.1 Modeling Overview

Oil spill modeling was performed for five hypothetical oil spill scenarios, ranging from higher probability small volume operational releases at the water surface to the unlikely large volume spill related to production or drilling operations originating either at the sea surface or from a subsea release at the seabed. These ranged as noted in Table 5 from smaller Tier I incidents of a single release of 50 bbls of marine diesel or crude oil to a loss of well control event resulting in 20,000 bbls of wellbore fluids being released for a maximum duration of 30-days. In these scenarios, the oil spill modeling was performed to determine the most likely trajectory from each scenario and to quantify the oil's fate as it interacts with the environment.

The oil spill modeling was performed in several steps. The first step was to utilize the historic data and perform stochastic modeling. In this type of modeling, the spill location and volume are utilized to determine how the spill would respond under actual historic wind and hydrodynamic (currents) conditions. The modeling tool selects about 100-200 random start times during the season of interest and utilizes the paired met ocean data to examine the fate and trajectory of each of the model runs. The combined output for a single stochastic analysis is presented in Figure A1.

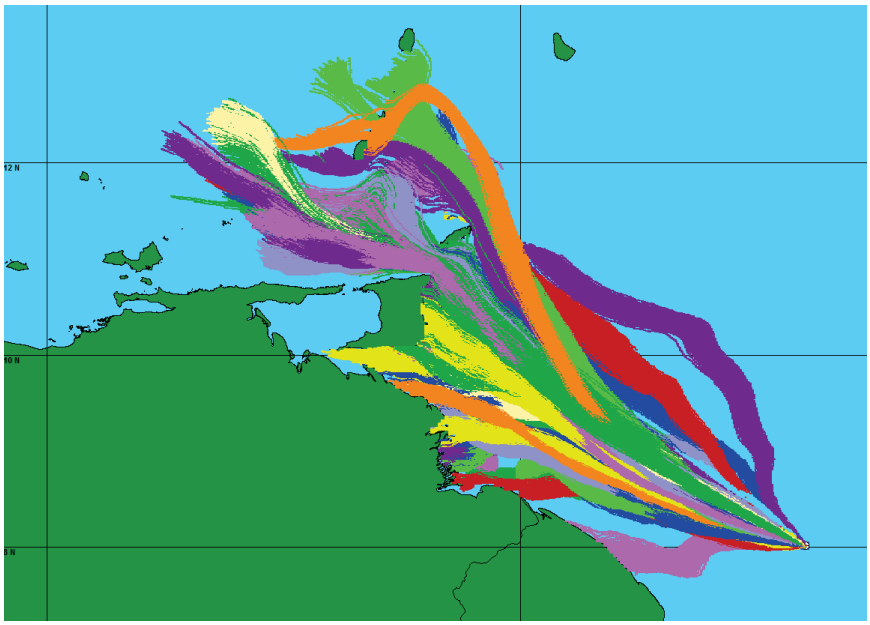

Figure A1: Example Model Iterations that are Utilized to Produce Stochastic Outputs

The results of this phase of the analysis are then post-processed to determine the following:

- The probability of oil on the water surface;
- The probability of oil on the shoreline; and
- The timing of oil to destination.

These three key factors are the primary inputs required for oil spill response. They provide an understanding of the probability that oil will be in a particular location from a release. The information also provides a sense for time to travel, so if a particular resource has a high probability of being impacted, the timing of impact is available so that a response can be mounted to that spill at the water surface and/or to provide timing for resource protection prior to the oil's arrival.

The individual data from the stochastic analysis in then reviewed once again to select a particular single, deterministic model run for further analysis. That model run can be selected based upon a variety of properties:

- Shortest time to shoreline impact;
- Largest swath over the water surface; and
- Greatest shoreline impact.

In the Phase 2 analyses, the greatest shoreline impact was selected as the parameter of interest for additional examination when shorelines were at risk from the release. This trajectory and fate were utilized for further examination in the second phase of the analysis. The trajectory and fate results were used to predict and determine spill pathways and quantify potential ecological and socioeconomic impacts from such events for both the summer season (June through November), as well as the more conservative winter season (December through May) when current speeds and Easterly winds are stronger.

Initial modeling results were run to show the ***unmitigated*** impacts not taking into account the immediate actions and sustained response and mitigation measures that would be employed in the event of a spill or release. This is done to examine the probability of the shoreline stranding and predict the timing of that stranding. A representative list of the spill prevention, mitigation measures, and embedded controls found in the EIAs of the FPSO Development Projects (Phase 1 and 2) can be found in Appendix G.

A Net Environmental Benefit Analysis (NEBA) for the Guyana Tier II and Tier III oil spill scenarios utilized additional model runs based on the implementation of those response strategies and mitigation measures set forth in this OSRP. The additional deterministic modeling results were prepared and have been provided in Appendix H along with a comparison of spill parameters. The comparison tables provide a quick mechanism to understand the environmental benefits of the mitigation that was undertaken.

Fate and Trajectory

Fate (weathering) and trajectory (movement) models were used to simulate oil transport and predict the changes the oil undergoes as it interacts with water, air, and land (oil fate). The models were used to simulate spill events using the best available characterization of the wind and hydrodynamic (marine currents) forces that drive oil transport. The models quantify the potential consequences from a spill, which can then be used to guide response planning and prioritize response asset deployment. There are typically two modes under which the models can be used: 1) the **stochastic** (statistical) mode that examines *many releases* from the same point utilizing historical data for wind and currents; and, 2) the **deterministic** mode that examines a *single release* utilizing a subset of historic wind and hydrodynamic data from the range of potential data,

or utilizing forecast data for an ongoing or future event. The coastal sensitivity maps that were used to identify and characterize the resources/receptors with the potential to be impacted by a spill based on the modeling results have been provided in the EIA for the Liza Phase 2 Development Project.

Metocean Conditions

Currents in the upper water column off the Guyana coast are strong and flow towards the northwest along the coast of South America over the entire year. The Guiana Current is part of the regional flow between South America, Africa and the Caribbean Sea, extending from Guyana to the Caribbean.

In the time since the earlier oil spill modeling study (Appendix B Liza Phase 1 Oil Spill Modeling Results), for which the historic data sets of wind and currents were developed, ExxonMobil has deployed and maintained a series of deep water current profile moorings and a meteorological station buoys in the Stabroek Block, offshore of Guyana (RPS 2016; RPS 2017a, b, c). Processed final data sets of the observations were available for first four mooring and buoy deployments spanning March 2016 through September 2017. There were five moorings deployed originally, four of which were instrumented.

Wind observations from the met station were compared to the NAVGEM model prediction and current observations were compared to the HYCOM model predictions previously utilized in modeling analyses. The field program had not yet started in 2015, which is the final year of the original 10-year model prediction data set provided by SAT-OCEAN; thus, an additional time period, corresponding to the mooring deployment period, of NAVGEM and HYCOM predictions was obtained for the direct comparison of the model predictions to the observations. As a correlation step, the NAVGEM predictions from the 2016-2017 field program period were compared to the 2006-2015 data set, and similarly HYCOM predictions from 2016-2017 were compared to the observation while HYCOM Reanalysis from 2005-2010 was compared with the SAT-OCEAN 2006-2015 data set.

The objective of the model to observations comparison was to assess whether the models are capable of capturing the important characteristics of the wind forcing (speed and direction frequency distribution) and the current speeds and circulation patterns (primarily the higher currents associated with the fluctuation of the Guyana current or the passage of NBC rings). An analysis of the previously used historic data and the measured data determined that the data were similar enough that utilization of the existing historical wind and current data utilized for Liza Phase 1 was appropriate for the Liza Phase 2 spill modeling presented here.

A.1.1 Oil Spill Model Scenarios

A series of stochastic and deterministic model simulations were run to determine the fate of the oil released for three different products for five different scenarios at the offshore location during two different seasons. Table A1 lists the scenarios that were modeled.

Blowout scenarios consist of 30 days of oil and gas discharge at the wellhead. The blowouts were simulated using the OILMAP Deep blowout model to determine the discharge plume geometry, define the oil droplet sizes and provide inputs for the SIMAP model simulations. All blowout simulations were run for the 30-day discharge period plus an additional 15 days after oil discharge ceased.

Table A1: Oil Spill Scenarios Defined for the Oil Spill Modeling

Release Volume	Released Product	Season
50 bbl	Marine Diesel	Summer
50 bbl	Marine Diesel	Winter
250 bbl	Marine Diesel	Summer
250 bbl	Marine Diesel	Winter
50 bbl	Crude Oil	Summer
50 bbl	Crude Oil	Winter
2,500 bbl	Crude Oil	Summer
2,500 bbl	Crude Oil	Winter
20,000 bbls	Wellbore Fluids	Summer
20,000 bbls	Wellbore Fluids	Winter

A.1.2 Exposure Thresholds

Minimum oil thickness thresholds are used in the SIMAP model in the determination of the probability of oil contamination. The thresholds are specific to the type of impact being considered, either ecological or socio-economic, and they are used in the calculation of oiling probability to determine if oil is present in a quantity sufficient to cause a particular impact.

Floating oil thickness is of interest because it can determine if mechanical recovery is possible and because different surface slick thicknesses will have different effects on waterfowl and other animals at the sea surface. Surface oil is often expressed in units of g/m^2, where 1 g/m^2 corresponds to an oil layer that is approximately 1 micron (µm) thick. Table A2 lists approximate thickness and mass per unit area ranges for surface oil of varying appearance. Dull brown sheens are about 1 µm thick. Rainbow sheen is about 0.2-0.8 g/m^2 (0.2-0.8 µm thick) and silver sheens are 0.05-0.2 g/m^2 (0.05-0.2 µm thick; NRC, 1985). Crude and heavy fuel oil that is greater than 1 mm thick appears as black oil. Light fuels and diesel that are greater than 1 mm thick are not black in appearance, but appear brown or reddish. Floating oil will not always have these appearances, however, as weathered oil would be in the form of scattered floating tar balls and tar mats where currents converge.

A typical approach to using oil spill models in OSRP is to first apply the stochastic model to determine the probability and timing for the spill scenarios of interest. The stochastic approach captures variability in the trajectories by simulating hundreds of individual spills and generating a map that is a *composite* of all of the trajectories and provides a *probability footprint* showing the most likely path for a given spill scenario. Spill scenarios are typically modeled in stochastic mode to provide composite footprints to estimate probability and timing for each season or wind regimes in the region.

Table A2: Oil Thickness (µm) and Equivalent Mass (g/m^2) and Appearance on Water (NRC, 1985)

Minimum	Maximum	Appearance
0.05	0.2	Colorless and silver sheen
0.2	0.8	Rainbow sheen
1	4	Dull brown sheen
10	100	Dark brown sheen
1,000	10,000	Black oil

The SIMAP model uses specific oil thickness thresholds for calculating the probability or likelihood of the presence of oil on the sea surface or shoreline. Oil thickness thresholds defining the minimum value for expected potential effects to the sea surface and shoreline are listed in Table A3. Socio-economic thresholds were used in all modeling for this project (1 µm for surface oiling and 1 µm for shoreline oiling). All predictions of the probability of shoreline oiling and sea surface contamination are based on these oil thickness thresholds.

Table A3: Oil Thickness Thresholds for Sea Surface and Shoreline Oiling

Threshold Type	Threshold (Mass/Unit Area)	Threshold (Thickness)	Rationale (Socio-economic, Ecological)
Oil on Water Surface	1.0 g/m^2	1.0 µm, 0.001 mm	A conservative ecological threshold for consideration of sublethal effects on birds, marine mammals, and sea turtles from floating oil.
Oil on Shoreline	1.0 g/m^2	1.0 µm, 0.001 mm	A conservative socioeconomic/ response threshold. This is a threshold for potential effects on socio-economic resource uses, as this amount of oil may trigger the need for shoreline cleanup on amenity beaches, and affect shoreline recreation and tourism.

A.2 Model Input Data

A.2.1 Oil Properties

The physical and chemical properties of the oil are used by the OILMAP Deep and SIMAP models in calculations of the transport and fate of the spill. The oil used in the models is light crude that can incorporate water when spilled, which can increase both the volume and viscosity. Assessment of this type of oil indicated that while it can take on water, it will not emulsify quickly as some heavier crude oils .This will serve to keep the oil relatively non-viscous for many hours depending on spill and environmental conditions, which improves the window of opportunity for oil spill response. The oil characterization utilized in this modeling study were determined from a chemical analysis of the oil collected in the field. Table A4 lists some of the properties of the oil used in the model simulations. It should be noted that the oil used in Liza Phase 2 modeling was slightly different than the oil used in Liza Phase 1 based on the characteristics of oil samples. This is reflected in some of the modeling results when compared side-by-side.

Table A4: Properties of the Lisa 4 Crude Oil Used in the Spill Modeling

Density (g/cm^3 @25°C)	Viscosity (cP@25°C)	API Gravity	Pour Point (°C)	Maximum Water Content (%)
0.8521	11.4	34.6	1.6	70

A.3 Stochastic Model Results – Unmitigated

The stochastic modeling results predicted that surface oil from an unmitigated spill would generally travel towards the northwest in all scenarios during both the summer and winter seasons. The probability of any shoreline oiling is generally low, with the smaller volume spills very unlikely to reach the shoreline, the oil spill model indicates that even in the unlikely event of a larger volume spill, there is only a 10 to 20 percent chance of shoreline oiling in Guyana. In the case of such a loss of well control, it is predicated that it would take 5 to 15 days for oil to reach shore in the absence of any spill response.

Not all of the individual unmitigated spill events are predicted to result in oil stranding in excess of the 1 µm thickness threshold with the highest risk to the shoreline of Trinidad and Tobago due to the predominant current flow through the Stabroek Block and into the Caribbean. The probability of oil exposure on the sea surface remains greater than 90% from the discharge site to the coast of Trinidad and Tobago and into the Caribbean Sea for a very large spill. It should be kept in mind that the probabilities are calculated using a minimum oil thickness of 1.0 µm which appears on the sea surface as dull brown sheen. The sea surface area oiled for individual very large spill events ranked as the 95th percentile ranges from 8717 to 613,218 km^2. None of the marine diesel spills are predicted to reach the shoreline. One wellbore fluid scenario predicted to reach the Guyana shore, exhibiting oiling of approximately 125 km at a thickness of 1 micron.

A.3.1 Marine Diesel Summer (June through November)

A.3.1.1 Water Surface Results – 50 Barrel Scenario (Unmitigated)

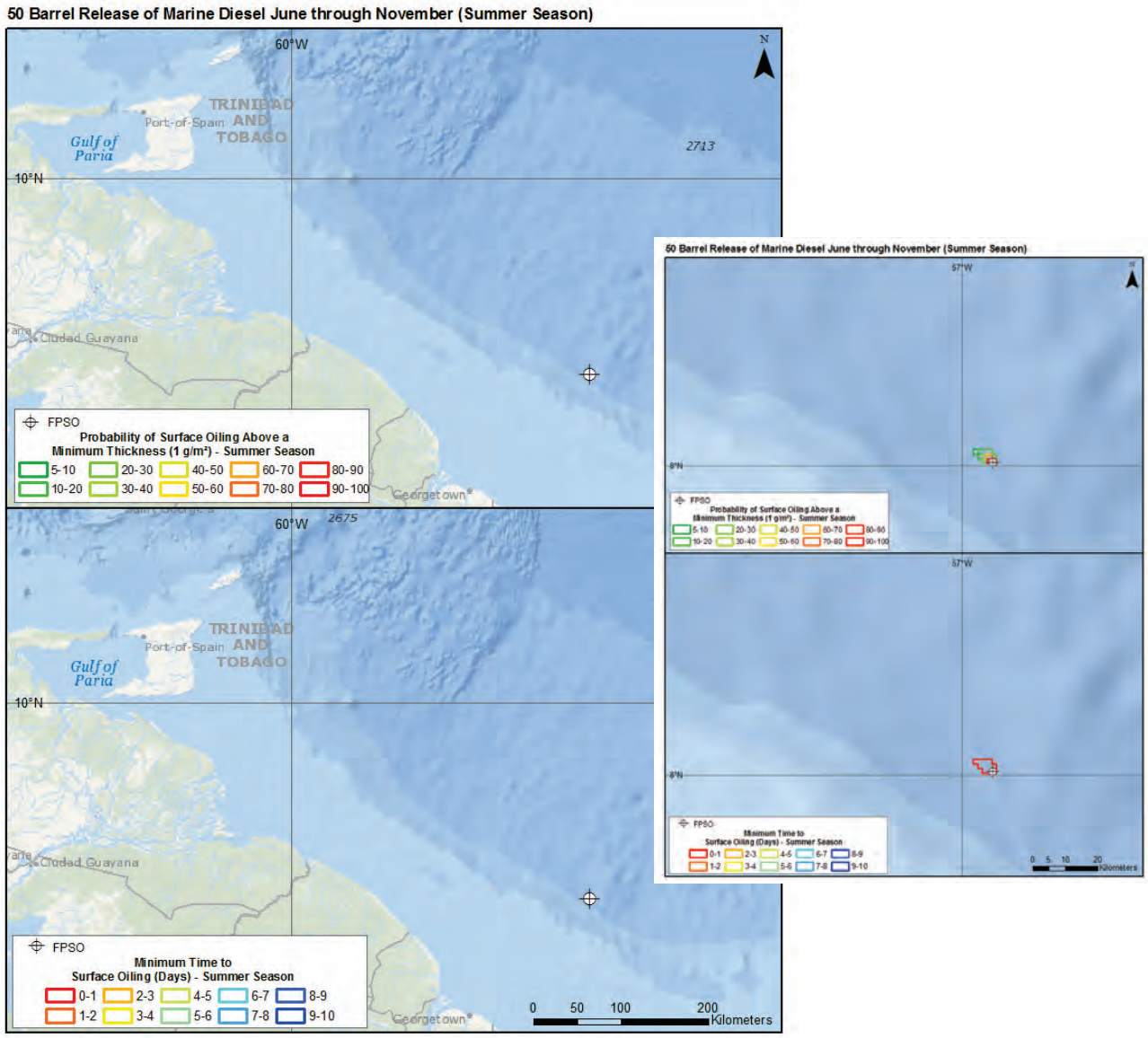

Figure A2: Top Panel – Probability of surface oiling above a minimum thickness of 1 µm from June through November for a 50 barrel release of Marine Diesel. Bottom Panel – Minimum time for surface oil thickness to exceed 1 µm. Inset Panel – Detail.

A.3.1.2 Water Surface Results – 250 Barrel Scenario (Unmitigated)

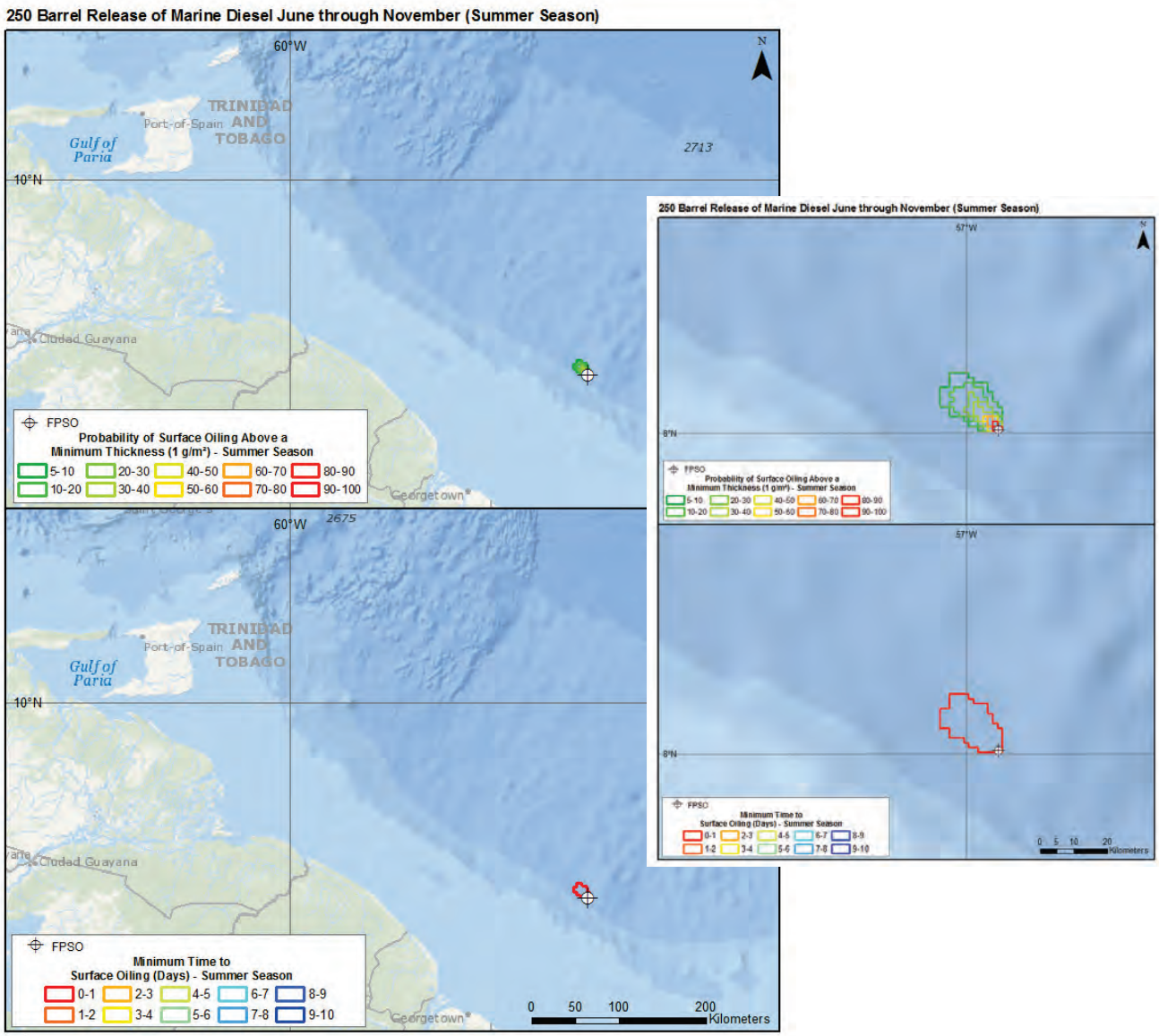

Figure A3: Top Panel – Probability of surface oiling above a minimum thickness of 1 µm from June through November for a 250 barrel release of Marine Diesel. Bottom Panel – Minimum time for surface oil thickness to exceed 1 µm. Inset Panel – Detail.

A.3.2 Marine Diesel Winter (December through May)

A.3.2.1 Water Surface Results – 50 Barrel Scenario (Unmitigated)

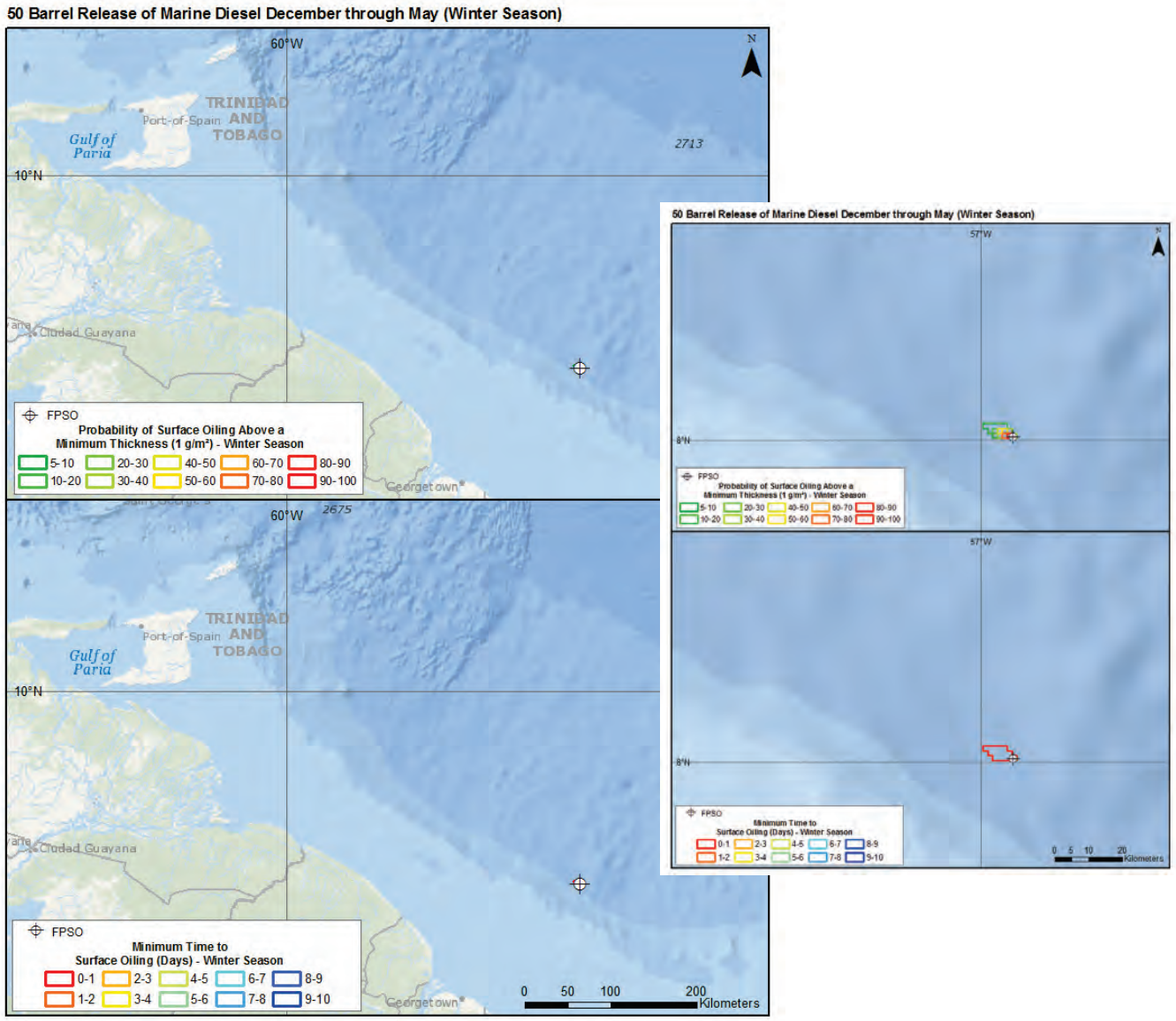

Figure A4: Top Panel – Probability of surface oiling above a minimum thickness of 1 µm from December through May for a 50 barrel release of Marine Diesel. Bottom Panel – Minimum time for surface oil thickness to exceed 1 µm. Inset Panel – Detail.

A.3.2.2 Water Surface Results – 250 Barrel Scenario (Unmitigated)

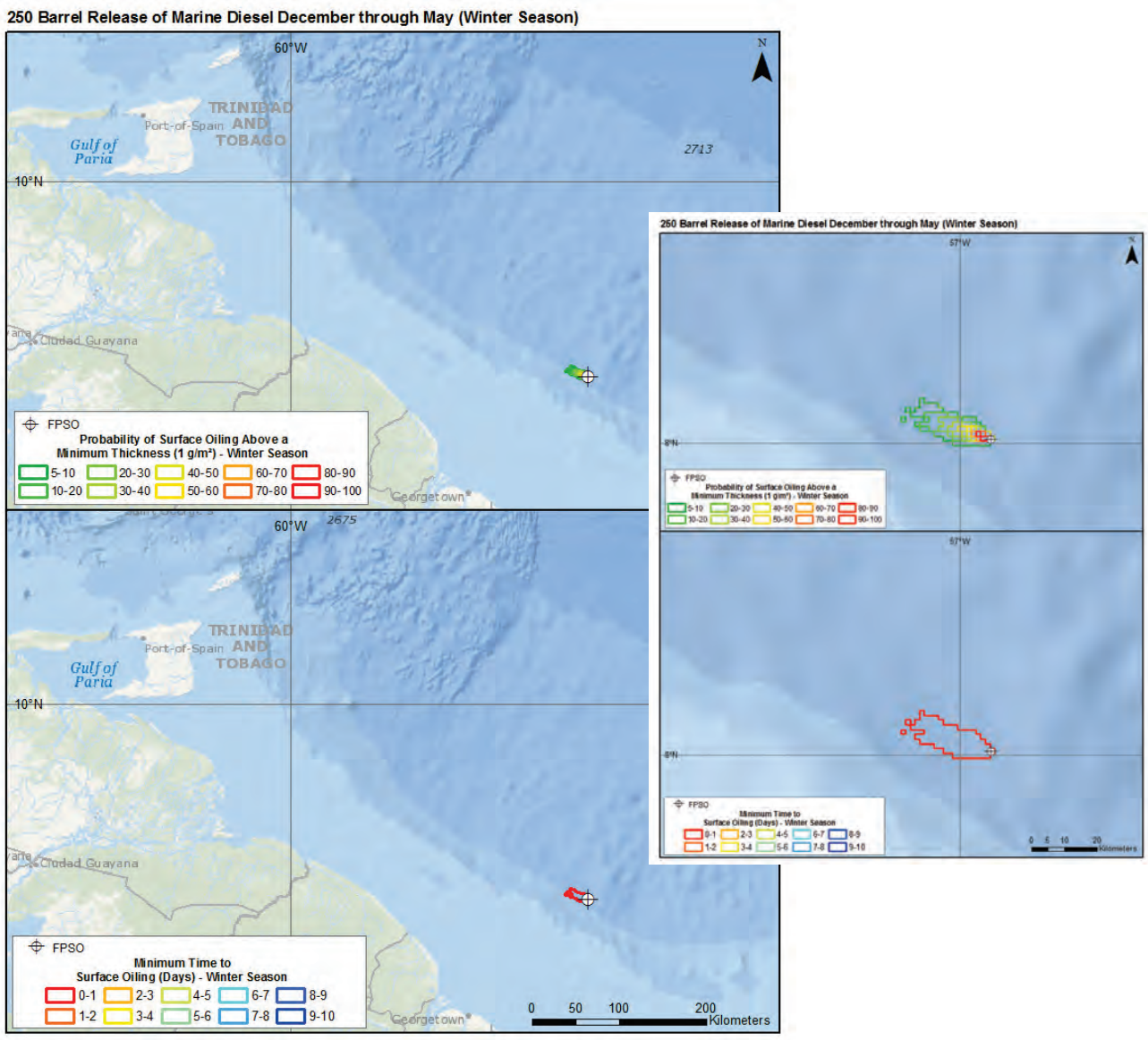

Figure A5: Top Panel – Probability of surface oiling above a minimum thickness of 1 µm from December through May for a 250 barrel release of Marine Diesel. Bottom Panel – Minimum time for surface oil thickness to exceed 1 µm. Inset Panel – Detail.

A.3.3 Crude Oil Summer (June through November)

A.3.3.1 Water Surface Results – 50 Barrel Scenario (Unmitigated)

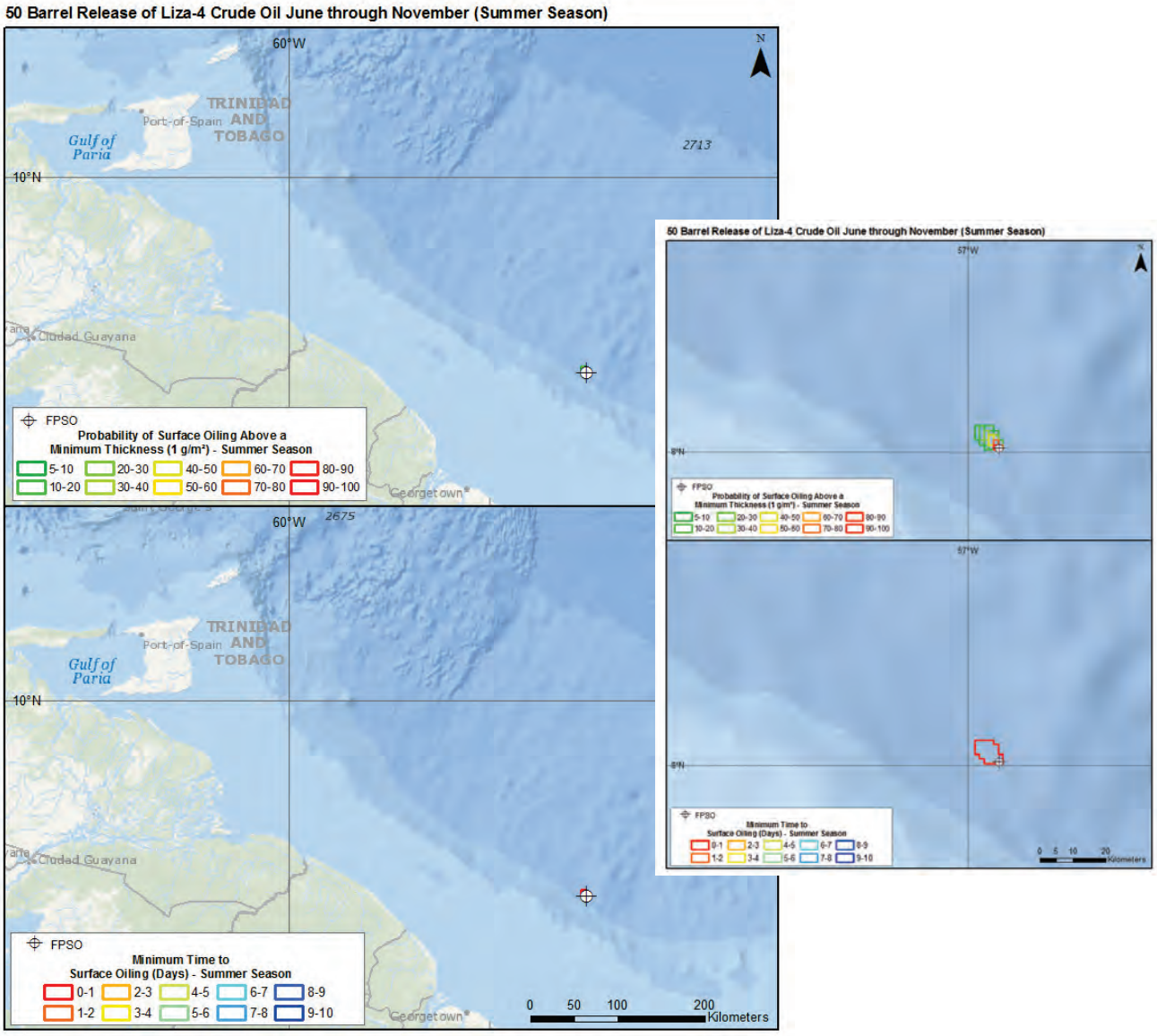

Figure A6: Top Panel – Probability of surface oiling above a minimum thickness of 1 µm from June through November for a 50 barrel release of Crude oil. Bottom Panel – Minimum time for surface oil thickness to exceed 1 µm. Inset Panel – Detail.

A.3.3.2 Water Surface Results – 2,500 Barrel Scenario (Unmitigated)

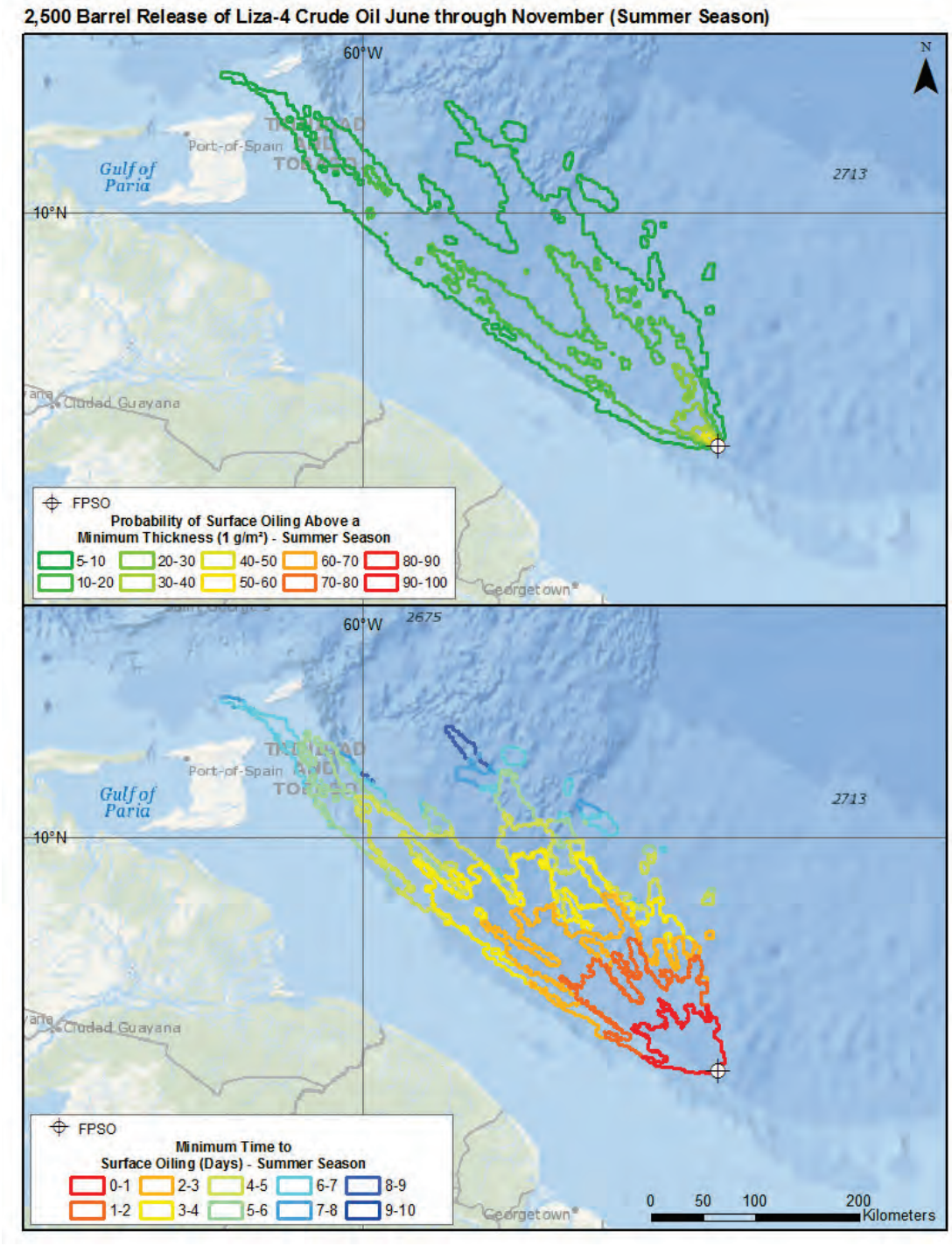

Figure A7: Top Panel – Probability of surface oiling above a minimum thickness of 1 µm from June through November for a 2,500 barrel release of Crude oil. Bottom Panel – Minimum time for surface oil thickness to exceed 1 µm.

A.3.4 Crude Oil Winter (December through May)

A.3.4.1 Water Surface Results – 50 Barrel Scenario (Unmitigated)

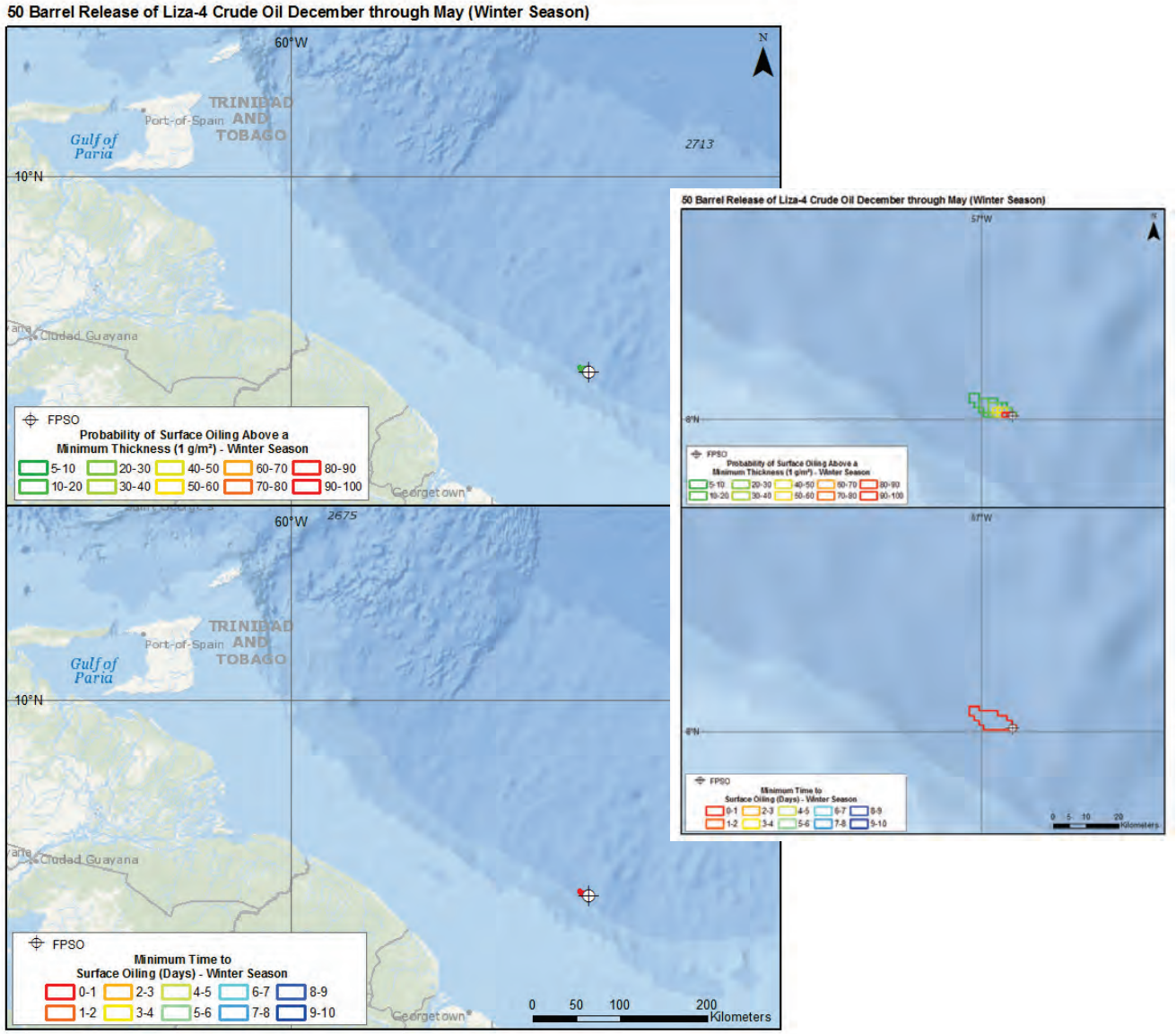

Figure A8: Top Panel – Probability of surface oiling above a minimum thickness of 1 µm from December through May for a 50 barrel release of Crude oil. Bottom Panel – Minimum time for surface oil thickness to exceed 1 µm. Inset Panel – Detail.

A.3.4.2 Water Surface Results – 2,500 Barrel Scenario (Unmitigated)

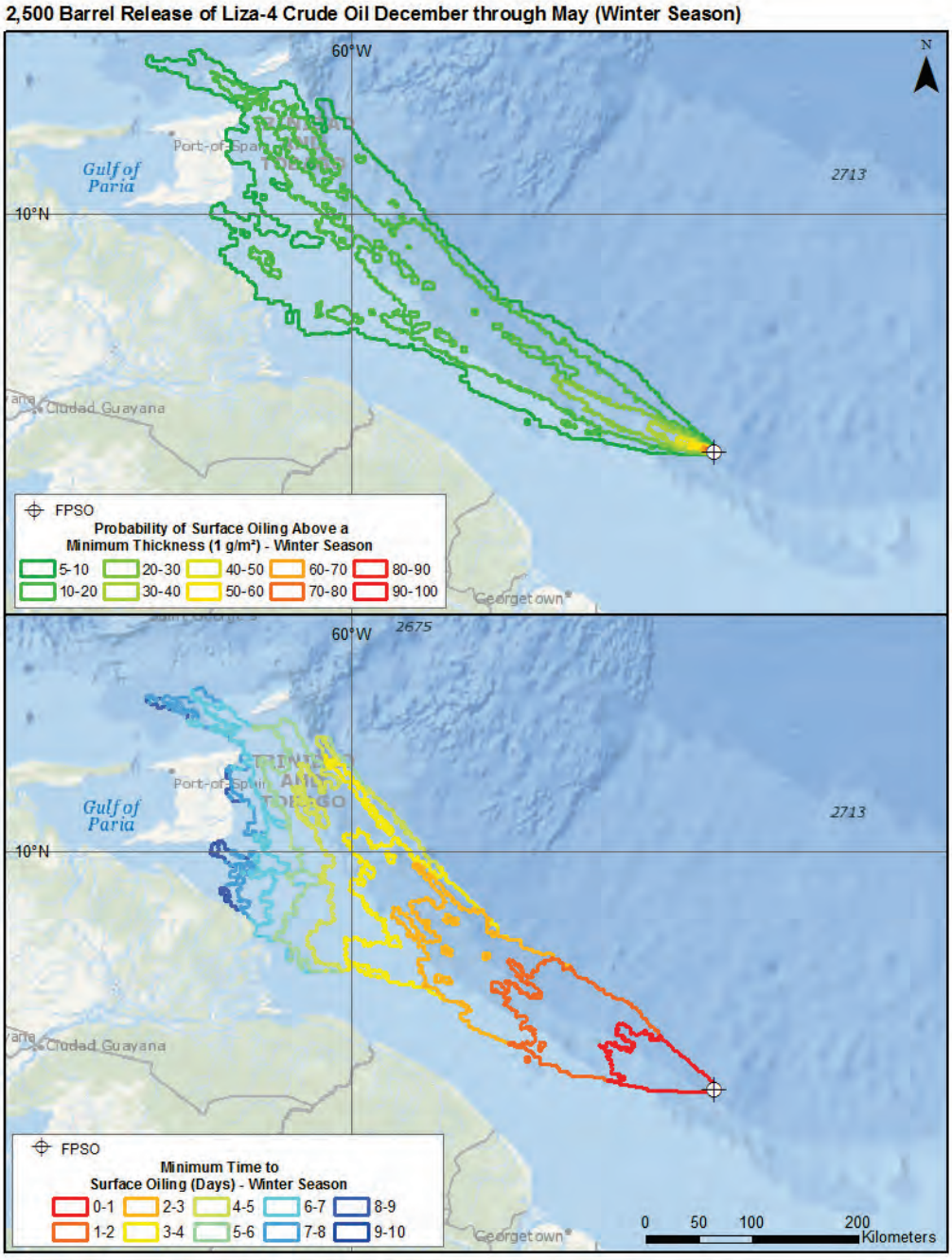

Figure A9: Top Panel – Probability of surface oiling above a minimum thickness of 1 µm from December through May for a 2,500 barrel release of Crude oil. Bottom Panel – Minimum time for surface oil thickness to exceed 1 µm.

A.3.4.3 Water Surface Results – 2,500 Barrel Scenario (Unmitigated)

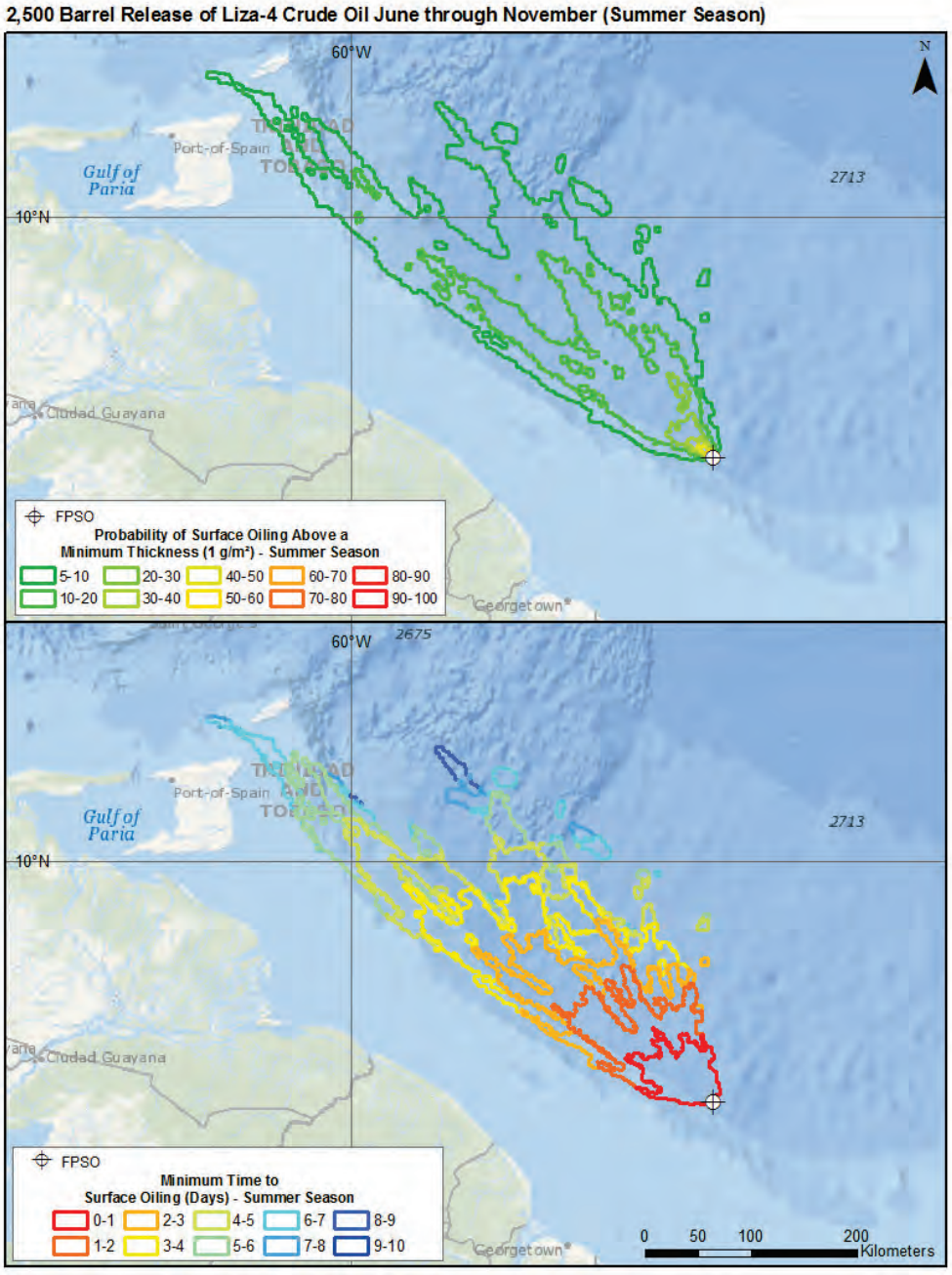

Figure A10: Top Panel – Probability of surface oiling above a minimum thickness of 1 µm from June through November for a 2,500 barrel release of Crude oil. Bottom Panel – Minimum time for surface oil thickness to exceed 1 µm.

A.3.5 Wellbore Fluids Summer (June through November)

A.3.5.1 Water Surface Results – 20,000 Barrel per Day Scenario for 30 days (Unmitigated)

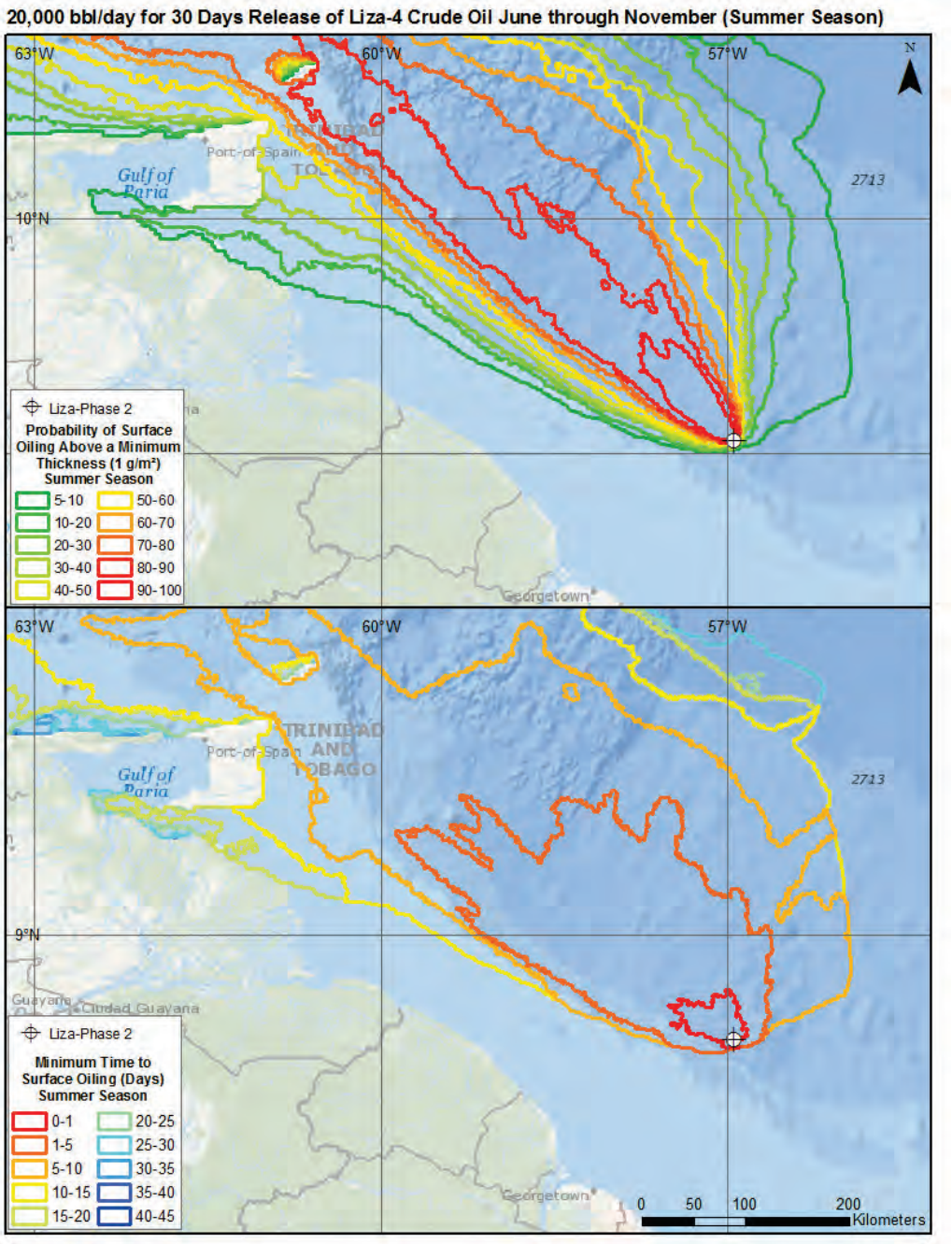

Figure A11: Top Panel – Probability of shoreline oiling above a minimum thickness of 1 µm for months June through November for a 20,000 barrel a day release of Crude oil for 30 days. Bottom Panel – Minimum time for shoreline oil thickness to exceed 1 µm.

A.3.6 Wellbore Fluids Winter (December through May)

A.3.6.1 Water Surface Results – 20,000 Barrel per Day Scenario for 30 days (Unmitigated)

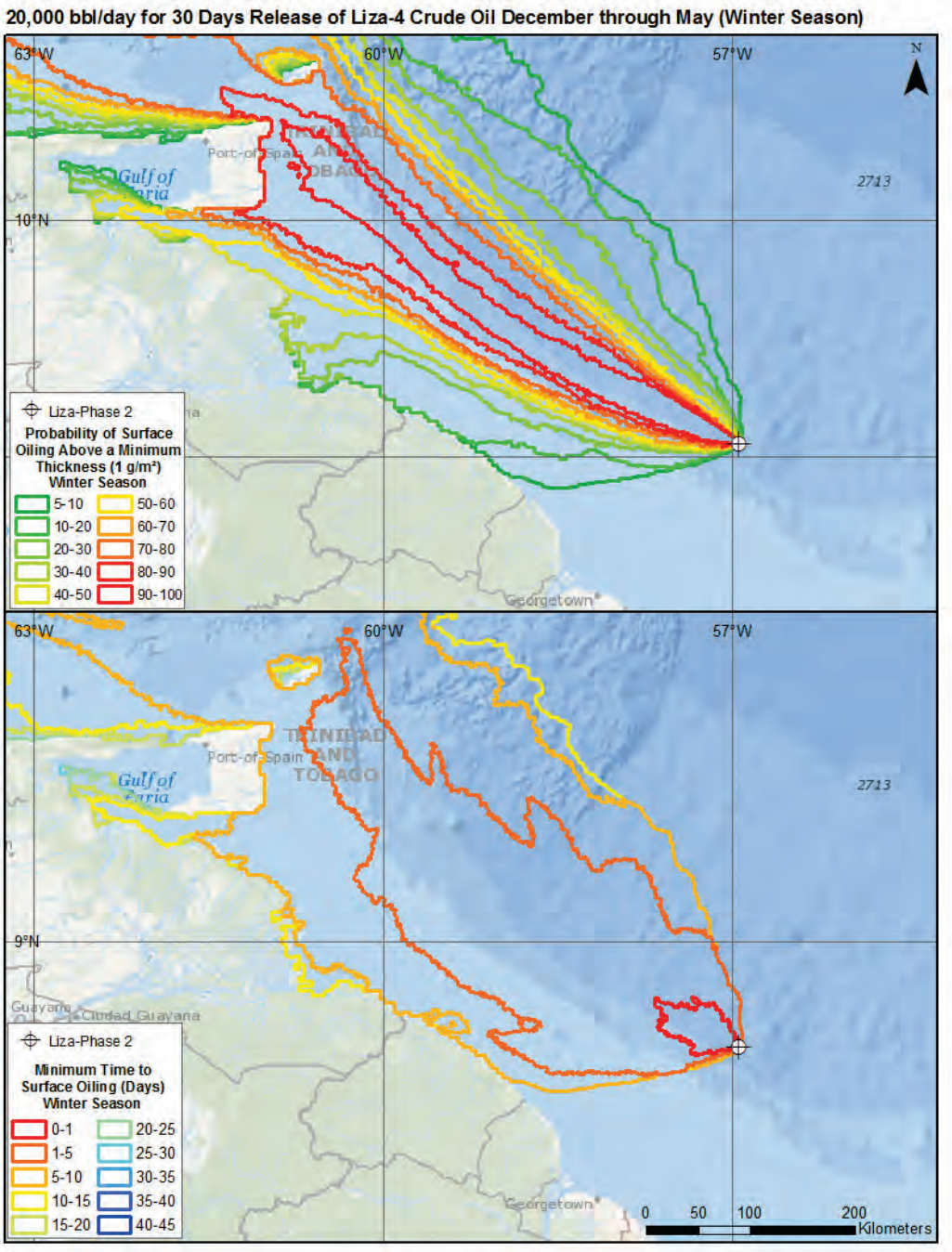

Figure A12: Top Panel – Probability of surface oiling above a minimum thickness of 1 µm for months December through May for a 20,000 barrel a day release of Crude oil for 30 days. Bottom Panel – Minimum time for surface oil thickness to exceed 1 µm.

A.4 Deterministic Model Results – Unmitigated and Mitigated

Each individual spill event simulated in a stochastic scenario produces a unique spill trajectory. Depending on environmental conditions at the time of release, the spill will take a different path, resulting in different impacts. The 95th percentile spill event for shoreline stranding by oil with a thickness greater than 1 µm was selected from each stochastic scenario in the summer and winter seasons. These deterministic results are presented in summary tables listing the sea surface area swept by oil and the length of shoreline oiled with a thickness greater than 1 µm. (Table A5).

The time of first arrival of oil on shore for the unmitigated spill events that reached shore ranked as the 95th percentile ranges from 5.9 to 8.8 days (Table A5). Differences in seasonal wind speed and direction as well as small differences in spill site location result in a wide range in sea surface exposure to oil (11 km^2 through 613,218 km^2) and shoreline length oiled (10 km though 795 km). Stronger easterly winds in the Winter season result in more significant shoreline oiling, particularly in Venezuela and Trinidad and Tobago, while lower wind speeds allow the surface plume to be transported to the north of Trinidad and Tobago and swept into the Caribbean Sea.

Table A5: Oil Effects Summary for 95th Percentile for Shoreline Impact for unmitigated & mitigated simulations

Spill Location	Season	Surface Area (km^2)	Shoreline Length (km)	Time to Shore (Days)
Marine Diesel – 50 bbl	Summer	11	0	n/a
	Winter	11	0	n/a
Marine Diesel – 250 bbl	Summer	71	0	n/a
	Winter	28	0	n/a
Crude Oil – 50 bbl	Summer	20	0	n/a
	Winter	12	10	6.0
Unmitgated Crude Oil – 2,500 bbl	Summer	9,196	21	7.3
	Winter	8,717	23	5.9
Mitigated Crude Oil – 2,500 bbl	Summer	451	0	n/a
	Winter	485	0	n/a
Unmitgated Wellbore Fluids – 20,000 bbls per day for 30 days	Summer	613,218	223	8.8
	Winter	106,687	795	6.2
Mitigated Wellbore Fluids – 20,000 bbls per day for 30 days	Summer	3,971	0	n/a
	Winter	3,071	0	n/a

A.4.1 Marine Diesel Summer (June through November)

A.4.1.1 50 Barrel Scenario (Unmitigated)

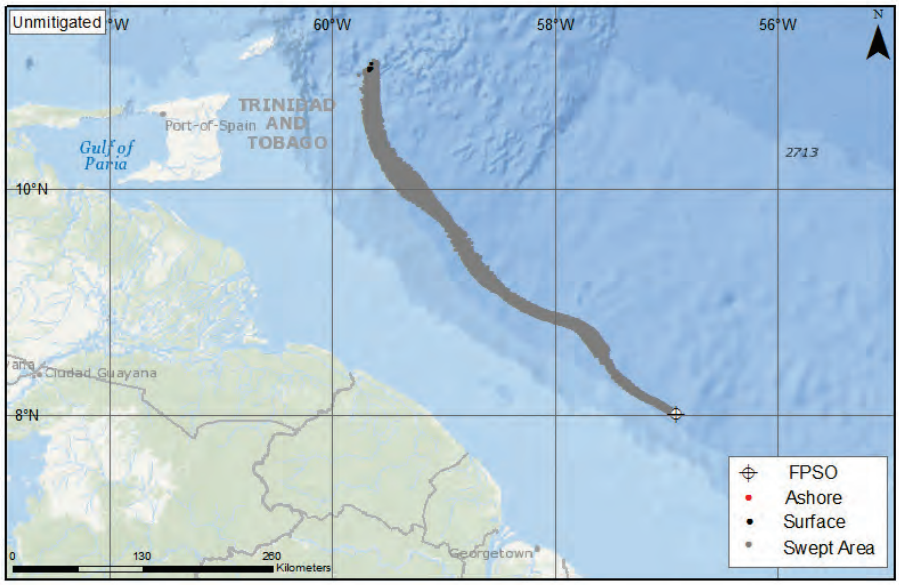

Figure A13: Unmitigated area swept results for the 95th percentile surface area oiled 50 bbl Marine Diesel release during summer months. Area swept is displayed in grey, surface oil droplets remaining at the end of the 10 day scenario are presented in black, and shoreline oiling is displayed in red (none in this scenario).

A.4.1.2 250 Barrel Scenario (Unmitigated)

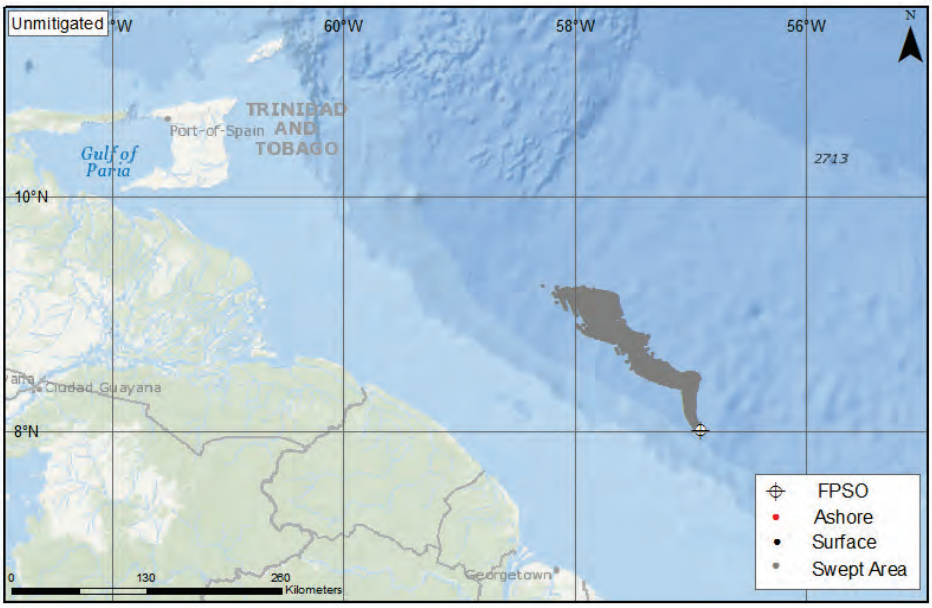

Figure A14: Area swept results for the 95th percentile surface area oiled 250 bbl Marine Diesel release during summer months. Area swept is displayed in grey, surface oil droplets remaining at the end of the 10 day scenario are presented in black (none in this scenario), and shoreline oiling is displayed in red (none in this scenario).

A.4.2 Marine Diesel Winter (December through May)

A.4.2.1 50 Barrel Scenario (Unmitigated)

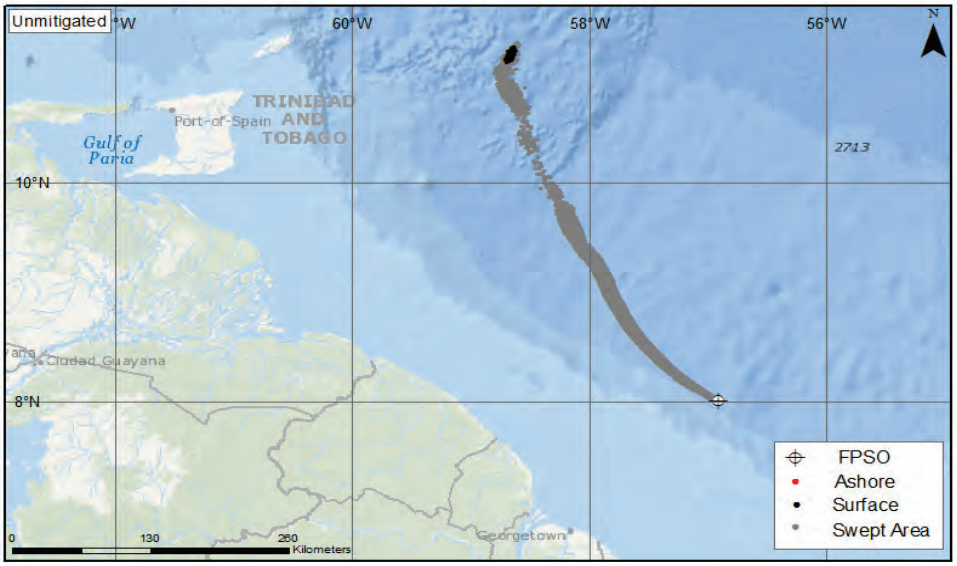

Figure A15: Unmitigated area swept results for the 95th percentile surface area oiled 50 bbl Marine Diesel release during winter months. Area swept is displayed in grey, surface oil droplets remaining at the end of the 10 day scenario are presented in black, and shoreline oiling is displayed in red (none in this scenario).

A.4.2.2 250 Barrel Scenario (Unmitigated)

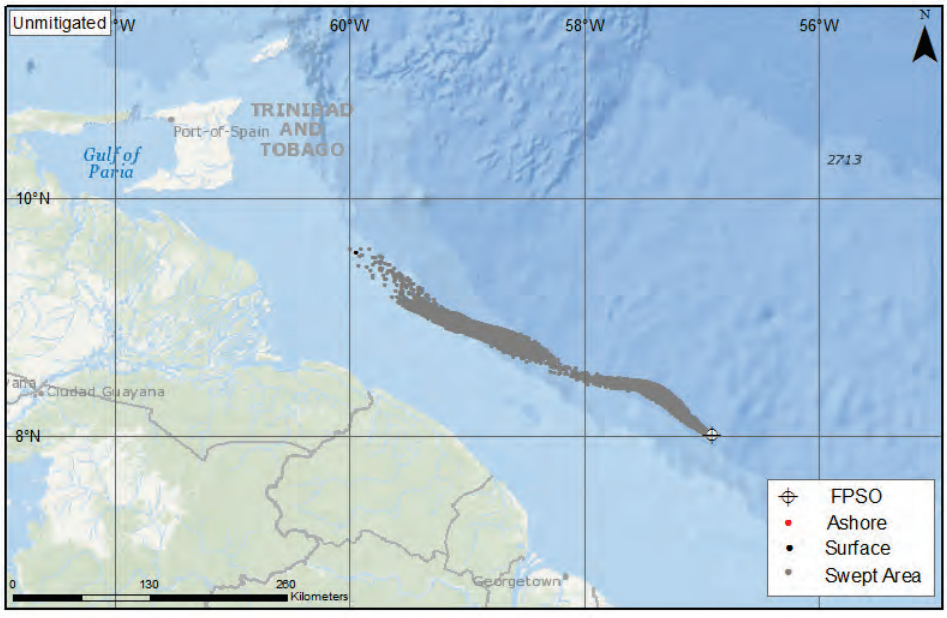

Figure A16: Unmitigated area swept results for the 95th percentile surface area oiled 250 bbl Marine Diesel release during winter months. Area swept is displayed in grey, surface oil droplets remaining at the end of the 10 day scenario are presented in black, and shoreline oiling is displayed in red (none in this scenario).

A.4.3 Crude Oil Summer (June through November)

A.4.3.1 50 Barrel Scenario (Unmitigated)

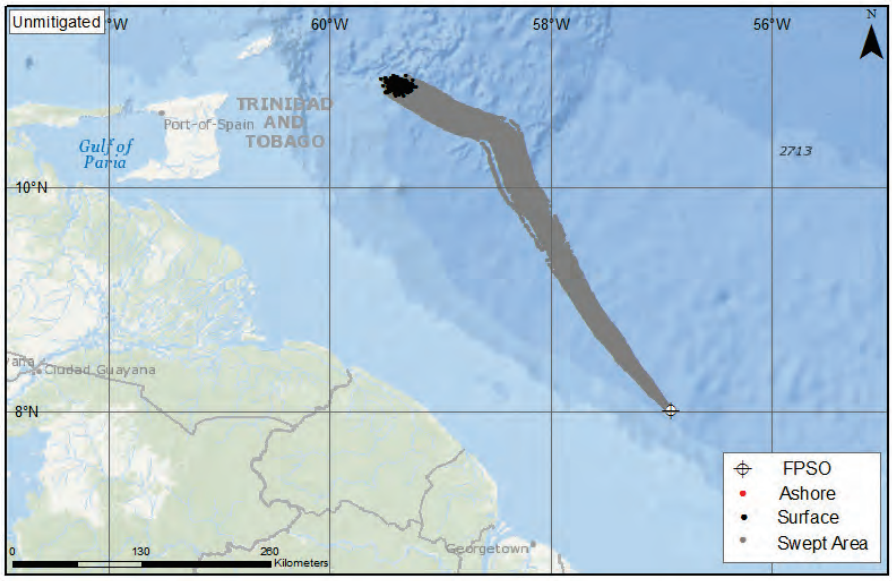

Figure A17: Unmitigated area swept results for the 95th percentile surface area oiled 50 bbl Crude Oil release during summer months. Area swept is displayed in grey, surface oil droplets remaining at the end of the 10 day scenario are presented in black, and shoreline oiling is displayed in red (none in this scenario).

A.4.4 Crude Oil Winter (December through May)

A.4.4.1 50 Barrel Scenario (Unmitigated)

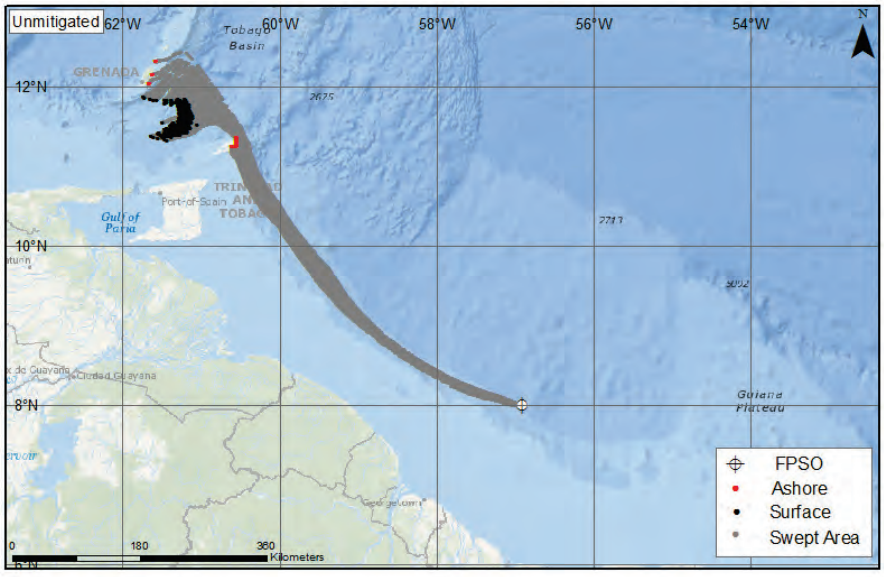

Figure A18: Area swept results for the 95th percentile surface area oiled 50 bbl Crude Oil release during winter months. Area swept is displayed in grey, surface oil droplets remaining at the end of the 10 day scenario are presented in black, and shoreline oiling is displayed in red.

A.4.5 Crude Oil Summer (June through November)

A.4.5.1 2500 Barrel Scenario (Unmitigated)

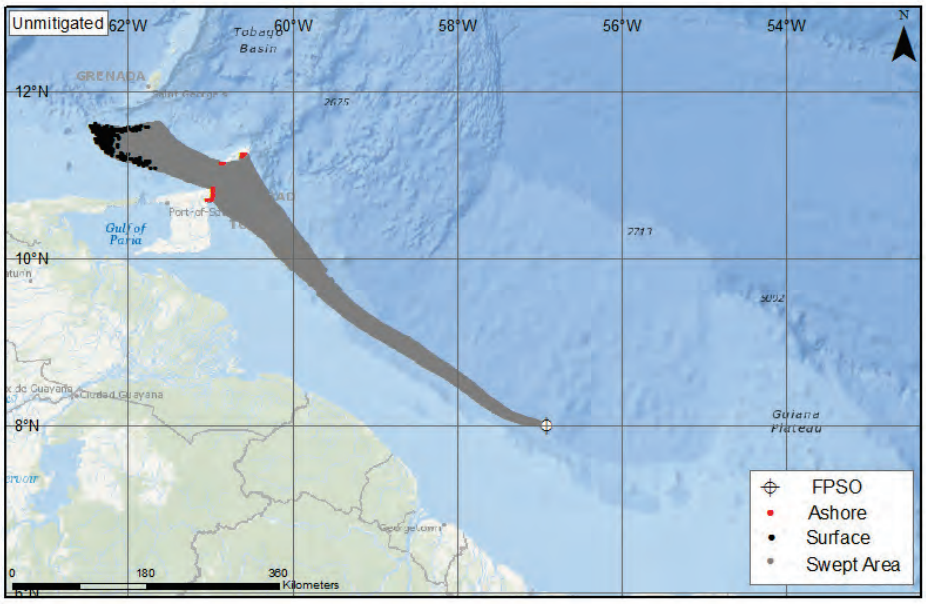

Figure A19: Unmitigated area swept results for the 95th percentile surface area oiled 2,500 bbl Crude Oil release during summer months. Area swept is displayed in grey, surface oil droplets remaining at the end of the 10 day scenario are presented in black, and shoreline oiling is displayed in red.

A.4.5.2 2500 Barrel Scenario (Mitigated)

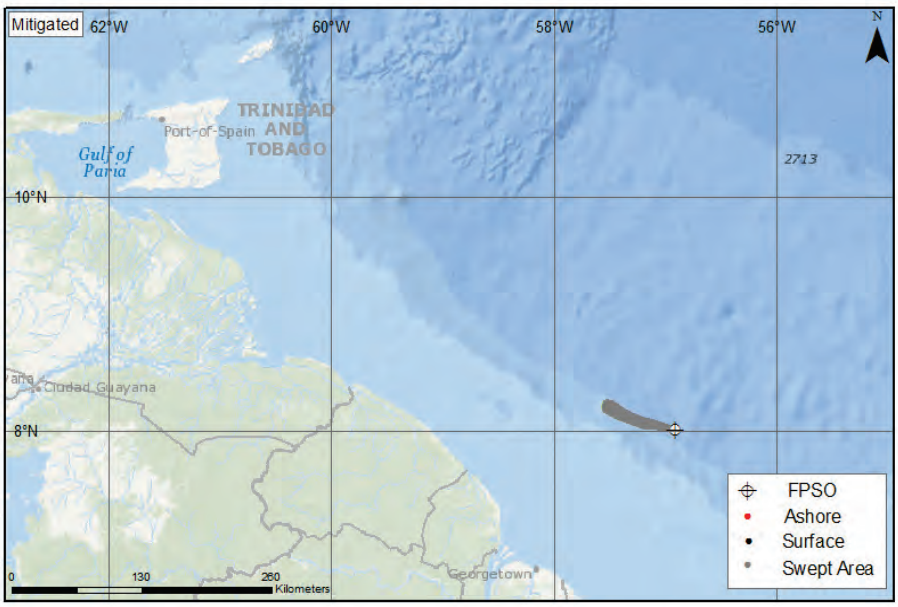

Figure A20: Mitigated area swept results for the 95th percentile shoreline area oiled 2,500 bbl Crude Oil release during summer months. Area swept is displayed in grey, no shoreline oiling occurred, and no surface oil remains.

A.4.6 Crude Oil Winter (December through May)

A.4.6.1 2500 Barrel Scenario (Unmitigated)

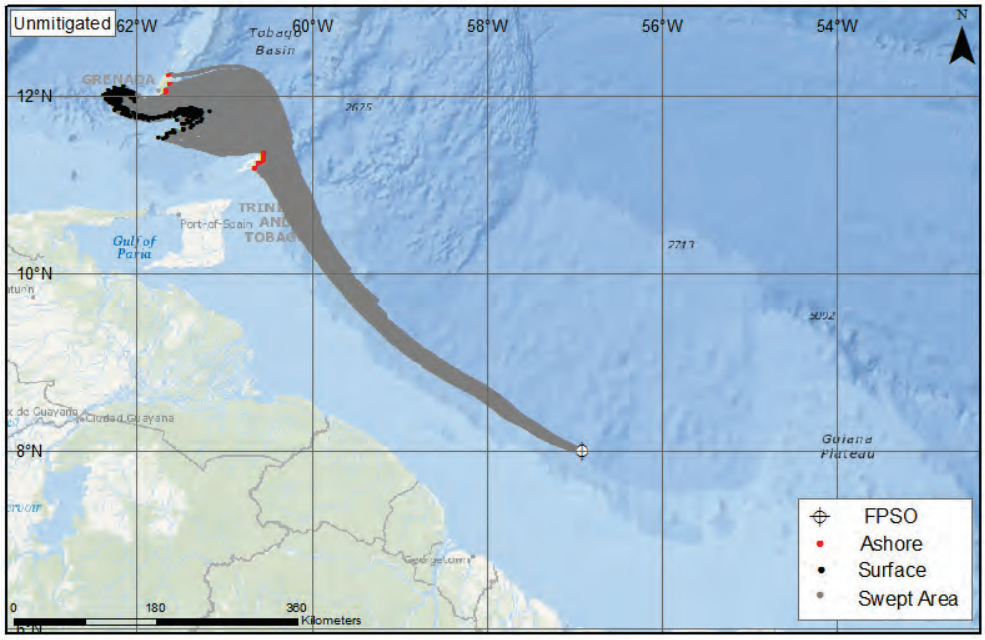

Figure A21: Unmitigated area swept results for the 95th percentile surface area oiled 2,500 bbl Crude Oil release during winter months. Area swept is displayed in grey, surface oil droplets remaining at the end of the 10 day scenario are presented in black, and shoreline oiling is displayed in red.

A.4.6.2 2500 Barrel Scenario (Mitigated)

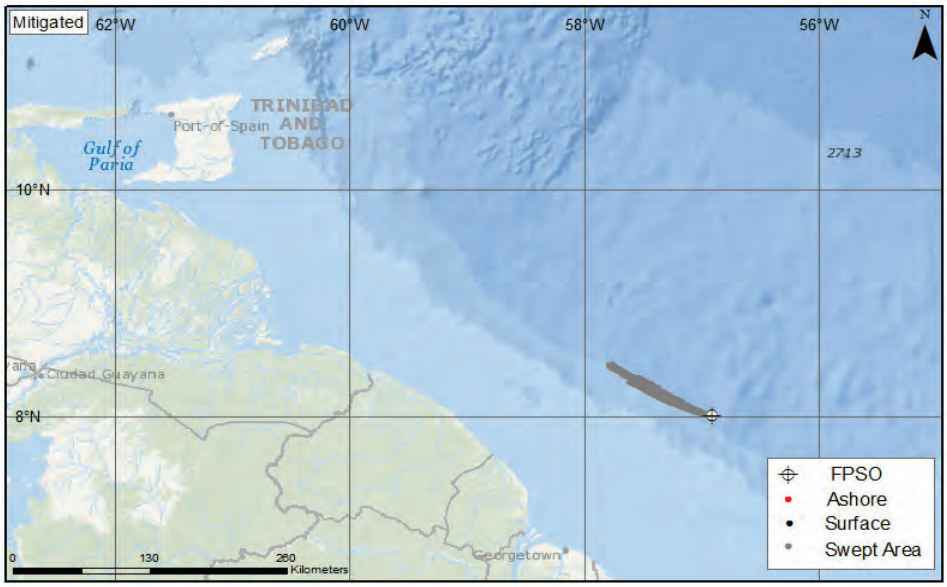

Figure A22: Mitigated area swept results for the 95th percentile shoreline area oiled 2,500 bbl Crude Oil release during winter months. Area swept is displayed in grey, no shoreline oiling occurred, and no surface oil remains.

A.4.7 Wellbore Fluids Summer (June through November)

A.4.7.1 20,000 Barrel Scenario (Unmitigated)

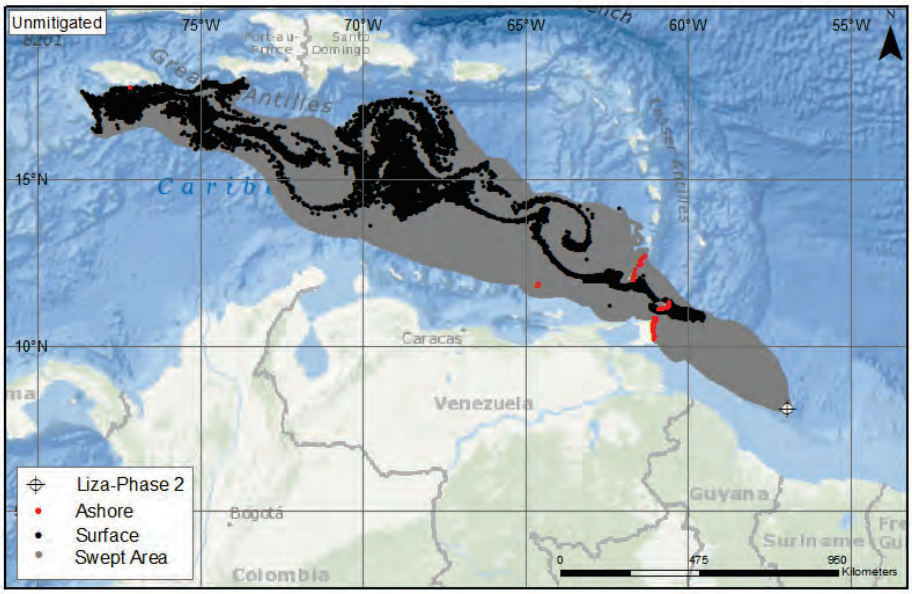

Figure A23: Unmitigated area swept results for the 95th percentile surface area oiled 20,000 bbl Wellbore Fluids per day release for 30 days during summer months. Area swept is displayed in grey, surface oil droplets remaining at the end of the 45 day scenario are presented in black, and shoreline oiling is displayed in red.

A.4.7.2 20,000 Barrel Scenario (Mitigated)

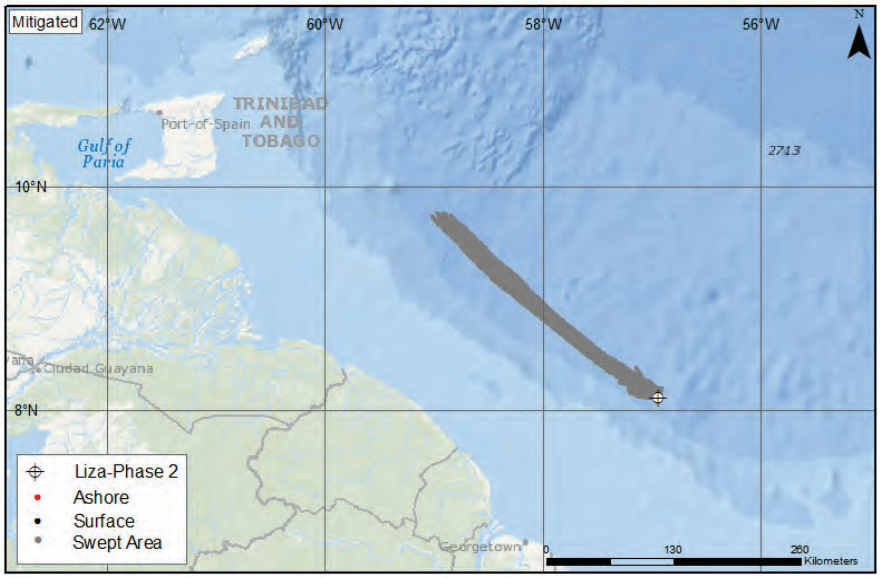

Figure A24: Mitigated area swept results for the 95th percentile shoreline area oiled 20,000 bbl Wellbore Fluids per day release for 21 days during summer months. Area swept is displayed in grey, no shoreline oiling occurred and no surface oil remains.

A.4.8 Wellbore Fluids Winter (December through May)

A.4.8.1 20,000 Barrel Scenario (Unmitigated)

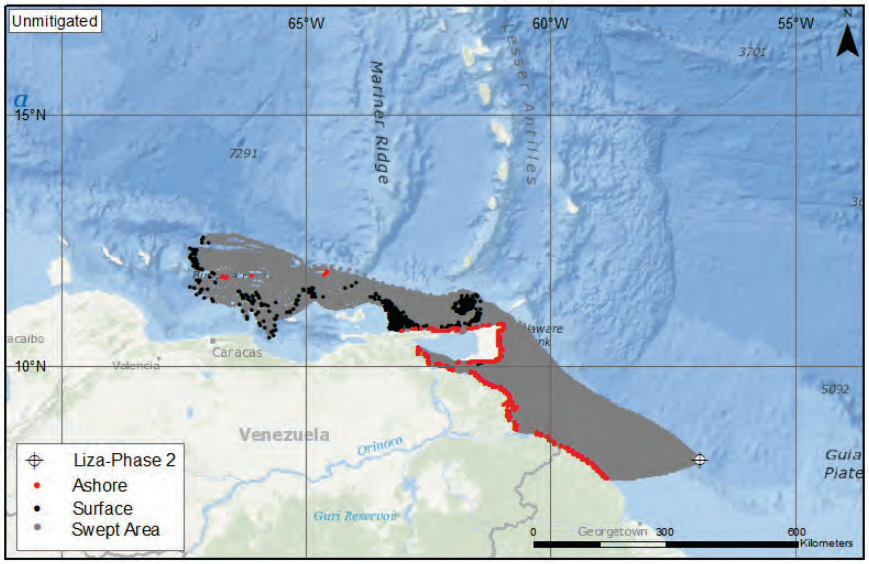

Figure A25: Unmitigated area swept results for the 95th percentile surface area oiled 20,000 bbl Wellbore Fluids per day release for 30 days during winter months. Area swept is displayed in grey, surface oil droplets remaining at the end of the 45 day scenario are presented in black, and shoreline oiling is displayed in red.

A.4.8.2 20,000 Barrel Scenario (Mitigated)

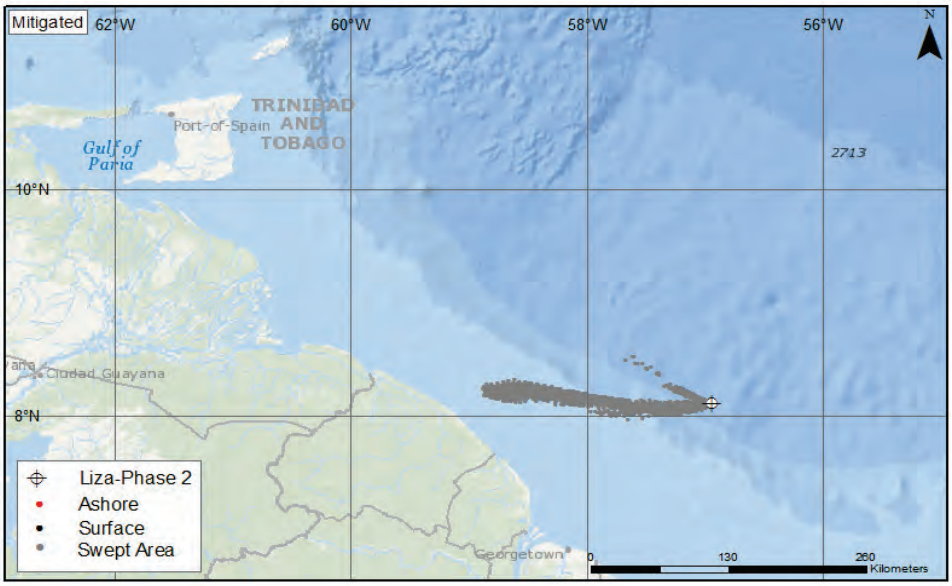

Figure A26: Mitigated area swept results for the 95th percentile shoreline area oiled 20,000 bbl Wellbore Fluids per day release for 21 days during winter months. Area swept is displayed in grey, no shoreline oiling occurred and no surface oil remains.

Appendix B - LIZA PHASE 1 MODELING RESULTS

B.1 Modeling Overview

Oil spill modeling was performed for five hypothetical oil spill scenarios, ranging from higher probability small volume operational releases at the water surface to the unlikely larger volume spills related to production or drilling operations originating either at the sea surface or from a subsea release at the seabed. These ranged as noted in Table B1 from smaller Tier I incidents of a single release of 50 bbls of marine diesel or crude oil to a loss of well control event resulting in 20,000 bbls of wellbore fluids being released for a maximum duration of 30-days. In these five scenarios, the oil spill modeling was applied to determine the most likely trajectory for a spill from each scenario and to quantify the oil's fate as it interacts with the environment.

The oil spill modeling was performed in several steps. The first step was to utilize the historic data and perform stochastic modeling. In this type of modeling, the spill location and volume are utilized to determine how the spill would respond under actual historic wind and hydrodynamic (currents) conditions. The modeling tool selects about 100-200 random start times during the season of interest and utilizes the paired met ocean data to examine the fate and trajectory of each of the model runs. The combined output for a single stochastic analysis is presented in Figure B1.

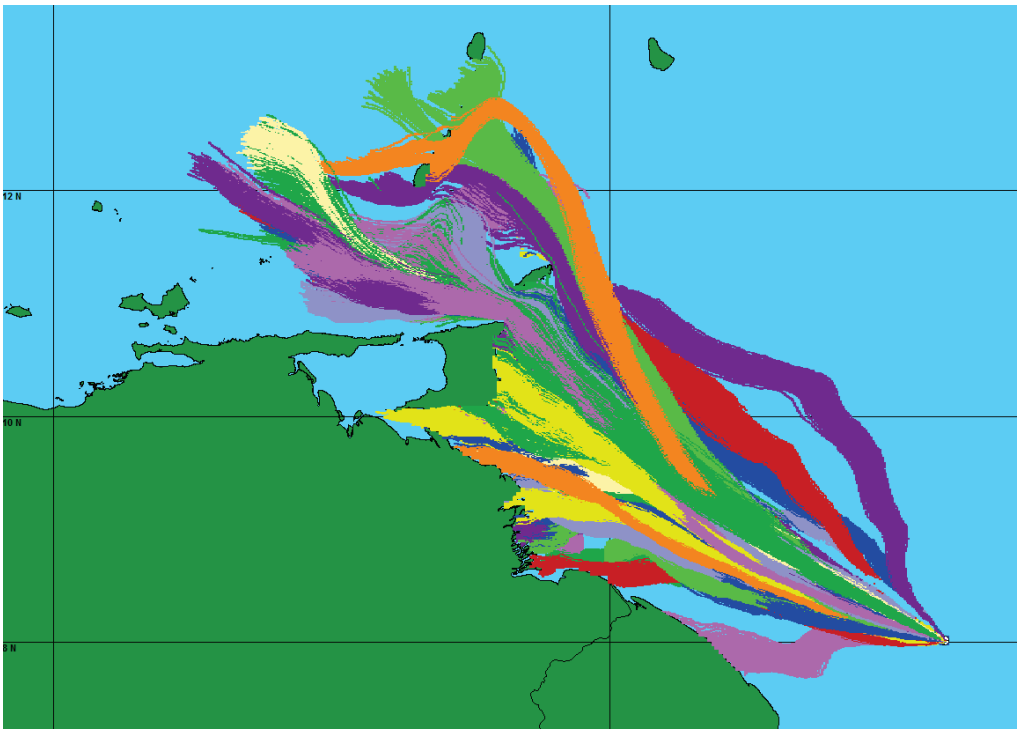

Figure B1: Example Model Iterations that are Utilized to Produce Stochastic Outputs

B.1.1 Oil Spill Model Scenarios

A series of stochastic and deterministic model simulations were run to determine the fate of the oil released for three different products for five different scenarios at the offshore location during two different seasons. Table B1 lists the scenarios that were modeled.

Table B1: Oil Spill Scenarios Defined for the Oil Spill Modeling

Release Volume	Released Product	Season
50 bbl	Marine Diesel	Summer
50 bbl	Marine Diesel	Winter
250 bbl	Marine Diesel	Summer
250 bbl	Marine Diesel	Winter
50 bbl	Crude Oil	Summer
50 bbl	Crude Oil	Winter
2,500 bbl	Crude Oil	Summer
2,500 bbl	Crude Oil	Winter
20,000 bbls	Wellbore Fluids	Summer
20,000 bbls	Wellbore Fluids	Winter

B.1.2 Exposure Thresholds

Minimum oil thickness thresholds are used in the SIMAP model in the determination of the probability of oil contamination. The thresholds are specific to the type of impact being considered, either ecological or socio-economic, and they are used in the calculation of oiling probability to determine if oil is present in a quantity sufficient to cause a particular impact. Table B2 lists approximate thickness and mass per unit area ranges for surface oil of varying appearance. Dull brown sheens are about 1 µm thick. Rainbow sheen is about 0.2-0.8 g/m^2 (0.2-0.8 µm thick) and silver sheens are 0.05-0.2 g/m^2 (0.05-0.2 µm thick; NRC, 1985).

Table B2: Oil Thickness (µm) and Equivalent Mass (g/m^2) and Appearance on Water (NRC, 1985)

Minimum	Maximum	Appearance
0.05	0.2	Colorless and silver sheen
0.2	0.8	Rainbow sheen
1	4	Dull brown sheen
10	100	Dark brown sheen
1,000	10,000	Black oil

The SIMAP model uses specific oil thickness thresholds for calculating the probability or likelihood of the presence of oil on the sea surface or shoreline. Oil thickness thresholds defining the minimum value for expected potential effects to the sea surface and shoreline are listed in Table B3. Socio-economic thresholds were used in all modeling for this project (1 µm for surface oiling and 1 µm for shoreline oiling). All calculations of the probability of oil shoreline and sea surface contamination are based on these oil thickness thresholds

Table B3: Oil Thickness Thresholds for Sea Surface and Shoreline Oiling

Threshold Type	Threshold (Mass/Unit Area)	Threshold (Thickness)	Rationale (Socio-economic, Ecological)
Oil on Water Surface	1.0 g/m^2	1 µm, 0.001 mm	A conservative ecological threshold for consideration of sublethal effects on birds, marine mammals, and sea turtles from floating oil.
Oil on Shoreline	1.0 g/m^2	1.0 µm, 0.001 mm	A conservative socioeconomic/ response threshold. This is a threshold for potential effects on socio-economic resource uses, as this amount of oil may trigger the need for shoreline cleanup on amenity beaches, and affect shoreline recreation and tourism.

B.2 Model Input Data

B.2.1 Oil Properties

The physical and chemical properties of the oil are used by the OILMAP DEEP and SIMAP models in calculations of the transport and fate of the spill. The oil used in the models is light crude that can incorporate water when spilled, which can increase both the volume and viscosity. Assessment of this type of oil indicated that while it can take on water, it will not emulsify quickly as some crude oils can. This will serve to keep the oil relatively non-viscous for many hours depending on spill and environmental conditions, which improves the window of opportunity for oil spill response. Table B4 lists some of the key properties of the oil used in the model simulations.

Table B4: Properties of the Lisa 4 Crude Oil Used in the Spill Modeling

Density @25°C) (g/cm^3	Viscosity (cP@25°C)	API Gravity	Pour Point (°C)	Maximum Water Content (%)
0.84579	12.797	35.8	12.78	30

B.3 Stochastic Model Results – Unmitigated

The stochastic modeling results predicted that surface oil would generally travel towards the northwest in all scenarios during both the summer and winter seasons. The probability of any shoreline oiling from an unmitigated oil spill is generally low, with the smaller volume spills very unlikely to reach the shoreline, and when they do the probability is less than 5%. The oil spill model indicates that even in the unlikely event of a larger volume spill, there is only a 5 to 10 percent chance of shoreline oiling in Guyana. In the case of such a loss of well control, it is predicated that it would take 5 to 15 days for oil to reach shore in the absence of any spill response.

Subsequent modeling runs were performed taking into consideration the implementation of all appropriate response strategies and mitigation measures as noted to prevent oil from reaching shore and effectively reducing the environmental impacts associated with the two largest spill scenarios namely a 2,500 bbl release during tanker offloading of crude and the second the loss of well control resulting in a release of 20,000 bbls/day for 21 continuous days until a capping stack can be put in place to cease the release from the well.

B.3.1 Marine Diesel Summer (June through November)

B.3.1.1 Water Surface Results – 50 Barrel Scenario (Unmitigated)

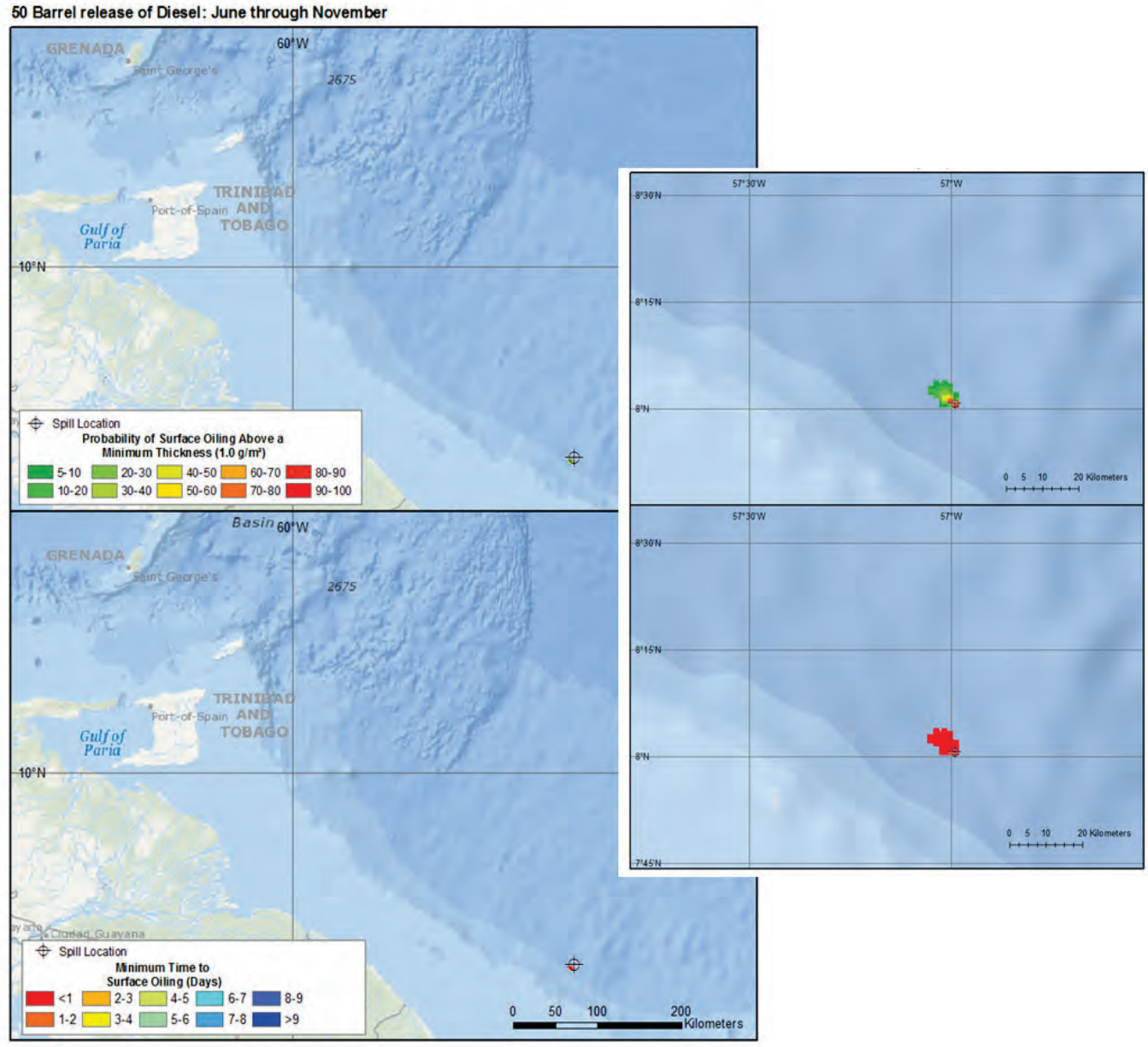

Figure B2: Top Panel – Probability of surface oiling above a minimum thickness of 1 µm from June through November for a 50 barrel release of Marine Diesel. Bottom Panel – Minimum time for surface oil thickness to exceed 1 µm. Inset Panel – Detail.

B.3.1.2 Water Surface Results – 250 Barrel Scenario (Unmitigated)

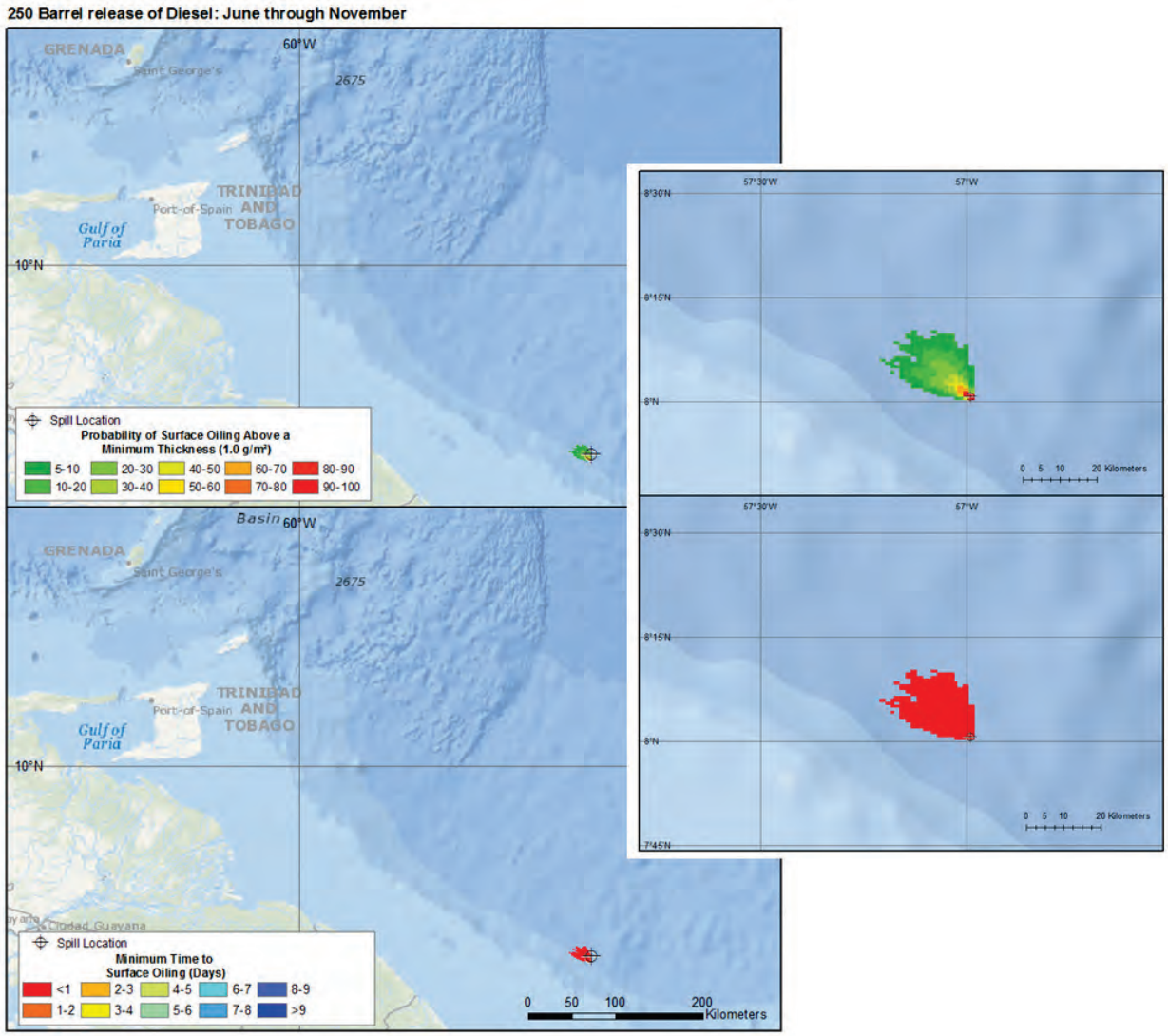

Figure B3: Top Panel – Probability of surface oiling above a minimum thickness of 1 µm from June through November for a 250 barrel release of Marine Diesel. Bottom Panel – Minimum time for surface oil thickness to exceed 1 µm. Inset Panel – Detail.

B.3.2 Marine Diesel Winter (December through May)

B.3.2.1 Water Surface Results – 50 Barrel Scenario (Unmitigated)

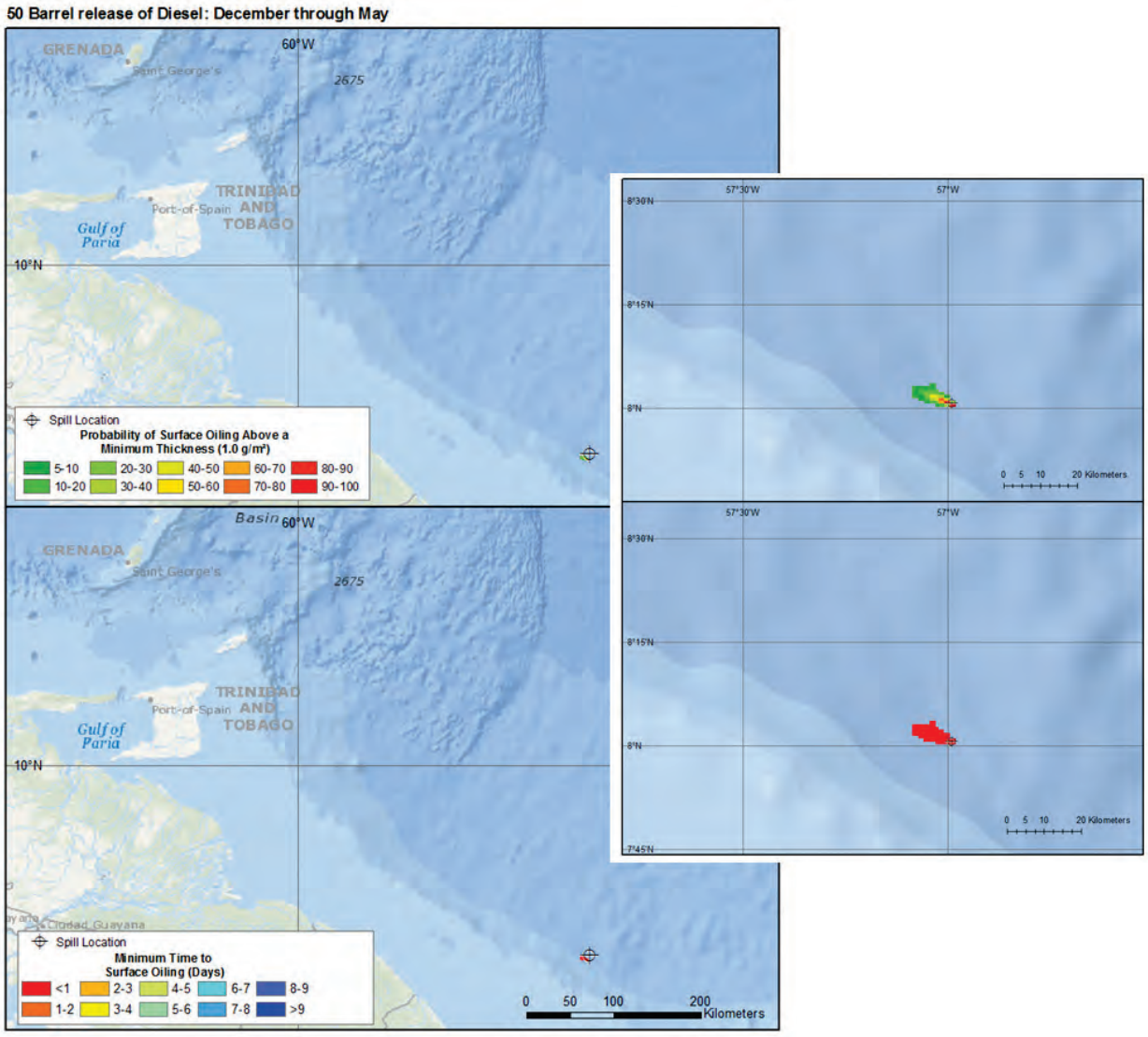

Figure B4: Top Panel – Probability of surface oiling above a minimum thickness of 1 µm from December through May for a 50 barrel release of Marine Diesel. Bottom Panel – Minimum time for surface oil thickness to exceed 1 µm. Inset Panel – Detail.

B.3.2.2 Water Surface Results – 250 Barrel Scenario (Unmitigated)

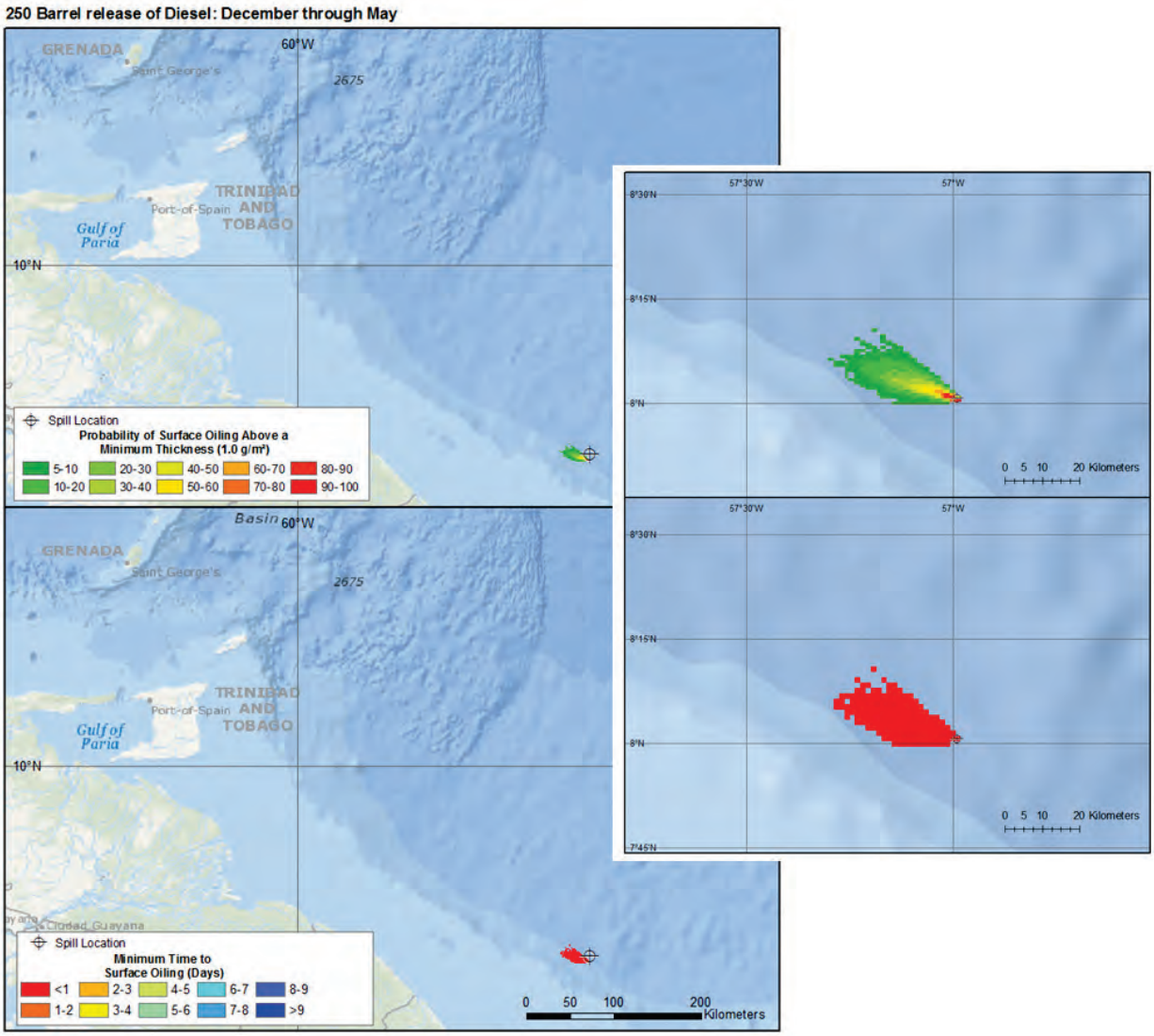

Figure B5: Top Panel – Probability of surface oiling above a minimum thickness of 1 µm from December through May for a 250 barrel release of Marine Diesel. Bottom Panel – Minimum time for surface oil thickness to exceed 1 µm. Inset Panel – Detail.

B.3.3 Crude Oil Summer (June through November)

B.3.3.1 Water Surface Results – 50 Barrel Scenario (Unmitigated)

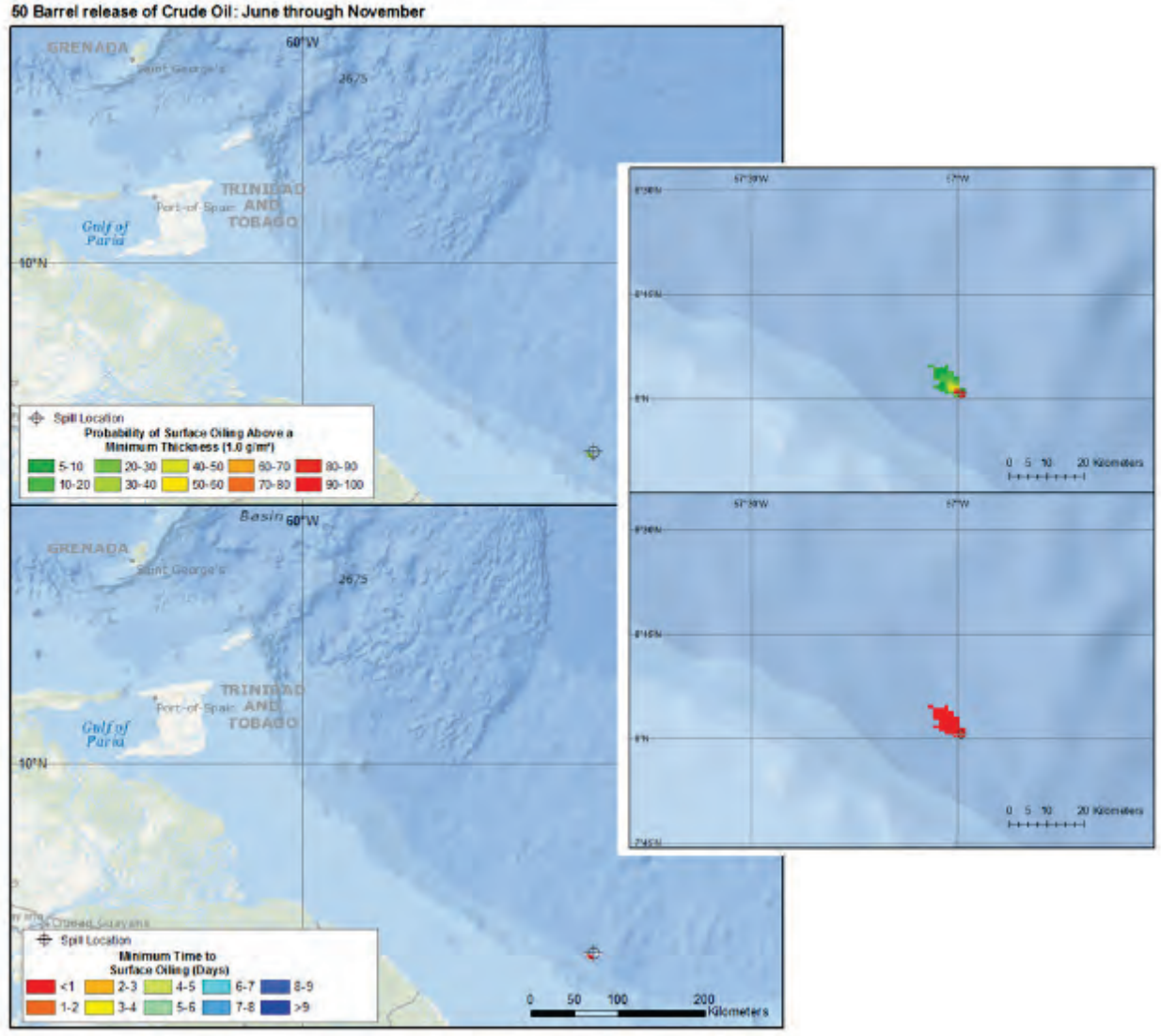

Figure B6: Top Panel – Probability of surface oiling above a minimum thickness of 1 µm from June through November for a 50 barrel release of Crude oil. Bottom Panel – Minimum time for surface oil thickness to exceed 1 µm. Inset Panel – Detail.

B.3.3.2 Water Surface Results – 2,500 Barrel Scenario (Unmitigated)

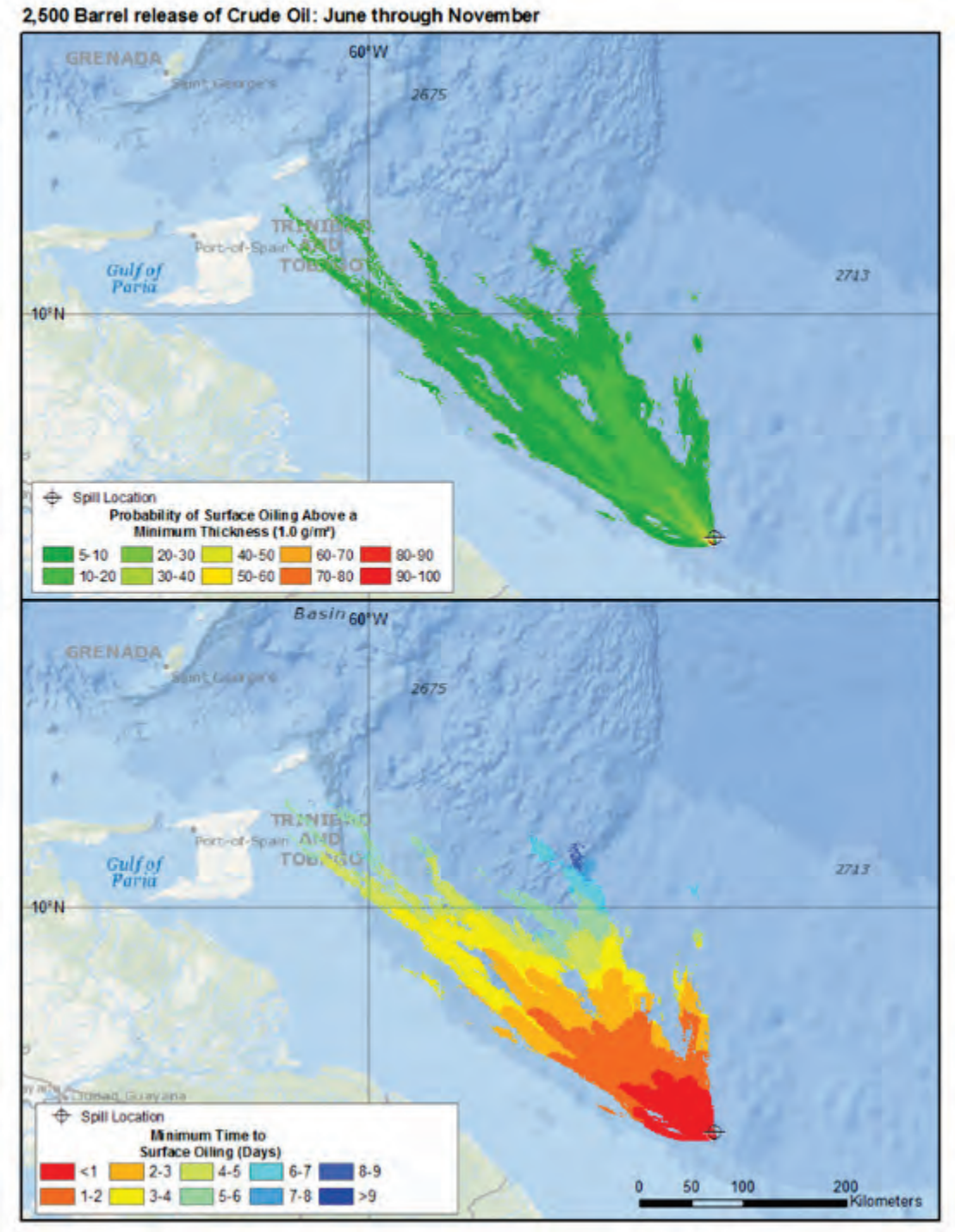

Figure B7: Top Panel – Probability of surface oiling above a minimum thickness of 1 µm from June through November for a 2,500 barrel release of Crude oil. Bottom Panel – Minimum time for surface oil thickness to exceed 1 µm.

B.3.4 Crude Oil Winter (December through May)

B.3.4.1 Water Surface Results – 50 Barrel Scenario (Unmitigated)

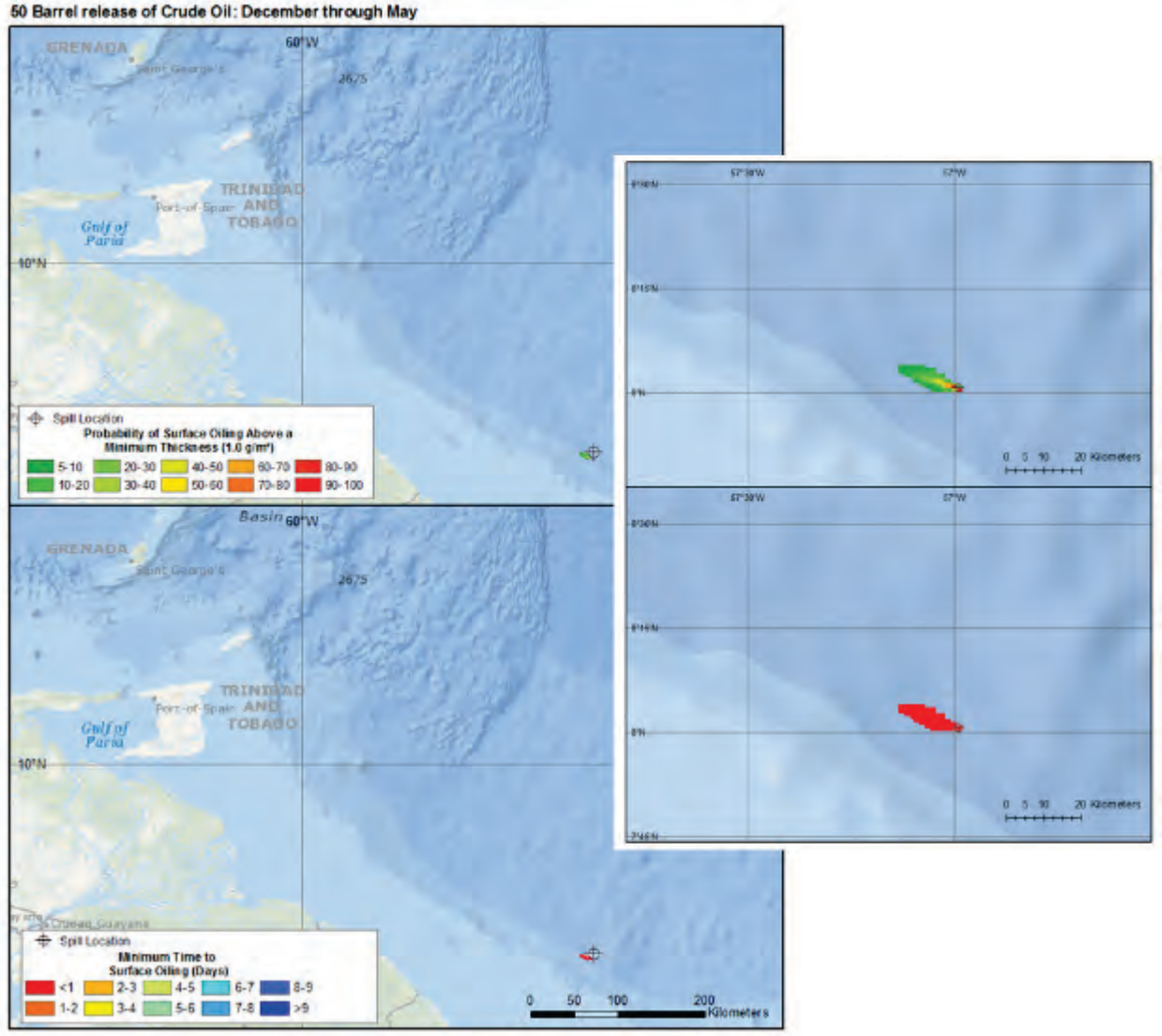

Figure B8: Top Panel – Probability of surface oiling above a minimum thickness of 1 µm from December through May for a 50 barrel release of Crude oil. Bottom Panel – Minimum time for surface oil thickness to exceed 1 µm. Inset Panel – Detail.

B.3.4.2 Water Surface Results – 2,500 Barrel Scenario (Unmitigated)

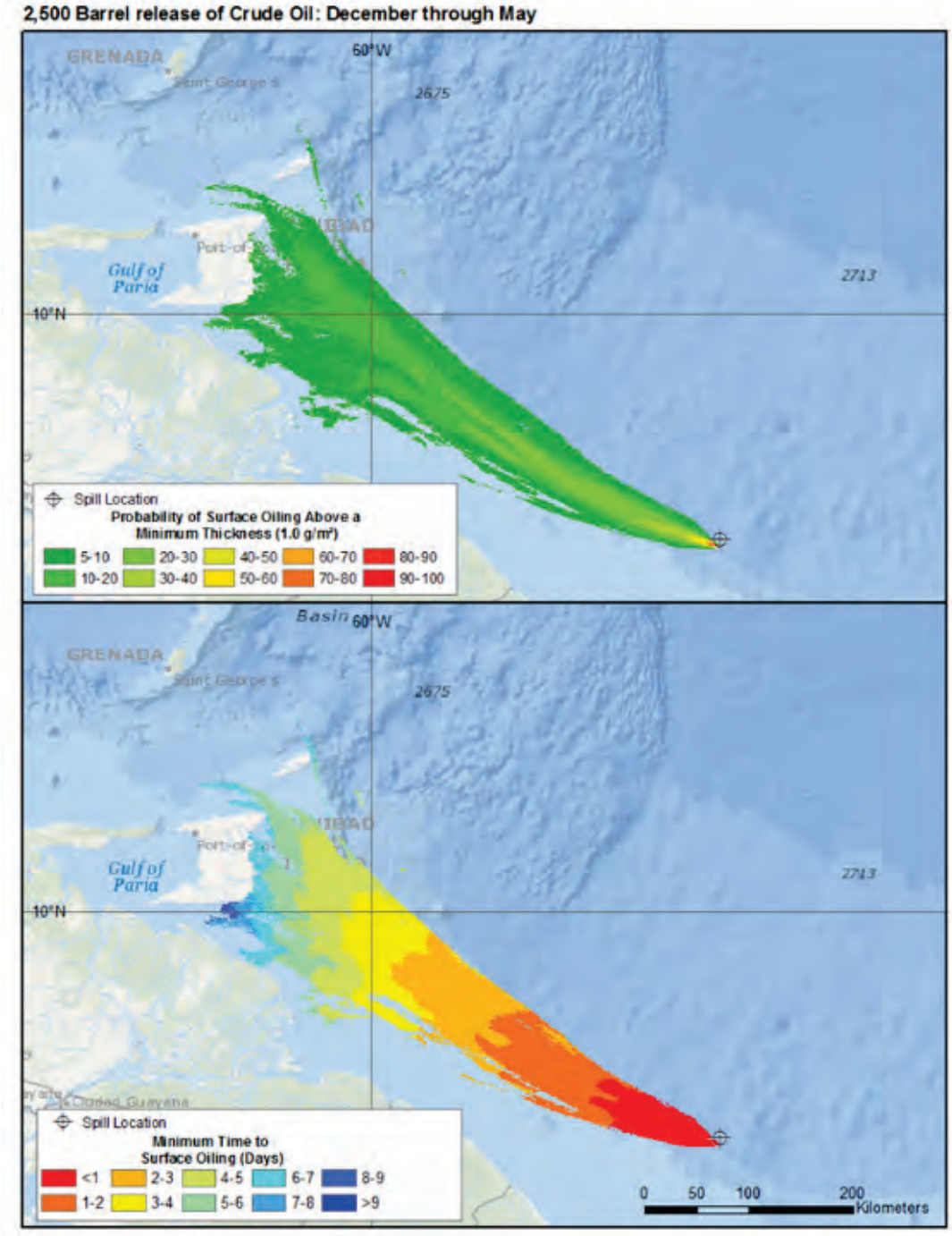

Figure B9: Top Panel – Probability of surface oiling above a minimum thickness of 1 µm from December through May for a 2,500 barrel release of Crude oil. Bottom Panel – Minimum time for surface oil thickness to exceed 1 µm.

B.3.4.3 Water Surface Results – 2,500 Barrel Scenario (Unmitigated)

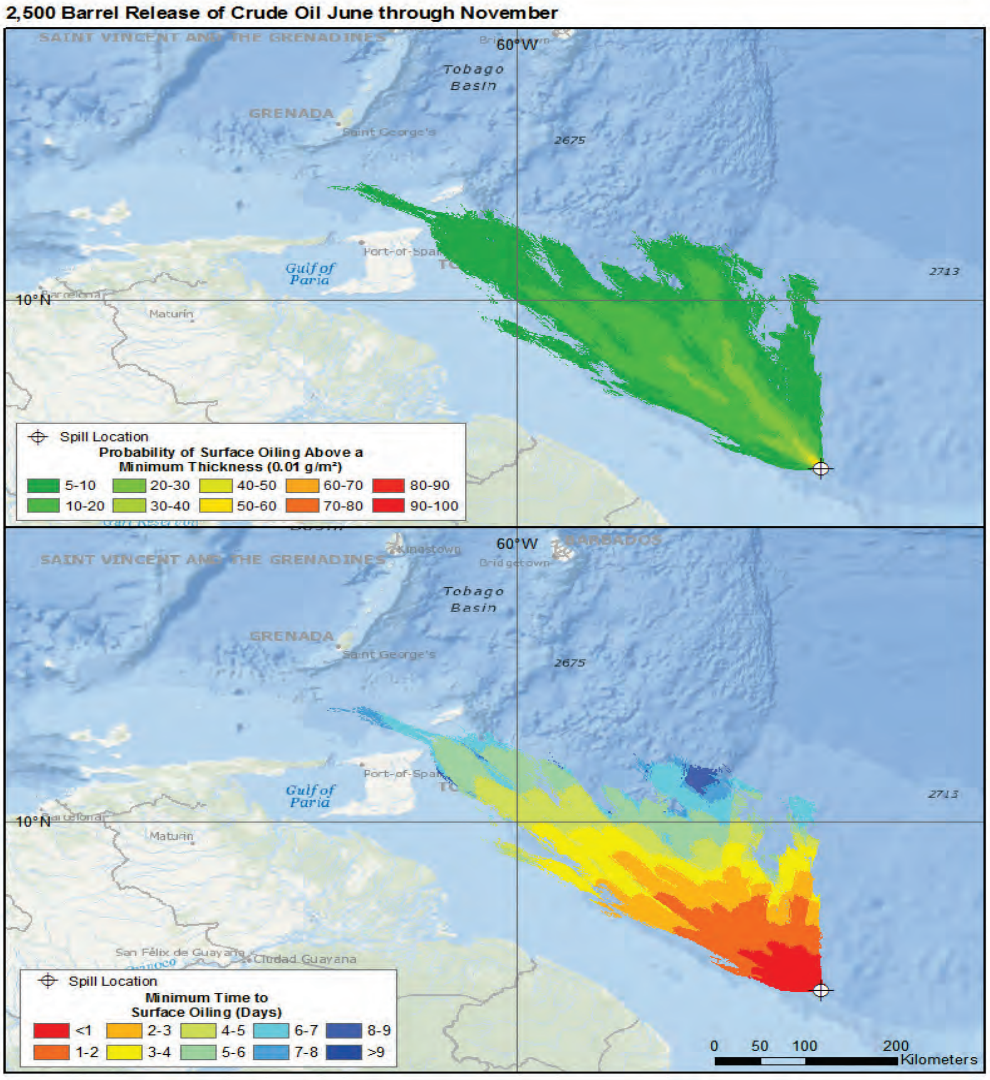

Figure B10: Top Panel – Probability of surface oiling above a minimum thickness of 1 µm from June through November for a 2,500 barrel release of Crude oil. Bottom Panel – Minimum time for surface oil thickness to exceed 1 µm.

B.3.5 Wellbore Fluids Summer (June through November)

B.3.5.1 Water Surface Results – 20,000 Barrel per Day Scenario for 30 days (Unmitigated)

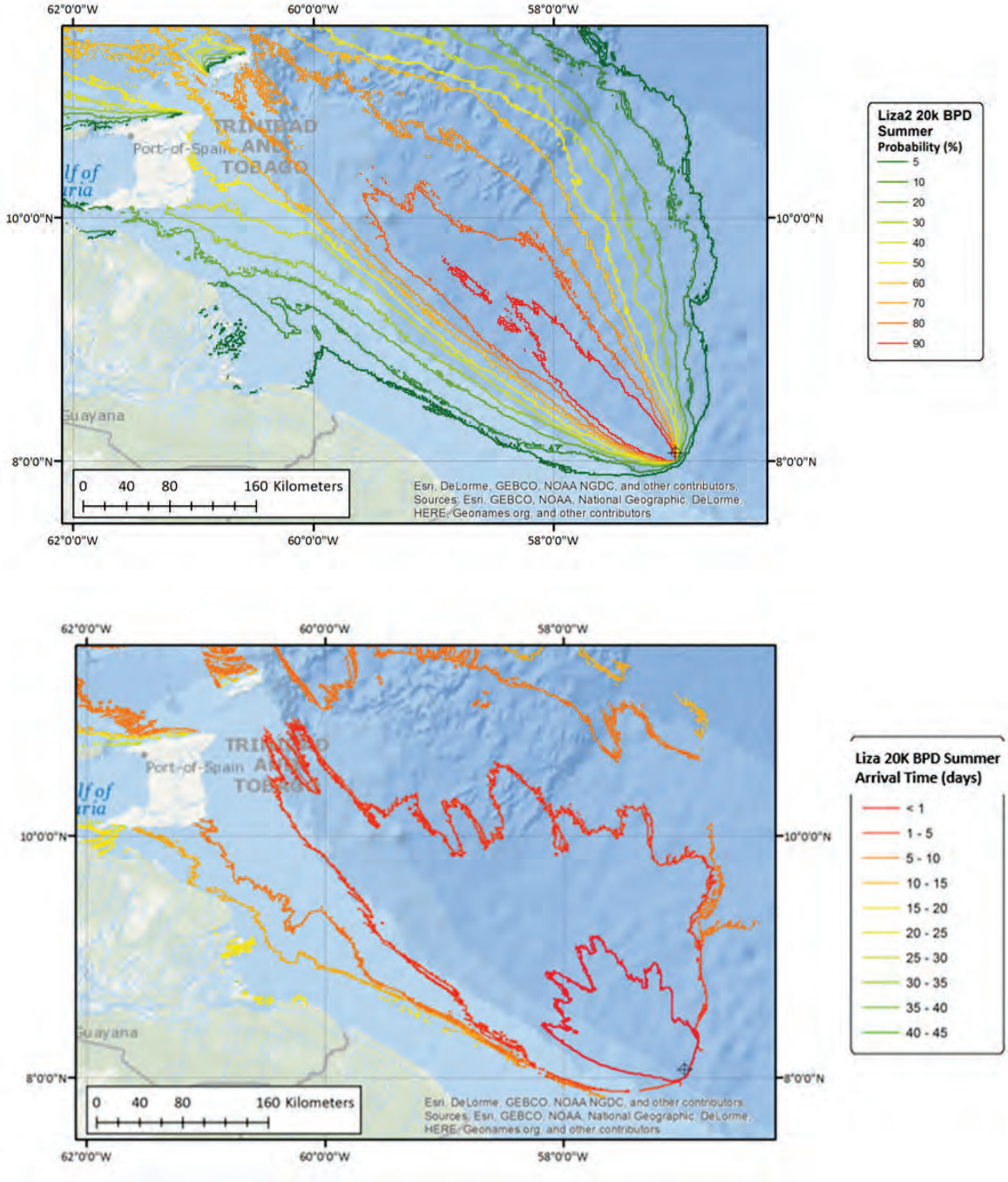

Figure B11: Top Panel – Probability of shoreline oiling above a minimum thickness of 1 µm for months June through November for a 20,000 barrel a day release of Crude oil for 30 days. Bottom Panel – Minimum time for shoreline oil thickness to exceed 1 µm.

B.3.6 Wellbore Fluids Winter (December through May)

B.3.6.1 Water Surface Results – 20,000 Barrel per Day Scenario for 30 days (Unmitigated)

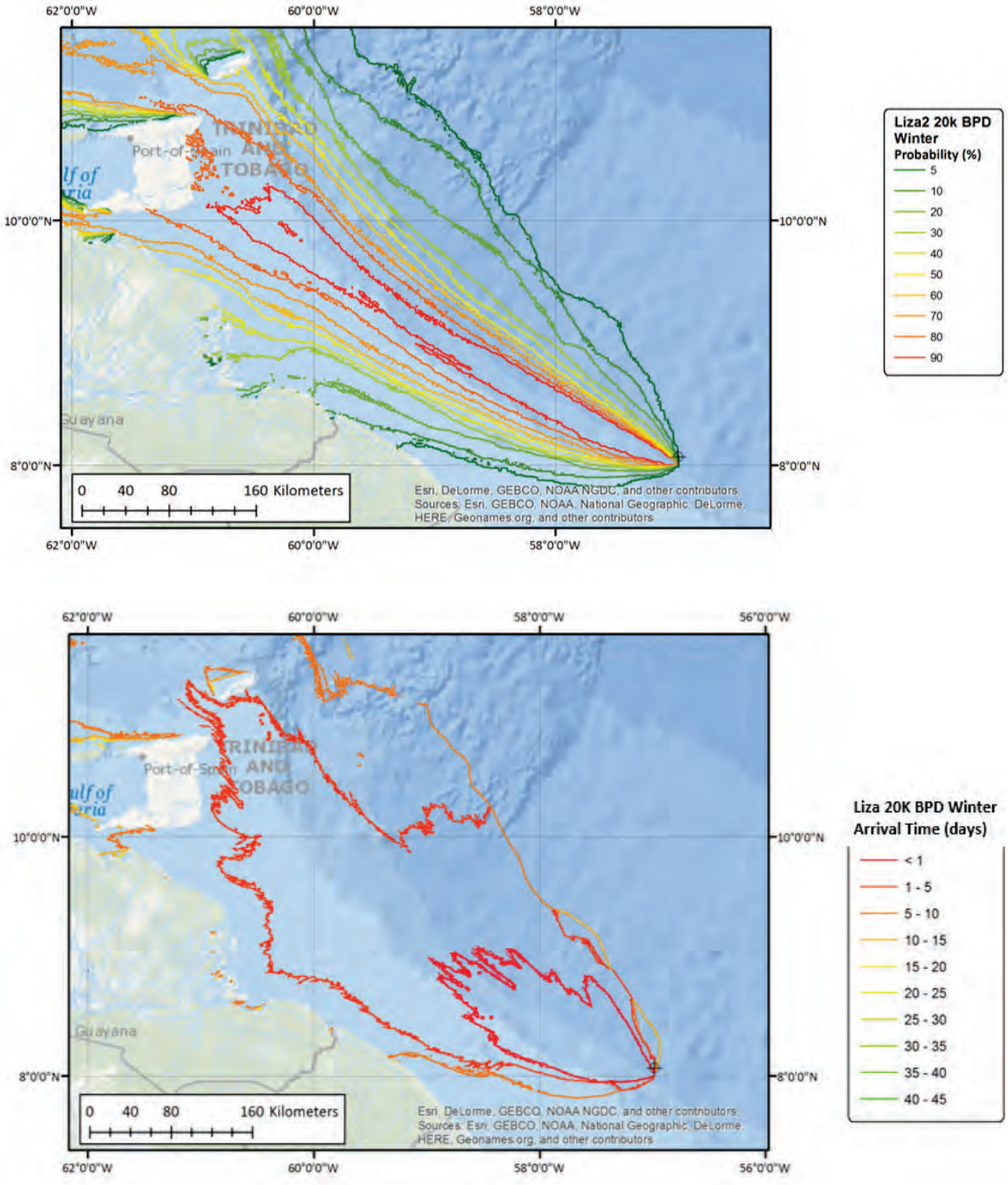

Figure B12: Top Panel – Probability of surface oiling above a minimum thickness of 1 µm for months December through May for a 20,000 barrel a day release of Crude oil for 30 days. Bottom Panel – Minimum time for surface oil thickness to exceed 1 µm.

B.4 Deterministic Model Results – Unmitigated and Mitigated

Each individual spill event simulated in a stochastic scenario produces a unique spill trajectory. Depending on environmental conditions at the time of release, the spill will take a different path, resulting in different impacts. The 95th percentile spill event for shoreline stranding by oil with a thickness greater than 1 µm was selected from each stochastic scenario in the summer and winter seasons. These deterministic results are presented in summary tables listing the sea surface area swept by oil with a thickness greater than 1 µm and the length of shoreline oiled with a thickness greater than 1 µm. (Table B5).

Oil effects summary for the 95th percentile spill event for sea surface area swept by oil above a thickness of 1 µm. Surface area is the maximum sea surface area swept above a threshold of 1 µm thick. Shoreline length is the maximum length of shoreline oiled above a threshold of 1 µm thick.

The time of first arrival of oil on shore for the spill events that reached shore ranked as the 95th percentile ranges from 5.9 to 9.3 days (Table B5). Differences in seasonal wind speed and direction as well as small differences in spill site location result in a wide range in sea surface exposure to oil (835 km^2 through 408,789 km^2) and shoreline length oiled (25.1 km though 355 km). Stronger easterly winds result in more significant shoreline oiling, particularly in Venezuela and Trinidad and Tobago, while lower wind speeds allow the surface plume to be transported to the north of Trinidad and Tobago and swept into the Caribbean Sea.

Table B5: Oil Effects Summary for 95th Percentile for Shoreline Impact for unmitigated & mitigated simulations

Spill Location	Season	Surface Area (km^2)	Shoreline Length (km)	Time to Shore (Days)
Marine Diesel – 50 bbl	Summer	854	0	n/a
	Winter	835	0	n/a
Marine Diesel – 250 bbl	Summer	5,450	0	n/a
	Winter	5,520	0	n/a
Crude Oil – 50 bbl	Summer	6,390	0	n/a
	Winter	6,500	25.1	5.9
Unmitigated Crude Oil – 2,500 bbl	Summer	13,800	56.6	9.25
	Winter	19,400	41.9	8.5
Migated Crude Oil – 2,500 bbls	Summer	719	0	n/a
	Winter	854	0	n/a
Unmitigated Wellbore Fluids – 20,000 bbls per day for 30 days	Summer	312,474	215	9.3
	Winter	408,789	355	6.4
Mitigated Wellbore Fluids – 20,000 bbls per day for 30 days	Summer	7,168	0	n/a
	Winter	13,860	0	n/a

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B.4.1 Marine Diesel Summer (June through November)

B.4.1.1 50 Barrel Scenario (Unmitigated)

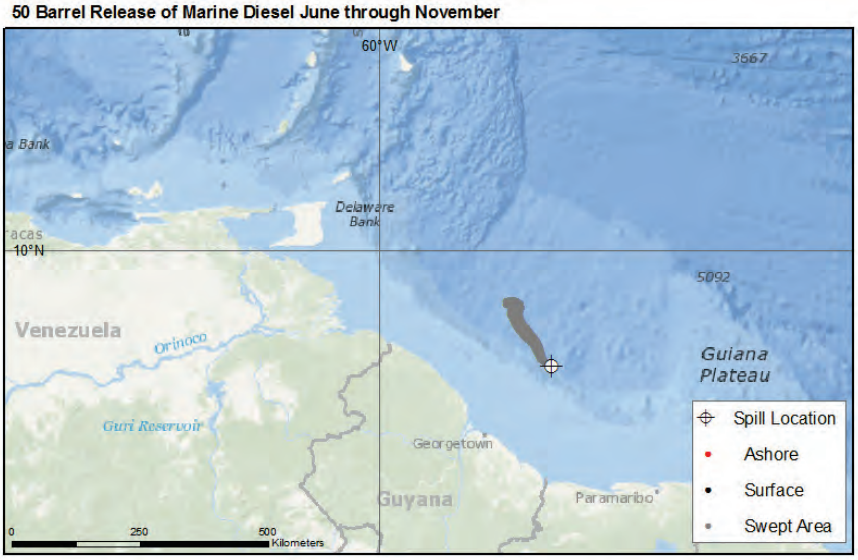


Figure B13: Unmitigated area swept results for the 95th percentile surface area oiled 50 bbl Marine Diesel release during summer months. Area swept is displayed in grey, surface oil droplets remaining at the end of the 10 day scenario are presented in black (none in this scenario), and shoreline oiling is displayed in red (none in this scenario).

B.4.1.2 250 Barrel Scenario (Unmitigated)

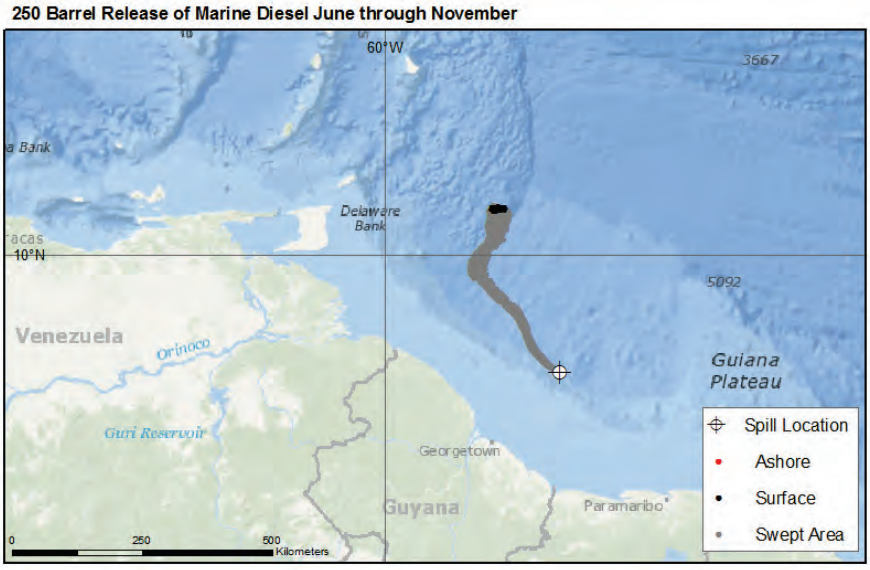


Figure B14: Area swept results for the 95th percentile surface area oiled 250 bbl Marine Diesel release during summer months. Area swept is displayed in grey, surface oil droplets remaining at the end of the 10 day scenario are presented in black, and shoreline oiling is displayed in red (none in this scenario).

B.4.2 Marine Diesel Winter (December through May)

B.4.2.1 50 Barrel Scenario (Unmitigated)

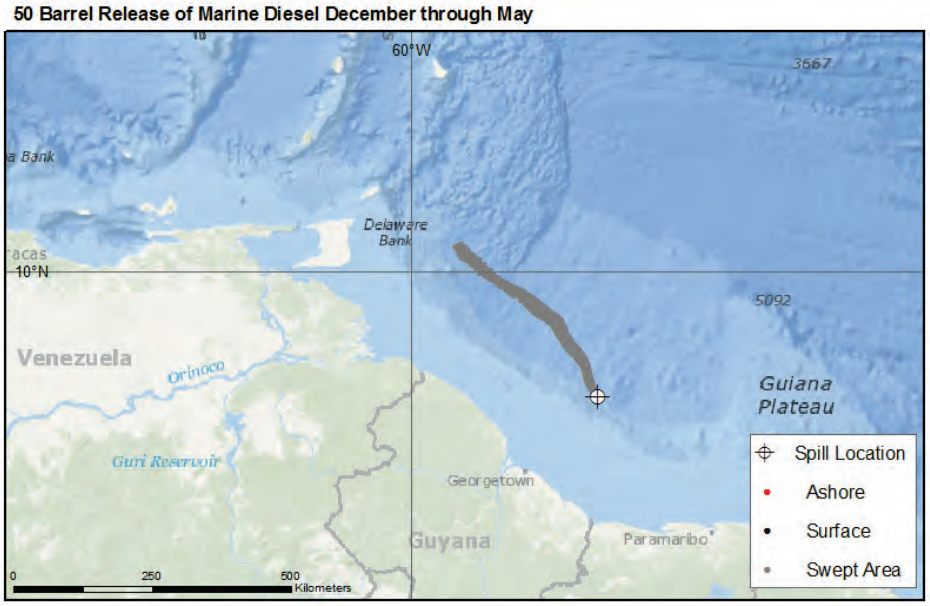


Figure B15: Unmitigated area swept results for the 95th percentile surface area oiled 50 bbl Marine Diesel release during winter months. Area swept is displayed in grey, surface oil droplets remaining at the end of the 10 day scenario are presented in black (none in this scenario), and shoreline oiling is displayed in red (none in this scenario).

B.4.2.2 250 Barrel Scenario (Unmitigated)

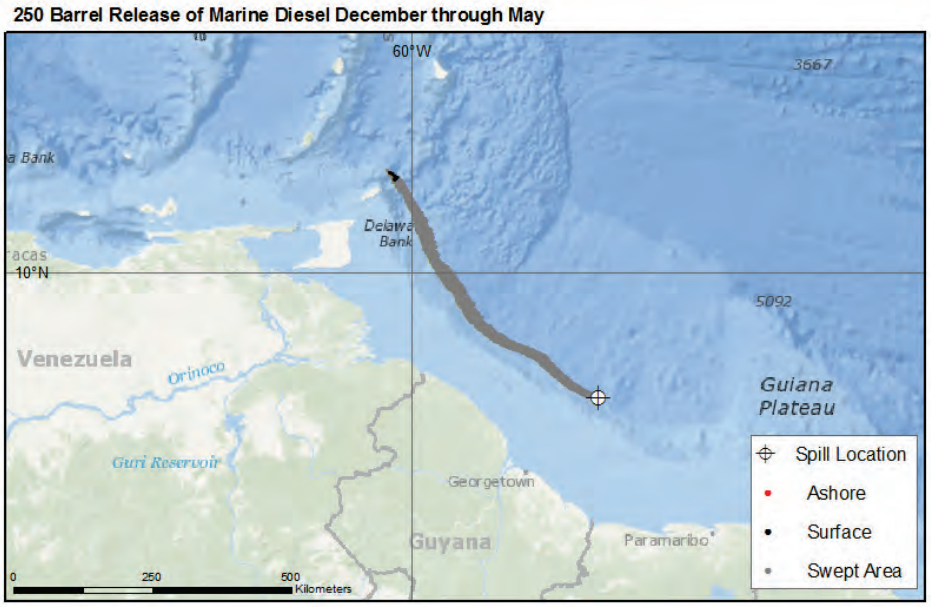


Figure B16: Unmitigated area swept results for the 95th percentile surface area oiled 250 bbl Marine Diesel release during winter months. Area swept is displayed in grey, surface oil droplets remaining at the end of the 10 day scenario are presented in black, and shoreline oiling is displayed in red (none in this scenario).

B.4.3 Crude Oil Summer (June through November)

B.4.3.1 50 Barrel Scenario (Unmitigated)

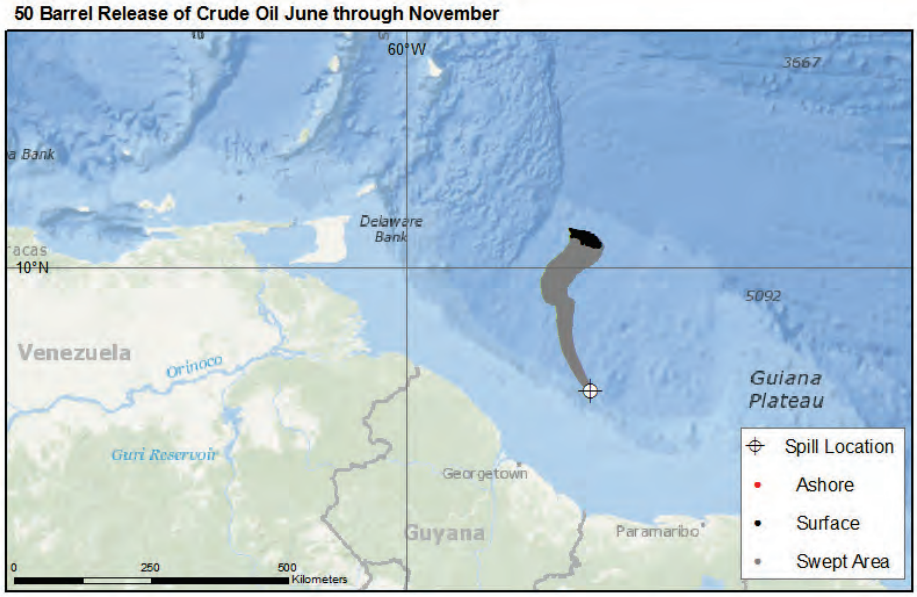


Figure B17: Unmitigated area swept results for the 95th percentile surface area oiled 50 bbl Crude Oil release during summer months. Area swept is displayed in grey, surface oil droplets remaining at the end of the 10 day scenario are presented in black, and shoreline oiling is displayed in red (none in this scenario).

B.4.4 Crude Oil Winter (December through May)

B.4.4.1 50 Barrel Scenario (Unmitigated)

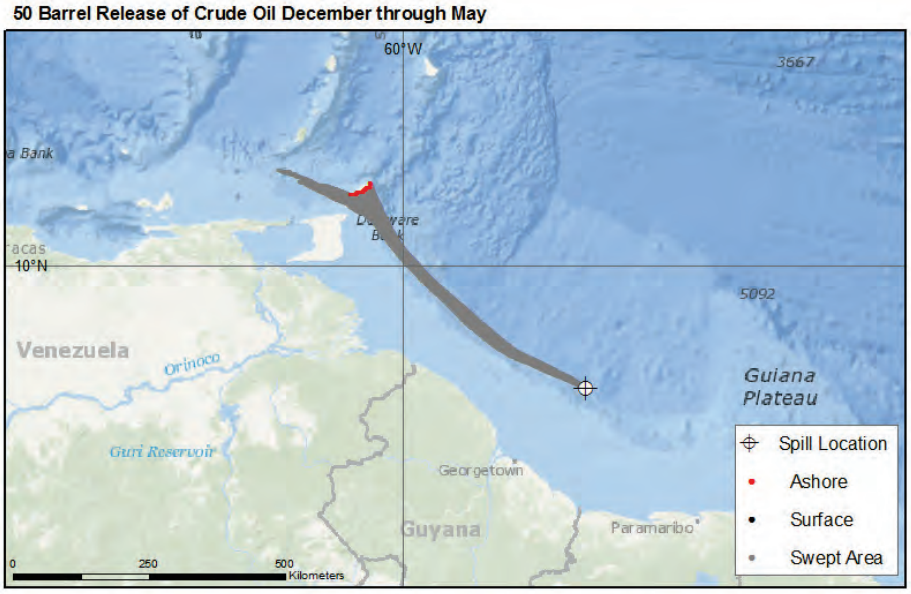


Figure B18: Area swept results for the 95th percentile surface area oiled 50 bbl Crude Oil release during winter months. Area swept is displayed in grey, surface oil droplets remaining at the end of the 10 day scenario are presented in black, and shoreline oiling is displayed in red.

B.4.5 Crude Oil Summer (June through November)

B.4.5.1 2500 Barrel Scenario (Unmitigated)

Figure B19: Unmitigated area swept results for the 95th percentile surface area oiled 2,500 bbl Crude Oil release during summer months. Area swept is displayed in grey, surface oil droplets remaining at the end of the 10 day scenario are presented in black, and shoreline oiling is displayed in red.

B.4.5.2 2500 Barrel Scenario (Mitigated)

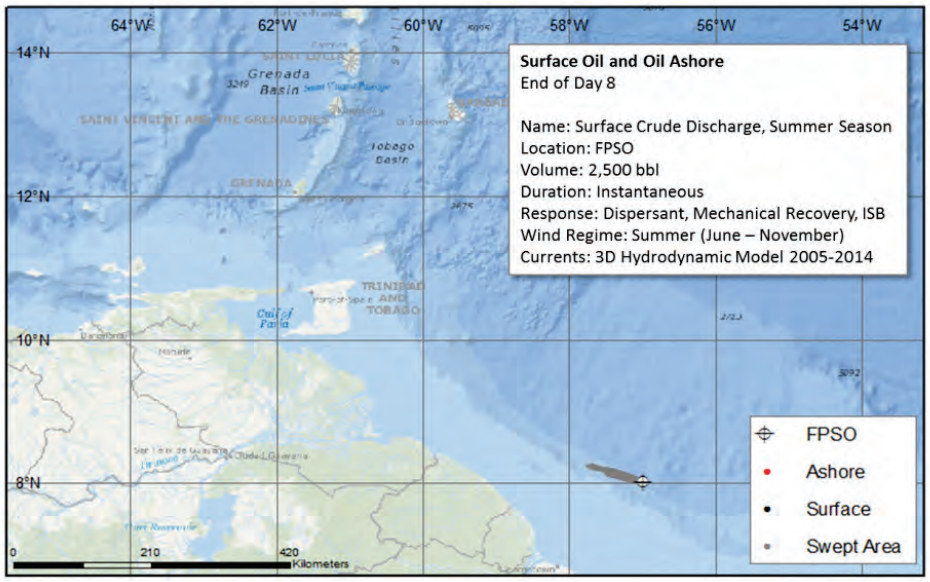


Figure B20: Mitigated area swept results for the 95th percentile shoreline area oiled 2,500 bbl Crude Oil release during summer months. Area swept is displayed in grey, no shoreline oiling occurred, and no surface oil remains.

B.4.6 Crude Oil Winter (December through May)

B.4.6.1 2500 Barrel Scenario (Unmitigated)

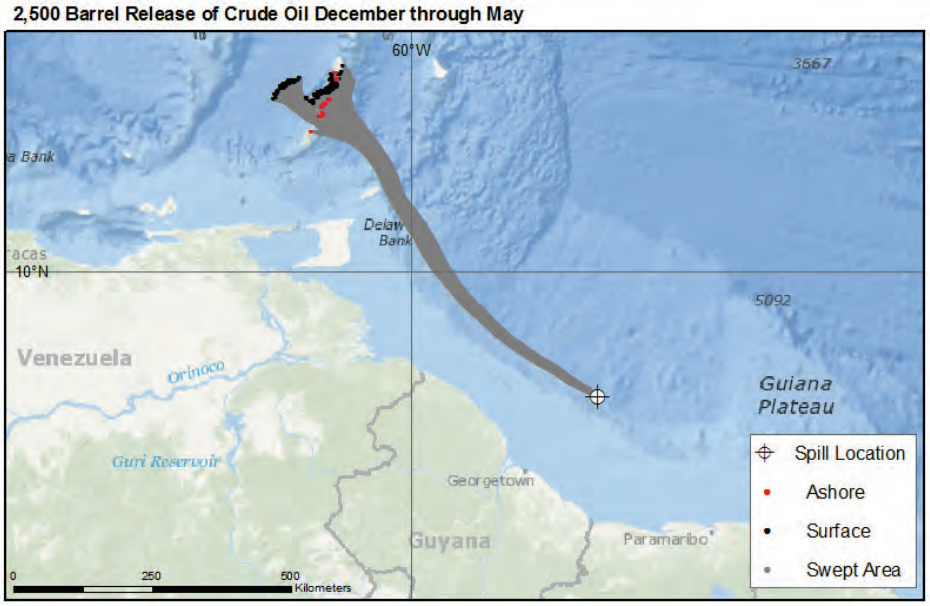


Figure B21: Unmitigated area swept results for the 95th percentile surface area oiled 2,500 bbl Crude Oil release during winter months. Area swept is displayed in grey, surface oil droplets remaining at the end of the 10 day scenario are presented in black, and shoreline oiling is displayed in red.

B.4.6.2 2500 Barrel Scenario (Mitigated)

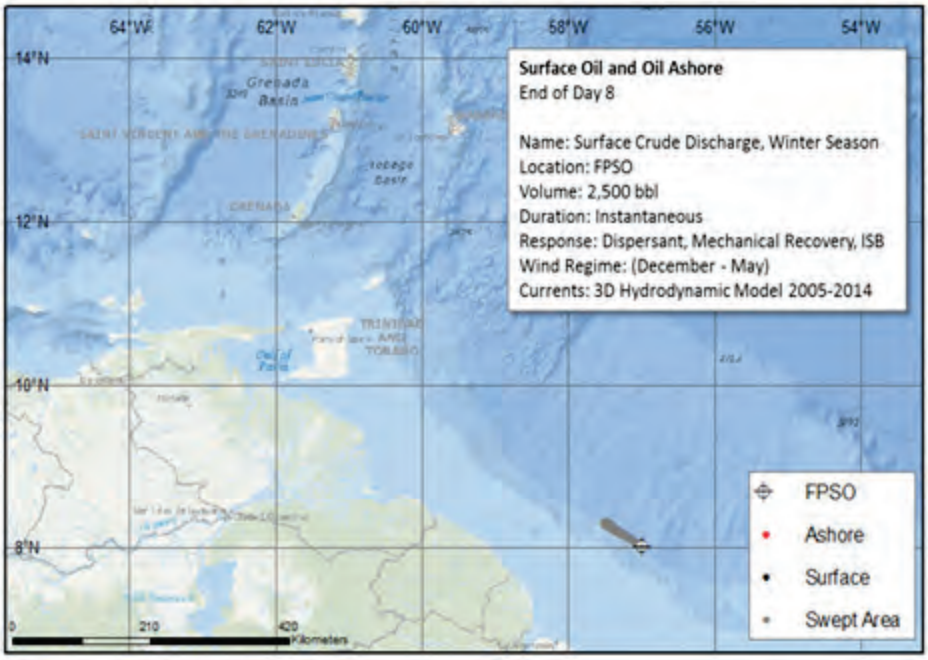


Figure B22: Mitigated area swept results for the 95th percentile shoreline area oiled 2,500 bbl Crude Oil release during winter months. Area swept is displayed in grey, no shoreline oiling occurred, and no surface oil remains.

B.4.7 Wellbore Fluids Summer (June through November)

B.4.7.1 20,000 Barrel Scenario (Unmitigated)

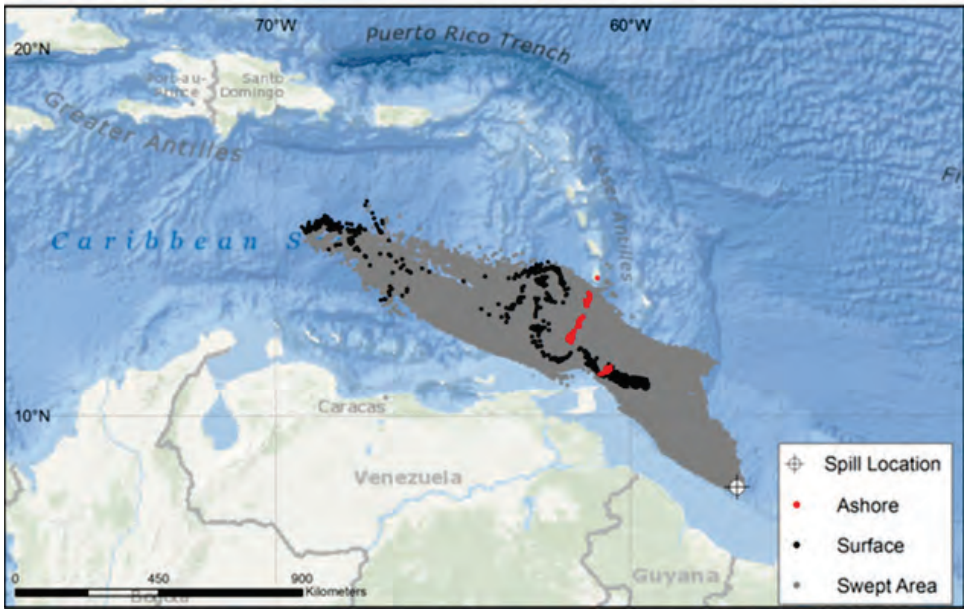


Figure B23: Unmitigated area swept results for the 95th percentile surface area oiled 20,000 bbl Wellbore Fluids per day release for 30 days during summer months. Area swept is displayed in grey, surface oil droplets remaining at the end of the 45 day scenario are presented in black, and shoreline oiling is displayed in red.

B.4.7.2 20,000 Barrel Scenario (Mitigated)

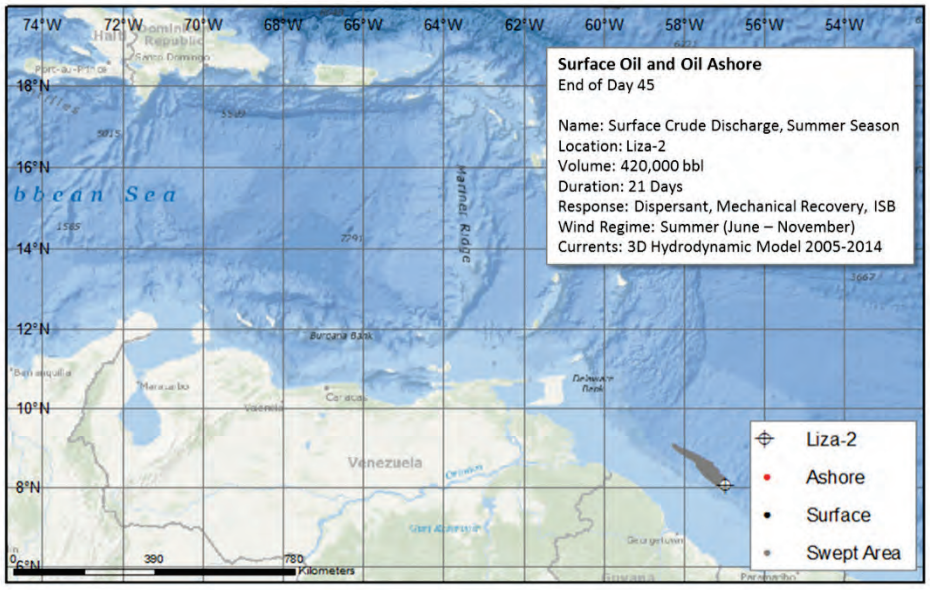


Figure B24: Mitigated area swept results for the 95th percentile shoreline area oiled 20,000 bbl Wellbore Fluids per day release for 21 days during summer months. Area swept is displayed in grey, no shoreline oiling occurred and no surface oil remains.

B.4.8 Wellbore Fluids Winter (December through May)

B.4.8.1 20,000 Barrel Scenario (Unmitigated)

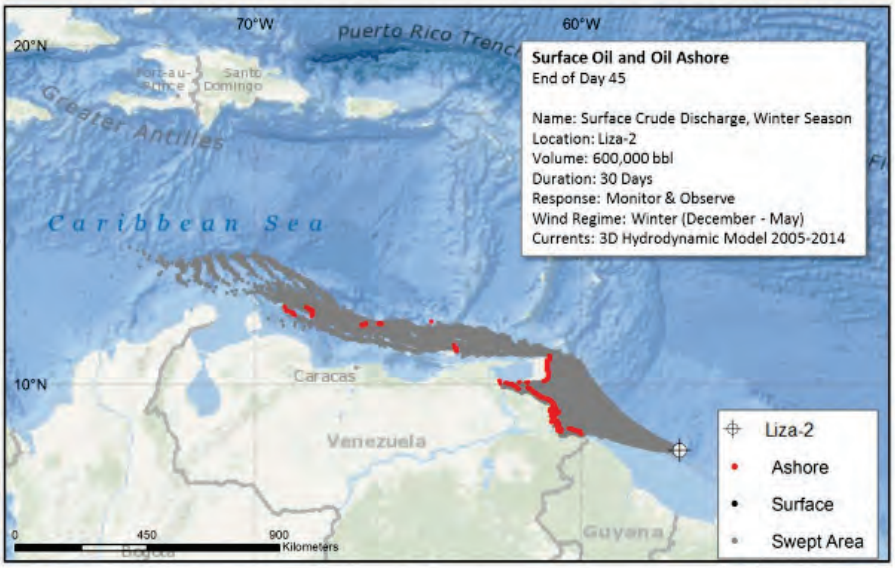


Figure B25: Unmitigated area swept results for the 95th percentile surface area oiled 20,000 bbl Wellbore Fluids per day release for 30 days during winter months. Area swept is displayed in grey, surface oil droplets remaining at the end of the 45 day scenario are presented in black, and shoreline oiling is displayed in red.

B.4.8.2 20,000 Barrel Scenario (Mitigated)

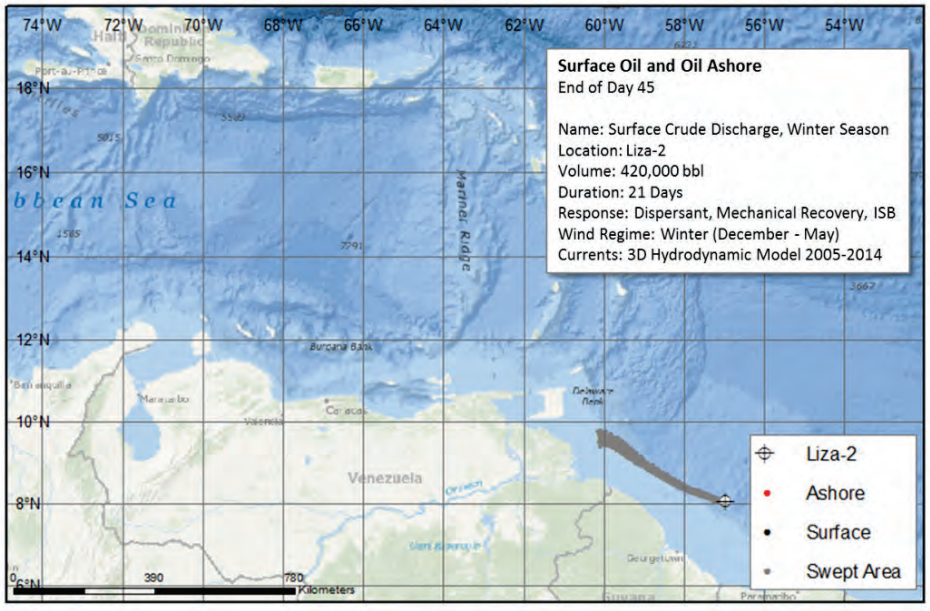
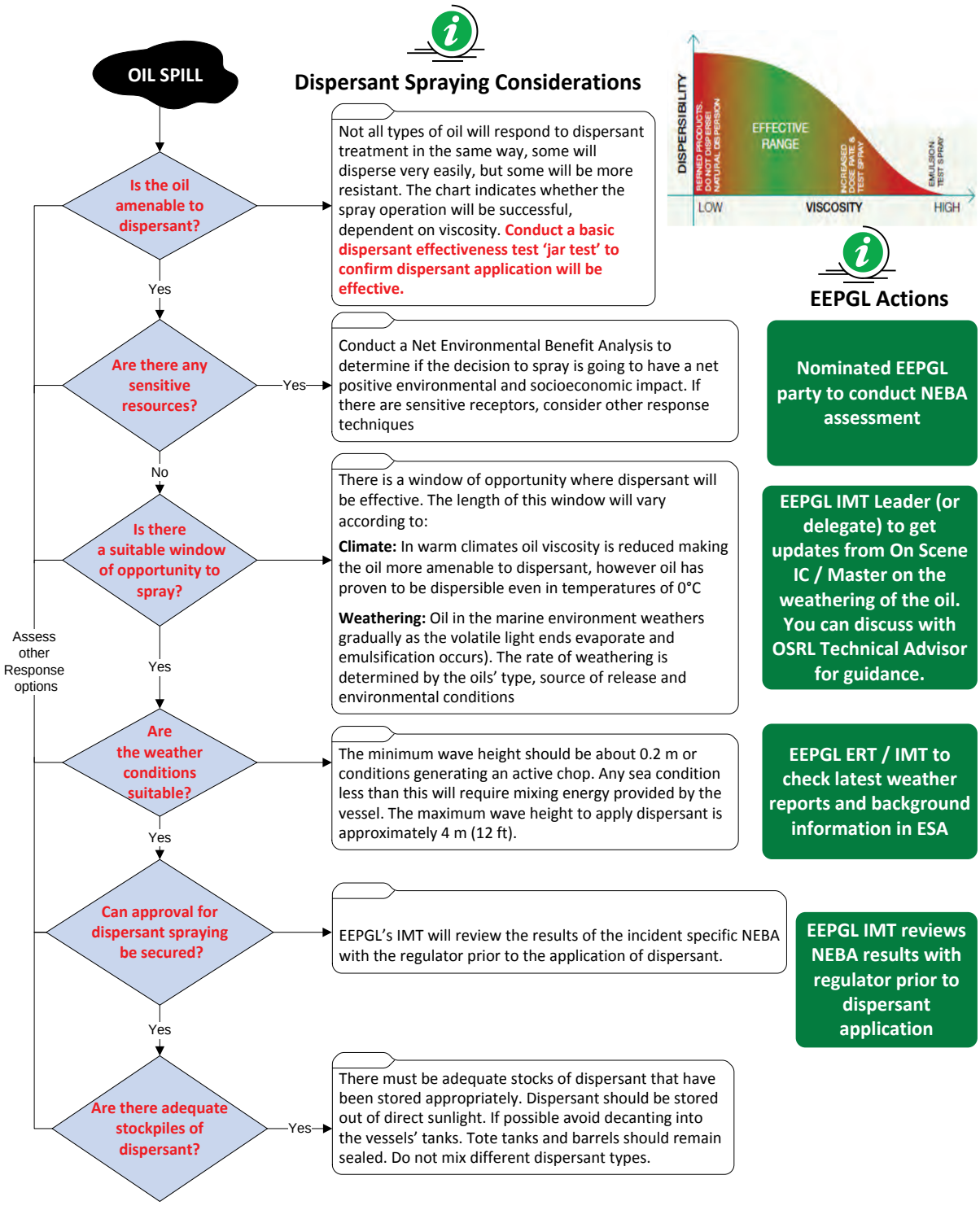


Figure B26: Mitigated area swept results for the 95th percentile shoreline area oiled 20,000 bbl Wellbore Fluids per day release for 21 days during winter months. Area swept is displayed in grey, no shoreline oiling occurred and no surface oil remains.

APPENDIX C - DISPERSANT SPRAYING CONSIDERATIONS



APPENDIX D – FORMS

D.1 Initial Spill Report Form

Complete prior to conversation with Guyana Authorities and other agencies.

Contact Details					
Reportee			Company		
Contact Number			Position		
Alt. Contact Number					
Spill Details					
Date / Time					
Installation	Name				
	Operator				
	Licence Holder				
	Response Primacy				
Hydrocarbon Spilled	Type				
	Name of Product				
Location of Spill	Latitude		Block		
	Longitude		Field		
Any Casualties / Damage to Installation			HSE been Advised?	YES I NO	
Source of Spill (If Known)					
Cause of Spill (If Known)					
Spill Quantity / Potential (If Known)	Quantity		Is it on going?	YES I NO	
	Potential				
Has Installation been Shut down and / or will Incident affect Production					
Appearance of Oil			Travel Direction of Spill (If Known)		
Possibility of Pollution reaching Shoreline / crossing Median Lines?	Where				
	Time				
Current Weather at Spill Location					
Wind Direction & Speed					
Sea State & Wave Height					

D.2 Safety Data Sheets for global dispersants

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MATERIAL SAFETY DATA SHEET

PRODUCT

COREXIT® 9500

EMERGENCY TELEPHONE NUMBER(S)
(800) 424-9300 (24 Hours) CHEMTREC

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME : **COREXIT® 9500**

APPLICATION : OIL SPILL DISPERSANT

COMPANY IDENTIFICATION : Nalco Energy Services, L.P.
P.O. Box 87
Sugar Land, Texas
77487-0087

EMERGENCY TELEPHONE NUMBER(S) : (800) 424-9300 (24 Hours) CHEMTREC

NFPA 704M/HMIS RATING
HEALTH : 1 / 1 FLAMMABILITY : 1 / 1 INSTABILITY : 0 / 0 OTHER :
0 = Insignificant 1 = Slight 2 = Moderate 3 = High 4 = Extreme

2. COMPOSITION/INFORMATION ON INGREDIENTS

Our hazard evaluation has identified the following chemical substance(s) as hazardous. Consult Section 15 for the nature of the hazard(s).

Hazardous Substance(s)	CAS NO	% (w/w)
Distillates, petroleum, hydrotreated light	64742-47-8	10.0 - 30.0
Propylene Glycol	57-55-6	1.0 - 5.0
Organic sulfonic acid salt	Proprietary	10.0 - 30.0

3. HAZARDS IDENTIFICATION

"EMERGENCY OVERVIEW"

WARNING
Combustible.
Keep away from heat. Keep away from sources of ignition - No smoking. Keep container tightly closed. Do not get in eyes, on skin, on clothing. Do not take internally. Avoid breathing vapor. Use with adequate ventilation. In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. After contact with skin, wash immediately with plenty of soap and water.
Wear suitable protective clothing.
Low Fire Hazard; liquids may burn upon heating to temperatures at or above the flash point. May evolve oxides of carbon (COx) under fire conditions. May evolve oxides of sulfur (SOx) under fire conditions.

PRIMARY ROUTES OF EXPOSURE :
Eye, Skin

HUMAN HEALTH HAZARDS - ACUTE :

EYE CONTACT :
May cause irritation with prolonged contact.

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SKIN CONTACT :
May cause irritation with prolonged contact.

INGESTION :
Not a likely route of exposure. Can cause chemical pneumonia if aspirated into lungs following ingestion.

INHALATION :
Repeated or prolonged exposure may irritate the respiratory tract.

SYMPTOMS OF EXPOSURE :
Acute :
A review of available data does not identify any symptoms from exposure not previously mentioned.
Chronic :
Frequent or prolonged contact with product may defat and dry the skin, leading to discomfort and dermatitis.

AGGRAVATION OF EXISTING CONDITIONS :
Skin contact may aggravate an existing dermatitis condition.

4. FIRST AID MEASURES

EYE CONTACT :
Immediately flush with plenty of water for at least 15 minutes. If symptoms develop, seek medical advice.

SKIN CONTACT :
Immediately wash with plenty of soap and water. If symptoms develop, seek medical advice.

INGESTION :
Do not induce vomiting: contains petroleum distillates and/or aromatic solvents. If conscious, washout mouth and give water to drink. Get medical attention.

INHALATION :
Remove to fresh air, treat symptomatically. Get medical attention.

NOTE TO PHYSICIAN :
Based on the individual reactions of the patient, the physician's judgement should be used to control symptoms and clinical condition.

5. FIRE FIGHTING MEASURES

FLASH POINT :	181.4 °F / 83 °C (PMCC)
LOWER EXPLOSION LIMIT :	Not flammable
UPPER EXPLOSION LIMIT :	Not flammable

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EXTINGUISHING MEDIA :
Alcohol foam, Carbon dioxide, Foam, Dry powder, Other extinguishing agent suitable for Class B fires, For large fires, use water spray or fog, thoroughly drenching the burning material.
Water mist may be used to cool closed containers.

UNSUITABLE EXTINGUISHING MEDIA :
Do not use water unless flooding amounts are available.

FIRE AND EXPLOSION HAZARD :
Low Fire Hazard; liquids may burn upon heating to temperatures at or above the flash point. May evolve oxides of carbon (COx) under fire conditions. May evolve oxides of sulfur (SOx) under fire conditions.

SPECIAL PROTECTIVE EQUIPMENT FOR FIRE FIGHTING :
In case of fire, wear a full face positive-pressure self contained breathing apparatus and protective suit.

6. ACCIDENTAL RELEASE MEASURES

PERSONAL PRECAUTIONS :
Restrict access to area as appropriate until clean-up operations are complete. Stop or reduce any leaks if it is safe to do so. Ventilate spill area if possible. Do not touch spilled material. Remove sources of ignition. Have emergency equipment (for fires, spills, leaks, etc.) readily available. Use personal protective equipment recommended in Section 8 (Exposure Controls/Personal Protection). Notify appropriate government, occupational health and safety and environmental authorities.

METHODS FOR CLEANING UP :
SMALL SPILLS: Soak up spill with absorbent material. Place residues in a suitable, covered, properly labeled container. Wash affected area. LARGE SPILLS: Contain liquid using absorbent material, by digging trenches or by diking. Reclaim into recovery or salvage drums or tank truck for proper disposal. Clean contaminated surfaces with water or aqueous cleaning agents. Contact an approved waste hauler for disposal of contaminated recovered material. Dispose of material in compliance with regulations indicated in Section 13 (Disposal Considerations).

ENVIRONMENTAL PRECAUTIONS :
Do not contaminate surface water.

7. HANDLING AND STORAGE

HANDLING :
Use with adequate ventilation. Keep the containers closed when not in use. Do not take internally. Do not get in eyes, on skin, on clothing. Have emergency equipment (for fires, spills, leaks, etc.) readily available.

STORAGE CONDITIONS :
Store away from heat and sources of ignition. Store separately from oxidizers. Store the containers tightly closed.

SUITABLE CONSTRUCTION MATERIAL :
Compatibility with Plastic Materials can vary; we therefore recommend that compatibility is tested prior to use.

Nalco Energy Services, L.P. P.O. Box 87 • Sugar Land, Texas 77487-0087 • (281)263-7000
For additional copies of an MSDS visit www.nalco.com and request access
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MATERIAL SAFETY DATA SHEET

PRODUCT

COREXIT® 9500

EMERGENCY TELEPHONE NUMBER(S)
(800) 424-9300 (24 Hours) CHEMTREC

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

OCCUPATIONAL EXPOSURE LIMITS :
Exposure guidelines have not been established for this product. Available exposure limits for the substance(s) are shown below.

ACGIH/TLV :
Substance(s)
Oil Mist — TWA: 5 mg/m3
STEL: 10 mg/m3

Propylene Glycol
OSHA/PEL :
Substance(s)
Oil Mist — TWA: 5 mg/m3
STEL: 10 mg/m3

Propylene Glycol
AIHA/WEEL :
Substance(s)

ENGINEERING MEASURES :
General ventilation is recommended.

RESPIRATORY PROTECTION :
Where concentrations in air may exceed the limits given in this section, the use of a half face filter mask or air supplied breathing apparatus is recommended. A suitable filter material depends on the amount and type of chemicals being handled. Consider the use of filter type: Multi-contaminant cartridge. with a Particulate pre-filter. In event of emergency or planned entry into unknown concentrations a positive pressure, full-facepiece SCBA should be used. If respiratory protection is required, institute a complete respiratory protection program including selection, fit testing, training, maintenance and inspection.

HAND PROTECTION :
Nitrile gloves, PVC gloves

SKIN PROTECTION :
Wear standard protective clothing.

EYE PROTECTION :
Wear chemical splash goggles.

HYGIENE RECOMMENDATIONS :
Keep an eye wash fountain available. Keep a safety shower available. If clothing is contaminated, remove clothing and thoroughly wash the affected area. Launder contaminated clothing before reuse.

HUMAN EXPOSURE CHARACTERIZATION :
Based on our recommended product application and personal protective equipment, the potential human exposure is: Low

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9. PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL STATE	Liquid
APPEARANCE	Clear Hazy Amber
ODOR	Hydrocarbon
SPECIFIC GRAVITY	0.95 @ 60 °F / 15.6 °C
DENSITY	7.91 lb/gal
SOLUBILITY IN WATER	Miscible
pH (100 %)	6.2
VISCOSITY	177 cps @ 32 °F / 0 °C 70 cps @ 60 °F / 15.6 °C @ 104 °F / 40 °C
VISCOSITY	@ 32 °F / 0 °C @ 60 °F / 15.6 °C 22.5 cst @ 104 °F / 40 °C
POUR POINT	< -71 °F / < -57 °C
BOILING POINT	296 °F / 147 °C
VAPOR PRESSURE	15.5 mm Hg @ 100 °F / 37.8 °C

Note: These physical properties are typical values for this product and are subject to change.

10. STABILITY AND REACTIVITY

STABILITY :
Stable under normal conditions.

HAZARDOUS POLYMERIZATION :
Hazardous polymerization will not occur.

CONDITIONS TO AVOID :
Heat

MATERIALS TO AVOID :
Contact with strong oxidizers (e.g. chlorine, peroxides, chromates, nitric acid, perchlorate, concentrated oxygen, permanganate) may generate heat, fires, explosions and/or toxic vapors.

HAZARDOUS DECOMPOSITION PRODUCTS :
Under fire conditions: Oxides of carbon, Oxides of sulfur

11. TOXICOLOGICAL INFORMATION

No toxicity studies have been conducted on this product.

SENSITIZATION :
This product is not expected to be a sensitizer.

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CARCINOGENICITY :
None of the substances in this product are listed as carcinogens by the International Agency for Research on Cancer (IARC), the National Toxicology Program (NTP) or the American Conference of Governmental Industrial Hygienists (ACGIH).

HUMAN HAZARD CHARACTERIZATION :
Based on our hazard characterization, the potential human hazard is: Moderate

12. ECOLOGICAL INFORMATION

ECOTOXICOLOGICAL EFFECTS :

The following results are for the product.

ACUTE INVERTEBRATE RESULTS :

Species	Exposure	LC50	EC50	Test Descriptor
Acartia tonsa	48 hrs	34 mg/l		Product
Artemia	48 hrs	20.7 mg/l		Product

MOBILITY :
The environmental fate was estimated using a level III fugacity model embedded in the EPI (estimation program interface) Suite TM , provided by the US EPA. The model assumes a steady state condition between the total input and output. The level III model does not require equilibrium between the defined media. The information provided is intended to give the user a general estimate of the environmental fate of this product under the defined conditions of the models. If released into the environment this material is expected to distribute to the air, water and soil/sediment in the approximate respective percentages;

Air	Water	Soil/Sediment
<5%	10 - 30%	50 - 70%

The portion in water is expected to float on the surface.

BIOACCUMULATION POTENTIAL
Component substances have a potential to bioconcentrate.

ENVIRONMENTAL HAZARD AND EXPOSURE CHARACTERIZATION
Based on our hazard characterization, the potential environmental hazard is: Low
Based on our recommended product application and the product's characteristics, the potential environmental exposure is: Low

If released into the environment, see CERCLA/SUPERFUND in Section 15.

13. DISPOSAL CONSIDERATIONS

If this product becomes a waste, it could meet the criteria of a hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA) 40 CFR 261. Before disposal, it should be determined if the waste meets the criteria of a hazardous waste.

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Hazardous Waste: D018

Hazardous wastes must be transported by a licensed hazardous waste transporter and disposed of or treated in a properly licensed hazardous waste treatment, storage, disposal or recycling facility. Consult local, state, and federal regulations for specific requirements.

14. TRANSPORT INFORMATION

The information in this section is for reference only and should not take the place of a shipping paper (bill of lading) specific to an order. Please note that the proper Shipping Name / Hazard Class may vary by packaging, properties, and mode of transportation. Typical Proper Shipping Names for this product are as follows.

LAND TRANSPORT :

For Packages Less Than Or Equal To 119 Gallons:

Proper Shipping Name :	PRODUCT IS NOT REGULATED DURING TRANSPORTATION

For Packages Greater Than 119 Gallons:

Proper Shipping Name :	COMBUSTIBLE LIQUID, N.O.S.
Technical Name(s) :	PETROLEUM DISTILLATES
UN/ID No :	NA 1993
Hazard Class - Primary :	COMBUSTIBLE
Packing Group :	III
Flash Point :	83 °C / 181.4 °F

AIR TRANSPORT (ICAO/IATA) :

Proper Shipping Name :	PRODUCT IS NOT REGULATED DURING TRANSPORTATION

MARINE TRANSPORT (IMDG/IMO) :

Proper Shipping Name :	PRODUCT IS NOT REGULATED DURING TRANSPORTATION

15. REGULATORY INFORMATION

NATIONAL REGULATIONS, USA :

OSHA HAZARD COMMUNICATION RULE, 29 CFR 1910.1200 :
Based on our hazard evaluation, the following substance(s) in this product is/are hazardous and the reason(s) is/are shown below.

Distillates, petroleum, hydrotreated light : Irritant
Propylene Glycol : Exposure Limit, Eye irritant
Organic sulfonic acid salt : Irritant

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CERCLA/SUPERFUND, 40 CFR 117, 302 :
Notification of spills of this product is not required.

SARA/SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT OF 1986 (TITLE III) - SECTIONS 302, 311, 312, AND 313 :

SECTION 302 - EXTREMELY HAZARDOUS SUBSTANCES (40 CFR 355) :
This product does not contain substances listed in Appendix A and B as an Extremely Hazardous Substance.

SECTIONS 311 AND 312 - MATERIAL SAFETY DATA SHEET REQUIREMENTS (40 CFR 370) :
Our hazard evaluation has found this product to be hazardous. The product should be reported under the following indicated EPA hazard categories:

X	Immediate (Acute) Health Hazard
-	Delayed (Chronic) Health Hazard
-	Fire Hazard
-	Sudden Release of Pressure Hazard
-	Reactive Hazard

Under SARA 311 and 312, the EPA has established threshold quantities for the reporting of hazardous chemicals. The current thresholds are: 500 pounds or the threshold planning quantity (TPQ), whichever is lower, for extremely hazardous substances and 10,000 pounds for all other hazardous chemicals.

SECTION 313 - LIST OF TOXIC CHEMICALS (40 CFR 372) :
This product does not contain substances on the List of Toxic Chemicals.

TOXIC SUBSTANCES CONTROL ACT (TSCA) :
The substances in this preparation are included on or exempted from the TSCA 8(b) Inventory (40 CFR 710)

FEDERAL WATER POLLUTION CONTROL ACT, CLEAN WATER ACT, 40 CFR 401.15 / formerly Sec. 307, 40 CFR 116.4 / formerly Sec. 311 :
None of the substances are specifically listed in the regulation.

CLEAN AIR ACT, Sec. 111 (40 CFR 60, Volatile Organic Compounds), Sec. 112 (40 CFR 61, Hazardous Air Pollutants), Sec. 602 (40 CFR 82, Class I and II Ozone Depleting Substances) :
None of the substances are specifically listed in the regulation.

Substance(s)	Citations
• Propylene Glycol	Sec. 111

CALIFORNIA PROPOSITION 65 :
This product does not contain substances which require warning under California Proposition 65.

MICHIGAN CRITICAL MATERIALS :
None of the substances are specifically listed in the regulation.

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STATE RIGHT TO KNOW LAWS :
The following substances are disclosed for compliance with State Right to Know Laws:

Propylene Glycol 57-55-6

NATIONAL REGULATIONS, CANADA :

WORKPLACE HAZARDOUS MATERIALS INFORMATION SYSTEM (WHMIS) :
This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR.

WHMIS CLASSIFICATION :
Not considered a WHMIS controlled product.

CANADIAN ENVIRONMENTAL PROTECTION ACT (CEPA) :
The substances in this preparation are listed on the Domestic Substances List (DSL), are exempt, or have been reported in accordance with the New Substances Notification Regulations.

16. OTHER INFORMATION

Due to our commitment to Product Stewardship, we have evaluated the human and environmental hazards and exposures of this product. Based on our recommended use of this product, we have characterized the product's general risk. This information should provide assistance for your own risk management practices. We have evaluated our product's risk as follows:

* The human risk is: Low

* The environmental risk is: Low

Any use inconsistent with our recommendations may affect the risk characterization. Our sales representative will assist you to determine if your product application is consistent with our recommendations. Together we can implement an appropriate risk management process.

This product material safety data sheet provides health and safety information. The product is to be used in applications consistent with our product literature. Individuals handling this product should be informed of the recommended safety precautions and should have access to this information. For any other uses, exposures should be evaluated so that appropriate handling practices and training programs can be established to insure safe workplace operations. Please consult your local sales representative for any further information.

REFERENCES

Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices, American Conference of Governmental Industrial Hygienists, OH., (Ariel Insight# CD-ROM Version), Ariel Research Corp., Bethesda, MD.

Hazardous Substances Data Bank, National Library of Medicine, Bethesda, Maryland (TOMES CPS# CD-ROM Version), Micromedex, Inc., Englewood, CO.

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IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Man, Geneva: World Health Organization, International Agency for Research on Cancer.

Integrated Risk Information System, U.S. Environmental Protection Agency, Washington, D.C. (TOMES CPS# CD-ROM Version), Micromedex, Inc., Englewood, CO.

Annual Report on Carcinogens, National Toxicology Program, U.S. Department of Health and Human Services, Public Health Service.

Title 29 Code of Federal Regulations, Part 1910, Subpart Z, Toxic and Hazardous Substances, Occupational Safety and Health Administration (OSHA), (Ariel Insight# CD-ROM Version), Ariel Research Corp., Bethesda, MD.

Registry of Toxic Effects of Chemical Substances, National Institute for Occupational Safety and Health, Cincinnati, OH, (TOMES CPS# CD-ROM Version), Micromedex, Inc., Englewood, CO.

Ariel Insight# (An integrated guide to industrial chemicals covered under major regulatory and advisory programs), North American Module, Western European Module, Chemical Inventories Module and the Generics Module (Ariel Insight# CD-ROM Version), Ariel Research Corp., Bethesda, MD.

The Teratogen Information System, University of Washington, Seattle, WA (TOMES CPS# CD-ROM Version), Micromedex, Inc., Englewood, CO.

Prepared By : Product Safety Department
Date issued : 08/14/2005
Version Number : 1.6

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TOTAL

MATERIAL SAFETY DATA SHEET

according to Regulation (EC) No. 1907/2006

SDS # : 30033

FINASOL OSR 51

Date of the previous version: 2012-09-12**** Revision Date: 2012-02-22 Version 1.01

1. IDENTIFICATION OF THE SUBSTANCE/MIXTURE AND OF THE COMPANY/UNDERTAKING

1.1. Product identifier

Product name	FINASOL OSR 51
Trade name	FINASOL OSR 51
Pure substance/mixture	Mixture

1.2. Relevant identified uses of the substance or mixture and uses advised against

Identified uses	dispersant.

1.3. Details of the supplier of the safety data sheet

Supplier	TOTAL FLUIDES 24, cours Michelet 92800 PUTEAUX FRANCE Tel: +33 (0)1 41 35 40 00 Fax: +33 (0)1 41 35 82 86

For further information, please contact

Contact Point	Service QSE : Tel : 01 41 35 33 64 / Fax : 01 41 35 33 50 Emergency number 24h/24h: +33 (0)1 41 35 65 00
E-mail Address	mfs.fds@total.com

1.4. Emergency telephone number

+33 1 49 00 00 49 (24h/24, 7d/7)
Official National Emergency Telephone Number or Poison Control Center Number
In France : - PARIS : Hôpital Fernand Widal 200, rue du Faubourg Saint-Denis 75475 Paris Cedex 10 , Tel : 01.40.05.48.48. - MARSEILLE : Hopital Salvator, 249 bd Ste Marguerite 13274 Marseille cedex 5, Tel : 04.91.75.25.25. - LYON : Hopital Hédouard Herriot, 5 place d'Arsonvil, 69437 Lyon cedex 3, Tel : 04.72.11.69.11. - NANCY : Hopital central, 29 Av du Mal De Lattre de Tassigny, 54000 Nancy, Tel : 03.83.32.36.36 ou le SAMU : Tel (15)

2. HAZARDS IDENTIFICATION

2.1. Classification of the substance or mixture

REGULATION (EC) No 1272/2008
For the full text of the H-Statements mentioned in this Section, see Section 2.2.

Classification

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Aspiration toxicity - Category 1 - H304
Serious eye damage/eye irritation - Category 1 - H318

DIRECTIVE 67/548/EEC or 1999/45/EC
For the full text of the R-phrases mentioned in this Section, see Section 16

Symbol(s)
Xn - Harmful
Classification
Xn;R65 - Xi;R41 - R66

2.2. Label elements

Labelled according to: REGULATION (EC) No 1272/2008

Signal Word
DANGER

Hazard Statements
H304 - May be fatal if swallowed and enters airways
H318 - Causes serious eye damage

Precautionary Statements
P305 + P351 + P338 - IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
P337 + P313 - If eye irritation persists: Get medical advice/attention
P280 - Wear protective gloves/ protective clothing/ eye protection/ face protection.
P301 + P310 - IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician
P331 - Do NOT induce vomiting

Supplemental Hazard Statements
EUH066 - Repeated exposure may cause skin dryness or cracking

2.3. Other hazards

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Physical-Chemical Properties Alkaline.
Combustible liquid.
Vapors may form explosive mixtures with air, at high temperatures.

Properties Affecting Health If swallowed accidentally, the product may enter the lungs due to its low viscosity and lead to the rapid development of very serious pulmonary lesions (medical survey during 48 hours) .

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.2. Mixture

Chemical Name	EC-No	REACH registration No:	CAS-No	Weight %	Classification (Dir. 67/548)	Classification (Reg. 1272/2008)
Hydrocarbons, C11-C14, n-alkanes, isoalkanes, cyclics, <2% aromatics	926-141-6	01-2119456620-43	*	60-70	Xn;R65 R66 ***	Asp. Tox. 1 (H304)
docusate sodium***	209-406-4	no data available	577-11-7	0.2-5	Xi;R38-41***	Skin Irrit. 2 (H315) Eye Dam. 1 (H318)

Additional information 15%-30% : Non-ionic surfactants
0.2%-5% : Anionic surfactants

For the full text of the R-phrases mentioned in this Section, see Section 16
For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1. Description of first-aid measures

General advice IN CASE OF SERIOUS OR PERSISTENT CONDITIONS, CALL A DOCTOR OR EMERGENCY MEDICAL CARE.

Eye contact Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes.

Skin contact Remove contaminated clothing and shoes. Wash off immediately with plenty of water for at least 15 minutes.

Inhalation In case of exposure to intense concentrations of vapours, fumes or spray, transport the person away from the contaminated zone, keep warm and allow to rest.

Ingestion If swallowed, do not induce vomiting - seek medical advice.
Risk of product entering the lungs on vomiting after ingestion. In this case, the casualty should be sent immediately to hospital.

Protection of First-aiders Use personal protective equipment.

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4.2. Most important symptoms and effects, both acute and delayed

Eye contact	Risk of serious damage to eyes.
Skin contact	Repeated exposure may cause skin dryness or cracking.
Inhalation	The inhalation of vapours or aerosols may be irritating for the respiratory tract and for mucous membranes.
Ingestion	Harmful: if swallowed accidentally, the product may enter the lungs due to its low viscosity and lead to the rapid development of very serious inhalation pulmonary lesions (medical survey during 48 hours). Ingestion may cause gastrointestinal irritation, nausea, vomiting and diarrhea. May cause central nervous system depression.

4.3. Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician	Treat symptomatically.

5. FIRE-FIGHTING MEASURES

5.1. Extinguishing media

Suitable Extinguishing Media	Foam. Dry powder. Carbon dioxide (CO_2). Water spray.
Unsuitable Extinguishing Media	Do not use a solid water stream as it may scatter and spread fire.

5.2. Special hazards arising from the substance or mixture

Special Hazard	Incomplete combustion and thermolysis may produce gases of varying toxicity such as carbon monoxide, carbon dioxide, various hydrocarbons, aldehydes and soot. These may be highly dangerous if inhaled in confined spaces or at high concentration.

5.3. Advice for fire-fighters

Special protective equipment for fire-fighters	In case of a large fire or in confined or poorly ventilated spaces, wear full fire resistant protective clothing and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.
Other information	Cool containers / tanks with water spray. Fire residues and contaminated fire extinguishing water must be disposed of in accordance with local regulations.

6. ACCIDENTAL RELEASE MEASURES

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6.1. Personal precautions, protective equipment and emergency procedures

General Information	Use personal protective equipment. Evacuate non-essential personnel. Ensure adequate ventilation, especially in confined areas. ELIMINATE all ignition sources (no smoking, flares, sparks or flames in immediate area). Do not touch or walk through spilled material.

6.2. Environmental precautions

General Information	Prevent further leakage or spillage if safe to do so. Dike to collect large liquid spills. The product should not be allowed to enter drains, water courses or the soil. Local authorities should be advised if significant spillages cannot be contained.

6.3. Methods and materials for containment and cleaning up

Methods for cleaning up	Soak up with inert absorbent material. Keep in suitable, closed containers for disposal. Following product recovery, flush area with water.

6.4. Reference to other sections

Personal Protective Equipment	See Section 8 for more detail.
Waste treatment	See section 13
Other information	Remove all sources of ignition.

7. HANDLING AND STORAGE

7.1. Precautions for safe handling

Advice on safe handling	For personal protection see section 8. Use only in well-ventilated areas. Do not breathe vapors or spray mist. Avoid contact with skin and eyes.
Technical measures	Ensure adequate ventilation.
Prevention of fire and explosion	Handle away from any source of ignition (open flame and sparks) and heat (hot manifolds or casings). Design installations (machinery and equipment) to prevent burning product from spreading (tanks, retention systems, interceptors (traps) in drainage systems). Take precautionary measures against static discharges.

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Hygiene measures	Ensure the application of strict rules of hygiene by the personnel exposed to the risk of contact with the product. When using, do not eat, drink or smoke. Do not dry hands with rags that have been contaminated with product.

7.2. Conditions for safe storage, including any incompatibilities

Technical measures/Storage conditions	Keep away from heat. Keep at temperatures between 5 and 35 °C. Use only containers, seals, pipes, etc... made in a material suitable for use with aromatic hydrocarbons.
Materials to Avoid	Strong acids. Oxidizing agents.
Packaging material	Keep only in the original container or in a suitable container for this kind of product: steel , Stainless steel.

7.3. Specific end uses

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1. Control parameters

Exposure limits	Ingredients with workplace control parameters
Legend	See section 16

DNEL Worker (Industrial/Professional)

Chemical Name	Short term, systemic effects	Short term, local effects	Long term, systemic effects	Long term, local effects
docusate sodium*** 577-11-7			31.3 mg/kg bw/day (dermal) 44.1 mg/m³ (inhalation)	

DNEL General population

Chemical Name	Short term, systemic effects	Short term, local effects	Long term, systemic effects	Long term, local effects
docusate sodium*** 577-11-7			18.6 mg/kg bw/day (dermal) 13 mg/m³ (inhalation) 18.8 mg/kg bw/day (oral)	

Predicted No Effect Concentration (PNEC)

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Chemical Name	Water	Sediment	Soil	Air	STP	Oral
docusate sodium*** 577-11-7	0.0066 mg/l (fw) 0.00066 mg/l (mw) 0.066 mg/l (or)	0.653 mg/kg dw (fw) 0.0653 mg/kg dw (mw)	0.138 mg/kg dw		122 mg/l	

8.2. Exposure controls

Occupational Exposure Controls

Engineering Measures Apply technical measures to comply with the occupational exposure limits.

Personal Protective Equipment

General Information These recommendations apply to the product as supplied.
If the product is used in mixtures, it is recommended that you contact the appropriate protective equipment suppliers.

Respiratory protection When workers are facing concentrations above the exposure limit they must use appropriate certified respirators.

Eye Protection Safety glasses with side-shields.
If splashes are likely to occur, wear:. Face-shield.

Skin and body protection Wear suitable protective clothing. Protective shoes or boots.

Hand Protection Hydrocarbon-proof gloves.
Please observe the instructions regarding permeability and breakthrough time which are provided by the supplier of the gloves. Also take into consideration the specific local conditions under which the product is used, such as the danger of cuts, abrasion.

Environmental exposure controls

General Information None in normal conditions.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1. Information on basic physical and chemical properties

Color	dark brown To black
Physical State @20°C	liquid
Odor	Petroleum solvent

Property	Values	Remarks	Method
pH	6.5 - 8.5		ASTM D 1172
pH (as aqueous solution)	8	solution (10 %)	ASTM D 1172

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Boiling point/boiling range	180 - 240 °C 356 - 464 °F		
Flash point	>= 65 °C >= 149 °F		ISO 2719 ISO 2719
Evaporation rate		No information available	
Flammability Limits in Air		No information available	
Vapor Pressure		No information available	
Vapor density		No information available	
Density	865 - 885 kg/m³	@ 20 °C	ISO 12185
Water solubility		No information available	
Solubility in other solvents		No information available	
logPow		Not applicable	
Autoignition temperature		No information available	
Viscosity, kinematic	7 - mm2/s	@ 40 °C	ISO 3104
Explosive properties	Not explosive		
Oxidizing Properties	No information available		
Possibility of hazardous reactions	No data available		

9.2. Other information

10. STABILITY AND REACTIVITY

10.1. Reactivity

10.2. Chemical stability

Stability: Stable under recommended storage conditions.

10.3. Possibility of hazardous reactions

Hazardous Reactions: None under normal processing.

10.4. Conditions to Avoid

Conditions to Avoid: Heat, flames and sparks. Take precautionary measures against static discharges.

10.5. Incompatible Materials

Materials to Avoid: Strong acids. Oxidizing agents.

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10.6. Hazardous Decomposition Products

Hazardous Decomposition Products Incomplete combustion and thermolysis may produce gases of varying toxicity such as carbon monoxide, carbon dioxide, various hydrocarbons, aldehydes and soot.

11. TOXICOLOGICAL INFORMATION

11.1. Information on toxicological effects

Acute toxicity Local effects Product Information***

Skin contact: Repeated exposure may cause skin dryness or cracking.

Eye contact: Risk of serious damage to eyes.

Inhalation: Not classified.
The inhalation of vapours or aerosols may be irritating for the respiratory tract and for mucous membranes.

Ingestion: Harmful: if swallowed accidentally, the product may enter the lungs due to its low viscosity and lead to the rapid development of very serious inhalation pulmonary lesions (medical survey during 48 hours).
Ingestion may cause gastrointestinal irritation, nausea, vomiting and diarrhea.
May cause central nervous system depression.

Acute toxicity Component Information

Chemical Name	LD50 Oral	LD50 Dermal	LC50 Inhalation
Hydrocarbons, C11-C14, n-alkanes, isoalkanes, cyclics, <2% aromatics	LD50 > 5000 mg/kg bw (rat - OECD 401)	LD50 (24h) > 5000 mg/kg bw (rabbit - OECD 402)	LC50 (8h) > 5000 mg/m³ (vapour) (rat - OECD 403)
docusate sodium***	> 2100 mg/kg (Rat)	> 10000 mg/kg (Rabbit)	

Sensitization

Sensitization: Not classified as a sensitizer.

Specific effects

Carcinogenicity: Contains no ingredient listed as a carcinogen.

Mutagenicity: Contains no ingredient listed as a mutagen.

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Reproductive toxicity	Contains no ingredient listed as toxic to reproduction.
Repeated Dose Toxicity	
Target Organ Effects (STOT)	
Specific target organ systemic toxicity (single exposure)	No known effect based on information supplied.
Specific target organ systemic toxicity (repeated exposure)	No known effect based on information supplied.
Aspiration toxicity	The fluid can enter the lungs and cause damage (chemical pneumonitis, potentially fatal).
Other information	
Other adverse effects	Frequent or prolonged skin contact destroys the lipoacid cutaneous layer and may cause dermatitis.

12. ECOLOGICAL INFORMATION

12.1. Toxicity

Acute aquatic toxicity Product Information

Acute aquatic toxicity Component Information

Chemical Name	Toxicity to algae	Toxicity to daphnia and other aquatic invertebrates	Toxicity to fish	Toxicity to microorganisms
Hydrocarbons, C11-C14, n-alkanes, isoalkanes, cyclics, <2% aromatics	ErL50 (72h) > 1000 mg/l (Pseudokirchneriella subcapitata - OECD 201) EbL50 (72h) > 1000 mg/l (Pseudokirchneriella subcapitata - OECD 201) NOELR (72h) = 1000 mg/l (Pseudokirchneriella subcapitata - biomass - OECD 201) NOELR (72h) = 1000 mg/l (Pseudokirchneriella subcapitata - growth rate - OECD 201)	EL50 (48h) > 1000 mg/l (Daphnia magna - OECD 202)	LL50 (96h) > 1000 mg/l (Oncorhynchus mykiss - OECD 203)	
docusate sodium*** 577-11-7		EC50 (48h) = 6.6 mg/l Daphnia magna	LC50 (96h) = 49 mg/l Brachydanio rerio (semi-static)	

Chronic aquatic toxicity Product Information

Version EU

TOTAL

SDS # : 30033

FINASOL OSR 51

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Chronic aquatic toxicity Component Information

Chemical Name	Toxicity to algae	Toxicity to daphnia and other aquatic invertebrates	Toxicity to fish	Toxicity to microorganisms
Hydrocarbons, C11-C14, n-alkanes, Isoalkanes, cyclics, <2% aromatics		NOELR (21d) = 1,22 mg/l (Daphnia magna - QSAR Petrotox)	NOELR (28d) = 0,17 mg/l (Oncorhynchus mykiss - QSAR Petrotox)	

Effects on terrestrial organisms
No information available.

12.2. Persistence and degradability

General Information
For : Hydrocarbons, C11-C14, n-alkanes, Isoalkanes, cyclics, <2% aromatics.

Biodegradation						
Type:	Method	Sampling time	Specific effects	Values	Unit	Biodegradability
	OECD 301 F	28, days		69	%	Readily biodegradable

12.3. Bioaccumulative potential

Product Information The potential for bioaccumulation of the product in the environment is very low.

logPow Not applicable
Component Information No information available.

12.4. Mobility in soil

Soil Given its physical and chemical characteristics, the product is generally mobile in the ground.

Air The product evaporates readily.

Water soluble.

12.5. Results of PBT and vPvB assessment

PBT and vPvB assessment This product contains no substance considered as PBT and/or vPvB according to REACH regulation annex XIII criteria.

12.6. Other adverse effects

TOTAL

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General Information	No information available.

13. DISPOSAL CONSIDERATIONS

13.1. Waste treatment methods

Waste from Residues / Unused Products	Dispose of in accordance with the European Directives on waste and hazardous waste.
Contaminated packaging	Empty containers should be taken to an approved waste handling site for recycling or disposal. Empty containers may contain flammable or explosive vapors.
EWC Waste Disposal No.	According to the European Waste Catalogue, Waste Codes are not product specific, but application specific. Waste codes should be assigned by the user based on the application for which the product was used.

14. TRANSPORT INFORMATION

ADR/RID	Not regulated
IMDG/IMO	Not regulated
ICAO/IATA	Not regulated

ADN

UN/ID No	UN9003
Proper shipping name	Substances with a flash-point above 60 degrees C and not more than 100 degrees C
Proper shipping name	SUBSTANCES WITH A FLASH POINT ABOVE 60°C AND NOT MORE THAN 100°C
Hazard class	9
Description	UN9003, SUBSTANCES WITH A FLASH-POINT ABOVE 60 DEGREES C AND NOT MORE THAN 100 DEGREES C (Hydrocarbons, C11-C14, n-alkanes, isoalkanes, cyclics, < 2% aromatics), 9, MIXTURE

15. REGULATORY INFORMATION

15.1. Safety, health and environmental regulations/legislation specific for the substance or mixture

European Union

TOTAL

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Take note of Directive 98/24/EC on the protection of the health and safety of workers from the risks related to chemical agents at work

International Inventories

Related CAS	Hydrocarbons, C11-C14, n-alkanes, isoalkanes, cyclics, <2% aromatics 64742-47-8
EINECS/ELINCS	-
TSCA	-
DSL	-
ENCS	-
IECSC	-
KECL	-
PICCS	-
AICS	-
NZIoC	-

Legend
EINECS/ELINCS - European Inventory of Existing Commercial Chemical Substances/EU List of Notified Chemical Substances
TSCA - United States Toxic Substances Control Act Section 8(b) Inventory
DSL/NDSL - Canadian Domestic Substances List/Non-Domestic Substances List
ENCS - Japan Existing and New Chemical Substances
IECSC - China Inventory of Existing Chemical Substances
KECL - Korean Existing and Evaluated Chemical Substances
PICCS - Philippines Inventory of Chemicals and Chemical Substances
AICS - Australian Inventory of Chemical Substances
NZIoC - New Zealand Inventory of Chemicals

Further information

15.2. Chemical Safety Assessment

Chemical Safety Assessment Not applicable

16. OTHER INFORMATION

Full text of R-phrases referred to under sections 2 and 3
R41 - Risk of serious damage to eyes
R65 - Harmful: may cause lung damage if swallowed

Full text of H-Statements referred to under section 2 and 3
H304 - May be fatal if swallowed and enters airways
H318 - Causes serious eye damage

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Abbreviations, acronyms
bw = body weight
bw/day = body weight/day
dw = dry weight
mw = marine water
fw = fresh water

Legend Section 8

*	Sensitizer	°	Skin designation
**	Hazard Designation	C:	Carcinogen
M:	Mutagen	R:	Toxic to reproduction

Revision Date: 2012-02-22
Revision Note (M)SDS sections updated: 3. ***
This safety data sheet complies with the requirements of Regulation (EC) No. 1907/2006

This safety data sheet serves to complete but not to replace the technical product sheets. The information contained herein is given in good faith and is accurate to the best of knowledge at the date indicated above.It is understood by the user that any use of the product for purposes other than those for which it was designed entails potential risk.The information given herein in no way dispenses the user from knowing and applying all provisions regulating his activity.The user bears sole liability for the precautions required when using the product.The regulatory texts indicated herein are intended to aid the user to fulfil his obligations. This list is not to be considered complete and exhaustive.It is the user's responsibility to ensure that he is subject to no other obligations than those mentioned.

End of the safety data sheet

DASIC INTERNATIONAL LTD

SAFETY DATA SHEET

Slickgone NS

Revision 2
Revision date 16-Apr-2009

1. IDENTIFICATION OF THE SUBSTANCE / PREPARATION AND THE COMPANY

Product name	Slickgone NS
Description	Internationally approved dispersant for treating marine oil spills.
Company	Dasic International Ltd Wincheeter Hill Romsey Hampshire SO51 7YD UK www.dasicinter.com
Telephone	+44 (0)1794 512419
Fax	+44 (0)1794 522346
Emergency telephone number	+44 (0)1794 512419

2. HAZARDS IDENTIFICATION.

Main hazards The product is classified as non hazardous. May cause degreasing of the skin. May cause irritation to eyes.

3. COMPOSITION / INFORMATION ON INGREDIENTS.

Hazardous Ingredients

	Conc.	CAS	EINECS	Symbols/Risk phrases
Kerosine - odourless - distillates (petroleum), hydrotreated light	60-70%	64742-47-8	265-149-8	Xn; R65
Sodium dioctylsulphosuccinate	1-10%	577-11-7		Xi;R36 Xi;R38

4. FIRST AID MEASURES

Skin contact	Remove contaminated clothing. Wash with water. Seek medical attention if irritation or symptoms persist. Wash all contaminated clothing before reuse.
Eye contact	Rinse immediately with plenty of water for 15 minutes holding the eyelids open. Contact lenses should be removed. Seek medical attention.
Inhalation	Move the exposed person to fresh air. Seek medical attention if irritation or symptoms persist.
Ingestion	DO NOT INDUCE VOMITING. Rinse mouth thoroughly. Drink 1 to 2 glasses of water. Seek medical attention.
General information	Potential for aspiration if swallowed.

5. FIRE FIGHTING MEASURES

Extinguishing media	Alcohol resistant foam, Carbon dioxide (CO2) Dry chemical. Do NOT use water jet. Cool fire exposed containers with waterspray.
Fire hazards	Burning produces irritating, toxic and obnoxious fumes.
Protective equipment	In case of fire and/or explosion do not breathe fumes. Self-contained breathing apparatus.

Slickgone NS

Revision 2
Revision date 16-Apr-2009

6. ACCIDENTAL RELEASE MEASURES

Personal precautions	Wear suitable protective equipment. See section 8 for further information.
Environmental precautions	Prevent further spillage if safe. Do not allow product to enter drains. Do not flush into surface water. Do not let product contaminate subsoil. Advise local authorities if large spills cannot be contained.
Clean up methods	Absorb with inert, absorbent material. Transfer to suitable, labelled containers for disposal. Contact a licensed waste disposal company. Clean spillage area thoroughly with plenty of water.

7. HANDLING AND STORAGE

Handling	Wear protective clothing. See section 8 for further information.
Storage	Keep out of the reach of children. Avoid contact with: strong oxidising agents. Keep in a cool, dry, well ventilated area.
Suitable packaging	Store in original container.
Specific use	Obtain special instructions from the supplier.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Exposure limits

Kerosine - odourless - distillates (petroleum), hydrotreated light	WEL 8-hr limit ppm:	WEL 8-hr limit mg/m3: 1000
	WEL 15 min limit ppm:	WEL 15 min limit mg/m3:

Engineering measures	Ensure adequate ventilation of the working area.
Respiratory protection	Not normally required. Wear suitable respiratory equipment when necessary. For short periods of work a combination of charcoal filter and particulate filter is suitable.
Hand protection	Chemical resistant gloves (PVC)
Eye protection	Approved safety goggles. Provide eye wash station.
Protective equipment	Apron (Plastic or rubber) Rubber boots.

9. PHYSICAL AND CHEMICAL PROPERTIES

Description	Viscous liquid.
Colour	Brown.
Odour	Mild.
Boiling point	192°C
Flash point	72°C
Relative density	0.87
Water solubility	slightly miscible in water.
Viscosity	Flow Time in 3mm ISO cup (ISO 2431) - 40

10. STABILITY AND REACTIVITY

Stability	Stable under normal conditions.
Conditions to avoid	Burning produces irritating, toxic and obnoxious fumes.
Materials to avoid	Strong oxidising agents.

Slickgone NS

Revision 2
Revision date 16-Apr-2009

11. TOXICOLOGICAL INFORMATION

Acute toxicity	Ingestion may cause nausea and vomiting.
Corrosivity	May cause irritation to eyes. May cause degreasing of the skin. Potential for aspiration if swallowed.
Repeated or prolonged exposure	Repeated or prolonged exposure may cause dermatitis.
Mutagenic effects	No mutagenic effects reported.
Carcinogenic effects	No carcinogenic effects reported.
Reproductive toxicity	No teratogenic effects reported.

12. ECOLOGICAL INFORMATION

Degradability	The surfactant(s) contained in this preparation complies(comply) with the biodegradability criteria as laid down in Regulation (EC) No.648/2004 on detergents. Data to support this assertion are held at the disposal of the competent authorities of the Member States and will be made available to them, at their direct request or at the request of a detergent manufacturer.
Bioaccumulation	Does not bioaccumulate.

13. DISPOSAL CONSIDERATIONS

General Information	Dispose of as special waste in compliance with local and national regulations.
Disposal of packaging	Dispose of in compliance with all local and national regulations.

14. TRANSPORT INFORMATION

Further information	The product is not classifed as dangerous for carriage.

15. REGULATORY INFORMATION

16. OTHER INFORMATION

Text of risk phrases in Section 3.	R36 - Irritating to eyes. R38 - Irritating to skin. R65 - Harmful: may cause lung damage if swallowed.

NALCO Environmental Solutions LLC

SAFETY DATA SHEET

PRODUCT

COREXIT® EC9527A

EMERGENCY TELEPHONE NUMBER(S)
(800) 424-9300 (24 Hours) CHEMTREC

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME : **COREXIT® EC9527A**

APPLICATION : OIL SPILL DISPERSANT

COMPANY IDENTIFICATION : Nalco Environmental Solutions LLC
7705 Highway 90-A
Sugar Land, Texas
77478

EMERGENCY TELEPHONE NUMBER(S) : (800) 424-9300 (24 Hours) CHEMTREC

NFPA 704M/HMIS RATING
HEALTH : 2 / 2* FLAMMABILITY : 1 / 1 INSTABILITY : 0 / 0 OTHER :
0 = Insignificant 1 = Slight 2 = Moderate 3 = High 4 = Extreme * = Chronic Health Hazard

2. COMPOSITION/INFORMATION ON INGREDIENTS

Our hazard evaluation has identified the following chemical substance(s) as hazardous. Consult Section 15 for the nature of the hazard(s).

Hazardous Substance(s)	CAS NO	% (w/w)
2-Butoxyethanol	111-76-2	30.0 - 60.0
Organic sulfonic acid salt	Proprietary	10.0 - 30.0
Propylene Glycol	57-55-6	1.0 - 5.0

3. HAZARDS IDENTIFICATION

****EMERGENCY OVERVIEW****

WARNING
Can be an eye and skin irritant. Repeated or excessive exposure to butoxyethanol may cause injury to red blood cells (hemolysis), kidney or the liver. Harmful by inhalation, in contact with skin or if swallowed.
Do not get in eyes, on skin or on clothing. Do not take internally. Use with adequate ventilation. Wear suitable protective clothing. Keep container tightly closed. Flush affected area with water. Keep away from heat. Keep away from sources of ignition - No smoking.
May evolve oxides of carbon (COx) under fire conditions.

PRIMARY ROUTES OF EXPOSURE :
Eye, Skin

HUMAN HEALTH HAZARDS - ACUTE :

EYE CONTACT :
Can cause irritation.

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PRODUCT

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SKIN CONTACT :
Can cause moderate irritation. Harmful if absorbed through skin.

INGESTION :
May be harmful if swallowed. May cause liver and kidney effects and/or damage. There may be irritation to the gastro-intestinal tract.

INHALATION :
Harmful by inhalation. Repeated or prolonged exposure may irritate the respiratory tract.

SYMPTOMS OF EXPOSURE :
Acute :
Excessive exposure may cause central nervous system effects, nausea, vomiting, anesthetic or narcotic effects.
Chronic :
Repeated or excessive exposure to butoxyethanol may cause injury to red blood cells (hemolysis), kidney or the liver.

AGGRAVATION OF EXISTING CONDITIONS :
Skin contact may aggravate an existing dermatitis condition.

HUMAN HEALTH HAZARDS - CHRONIC :
Contains ethylene glycol monobutyl ether (butoxyethanol). Prolonged and/or repeated exposure through inhalation or extensive skin contact with EGBE may result in damage to the blood and kidneys.

4. FIRST AID MEASURES

EYE CONTACT :
Flush affected area with water. Get medical attention.

SKIN CONTACT :
Flush affected area with water. Get medical attention.

INGESTION :
Do not induce vomiting without medical advice. If conscious, washout mouth and give water to drink. Get medical attention.

INHALATION :
Remove to fresh air, treat symptomatically. If symptoms develop, seek medical advice.

NOTE TO PHYSICIAN :
Based on the individual reactions of the patient, the physician's judgement should be used to control symptoms and clinical condition.

5. FIRE FIGHTING MEASURES

FLASH POINT : 163 °F / 72.7 °C (TCC)

This product does not sustain combustion per the method outlined in 49 CFR Appendix H.

NALCO Environmental Solutions LLC

SAFETY DATA SHEET

PRODUCT

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EXTINGUISHING MEDIA :
This product would not be expected to burn unless all the water is boiled away. The remaining organics may be ignitable. Use extinguishing media appropriate for surrounding fire.

FIRE AND EXPLOSION HAZARD :
May evolve oxides of carbon (COx) under fire conditions.

SPECIAL PROTECTIVE EQUIPMENT FOR FIRE FIGHTING :
In case of fire, wear a full face positive-pressure self contained breathing apparatus and protective suit.

6. ACCIDENTAL RELEASE MEASURES

PERSONAL PRECAUTIONS :
Restrict access to area as appropriate until clean-up operations are complete. Stop or reduce any leaks if it is safe to do so. Do not touch spilled material. Ventilate spill area if possible. Use personal protective equipment recommended in Section 8 (Exposure Controls/Personal Protection).

METHODS FOR CLEANING UP :
SMALL SPILLS: Soak up spill with absorbent material. Place residues in a suitable, covered, properly labeled container. Wash affected area. LARGE SPILLS: Contain liquid using absorbent material, by digging trenches or by diking. Reclaim into recovery or salvage drums or tank truck for proper disposal. Contact an approved waste hauler for disposal of contaminated recovered material. Dispose of material in compliance with regulations indicated in Section 13 (Disposal Considerations).

ENVIRONMENTAL PRECAUTIONS :
Do not contaminate surface water.

7. HANDLING AND STORAGE

HANDLING :
Avoid eye and skin contact. Do not take internally. Ensure all containers are labeled. Keep the containers closed when not in use.

STORAGE CONDITIONS :
Store the containers tightly closed.

SUITABLE CONSTRUCTION MATERIAL :
Stainless Steel 316L, Hastelloy C-276, MDPE (medium density polyethylene), Nitrile, Plexiglass, TFE, HDPE (high density polyethylene), Neoprene, Aluminum, Polypropylene, Polyethylene, Carbon Steel C1018, Stainless Steel 304, FEP (encapsulated), Perfluoroelastomer, PVC, PTFE, Polytetrafluoroethylene/polypropylene copolymer, Compatibility with Plastic Materials can vary; we therefore recommend that compatibility is tested prior to use.

UNSUITABLE CONSTRUCTION MATERIAL :
Copper, Mild steel, Brass, Nylon, Buna-N, Natural rubber, Polyurethane, Ethylene propylene, EPDM, Fluoroelastomer, Chlorosulfonated polyethylene rubber

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8. EXPOSURE CONTROLS/PERSONAL PROTECTION

OCCUPATIONAL EXPOSURE LIMITS :
Exposure guidelines have not been established for this product. Available exposure limits for the substance(s) are shown below.

Substance(s)	Category:	ppm	mg/m3	Non-Standard Unit
2-Butoxyethanol	ACGIH/TWA	20		
	OSHA Z1/PEL	50	240	
	OSHA Z1/Skin*.			
Propylene Glycol (Aerosol.)	WEEL/TWA		10	

* Can be absorbed through the skin.

ENGINEERING MEASURES :
General ventilation is recommended.

RESPIRATORY PROTECTION :
Where concentrations in air may exceed the limits given in this section, the use of a half face filter mask or air supplied breathing apparatus is recommended. A suitable filter material depends on the amount and type of chemicals being handled. Consider the use of filter type: Multi-contaminant cartridge. with a Particulate pre-filter. In event of emergency or planned entry into unknown concentrations a positive pressure, full-facepiece SCBA should be used. If respiratory protection is required, institute a complete respiratory protection program including selection, fit testing, training, maintenance and inspection.

HAND PROTECTION :
Neoprene gloves Nitrile gloves Butyl gloves PVC gloves Breakthrough time not determined as preparation, consult PPE manufacturers.

SKIN PROTECTION :
Wear standard protective clothing.

EYE PROTECTION :
Wear chemical splash goggles.

HYGIENE RECOMMENDATIONS :
Use good work and personal hygiene practices to avoid exposure. Keep an eye wash fountain available. Keep a safety shower available. If clothing is contaminated, remove clothing and thoroughly wash the affected area. Launder contaminated clothing before reuse. Always wash thoroughly after handling chemicals. When handling this product never eat, drink or smoke.

HUMAN EXPOSURE CHARACTERIZATION :
Based on our recommended product application and personal protective equipment, the potential human exposure is: Low

NALCO Environmental Solutions LLC

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9. PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL STATE	Liquid
APPEARANCE	Clear Amber
ODOR	Mild
SPECIFIC GRAVITY	0.98 - 1.02
DENSITY	8.2 - 8.5 lb/gal
SOLUBILITY IN WATER	Complete
pH (100 %)	6.1
VISCOSITY	160 cst @ 32 °F / 0 °C
POUR POINT	ASTM D-97 -66.9 °F / -55 °C
POUR POINT	< -40 °F / < -40 °C
BOILING POINT	340 °F / 171 °C
VAPOR PRESSURE	< 5 mm Hg @ 100 °F / 38 °C Same as water
EVAPORATION RATE	0.1 (water=1)

Note: These physical properties are typical values for this product and are subject to change.

10. STABILITY AND REACTIVITY

STABILITY :
Stable under normal conditions.

HAZARDOUS POLYMERIZATION :
Hazardous polymerization will not occur.

CONDITIONS TO AVOID :
Extremes of temperature

MATERIALS TO AVOID :
Contact with strong oxidizers (e.g. chlorine, peroxides, chromates, nitric acid, perchlorate, concentrated oxygen, permanganate) may generate heat, fires, explosions and/or toxic vapors.

HAZARDOUS DECOMPOSITION PRODUCTS :
Under fire conditions: Oxides of carbon

11. TOXICOLOGICAL INFORMATION

The following toxicity information is for the product.

SENSITIZATION:
This product is not expected to be a sensitizer.

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CARCINOGENICITY:
None of the substances in this product are listed as carcinogens by the International Agency for Research on Cancer (IARC) or the National Toxicology Program (NTP). 2-Butoxyethanol is listed as an A3 carcinogen (confirmed animal carcinogen with unknown relevance to humans) by the American Conference of Governmental Industrial Hygienists (ACGIH). Upon further independent evaluation by IARC (2004) and IRIS (EPA Integrated Risk Information System) (2005) 2-butoxyethanol was found to be "not classifiable as to carcinogenicity to humans" and "not likely to be a human carcinogen", respectively.

HUMAN HAZARD CHARACTERIZATION:
Based on our hazard characterization, the potential human hazard is: High

TOXICOLOGICAL INFORMATION RELATED TO THE WHOLE PRODUCT AND ITS COMPONENTS:

Acute mammalian toxicity studies have been conducted under laboratory conditions that test the toxicity of the product following exposure that would not reflect those for humans under normal use situations. This information is provided below. Other information is also provided from third party sources related to the mammalian toxicity for the six components in the product.

ACUTE TOXICITY FOR THE PRODUCT MIXTURE:

ORAL (Rat): LD50 > 1,750 mg/kg

DERMAL (Rabbit): LD50 > 1,000 mg/kg

(Rat): LD50 > 2,000 mg/kg

DERMAL IRRITATION (Rabbit): Very mild irritant. No clinically significant effects beyond day 10 post-application.

INHALATION (Rat): LC50 < 2.08 mg/L

EYE IRRITATION(Rabbit): Moderate eye irritant, corneal opacity in 1/4 rabbits; all cornea, iris and conjunctival effects cleared in all rabbits by day 14.

ACUTE ORAL TOXICITY FOR THE COMPONENTS:

Component:	Polyol ester
Species:	Rat
LD50:	> 16,000 mg/kg
Remarks:	This data was sourced from the supplier MSDS.

Component:	2-Butoxyethanol
Species:	Rat
LD50:	1,746 mg/kg
Remarks:	This data was sourced from the supplier MSDS.

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EMERGENCY TELEPHONE NUMBER(S)
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Component: 2-Butoxyethanol
Species: Guinea Pig
LD50: 1,400 mg/kg
Remarks: This data was sourced from the supplier MSDS.

Component: Oxyalkylated Fatty Acid Derivative
Species: Rat
LD50: > 38,000 mg/kg
Remarks: This data was sourced from the supplier MSDS.

Component: Oxyalkylate Polymer
Species: Rat
LD50: > 36,400 mg/kg
Remarks: This data was sourced from the supplier MSDS.

Component: Organic Sulfonic Acid Salt
Species: Rat
LD50: 4,620 mg/kg
Remarks: This data was sourced from an IUCLID Dataset searched on 6/2/2010.

Component: Propylene glycol
Species: Rat
LD50: 29,536 mg/kg
Remarks: This data was sourced from an IUCLID Dataset searched on 6/3/2010.

Component: Propylene glycol
Species: Mouse
LD50: 22,000 mg/kg
Remarks: This data was sourced from an IUCLID Dataset searched on 6/3/2010.

Component: Propylene glycol
Species: Rabbit
LD50: 18,500 mg/kg
Remarks: This data was sourced from an IUCLID Dataset searched on 6/3/2010.

Component: Propylene glycol
Species: Dog
LD50: 22,000 mg/kg
Remarks: This data was sourced from an IUCLID Dataset searched on 6/3/2010.

ACUTE DERMAL TOXICITY FOR THE COMPONENTS:

Component: 2-Butoxyethanol
Species: Guinea Pig
LD50: > 2,000 mg/kg
Remarks: This data was sourced from the supplier MSDS.

NALCO Environmental Solutions LLC

SAFETY DATA SHEET

PRODUCT

COREXIT® EC9527A

EMERGENCY TELEPHONE NUMBER(S)
(800) 424-9300 (24 Hours) CHEMTREC

Component: 2-Butoxyethanol
Species: Rat
LD50: 2,210 mg/kg
Remarks: This data was sourced from the supplier MSDS.

Component: 2-Butoxyethanol
Species: Rabbit
LD50: 99 - 610 mg/kg
Remarks: This data was sourced from the supplier MSDS.

Component: Organic Sulfonic Acid Salt
Species: Rabbit
LD50: 10,000 mg/kg
Remarks: This data was sourced from an IUCLID Dataset searched on 6/2/2010.

Component: Propylene glycol
Species: Rabbit
LD50: 20,800 mg/kg
Remarks: This data was sourced from an IUCLID Dataset searched on 6/3/2010.

ACUTE INHALATION TOXICITY FOR THE COMPONENTS:

Component: 2-Butoxyethanol
Species: Rat
LD50: 700 mg/l (7 hrs)
Remarks: This data was sourced from the supplier MSDS.

Component: Organic Sulfonic Acid Salt
Species: Rat
LD50: 20 mg/l (96 hrs)
Remarks: This data was sourced from an IUCLID Dataset searched on 6/2/2010.

CHRONIC TOXICITY DATA FOR THE COMPONENT: 2-Butoxyethanol

The principal health effects following acute exposure to 2-butoxyethanol are irritation of the eyes and respiratory tract. 2-butoxyethanol is readily absorbed through the skin. In laboratory animals exposed to 2-butoxyethanol via inhalation, blood (hemolysis) and secondary effects on the kidney and liver have been observed. When 2-butoxyethaol is ingested it is metabolized to butoxyacetic acid (BAA), which can cause hemolysis. BAA is rapidly excreted in urine in animals and humans with a urinary excretion half-life of approximately 3-6 hours in humans. Human red blood cells have been shown to be significantly less sensitive to hemolysis than those of rodents and rabbits. These effects are transient and when exposure is discontinued, these effects subside. 2-butoxyethanol does not cause adverse reproductive or birth effects in animals, unless exposures occur at levels high enough to induce significant maternal toxicity.

NALCO Environmental Solutions LLC

SAFETY DATA SHEET

PRODUCT

COREXIT® EC9527A

EMERGENCY TELEPHONE NUMBER(S)
(800) 424-9300 (24 Hours) CHEMTREC

12. ECOLOGICAL INFORMATION

ECOTOXICOLOGICAL EFFECTS :

The following results are for the product, unless otherwise indicated.

Acute Fish Results :

Species	Exposure	Test Type	Value	Test Descriptor
Turbot	96 hrs	LC50	50 mg/l	Product
Fathead Minnow	96 hrs	LC50	201 mg/l	Product
Inland Silverside	96 hrs	LC50	14.57 mg/l	Product
Common Mummichog	96 hrs	LC50	81 mg/l	Product

ACUTE INVERTEBRATE RESULTS :

Species	Exposure	Test Type	Value	Test Descriptor
Acartia tonsa	48 hrs	LC50	23 mg/l	Product
Mysid Shrimp (Mysidopsis bahia)	48 hrs	LC50	24.14 mg/l	Product
Artemia	48 hrs	LC50	40 mg/l	Product

AQUATIC PLANT RESULTS :

Species	Exposure	Test Type	Value	Test Descriptor
Marine Algae (Skeletonema costatum)	72 hrs	EC50	9.4 mg/l	Product

MOBILITY :
The environmental fate was estimated using a level III fugacity model embedded in the EPI (estimation program interface) Suite TM, provided by the US EPA. The model assumes a steady state condition between the total input and output. The level III model does not require equilibrium between the defined media. The information provided is intended to give the user a general estimate of the environmental fate of this product under the defined conditions of the models.
If released into the environment this material is expected to distribute to the air, water and soil/sediment in the approximate respective percentages:

Air	Water	Soil/Sediment
<5%	10 - 30%	70 - 90%

The portion in water is expected to be soluble or dispersible.

BIOACCUMULATION POTENTIAL
Based on a review of the individual components, utilizing U.S. EPA models, this material is not expected to bioaccumulate.

ENVIRONMENTAL HAZARD AND EXPOSURE CHARACTERIZATION
Based on our hazard characterization, the potential environmental hazard is: Moderate
Based on our recommended product application and the product's characteristics, the potential environmental exposure is: Low

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PRODUCT

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If released into the environment, see CERCLA/SUPERFUND in Section 15.

13. DISPOSAL CONSIDERATIONS

If this product becomes a waste, it is not a hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA) 40 CFR 261, since it does not have the characteristics of Subpart C, nor is it listed under Subpart D.

As a non-hazardous waste, it is not subject to federal regulation. Consult state or local regulation for any additional handling, treatment or disposal requirements. For disposal, contact a properly licensed waste treatment, storage, disposal or recycling facility.

14. TRANSPORT INFORMATION

The information in this section is for reference only and should not take the place of a shipping paper (bill of lading) specific to an order. Please note that the proper Shipping Name / Hazard Class may vary by packaging, properties, and mode of transportation. Typical Proper Shipping Names for this product are as follows.

LAND TRANSPORT :

Proper Shipping Name : PRODUCT IS NOT REGULATED DURING TRANSPORTATION

AIR TRANSPORT (ICAO/IATA) :

Proper Shipping Name : PRODUCT IS NOT REGULATED DURING TRANSPORTATION

MARINE TRANSPORT (IMDG/IMO) :

Proper Shipping Name : PRODUCT IS NOT REGULATED DURING TRANSPORTATION

15. REGULATORY INFORMATION

This section contains additional information that may have relevance to regulatory compliance. The information in this section is for reference only. It is not exhaustive, and should not be relied upon to take the place of an individualized compliance or hazard assessment. Nalco accepts no liability for the use of this information.

NATIONAL REGULATIONS, USA :

OSHA HAZARD COMMUNICATION RULE, 29 CFR 1910.1200 :
Based on our hazard evaluation, none of the substances in this product are hazardous.

CERCLA/SUPERFUND, 40 CFR 302 :
Notification of spills of this product is not required.

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SARA/SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT OF 1986 (TITLE III) - SECTIONS 302, 311, 312, AND 313 :

SECTION 302 - EXTREMELY HAZARDOUS SUBSTANCES (40 CFR 355) :
This product does not contain substances listed in Appendix A and B as an Extremely Hazardous Substance.

SECTIONS 311 AND 312 - MATERIAL SAFETY DATA SHEET REQUIREMENTS (40 CFR 370) :
Our hazard evaluation has found this product to be hazardous. The product should be reported under the following indicated EPA hazard categories:

X	Immediate (Acute) Health Hazard
X	Delayed (Chronic) Health Hazard
X	Fire Hazard
	Sudden Release of Pressure Hazard
	Reactive Hazard

Under SARA 311 and 312, the EPA has established threshold quantities for the reporting of hazardous chemicals. The current thresholds are: 500 pounds or the threshold planning quantity (TPQ), whichever is lower, for extremely hazardous substances and 10,000 pounds for all other hazardous chemicals.

SECTION 313 - LIST OF TOXIC CHEMICALS (40 CFR 372) :
This product contains the following substance(s), (with CAS # and % range) which appear(s) on the List of Toxic Chemicals

Hazardous Substance(s)	CAS NO	% (w/w)
Glycol Ethers		30 - 60

TOXIC SUBSTANCES CONTROL ACT (TSCA) :
The substances in this preparation are included on or exempted from the TSCA 8(b) Inventory (40 CFR 710)

FEDERAL WATER POLLUTION CONTROL ACT, CLEAN WATER ACT, 40 CFR 401.15 / formerly Sec. 307, 40 CFR 116.4 / formerly Sec. 311 :
Substances listed under this regulation are not intentionally added or expected to be present in this product. Listed components may be present at trace levels.

CLEAN AIR ACT, Sec. 112 (Hazardous Air Pollutants, as amended by 40 CFR 63), Sec. 602 (40 CFR 82, Class I and II Ozone Depleting Substances) :
Substances listed under this regulation are not intentionally added or expected to be present in this product. Listed components may be present at trace levels.

CALIFORNIA PROPOSITION 65 :
Substances listed under California Proposition 65 are not intentionally added or expected to be present in this product.

MICHIGAN CRITICAL MATERIALS :
Substances listed under this regulation are not intentionally added or expected to be present in this product. Listed components may be present at trace levels.

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STATE RIGHT TO KNOW LAWS :
The following substances are disclosed for compliance with State Right to Know Laws:

2-Butoxyethanol	111-76-2
Propylene Glycol	57-55-6

INTERNATIONAL CHEMICAL CONTROL LAWS :

CANADIAN ENVIRONMENTAL PROTECTION ACT (CEPA) :
The substances in this preparation are listed on the Domestic Substances List (DSL), are exempt, or have been reported in accordance with the New Substances Notification Regulations.

AUSTRALIA
All substances in this product comply with the National Industrial Chemicals Notification & Assessment Scheme (NICNAS).

CHINA
All substances in this product comply with the Provisions on the Environmental Administration of New Chemical Substances and are listed on or exempt from the Inventory of Existing Chemical Substances China (IECSC).

EUROPE
The substance(s) in this preparation are included in or exempted from the EINECS or ELINCS inventories

JAPAN
All substances in this product comply with the Law Regulating the Manufacture and Importation Of Chemical Substances and are listed on the Existing and New Chemical Substances list (ENCS).

KOREA
All substances in this product comply with the Toxic Chemical Control Law (TCCL) and are listed on the Existing Chemicals List (ECL)

PHILIPPINES
All substances in this product comply with the Republic Act 6969 (RA 6969) and are listed on the Philippines Inventory of Chemicals & Chemical Substances (PICCS).

16. OTHER INFORMATION

Due to our commitment to Product Stewardship, we have evaluated the human and environmental hazards and exposures of this product. Based on our recommended use of this product, we have characterized the product's general risk. This information should provide assistance for your own risk management practices. We have evaluated our product's risk as follows:

* The human risk is: Low

* The environmental risk is: Low

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Any use inconsistent with our recommendations may affect the risk characterization. Our sales representative will assist you to determine if your product application is consistent with our recommendations. Together we can implement an appropriate risk management process.

This product material safety data sheet provides health and safety information. The product is to be used in applications consistent with our product literature. Individuals handling this product should be informed of the recommended safety precautions and should have access to this information. For any other uses, exposures should be evaluated so that appropriate handling practices and training programs can be established to insure safe workplace operations. Please consult your local sales representative for any further information.

REFERENCES

Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices, American Conference of Governmental Industrial Hygienists, OH., (Ariel Insight™ CD-ROM Version), Ariel Research Corp., Bethesda, MD.

Hazardous Substances Data Bank, National Library of Medicine, Bethesda, Maryland (TOMES CPS™ CD-ROM Version), Micromedex, Inc., Englewood, CO.

IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Man, Geneva: World Health Organization, International Agency for Research on Cancer.

Integrated Risk Information System, U.S. Environmental Protection Agency, Washington, D.C. (TOMES CPS™ CD-ROM Version),
Micromedex, Inc., Englewood, CO.

Annual Report on Carcinogens, National Toxicology Program, U.S. Department of Health and Human Services, Public Health Service.

Title 29 Code of Federal Regulations, Part 1910, Subpart Z, Toxic and Hazardous Substances, Occupational Safety and Health Administration (OSHA), (Ariel Insight™ CD-ROM Version), Ariel Research Corp., Bethesda, MD.

Registry of Toxic Effects of Chemical Substances, National Institute for Occupational Safety and Health, Cincinnati, OH,
(TOMES CPS™ CD-ROM Version), Micromedex, Inc., Englewood, CO.

Ariel Insight™ (An integrated guide to industrial chemicals covered under major regulatory and advisory programs), North American Module, Western European Module, Chemical Inventories Module and the Generics Module (Ariel Insight™ CD-ROM Version), Ariel Research Corp., Bethesda, MD.

The Teratogen Information System, University of Washington, Seattle, WA (TOMES CPS™ CD-ROM Version), Micromedex, Inc., Englewood, CO.

Prepared By : Product Safety Department
Date issued : 03/01/2012

SAFETY DATA SHEET

PRODUCT

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Version Number : 4.3

D.3 Dispersant use planning form – initial incident information

Incident Sheet for Dispersant Use Concurrence Requests				
Name of Incident: **Initial Time of Spill:** **Date**_____/_____/_____ Time: ____:____ _____ Month Day Year 24 Hour Clock Time Zone				
Air Monitoring Data: (Maximum reported in Source Control area of operations)				
VOC:	Percent LEL:			
Incident Location:				
Distance (miles/km) and Direction to nearest land:	Lat: N/S Long: E/W			
Block Name: Block Number: Water Depth:				
Brief Description of Incident:				
Incident: Pipeline___ Transfer Operations___ Explosion___ Collision___ Blowout___ Facility Release___ Other_____ Type of Release: Instantaneous (___) Continuous Flow (___) Did the source burn? Yes (___) No (___) Is the source still burning? Yes (___) No (___) Estimated water surface covered (square miles/square km) _____				
Event Chronology:				
Oil Characteristics:				
Name:	API Gravity:	GOR:	Pour Point:	Viscosity at release
Is the oil dispersible into the water column: Yes/No (circle one)				

Spill Description:	
Estimated Flow Rate (bopd): _____ Estimated Spill Volume:_____ Product easily emulsified? Yes (___) No (___) Product already emulsified?No (___)	
Method used for estimate:	
Current On Site Weather Conditions (relative to subsea injection readiness)	
Sea state – wave height:	Beaufort Scale:
Wind direction and velocity (knots):	
Ceiling:	Visibility:
Five day forecast: Forecasted wind speed / direction (24 hours): _____knots from the _____ (direction) Forecasted wind speed / direction (48 hours): _____knots from the _____ (direction) Temperature: Air ___OF/C Water ___OF/C Dominant Current, net drifts (towards): Speed ___ knots; Direction ____ Water Depth (fathoms ___ Feet ___) 0-3 (___) 4-10 (___) 11-30 (___) 31-99 (___) >100 (___) Other considerations: Low Visibility (___) Rip Tides (___) Whirlpools (___) Eddies (___)	
Additional Data that could affect operations: (e.g. subsea currents speed and direction, oil seeps)	
Surface Slick/Subsurface Plume Modeling	
2-D/ 3-D Model(s) used:	
Expected slick/plume trajectory and behavior:	

D.4Dispersant use planning form – application tactics

Reason(s) for requesting dispersant use: _____
Location of area to be treated relative to the following, as shown on attached chart:
Slick/Trajectory Dispersant Zone
Nearest Land Wellhead

Name of dispersant proposed for use: COREXIT EC9500A] (___) Other _____
Application platform(s): Fixed-wing___ Helicopter ___ Vessel ___ Subsea ____
Safety plan for applicable platform in place? Yes (___) No (___)
Dispersant dosage goals:
Ratio of dispersant-to-oil (DOR): Surface 1:20 ☐ Subsea 1:100 ☐ Other: _____
Gallons per acre: _____ gals per acre Other: _____
Time of dispersant application: Start Time _____ Day ___/___/____
Finish Time _____ Day ___/___/____
Estimate percentage of surface spill area to be treated (if known):
1-5% (___) 6-20% (___) 21-40% (___) 41-70% (___) 71-99% (___) 100% (___)
Gallons per minute: _____ gals per minute Other: _____
Time of dispersant application: Start Time _____ Day ___/___/____
Finish Time _____ Day ___/___/____
Estimate percentage of subsea volume treated (if known):
1-5% (___) 6-20% (___) 21-40% (___) 41-70% (___) 71-99% (___) 100% (___)

Dispersant Decision

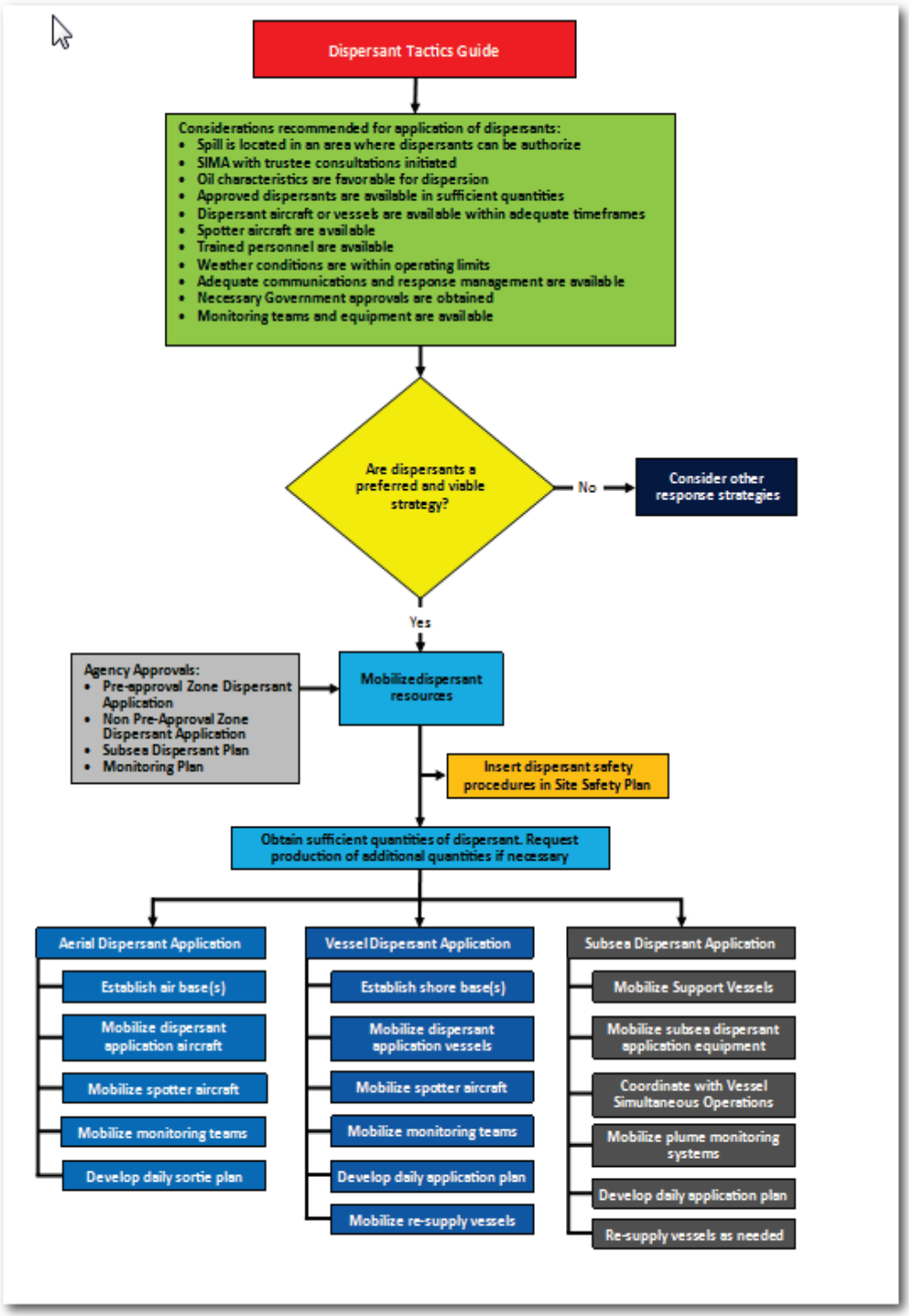
Responsible Party Incident Commander ☐ Approve/Concur Signature: _____
Regulatory Agency Coordinator ☐ Approve/Concur Signature: _____
Regulatory Agency Coordinator ☐ Approve/Concur Signature: _____

Additional consultation or concurrence, if needed

Agency/Contact	Concurrence/Consultation	Time/Date	Method (verbal/written)
_____	_____	_____	_____
_____	_____	_____	_____

Points of Contact for checklist:

Name	Position	Telephone
Regulatory Agency	_____	_____ (____)____-_____
Regulatory Agency	_____	_____ (____)____-_____
Responsible Party	_____	_____ (____)____-_____
Other	_____	_____ (____)____-_____
Other	_____	_____ (____)____-_____



General Surface and Subsea Dispersant Guide

Note: Dispersants shall not be used except as authorized by the EPA with concurrence of the officials charged with health/sensitive area responsibilities.

D.5 Dispersant use request form

Dispersant Use Request Form		
Request from		
Name and Position	Contact Details	Date and Time of Request
Request made to		
Name and Position	Contact Details	Date and Time Request Received
Reason for Dispersant Use Request		
Use of dispersants provides the important advantage of removing oil from the surface of the water thereby minimizing the effects of an oil spill by dispersing oil before it reaches shorelines or sensitive areas. Removing oil from the surface of the water can reduce the potential for impacts to wildlife including birds and marine mammals that could be found on or near the sea surface and limits the action of wind on spill movement. Dispersants can be applied and are effective across a wide range of environmental, metrological and oceanographic condition, where mechanical responses are limited. Dispersants can also be applied rapidly over a greater area in a given time than other response options.		
Expected Dispersant Effectiveness		
Has a Dispersant Effectiveness Test or Test Spray Run been carried out? Yes/No (If yes attach results to request form).	In this section, discuss the type of oil product spilled and its relative dispersibility. Reference available technical information or describe whether experience suggests that the spilled product is dispersible and will still be dispersible in the time frame of anticipated application of dispersants.	
Based on the assessment of the Incident what is the estimated timeframe available for a dispersant spraying operation to be effective?		

Dispersant Use Request Form	
Overview of Incident	
Describe the location and extent of spill, and spill volume (known or estimated).	
State oil type, API gravity, viscosity and pour point. (Attach SDS if available).	
State whether the spill is in a location approved for Dispersant use by Caribbean Island OPRC Plan 2012 or provide details of why use dispersant approval is required if outside of these parameters.	
State whether spill is instantaneous or continuous (include flow rate if known).	
Predicted oil spill movement (attach oil spill modeling trajectory if available).	
Predicted sub-surface dispersant plume flow (attach oil spill modeling trajectory if available).	
Distance from shoreline.	
Depth of water.	
Weather Conditions	
Are current weather conditions suitable for a dispersant application operation? Yes/No	In this section, include current and forecasted weather conditions and whether they are suitable for dispersant application
Wind (from) direction.	
Wind speed (knots).	
Current velocity (knots).	
Current (to) direction.	
Visibility (nautical miles).	
Sea state	
Dispersant Application Details	
Dispersant type (Attach SDS) What is the current Dispersant stockpile level available for the dispersant spraying operation?	In this section, describe the dispersant product to be used (name). Attach an SDS. Describe the dispersant application method, the expected amount of dispersant to be used and estimated timeline for the dispersant spaying operation.
Application Method. (Include proposed DOR, dosage rate (gpa /lpha) and maximum equipment application rate.	
Estimated Dispersant quantity to be used.	
Describe Dispersant Spraying Operational area. Include any environmental and socio-economic sensitivities in the region. Use maps / charts if available.	

Dispersant Use Request Form	
Dispersant Effectiveness Monitoring Program	
Describe the level of dispersant effectiveness monitoring to be applied during the dispersant spraying operations.	State how observations will be carried out and documented. Describe how the dispersant spraying operations results will be communicated to the regulatory approvers.
Dispersant Spraying Operation Approval Decision	
Approved Provide Additional Comments as Required	Not Approved Provide Details on Why Approval was Not Granted

Decision Makers Name and Position	Contact Details	Date and Time

D.6 Oil spill response limited (OSRL) notification form

OSRL NOTIFICATION FORM			
WARNING! Ensure telephone contact has been established with OSRL's Duty Manager before using e-mail and fax communications.			
To	Duty Manager		
Southampton Emergency Fax	+44 (0)23 8072 4314	Fort Lauderdale Emergency Fax	+1 954 987 3001
Southampton Telephone	+44 (0)23 8033 1551	Fort Lauderdale Telephone	+1 954 983 9880
Email	dutymanagers@oilspillresponse.com		
Section 1	**Obligatory Information Required-Please Complete All Details**		
Name of person in charge			
Position			
Company			
Contact telephone number			
Contact Mobile number			
Contact fax number			
E-mail address			
Section 2	**Spill Details**		
Location of spill			
Description of slick (size, direction, appearance)			
Latitude / longitude			
Situation (cross box)	❑ Land ❑ River ❑ Estuary ❑ Coastal ❑ Offshore ❑ Port		
Date & time of spill	❑ GMT ❑ Local		
Source of spill			
Quantity (if known)	❑ Cross box if estimate		
Spill status (cross box)	❑ On-going ❑ Controlled ❑ Unknown		
Action taken so far			
Product name			
Viscosity			
API / SG			
Pour point			
Asphaltene			
Section 3	**Weather**		
Wind speed & direction			
Sea state			
Sea temperature			
Tides			
Forecast			

Section 4	Additional Information Required – Please Complete Details if Known
Resources at risk	
Clean-up resources	
On-site / Ordered	
Nearest airport (if known)	
Runway length	
Handling facilities	
Customs	
Handling agent	
Section 5	**Vessel Availability**
Equipment deployed	
Recovered oil storage	
Section 6	**Equipment Logistics**
Transport	
Secure storage	
Port of embarkation	
Location of command centre	
Other designated contacts	
Section 7	**Special Requirements of Country**
Security	
Visa	
Medical advice	
Vaccinations	
Others (specify)	
Section 8	**Climate Information**
Section 9	**Other Information**

D.7 Oil spill response limited (OSRL) mobilization form

OSRL MOBILIZATION FORM
WARNING! Ensure telephone contact has been established with OSRL's Duty Manager before using e-mail and fax communications.

To	Duty Manager
Southampton Emergency Fax	+44 (0)23 8072 4314
Southampton Telephone	+44 (0)23 8033 1551
Email	dutymanagers@oilspillresponse.com

Authorizer's Details	
Subject	Mobilization of OSRL
Date	
Name	
Company	
Position	
Contact Telephone Number	
Contact Mobile Number	
Contact Email Address	
Incident Name	
Invoice Address	
I, authorize the activation of Oil Spill Response Limited and its resources in connection with the above incident under the terms of the Agreement in place between above stated Company and Oil Spill Response Limited.	
Signature:	

If OSRL personnel are to work under another party's direction please complete details below:

Additional Details	
Name	
Company	
Position	
Contact Telephone Number	
Contact Mobile Number	
Contact Email Address	

Appendix E GEOGRAPHICAL STRATEGIC RESPONSE MAPS

The Response Group (TRG) has generated a comprehensive Geographic Response Plan (GRP) for the coastlines of Guyana and Trinidad & Tobago to support EEPGL offshore operations in Guyana. The geographical footprint of the GRP was based on projected impacts from the (unmitigated) stochastic modeling of the 20,000 barrel per day well control scenario(s) and the initially impacted shorelines as outlined in this OSRP. TRG conducted a full desktop review in detail at a scale of 1:5,000 to determine any potentially impacted sensitivities along the entire coastline of Guyana. As TRG had previously developed a Tactical Response Plan (TRP) for Trinidad and Tobago during 2007 and 2008, these developed strategies were reviewed and updated based on the changes in the coastlines over that time period.

Once the Environmental Impact Analysis (EIA) data (sourced from the Liza Phase 2 Development Project) was received in Geographical Information Systems (GIS) format, the data was overlaid to help inform the response actions by location. By combining the environmental GIS data into the GRP, responding organizations can review locations of sensitivities, access points, response actions as well as resource requirements in one document. The GRP also defines the equipment needs (totals) for each division to support efficient resource ordering practices upon utilization of the plan. To further support response activities, the GRP also provides an appendix to response methods by shoreline type to support response activities and decision-making on impacted areas outside the scope of the GRP.

The GRP is a large document (500+ pages) and is managed outside of the OSRP for efficiency purposes. Example maps and tables are shown in this appendix to provide users with a conceptual overview. The full suite of Geographical Strategic Response Maps will be immediately available to the response team(s) in the event of an oil spill.

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GUYANA
Strategic Geographical Response Maps

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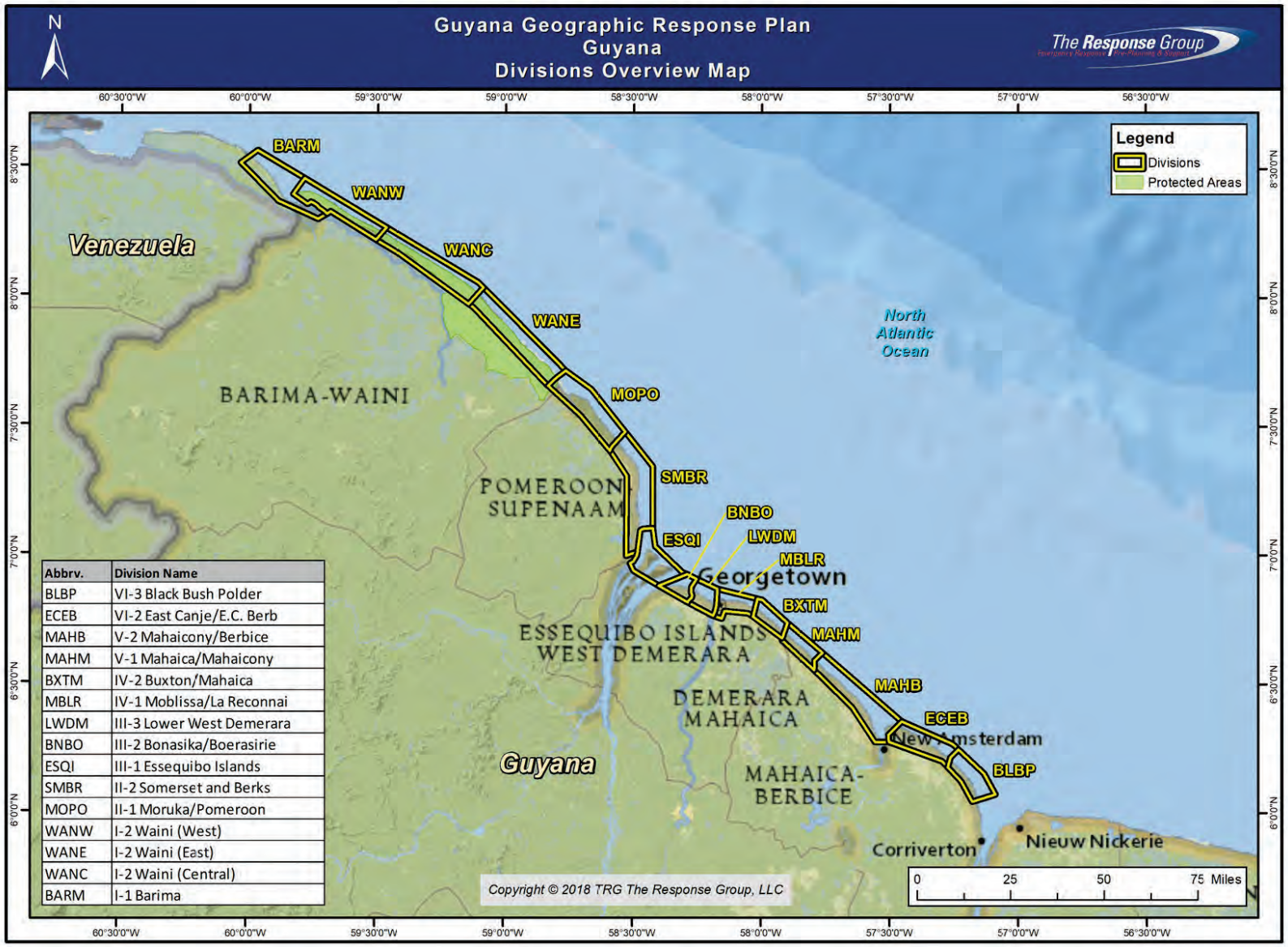


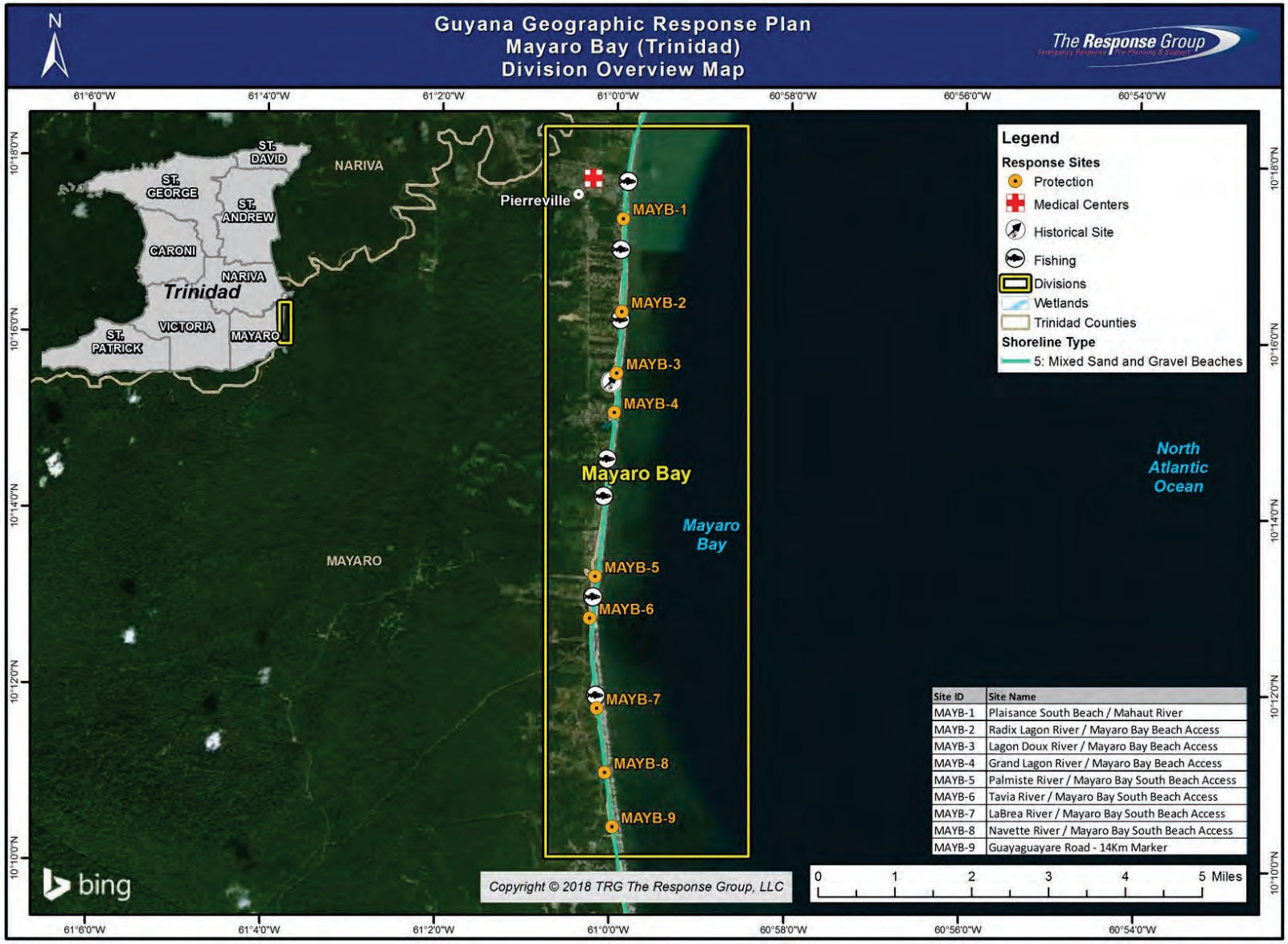
Abbrv.	Division Name
BLBP	VI-3 Black Bush Polder
ECEB	VI-2 East Canje/E.C. Berb
MAHB	V-2 Mahaicony/Berbice
MAHM	V-1 Mahaica/Mahaicony
BXTM	IV-2 Buxton/Mahaica
MBLR	IV-1 Moblissa/La Reconnai
LWDM	III-3 Lower West Demerara
BNBO	III-2 Bonasika/Boerasirie
ESQI	III-1 Essequibo Islands
SMBR	II-2 Somerset and Berks
MOPO	II-1 Moruka/Pomeroon
WANW	I-2 Waini (West)
WANE	I-2 Waini (East)
WANC	I-2 Waini (Central)
BARM	I-1 Barima


Guyana Geographic Response Plan
I-2 Waini West (Guyana)
Division Overview Map
The Response Group
N
59°50'0"W
59°45'0"W
59°40'0"W
59°35'0"W
59°30'0"W
8°25'0"N
8°20'0"N
8°15'0"N
Legend
Response Sites
Protection
Protected Areas
Divisions
Shoreline Type
10D-Scrub and Shrub Wetlands
WANW-3
WANW-2
WANW-1
I-2 Waini West
North Atlantic Ocean
Baroma River
Guyana
I
II
III
IV
V
VI
VII
X
0 2 4 6 Miles
Copyright © 2018 TRG The Response Group, LLC


Guyana Geographic Response Plan
I-2 Waini West Division: WANW-2
Protection Site - Strategy Map
The Response Group
N
Boom
Resources | Qty | Qty UoM | Size | Size UOM
Inflatable Boom | 900 | ft | 43 | Inch
Lat: 8° 19' 58.850" N
Long: 59° 37' 29.671" W
North Atlantic Ocean
WANW-2
300
300
300
I-2 WAINI
Legend
Response Sites
Protection
Boom
Inflatable Boom
bing
Copyright © 2018 TRG The Response Group, LLC
0 1,000 2,000 3,000 Feet
59°38'15"W
59°38'0"W
59°37'45"W
59°37'30"W
59°37'15"W
59°37'0"W
59°36'45"W
8°20'30"N
8°20'15"N
8°20'0"N
8°19'45"N
8°19'30"N

GRP Area Maintenance			GRP Area: WANW-2	
Resources Required				
Area Of Operation	***Resource Kind***	***Description***	***Quantity***	***Size***
WANW-2	Boom Accessories	Boom Anchors	33 each	20 pound(s)
WANW-2	Boom	Inflatable Boom	900 feet	43 inch (es)
WANW-2	Vessel	Work Boat	6 each	18 feet
WANW-2	Manpower: Operator	Boat Operator	6 each	
WANW-2	Manpower: Responder	Responder	10 each	
WANW-2	Manpower: Supervisor	Supervisor	3 each	
Assignments				
1.) Deploy (3) 300 ft sections of inflatable boom in a cascade formation to deflect spilled material away from the shoreline				
Location of Work				
Latitude: 8° 19' 58.850" N Longitude: 59° 37' 29.671" W				
Special Environmental Considerations				
Shoreline Types: 10D: Scrub and Shrub Wetlands				


Guyana Geographic Response Plan
Trinidad
Divisions Overview Map
The Response Group
Abbrv. | Division Name
BALA | Balandra Bay
CANA | Canari Bay
GUAY | Guayaguayare
MATU | Matura Beach
MAYB | Mayaro Bay
NARI | Nariva
PRAD | Point Radix
TOCO | Toco
Legend
Divisions
Trinidad Counties
Caribbean Sea
Gulf of Paria
North Atlantic Ocean
Columbus Channel
TRINIDAD AND TOBAGO
Port of Spain
San Juan
Arima
Chaguanas
San Fernando
Point Fortin
ST. GEORGE
ST. DAVID
ST. ANDREW
CARONI
NARIVA
VICTORIA
MAYARO
ST. PATRICK
TOCO
BALA
MATU
NARI
PRAD
MAYB
GUAY
CANA
Copyright © 2018 TRG The Response Group, LLC
0 5 10 15 20 25 Miles
61°45'0"W
61°30'0"W
61°15'0"W
61°0'0"W
60°45'0"W
60°30'0"W
10°45'0"N
10°30'0"N
10°15'0"N
10°0'0"N


Guyana Geographic Response Plan
Mayaro Bay (Trinidad)
Division Overview Map
The Response Group
N
61°6'0"W
61°4'0"W
61°2'0"W
61°0'0"W
60°58'0"W
60°56'0"W
60°54'0"W
10°18'0"N
10°16'0"N
10°14'0"N
10°12'0"N
10°10'0"N
ST. DAVID
NARIVA
ST. GEORGE
ST. ANDREW
CARONI
NARIVA
Trinidad
VICTORIA
MAYARO
ST. PATRICK
MAYARO
Pierreville
MAYB-1
MAYB-2
MAYB-3
MAYB-4
Mayaro Bay
Mayaro Bay
MAYB-5
MAYB-6
MAYB-7
MAYB-8
MAYB-9
North Atlantic Ocean
Legend
Response Sites
Protection
Medical Centers
Historical Site
Fishing
Divisions
Wetlands
Trinidad Counties
Shoreline Type
5: Mixed Sand and Gravel Beaches
Site ID | Site Name
MAYB-1 | Plaisance South Beach / Mahaut River
MAYB-2 | Radix Lagon River / Mayaro Bay Beach Access
MAYB-3 | Lagon Doux River / Mayaro Bay Beach Access
MAYB-4 | Grand Lagon River / Mayaro Bay Beach Access
MAYB-5 | Palmiste River / Mayaro Bay South Beach Access
MAYB-6 | Tavia River / Mayaro Bay South Beach Access
MAYB-7 | LaBrea River / Mayaro Bay South Beach Access
MAYB-8 | Navette River / Mayaro Bay South Beach Access
MAYB-9 | Guayaguayare Road - 14Km Marker
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0 1 2 3 4 5 Miles

Guyana Geographic Response Plan	Mayaro Bay Division – MAYB-1 Protection Site	Plaisance South Beach / Mahaut River

Site Information

Site Name:
Plaisance South Beach / Mahaut River
Latitude:
10° 17' 20.677" N
Longitude:
60° 59' 54.923" W
County: Mayaro
Country: Trinidad
Population Density: Moderate
Land Use: Recreational, Residential
Existing Response Support Capabilities: None

Site Picture

Photo 1: Looking north at the Mahaut River.

Access Information

Site Access: Road, ATV
Road Type: Light Duty
Road Surface Type: Paved
Road Condition: All Weather
Access Type: Public
Bridge Height: N/A

Waterway Information

Type of Waterway: Bay, River
Waterway Name:
Mayaro Bay, Mahaut River
Average Current Speed: N/A
Waterway Width:
Low Water: ~ 30 ft (River)
High Water: ~ 50 ft (River)
Tidally Influenced: Yes
Shoreline Type: Mixed Sand and Gravel Beaches
Bank Slope: Slight
Bank Height: N/A

Response Information

Deployment Strategy: Protection
Low Water: Booming
High Water: Booming
Boom Required: 150 ft of Hard Boom, 250 ft of Shore Seal Boom
Recovery Method: N/A
Tank Truck Access: N/A
Pump / Hose Required: N/A
Recommended Staging Area: N/A
Nearest Boat Ramp & Dist.:
N/A

Site Contact Information

Organization: N/A

Phone: N/A

Cellular Service: Good

Site Description

Access Location Description: This site is located along Mayaro Bay near the mouth of Mahaut River. Access to site by foot or ATV off Manzanilla / Mayaro Road.

Hazards: Slips, trips, and falls. Underwater hazards and currents.

Obstructions / Limitations: Debris along shoreline.

Considerations

Associated Sensitivities: Sea turtle nesting area.

Strategy Considerations: Mahaut River is in a residential areas as well as a potential sea turtel nesting area. Popular recreational beach and fishing area. Multiple access points to beach off Manzanilla Mayaro Road south of Pierreville. Heaviest recreational use during public holidays and school vacation (July-September) and Easter (2 weeks in April).

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MAYB-1

Guyana
Geographic Response Plan

Mayaro Bay Division – MAYB-1
Protection Site

Plaisance South Beach /
Mahaut River

Site Pictures

Photo 2: Looking northeast at the Mahaut River.

Photo 3: Looking south from the Mahaut River outfall.

Strategy Map

Assignments

1.) Deploy 150 ft section of hard boom in a chevron configuration to protect the mouth of Mahaut River along Mayaro Bay.
2.) Deploy 250 ft section of shore seal boom protect the mouth of Mahaut River and shoreline.

Resources Required

Type	Description	Qty.	Size	Type	Description	Qty.	Size
Boom Accessories	Anchor Stakes	6 ea	N/A	Boom	Hard Boom	150 ft	18 in
Boom Accessories	Boom Anchors	4 ea	40 lbs	Manpower: Responder	Responder	6 ea	N/A
Manpower: Supervisor	Supervisor	1 ea	N/A	Boom	Shore Seal Boom	250 ft	22 in

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MAYB-1

TRINIDAD AND TOBAGO
Strategic Geographical Response Maps

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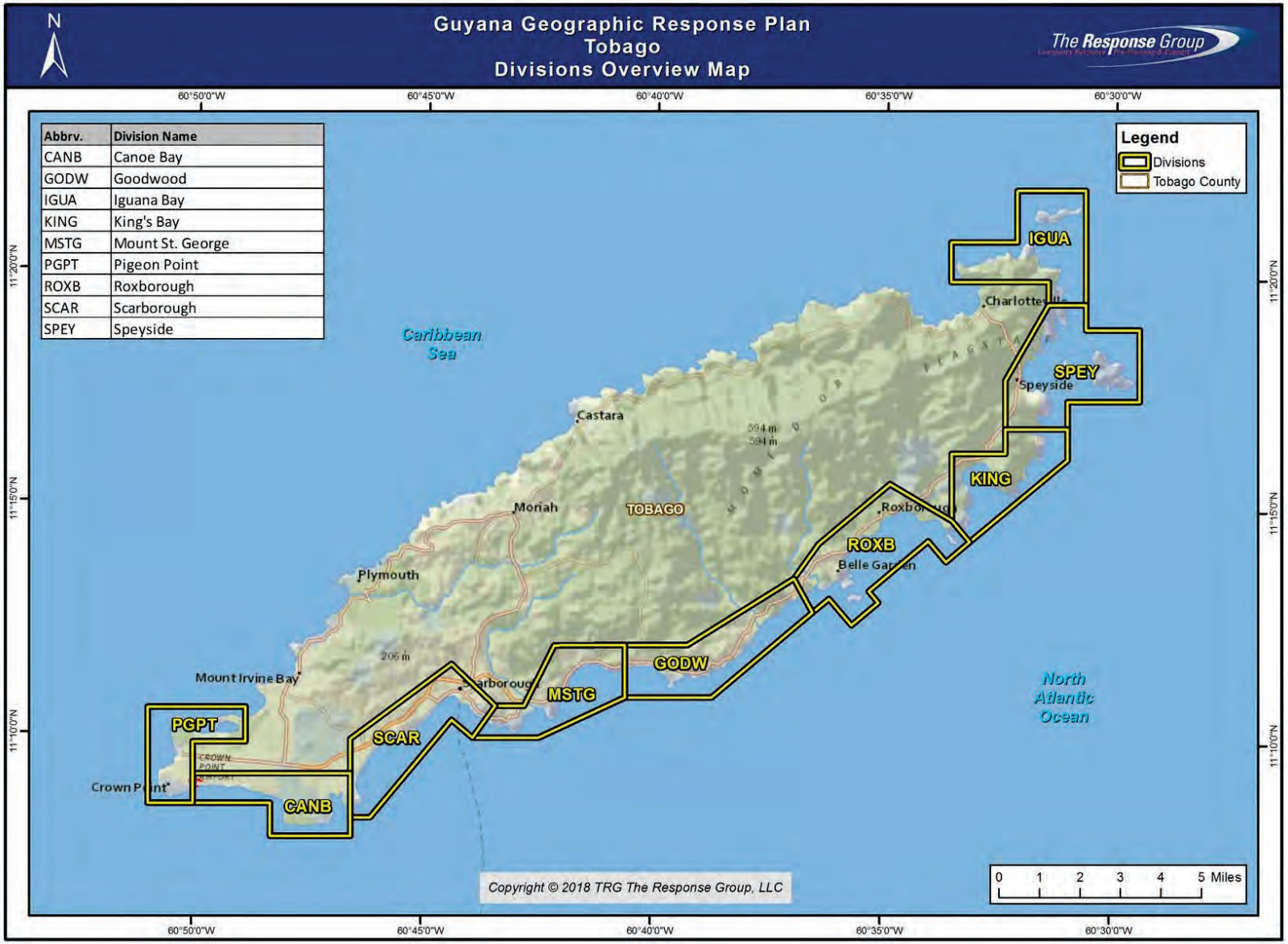
Guyana Geographic Response Plan
Tobago
Divisions Overview Map
The Response Group
N
Abbrv. | Division Name
CANB | Canoe Bay
GODW | Goodwood
IGUA | Iguana Bay
KING | King's Bay
MSTG | Mount St. George
PGPT | Pigeon Point
ROXB | Roxborough
SCAR | Scarborough
SPEY | Speyside
Legend
Divisions
Tobago County
60°50'0"W
60°45'0"W
60°40'0"W
60°35'0"W
60°30'0"W
11°20'0"N
11°15'0"N
11°10'0"N
Caribbean Sea
North Atlantic Ocean
TOBAGO
Castara
Moriah
Plymouth
Mount Irvine Bay
Crown Point
Charlotteville
Speyside
Roxborough
Belle Garden
Scarborough
IGUA
SPEY
KING
ROXB
GODW
MSTG
SCAR
PGPT
CANB
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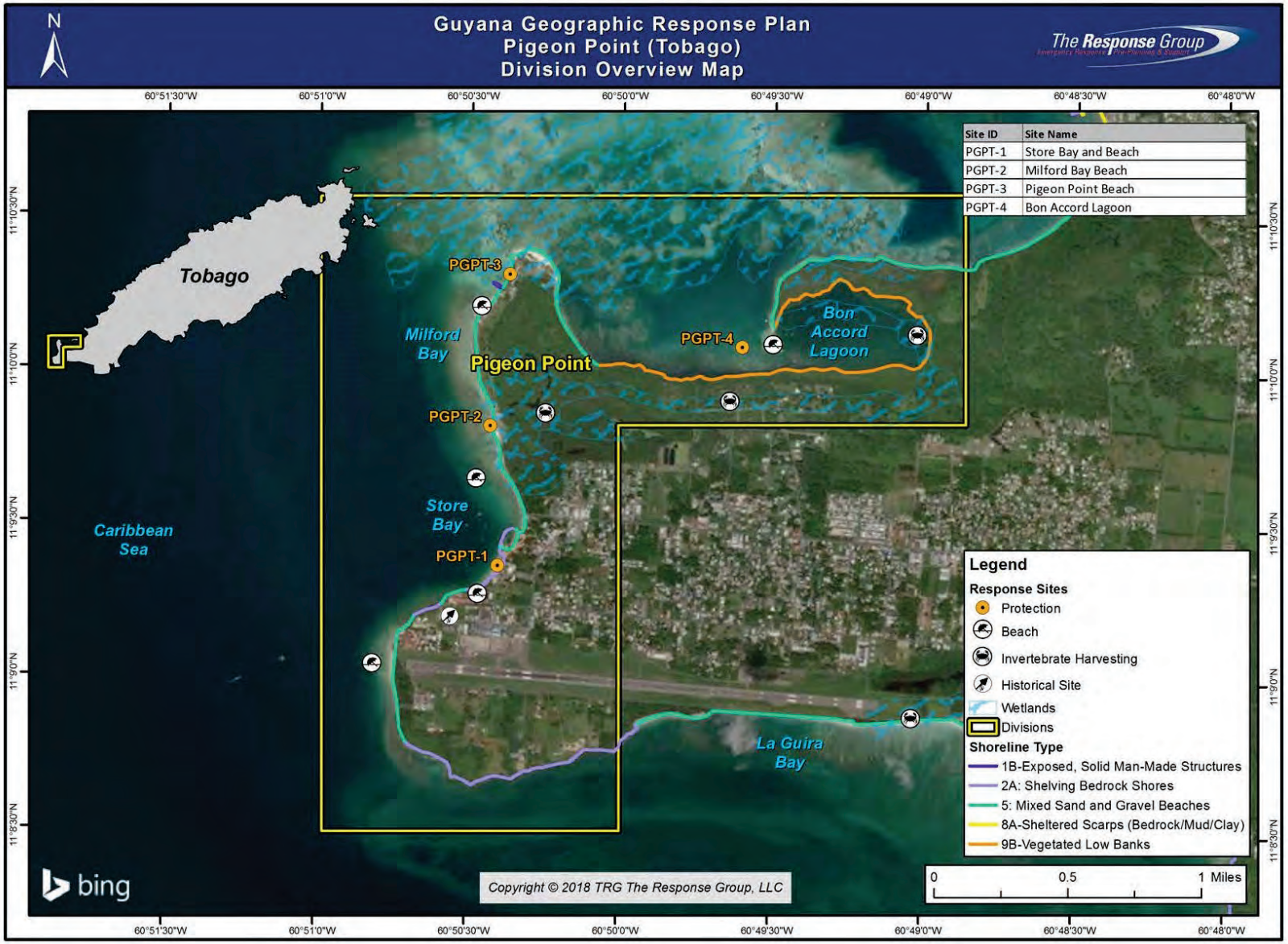
Guyana Geographic Response Plan
Pigeon Point (Tobago)
Division Overview Map
The Response Group
N
60°51'30"W
60°51'0"W
60°50'30"W
60°50'0"W
60°49'30"W
60°49'0"W
60°48'30"W
60°48'0"W
11°10'30"N
11°10'0"N
11°9'30"N
11°9'0"N
11°8'30"N
Site ID
Site Name
PGPT-1
Store Bay and Beach
PGPT-2
Milford Bay Beach
PGPT-3
Pigeon Point Beach
PGPT-4
Bon Accord Lagoon
Tobago
PGPT-3
Milford Bay
Pigeon Point
PGPT-4
Bon Accord Lagoon
PGPT-2
Store Bay
Caribbean Sea
PGPT-1
La Guira Bay
Legend
Response Sites
Protection
Beach
Invertebrate Harvesting
Historical Site
Wetlands
Divisions
Shoreline Type
1B-Exposed, Solid Man-Made Structures
2A: Shelving Bedrock Shores
5: Mixed Sand and Gravel Beaches
8A-Sheltered Scarps (Bedrock/Mud/Clay)
9B-Vegetated Low Banks
0
0.5
1 Miles
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Guyana Geographic Response Plan	Pigeon Point Division – PGPT-4 Protection Site	Bon Accord Lagoon

Site Information

Site Name:
Bon Accord Lagoon
Latitude: 11° 10' 5.052" N
Longitude: 60° 49' 35.734" W
County: Tobago
Country: Tobago
Population Density: Moderate
Land Use: Recreational, Commercial
Existing Response Support Capabilities: Boat Ramp

Site Picture

Photo 1: Looking East across Bon Accord Lagoon

Access Information

Site Access: Road, Boat
Road Type: Light Duty
Road Surface Type: Paved
Road Condition: All Weather
Access Type: Public
Bridge Height: N/A

Waterway Information

Type of Waterway: Bay
Waterway Name: Bon Accord Lagoon
Average Current Speed: N/A
Waterway Width: Low Water: N/A
High Water: N/A
Tidally Influenced: Yes
Shoreline Type: Mixed Sand and Gravel Beaches, Vegetated Low Banks
Bank Slope: Slight
Bank Height: N/A

Response Information

Deployment Strategy: Protection
Low Water: Booming
High Water: Booming
Boom Required: 4,600 ft of Hard Boom
Recovery Method: N/A
Tank Truck Access: N/A
Pump / Hose Required: N/A
Recommended Staging Area: N/A
Nearest Boat Ramp & Dist.:
Bon Accord Lagoon Boat Ramp

Site Contact Information

Organization: N/A

Phone: N/A

Cellular Service: Good

Site Description

Access Location Description: This site is located along the shoreline of Bon Accord Lagoon between Pigeon Point and No Man's Island.

Hazards: Slips, trips, and falls. Underwater hazards and currents.

Obstructions / Limitations: Debris along shoreline including wood.

Considerations

Associated Sensitivities: Mangrove Trees

Strategy Considerations: Environmentally sensitive sheltered lagoon with mangroves lining 90% of the shoreline. Boats anchor offshoreline near Pigeon Pt. Beach. Small boat launch on southside of lagoon in remote area. Only access is by boat. Area is covered in sea grass beds near shore and scattered coral reefs further offshore.

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PGPT-4

Guyana
Geographic Response Plan

Pigeon Point Division – PGPT-4
Protection Site

Bon Accord Lagoon

Site Pictures

Photo 2: Looking North down the beach towards Pigeon Point

Photo 3: Looking North towards the boat ramp

Strategy Map

Assignments

1.) Deploy a total of 3,600 ft of hard boom to protect the shoreline.
2.) Deploy a total of 1,000 ft of hard boom across the waterway to protect Bon Accord Lagoon.

Resources Required

Type	Description	Qty.	Size	Type	Description	Qty.	Size
Manpower: Supervisor	Supervisor	2 ea	N/A	Manpower: Responder	Responder	12 ea	N/A
Boom Accessories	Anchor Stakes	50 ea	N/A	Boom	Hard Boom	4600 ft	18 in
Manpower: Operator	Boat Operator	4 ea	N/A	Vessel	Work Boat	4 ea	20 ft
Boom Accessories	Boom Anchors	20 ea	40 lbs				

The Response Group

PGPT-4

Appendix F WILDLIFE RESPONSE PLAN

Wildlife Response Plan

Prepared for

Esso Exploration and Production Guyana Limited (EEPGL)

ExxonMobil Biomedical Sciences, Inc.

Updated May 2018

1. Introduction

Objective

Prevention of oil spills remains the top priority for EEPGL. In the unlikely event of a spill, it is important to be prepared to minimize the duration and impact of any release. For a subsea well release, capping and containment measures are available to serve this purpose. Beyond those mitigation measures, it is important to have a robust spill response capability utilizing all appropriate tools. The proper selection and use of those tools should be based on minimizing overall harm to environmental and economic resources. A critical aspect of protecting wildlife once oil is released is to minimize the formation of floating slicks and when formed to prevent such slicks from coming ashore driven by wind/currents. As this is not always possible more detailed wildlife response planning is necessary.

This Wildlife Response Plan is supplemental to the Esso Exploration and Production Guyana Limited (EEPGL) Oil Spill Response Plan (OSRP) and is intended to serve as general guidance for wildlife deterrence (hazing), capture, and rehabilitation during an oil spill response. The principal objectives of Wildlife Operations during a spill are:

- Provide the best achievable protection of wildlife and habitats from contamination;
- Minimize injuries to wildlife and habitats from contamination;
- Minimize injuries to wildlife from the cleanup;
- Provide the best achievable capture and care for injured wildlife;
- Document adverse effects that result from the spill and cleanup; and
- Prevent injuries to responders and the public.

In the event of potential wildlife impacts, EEPGL personnel will immediately contact and request assistance/expertise from the ExxonMobil Regional Response Team (RRT), ExxonMobil Biomedical Sciences Inc. (EMBSI), and Sea Alarm/Oil Spill Response Ltd (OSRL). Contact numbers are listed in Table 3-1. Initial wildlife response guidance is provided in Appendix G of this plan.

Potential Oil Spill Impacts on Wildlife

Wildlife may be vulnerable to oiling depending on their behavior, food preferences, and habitat requirements. They may encounter oil in near-shore and intertidal areas, and at sea. The number of individuals and species affected by an oil spill will depend on the size of the spill, chemistry of the petroleum product spilled, meteorological and oceanographic conditions, time of year, and the location of the spill. Species feeding in intertidal and near-shore areas are often vulnerable to oiling. Many important bird and turtle habitats are located in near-shore and intertidal areas. Some mammals may scavenge for food in intertidal areas and may encounter oiled carcasses. Foraging animals may encounter and ingest oil-contaminated vegetation or other oil-contaminated food sources in coastal areas.

Seabirds are highly vulnerable to oiling since they feed and rest on the water surface. Whales and dolphins have low vulnerability to oiling as these animals tend to avoid areas that are oiled. Turtles generally have a low vulnerability to oiling, but vulnerability may increase during nesting seasons.

Exposure to oil can occur from swimming or wading through oil. Ingestion of oil may occur if an animal attempts to clean its oiled feathers or fur. Another route of oil exposure is through the consumption of oil-contaminated food or water.

General effects of oil on wildlife can be separated into physical and toxicological effects. An example of a physical effect is loss of water repellency and insulating properties of feathers when birds become oiled. As a result, the ability to thermo-regulate may be impaired or lost.

Toxicological effects of oil on wildlife include irritation of the eyes, skin, mucous membranes, lungs, and digestive tract. Organ damage and disruption of immune responses may occur. Effects of oil on wildlife reproduction may include altered breeding behavior, decreased hatching success, and decreased survival rates of the young.

Protected Species and Areas of Special Value

Protected species and associated habitats that are at risk of oiling should be given priority protection during an oil spill response. In oiled wildlife response planning, it is important to consider:

- Input from appropriate regulatory agencies;
- Seasonality of species occurrences (breeding, nesting, and migration periods);
- Habitats important for breeding, nesting, feeding, or resting;
- Areas of high density occurrences; and
- Prioritization for protection of important habitats identified in the oil spill response plans.

Appendices A, B, C and D of this plan describe some of the habitats, birds, and marine reptile and mammal species that are at risk of oiling from EEPGL operations. In these appendices, information is provided for key sensitive periods (nesting, molting, migration, breeding, rearing).

Basis for Wildlife Response Plan

Under the country's Environmental Protection Act, companies active in oil and gas exploration or drilling must prepare an Emergency Response Plan / Oil Spill Contingency Plan that includes provisions for rescuing and restoring plants, animals, etc. (i.e., Oiled Wildlife Response Plan, and Environmental Management or Pollution Prevention Plan). An oiled wildlife response plan provides for pre-planning for the protection of sensitive habitats and species while considering seasonal effects and behaviors. The plan facilitates the identification of protocols, and resources (equipment and personnel) necessary to respond to an incident in a timely manner. Lastly, the plan identifies the needs and capabilities necessary to reduce or avoid impacts to sensitive habitats and species during an oil spill response.

Geographical Extent of Response

The geographic area of concern for response activities for wildlife is typically defined by the extent of the influence of the Project and its alternatives. See Section 2.2 of the OSRP for a description of the geographic extent of an EEPGL response.

2. Incident Command System and Tiered Response

This section provides a general overview of the ICS and a tiered approach used for oil spill response, with emphasis on wildlife response activities. The ICS designed to provide a framework for a consistent, efficient, and effective means to train, activate, and implement EEPGL's response resources. The ICS also facilitates interaction with Contractors, Subcontractors, Guyana government agencies, and non-government organizations that could become involved during a spill response. Table 2-1 shows the sections and key activities of the ICS.

Table 2-1 Key ICS Sections and Activities

ICS Function	Activities
Command Staff	Overall Oil Spill Response Management Management Liaison Government Liaison Community Liaison Media/Public Affairs Liaison Legal Support Safety and Health Oversight
Operations Section	Oil Spill Source Control Site Safety and Security Surveillance Dispersant Application *In-Situ* Burning Offshore/Near-shore Containment and Recovery On Land Containment and Recovery Shoreline, River, and Resource Protection Pre-Impact Debris Removal Shoreline Treatment and Cleanup Bioremediation Waste Management Wildlife Deterrence, Capture, and Rehabilitation
Planning Section	Site Characterization and Analysis Documentation Spill Tracking and Surveillance Sensitive Areas Identification and Characterization Environmental Monitoring Incident Action Plan Coordination Oil Spill Sampling Oil Spill Response Technical Support Dispersant / *In-Situ* Burning Support Waste Management Support Demobilization

Finance and Logistics Sections	Transportation (Air, Water, Land) Housing Catering Telecommunications Customs Clearance Security Field Operations Support Personnel Resourcing Material Distribution

The structure for the wildlife response organization is designed to fit within the ICS and allows for the integration of wildlife activities into the entire oil spill response plan (IPIECA, 2004).

Wildlife response is typically managed under the Wildlife Branch of the Operations Section of the ICS and coordinated through the Environmental Unit of the Planning Section. For example, the Planning Section identifies and characterizes environmentally sensitive areas and wildlife at risk. The Operations Section is responsible for wildlife deterrence, capture, rehabilitation, and shoreline protection. See Appendix G for initial response activities of the Wildlife Branch.

The tiered response system provides preparedness for the full range of scenarios that may be imaginable, from an incident of lessor wildlife significance (a few animals threatened or affected) to a more significant incident (e.g. thousands of animals, a mix of species groups, large stretches of complicated shorelines).

In a tiered response, assets are mobilized locally or from further afield according to the size and complexity of the incident and the availability of appropriate resources. In a Tier I response, assets are mobilized within hours of notification of the incident; and can be sourced from pre-identified stocks located at either the Project shorebase(s(, to deal with an incident in its early stage of development. If a more complicated scenario begins to unfold (Tier II or III), EEPGL would activate additional resources such as the ExxonMobil Regional Response Team and/or OSRL to mitigate the impacts of the spill.

3. Response Personnel

Only trained and qualified personnel should haze, capture, transport, and rehabilitate oiled wildlife. ExxonMobil has contracts in place with two internationally recognized oiled wildlife response organizations: International Bird Rescue (IBR) and Tri-State Bird Rescue & Research, Inc. Experts from these two organizations, and other available international organizations, can be mobilized to Guyana within days by contacting Sea Alarm. ExxonMobil is a participant in a Global Oiled Wildlife Response System (GOWRS) which is monitored by Sea Alarm. Wildlife response experts who are prepared to assist ExxonMobil during an oil spill are listed in Table 3-1.

The OSR Wildlife Plan will be implemented with the assistance of trained and qualified contractors and support groups. Upon notification, contractors and trained local experts (if applicable) will mobilize equipment and trained personnel to the spill site and begin wildlife response operations. Wildlife Response equipment for the initial response is available through OSRL in Fort

Lauderdale, Florida, USA. Additional equipment will be brought in as needed. Wildlife response standard operational protocols can be supplied by wildlife experts at the time of response or developed ahead of time.

There are no wildlife rehabilitators in Guyana with oiled wildlife experience. There are also no permanent facilities for oiled wildlife rehabilitation and few organized wildlife rehabilitation programs in the country. The Karanambu Trust may be able to help should otters be affected by a spill. The Guyana Marine Turtles Conservation Society (GMTCS) would likely be involved in marine turtle response. Several small facilities in Trinidad and Tobago are available for Tier I responses, and are listed below.

Conservation organizations in Guyana include:

Government Ministries:

- Environmental Protection Agency;
- Protected Areas Commission;
- Guyana Forestry Commission;
- Wildlife Management Authority.

Non-Governmental and Academic Institutions:

- Conservation International;
- Guyana Marine Turtles Conservation Society (GMTCS);
- Guyana Tropical Birds Society;
- Guyana Mangrove Restoration Project;
- Centre for the Study of Biological Diversity;
- School of Earth and Environmental Sciences, University of Guyana;
- Environmental Clubs of Guyana.

Organizations in Trinidad and Tobago:

- Wildlife Orphanage and Rehabilitation Center – WORC (Trinidad);
- El Soccoro Center for Wildlife Conservation (Trinidad);
- Pointe-a-Pierre Wildfowl Trust (Trinidad);
- Tobago SPCA (Tobago).

Table 3-1. Contact Information for Wildlife Experts and Responders

Contact	Contact Name	Contact Information	Comments
GDF Coast Guard	Operations Center	+592-226-8488	Spill notifications
Guyana Environmental Protection Agency	Duty Officer	+592-225-5467 or +592-225-5469	Spill notifications
Guyana Ministry of Natural Resources and the Environment	Department of Governance	+592-231-2506 ministry@nre.gov.gy	Spill notifications
Harbour Master Starbroek, Georgetown	Duty Officer	+592-226-7842	Spill notifications
Guyana Marine Turtle Conservation Society (GMTCS)	Michelle Kalamandeen, Project Coordinator	+592-665-4876 gmtcs@bbgy.com	Conservation organization
The Karanambu Trust	Diane McTurk Executive Director	www.karanambutrustandlodge.org	Giant Otter expertize
ExxonMobil Biomedical Sciences, Inc. (EMBSI)	Richard Davi Richard Woods	+1 (908) 730-1111 richard.a.davi@exxonmobil.com richard.w.woods@exxonmobil.com	Wildlife Response Issues
Sea Alarm	Hugo Nijkamp	(Office) +322 2788 744 (Mobile) +32 494900012 (Mobile) +32 499624772 Nijkamp@sea-alarm.org	Oiled Wildlife Response facilitator
Oil Spill Response Ltd. (OSRL)	Duty Manager Fort Lauderdale, FL, USA	+1 (954) 983-9880 +44 (0)23 8033-1551 (UK)	Wildlife Response equipment
IBR (International Bird Rescue)	Barbara Callahan	+1 (907) 230-2492 barbara.callahan@bird-rescue.org	ExxonMobil has a contract in place with IBR
Tri-State Bird Rescue & Research, Inc., Delaware	Dr. Heidi Stout, veterinarian	Main +1 (302) 737-9543 hstout@tristatebird.org www.tristatebird.org	ExxonMobil has a contract in place with Tri-State
WORC (Trinidad)	No contact name available	299 Queen Elizabeth Avenue Petit Valley, Trinidad and Tobago, West Indies Tel: (868) 637-3842 Email: worctrinidad@gmail.com	Oiled wildlife facility in Trinidad (25 animal capacity)
El Socorro Center for Wildlife Conservation	Gia Narinesingh Ricardo Meade	Freeport, Trinidad and Tobago +1 (868) 673-5753	Wildlife facility in Trinidad (limited capacity)
Pointe-a-Pierre Wildfowl Trust	Molly Gaskin – Trust President	St. James, Trinidad +1 (868) 658-4200 ext. 2512	Wildlife facility in Trinidad (limited capacity)

A licensed veterinarian is integral to the oiled wildlife response organization. The veterinarian, using a pre-approved decision tree, will confer with the appropriate Guyana authorities and fauna experts to decide which oiled animals should be rehabilitated and which animals should be euthanized. For those animals that will be rehabilitated, the veterinarian administers or supervises the appropriate treatment.

According to the Guyana Agriculture Ministry, there are approximately 45 active veterinarians in Guyana. Contact can be made through the Guyana Veterinary Association.

Trained and qualified personnel are essential to an oiled wildlife response. The training that each person receives will depend on the task that the person will perform during the response. Personnel may conduct wildlife deterrence operations or search for and capture oiled animals. Other personnel may stabilize and transport oiled animals to a treatment area. Once oiled animals arrive at the treatment area, additional personnel maintain records on the animals, clean pens, and prepare food for the animals. Qualified personnel that have received additional training may perform tasks such as administering fluids to dehydrated animals, take blood samples from animals, and wash oiled animals.

4. Training and Health and Safety

Worker health and safety are a priority during oiled wildlife response operations. The following is a summary list of safety precautions that need to be considered in the development of the Wildlife HSE Plan. Additional safety plans may need to be written for operation of specialized equipment (such as propane cannons, etc).

- Be proficient with Safety Data Sheets (SDS);
- Recognize that most common hazards are slips, trips, and falls;
- Maintain necessary immunizations, including tetanus and hepatitis;
- Observe all industrial hygiene safety precautions stated in the Safety Plan;
- Ensure proper training regarding hazards of the work task, and the proper use of personal protective equipment (PPE);
- ALWAYS work in teams; never conduct wildlife rescue work alone;
- Don’t overwork;
- Keep animals at or below one’s waist level to protect the face and eyes from pokes, bites, and scratches;
- Wear approved personal protective equipment;
- Always remove PPE and wash hands and face with soap and water or approved cleaners before eating, drinking, or smoking;
- Never eat, drink, or smoke in wildlife handling areas;
- Minimize contact with contaminated materials and inhalation of vapors even when wearing PPE;

- Keep all oil, cleaning compounds, and contaminated materials away from face, eyes, and skin;
- Ensure work areas are clean and well ventilated;
- Report all injuries and illnesses to the supervisor and/or Command Center medical staff;
- Do not work with oiled wildlife if you are ill, pregnant, have an immunosuppressive condition, or are taking medication that might affect your natural immunity.

4.1 Training for Wildlife Response Personnel

In addition to being trained in specific wildlife response tasks, personnel will be trained to recognize and prevent oil-related and physical hazards associated with wildlife response operations. Complete training will be given to a core group prior to participation in oiled wildlife response activities.

4.1.1 Personal Protective Equipment (PPE)

To prevent exposure to oil and injury from wildlife, workers should wear approved personal protective equipment appropriate to their task. The following is a list of recommended PPE:

- Full eye protection (goggles or safety glasses) – eye protection is required when handling animals, especially birds. Birds will peck when under stress and should be considered dangerous as they will aim for eyes;
- Oil resistant rain gear or oil protective clothing (coated Tyvek, Saranex, etc.);
- Gloves (neoprene or nitrile rubber) that are oil resistant and waterproof and provide protection against beaks and claws;
- Non-skid shoes / boots, which are oil resistant and waterproof;
- Duct tape, used to tape rain jacket sleeves to gloves and rain pants to boots;
- Ear protection (muff or ear plug type) during deterrent operations, if appropriate;
- Respiratory protection, if appropriate.

In addition, the following PPE are recommended:

- Long-sleeved shirts;
- Hat (to provide shade in hot weather);
- Change of clothes (to rest or leave in);
- Clean towel / toiletries;
- No jewelry (birds will peck at bright, shiny objects).

Clothing and equipment to protect against bites and scratches should be worn underneath the oil protective equipment whenever necessary. Respiratory protection from organic vapor hazards may also be required for some operations. If respirators are used, respirator training and fit testing are required. Workers will be trained in the proper use and limitations of all PPE prior to using the equipment.

4.2 Worker Safety

Worker safety is the primary consideration in wildlife handling. Handling and restraint techniques appropriate for specific species need to be applied by trained and experienced personnel.

Oiled wildlife response is often physically and emotionally stressful. Dehydration, exhaustion, and poor nutrition can affect a person's ability to assess and react to a dangerous situation. It is therefore important that workers stay well hydrated and eat nutritionally sound meals. Rest is equally important. The safety of all depends on the alertness of each individual.

In addition to hazards from oil, numerous physical hazards may be associated with wildlife response activities. Workers should be aware of changing weather conditions, strong undertows in tidal areas, slick surfaces along shorelines. Personal flotation devices should be worn for all on-water and in-water operations.

4.3 Zoonosis

Wildlife may carry diseases that are transmissible to people. Diseases that are transmitted from animals to humans are called zoonoses, they may be viral, bacterial, fungal, or parasitic. **Individuals who have immunosuppressive conditions are more susceptible to contracting zoonotic diseases.**

Zoonoses can be transmitted to humans by:

- Inhalation of particles (spores, bacteria) in the air;
- Ingestion of feces (i.e. projectile feces, poor hygiene, etc.);
- Contact with the skin.

To reduce risk of contracting a zoonotic disease, wildlife handlers should always:

- Wash hands thoroughly with soap and water after handling wildlife;
- Wash hands well before and after eating or smoking;
- Smoke, drink, or eat in designated areas only and not near wildlife;
- Clean and treat all cuts and scratches;
- Use gloves as much as possible;
- Use surgical masks as appropriate.

In addition, there is a potential health risk to poultry, farm, and domestic animals (including pets) from clothing or equipment that has been in contact with wildlife. Return used oil spill response equipment and supplies for proper decontamination or disposal. Thoroughly wash, and disinfect as appropriate, all personal items after completing wildlife response tasks for the day.

5 Wildlife Deterrence (Hazing)

5.1 Introduction

The primary strategy for wildlife protection is controlling the spread of spilled oil to prevent or reduce oil contamination of potentially affected species and habitats. Removal of oiled debris and contaminated food sources also protects wildlife. Another method of wildlife protection is deterrence or hazing. Hazing is the term used when a variety of deterrents are used to prevent wildlife from entering areas already oiled or areas that are in the projected pathway of the oil. Hazing should be carefully planned and executed, since hazed wildlife could move into other oiled areas.

Common hazing techniques include:

- Making noise with pyrotechnics, firearms, air horns, motorized equipment, or recorded bird alarm sounds;
- Using scare devices such as mylar tape, helium-filled balloons, scarecrows, predator effigies in oiled areas;
- Herding wildlife using aircraft, boats, ATVs, UAVs, or other vehicles;
- Hazing by human presence.

Information necessary to help determine whether or not to begin hazing operations include time of year, availability of nearby uncontaminated habitat, proximity of nesting colonies and location of species in relation to the spill. The decision tree for hazing is presented in Figure 5-1. Once the decision to haze is made, review the hazing plan with the Operations Section Chief, Incident Commander, and other appropriate authorities and obtain all necessary approvals, and permits (if required). Initiate deterrence activities as soon as possible. Whether or not a deterrent operation will be effective depends on the habitat, season, species, and their residency status and age. Deterrent effectiveness can decrease for birds occupying key habitat areas (established nesting colonies, important foraging areas) or during molting season.

The potential effects of human activity and disturbance on sensitive habitats should be considered prior to starting a hazing operation. For example, take care not to trample fragile vegetation by foot traffic or off-road vehicles. If pyrotechnics or gas operated cannons are used, take care to prevent igniting vegetation. Wakes from boat operations should not push floating oil further into wetlands or mangroves. If nesting season, consider the potential effects of hazing on bird reproduction. Young birds are more susceptible to predation if they become separated from their parents.

Each spill situation will be unique and preplanned deterrence activities are considered tentative. Consultation with local experts is advisable. Regulations should be followed regarding the purchase, possession, and discharge of firearms or explosives, including shotgun and pistol-launched pyrotechnics.

No attempt should be made to haze oiled wildlife. Depending on the extent of oiling, wildlife that is already oiled may need to be captured and cleaned. Hazing is most effective if the area of concern can be hazed as continuously as possible. Avoid hazing in areas with oiled habitat or adjacent to oiled habitats where hazed wildlife could become contaminated with oil.

Habituation is the gradual decrease in response to a deterrence method due to increased familiarity and acceptance. Habituation can be minimized by using a combination of hazing methods and frequently changing the type, timing, and location of the hazing devices. It is recommended that human patrols be incorporated in hazing operations. Molting birds are not easily deterred and require a combination of different techniques.

Hazing is not generally recommended for marine mammals. Before hazing is being considered for marine mammals (whales, dolphins, seals, otters, manatees), consult the appropriate regulatory authorities and marine mammal experts. There are no established methods or data for hazing whales and dolphins. Attempts to haze seals from rookery or haul out areas may cause panic and a stampede, resulting in injuries or death, especially for pups. Pup mortalities can also result from abandonment.

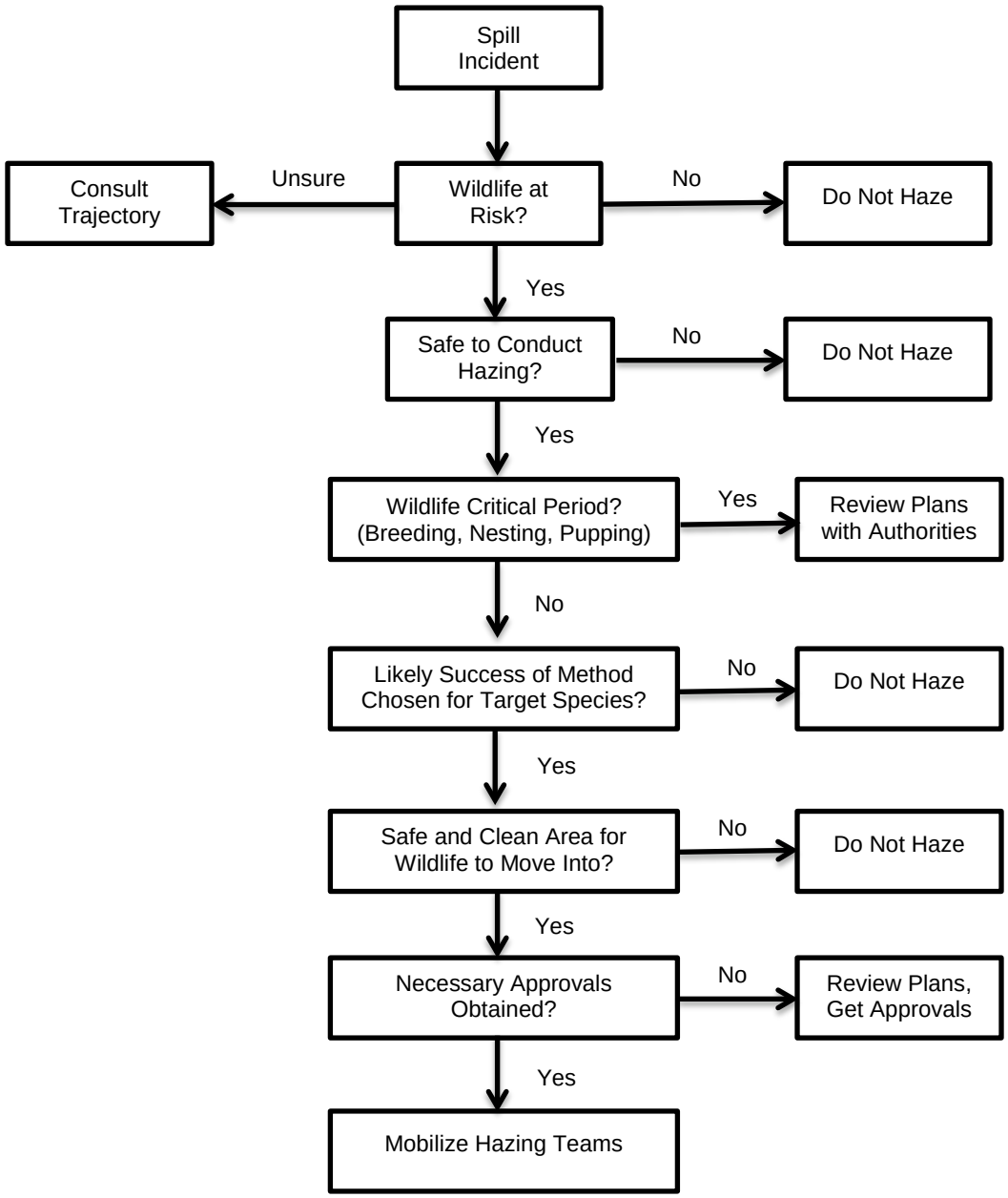

Figure 5-1: Hazing Decision Tree

5.2 Deterrence Methods and Equipment

Deterrent operations should include both visual and auditory techniques. Some petroleum products are highly flammable during the first few hours after a spill, due to high concentrations of volatile oil fractions. Techniques with potential to induce sparks should be avoided in these situations. The effects of sound emitting devices on humans, in terms or irritation and noise, especially at night, will influence whether or not some hazing methods will be acceptable.

5.2.1 Gas-Operated Cannons

Gas-operated cannons should only be used by trained personnel. The cannons produce a loud shotgun-like noise when discharged. Blasts are emitted at adjustable time intervals from less than one minute to as much as 30 minutes. If multiple cannons are used in an area, stagger the firing intervals. Cannons should be elevated at a 45 degree angle and preferably aimed downwind to increase effectiveness. Propane cannons are more effective for migrating and hunted species that associate danger with loud noises.

5.2.2 Pyrotechnics

Pyrotechnic devices disturb wildlife by producing a whistling noise, explosion, and/or flash of light. Types include shotgun-launched projectiles (crackers), fireworks, and a variety of pistol-launched projectiles. Pyrotechnic devices are potentially dangerous and should only be used by trained personnel. Safety goggles and ear protection should be worn by operators. When using these devices, care must be taken not to ignite spilled oil or vegetation.

5.2.3 Aircraft

Aircraft are often effective for deterring birds and terrestrial mammals because of the combination of loud noise and rapid approach from above. Because of their maneuverability and noise, helicopters are probably more effective than fixed-wing aircraft.

5.2.4 UAVs

Unmanned Aerial Vehicles (UAVs) operate similarly to manned aircraft, but may be able to operate at lower altitudes. Typically they operate in conjunction with ground or boat based personnel. UAVs can be used to scare off birds in flight. UAVs should be operated by trained personnel and must be approved by the Aviation Branch and appropriate government authorities.

5.2.5 Boats

Air boats or boats propelled by outboard motors can be used to haze wildlife and marine mammals. Small, noisy, shallow draft boats have been reported to be particularly effective. Boats can be used in combination with other hazing methods (i.e., UAVs, pyrotechnics).

5.2.6 All-Terrain Vehicles (ATVs)

ATVs are moderately effective for hazing many species of wildlife. Human presence reinforces the effects of the noise and rapid movement of the vehicle.

5.2.7 Air Horns

Air horns can be used to deter wildlife. Since habituation may be rapid, it is recommended that air horns be used in combination with other deterrent methods or devices.

5.2.8 Electronic Sound Generators

Sound generators broadcast loud, intermittent electronically synthesized sounds. The units can be adjusted to the most effective range of sound patterns for the target species. Sound generators can be positioned on land, mounted on boats, or housed within floats in water. When a sound generator is deployed within a drifting slick, the potential of scaring birds directly into the oil-contaminated water is reduced.

5.2.9 Balloons

All-weather helium balloons are considered effective if frequently refilled and moved. They can be suspended from land or from floating objects in water (e.g., spill booms). They should not be located near trees or other objects that could cause puncturing.

5.2.10 Human Effigies and Predator Models

Human effigies (scarecrows) and raptor models may be effective if they appear lifelike, have motion, are moved frequently, and are used in combination with loud sounds or recorded distress calls.

Additional hazing techniques are available. The recommendation to haze will be guided by site-specific and species-specific factors present at the time of the spill, and availability of proven hazing techniques.

6 Capture and Transport of Oiled Wildlife

6.1 Objective

The sooner oiled wildlife can be captured and treated the better their chances for survival. It is helpful to plot and number oiled wildlife on maps and charts to identify search and recovery patterns. Reconnaissance surveys for oiled wildlife may occur in offshore and near-shore waters, shorelines in oiled areas, in addition to areas that could potentially be oiled. Reconnaissance surveys may also be conducted at nearby feeding and nesting areas to detect oiled wildlife that may have moved away from oiled areas. The objectives of a reconnaissance survey are to 1)

evaluate the number, species, and locations of wildlife potentially affected by an oil spill and 2) determine the feasibility to rescue oiled wildlife.

Local experts can provide information regarding special site considerations (i.e., nesting grounds, cultural or historic sites) and oiled species prioritization for capture. An effort should be made to avoid capturing birds, or other animals, that are not impacted by the spill, unless otherwise authorized.

Wildlife capture operations should only be conducted when weather conditions permit. Captured wildlife may be aggressive and should be regarded as potentially dangerous. Only trained individuals should undertake the capture and treatment of oiled wildlife.

6.2 Capture

A capture team consists of two or more individuals wearing appropriate protective clothing. Capture strategies should be discussed before any attempt to capture oiled wildlife. Safety of individuals is not to be compromised for the objective of capture.

A variety of methods can be used to capture wildlife:

- Dip nets, throw nets, or mist nets can be used for small birds and mammals;
- Seine nets and net guns can be used for larger birds or turtles;
- Capture poles can also be used.

Oiled birds can be approached using boats, but it is best to allow them to reach the shore if possible. Oiled wildlife should be approached carefully so as not to further stress the animal.

Appropriate handling techniques are based on the size and species of the animal. Field personnel should be properly trained before attempting to handle oiled wildlife.

Dead wildlife should also be collected to prevent other wildlife from becoming oiled as they attempt to eat the carcasses. Each carcass should be labelled, numbered, and documented on the appropriate form.

6.3 Transport

Oiled wildlife should be transported in well ventilated containers of sufficient size for the species captured. Some species may be placed 2 or 3 to a container. Containers should be placed in an area separate from the operator of the transport vehicle to protect the operator from inhaling vapors. Temperature should be maintained at an adequate level to prevent hypothermia or overheating.

7 Stabilization, Rehabilitation, and Husbandry

7.1 Introduction

If an oiled animal is hypothermic, dehydrated, sick, or injured, it may not survive the stress of being washed. Stabilization increases an oiled animal's chances for a successful rehabilitation and release.

7.2 Stabilization

A stabilization center will serve as a collection site for all oiled wildlife collected by the wildlife search teams. A field stabilization group will provide initial care in the field prior to transportation to the rehabilitation facility. Stabilization can include warming or cooling of oiled animals to stabilize body temperature, preliminary examinations and initial cleaning, and providing fluids and nutrition.

7.3 Rehabilitation

A suitable facility must have a large open space that can easily be reconfigured to accommodate the changing needs of the wildlife rehabilitation process. Contracted wildlife specialists and/or agency representatives should be consulted regarding facility requirements for optimum rehabilitation. The following are equipment and facility considerations:

- Location with respect to location of spill;
- Anticipated number of animals;
- Types and numbers of species;
- Season / weather;
- Hot and cold water capacity;
- Electric and lighting;
- HVAC systems (good air handling necessary);
- Communications;
- Noise control;
- Waste management issues (collection and storage);
- Appropriate holding pens (species dependent).

Each wildlife rehabilitation facility must have a Site Safety Plan in place prior to start-up. The Site Safety Plan must include checklists for measures to avoid physical, chemical, and biological hazards, safe animal handling procedures, and other emergency procedures and contact numbers.

Buildings of Opportunity

It may be possible to secure an appropriate building for oiled wildlife rehabilitation that is normally used for some other purpose but can be quickly transformed into a suitable facility. Examples may include warehouses, community centers, etc. To utilize this option will require considerable planning and contracts with building owners, suppliers and tradesmen to ensure that the facility can be up and running within hours when needed, and is able to provide the required space, water, heating and ventilation necessary to meet the goals of the wildlife plan (IPIECA, 2014).

Mobile facilities

Mobile facilities are comprised of modules (trailers, containers, tents, etc.) that can be easily transported and set up wherever they are needed. Infrastructure needs may vary, and potential settings could, for example, range from a large warehouse space with water and utilities to a level field or the deck of a barge or large ship. Such facilities may be used for field operations or all phases of rehabilitation. A wide variety of examples of mobile units exist that are intended for use as specific components or as a complete oiled wildlife rehabilitation facility (IPIECA, 2014).

8 Wildlife Release Considerations

The goal in rehabilitating oiled wildlife is the release of healthy animals back into their natural environment. Release of rehabilitated wildlife requires planning in advance. Consultation with local wildlife experts, government agencies, and Incident Command is necessary to determine appropriate release sites and disposition of animals that cannot be released. Timely release is important to prevent or reduce occurrence of secondary problems associated with captivity. For wildlife that cannot be released, the options are euthanasia or placement in a long-term facility.

To be released, wildlife must exhibit:

- Normal behavior;
- Normal body weight;
- Waterproof (particularly in seabirds);
- Normal blood values and physical exam;
- Normal feeding.

Release sites should:

- Be free of oil contamination and not at risk of re-contamination;
- Same general geographic area or habitat of capture;
- Minimal human disturbance;
- Appropriate seasonal range for species (important for long rehabilitations);
- Safe for response personnel.

If post-release monitoring is necessary, wildlife should be tagged or banded prior to release to aid visual observation.

9 Record Keeping

Record keeping is an important part of a wildlife rehabilitation program. Records are essential for evaluating the effectiveness of treatments and whether the rehabilitation efforts were successful. In addition records are used to determine a spill's impact on wildlife. Records are usually divided into the following types:

- Field Survey and Wildlife Collection:
  - Document species collected, numbers, condition, location, etc.;
- Chain-of-Custody:
  - Used to track transport and transfer of all collected animals;
- Admission and Examination:
  - Record of admission to rehab center, initial assessments, etc.;
- Treatment:
  - Tracks treatment of individual animals, feeding, behavior, etc.;
- Necrospy:
  - For use by veterinarian for determining cause of death.

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See additional references in EIA for Liza Phase 2 Development Project.

Appendix A – Habitats

Additional information on habitats in Guyana is included in EIA for Liza Phase 2 Development Project.

Coastal and Marine Habitats

Several habitat types are present in the network of plains and low hills that comprise Guyana's coast, including mangroves, salt to brackish lagoons, brackish herbaceous swamps, swamp woods and swamp forests. The swamps are an important source of freshwater to mangroves and other flora and fauna. The coastal mangroves are vital to Guyana's biodiversity, physical security, and economy. Guyana has relatively few beaches, but the Shell Beach Protected Area beaches are critically important nesting habitats for marine turtles.

Guyana's continental shelf occupies an area of 48,665 sq. km. The average width of the continental shelf is 112.6 km (NDS, 1997). The shelf is widest near the Suriname and Venezuela borders, and slightly narrower near the center, north of Georgetown. The entire continental shelf, continental slope, and the adjoining portion of the abyssal plain (including the Sorubim and Liza Areas of Interest) are part of the North Brazil Large Marine Ecosystem (LME). The North Brazil LME is an oceanic habitat unit that extends from the Caribbean Sea south to the Parnaiba River in Brazil. Marine benthic biological resources offshore of Guyana are poorly studied, but do not include the matrix of shallow coral reefs and seagrass meadows that are characteristic of coastal tropical Atlantic environments elsewhere. This is due to the highly turbid conditions offshore of Guyana, which do not permit the growth of warm water corals, since they rely on symbiotic photosynthetic algae for nourishment (ERM, 2016).The substrate is generally composed almost entirely of mud and silt deposited by the North Brazil Current.

Mangroves

Mangroves are important ecosystems to security of the biodiversity of the entire Guiana Shield region. They occupy over 81,000 hectares of Guyana's coast but the distribution of mangroves along the coast is highly dynamic, and subject to rapid change. Six of Guyana's ten geopolitical regions have mangroves but approximately 75% of the country's mangroves are concentrated in the Barima-Waini and Pomeroon-Supenaam regions.

There are currently three species of mangrove in Guyana: Rhizophora mangle (Red mangrove), Avicennia germinans (Black mangrove), and Laguncularia racemosa (White mangrove). Many invertebrates live either on or in close proximity to mangrove roots and substrate and include snails, barnacles, tunicates, mollusks, polychaete worms, oligochaete worms, small shrimps and crabs, sponges, jellyfishes, amphipods and isopods. These small organisms provide forage for birds, mammals, reptiles, amphibians, fish, and other larger crustaceans.

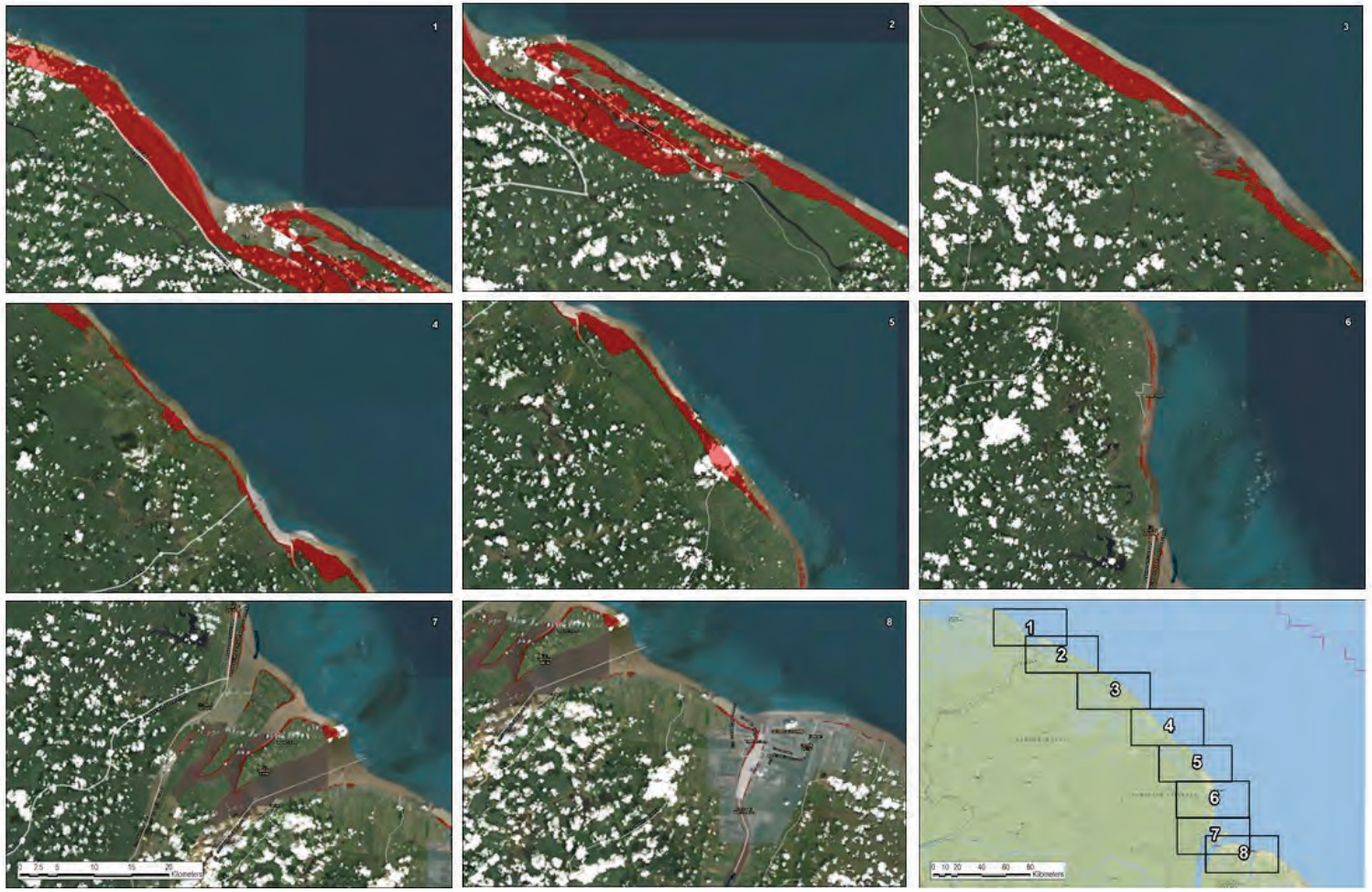

Figure F-1: Guyana's Coastal Mangrove Distribution (Georgetown west to Venezuelan Border, Red Shading Indicates Mangroves)

Mud Banks

The 1,500 km-long coast of South America between the Amazon and Orinoco River mouths is the world's muddiest coastline. Mud banks extend approximately 20 to 460 km offshore to an average thickness of 20m, and are located seaward of the mangrove swamps that fringe much of the coastline. The mud banks are rich in invertebrate fauna, including plankton and micro-plankton assemblages, algae mats (diatoms), and benthic communities of Nematodes (worms), Tanaidacea (crustaceans), and Foraminifera (amoeboid protists). These small organisms provide habitat for fish species, post-larval and juvenile shrimps, and crabs, and numerous resident and migratory shore birds.

Shell Beach

Shell Beach is a protected area on Guyana's coast that could potentially be impacted by a spill. It accounts for 200,000 ha or approximately 11% of Guyana's total protected area. Figure A-2 provides a detailed map of Shell Beach and the surrounding area. It is located in northwestern Guyana and extends for almost 140km between the Waini, Baramani, and Moruka rivers and the Atlantic Ocean. Shell Beach is a dynamic area and constantly changes due to the competing effects of erosion and deposition along the shorefront. Seventy percent of the area is forested; the rest is made up of mostly swamp (28.8%), and sandy beaches (1.2%). Shell Beach supports numerous species of plants including coconut, papaya, and palm trees.

Shell Beach is not the only portion of Guyana's coast that contains mangroves; mangroves are a prominent feature along much of northwest Guyana's coastline. They are ecologically important, and are a critical natural component of Guyana's coastal defense network, protecting the low-lying inland areas of the coast from sea-level rise and saltwater intrusion during storm events.

Shell Beach is best known as a marine turtle nesting site. The composition of the substrate at Shell Beach, its geographical location and the low human impact makes it an ideal nesting site for marine turtles. Most nesting beaches in Guyana are used by only one or two species of sea turtle but four species of sea turtle (Leatherback, Hawksbill, Olive Ridley, and Green Turtle) found in Guyana nest at Shell Beach (Pritchard, 2001).

In addition to the sea turtles there are also at least four other species of turtles present within the protected area including the yellow-foot tortoise (*Geochelone denticulate*), scorpion mud turtle (*Kinosternon scorpioides*), giant river turtle (*Podocnemis expansa*) and mata mata (*Chelus fimbriata*).

The Shell Beach area is also home to several species of mammals, including howler monkeys (*Alouatta* spp.), jaguars (*Panthera* spp.), and manatees (*Trichechus* sp.) (ERM, 2016). Amerindian groups also inhabit the Shell Beach area and are concentrated along the areas of Almond Beach, Father's Beach, and Assakata (ERM, 2016).

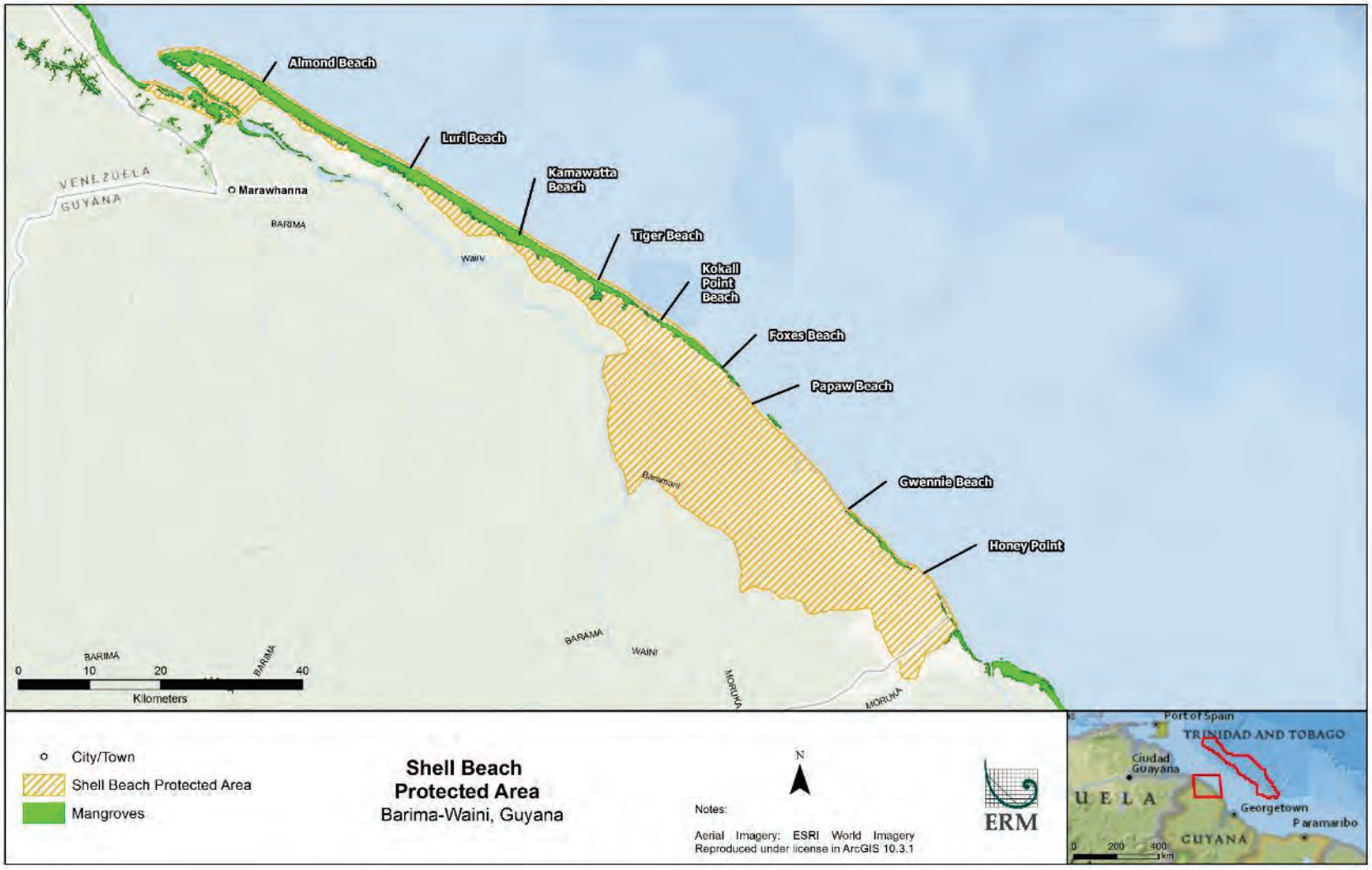

Figure F-2: Shell Beach Protected Area

Appendix B – Bird Species

Birds are by far one of the most diverse classes in the animal kingdom, owing their success to several adaptations over the course of evolution. Birds comprise over 8,600 species distributed among 23 orders.

Over 800 species of birds occur in Guyana, of which over 200 occur in coastal and/or offshore marine habitats for at least part of their life cycle. The bird groups that are most strongly affiliated with the coast are waterfowl, shorebirds, and colonial waterbirds. Waterfowl are species of birds that are ecologically dependent upon wetlands or waterbodies for their survival (e.g., ducks, geese, etc.). Shorebirds are found mainly on beaches and mudflats between the low and high water marks and are typically migratory, utilizing Guyana's coastline during the course of their bi-annual migrations. Colonial waterbirds are birds that live near water and nest in colonies or groups (e.g., gulls, terns, ibis, herons, etc.). Oceanic species such as frigatebirds and albatross spend most of their time at sea and are less common along the coast. Thirty-five species of seabirds are known to occur in Guyana (see Table F-1).

Many of Guyana's coastal bird species are migratory and so occur in Guyana on a seasonal basis, either spending the winter there or migrating through on their bi-annual northward and southward migrations. Birds that overwinter in or migrate through Guyana utilize the Atlantic and Central Flyways for their migration (see Figure F-3). These migratory paths are influenced by winds and geography. Guyana's coastal mangroves are noted for being wintering grounds for migratory birds including austral and Nearctic migratory species. Austral migrants breed in temperate South America during the summer, but spend the remainder of the year in the tropics. Nearctic migrants migrate in the other direction, breeding in North America during summer and overwintering in tropical South America. Both groups spend winter in Guyana, which creates a peak in migratory waterbird abundance in Guyana from September through mid-April.

Coastal habitats of South America provide ideal conditions for coastal birds, with mangrove forests providing shelter and nesting areas, mudflats providing important foraging sites, sandy beaches providing nesting habitat, and shallow water habitats providing foraging.

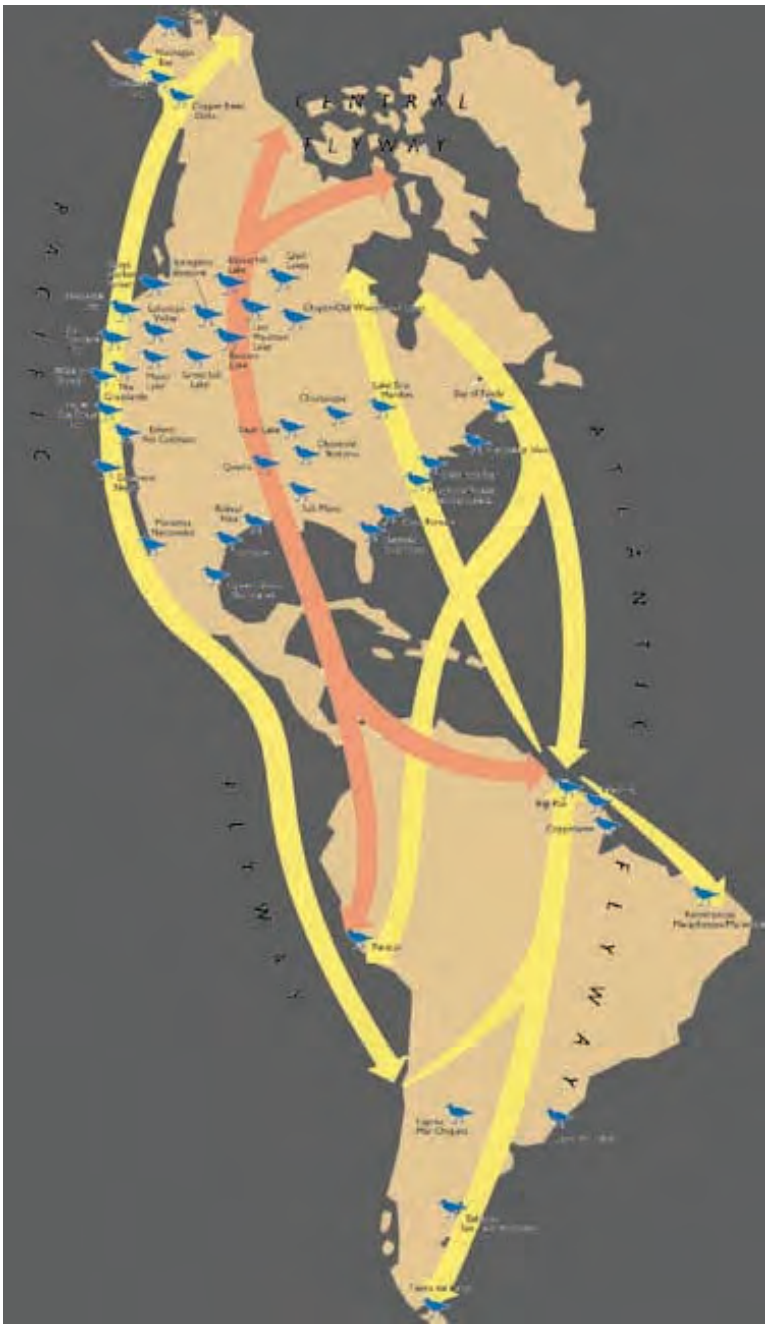

Figure F-3: Migratory Routes of Shorebirds

Migratory routes of shorebirds follow three main flyways: The Atlantic Flyway, The Pacific Flyway and The Central Flyway.

Table F-1: Seabird Species Known to Occur in Guyana

Common Name	Scientific Name
Great Shearwater a, b	*Ardenna gravis*
Cory's Shearwater a	*Calonectris borealis*
Barolo Shearwater d	*Buffinus baroli*
Audubon's Shearwater a, b	*Puffinus lherminieri*
Wilson's Storm-Petrel a, b	*Oceanites oceanicus*
Leach's Storm-Petrel a, b	*Oceanodroma leucorhoa*
Black-capped Petrel a, c	*Pterodroma hasitata*
Brown Pelican a, b	*Pelecanus occidentalis*
Brown Booby a, b, c	*Sula leucogaster*
Masked Booby c	*Sula dactylatra*
Red-footed Booby c	*Sula sula*
Magnificent Frigatebird a, b, c	*Fregata magnificens*
White-tailed Tropicbird c	*Phaethon lepturus*
Parasitic Jaeger b, c, d	*Stercorarius parasiticus*
Pomarine Jaeger a, b, c	*Stercorarius pomarinus*
Great Skua a, b	*Stercorarius skua*
Lesser Black-backed Gull c, d	*Larus fuscus*
Laughing Gull a, b, c	*Leucophaeus atricilla*
Brown Noddy a, c	*Anous stolidus*
Black Tern b, c, d	*Chlidonias niger*
Gull-billed Tern a, c	*Gelochelidon nilotica*
Bridled Tern c	*Onychoprion anaethetus*
Sooty Tern a	*Onychoprion fuscatus*
Black Skimmer a, c	*Rhynchops niger*
Roseate Tern a, c	*Sterna dougalli*
Common Tern a, b, c	*Sterna hirundo*
Royal Tern b, c, d	*Sterna maxima*
Arctic Tern c	*Sterna paradisaea*
Sandwich Tern c, d	*Thalasseus sandvicensis*
Bridled Tern e	*Onychoprion anaethetus*
Black-browed Albatross e	*Thalassarche melanophrys*
Red-billed Tropicbird e	*Phaethon aethereus*
Northern Gannet e	*Morus bassanus*
Bulwer's Petrel e	*Bulweria bulwerii*
Band-rumped Storm-Petrel e	*Oceanodroma castro*

[a] Braun et al. 2007
[b] BirdLife International 2016a
[c] eBird 2018
[d] Sight record only (Braun et al. 2007)
[e] ERM, 2018b

Important Bird Areas (outside of the Stabroek Area of Operation)

Three Marine IBAs of global or regional importance to seabirds have been designated in neighboring countries: St. Giles Islands and Little Tobago, both located off the northeastern tip of Tobago, and Isla de Aves in Venezuela (Lentino and Esclasans, 2009; Birdlife International 2016b; Devenish et al., 2009). Figure F-4 depicts the location of these IBAs relative to the Stabroek Block.

St. Giles Islands IBA: includes one main island and several surrounding rock outcrops that support globally important numbers of breeding Red-billed Tropicbird (*Phaethon aethereus*) and regionally important numbers of breeding Audubon's Shearwater (*Puffinus lherminieri*), Magnificent Frigatebird (*Fregata magnificens*), Masked Booby (*Sula dactylatra*), and Red-footed Booby (*S. sula*). Other seabirds such as Brown Booby (*S. leucogaster*) and Brown Noddy (*Anous stolidus*) also breed there (White, 2008; Devenish et al., 2009).

Little Tobago IBA: supports globally important breeding populations of Red-billed Tropicbird and Laughing Gull (*Larus atricilla*), and regionally important breeding populations of Audubon's Shearwater, Brown Booby, Red-footed Booby, and Bridled Tern (White, 2008; Devenish et al., 2009).

Field surveys conducted as part of the coastal mapping of Trinidad and Tobago documented large colonies of seabirds at both St. Giles Island and Little Tobago, as well as along the northeastern cliffs of Tobago, from Corvo Point to Pedro Point (ERM, 2016).

The Isla de Aves IBA: in Venezuela supports the largest breeding colony of Brown Noddy known from the Caribbean (5,509 pairs), as well as the principal breeding colony of Sooty Tern (*Sterna fuscata*) in Venezuela (12,182 pairs) (Lentino and Esclasans, 2009).

Figure F-4: IBAs with Importance to Seabirds Relative to Stabroek Block

Appendix C – Marine Mammals

The equatorial waters of Guyana are home to several species of marine mammals. The acoustic and visual monitoring that EEPGL has conducted since 2014 represents the most robust dataset developed for marine mammals offshore Guyana, but regional studies and bycatch reports provide additional insight into the composition and distribution of the marine mammal community in the vicinity of the Project. Marine mammals whose distributions overlap with Guyana's Exclusive Economic Zone (EEZ) are listed in Table D-2.

Marine mammals are highly migratory and should be able to avoid a spill should one occur. The greatest danger to marine mammals is from collisions with vessels during operations. Marine mammals not directly impacted from a spill may also be impacted indirectly through food-chain related impacts.

The data from a 2012 Suriname survey strongly suggest that toothed whales (including dolphins, porpoises, pilot whales, and sperm whales) are more common offshore of Suriname than the baleen whales (including Bryde's and sei whales). The species with the highest abundance index was the melon-headed whale, while the lowest was the Bryde's whale. The most frequently sighted species was the spinner dolphin, and the least frequently sighted was the sei whale (Boer, 2012). The highest number of strandings reported were for sperm whales, and the lowest number were for sei whales (Boer, 2012). The 2012 Suriname study was conducted at similar depths and distances offshore as the Sorubim and Liza Areas of Interest, so such species could occupy similar ranges within the Project lead areas as well.

Data from EEPGL activities since 2014 demonstrate that dolphins are more common than large whales offshore. Sperm whales are apparently the most common large whale offshore Guyana, accounting for 25% of the total number of marine mammal detections that could be verified to the species level since 2014. Pantropical spotted dolphin, common bottlenose dolphin, spinner dolphin, and Bryde's whale complete the top five most common species verified to the species level and together they represent over 80 percent of the observations that produced a confirmed detection of a particular species.

Table F-2: Marine Mammals with Ranges that include Guyana's Coastal and Offshore Marine Territorial Waters

Common name	Scientific Name
Sei whale	*Balaenoptera borealis (EN)*
Bryde's whale *	*Balaenoptera brydei*
Blue whale	*Balaenoptera musculus (EN)*
Fin whale	*Balaenoptera physalu (EN)*
Short beaked common dolphin*	*Delphinus delphis (LC)*
Long-beaked common dolphin	*Delphinus capensis*
Minke whale	*Balaenoptera acutorostrata (LC)*
North Atlantic right whale	*Eubalaena glacialis (EN)*
Pygmy killer whale	*Feresa attenuate*
Short-finned pilot whale *	*Globicephala macrorhynchus*
Rissos dolphin *	*Grampus griseus (LC)*
Boto	*Inia geoffrensis*
Pygmy sperm whale	*Kogia breviceps*
Dwarf sperm whale	*Kogia simus*
Frasers dolphin *	*Lagenodelphis hosei (LC)*
Humpback whale	*Megaptera novaeangliae (LC)*
Blainvilles beaked whale	*Mesoplodon densirostris*
Gervais beaked whale	*Mesoplodon europaeus*
Trues beaked whale	*Mesoplodon mirus*
Melon-headed whale *	*Peponocephala electra (LC)*
Sperm whale *	*Physeter macrocephalus (VU)*
False killer whale	*Pseudorca crassidens*
Tucuxi	*Sotalia fluviatilis*
Pantropical spotted dolphin *	*Stenella attenuate (LC)*
Clymene dolphin	*Stenella clymene*
Striped dolphin	*Stenella coeruleoalba (LC)*
Rough-toothed dolphin*	*Steno bredanensis (LC)*
Spinner dolphin *	*Stenella longirostris*
Atlantic spotted dolphin*	*Stenella frontalis*
West Indian manatee	*Trichechus manatus*
Common bottlenose dolphin*	*Tursiops truncatus*

LC = Least Concerned VU = Vulnerable EN = Endangered

Note: species marked with an asterisk (*) were confirmed sighted during EEPGL activities since 2014.

Appendix D – Marine Reptiles

Five sea turtle species are found in the wider Caribbean, all of which occur in Guyanese waters. Four of these species: green turtle (Chelonia mydas), leatherback (Dermochelys coriacea), hawksbill (Eretmochelys imbricata), and Olive Ridley turtle (Lepidochelys olivacea) nest on Guyana's beaches. The primary nesting site for all these species is Shell Beach, located on the northwestern coast of Guyana. The exact location of secondary nesting sites changes due to coastal erosion which creates and destroys nesting areas continuously, but they are generally distributed along the northwest coast between the Pomeroon and the Waini river estuaries. Leatherback turtles are the most common species on the nesting beaches, while nesting green and hawksbill turtles are less common. Olive Ridley turtle populations have declined in recent times, but remain stable. Loggerhead turtles (Caretta caretta) also occur offshore Guyana but rarely come ashore.

According to the Center for Rural Empowerment and the Environment (CREE), the primary nesting season for the leatherback, green, and olive ridley turtles in Guyana (Shell Beach) occurs during the cover of darkness from March to August (CREE, 2014). Hawksbill turtles nest primarily on Almond Beach in the northwest corner of the Shell Beach Protected Area. Large populations of the green and leatherback turtles are located in the Guianas (Suriname and French Guiana), while smaller nesting areas are located from northwestern Guyana (Shell Beach) to Venezuela and into the Caribbean Sea (which includes the Netherland, Lesser, and Greater Antilles); the Gulf of Mexico (Central America); and Atlantic Ocean (the Bahamas; and the southern coast of the United States) (Piniak, 2011).

The hawksbill turtles' range is primarily in the Caribbean Sea with small nesting areas in the Guianas and in eastern Brazil. The olive-ridley turtles primarily nest along the French Guiana coast with small nesting areas along the northeastern coast of Venezuela to the Suriname and in eastern Brazil (Piniak, 2011).

The primary threats to sea turtles are poaching of eggs and adults, intentional and accidental fishing, and habitat disturbance and degradation due to marine pollution, coastal zone development, shore erosion, lighting and debris. Population monitoring and conservation activities are limited, primarily due to the logistical challenges associated with the remoteness of primary nesting sites. Most marine turtle species are believed to move out of Guyanese waters as juveniles (Piniak, 2011).

Table F-3: Marine Reptiles with Ranges that include Waters Offshore Guyana

Common name	Scientific name	Nest
Green turtle	*Chelonia mydas*	*Shell Beach*
Leatherback turtle	*Dermochelys coriacea*	*Shell Beach*
Hawksbill turtle	*Eretmochelys imbricata*	*Almond Beach*
Olive Ridley turtle	*Lepidochelys olivacea*	*Shell Beach*
Loggerhead turtles	*Caretta caretta*	*Rare*

Appendix E – Marine Finfish

Most of what is known about the marine finfish off the coast of Guyana is through commercial fishing. Approximately 80 species of fish can be found in Guyanese waters (ERM, 2016), of which about 30 are ranked by the IUCN. The inshore finfish community is dominated by drums, croakers, and marine catfishes, and includes other species such as snooks and tarpon. Offshore, the community is dominated by migratory pelagic species such as tuna, jacks, groupers and mackerals. Several species of shark are also present.

Table F-4: Marine Finfish Offshore Guyana on IUCN Redlist

Common name	Scientific name	Species Status
Spotted Eagle Ray	*Aetobatus narinari*	*NT*
Common Thresher Shark	*Alopias vulpinus*	*VU*
Foureyed Flounder	*Ancylopsetta kumperae*	*DD*
Blackbelly Skate	*Breviraja nigriventralis*	*DD*
Blacknose Shark	*Carcharhinus acronotus*	*NT*
Spinner Shark	*Carcharhinus brevipinna*	*NT*
Silky Shark	*Carcharhinus falciformis*	*NT*
Bull Shark	*Carcharhinus leucas*	*NT*
Blacktip Shark	*Carcharhinus limbatus*	*NT*
Oceanic Whitetip Shark	*Carcharhinus longimanus*	*VU*
Dusky Shark	*Carcharhinus obscurus*	*VU*
Caribbean Reef Shark	*Carcharhinus perezi*	*NT*
Smalltail Shark	*Carcharhinus porosus*	*DD*
Night Shark	*Carcharhinus signatus*	*VU*
Frilled Shark	*Chlamydoselachus anguineus*	*NT*
Hookskate	*Dactylobatus clarkii*	*DD*
Southern Stingray	*Dasyatis americana*	*DD*
Sharpsnout Stingray	*Dasyatis geijskesi*	*NT*
Sickelfish Grouper	*Dermatolepis inermis*	*NT*
Atlantic Goliath Grouper	*Epinephelus itajara*	*CE*
Red Grouper	*Epinephelus morio*	*NT*
Nassau Grouper	*Epinephelus striatus*	*EN*
Tiger Shark	*Galeocerda cuvier*	*NT*
Nurse Shark	*Ginglymostoma cirratum*	*DD*
Blue Marlin	*Makaira nigricans*	*VU*
Albacore Tuna	*Thunnus alalunga*	*NT*
Yellowfin Tuna	*Thunnus albacares*	*NT*
Bigeye Tuna	*Thunnus obesus*	*VU*
Atlantic Bluefin Tuna	*Thunnus thynnus*	*EN*
Scalloped Hammerhead	*Sphyrna lewini*	*EN*
Squat-headed Hammerhead	*Sphyrna mokarran*	*EN*
Smalleye Hammerhead	*Sphyrna tudes*	*VU*

NT = Near Threatened VU = Vulnerable EN = Endangered CE = Critically Endangered DD = Data Deficient

Appendix F – Marine Fisheries

There are four main types of marine fisheries in Guyana (MOA, 2013) that can be defined by the species targeted, gear types used, and the depth of water where the fishery takes place. Table F-5 summarizes the characteristics of these fisheries.

Table F-5: Primary Characteristics of Marine Fisheries in Guyana

Type of Fishery	Species	Gear	Depth
Industrial	Seabob, shrimps, and prawns	Trawls	Primarily between 13-16 m, but can occur from 0-75 m
Semi-industrial	Red snapper and vermillion snapper	Fish traps and lines	Edge of continental shelf
Artisanal	Mixed finfish and shrimp	Gillnets, seines, and others	0–18 m
Shark	Various	Trawls, gillnets, and hook and line	Throughout the continental shelf waters

Pelagic fisheries have traditionally been underexploited in Guyana, but tuna, such as yellowfin tuna (Thunnus albacares) and skipjack tuna (Katsuwonus pelamis) have recently been identified as a potential oceanic target species of commercial interest. The industrial seabob shrimp sector, as well as the artisanal finfish sector, are important commercial fisheries for Guyana that intersect the POA (see Figure F-5).

The productivity of Guyana's marine fisheries has experienced recent volatility. According to data from the PSC and the Ministry of Agriculture, fishery yields declined between 2014 and 2015. The PSC attributes this to El Niño-related weather phenomena, while the Ministry of Finance characterizes this as part of a longer-term decline caused by unsustainable overfishing, including illegal fishing by foreign vessels. However, the sector recovered in 2016 with growth in both fish and shrimp outputs. Fish output improved by 20.5 percent, and (total) shrimp output grew by 9 percent. The improvement in finfish production continued into the first half of 2017 with an increase of 33.2 percent. Prawn output fell by 17.8 percent in 2016 before growing by 24.2 percent in 2017.

Guyana's marine finfish community exemplifies the ecological connectivity among the mangroves, estuaries, and offshore zones, because many fish species are dependent on different habitats at specific life stages or occur in more than one habitat type. Several species that occur in the inshore and offshore zones as adults are dependent on coastal mangroves as juveniles, particularly drums, croakers, and snappers. Catfishes occur in the mangroves, estuaries, and oceanic waters as adults (ERM, 2016). As a result, impacts in these areas may also have an impact on the fishery.

The Guyana Fisheries Department (a division of the Guyana Ministry of Agriculture), should be consulted on any potential impacts of an unplanned release.

** NOTE: Map does not represent a depiction of the maritime boundary lines of Guyana*

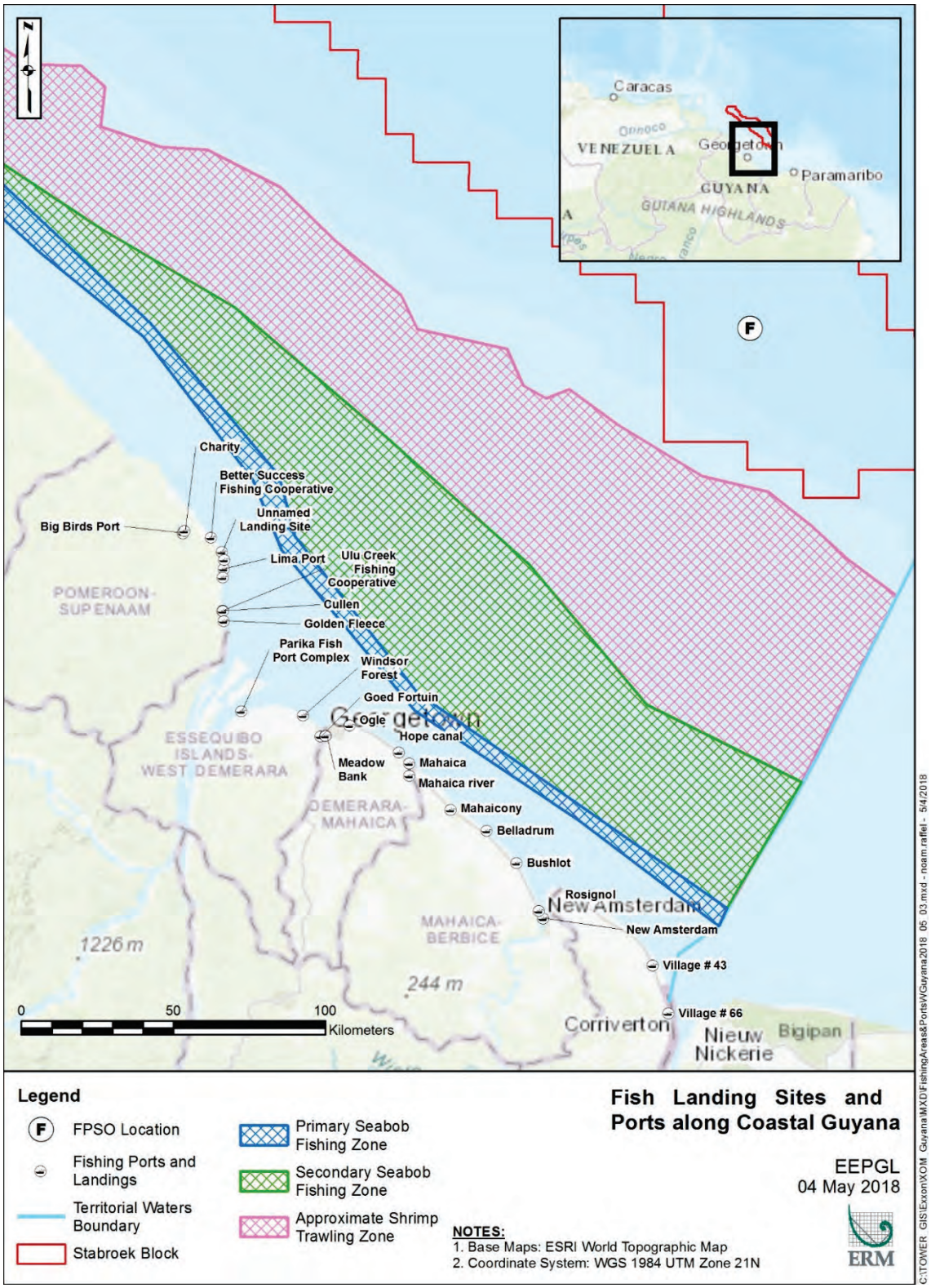

Figure F-5: Fishing Zones and Ports

Appendix G – Wildlife Branch Guidance

In the early hours of a spill response it is important to quickly estimate the scale of the event (relative to potential animal impacts) as best as possible and order the equipment and personnel. Estimating size and ordering resources should be the first priority as it will take some time to mobilize and deploy resources.

Wildlife Branch Objectives:

- Develop a Wildlife Plan for inclusion in the Incident Action Plan (IAP);
- Identify and mobilize equipment/facilities;
- Identify and mobilize personnel and support;
- Complete notifications: internal and external (phone list);
- Maintain communication: internal and external.

Staffing/Positions (depending on response level):

- Branch Director (BD):
    - Leads Wildlife Branch, develops incident specific wildlife plan.
- Deputy Branch Director (DBD):
    - Backup to the Director, compiles wildlife plan info, manages wildlife branch deadlines.
- Wildlife Reconnaissance Group Supervisor (WRGS):
    - Develops land, water, air reconnaissance plans;
    - Coordinates activities with Land, Water, and Air Operations.
- Bird Recovery and Rehabilitation Group Supervisor (BRRGS):
    - Coordinates bird handling issues, protocols, and hazing activities.
- Marine Mammal Recovery and Rehabilitation Group Supervisor (MMRRGS):
    - Develops and coordinates capture, handling, and rehabilitation of marine mammals;
    - Develop and coordinate efforts for handling marine reptiles.
- Wildlife Volunteer Coordinator (VC):
    - If necessary, will coordinate training, use, and deployment of volunteers for wildlife collection and rehab activities.
- Liaison (L):
    - Will coordinate communication between Environmental Unit in Planning, JIC, etc., and the Wildlife Branch in Operations;
    - Assist in maintaining communication with government agencies, NGOs, and other involved parties.
- IAP software specialist:
    - Enter forms into the IAP;
    - Assist in getting maps and updating the Common Operating Picture (COP).
- Documentation tracker (for larger events).

Initial steps (complete these in this order and on Day 1 when possible):

- Notify Command (as appropriate) that Wildlife Branch is up and running and making plans:
    - Notify Operations Section Chief;
    - Notify Environmental Unit;
    - Notify interested agencies, parties, or organizations.
- Begin Unit Log (ICS 214).
- Identify Branch staff and assignments. Use the list of positions and tasks above to identify tasks and who will be doing them. Remember, the number of personnel expands and contracts as appropriate to the event so it may be one person doing everything or there may be a full contingent of staff. (Provide an organization chart (ICS 207) and contact information to resources).
- Estimate equipment (facility) and personnel needed based on the estimated number and type of animals anticipated. Lean toward over responding as it's easier to send resources back than not have resources when needed.
- Identify deployment locations for equipment and personnel. Equipment locations need to be available for a long enough time to handle entire (anticipated) response AND rehabilitation to avoid having to move during the process.
- Develop reconnaissance plan or "animal location" needs (on Day 1 this will be a very brief plan, if one at all). Coordinate with EU and Flight Operations, etc.
- Develop search and collection and transportation plans (Day 1 there may not be formal plans, Day 2 will). Identify search areas, number of crews, support needs, etc. (ICS 204 and ICS 204a).
- Develop a wildlife rehabilitation plan.
- Begin drafting the Wildlife Plan for inclusion in the IAP. Templates are on the RRT Sharepoint page.
- Provide an Oiled Wildlife Statement to the JIC, listing phone numbers for reporting oiled wildlife and warning the public to stay away from oiled wildlife. A template is available on the RRT Sharepoint page.

APPENDIX G

SUMMARY OF SPILL PREVENTION, MITIGATION MEASURES AND EMBEDDED CONTROLS

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Appendix G SUMMARY OF SPILL PREVENTION, MITIGATION MEASURES AND EMBEDDED CONTROLS

The following table is sourced from the Liza Phase 1 Development Project EIA and is considered a *representative list* of embedded controls and spill prevention measures utilized on an FPSO Development Project inclusive of drilling operations. These controls and measures are not necessarily applicable to every EEPGL operation or asset.

#	Embedded Control / Spill Prevention Measure
1	Engineering design and operations will be carried out according to applicable Guyana statutory requirements, applicable international design codes and standards, as well as the EEPGL Operations Integrity Management System (OIMS) and the EEPGL Safety, Security, Health, and Environment (SSHE) policies. EEPGL and its contractors will have structured management systems to verify the ongoing application of all necessary codes, standards, procedures, and SSHE management systems.
2	The planned development drilling program and its cuttings management approach is consistent with industry practices, considered protective of the environment, and has been the basis for the Liza-1, Liza-2 and Liza-3 exploration wells.
3	The size and strength of the casings to be used in the design of the development wells takes into account the peak reservoir temperature and pressure conditions that may be encountered during drilling and during production operations when the wells are flowing reservoir fluids. After each casing string cement job is completed, pressure testing will be performed to confirm integrity according to standard industry practices.
4	A drilling riser will be deployed to connect the conductor casing and the drill ship, and the blowout preventer (BOP) will be installed. Marine drilling risers with buoyant joints and tension will be used to connect the wells via the BOP to the drill ship. BOPs will be periodically tested during the well construction process.
5	The production tubing includes the subsurface safety valve (SSSV), which is designed to mitigate the uncontrolled release of fluids from the reservoir during the production process. The production tubing also protects the production casing from corrosion and deposition of by-products, such as sand, paraffins, and asphaltenes.
6	Based on wellbore stability analysis and experience gained from Liza-1 and Liza-2 drilling, NADF will be required to maintain borehole stability while drilling all well sections below the conductor casing.
7	The SURF system will be designed to withstand the full shut in pressure from the production wells, and the gas/water injection components will be designed to withstand the highest required injection pressures. Overpressure protection will be provided on the FPSO, in accordance with industry standards, to protect the subsea systems.
8	The production drill centers will be connected to the FPSO with round-trip piggable production flowlines. Pigging is performed to aid and assist in the maintenance, operations, cleaning, and inspection of flowlines.
9	Each subsea development well is capped by a subsea tree, which include several isolation valves and a choke valve to control production and water and gas injection.

#	Embedded Control / Spill Prevention Measure
10	The FPSO will be configured with back-up power, in the event primary power is lost.
11	The subsea trees and manifolds will be monitored and controlled through the subsea control system on the FPSO via a steel umbilical. Subsea control system will accommodate typical monitoring requirements such as pressure and temperature measurement.
12	Key FPSO design features include the following: • The FPSO will be designed to remain moored for at least 20 years without dry-docking and will include facilities to support in-water hull/structural surveys and repair and maintenance. • The FPSO will be designed to operate in extreme (100-year return period) environmental conditions (associated wind, waves, and current).
13	A flare system will be provided for the collection and safe disposition of produced hydrocarbon gases resulting from unplanned, non-routine relief and blowdown events. Relief events occur to prevent overpressure scenarios in the process equipment. Blowdown events occur to depressure the facilities in a controlled manner as a result of emergency shutdown events.
14	The required power for the FPSO will be generated by three systems as follows: • The main power generation system will be gas turbine driven generator sets with spares available in the case of unplanned downtime. All generator sets will be dual fuel (diesel, produced gas) capable to allow for restoring power to the facility (i.e., black start). • The essential services power generation system will be a diesel driven generator set. Essential services include systems required for facility restart and for flow assurance hydrate mitigation activities after an unplanned shutdown. • The vessel emergency power generator set will be diesel driven and will provide power to both the hull and topsides emergency systems (e.g., safety systems including emergency lighting, telecommunication). Additionally, for back-up power during emergency situations, the uninterruptible power supply (UPS) system will be provided to power equipment such as the Integrated Control and Safety System (ICSS) and subsea controls, among others.
15	Monitoring and control of the FPSO production operations will be performed by an Integrated Control and Safety System (ICSS). Located in the main control room of the FPSO, the ICSS will include process shutdown, emergency shutdown, and fire and gas systems to protect the facilities and personnel. These systems will interface to a public address and general alarm system (PA/GA) to provide distinct audible and visual alarm notification. The ICSS includes the Process Control System (PCS), Safety Instrumented System (SIS), the Fire and Gas (F&G) system, the Alarm Management System (AMS), the Operator graphics / consoles; and the third-party interfaces to packaged systems (such as compressors, subsea, and marine, among others).
16	Telecommunications equipment will be installed on the FPSO to enable safe operation of the facilities in normal and emergency conditions. This equipment will allow communication with the shorebase, support vessels, helicopters, and tankers as well as communication on the FPSO.
17	The FPSO cargo tanks will be blanketed with inert gas. A tank vent system will be provided to release vapor and inert gas from the cargo tanks to a safe location, toward the bow of the FPSO, to prevent an overpressure event in the tanks.
18	The marine cargo system supports the following routine activities: • Flushing of the crude oil offloading export hose; • Emergency and temporary ballasting of FPSO cargo tanks with seawater; and • Inspection and maintenance of FPSO cargo tanks and piping systems between offloading operations.

#	Embedded Control / Spill Prevention Measure
19	FPSO safety systems will include: • Firewater System – The firewater system will have one pump each located at the fore and aft ends of the FPSO, with one pump serving as a redundant backup. • Fire and Gas Detection Systems – Fire and smoke detectors will be located throughout the topsides and living quarters and will be wired centrally with alarms sounding in the central control room (CCR), which will activate the general alarm system on the FPSO. Gas detectors will be placed in areas where gas might be released or could accumulate. • Blanket Gas Generation – To prevent fires, the cargo tanks will be operated with an inert gas blanket at all times except during tank entry. The inert gas for cargo tanks will be supplied by an inert gas system utilizing flue gas from the marine boilers. To provide gas blanketing for other spaces, including the methanol and xylene tanks, inert gas will be provided by routing compressed air through the nitrogen membrane package.
20	• Production, water injection, and gas injection flowlines and risers will be cleaned and tested to verify and ensure integrity after installation, and then staged on the seafloor until arrival of the FPSO. • Manifolds, manifold foundation piles, jumpers, Subsea Distribution Units, and flying leads at the drill centers will be integrity tested and verified following installation. • The connected, integrated FPSO and SURF production systems will be tested and commissioned, including testing and de-watering / displacing flowlines and umbilicals with commissioning fluids, and testing SURF control and shutdown systems.
21	Throughout production operations, EEPGL's personnel will perform oversight and monitoring of the FPSO contractor to ensure that management systems pertinent to safety, the environment, and operations integrity are properly implemented. To accomplish this, EEPGL plans to utilize an onboard representative (OBR) supported by operational and technical specialists to monitor, and direct as necessary, operation of the FPSO and SURF facilities.
22	Internal corrosion of the subsea facilities shall be managed by a combination of material selection and injection of inhibitor. Components in the production path upstream of the flowlines will be fabricated from corrosion-resistant alloys suitable for the intended service. The carbon steel flowlines and risers will be protected by the injection of corrosion inhibitor at the subsea production manifold headers.
23	For decommissioning phase, all risers, pipelines, umbilicals, subsea equipment, and topside equipment will be safely and properly isolated, de-energized, and cleaned to remove hydrocarbons and other hazardous materials to a suitable level prior to being taken out of service. Wells will be permanently plugged and abandoned (P&A) by restoring suitable cap rock to prevent escape of hydrocarbons to the environment. P&A barriers will be installed in the wellbore, of adequate length to contain reservoir fluids and deep enough to resist being bypassed by fracturing.
24	All chemicals will be stored, either at the shorebase(s) or on the drill ship or FPSO, in appropriate storage containers with either secondary containment or appropriate drainage control.
25	With respect to prevention of spills of hydrocarbons and chemicals during the drilling stage: • Change liquid hydrocarbon transfer hoses periodically; • Utilize dry-break connections on liquid hydrocarbon bulk transfer hoses; • Utilize a liquid hydrocarbon checklist before bulk transfers; • Perform required inspections and testing of equipment prior to deployment/installation; • Utilize certified Blowout Prevention (BOP) equipment; • Regularly test certified BOP equipment and other spill prevention equipment;

#	Embedded Control / Spill Prevention Measure
	• Utilize overbalanced drilling fluids to control wells while drilling; • Perform operational training certification (including well control training) for drill ship supervisors and engineers; • Regularly audit field operations on the drill ships, FPSO, and shorebase(s) to ensure application of designed safeguards; and • Controls for mitigating a failure of the dynamic positioning system on the drill ships and maintain station keeping, which include: – Use of a Class 3 Dynamic Positioning (DP) system, which includes numerous redundancies; – Rigorous personnel qualifications and training; – Seatrials and acceptance criteria; – Continuous DP proving trials; – System Failure Mode and Effects Analysis; – Continuous DP failure consequence analysis; and – Establishment of well-specific operations guidelines.
26	Maintain marine safety exclusion zones with a 500 m (~1,640 ft) radius around drill ships and major installation vessels to prevent unauthorized vessels from entering potentially hazardous areas.
27	Utilize a Mooring Master from the FPSO located onboard the offloading tanker to support safe tanker approach/departure and offloading operations.
28	Utilize support tugs to aid tankers in maintaining station during approach/departure from FPSO and during offloading operations.
29	Utilize a hawser with a quick release mechanism to moor the FPSO to the tanker at a safe separation distance during offloading operations.
30	FPSO offloading to tankers will occur within an environmental operating limit that is established to ensure safe operations. In the event that adverse weather occurs during offloading operations that is beyond the environmental operating limit the tanker will cease the offloading operations, and may disconnect and safely maneuver away from the FPSO as appropriate.
31	Utilize a marine bonded, double-carcass floating hose system certified by Class or other certifying agency that complies with the recommendations of OCIMF Guide to Manufacturing and Purchasing Hoses for Offshore Moorings (GMPHOM) 2009 Edition or later.
32	Utilize breakaway couplers on offloading hose that would stop the flow of oil from FPSO during an emergency disconnect scenario.
33	Utilize a load monitoring system in the FPSO control room to support FPSO offloading.
34	Utilize leak detection controls during FPSO offloading which include: • Leak detection for breach of the floating hose that complies with the recommendations of OCIMF GMPHOM 2009 Edition or later; • Utilization of instrumentation/procedures to perform volumetric checks during offloading.
35	Utilize marine safety exclusion zone of 2 nautical miles around the FPSO to prevent unauthorized vessels from entering potentially hazardous areas.
36	Regularly inspect and service shorebase cranes and construction equipment in order to mitigate the potential for spills and to maintain air emissions at optimal levels.
37	Utilize secondary containment for bulk fuel storage, drilling fluids, and hazardous materials, where practical.
38	Regularly check pipes, storage tanks, and other equipment associated with storage or transfer of hydrocarbons/chemicals for leaks.

#	Embedded Control / Spill Prevention Measure
39	Perform regular audits of field operations on the drill ship, FPSO, and shorebase to ensure application of designed safeguards.
40	Observe standard international and local navigation procedures in and around the Georgetown Harbour and Demerara River, as well as best ship-keeping and navigation practices while at sea.
41	Maintain an OSRP to ensure an effective response to an oil spill, including maintaining the equipment and other resources specified in the OSRP and conducting periodic training and drills.
42	EEPGL is using the most appropriate industry-proven technology in developing the Project in terms of well drilling, drilling fluids, equipment selection, development concepts, and environmental management.
43	Adhere to the International Convention Relating to Intervention on the High Seas in Cases of Oil Pollution Casualties, which confirms the right of coastal member states to take specific actions when necessary to prevent pollution from oil following a maritime casualty. This convention would protect Guyana's rights to respond to an oil spill if such an event were to occur.
44	Adhere to the International Convention on Civil Liability for Oil Pollution Damage, which establishes vessel owners' liability for damages caused by pollution from oil spills and provides for compensation would be available where oil pollution damage was caused by maritime casualties involving oil tankers. This convention would not apply directly to EEPGL's activities, but would apply to potential spills from tankers that had received oil from the FPSO.
45	Adhere to the International Convention on Oil Pollution Preparedness, Response and Cooperation, which establishes measures for dealing with marine oil pollution incidents. This convention requires ships to have a shipboard oil pollution emergency plan.
46	The Company and its affiliates (including EEPGL) are committed to conducting business in a manner that is compatible with the environmental and economic needs of the communities in which it operates, and that protects the safety, security, and health of its employees, those involved with its operations, its customers, and the public. These commitments are documented in its Safety, Security, Health, Environmental, and Product Safety policies. These policies are put into practice through a disciplined management framework called OIMS. EEPGL's OIMS Framework establishes common expectations used by Company affiliates worldwide for addressing risks inherent in its business. The term Operations Integrity (OI) is used to address all aspects of its business that can impact personnel and process safety, security, health, and environmental performance. Application of the OIMS Framework is required across all Company affiliates, with particular emphasis on design, construction, and operations. Management is responsible for ensuring that management systems that satisfy the OIMS Framework are in place. Implementation will be consistent with the risks associated with the business activities being planned and performed.
47	The interaction between the EIA team and the design and decision-making process was one of the key areas in which the EIA influenced how the Project would be developed. It included involvement in defining the Project and identifying those activities with the potential to cause physical, biological, or socioeconomic impacts. Project planning, decision making, and refinement of the Project description continued throughout the assessment process in view of identified impacts and proposed mitigation measures. During the EIA process, there was extensive communication between the impact assessment team and the Project design team with regard to identifying alternatives, potential impacts, and mitigation measures.
48	Hydrocarbon releases under Scenarios 1 through 4 (per EIA Table 7-82) would all be small and under control quickly, and would be managed with locally available spill control equipment.

#	Embedded Control / Spill Prevention Measure
49	A hydrocarbon release under Scenario 6 (per EIA Table 7-82) would be quickly controlled and contained because of the relatively small volumes and the ready access to spill control equipment.
50	Oil spill modeling and coastal sensitivity mapping have been conducted to identify and characterize the resources/receptors with the potential to be exposed to oil.
51	Oil spill modeling was used to simulate spill events using the best available characterization of the wind and hydrodynamic (marine currents) forces that drive oil transport, and quantify the potential consequences from a spill, which can then be used to guide response planning and prioritize response asset deployment.
52	Coastal sensitivity mapping was conducted for the entire coastal area identified in the oil spill modeling as being potentially exposed to hydrocarbons as a result of a Tier III Marine Oil Spill (Scenario 9). The mapping included the following resources and receptors: • Environmental – protected areas, wetlands, mangroves, beach types, seagrass beds, coral reefs, and other sensitive habitats; and • Socioeconomic – coastal and/or indigenous peoples communities (e.g., location and socioeconomic characteristics), coast-dependent commercial and artisanal activities (e.g., fishing, foraging), other industrial activities, and infrastructure (e.g., water intake facilities). This information enables EEPGL to prioritize the mobilization of emergency response resources (manpower and equipment) to those areas most sensitive to a spill. These maps are included in the OSRP.
53	Regarding spill prevention controls associated with Scenario 9 (well control release), EEPGL's well control philosophy is focused on spill prevention using safety and risk management systems, management of change procedures, global standards, and trained experienced personnel. EEPGL has a mature OIMS that emphasizes attention to safety, well control, and environmental protection. Measures to avoid any loss of well control include proper preparation for wells (well design, well control equipment inspection and testing), automatic detecting of the influx of reservoir fluids entering the well during drilling, the use of physical barriers including automatic BOPs, personnel training and proficiency drills for well control, and the use of drilling fluids to control pressures within the well.
54	Regarding spill prevention controls associated with Scenario 8 (FPSO offloading spill), the major spill prevention controls associated with FPSO offloading include: FPSO and tanker collision avoidance controls; use of a certified engineered floating double carcass hose system; use of emergency disconnect controls on the floating double carcass hose system; use of load monitoring systems in FPSO control room; and use of leak detection controls including infrared leak detection, flood lighting for night operations, and volumetric checks during offloading.
55	EEPGL also has developed a detailed Oil Spill Response Plan (OSRP), which is included in the Project's ESMP, to ensure an effective response to an oil spill, if one were to occur. The OSRP: • Describes the response measures which are dependent on the magnitude and complexity of the spill; • Clearly delineates the responsibilities of each entity that would take part in a response; • Describes how EEPGL and its contractors would mobilize local oil spill response resources, which would be complemented by the regional and international resources provided by its oil spill response contractors; and • Describes the EEPGL process for notifying the government of Guyana with respect to mobilizing its resources.

#	Embedded Control / Spill Prevention Measure
56	During offloading of crude oil for export, the offloading tanker must approach at a controlled, safe speed within about 120 m (~390 ft) of the FPSO. To minimize the risk of collision during the approach to the FPSO and during offloading, EEPGL will utilize a Mooring Master onboard the offloading tanker. The Mooring Master will guide the offloading tanker to the FPSO for offloading, remain on board during offloading, and then guide the offloading tanker away from the FPSO upon completion of offloading. Up to three assistance tugs will assist in positioning the offloading tanker during the approach to the FPSO to maintain a safe separation from the FPSO. During offloading, these tugs along with a hawser (taunt line connecting the FPSO and tanker) will help ensure the offloading tanker maintains a safe distance from the FPSO at all times. Offloading will only occur when weather and sea conditions allow for safe operations. If the environmental conditions prior to the commencement of offloading are not suitable, the tanker will standby at a safe distance away until conditions are within acceptable limits. If unexpected adverse weather (e.g., a squall) occurs during offloading operations, the offloading operation will be stopped, and the tanker disconnected and moved away from the FPSO until conditions are again within approved safe limits.
57	A number of controls will be implemented to prevent collision near shore between a Project supply vessel and another (non-Project) vessel or structure (e.g., due to navigation error or temporary loss of power). EEPGL has comprehensive contractor selection guidelines to ensure contractors are qualified and have robust safety, health, and environmental management systems. EEPGL will provide active oversight over its contractors to verify they are complying with its requirements. Contractors are required to perform regular inspections of their vessels which address marine safety and maintenance considerations, which should reduce the risk of loss of power incident scenario. In addition, vessels operating within the Georgetown Harbour or other coastal areas will be adhering to speed restrictions and navigation aids.
58	EEPGL will utilize a Simultaneous Operations procedure to safely manage Project marine vessels which are performing work in the same vicinity of each other, which will include considerations to avoid vessel collisions.
59	Marine vessels will have industry proven station-keeping systems (e.g., FPSO mooring system, dynamic position systems on drill ship, support vessels) to maintain station in the offshore environment.
60	A Wildlife Response Program would be established at the onset of an oil release from a large Marine Oil Spill to minimize impacts on ecological balance and ecosystems.
61	The coastal sensitivity mapping that supports the OSRP includes mangroves as a sensitive coastal resource and in the unlikely event of an oil spill; EEPGL will deploy emergency response equipment to protect these sensitive resources, as appropriate.
62	A claims process would be established at the onset of a large Marine Oil Spill incident to compensate for loss of sustenance and income (e.g., fisherfolk for loss of harvest due to regional fisheries closures) that were attributed to the oil spill.
63	Implementation of the OSRP would help minimize transboundary impacts just as it would minimize impacts within the Guyana EEZ. EEPGL will work with representatives for the respective countries to be prepared for the unlikely event of a spill by: • Establishing operations and communication protocols between different command posts. • Creating a transboundary workgroup to manage waste from a product release – including identifying waste-handling locations in the impacted region and managing commercial and legal issues. • Identifying places of refuge in the impacted region where vessels experiencing mechanical issues could go for repairs and assistance. • Determining how EEPGL and the impacted regional stakeholders can work together to allow equipment and personnel to move to assist in a spill response outside the Guyana EEZ.

#	Embedded Control / Spill Prevention Measure
	• Assigning or accepting financial liability and establishing a claims process during a response to a transboundary event. • Informing local communities regarding response planning.
64	Implement an ESMP, which describes the measures EEPGL will implement to manage the Project's potential environmental and socioeconomic risks and reduce impacts to the environment and communities.
65	EEPGL will perform regular oil spill response drills, simulations, and exercises, document the availability of appropriate response equipment on board the FPSO, and demonstrate that offsite equipment could be mobilized for a timely response.
66	The Project will issue Notices to Mariners via MARAD, the Trawler's Association, and fishing co-ops for movements of major marine vessels (including the FPSO, drill ship, and installation vessels) to aid them in avoiding areas with concentrations of Project vessels and/or where marine safety exclusion zones are active.
67	Augment ongoing stakeholder engagement process to identify commercial cargo, commercial fishing, and subsistence fishing vessel operators who might not ordinarily receive Notices to Mariners, and where possible communicate Project activities to those individuals to aid them in avoiding Project vessels.
68	Promptly remove damaged vessels (associated with any vessel incidents) to minimize impacts on marine use, transportation, and safety.
69	Implement the OSRP in the unlikely event of an oil spill, including: • Conduct air quality monitoring during emergency response; • Require use of appropriate PPE by response workers; • Implement a Wildlife Oil Response Program, as needed; and • Implement a claims process for damage caused by an oil spill, as needed.
70	EEPGL will proactively obtain additional support and resources to reduce the impact of a spill in the unlikely event it shows potential to exceed Tier I capabilities. The ERT will manage Tier I spill responses using the site-specific ERP and resources located on vessels and in port facilities in Guyana and Trinidad. Such resources as well as dispersant application from vessels will also be used for larger Tier II spills until supplemental OSR resources arrive on-scene. For incidents that may exceed Tier I capabilities, EEPGL would notify Oil Spill Response Ltd (OSRL) in Southampton, UK1 (Refer to forms in Appendices), to provide immediate incident management support as well as OSRL's global oil spill technical response teams and equipment.
71	Given the limited resources in-country, company will consider setting up a cooperative with a regional OSRO (e.g., Trinidad) to support Tier II+ oil spill response prior to offshore execution.
72	The EEPGL OSRP is supported by the EEPGL Emergency Response Plan (ERP) which provides a structured and systematic process for responding to incidents, and outlines plans and procedures for engagement between the incident site, EEPGL, and ExxonMobil management and the relevant authorities in Guyana.
73	EEPGL will initiate a systematic search with vessels and aircraft (weather permitting) to locate the spill and determine its coordinates. EEPGL will estimate spill size and movement using coordinates, photographs, drawings, and other information received from vessels, aircraft and satellite imagery. Spotters will photograph the spill from aircraft as often as necessary for operational purposes, and determine its movement based on existing reference points, such as vessels and familiar shoreline features. Modeling of the oil release may be utilized to predict the oil slick's surface movement or trajectory. Modeling will help to identify shorelines that may be at risk from oil stranding, predict the probable timing of that stranding, and provide information regarding how the oil is changing with time.

#	Embedded Control / Spill Prevention Measure
74	In the event of a release, EEPGL and ExxonMobil technical experts will complete a revised NEBA in real-time predicated on the current metocean conditions, location and nature of the release for review and discussion withthe Guyana EPA and Civil Defense Commission (CDC) as soon as practical.
75	During EEPGL's operations, the on-site Emergency Response Team (ERT) will endeavor to contain any spill at the source, whether it be onshore (shorebase or port) or onboard a vessel (i.e. PSV, FSV, installation, drillship, tug, tanker or FPSO) and minimize any impacts to the environment, using the equipment available at the worksite. In the event of an on-water release, EEPGL will ensure the required notifications are made, initial response actions are implemented and monitor the incident and consider all appropriate response strategies, including containment and recovery as well as dispersants to appropriately respond to the incident.
76	If released oil is predicted to reach a shoreline, EEPGL will continue to leverage all available resources to stop the release at the source, utilizing provided containment, mechanical recovery, open burning, surface and subsurface dispersant application. EEPGL will also consider and evaluate shoreline protection measures (based on consultation with the appropriate government authorities) and outcomes from the NEBA to identify the combination of key response strategies that would be appropriate, given the specific situation, fate, and trajectory of the oil spill and weather conditions. Local regulatory approval and the ExxonMobil Oil Spill Dispersant Guidelines will govern the application of dispersants.
77	EEPGL will use the Net Environment Benefit Analysis (NEBA) process as a key input to the overall Incident Response Planning. NEBA compares the impacts of available response options, and selects the option or combination of options that minimizes overall harm to environmental and socioeconomic resources. The use of NEBA will ensure that EEPGL selects the most appropriate response techniques available to minimize overall environmental impact based on the conditions and sensitivities of an actual incident.
78	EEPGL will respond to a release as far offshore as possible, using all appropriate tools and tactics to minimize shoreline impact. In consultation with the Guyana EPA, EEPGL will develop Incident Response Plans that could respond with aerially applied dispersants, which can be quickly deployed and treat large surface areas rapidly and efficiently.
79	The safety of responders also needs to be considered in the evaluation of response strategies. Response tactics depend upon a variety of environmental conditions. • Implement subsea dispersant application as soon as possible, if warranted, to treat most if not all oil spilled at the source before it encounters surface water resources; • Deploy in situ burning equipment to burn thick oil near the source; • Continue to use aerially applied dispersant as a primary response tool for oil further from the source where mechanical recovery/in situ burn operations are less effective; • Utilize aerial dispersant application during calm seas on emulsified oil; and • Outfit vessels of opportunity (VOO) with dispersant delivery and mechanical containment and recovery systems to provide a fleet of vessels that can be a line of defense against surface oil approaching shorelines. Shoreline protection and cleanup may be potentially needed for some scenarios, in which case, sensitive shorelines will receive prioritization for protective booming.
80	In the event that there is an incident that impacts areas outside the Guyana Exclusive Economic Zone (EEZ), EEPGL will work with representatives for the respective locations to: • Coordinate operations and communication between different command posts;

#	Embedded Control / Spill Prevention Measure
	• Create a trans-boundary workgroup to manage waste from a product release – including pinpointing waste-handling locations in the impacted region and managing commercial and legal issues; • Identify places of refuge in the impacted region where vessels in mechanical trouble could go for repairs and assistance; • Determine how EEPGL and the impacted regional stakeholders can work together to allow equipment and personnel to move to assist in a spill response outside the region while still retaining a core level of response readiness within the two jurisdictions; • Work with local communities within the impacted area to raise awareness of oil spill planning and preparations.
81	Utilize surveillance and monitoring teams, which can fulfill the following response objectives: • Verify oil spill scale and location; • Monitor effectiveness of applied response strategies; • Visually quantify spill volume; • Direct operations – dispersant application, containment and recovery, shoreline assessment, in situ burning; and • Monitor wildlife.
82	At a minimum, surveillance and monitoring personnel will take visual observations, and vessel owners/operators will implement their ER/SOPEP's, deploying the Tier I response equipment they have onboard.
83	For Tier II or Tier III incidents EEPGL will scale up to a full surveillance plan using helicopters, fixed wing aircraft and satellite imagery.
84	The IMT will assign an Air Operations Branch as part of the Operations Section for large or complex incidents. The Air Operations Branch will coordinate aerial support according to operational needs and document operational assignments in an ICS-220 Air Operations Summary form, which will be included in the Incident Action Plan (IAP).
85	To assist the natural dispersion process techniques such as prop washing or water hoses can be implemented to introduce energy and agitate the hydrocarbons, thereby assisting with the break up of a surface slick and promoting biodegradation.
86	For operational spills: • Shorebases in Guyana and Trinidad have site specific ER Plans and are equipped with Tier I spill response kits; • Vessels maintain a Shipboard Oil Pollution Emergency Plan (SOPEP) and associated equipment onboard the vessel.
87	EEPGL will use harbor containment and recovery should a PSV or FSV release hydrocarbons in Port. The harbor response team will employ a strategy that considers tides, currents, wind, vessel traffic, and local infrastructure and stakeholder input. EEPGL will deploy equipment available on site and in the Port (such as or similar to the equipment and trained personnel at the Guyana Fuel Terminals and resources held by NRC for Trinidad) immediately following a release.
88	EEPGL will implement a shoreline response if released hydrocarbons show the potential to affect a shoreline, prioritizing environmentally or socio-economically sensitive areas (ESAs). This will consist of using vessel dispersant application to prevent approaching slicks from impacting ESAs and using shoreline booming to protect sensitive areas and provide collection points for hydrocarbon recovery.
89	EEPGL will only apply dispersants if there is a direct advantage to protecting environmental or socio-economical sensitivities (determined using NEBA) and they have obtained regulatory approval.

#	Embedded Control / Spill Prevention Measure
90	Vessel mounted systems will be used to apply dispersant in small-scale incidents and aircraft will apply dispersant on large oil slicks. Dispersant (and associated vessel spray equipment) will be kept at the shorebase or other easily accessible location where it can be easily loaded on vessels for application. OSRL will conduct aerial dispersant application and will likely base the operation out of the Georgetown airport. In the unlikely event of a well blowout, dispersant is injected subsea at the wellhead location on the seafloor using specialized equipment and Remotely Operated Vehicles (ROVs).
91	EEPGL is using the OSRP as the instrument for pre-approval to use dispersants. Requesting approval at the time of an incident delays the response, potentially increasing environmental damage.
92	EEPGL will use the Dispersant Spraying Considerations Flowchart as a guide for whether to use dispersants. Dispersant will be applied according to manufacturers' guidelines and the operating procedures of the spray applicators. EEPGL will work with the EPA to develop a dispersant application, monitoring and evaluation strategy.
93	EEPGL will source Vessels of Opportunity (VOOs) to provide platforms for the containment and recovery systems.
94	A Wildlife Response Plan (WRP) specific to Guyana has been developed to allow for a timely, coordinated and effective protection, rescue, and rehabilitation of wildlife to minimize any negative impacts of a spill. Should a wildlife response be required, EEPGL will call upon the Sea Alarm Foundation via OSRL to provide specialist advice and assistance with carrying out a response.
95	EEPGL is may use in situ burning for large-scale Tier III incidents. OSRL will provide the resources required.
96	EEPGL will manage hazardous waste resulting from clean-up activities and ensure appropriate disposal.
97	The Tanker Owner/Operator will implement an ERP should any spill occur during tanker offloading and the FPSO ERP will have similar details on the surface and subsea response for a spill from either the FPSO, during tanker offloading or SURF (Subsea umbilical, riser, flowline) equipment during production operations.
98	If a Tier III well control incident occurs involving the release of wellbore fluids into the sea, EEPGL will perform a site survey, conduct debris removal operations (as required), evaluate and execute well intervention options, install subsea dispersant application hardware, and mobilize and install a capping device/auxiliary equipment as required. If a relief well is required, it will be drilled to intersect the original well and address specific issues encountered in the original wellbore.
99	EEGP will utilize OSRL's Subsea Well Intervention Service (SWIS), which provides access to a Subsea Incident Response Toolkit (SIRT), Global Dispersant Stockpile (GDS) and multiple Capping Stack Systems (CSS). The CSS and SIRT includes equipment that can be mobilized directly to the well site: • Survey & debris clearance equipment; • Intervention equipment; • Dispersant hardware application system*; and • Capping stack systems and auxiliary equipment. *Dispersant will be mobilized simultaneously through the OSRL GDS service via the EEPGL IMT. For detailed information on the implementation of a subsea response, refer to the Drilling ERP.
100	In the event of a spill, an incident-specific Decontamination Plan will be developed by EEPGL relevant with the nature and extent of the spill to prevent further oiling through secondary contamination.

#	Embedded Control / Spill Prevention Measure
101	The Tier I equipment held at EEPGL's onshore and offshore operations, including shorebases, fueling terminal, support vessels, drill ship, tankers and FPSO will be available for rapid deployment in the event of an incident.
102	Equipment and trained personnel are available through the terminals and shorebases to initiate an onshore/nearshore response to a Tier II incident. Vessel dispersant spray operations will be initiated from the PSVs and supported from the shorebases or other accessible locations as needed to supplement other Tier II response actions.
103	The RRT can be partially or fully activated, and includes trained individuals and specialists, with assigned roles and responsibilities, who can be deployed at short notice to address a broad range of emergency situations.
104	EEPGL is a Participant member with OSRL, and therefore has immediate access to Tier III technical advice, resources and expertise 365 days a year on a 24 hour basis.
105	EEPGL has access to the Global Dispersant Stockpile (GDS), which is an additional 5,000 m^3 of dispersant located across the OSRL bases and in France.
106	EEPGL has access to the OSRL Subsea Well Intervention Service (SWIS), Oceaneering, Wild Well Control, Trendsetter Engineering and Halliburton Boots & Coots Services for subsea well response. SWIS holds and maintains four CSSs and two SIRTS globally: • 15k PSI Subsea Well Capping Stack – Norway and Brazil; • 10k PSI Subsea Well Capping Stack – South Africa and Singapore; • Subsea Incident Response Toolkit – Norway and Brazil.
107	EEPGL conducts oil spill training courses and exercises (desktop and in-field) for operations offshore Guyana. The training, drills, and exercises familiarize response personnel with their duties and responsibilities in an oil spill.
108	EEPGL ERT and IMT members, which includes the Regional Response Team, will receive oil spill response training listed in the OSRP Table 10 (or equivalent training such as XOM ICS 100/200 CBT and University of Spill Management) based on their response position.
109	ERT and IMT members will receive appropriate Incident Command System (ICS) Training listed in OSRP Table 11 based on their roles and responsibilities.
110	EEPGL will conduct oil spill response exercises to test incident response personnel function and responsibilities, in line with OSRP.
111	EEPGL will implement a Wildlife Response Plan as a supplement to the OSRP to serve as general guidance for wildlife deterrence (hazing), capture, and rehabilitation during an oil spill response.

Appendix H OIL SPILL SCENARIOS AND NET ENVIRONMENTAL BENEFIT ANALYSIS (NEBA) FOR SELECTION OF RESPONSE TECHNOLOGIES

This NEBA analysis was performed for the Liza Phase 1 Development Project. It is considered a representative analysis for an FPSO Development Project, and would be consistent with the results of a Liza Phase 2 Development Project analysis.

The principal objectives of oil spill response is the elimination and collection of the maximum amount of oil in order to prevent its approach to the coast and subsequent stranding on the shoreline. In case of large spills of oil, the use of all available resources for oil spill response (OSR), including dispersants, is recommended. The decision to use dispersants may utilize a NEBA. This is an analysis based upon results of modeling of the spilled oil behavior on water and the efficiency of various response technologies as well as information about the oil's environmental impact. The analysis can determine the combination of response technologies that can best prevent stranding of oil on shorelines.

Data obtained in the course of the NEBA are used to develop recommendations for the use of available response technologies. In order to conduct the modeling, various scenarios of potential oil spill on facilities are utilized. These scenarios are selected from the possible releases that represent the risk of spills from a project.

Oil Spill Scenarios

During the development of oil spill scenarios and response measures, the following input data are taken into account:

- Locations of potential oil spills and volumes of the spills determined on the basis of the project's risks.
- Hydrodynamic and meteorological conditions that best represent the region and conditions under which the spills take place.
- Information on OSR technologies, the resources available, their performance parameters, and timing to implement them.

Spill Sources and Volumes

Oil spill scenarios were for this NEBA were developed for the following releases:

- A Tier III crude release from loss of well control at the FPSO – 20,000 BBL/day, for two seasons
- A Tier II crude release at the FPSO resulting from a loading hose malfunction – 2500 BBL, for two seasons

This approach ensures that the NEBA results would also be applicable to any potential smaller spills. The duration of the Tier III well control release at the FPSO was 30 days for Monitor and Observe (Unmitigated) analysis, and 21 days for the Full Response (Mitigated) analysis. The Response analysis considered the shut-in of the well at 21 days. The model runs for the Tier III analysis was 45 days. The duration of the release for the Tier II loading hose malfunction was less than 1 hour and the model was run for 8 days.

Seasons of the Year and Met Ocean Conditions

A technical report commissioned by ExxonMobil Upstream Research Company (Berek, et al., 2015) describes the results of an analysis of the regional wind time series data and characterizes the prevailing winds offshore Guyana:

- Winter – Winds from the east-northeast during the months December through May
- Summer – Winds from east during the months June through November

Wind data used in the oil spill model simulations were taken from two global models, NOGAPS and NAVGEM. These global models define wind speed and direction time series over the region. Data from the two models cover the same 10-year period as the hydrodynamics (2005-2014).

The hydrodynamics or currents in the upper water column off the Guyana coast are strong and flow towards the northwest along the coast of South America over the entire year. The Guiana Current is part of the regional flow between South America, Africa and the Caribbean Sea, extending from Guyana to the Caribbean. Current data produced by the SAT-OCEAN model covering the area around the Stabroek block were used in combination with currents extracted from the U.S. Navy HYCOM global hind cast model as inputs to the spill simulations.

Oil Spill Response Resources and Limitations on Their Use

The following oil spill response technologies were studied:

- Monitor and Observe – This unmitigated spill has no active OSR measures beyond the organization of monitoring;
- Full Response – The mitigated response represents joint in-situ burning, mechanical recovery of oil, the use of dispersants, and installation of a capping stack.

EEPGL has various oil-recovery and response devices and watercraft at its disposal for use in recovering and removing spilled oil from the sea surface. This equipment is maintained and provided to EEPGL upon demand for spill response by Oil Spill Response Limited (OSRL). OSRL is a world-wide provider of response equipment funded by the oil industry. In addition, OSRL also has a supply of oil dispersants and the appropriate equipment needed for application at the water surface by vessels and aircraft, and for subsea application at the well head. A list of the oil spill response resources used in the modeling simulations is presented below. This equipment list

excludes any equipment intended for onshore or on land response, as this NEBA effort is only focused on offshore spill response only.

It should be noted that the referenced vessels are the same as those references in the Liza 1 oil spill response analysis. This allows a direct comparison with the Liza 1 analysis. It should also be noted that as the project increases in size and complexity, the named project related vessels are changing and the number of vessels is increasing dramatically. If a significant incident were to occur, appropriate response vessels would expected to be readily available.

Table H1: Equipment Used during Modeled OSR Operations

Location	Response type	Mechanical oil recovery and burning	Dispersant Application
Downstream of FPSO	Oil Burning	Vessels-1 Project PSV and tug Vessels-2 Project PSV and tug Vessels-3 Project PSV and tug Vessels- 4 VOO* and other VOOs	
Water Surface Above Well	Dispersants		Project PSV
Subsurface at Well Head	Dispersants		Project MPV
Downstream of FPSO	Aerial dispersant application		Boeing 727 – 1 Boeing 727 – 2
Downstream of FPSO	Mechanical Recovery	Vessels-1 VOO and other VOOs Vessels-2 VOO and other VOOs Vessels-3 VOO and other VOOs Vessels- 4 VOO and other VOOs	
Well Head	Capping Stack		

PSV – Project Support vessel
MPV - Multi-purpose vessel equipped with geo-locators and ROV
*VOO – Vessels of Opportunity

Information collected from modeling of Oil Spill Scenarios

The following information is collected to compare the results of the Monitor and Observe (Unmitigated) scenarios with the Full Response (Mitigated) scenarios:

- Shoreline area where oil has stranded (m^2)
- Volume of oil stranded on shorelines (BBL)
- Volume of oil dispersed by aircraft (BBL)
- Volume of oil burned (BBL)
- Volume of oil recovered mechanically (BBL)
- Volume of oil evaporated (BBL)
- Volume of oil remaining on the surface of the sea (BBL)

Modeling of the Behavior of Spilled Oil and Response Performance

Modeling of oil spills was performed with the aim of assessing the efficiency of various response technologies available to EEPGL via OSRL. The results of this assessment are the basis of the NEBA. The modeling was conducted by RPS using the SIMAP model, developed for the purpose of predicting the impact and behavior of spilled oil. This model makes it possible to quantitatively study the changes that occur with spilled oil under the action of natural factors (spreading, evaporation, dispersion). The model also predicts the possible areas of oiling of the water and the oiling of the coastal zone. Finally, the model predicts the amount of oil removed using burning, mechanical recovery, and the amount of oil dispersed using dispersants. The reliability of the model was confirmed by comparing the results obtained from modeling to actual observed oil spill behavior during actual oil and oil product spills, a list of which is presented in Table H2.

Table H2: List of Spills Used to Validate the SIMAP Model

Spill source, name of ship	Spill mass, tonnes	Duration of spill (hours)	Type of oil	Date of spill	Ambient temperature, °C
American Trader	1,317	1	Crude, Alaska	July 1980	15
Apex Houston	83	27	Crude, Alaska	January 1986	13
Puerto Rican	3,473	1	Heavy fuel oil	November 1984	14
Command	11	1	Heavy fuel oil	September 1988	14
Cape Mohican	150	16	Medium viscosity fuel oil	October 1986	13
Arco Anchorage	830	4	Crude, Alaskan	December 1985	10
Bouchard Barge #155	1,208	0.25	Heavy fuel oil	August 1980	30
Exxon Bayway	1,837	3	No. 2 fuel oil	January 1980	8
Exxon Valdez	34,800	10	Crude, Alaskan	March 1988	2
North Cape	2,682	26	No. 2 fuel oil	January 1986	2
New Carissa	252	102	No. 6 and No. 2 fuel oils	February 1988	8
Buochard Barge #120	208	3	Heavy fuel oil	April 2003	7
Macondo	600,000	2,064	Louisiana Light	April 2010	20

In preparing information for this NEBA, a number of potential oil spill scenarios (Table H3) have been analyzed. These scenarios characterize the conditions for hypothetically more severe scenarios in terms of oil spilled volumes. The selection of these scenarios with large volumes of spilled oil was dictated by the need for developing response measures that might be applied to any smaller spills.

For each release and wind regime, the effects of various response strategies were modeled for their predicted ability to treat oil on the water surface and subsequently reducing the amount of oil stranded on shore. The response strategies included the following: Monitor and Observe or no active mitigation, and Full Response or mitigation with the combined use of in-situ burning,

mechanical recovery, dispersant application both at the surface and in subsurface waters at the wellhead, and the installation of a capping stack.

The modeling provides the ability to evaluate and compare response results for a variety of quantitative parameters: oil stranded on shorelines, oil remaining on the surface of the sea, oil burned and recovered mechanically, and dispersed into the water as a result of both natural factors and after dispersant application.

Table H3: List of Oil Spill Scenarios Analyzed

No.	Wind regime	Spill Source	Response options	Spill mass, BBL	Spill duration
1	Summer	Loading Hose	Monitor and Observe	2,500	1 hour
2	Summer	Loading Hose	Burning, Dispersants, and Mechanical Recovery	2,500	1 hour
3	Winter	Loading Hose	Monitor and Observe	2,500	1 hour
4	Winter	Loading Hose	Burning, Dispersants, and Mechanical Recovery	2,500	1 hour
5	Summer	Well Control Loss	Monitor and Observe	600,000	30 Days
6	Summer	Well Control Loss	Burning, Dispersants, and Mechanical Recovery	420,000	21 Days
7	Winter	Well Control Loss	Monitor and Observe	600,000	30 Days
8	Winter	Well Control Loss	Burning, Dispersants, and Mechanical Recovery	420,000	21 Days

For each set of scenarios, a comparison of predicted oil volumes was made for the following model parameters:

- Monitor and Observe – when no actions are taken to recover, remove, or disperse the oil, and it is broken down only by natural factors such as wind and waves;
- Full Response – Utilization of In-situ burning, mechanical recovery, the use of dispersants both at the water surface and in subsurface waters at the wellhead, and installation of a capping stack.

The SIMAP Model was used to determine the potential performance of response equipment used for in-situ burning, mechanical oil recovery, capping stack installation and dispersant application. The potential capacities were determined for the equipment deployed and these were taken into account in the modeling analysis. The environmental limits of the various types of equipment were used to account for conditions in which the equipment could not be operated safely or effectively.

Response Conditions and Limits

Mechanical oil recovery, surface application of dispersants with a vessel at the well site, aerial dispersant application, and subsurface dispersant application at the well head were simulated utilizing the capabilities presented in Tables H4 to H9. The timing of the initiation of those responses are presented in Table H10.

Table H4: Mechanical Recovery Parameters and Limitations

Mechanical Recovery
Vessel based recovery using boom and skimmer systems – VOO Based operations
4 vessels conduct oil collection
Recovery rates or skimmer ratings-200gpm
Maximum vessel speed 15 knots
Staffed with 2 crews
Daylight operations only
Winds < 20 Knots
Waves < 1.5 m
Boom swath width 50m
Temporary storage 25 m^3 (6,604.3 gal) per vessel system unloaded
Times for transit to offload and offload = 2 hours
No need to return to port nightly

Table H5: In-Situ Burning Parameters and Limitations

In-Situ Burning
Vessel based burning operations utilizing burn boom – Project vessels with VOO assist, 4 burning operations total
Maximum vessel speed 15 knots
Staffed with 2 crews
Daylight operations only
Oil weathering 24 to 72 hours
Emulsification <25% water
Burn location >3 NM from well head and populated areas
Winds < 20 Knots
Waves < 1.5 m
Currents – adjusted to < 1 knot with vessels and positioning
Boom swath width 50m
Assume 2 burns/day per vessel pair, 300 BBL/burn
No need to return to port daily

Table H6: Surface Dispersant Application Parameters and Limitations

Surface Dispersant Application
Vessel with spray arms – 1 Project vessel
Dispersant spraying of oil surfacing above well-head
Staffed with 2 crews
Vessel Dispersant Capacity – Restock offshore in evening
Maximum vessel speed 20 knots
Vessel Dispersant Application Speed – Average 5 knots
Unlimited dispersant access for daylight operations
Daylight operations only
No minimum sea state
No spraying above 35 mph wind speed
Spray arms are 6 m and attached to both sides of vessel
Desired dispersant to oil ratio (DOR) 20:1

Table H7: Aerial Dispersant Application Parameters and Limitations

Aerial Dispersant Application
Boeing 727 – 2 identical aircraft
15,000 L dispersant capacity
Cruising speed 930 kmh (577 mph)
Dispersant Application Speed- 150 mph
DOR 20:1
Based in Trinidad
Unlimited dispersant access
Staffed with 2 crews
Daylight operations only
No minimum sea state
No spraying above 35 mph wind-speed

Table H8: Wellhead Dispersant Parameters and Limitations

Wellhead Dispersant Injection
Coil tubing delivery at well head – Project Multi-purpose vessel equipped with geolocation system and a dedicated ROV.
No minimum or maximum operating limits, limits are defined by safe operating conditions.
No limitations from gas flux at the surface.
24/7 Operations
Staffed with 2 crews
Unlimited dispersant access
DOR determined with sensitivity analysis
Assume 100% of discharged oil is treated

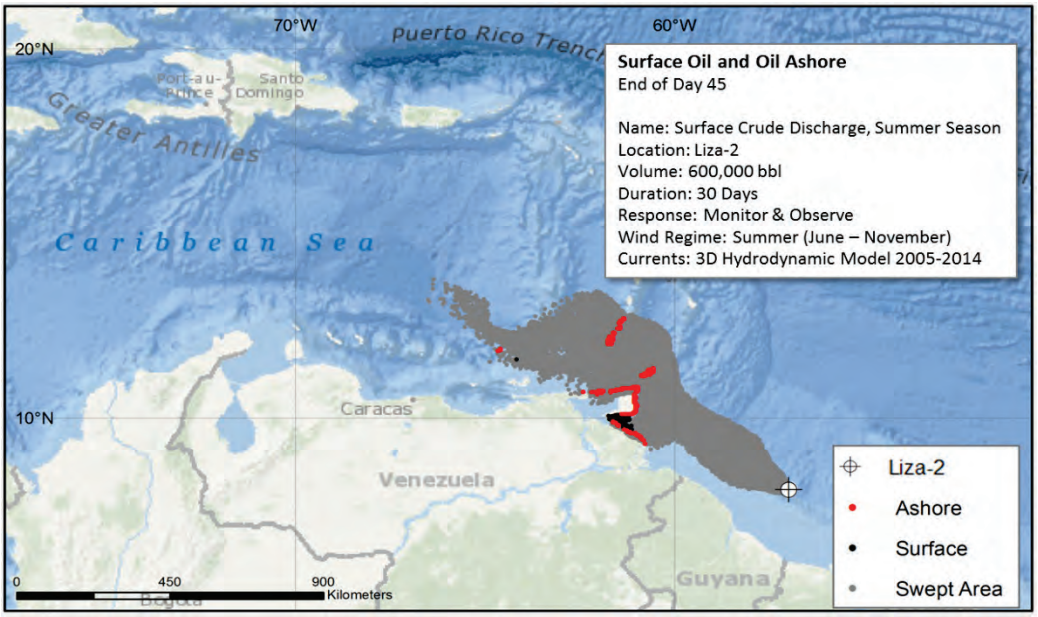
Table H9: Timing of Response Activities

	Day	1	2	3	4	5	6	7	10	12	14	21
Aircraft 1			x									
Aircraft 2					x							
Well-Head Dispersants							x					
Vessel with Spray Arms							x					
Burn Boat 1							x					
Burn Boat 2							x					
Burn Boat 3								x				
Burn Boat 4								x				
Mechanical Boat 1									x			
Mechanical Boat 2									x			
Mechanical Boat 3										x		
Mechanical Boat 4										x		
Capping Stack												x

Results of the NEBA Analysis

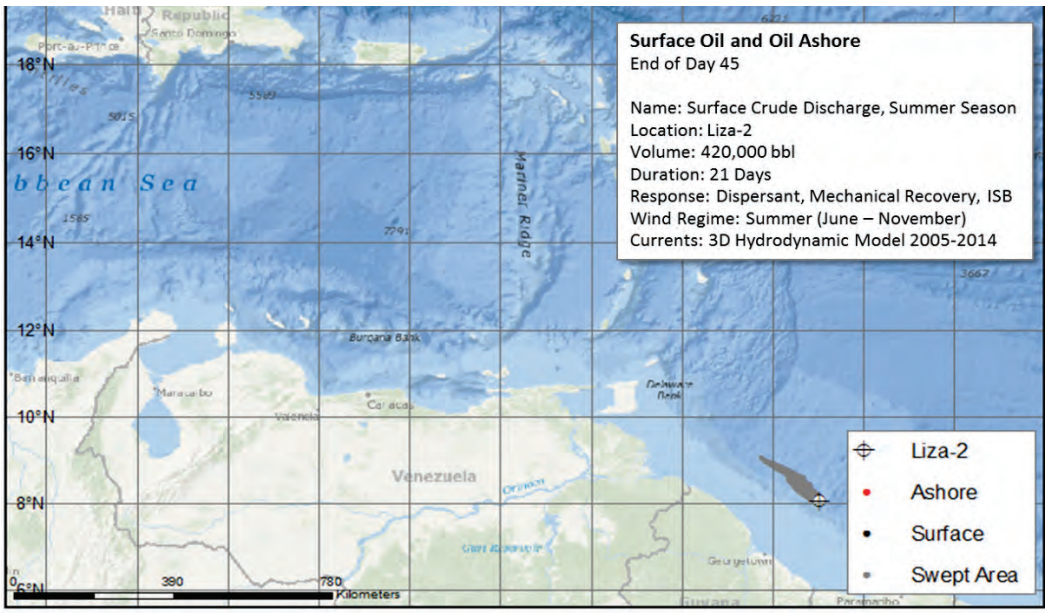
The results of the NEBA analyses has been presented in the following manner:

- Maps representing the releases as “unmitigated” or Monitor and Observe only without active oil spill response measure being implemented; followed by
- Map representing the releases with “mitigation” or a Full Response with all response activities being implemented jointly.
- These are then followed by summary tables, which show the difference between these model runs and associated performance parameters for both unmitigated and mitigated releases that were depicted in the maps earlier.



Areas colored gray show the sea surface area swept by oil. Red indicates where oil has stranded on the shoreline. Areas colored black show the presence of oil on the sea surface.

Figure H1: Model Predicted <u>Unmitigated</u> Oil at the End of a 45-day Simulation Originating at the Liza Phase 1 Well Site in the Summer Season



Areas colored gray show the sea surface area swept by oil. There is no shoreline oiling and no surface oil remains. ISB = in-situ burning.

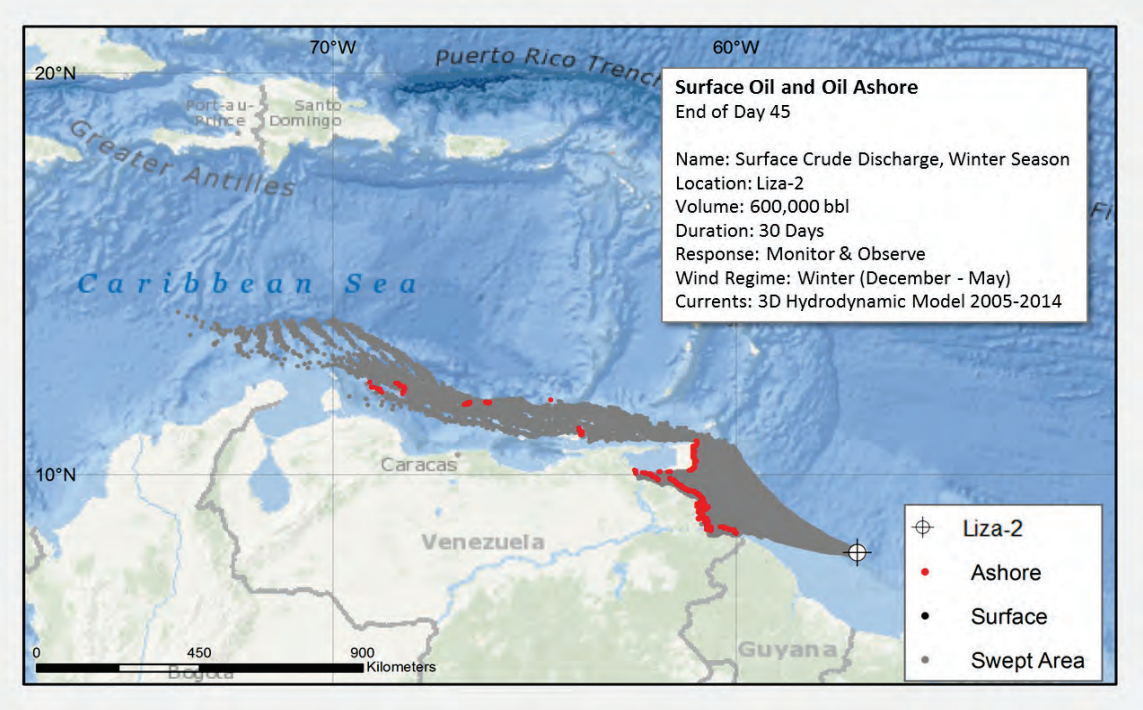
Figure H2: Model Predicted <u>Mitigated</u> Oil Surface Oil at the End of a 45-day Simulation Originating at the Liza Phase 1 Well Site in the Summer Season

Table H10: Comparison of Key Model Output Parameters for the Liza 20 KBD Summer Season Release for Mitigated (Full Response) and Unmitigated (Monitor and Observe)

	Monitor and Observe 600,000 bbl	Full Response* 420,000 bbl
Shoreline area oiled (m^2)	2	0
Oil washed ashore (bbl)	54,970	0
Oil in water column (bbl)	26,740	155,300**
Oil dispersed from vessels and aircraft (bbl)	0	77,100
Oil burned (bbl)	0	870
Oil mechanically recovered (bbl)	0	3,320
Oil biodegraded (bbl)	79,550	226,500
Oil evaporated (bbl)	282,720	34,010

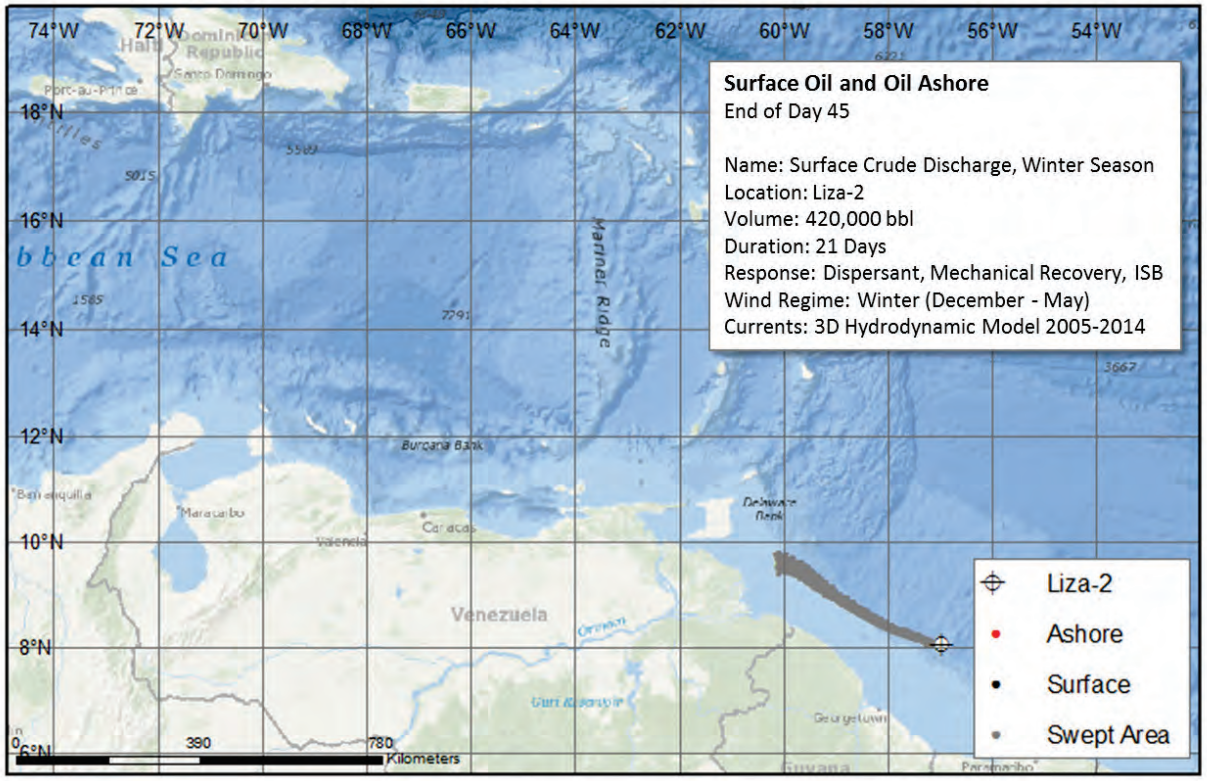
** Full Response includes installation of a capping stack on Day 21 that reduces volume*

*** Includes dispersant application at wellhead*



Areas colored gray show the sea surface area swept by oil. Red indicates where oil has stranded on the shoreline. Areas colored black show the presence of oil on the sea surface.

Figure H3: Model Predicted Unmitigated Oil at the End of a 45-day Simulation Originating at the Liza Phase 1 Well Site in the Winter Season



Areas colored gray show the sea surface area swept by oil. No shoreline oiling occurred and no surface oil remained.

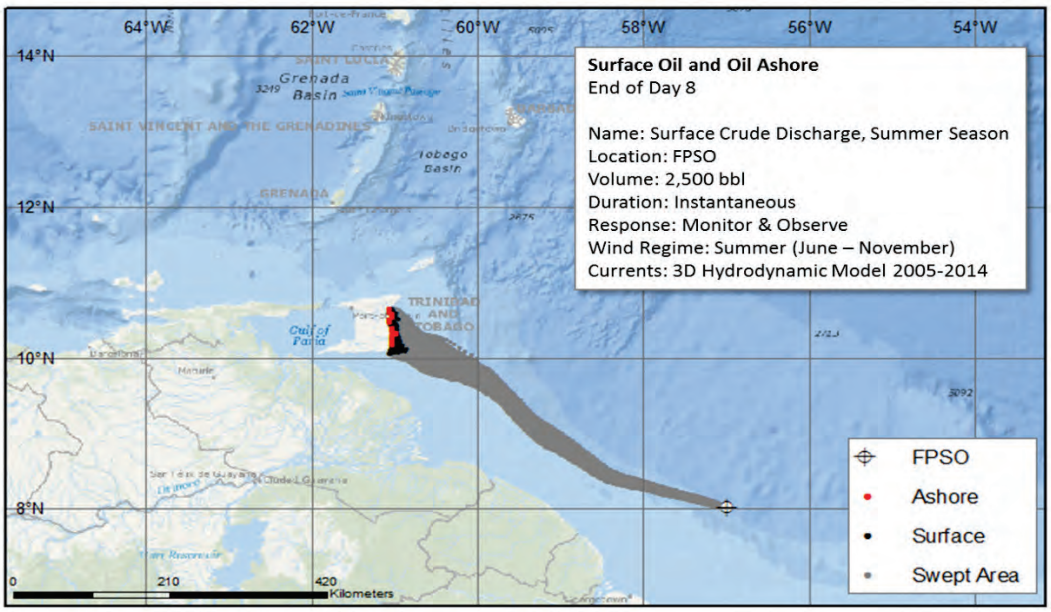
Figure H4: Model Predicted Mitigated Oil at the End of a 45-day Simulation Originating at the Liza Phase 1 Well Site in the Winter Season

Table H11: Comparison of Key Model Output Parameters for the Liza 20 KBD Winter Season Release for Mitigated (Full Response) and Unmitigated (Monitor and Observe)

	Monitor and Observe 600,000 bbl	Full Response * 420,000 bbl
Shoreline area oiled (m^2)	10	0
Oil washed ashore (bbl)	193,170	0
Oil in water column (bbl)	45,780	156,350**
Oil dispersed from vessels and aircraft (bbl)	0	73,300
Oil burned (bbl)	0	1,500
Oil mechanically recovered (bbl)	0	1,200
Oil biodegraded (bbl)	85,680	226,850
Oil evaporated (bbl)	246,140	34,100

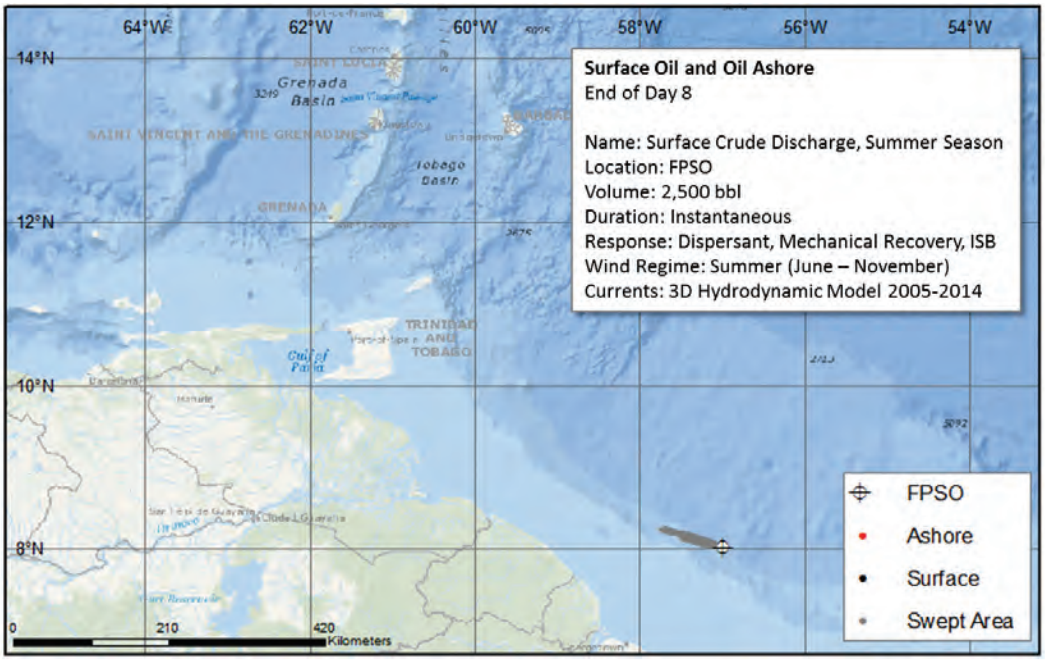
** Full Response includes installation of a capping stack on Day 21 reducing flow*

*** Includes dispersant application at wellhead*



Areas colored gray show the sea surface area swept by oil. Red shows areas of shoreline oiling and black represents remaining surface oil.

Figure H5: Model Predicted <u>Unmitigated</u> Oil at the End of an 8-day Simulation Originating at the Liza Phase 1 Well Site in the Summer Season

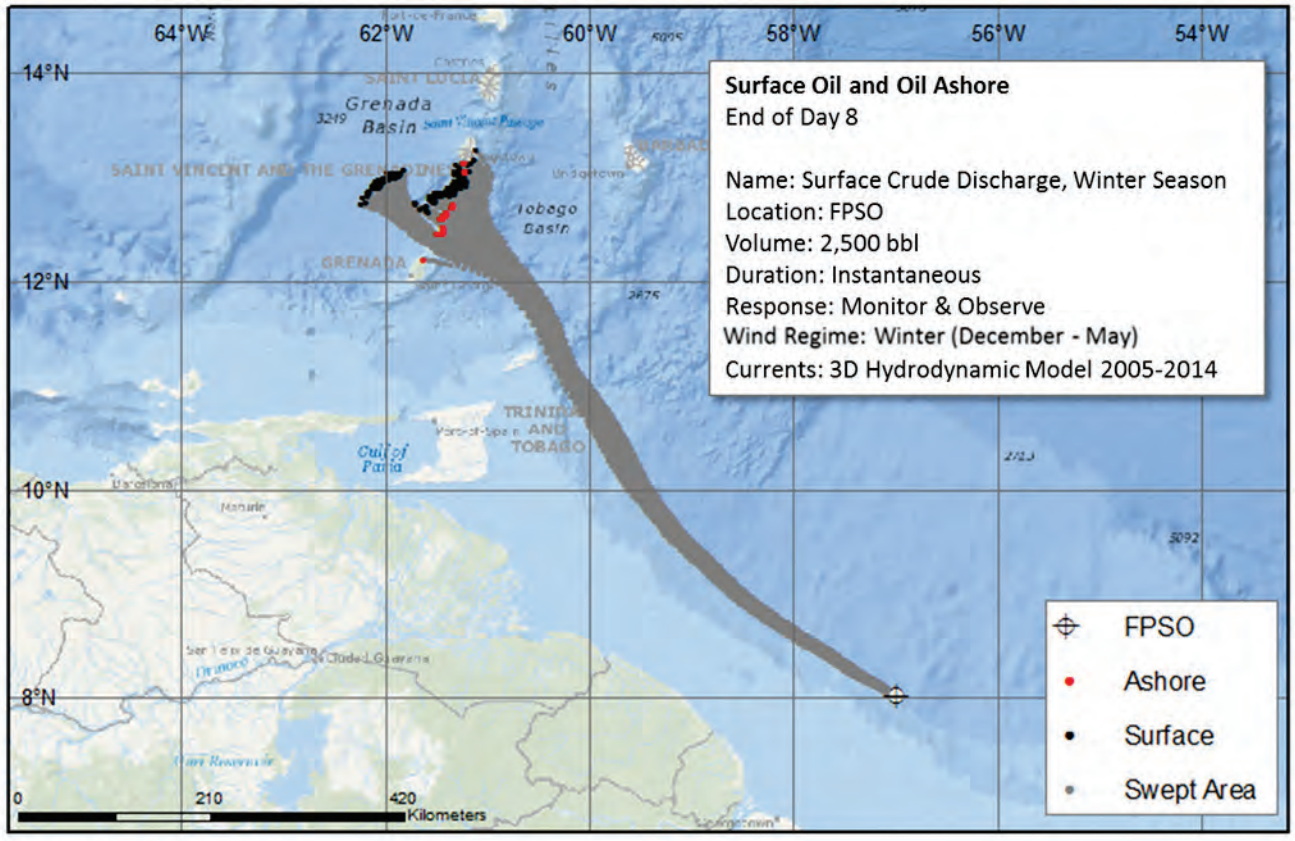


Areas colored gray show the sea surface area swept by oil. No shoreline oiling occurred and no surface oil remained.

Figure H6: Model Predicted <u>Mitigated</u> Oil at the End of an 8-day Simulation Originating at the Liza Phase 1 Well Site in the Summer Season

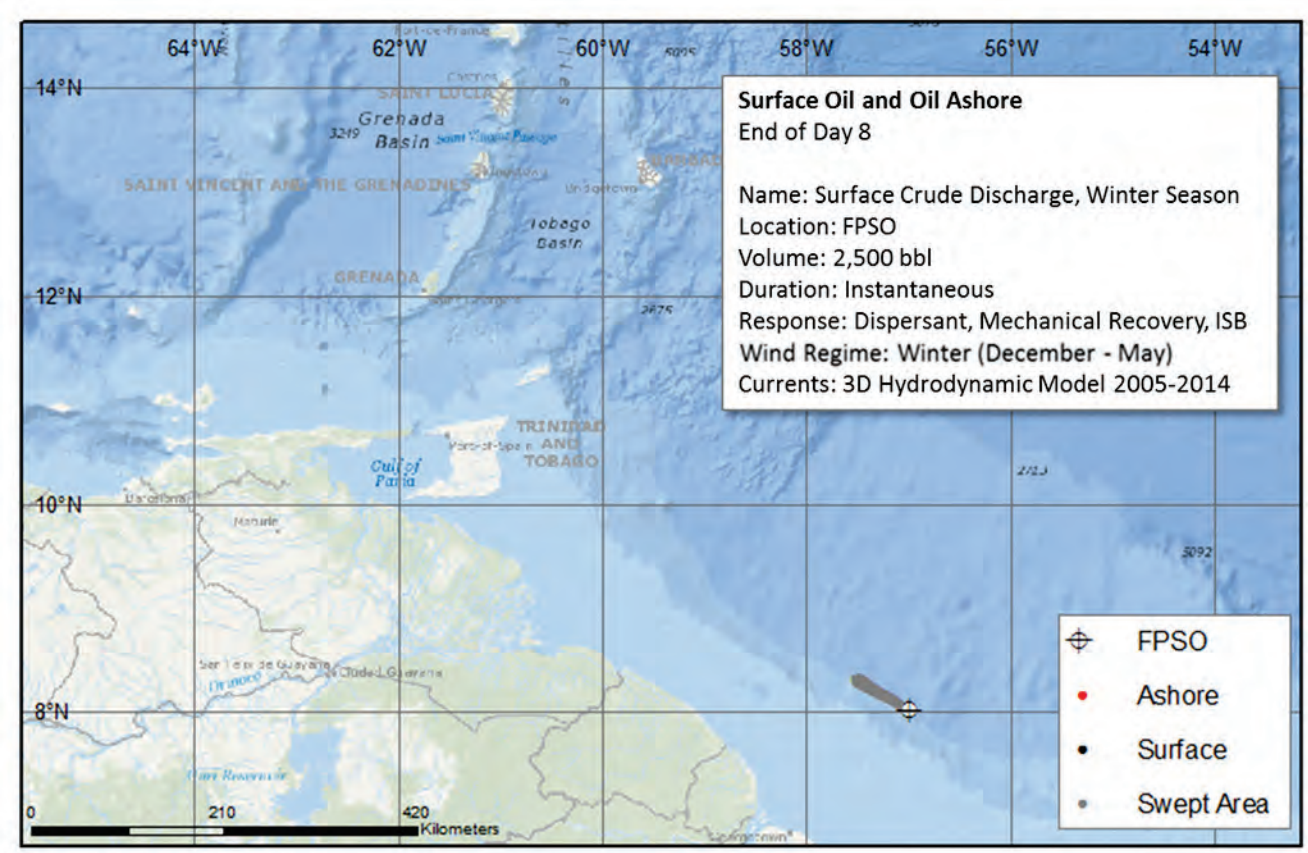
Table H12: Comparison of Key Model Output Parameters for the Liza 2500 BBL Summer Season Release for Mitigated and Unmitigated

	Monitor and Observe	Full Response
Shoreline area oiled (m^2)	0	0
Oil washed ashore (bbl)	70	0
Oil in water column (bbl)	30	1,350
Oil dispersed from aircraft (bbl)	0	1,550
Oil burned (bbl)	0	0
Oil mechanically recovered (bbl)	0	0
Oil biodegraded (bbl)	120	220
Oil evaporated (bbl)	1,000	930



Areas colored gray show the sea surface area swept by oil. Red shows areas of shoreline oiling and black represents remaining surface oil.

Figure H7: Model Predicted Unmitigated Oil at the End of an 8-day Simulation Originating at the Liza Phase 1 Well Site in the Winter Season



Areas colored gray show the sea surface area swept by oil. No shoreline oiling occurred and no surface oil remained.

Figure H8: Model Predicted Mitigated Oil at the End of an 8-day Simulation Originating at the Liza Phase 1 Well Site in the Winter Season

Table H13: Comparison of Key Model Output Parameters for the Liza 2500 BBL Winter Season Release for Mitigated and Unmitigated

	Monitor and Observe	Full Response
Shoreline area oiled (m^2)	0	0
Oil washed ashore (bbl)	70	0
Oil in water column (bbl)	230	1,340
Oil dispersed from aircraft (bbl)	0	1,540
Oil burned (bbl)	0	0
Oil mechanically recovered (bbl)	0	0
Oil biodegraded (bbl)	130	230
Oil evaporated (bbl)	1,000	930

NEBA Summary

The analysis of oiling parameters in the Monitor and Observe vs. Full Response oil spill responses demonstrates that the timing and response approach was effective in avoiding shoreline impacts. The reduction or elimination of shoreline impact is critical to successful spill response because oil can collect in quantities on shorelines and near shore environments that may cause significant environmental damage and persist for years. The response to shoreline stranding may require invasive cleaning technologies to eliminate bulk oil. In some cases these invasive technologies can be harmful and like oiling can produce long-lasting environmental effects.

A risk analysis that considers environmental effects and the time to recovery is presented in the Figure H9.

Risk Matrix		Consequence/Severity		
		Low	**Medium**	**High**
Likelihood	Unlikely	Minor	Minor	Moderate
	Possible	Minor	Moderate	Major
	Likely	Moderate	Major	Major

Figure H9: Risk Assessment for Environmental Effects

This risk analysis can be utilized to help understand the benefits of oil dispersant utilization in a response. The goal of the spill response is to shift the amount and duration of environmental effects from a higher severity to a lower severity. In the above figure, that shift would be represented by moving the consequence and severity from the right to the left.

The environmental effects of an oil spill on the coastline of Guyana can be represented in Figure H10. An unmitigated oil spill that impacts the shoreline will affect vegetation and organisms living in the intertidal zone. This is the area of the coastline between high tide and low tide. In Guyana, much of the coastline is vegetated by mangroves, an ecosystem that is rich in diversity because it provides a protective environment for fish, crabs, and shellfish. When mangrove forests are impacted by oil, the roots that are important for respiration are smothered and the plants die. The recovery time for mangroves may be decades. The recovery time for fish, crabs, and shellfish may be 1 to 3 years, however, the loss of protective habitat makes them more vulnerable to predation which ultimately affects species diversity. Therefore the effects from an oil spill with no active mitigation are represented by the red zones in Figure H9.

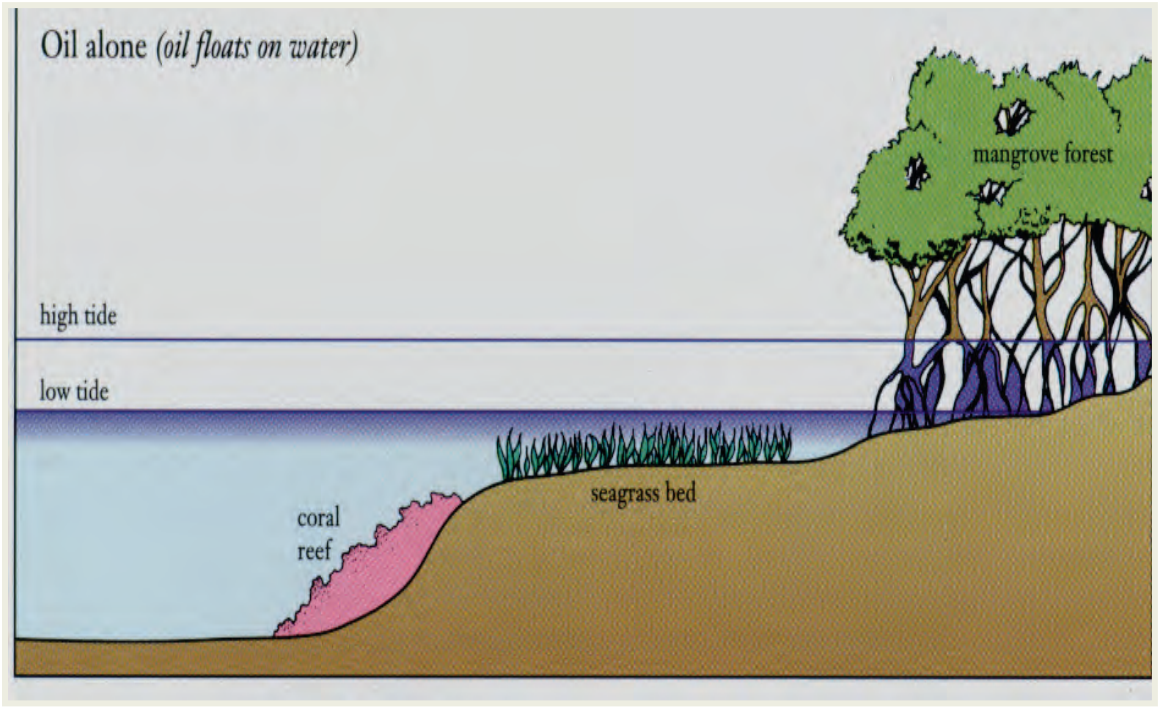


Figure H10: Intertidal Zone between Low and High Tide at Risk from Floating Oil

Figure H11 represents the shoreline affected by an oil spill that has been mitigated with dispersants in order to avoid shoreline impact.

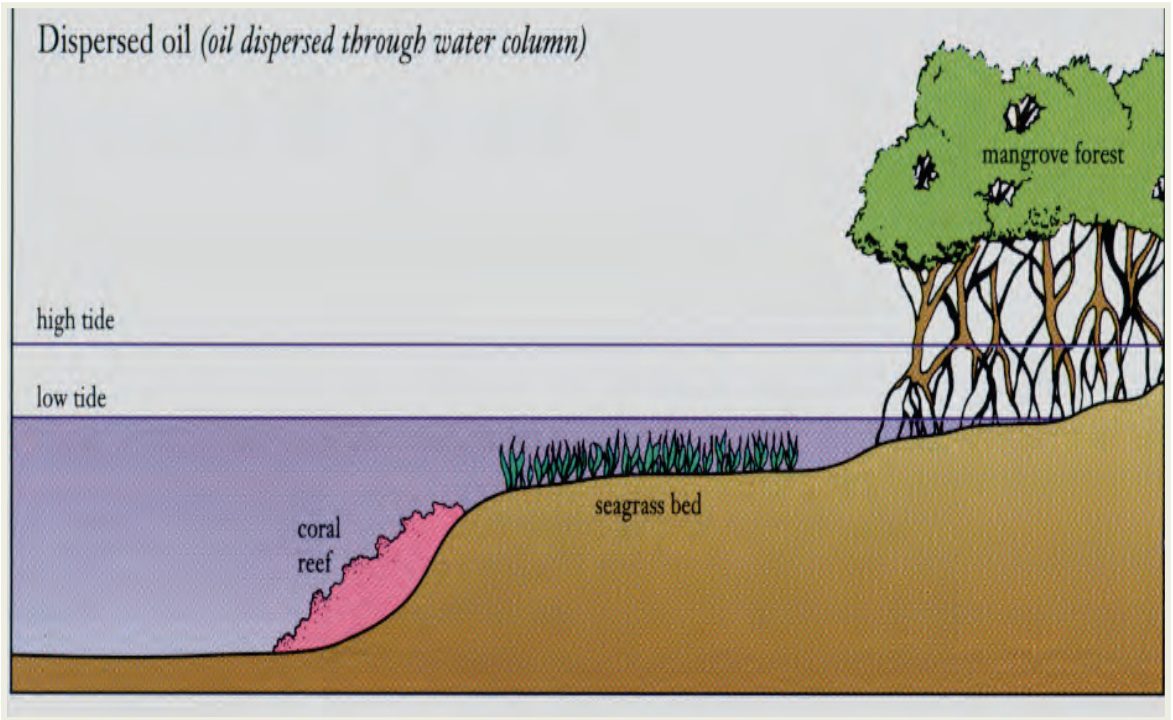


Figure H11: Shallow Sub-Tidal Zone at Risk from Dispersed Oil

In this case, the spill response that includes dispersant utilization has prevented shoreline stranding in the intertidal zone so that the mangrove forests and the species inhabiting them remain intact. However, in this case, there is a trade-off between the potential effects in the intertidal zone with potential effects in the shallow sub-tidal zone below low tide. In this case the oil that was floating on the water is now dispersed into very small droplets in the top of the water column. During the brief period, generally < 1 day, that high concentrations of oil droplets are present, these sub-tidal organisms may be at risk. Therefore, near-shore shallow sub-tidal sea grass beds, the fish and other organisms that inhabit them and shallow corals may be at risk. However, the exposure times are brief and the duration of the impacts are limited. Therefore if we consider the risks in Figure H9, the damages and recovery times are limited and risks are reduced (i.e., shifted to the left on the risk matrix) representing lower consequences.

This NEBA analysis examined both Tier II and Tier III releases from the Liza Phase 1 Development Project. The response analyses that were utilized in the mitigated results represent the types of equipment and timing of a response that can be mounted at this time. In the event of an actual release in the future, these presentations may serve as the underlying basis for an updated NEBA. The goal of this analysis has been to present large releases so that they would encompass the response to smaller, more probable releases. In consideration of their success in eliminating surface oiling and shoreline stranding, they represent the extent of EEPGL's full resources. EEPGL's goal is to have no spill releases at all and that remains the primary focus at all times. However, if an accidental release does occur, spill response experts and technical specialists will be available to provide NEBA updates and analyses as necessary for consideration by the corresponding Guyana authorities.