



**Oilfield Service Facility
Environmental Management Plan
Guyana**

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1.0 INTRODUCTION

1.1 Background

Baker Hughes (BKR) is one of the world's leading energy technology companies and has operations in more than one-hundred and twenty (120) countries with sixty-seven thousand (67,000) employees. The company is focused on designing, manufacturing and servicing transformative technologies to take energy and industry forward. Baker Hughes portfolio of services and products include oilfield services; oilfield equipment; turbomachinery and process solutions for onshore and offshore productions, among other types of operations; and digital solutions. Baker Hughes is committed to reducing its environmental footprint by minimizing emissions and waste from its operations each year. At the global level, the company partners with customers to reduce their environmental footprint, invents technologies and invests in a portfolio of low-carbon products and services.

Baker Hughes (Trinidad) Limited intends to establish an Oil Field Services facility in Land of Canaan, Guyana to support the offshore oil and gas operators. BKR is committed to complying with all of Guyana's environmental requirements relevant to its operations.

1.2 Objective and Scope of the EMP

The EMP is prepared in accordance with the EPA's guidelines for the preparation of EMPs. The EMP is focused on identifying and assessing the potential impacts arising from the operation of the service facility. For any potential adverse impacts that cannot be avoided, the EMP identified the appropriate mitigation actions. Measures are also outlined for responding to unplanned events such as emergencies.

Specifically, the EMP:

- Presents a description of the project including its location, scale, components and key activities.
- Assesses the policy, regulatory and institutional framework for the project, including identifying the relevant national policies, legislation, standards and guidelines that define the implementation framework of the project, as well as the responsible institutions.
- Provides measures to prevent or reduce adverse impacts to acceptable levels for the operation phase of the project.
- Outline the company's Contingency and Emergency Response Plan, Monitoring Plan and Closure Plan.

1.3 Methodology

The EMP was prepared during the period February – March 2020 and was undertaken in the following three phases:

Understanding the Project, Project Environment and Concerns of Stakeholders

- Applicable national policies, strategies, plans and legislation were reviewed to determine the national and legal framework within which the project will be implemented.

- Information on the project area was collected by reviewing existing reports and visits to the project area.
- Project information was reviewed and discussions held with key company personnel to provide a good understanding of the activities involved in the project. An analysis of the site layout and project design was also done.
- The project's Area of Influence (Aoi) was identified and which is defined as the footprint of the actual facility to be constructed, plus a fringe of land extending some 50m around the actual site in all directions.

Impact Analysis

The potential environmental and social impacts of project activities were then assessed using an impact assessment matrix to predict the significance of the impacts. The full range of potential impacts were examined using qualitative assessments to identify, prioritize and recommend appropriate and adequate mitigation and management measures. The impacts prediction matrix was utilized to identify short-term and long-term impacts, positive and negative impacts, unavoidable, or irreversible; and direct and indirect impacts.

Mitigation and Management Planning

Mitigation and management planning was conducted to identify feasible and practical measures to reduce and mitigate the potential negative impacts, as well as, maximise the positive impacts. Procedures to be undertaken to prepare and respond to an emergency situation were examined, and a framework proposed to implement, monitor and assess the effectiveness of the mitigation measures recommended.

2.0 COMPANY DESCRIPTION

Baker Hughes is one of the world's leading energy technology companies. For more than a century, Baker Hughes has been at the forefront of designing, manufacturing and servicing transformative technologies to help take energy forward. The company operates in more than 120 countries and works in partnership with its customers to deliver better outcomes. Baker Hughes also has operations in Barbados and Trinidad and Tobago, which, like Guyana, are member states of the Caribbean Community. Baker Hughes promotes an inclusive and collaborative workplace culture for the 67,000 employees which are employed by the company's global operations¹.

Baker Hughes offers a broad portfolio of technology solutions for energy and industry to improve productivity, reliability and create transformative outcomes. The company offers a portfolio of services and products which include²:

- Oilfield services to help produce oil and gas at the lowest possible cost per barrel through the lifetime of a well, starting with evaluation of the asset to its decommissioning.
- Oilfield equipment which delivers a comprehensive suite of solutions, systems and products primarily to subsea operations.
- Turbomachinery and process solutions for onshore and offshore productions, liquefied natural gas, pipeline and gas processing, refinery and petrochemical, and industrial.
- Digital solutions that use intelligent, connected technologies to sense, monitor, control and inspect operations to facilitate digital transformation.

2.1 Health, Safety and Environment Policy Statement

Baker Hughes takes energy forward making it safer, cleaner, and more efficient for people, and the planet.

Energy is expanding beyond just oil and gas, and so is Baker Hughes. Building on the company's heritage, Baker Hughes is researching, innovating, and accelerating the industry beyond where it has ever been. Health, Safety, Environment (HSE) and Corporate Responsibility are built into everything the company does, from the way the technology portfolio is developed, recruiting and developing employees, to the way the company plans and executes for customers.

Baker Hughes is passionate about trying new things and revolutionizing industry and is committed to doing so safely, in a way that takes care of people, customers, the communities in which the company operates, and the environment. Through a commitment to a culture of health, the company strives to create an environment that promotes the importance of wellbeing and encourages all employees to be a leader in their own health while at work, at home, and in the community. Baker Hughes goal is to make every day a Perfect HSE Day with no injuries, accidents, illnesses, or harm to the environment. Every employee is responsible to help us achieve this goal by committing to:

Care: doing the right thing, always, for our customers, our people, and the environment

HSE is instilled into the company's culture, it's integrated into business decisions, management systems, and everything Baker Hughes does.

¹ Baker Hughes, 2019. About us. Available online: <https://www.bakerhughes.com/company/about-us>

² Baker Hughes, 2019. Products and Services What We Do. Available at: <https://www.bakerhughes.com/products-services>

High Standards

All employees must comply with the company’s HSE standards and procedures, policies, laws, regulations, and requirements. Baker Hughes is able to articulate these standards to anyone in the company’s business from leadership, to suppliers, contractors, and customers. At Baker Hughes, everyone is accountable to maintaining the same high standards.

Collaboration

At Baker Hughes, everyone works together, colleagues, suppliers, and customers to improve the HSE outcomes of the company and the industry by communicating openly to share best practices and lessons learned.

Sustainability and Efficiency

Baker Hughes is continuously improving the sustainable and efficient use of resources. The company is committed to achieving net-zero carbon emissions by 2050 by transforming how the company works. As a leading partner to the energy industry, Baker Hughes is investing and deploying new energy solutions to reduce the footprint of customers’ operations around the world.

Immediate Action

At Baker Hughes, identifying and stopping any unsafe acts before they happen is critical. Everyone is responsible and empowered to observe, intervene, and report unsafe conditions and behaviors immediately.

Baker Hughes intends to meet these commitments through clearly documented HSE objectives and routine management reviews and cultivating an interdependent HSE culture where employees watch out for the safety of everyone around them.

Health, Safety & Environment

At Baker Hughes Health, Safety and Environment (HSE) is integrated into our business and has become part of who we are; it’s in our DNA.



2.2 Corporate Responsibility³

Baker Hughes has embraced a people, planet and principles framework to promote sustainability of the company's operations and which allows the company to achieve its business priorities. The company's corporate responsibility is to continue to foster an inclusive culture that supports people and communities, to be stewards of the environment, and to operate with sound governance and ethical and responsible business practices.

2.2.1 People

Baker Hughes values an inclusive culture that supports people and communities. The company is committed to increasing diversity in leadership, the employee base and the supply chain to reflect the local communities where Baker Hughes operates. Women account for 19% of the company's senior leadership and 17% of the company's global workforce. Baker Hughes attracts, equips, and empowers the workforce by investing in early leadership development, supporting employee health and wellbeing, and creating opportunities for the next generation of talent. Baker Hughes also collaborates with organizations and on projects aligned with interests and needs of the communities where in which the company operates.

Baker Hughes promotes sustainability in communities and works to advance public health and safety. The company also supports inclusive education and training including a focus on Science, Technology, Engineering and Mathematics (STEM). The Baker Hughes Foundation has provided Global Program Support since 2018. In 2019, Team Guyana performed exceptionally well by winning the gold medal for Albert Einstein Excellence award in the First Global STEM Olympiad held in Dubai, United Arab Emirates.⁴

Baker Hughes was named one of the 250 best managed companies in the Wall Street Journal's Management Top 250 and received the highest ranking in their sector.

2.2.2 Planet

Baker Hughes has reduced its environmental footprint by minimizing emissions and waste each year from its operations. Since 2012, emissions of carbon dioxide equivalents (CO₂eq) has decreased by 34% percent. The company aims to further accelerate its ambition for emissions reductions by reducing CO₂eq emissions by 50% by 2030 and ultimately, to have a net zero-percent of CO₂eq emissions by 2050. Moreover, Baker Hughes has voluntarily reported the emissions from its operations for more than a decade to the Carbon Disclosure Project (CDP). Baker Hughes will continue to partner with customers to help them to reduce their environmental footprint and will continue to invent technologies and invest in a portfolio of low-carbon products and services. Baker Hughes employees have conducted 17,000 hours of community service, in 2018, focused on fundraising and global clean-up exercises of beaches, deserts, parks and cities⁵.

In 2019, Baker Hughes was ranked thirty-sixth on Barron's 100 Most Sustainable Companies. This was the second year in which the company was ranked and no other oil and gas or oilfield services company was included.

2.2.3 Principles

³ Baker Hughes, 2019. Corporate Responsibility. Available at: <https://www.bakerhughes.com/company/corporate-responsibility>

⁴ Baker Hughes, 2019. Presentation titled Baker Hughes Guyana Drilling Fluids and Cement Facility Info Sharing delivered at a Public Meeting on November 06, 2019.

⁵ Ibid

Baker Hughes seeks to do the right thing always and in so doing, embraces the following principles:

- Make every day a Perfect HSE Day—a day with no injuries, accidents, or harm to the environment. HSE is integrated into all of the company's operations. Baker Hughes had 153 Perfect HSE days in 2018, a 20% increase from 2017 and has won 55 industry HSE awards. For example, every 4 of the last 5 years Baker Hughes was awarded by the Center for Offshore Safety and Leadership Award for Improving Safety Management. Baker Hughes was also ranked AAA by the Morgan Stanley Capital International ESG Survey, and was the only company AAA-rated amongst the company's 10 largest peers.
- Do the right thing always, delivering the best quality products, services, processes, and technologies in the industry.
- Maintain ethical practices, as well as supply chains through a risk-mitigation management approach across the company's global operations to ensure there is a rigorous approach in safeguarding human rights.

2.3 Innovation and Technology⁶

Baker Hughes' approach to research and development is to invent, accelerate, and collaborate to bring the most transformative technologies to market and to solve some of the most complex challenges with technologies that explore the future of design and manufacturing, artificial intelligence, and computing.

In 2018, Baker Hughes invested USD 700 million in research and development and approximately 2,700 patents were issued globally. The company has more than 9,000 engineers and scientists at 17 Global Innovation and Education Centers around the world including Centers in the United States of America (USA), Saudi Arabia, Italy and Brazil.

⁶ Baker Hughes, 2019. Innovation and Technology. Available at: <https://www.bakerhughes.com/company/innovation-technology>

Corporate Responsibility



"We hold ourselves accountable to do the right thing, always. Our commitments, activities and investments are prioritized around **People, Planet and Principles.**"

People

We value an inclusive culture that supports people and communities

- 17% Women in global workforce
- Emphasis on diversity and local content

Planet

We reduce our own carbon footprint + help to reduce our customers' carbon footprint

- 34% Emission reduction since 2012
- 10 years carbon transparency

Principles

We seek to do the right thing always

- 153 Perfect HSE Days for 2018 (+20% over 2017)
- 55 Industry HSE awards



Carbon Disclosure Project
10 years of reporting to the Carbon Disclosure Project



Barron's 100 Most Sustainable Companies
Ranked 36th in 2018 list; Second year ranked and no other oil and gas or oilfield



Center for Offshore Safety Leadership Award
Awarded 4 of last 5 years for drills, programming and contributions to improving



Morgan Stanley Capital International ESG Survey
AAA ranking for 2018; Only AAA-rated company amongst our 10 largest



Wall Street Journal's Management Top 250
Named one of the 250 Best Managed Companies; Highest return on capital in our sector

Our Community Investments

Focused on Meaningful, Measurable Impact on Communities, Future Generations & Ecosystems



Inclusive Education & Training including focus on STEM (Science, Technology, Engineering and Mathematics)
Promoting Sustainability in Communities
Advancing Public Health & Safety



17,000 Hours in Employee Community Service in 2018
Motivated Fundraising Teams
Beach, Desert, Park, & City Litter Clean-Ups Globally

FIRST Global Charitable Partnership

Impacting the Lives of Young People through STEM Education & Robotics Competition

- Teams of Students ~190 Countries Participate
- The 'Olympics' of Robotics Competition
- Baker Hughes Foundation has provided Global Program Support since 2018



Team Guyana at FIRST Global Competition in Dubai, UAE
October 24-27, 2019

3.0 PROJECT DESCRIPTION

3.1 Project Rationale

The development of the petroleum sector in Guyana requires investments in local infrastructure so as to adequately provide shore base services to offshore oil and gas operators. Moreover, the Government of Guyana (GoG) has encouraged oil and gas operators to develop and utilize supply bases in Guyana instead of accessing such services directly from Trinidad and Tobago, or the United States of America (USA). In this context, Baker Hughes intends to establish an Oil Field Service Facility in Land of Canaan, Guyana to support the offshore oil and gas operators.

3.2 Project Investment and Lifespan

Baker Hughes intends to invest over USD \$8 Million to construct the Oil Field Service Facility.

The lifetime of the project is fifteen (15) years or for as long as contracts are available to service the oil and gas operators.

3.3 Employment Opportunities

There could be as much as seventy five (75) local workers required during the construction phase of the project.

The operations phase is expected to employ approximately fifteen to twenty full-time employees to operate the service facility.

3.4 Project Implementation

The construction phase of the project is estimated to take approximately 6-8 months. Baker Hughes envisages operations to commence by Q3 2020.

3.5 Project Location

The project will be located 14 miles south of Georgetown in the Land of Canaan, Guyana (Figure 3-1). The Oilfield Service Facility will be located on 40,483m² (435,600 square feet) just north of Land of Canaan along the East Bank Public Road along the Demerara River as seen in Figure 3-2.

Figure 3-1: Geographical Location of Property



Figure 3-2: Location of the BKR Facility on Property



3.6 Stages of the Project

The project is expected to be implemented in two stages:

- Construction: Laying site foundation and installation of facilities and equipment.
- Operations: Operations include maintenance of oilfield tools including washing, inspection and assembly and disassembly.

3.6.1 Construction

3.6.1.1 Construction of Oilfield Service Facility

Construction will be supervised by an experienced superintendent. Construction materials will be sourced locally to the extent that it is economically feasible. General Baker Hughes performance construction specifications are presented as Appendix C and a drawing of the planned facility is presented as Figure 3-3 & Figure 3-4.

Table 3-1: Facility Equipment

910 M² of Office Area
2,913 M² of Covered Shop Area
2,787 M² of Combined Storage Area
2 x Torque Machines
3 x 10 ton Overhead Cranes
1 x 5 ton Overhead Crane
1 x 3 ton Overhead Crane
1 x 2 ton Overhead Crane
2 x 2 ton Jib Cranes
Air Compressors
Diesel Fuel Storage Tank
1 x 1000-gallon Oil/Water Separator
1 x Water Reclamation System
Emergency generator
1 x Pressure Test Cell
1 x Gun Loading Area
1 x Explosives Storage Area
5 x Washbay Area including trench drain with sump

Figure 3-3: Generalized Layout of Service Facility

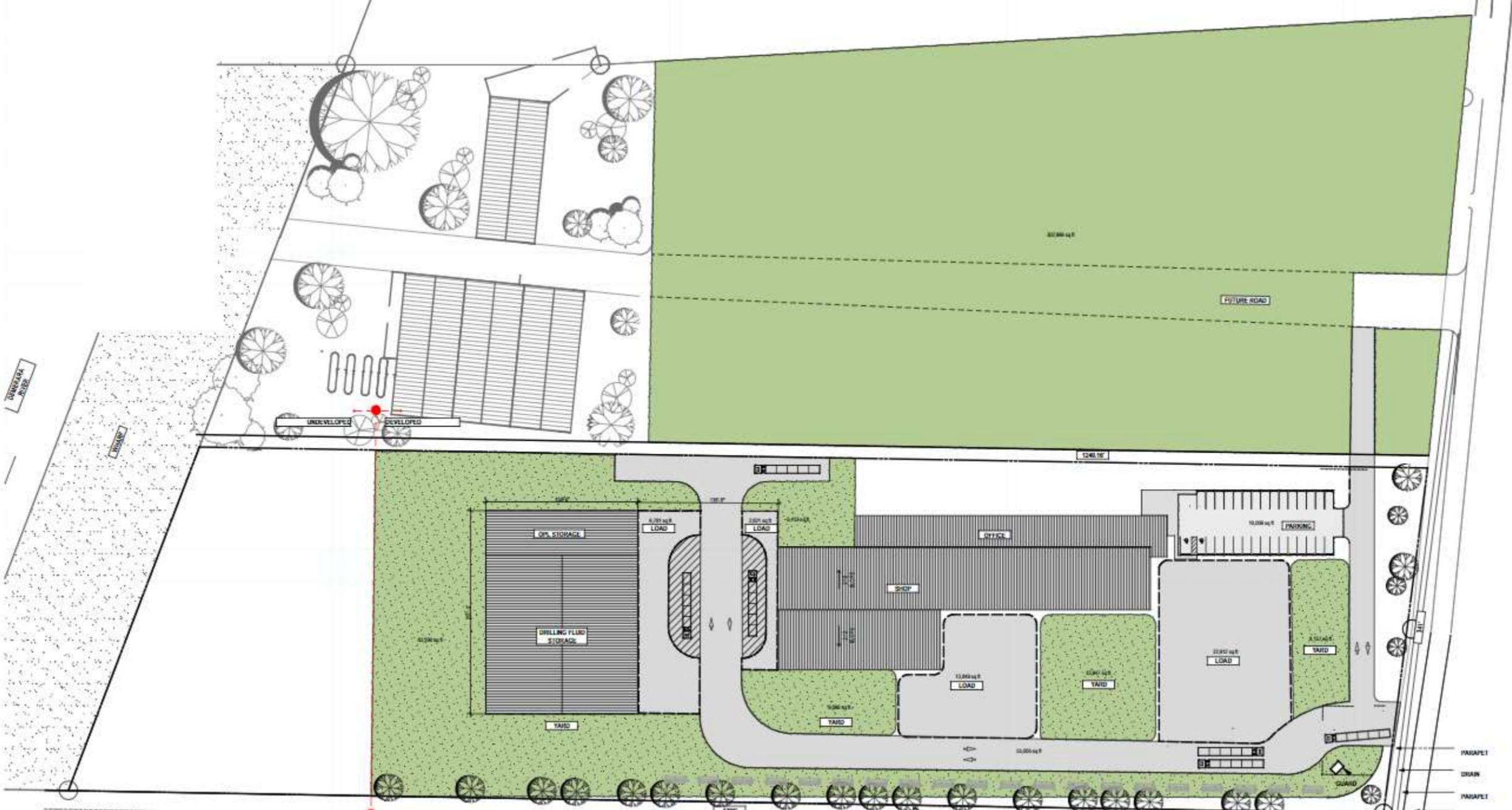
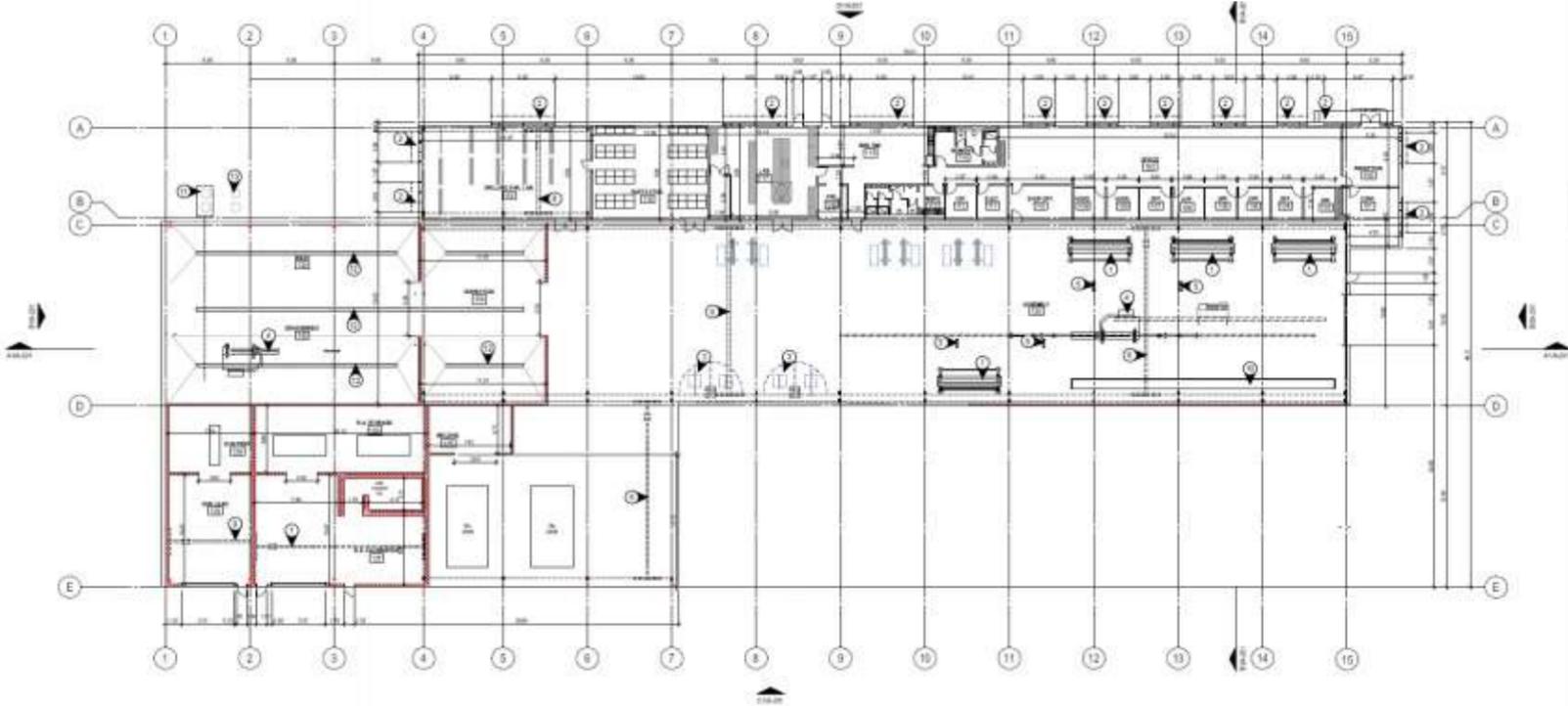
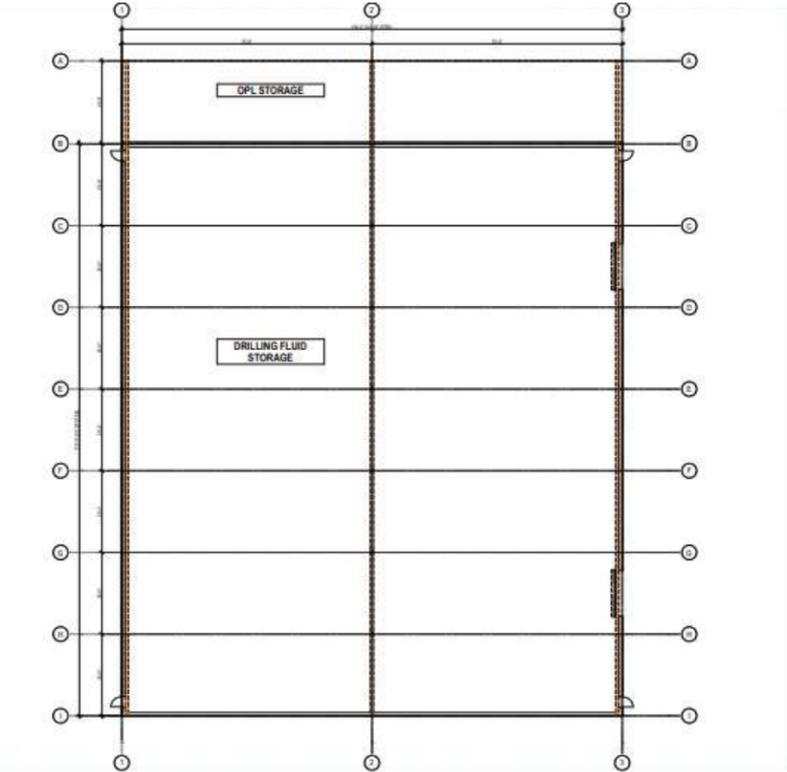


Figure 3-4: Generalized Floorplan of Service Facility



GENERAL FLOOR PLAN NOTES

- A. ALL DIMENSIONS ARE SHOWN FROM OUTSIDE FACE TO OUTSIDE FACE OF GYP-SUM BOARD, UNLESS NOTED OTHERWISE.
- B. REFERENCE SHEET 4-001 & 4-002 FOR PARTITION ASSEMBLIES.
- C. ALL PARTITIONS ARE TYPE 82 UNLESS NOTED OTHERWISE.
- D. REFER TO MEP FOR AC UNITS EQUIPMENT LOCATIONS.
- E. PROVIDE SOUND ATTENUATION AT RESTROOMS AND SHOP OFFICE WALL.
- F. PROVIDE IN-WALL BLOODING FOR WALL MOUNTED DEVICES INCLUDING MEP DEVICES, EQUIPMENT, TOILET ACCESSORIES AND MILLWORK.
- G. TYP INTERIOR COLUMN FURN-OUTS ARE TYPE 102 UNLESS NOTED OTHERWISE.
- H. TYP INTERIOR COLUMNS.

SYMBOL LEGEND

- MILLWORK PATCH, REFER TO MILLWORK DRAWINGS
- FIRE EXTINGUISHER AND BRACKET
- FLOOR DRAIN, RE. PLUMBING
- REFER TO EXTERIOR WALL ASSEMBLY SHEET
- REFER TO ROOF ASSEMBLY SHEET
- DESIGNATED INTERIOR & EXTERIOR WINDOW
- DENOTES DOWNPOUT LOCATION

KEYED NOTES - FLOOR PLAN

- 1. TOOL RACK
- 2. PERS. CANOPY ABOVE
- 3. 2 TON JIB CRANE
- 4. TORQUE MACHINE
- 5. W/ICE
- 6. 10 TON O.H.C. (OWNER PROVIDED)
- 7. 8 TON O.H.C. (OWNER PROVIDED)
- 8. 3 TON O.H.C. (OWNER PROVIDED)
- 9. 5 TON O.H.C. (OWNER PROVIDED)
- 10. PRESSURE TEST CELL
- 11. OIL/WATER SEPARATOR TO SANITARY (RE. CIVIL)
- 12. TRENCH-DRAIN - IN SLAB
- 13. WATER FILLER
- 14. CHAIN LINK FENCE (24 HIGH)

3.6.1.2 Construction of Gun Loading

Gun Loading Facilities (GLF) are typically constructed of steel reinforced concrete 15.24cm (6in) thick or steel reinforced concrete masonry hollowed block filled with sand or mortar. Foundations and floors are constructed to withstand both static and dynamic weight of handling equipment and stored materials. A minimum of two secured egress doors to allow movement of magazines through the door in the event of an emergency.

Permanent wiring is typically surface mounted aluminum rigid conduit or incorporated within the wall structure. Where feasible, all switch boxes are to be mounted external to the GLF. Installation is bonded throughout and grounded at the point of entry into the building. The actual grounding connection to the earth is to be made outside the building. The entire circuit must incorporate a ground fault interrupter. All electrical wiring and lighting in the strip assembly area must meet at a minimum Class 2/Div. 2 requirements (alternatively utilize air driven tools from remote compressor).

Work bench is typically constructed with non-sparking and non-electrostatic material. No electrical outlets are permitted on or below the work bench area. Work bench dimensions are constructed to accommodate the length of the explosive devices being assembled. Height is constructed to dimensions that will not cause ergonomic stress or strain to employees. Work bench design must be able to support the weight of a fully assembled jet perforating gun. A table of distances for storage of explosive materials is presented as Table 3-3. A typical GLF diagram is also presented as Figure 3-6.

3.6.1.3 Explosive Storage Magazine

Subject to local police authority and approval, the explosive storage will be stored and situated at a safe distance from other occupied places. US Bureau of Alcohol Tobacco & Firearms (ATF) distance requirements listed as Table 3-2 will be strictly adhered to and building is built to satisfy US ATF Standards 27 CFR 555.207 and 208. Explosives will be stored at a minimum of 50 feet from volatile/combustible materials. Buildings containing explosives are completely wood lined and a smooth floor surface of non-dusting material. There can be no exposed iron or steel internally. Steel doors need only be painted to have no bare metal.

Foundations and floors are typically constructed of brick, concrete, cement block, stone or wood posts. If piers or posts are used in lieu of a continuous foundation, the space under the buildings is to be enclosed with metal. Floors are constructed or covered with non-sparking material and shall be strong enough to bear the weight of the maximum quantity stored.

All doors are to be constructed of not less than ¼ inch plate steel and lined with at least four inches of hardwood. Hinges and hasps are to be attached to the doors by welding. Each door is equipped with two steel hooded locks.

Ventilation is to be provided to prevent dampness and heating of stored explosive materials. Ventilation openings must be screened to prevent the entrance of sparks. Ventilation openings in side walls and foundations must be offset or shielded for bullet-resistant purposes. Magazines having foundation and roof ventilators with the air circulating between the side walls and the floors and between the side walls and the ceiling must have a wooden lattice lining or equivalent to prevent the packages of explosive materials from being stacked against the side walls and blocking the air circulation.

Quantity and type of explosives provided in Table 3-2 below are typical stock for offshore pipe recovery.

Table 3-2: Typical Quantity and Type of Explosives

QTY	Name	Service	Classification	Shipping
String Shot- Back Off				
10	RP-800	Top fire gun/ BO	Detonator Electric UN 0255 1.4B	EX 2010111063
10	BI-DI Booster	Guardian Back off	Articles Explosives N.O.S UN 0349 1.4S	EX 199409083
500'	80 Gr. HMX	Back off	Cord, Detonating UN 0289 1.4D	EX 1992020035
Perforators				
500'	40 HMX LS Ribbon	Perf gun	Cord, Detonating UN 0289 1.4D	EX 1992020035
100	RTG 1562 459	5/8-3/4 circ chgs	Charges Shaped UN 0440 1.4D	EX 1994050290
100	RTG 1562 455	1/2-5/8 circ chgs	Charges Shaped UN 0440 1.4D	EX 1994050290
100	Predator ZX HMX	DP Charges	Charges Shaped UN 0440 1.4D	EX 1998010072
Severing tools				
20	EBW Detonator	Severing tool	Detonator Electric UN 0456 1.4S	EX 2004100104
120	CRT 3030 400 JV	2" sev Pellets	Articles Explosives N.O.S (Articles containing HMX)UN 0352 1.4D	EX 2000030156
264	CRT 3030 400 LV	2 3/8" Pellets	Articles Explosives N.O.S (Articles containing HMX)UN 0352 1.4D	EX 2000030156

A pictured example of an outdoor magazine is presented as Figure 3-5 and shop day magazine as Figure 3-5b.

3.6.1.4 Radiation Calibration and Storage

Radiation source calibration and storage area is a building structure that is self-contained from the main workshop. The facility ensures that radiation doses are kept “as low as reasonable achievable (ALARA)”. A typical source calibration and storage area is presented as Figure 3-7. Radiation source Safety Data Sheets (SDS) are presented as Appendix F.

Aboveground Source Container Storage

Floors are constructed of reinforced concrete not less than 0.15m (6in) thick, capable of supporting combined load of stored containers and truck/forklift traffic based on soil conditions. All shielding walls are poured of concrete or solid concrete block and mortar with a density not less than 2355 kg/m³ (147lb/ft³). The walls are to be of a thickness not less than 30 cm (1 ft) and built to a minimum height of 3.0m (10 ft). Shielding walls cannot be penetrated by wiring, plumbing and no windows are allowed (all electrical installations are to be surface mounted). Inside door frames should not have lintels (headers) to enable source containers to be moved through the door way with the overhead crane. The outer walls of the radiation building are to be constructed not less than 3 m (10 ft) from the external boundary fence and/or set-back area of the base facility.

Underground Source Container Storage

Single Storage Bunker Pit is constructed of reinforced poured 6 inch high density concrete (2355 kg/m³, 147 lb/ft³) in a manner which prevents the influx of any subsurface water. Bunker cover has

lockable cover with hand railing and access gate. Floor grating is placed on bottom of bunker pit if pit floor is uneven along with a sump pump at bottom for risk groundwater entry exist.

Calibration & Inspection

The calibration tank footprint equals 5.9m (19' 4") minimum length X 1.5m (5' 0") minimum width with a total work area 35 m². Area will be supported by a 5 ton overhead crane. Fresh water provision and drainage for calibration tank is required. A diagram of the calibration tank is presented as Figure 3-8.

Enclosure provided to accommodate fixed source inspection bench requires a foot print of 1.7m (5' 6") length X 0.5m (1' 8") width. Walls surrounding the source inspection area are to be constructed of the same density and height as the shielding walls, but with a minimum thickness of 45cm (1.5 ft).

3.6.1.5 Washbay Construction

The service facility will consist of washbays for tool cleaning. High pressure water and detergent are used to remove residual oil and grease from tools returning from offshore installations. Typically wash water from washbays is captured in sumps and gravity feed to oil water separators (Figure 3-9) and then reclaimed in a reclamation system where water is reused. Eventually due to high solid content water is eventually replaced.

3.6.1.6 Drilling Fluid Product Storage

The drilling fluid product storage building will consist of a paved and fully enclosed covered storage area with bunded containment (Figure 3-3). The warehouse is constructed for the storage of palletized chemicals both dry and wet for transport to the Baker Hughes Liquid Mud Plant located in Georgetown, Guyana. A list of chemicals and volumes typically stored is provided in Appendix D.

Table 3-3: Distances for Storage of Explosive Material

Quantity of Explosives		Distances in Feet							
Pounds over	Pounds not over	Inhabited Buildings		Public Highways with traffic volume of 3000 or fewer vehicles/day		Passenger Railways—Public Highways with traffic volume of more than 3,000 vehicles/day		Separation of Magazines	
		Barricaded	Un-barricaded	Barricaded	Un-barricaded	Barricaded	Un-barricaded	Barricaded	Un-barricaded
0	5	70	140	30	60	51	102	6	12
5	10	80	160	35	70	64	128	8	16
10	20	110	220	45	90	81	162	10	20
20	30	125	250	50	100	90	180	11	22
30	40	140	280	55	110	100	200	12	24
40	50	150	300	60	120	110	220	14	28
50	75	170	340	70	140	127	254	15	30
75	100	190	380	75	150	139	278	16	32
100	125	200	400	80	160	150	300	18	36
125	150	215	430	85	170	159	318	19	38
150	200	235	470	95	190	175	350	21	42
200	250	265	510	105	210	189	378	23	46
250	300	270	540	110	220	191	402	24	48
300	400	295	590	120	240	221	442	27	54
400	500	320	640	130	260	238	476	29	58
500	600	340	680	135	270	253	506	31	62
600	700	355	710	145	290	266	532	32	64
700	800	375	750	150	300	278	556	33	66
800	900	380	760	155	310	289	578	35	70
900	1,000	400	800	160	320	300	600	36	72
1,000	1,200	425	850	165	330	318	636	39	78
1,200	1,400	450	900	170	340	328	657	41	82
1,400	1,600	470	940	175	350	351	702	43	86
1,600	1,800	490	980	180	360	366	732	44	88
1,800	2,000	505	1,010	185	370	378	756	46	92
2,000	2,500	545	1,090	190	380	408	816	49	98
2,500	3,000	580	1,160	195	390	432	864	52	104
3,000	4,000	635	1,270	210	420	474	948	56	112
4,000	5,000	685	1,370	225	450	513	1,026	61	122
5,000	6,000	730	1,460	235	470	546	1,092	65	130
6,000	7,000	770	1,540	245	490	573	1,146	68	136
7,000	8,000	800	1,600	250	500	600	1,200	72	144
8,000	9,000	835	1,670	255	510	624	1,248	75	150
9,000	10,000	865	1,730	260	520	645	1,290	76	152
10,000	12,000	875	1,750	270	540	687	1,374	82	164
12,000	14,000	885	1,770	275	550	721	1,446	87	174
14,000	16,000	900	1,800	280	560	756	1,512	90	180
16,000	18,000	940	1,880	285	570	786	1,572	94	188
18,000	20,000	975	1,950	290	580	813	1,626	96	192
20,000	25,000	1,055	2,090	315	630	876	1,752	105	210
25,000	30,000	1,130	2,200	340	680	951	1,902	112	224
30,000	35,000	1,205	2,300	360	720	981	1,962	119	236
35,000	40,000	1,275	2,400	380	760	1,026	2,050	124	248
40,000	45,000	1,340	2,400	400	800	1,086	2,160	129	258
45,000	50,000	1,400	2,400	420	840	1,134	2,260	135	270
50,000	55,000	1,460	2,400	440	880	1,14	2,000	140	280
55,000	60,000	1,515	2,400	455	910	1,173	2,000	145	290
60,000	65,000	1,565	2,400	470	940	1,206	2,000	150	300
65,000	70,000	1,610	2,400	485	970	1,236	2,000	155	310
70,000	75,000	1,655	2,400	500	1,000	1,263	2,000	160	320

Quantity of Explosives		Distances in Feet							
Pounds over	Pounds not over	Inhabited Buildings		Public Highways with traffic volume of 3000 or fewer vehicles/day		Passenger Railways—Public Highways with traffic volume of more than 3,000 vehicles/day		Separation of Magazines	
		Barricaded	Un-barricaded	Barricaded	Un-barricaded	Barricaded	Un-barricaded	Barricaded	Un-barricaded
75,000	80,000	1,665	2,000	510	1,020	1,293	2,000	165	330
80,000	85,000	1,730	2,000	520	1,040	1,317	2,000	170	340
85,000	90,000	1,760	2,000	530	1,060	1,344	2,000	175	350
90,000	95,000	1,790	2,000	540	1,080	1,368	2,000	180	360
95,000	100,000	1,815	2,000	545	1,090	1,392	2,000	185	370
100,000	110,000	1,835	2,000	550	1,100	1,437	2,000	195	390
110,000	120,000	1,855	2,000	555	1,110	1,479	2,000	205	410
120,000	130,000	1,875	2,000	560	1,120	1,521	2,000	215	430
130,000	140,000	1,890	2,000	565	1,130	1,557	2,000	225	450
140,000	150,000	1,900	2,000	570	1,140	1,593	2,000	235	470
150,000	160,000	1,935	2,000	580	1,160	1,629	2,000	245	490
160,000	170,000	1,965	2,000	590	1,180	1,662	2,000	255	510
170,000	180,000	1,990	2,000	600	1,200	1,695	2,000	265	530
180,000	190,000	2,010	2,010	605	1,210	1,725	2,000	275	550
190,000	200,000	2,030	2,030	610	1,220	1,755	2,000	285	570
200,000	210,000	2,055	2,055	620	1,240	1,782	2,000	295	590
210,000	230,000	2,100	2,100	635	1,270	1,836	2,000	315	630
230,000	250,000	2,155	2,155	650	1,300	1,890	2,000	335	670
250,000	275,000	2,215	2,215	670	1,340	1,950	2,000	360	720
275,000	300,000	2,275	2,275	690	1,380	2,000	2,000	385	770

T.D. ATF-87, 46 FR 40384, Aug. 7, 1981, as amended by T.D. ATF-400, 63 FR 45003, Aug. 24, 1998; T.D. ATF-446, 66 FR 16602, Mar. 27, 2001; T.D. ATF-446a, 66 FR 19089, Apr. 13, 2001]

Figure 3-5: Example of Explosive Storage Magazine



Figure 3-5b: Example of Explosive Day Magazine



Figure 3-6: Conceptual Layout of Gun Loading Area

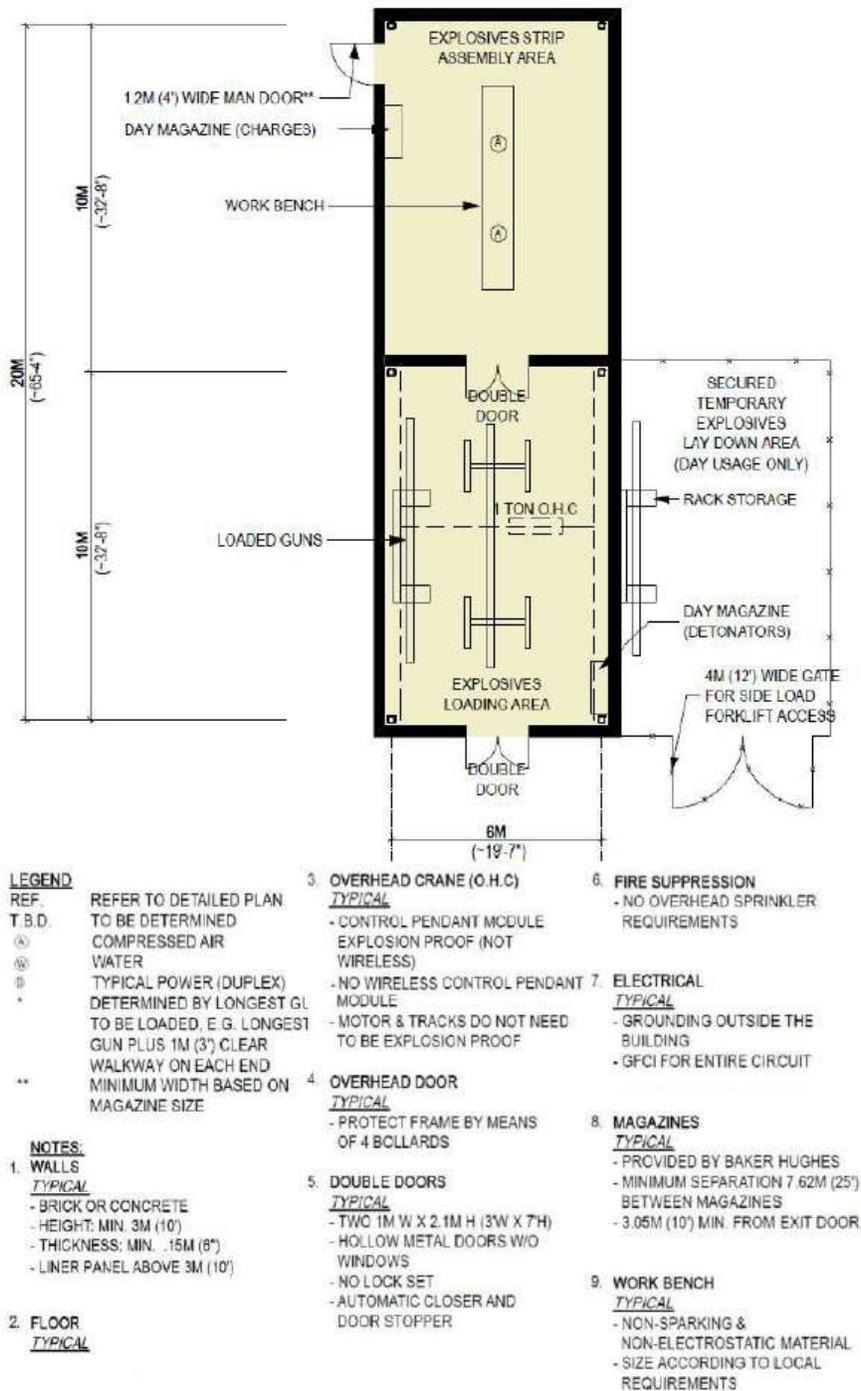


Figure 3-7: Typical Source Calibration and Storage

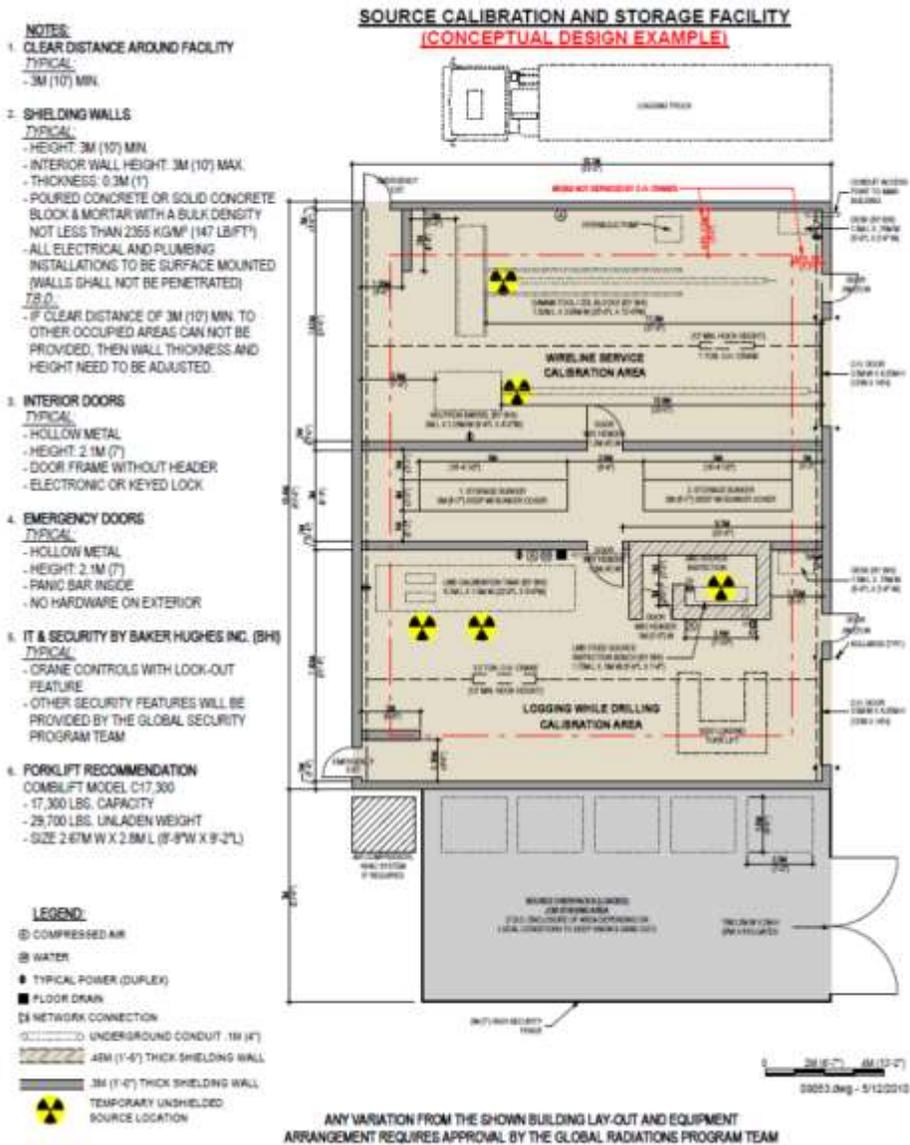


Figure 3-8: Typical Source Calibration Tank

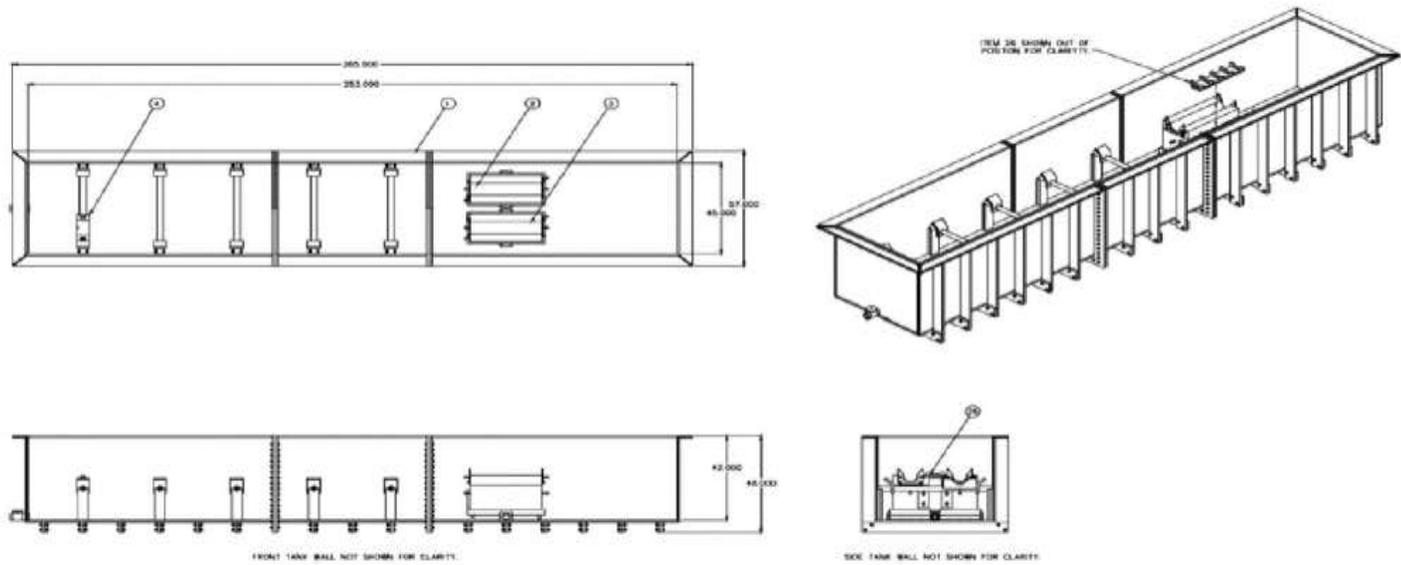
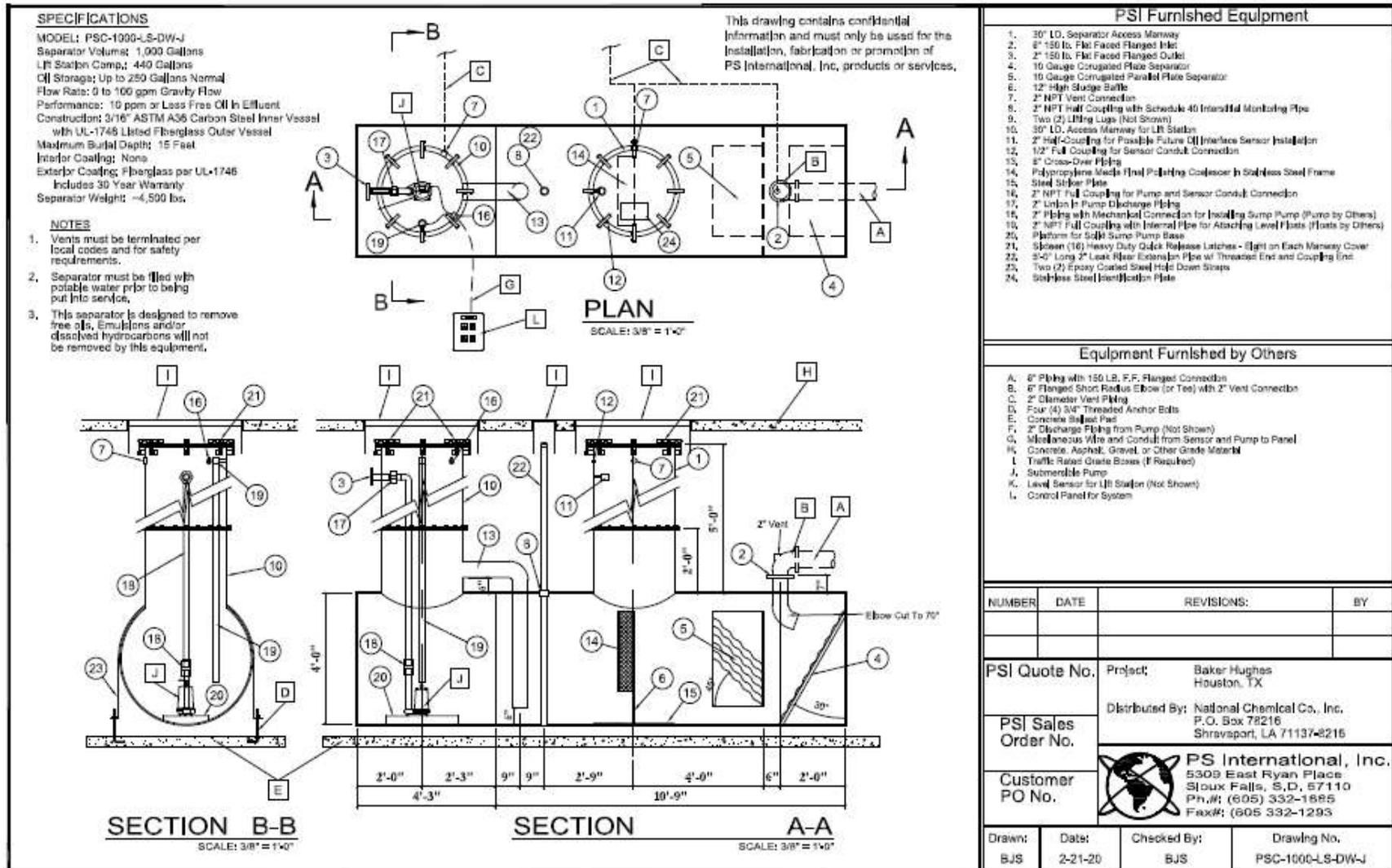


Figure 3-9: Oil Water Separator



3.6.2 Operations

The purpose of the Oilfield Service Facility will be to prepare products to be used in drilling and completing offshore oil wells.

3.6.2.1 Product Lines

The Oilfield Service Facility will be supported by multiple product lines product lines to supply offshore oil and gas operators. The Oilfield Service Facility will serve as an Assembly Maintenance and Overhaul (AMO) facility to clean, inspect, disassemble and assemble tools for completions, wireline & drilling services product lines for delivery to oil and gas operators.

3.6.2.1.2 Assembly Maintenance Overhaul (AMO)

Completion, Drilling Services and Wireline tools from oil and gas locations are unloaded from a truck using a forklift and placed onshore to be reworked. Depending on condition and immediate process requirements, goods may be staged on tool racks prior to final work. For large equipment (i.e. cabins, trucks), these will normally be allocated to available space within the yard area of the facility.

Tools are first brought into the disassembly area to be disassembled, washed and inspected. Disassembly consists of breaking down tools into smaller more manageable parts using a torque machine or shop vice. Washing consists of a high pressure water rinse to remove any oil or grease that attached itself during operations on the oil and gas location. Once parts have been broken down they pass into the inspection bay where they undergo Non-Destructive Testing (NDT) using a combination of chemicals to identify imperfections in steel components. Once inspection is completed tools move into the assembly area where they are placed on holding racks or re-assembled.

Assembly consists of reattaching tubular components together with hand tools such as wrenches and torque machines. Tools are brought into the assembly area via an overhead crane and placed in vices or torque machines where they are reassembled for shipment to jobsite.

3.6.2.2 Sourcing, Shipping and Storage

Radiation

Source shipping containers are lead filled and certified by the manufacturer with international agencies. Containers are approved through the International Air Transportation Association (IATA) and Compliant with International Maritime Dangerous Goods (IMDG) Code. Sources capsules are competent authority certified through the International Atomic Energy Agency (IAEA).

Overpacks are used when transporting and storing sources for jobsites. Overpacks are steel construction and water filled to provide additional shielding. Overpacks weight 2,722 kg (6,000lbs) with a bolted lid and three levels of security. Prior to transporting, Overpacks are appropriately labeled for over the road travel and radiation dosage is measured to ensure protection of the general public. Picture of both overpack and source containers are presented as Figure 3-8.

Chemicals

Various lubricants and solvents will be used as part of the AMO processes. Flammables will be stored inside National Fire Protection Association (NFPA) compliant flammable cabinets. A HAZCOM plan detailing administrative responsibility, workplace inventory, labeling, and employee training will be completed once a full list of chemicals has been procured. Chemical inventory is expected to only include small aerosol up to 1-gallon containers. AMO facilities typically include a small portable 500 gallon diesel tank for forklift refueling. The diesel tank will be stored in secondary containment able to hold a spill of 110% of the tank volume. Diesel is expected to be sourced locally.

3.6.2.3 Freshwater Consumption in the Production Process

Freshwater is required as a resource input for washing tools, source calibration tank and general domestic use.

Approximately 500 gallons of freshwater will be used by the Oilfield Service Facility on a monthly basis. This water will be sourced from a water well that is located on the property, and will be piped to the facility.

3.6.2.5 Power Generation

Typically power is supplied to Oilfield Service Facilities by 480v 3 phase or equal for 20 to 25 watts per square foot. Diesel generators will be installed at this location to ensure no reliance on local power grid. In addition, BKR will have an emergency back-up generator. A small 200 gallon diesel tank will be required to run generators.

Figure 3-10: Overpack and Source Containers



4.0 PROJECT ENVIRONMENT

4.1 Physical Environment

4.1.1 Geomorphology and Soils

Guyana is usually considered to consist of four main natural regions; Coastal Plain, Hilly Sand and Clay Region, Interior Savannas and Forested Highlands. The project site is located within Guyana's Coastal Plain on the eastern bank of the Demerara River, near the Land of Canaan.

The Coastal Plain is a narrow belt (ranging between 8 and 65km in width with a length of 440km) stretching from the Corentyne River in the east to Waini Point in the west. East of the Essequibo River the plain consists of recent and old sediments with recent deltaic and fluvio-marine clays and silts occurring on the coast with silty clays and sands inland. The recent plain occurs at elevations of 2m below to 3m above sea level with sandy old beach ridges forming higher ground. The older coastal plain lies at an altitude of about 3-9 m above sea level. The normal tidal range is about 3m with resultant flooding (particularly sea invasion) especially during the wet seasons from April to August and November to January and during high tides. Many areas of the coastal plain are below sea level while other areas are man-made and built-up to raise them above the surrounding land level. An elaborate system of sea defences, along with irrigation and drainage canals, is required to protect the area from flooding. West of the Essequibo River the coastal plain narrows with extensive organic wetland 'pegasse' deposits inland. While these are most extensive in the west of the country, (Regions 1 & 2) they also occur scattered between the Essequibo, Demerara and Berbice Rivers. East of the Berbice River the pegasse area is small and the coastal 'frontland' and 'riverain' clays relatively wide.⁷

The topography of the area in and around the project site is typically low-lying and flat. The soils of the area range from predominantly alluvial deposits over organic material and silts comprising the Demerara Formation to the White Sand Plateau. The Demerara Formation consists of soft clays and silts and is subdivided into Mara and Coronie deposits. The Mara clay settled during the period of rapid sea level rise (Holocene period). The Coronie sediments were deposited subsequently. The thickness of the Demerara and Coronie formation is approximately 30m and 15m respectively. There are four main types of soils on the Coastal Plain (Bernard, 1999):

- Clays (found near the sea; known as frontland or marine clays);
- Silty clays (found along major rivers);
- Histosols (known as *pegasse* in Guyana; found along the coast in swampy areas particularly in the Demerara and Essequibo areas); and,
- Areas of mixed soils (includes clays, silts, laterites, podsols, histosols, regosols)

Soils in the project area are typically frontland or marine clays and are poorly drained, of fine texture and of relatively low fertility. Textures are usually clay to silt loam and subsoil textures are clay, silty clay or silty clay loam. Most soils have a thin layer of organic material on the surface, grayish colour, are deep and developed from unconsolidated and stratified deposits or marine origin. These soils are placed in land capability Class 1-11, good to moderate agricultural land.

⁷ Guyana Lands and Surveys Commission. (2013). Draft Guyana Land Use Plan.

4.1.2 Riverine Features

The Demerara River is an important natural resource for potable water, recreation, water transportation and fisheries. The Riverine Ecosystem comprises tidal wetlands which occur along river banks. These are subject to periodic or continuous inundation.

The Demerara River separates Regions 3 and 4, and extends into Region 10. Its source is found in the Maccari Mountains, and it flows northwards for 346 km (215 miles) to the Atlantic Ocean at Georgetown. Its narrow estuary and rapid flow carves a direct channel of 5-6 m (20 feet) to the Ocean.

Guyana's major ports and wharfs are also located on the banks of the Demerara River in Georgetown and surrounding areas. This results in the Demerara River experiencing the highest volume of river traffic of Guyana's main rivers, and the location of choice by many developments. With Georgetown being the capital city and business centre of Guyana, the Demerara Watershed is the major transportation hub for Guyana.

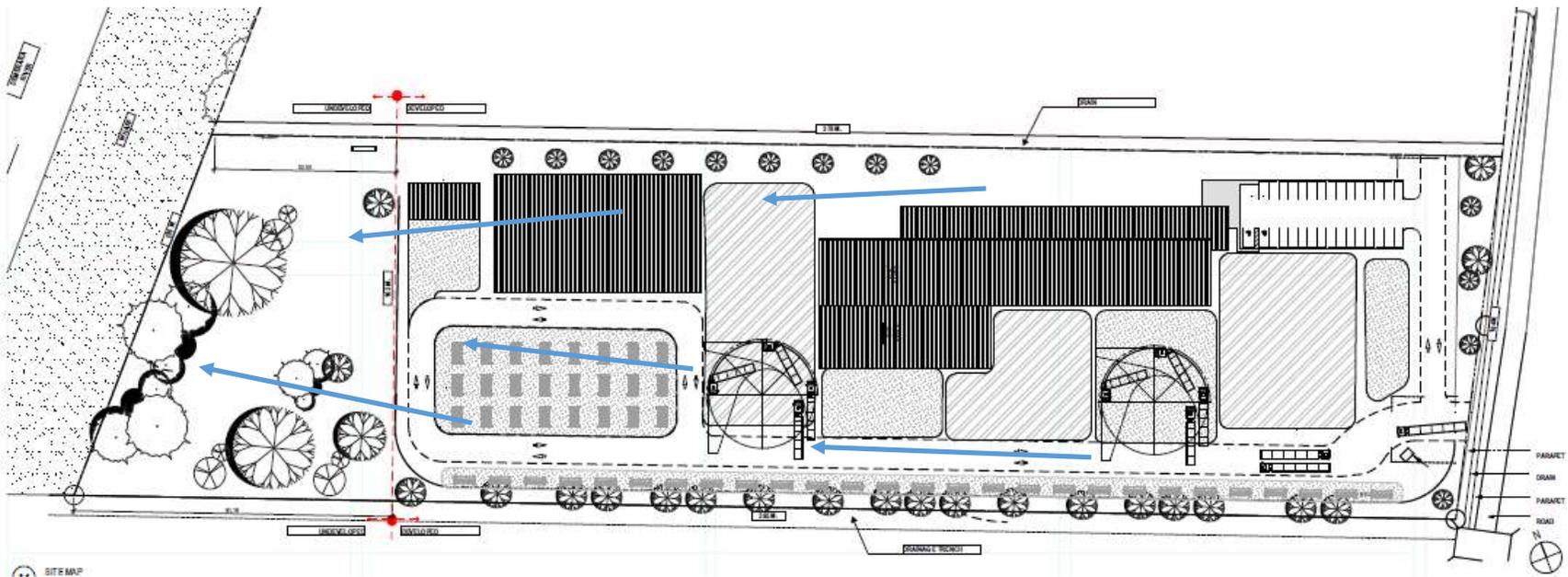
4.1.3 Hydrology and Drainage

The hydrology of the site is largely controlled by its situation in the low coastal plain. The coast of Guyana lies between 1.5m and 2m below the mean high tide level. The soils are clay rich, with poor internal drainage. Generally, drainage of properties is done by a series of ditches which discharges into the Demerara River.

The primary drainage system consists of a series of canals or trenches running east - west which is discharged by gravity into the Demerara River. However, this drainage system is limited by the tide. The Demerara River is tidal and flows in both directions twice a day. Tidal activity is offset by an hour each day, meaning that respective high and low tides are staggered an hour later than the previous day, every day.

At the project site storm water is discharged into the Demerara River as it does today. The drainage of the general area can be observed in Figure 4-1.

Figure 4-1: Generalized Drainage around the Project Site



← General direction of surface flow

4.1.4 Surface Water Quality

The major natural waterway in proximity to the project site is the Demerara River, which is west of the site. The River is prone to considerable tidal influence, which means that during high tides brackish water flows upstream, and freshwater issuing from the River mouth during low tides.

Despite not having extensive information on the water quality within this River there is a good understanding of the quality. The EPA in 2006, in preparing the State of the Environment Report for the Demerara Watershed⁸ conducted water quality testing along the course of the Demerara River. The section of the River with proximity to project site consists of brackish/estuarine water.

In brackish waters pH averaged 6.2 due to the mixing of freshwaters with ocean waters, which is at pH 8.0 or higher. Dissolved oxygen (DO) averaged 4.8 mg/L throughout. At the time of the survey, water temperatures ranged from a low of 27°C to a maximum of 30°C. Conductivity levels averaged 620 µS/cm. Average salinity for brackish water, measured after slack tide was 0.4% (Ocean water is 3.5%). In brackish waters, turbidity ranged from 2.0 to 82.0 NTU indicating the presence of algae, sediments, suspended solids and domestic and industrial wastes. Alkalinity averaged 34.7 mg/L (CaCO₃). Carbon dioxide (CO₂) was 5.8 mg/L in brackish waters. Hardness averaged 0.5 mg/L. Total ammonia was 0.2 mg/L in the brackish section. Anomalies with high ammonia values were measured at many stations, tributaries and point sources. Such values were all due to anthropogenic inputs (from non-point sources and point sources), which were run-off from agricultural fields, and municipal and industrial discharges along the river. Total ammonia concentrations in these cases were likely beyond what is considered acceptable for the protection of aquatic life. Phosphate averaged 0.0 mg/L (i.e. non-detectable with the test method utilized) while silica averaged 3.0 mg/L throughout the Demerara.⁹

4.1.5 Ground Water Quality

For groundwater, the A Sand aquifer is considered the principal water source for Georgetown and the coastal lowlands region. The Intermediate Clay Formation, which is about 90 meters thick and composed of clay and shale, acts as an impermeable barrier between the Upper Sands and the A Sand aquifers. The A Sand aquifer is composed of quartz sand and fine gravel, and ranges from 150 to 215 meters deep and 12 to 27 meters thick. The quality of water withdrawn from this aquifer is good with low chloride content; however, its high carbon dioxide and iron content can corrode ferrous and cement-based materials, with the excessive iron requiring treatment¹⁰.

4.1.6 Climate

Guyana is situated at latitude 5° north and 59° west longitude and therefore, in the wet, hot and humid tropics just above the equator. The hot, humid climate is moderated by the northeast Trade Winds along the coastal plain. Guyana's weather is affected by the migration patterns of the Inter-Tropical Convergence Zone (ITCZ), a massive system of weather located over the Atlantic Ocean, as well as by easterly and tropical waves moving west across the Atlantic. The westerly movement of tropical waves can bring disruptive weather and high rainfall conditions (e.g. during hurricane season in the Caribbean). Guyana's weather is also affected by periodic episodes of the El Niño-Southern Oscillation (ENSO) weather system off the west (Pacific) coast of South America and the counter-cycles of La Niña that bring drier and wetter conditions, respectively.¹¹

⁸ The project site is located within the Demerara River Watershed.

⁹ The information presented in this paragraph was gathered from pages ES- and ES-2 of the State of the Environment Report for the Demerara River Watershed.

¹⁰ Information sourced from the Water Resources Assessment of Guyana conducted by the US Army Engineering Corp in 1998.

¹¹ Government of Guyana, 2019. Green State Development Strategy

The coastal areas experience a bimodal annual cycle of rainfall with distinct wet seasons. The first rainy season is the primary wet season and extends from mid-April to the end of July and the secondary wet season occurs from mid-November to January. The periods in between are often referred to as primary dry (long) season and secondary (short) dry season respectively. Wind speed is generally 10 to 15 mph in east to north east direction¹². Ambient air temperatures in the coastal areas range between 25°C and 34°C. The number of sunshine hours is not very high because of high cloud cover, with the lowest (5-6 hours) in May-June coinciding with the very wet rainy season and the highest number of sunshine hours (8 hours) from August-October.¹³

Rainfall data obtained for the Botanical Gardens Weather Station¹⁴ from the Hydrometeorological Department over the last fifteen years shows that the annual rainfall for the general area is approximately 2000-2500 mm. Rainfall data from 2004 to 2018 is presented in Table 4-1. The wettest periods are May to June and December to January although episodes of heavier-than-normal rainfall typically occur in December to January, as can be observed in Figure 4-2.

Table 4-1: Rainfall (mm) for Georgetown from 2004 to 2018

Years	Months											
	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
2004	162.3	124	54	320.4	407.4	255.6	377.2	117	110.6	61.8	26.4	404.6
2005	1108.2	203.7	78.5	219.6	296	102.8	380.5	57.3	55.4	67.3	229.5	516.7
2006	571.3	73.2	43.8	93.4	477.6	440.8	224.6	116.5	185.7	137.7	209.6	253.7
2007	156.5	26.3	121.8	111.7	433.4	398.1	297.6	375.5	154.1	53.1	179.9	633.7
2008	203.6	365	210.2	145.5	311.1	298.3	406.7	228	62.5	59	155.7	919.6
2009	515	151.6	65.8	316.3	58.3	295	213.4	59.9	71.6	79.3	63.1	97.5
2010	20.6	24.7	41	299	401.9	246.7	469.1	154.2	159	99.4	352	319.4
2011	136.6	413.9	500.7	34	269.9	170.4	182.9	118.3	30.8	194.4	167.4	233.6
2012	387.4	347	32.2	110.7	307.2	238.6	367.8	136.7	31.7	26.9	194.2	309.3
2013	82.7	116.3	27.7	129.2	347	282.2	418.9	289.1	117.9	117.2	336.2	283.5
2014	275.3	147.6	61.2	67.5	125.1	224.1	148.9	194	21.6	49.3	374.2	127.3
2015	206.8	118.8	96.9	64.4	453.5	389.1	510.8	82.1	76.4	52.2	123.1	151
2016	27.3	38.5	34	230.5	203.9	251.3	223.4	178.7	173.4	22.9	93.5	395.3
2017	292	232	169.4	96.6	308.2	409.5	249.7	94.8	113.7	86.2	217.5	379.1
2018	136.6	121.3	80.1	263.4	205.3	274.8	253.3	119.8	128.2	22.9	155	90.9

Source: Hydrometeorological Department

¹² Government of Guyana, 2012. Second National Communication to the United Nations Framework Convention on Climate Change.

¹³ Government of Guyana, 2019. Green State Development Strategy

¹⁴ Botanical Gardens Weather Station is located in Georgetown and is the closest weather station to the site.

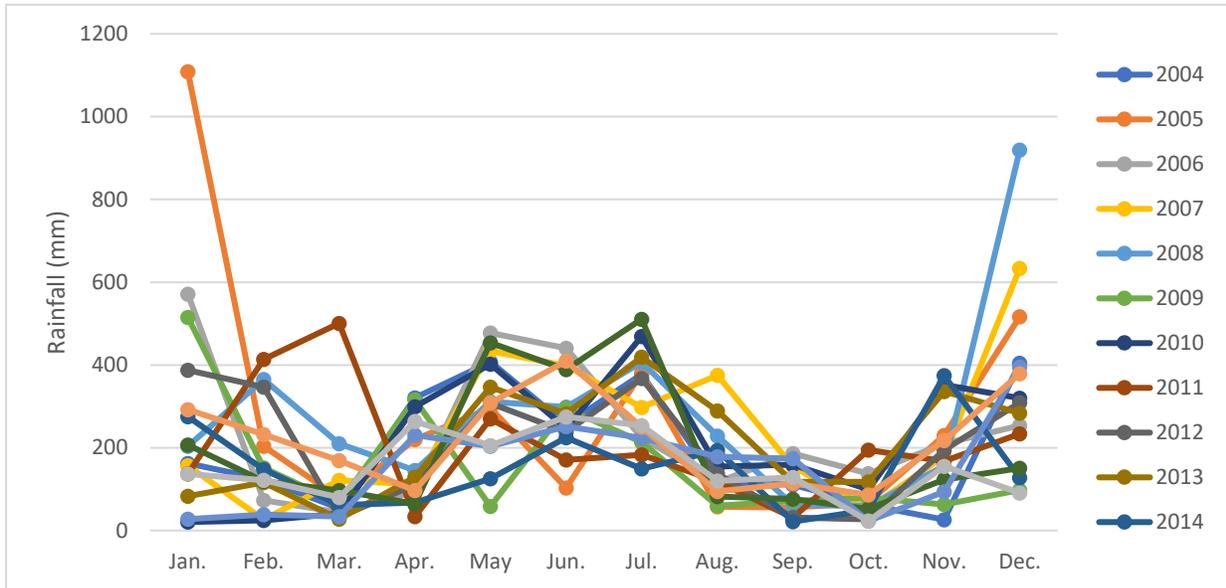


Figure 4-2: Rainfall Patterns for Georgetown (2004 – 2014)

4.1.7 Air Quality

There is a general lack of air quality testing and air quality monitoring in Guyana and as such data is limited. The EPA is now pursuing obtaining this type of data. However, the EPA in 2006, in preparing the State of the Environment Report for the Demerara Watershed, utilized the Industrial Pollution Projection System (IPPS) software to estimate emission levels. The report indicated that generally air quality in the Demerara Watershed is good except for the areas immediately around industries. This was due to most industrial operations not having appropriate controls, and they did not practice pollution abatement. The industries of most concern were wood processing (sawmills and plywood factories) and power generation (frequent use of small to medium-sized generators). A third major source of pollution is the frequent uncontrolled open burning of agricultural wastes. The report also indicated that Sulphur Dioxide (SO₂) is estimated to be the largest emission in both the Demerara Watershed and Guyana as a whole. At the time the estimated emissions from the Demerara Watershed accounted for 5% of SO₂, 24% of Nitrogen Dioxide (NO₂), 7% of CO, 30% of Volatile Organic Compounds (VOCs) 10% of Particulate Matter (PM₁₀) and 15% of particulates of Guyana's emissions.

4.2 Biological Environment

A significant part of the Guyana's biodiversity exists on the coastal zone, though most of it is located within the forest and savannah provinces.

The mouth of the Demerara River is likely to possess a wide range of fish species given the tidal influence. The tides presumably allow for estuarine and coastal species to have an avenue of brackish water to follow upstream, as well as freshwater fishes having a plume of freshwater issuing from the river mouth during low tides. This allows considerable mobility of euryhaline (brackish or salt-tolerant) species across the river and estuary habitats. Further, the composition of the nearshore and estuarine fish community is strongly influenced by seasonal fluctuations in freshwater input.

Detailed data on the fish community within the estuarine environment is limited. Esso Exploration and Production Guyana Limited (EEPGL) commissioned a survey which collected data at nearshore and

estuarine sampling sites in September–October 2017, April 2018, and January 2019. Five estuarine locations were sampled during this exercise, including the mouth of the Demerara River and 20 species were observed. It should be noted that from the nearshore surveys, nine species appeared in all three seasons, and the most prominent members of this group (accounting for five of the nine species) are the catfishes and drums/croakers (Ictaluridae and Sciaenidae, respectively). All of these species are demersal or at least generally bottom-oriented. Six of these nine species have been found in the estuary samples, so most of these species likely move freely along the coast and into the estuaries as conditions require. Another noteworthy aspect of the estuarine surveys was the prevalence of leptocephalus¹⁵ larvae in the samples. The larvae were not identified to species, but they comprised more than 30 percent of the entire catch across the five estuarine stations. Tarpon and ladyfish are both nearshore marine/estuarine species, but the leptocephali could also have been the larvae of a marine eel, such as a moray. Regardless of the species, their ubiquity and abundance in the estuarine stations underscores the importance of the estuaries as fish nursery habitats. Ichthyoplankton sampling of the nearshore and continental shelf was also conducted and suggest that the waters off Guyana provide habitat for the early life stages of a variety of taxa and that species composition and relative abundance of ichthyoplankton off Guyana is similar to that of nearby regions, such as Brazil, indicating this region is as important as others for providing habitat for both nearshore and offshore species.¹⁶

Some recent data is also available from a survey of the Lower Demerara River and its estuary conducted in March, 2015 by researchers from the Royal Ontario Museum and the University of Toronto in collaboration with the University of Guyana. The expedition produced an approximate total of 115 species, in 44 families, showcasing the incredible disparity in biodiversity between estuaries and freshwater systems. Of these 40+ families, 16+ are important from an economic and human-health standpoints, being that they represent commercial species which are consumed either locally or regionally. Notably, the ariid catfishes (Ariidae) and drum, croakers, and basshar (Sciaenidae) are highly abundant in the Demerara estuary and contribute greatly to the catches of local fishermen. Of the fishes collected in the Demerara estuary, approximately 25-30 species in 11 families utilize this estuary at younger life history stages as a nursery and foraging area, before moving farther upriver (pimelodid catfishes) to spawn or moving offshore as adults (many sciaenids, several shark species, haemulids, lutjanids, etc). This finding suggests that despite the considerable human influence on the dynamics of the Lower Demerara and its estuary, this region still functions as a vital staging ground for many offshore (and inshore) species, including commercially important taxa. However, the findings also suggests that the fish fauna surveyed has changed considerably over the last 60-100 years for which semi-reliable records exists. Lowe-McConnell surveyed British Guiana in the late 1950s and found drum and croaker (Sciaenidae) to be both particularly abundant and providing the basis of the food fishery for Georgetown and the surrounding coastal population. In contrast, ariid catfishes made up the majority of the diversity of the catches during this survey suggesting a shift in faunal abundance since the 60s. The reason for this potential change is unknown, but could be effected by: (i) intensified coastal shelf trawling which could have interrupted offshore sciaenid breeding demographics; (ii) degradation of coastal mangrove and seagrass habitats (which form refuges and nurseries for juvenile fishes like drum), (iii) changes in the watershed management and hydrology of the Lower Demerara proper; or (iv) local overfishing due to the growing population of Georgetown and the surrounding region. As stated, any or a combination of all these considerations could be influencing observed shifts in fish abundance.¹⁷

¹⁵ A leptocephalus is a slim, transparent larval form of eels and other more distantly related species including tarpon (*Megalops atlanticus*), known as “cuffum” in Guyana, and ladyfish (*Elops saurus*), known as “silverfish” in Guyana.

¹⁶ Esso Exploration and Production Guyana Ltd., 2019. Draft Environmental Impact Assessment – Payara Development Project.

¹⁷ Kolmann, M., Liverpool, E., and Taphorn, D, 2015. Report for the Survey of Freshwater, Estuarine, and Coastal Fishes of the Demerara River

Regarding marine mammals, there are five species of riverine mammals in Guyana. However, only two species are likely to be found in the Demerara River in the vicinity of the project site. These are the West Indian manatee and the neotropical otter, since these species occur in the brackish/intertidal waters of the Demerara River. Recent surveys commissioned by EEPGL in 2019 have confirmed the presence of the West Indian manatee, with two sightings, including one at the mouth of the River. No other riverine mammals were observed during these survey events.¹⁸

4.3.3 Population

According to the 2012 National Census Report Georgetown has a population of 118,363 persons. There was a 12% decline in the population as compared to the 2002 National Census results. There were more females (62,131) as compared to 56,232 males. Within Georgetown there were 24,849 persons residing within the City while 93,514 were residing in the suburbs. There were 37,523 households in Georgetown¹⁹. The wards of Kingston and North Cummingsburg are closest to the project site and according to data from the 2012 National Census, Kingston had a population of 971 and North Cummingsburg 781²⁰.

4.2.1 Navigation and Marine Infrastructure

The Demerara's estuary is narrow and the flow rapid. From Houston to the mouth of the River the scouring action due to high flows maintains a 5-6 meter-deep direct channel to the Ocean. However, from Houston to Grove the water depth is 3 m which requires vessels to pass only at high tide. Crossing the Houston-Grove, river section in the present situation is a time consuming activity, with vessels having to wait for appropriate tide conditions with optimum water depth and water current conditions. Generally, vessels enter the port at high tide over the bar in the river mouth and if destined to transit south of the harbour beyond Peters Hall, vessels will anchor until the next high tide. When returning to sea, a vessel has to wait for high water at the anchorage in Grove. At high tide the vessels pass in a small opposing flood current and continue their journey to sea.

The River's width and depth allow oceangoing vessels up to 5,000 tons to navigate up to Linden (105 km from the mouth), while smaller vessels may reach up to Malali (245 km from the mouth). Beyond Malali, numerous rapids make further upstream travel impossible.

The Ports and Harbours Division of the Maritime Administration Department (MARAD) is responsible for the management and development of the ports in Guyana and they also provide pilotage services to international vessels in and out of port Georgetown. In addition, the Division is in charge of buoyage, and the dredging of the ships' channels in Georgetown. Navigation charts are also produced for all the rivers in Guyana, and tide tables are developed which give tidal predictions for the entire country.

The Port of Georgetown contains more than 40 separate wharves, including six primary cargo wharves, ferry and fishing docks, among others. The Port's waterways and wharves are congested, and host vessel activity ranging from deep-draft oceangoing cargo and tanker vessels to small fishing vessels. While Port congestion is readily observable, MARAD has no reliable data on vessel activity within the Georgetown Harbour area.

4.2.2 Marine Traffic

A shipping channel is maintained on the lower Demerara River for the use of private, commercial, and military vessels. Pilotage is required to access the channel, and is provided by the Harbour Master. Vessels arrive in or depart from the Port of Georgetown in the vicinity of the Fairway Buoy, which is

¹⁸ Esso Exploration and Production Guyana Ltd., 2019. Draft Environmental Impact Assessment – Payara Development Project.

¹⁹ Bureau of Statistics, 2012. Guyana Population and Household Census 2012 Preliminary Report

²⁰ Bureau of Statistics, 2012. Guyana Population and Household Census 2012 Population by Village

located approximately 9 nautical miles from the port. Departing vessels then proceed eastward or westward of the buoy depending on the destination port. The total number of vessels piloted by the Harbour Master in the Demerara River increased by 1.9 percent in 2017 compared to 2016. Over that period, cargo vessels increased by approximately 5 percent and tankers by approximately 8 percent. However, container vessels declined by approximately 18 percent.

EEPGI commissioned a survey from April 16 to April 30, 2018 which recorded vessel traffic in Georgetown Harbour between the mouth of the harbor and an existing shorebase at Houston. There were two observations points: one at the Kingston Outfall Channel near the mouth of the harbor, and one at the Quick Shipping Wharf. At the Kingston Outfall almost 1,800 vessel movements were counted, yielding an average of 126 vessels per day. More than 2,100 vessel movements were recorded at the Quick Shipping Wharf, yielding an average of 153 vessels per day. Many of the vessels movements were “linked,” meaning they were counted at both locations during the same movement (i.e., as they passed them successively). Fishing vessels accounted for most of the marine traffic. At the Kingston Outfall 76 percent of vessel movements were either trawlers or other kinds of fishing boats. At the Quick Shipping Wharf observation location, fishing boats and trawlers accounted for 71 percent of the traffic, while passenger boats and “other” vessels (primarily small, private boats) made up 11 percent of the traffic. Larger vessels, including ocean-going vessels, coastal vessels, and oilfield service vessels, comprised a higher proportion of the vessel traffic observed at the Kingston Outfall, totaling 14 percent of the vessels counted at this location. Marine traffic activity was nearly continuous throughout each day. The highest volumes of marine traffic consistently occurred between 9:00 a.m. and 6:00 p.m. daily, although other times were also quite active. From 10:00 p.m. until 6:00 a.m., local fishing boats made up 78 percent of the marine traffic observed from the Quick Shipping Wharf location. Day-to-day variations, particularly in fishing vessel movements, resulted from tides and weather. The local fishing boats tend to go to sea on a rising tide so that they can set their nets at the high tide, and return with their catch when the tide is falling. Tidal conditions resulted in high traffic volumes during some night or early morning hours.²¹

4.2.3 Land Transportation

Traffic congestion is a chronic problem in and around Georgetown. Many different types of vehicles including cars, large commercial vehicles, mini-buses, horse drawn carts, bicycles, mopeds, scooters, and motorcycles all share the same travel lanes. Traffic congestion occurs frequently, including just before and just after school hours.

Driving behavior also contributes to poor and dangerous land transportation conditions. Speeding, aggressive driving, and driving under the influence of alcohol contribute to traffic accidents in Georgetown.

Overland the project site is accessed via Water Street which has road connections to other parts of Georgetown, East Coast Demerara, and the East Bank Demerara areas.

The main transport service providers to the project area are a network of privately owned minibuses and taxi services. Though the area is not directly serviced by a particular bus route it can be accessed from the central business district via minibuses plying the Alberttown/Hospital Route which sometimes detour to Water Street, but which usually traverse Main Street, a block away. This is also complimented by taxi services.

²¹Eso Exploration and Production Guyana Ltd., 2019. Draft Environmental Impact Assessment – Payara Development Project.

Road infrastructure within the area were observed to be in good to excellent conditions. All the roads within the area have asphalt surface and most are properly accessorized with the necessary markings and signage. The area has an adequate amount of parking along the roadways.

4.2.4 Utilities and Services

Potable water within the area is being supplied by onsite water well through a series of interconnected pipes to the facility.

Both energy and telecommunication services within this area can be described as being between fair to good. Power for the area and its immediate surroundings is being supplied from the national grid by the Guyana Power and Light Company. The area is equipped with land line services which are being provided by the Guyana Telephone and Telegraph Company (GTT). This area is also adequately served with cellular services from both Digicel and GTT.

Baker Hughes will utilize 3rd party companies, contracted private disposal companies, to collect their waste. Waste collected by private companies is taken to the Haags Bosch landfill site for final disposal.

5.0 POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK

The LMP and Cement Facility is required to be in compliance with Guyana’s national environmental and related policies, legislation, and institutional frameworks. The project will also comply international institutional frameworks such as the International Organisation for Standardisation (ISO). The relevant policies, legislative and institutional context within which the project will be implemented are outlined in Table 5-1 below.

Table 5-1: Relevant Legislation, Policies and Strategies

Policy and Strategic Framework	Guyana Green State Development Strategy: Vision 2040 (2019)
	Guyana Petroleum Sector Local Content Policy (Draft)
	National Development Strategy (2001 – 2010)
	Green Paper for a Draft National Energy Policy (2017)
Legal Framework	The Constitution of the Cooperative Republic of Guyana (1980 and 2013)
	Environmental Protection Act (1996)
	Environmental Protection Regulations: <ul style="list-style-type: none"> ▪ Environmental Protection Authorizations Regulations (2000). ▪ Environmental Protection Air Quality Regulations (2000). ▪ Environmental Protection Water Quality Regulations (2000). ▪ Environmental Protection Noise Management Regulations (2000). ▪ Environmental Protection Hazardous Wastes Management Regulations (2000). ▪ Environmental Protection (Litter Enforcement) Regulations (2013). ▪ The Environmental Protection (Expanded Polystyrene Ban) Regulations 2016.
	Environmental Protection Guidelines: <ul style="list-style-type: none"> ▪ Environmental Guideline for the Preparation of an Environmental Management Plan. ▪ Environmental Guidelines for the Transportation, Storage and Occupational Handling of Chemical/Industrial Hazardous Wastes.
	Labour Act (1942)
	Occupational Health and Safety Act (1997)
Institutional Framework	Ministry of Public Infrastructure, Transport and Harbours Department
	Environmental Protection Agency
International Framework	ISO: 140001
	BS OHSAS 18001
	International Association of Oil and Gas Producers
	International Maritime Dangerous Goods (IMDG) Code
	International Atomic Energy Agency (IAEA)
	International Air Transportation Association (IATA)

5.1 National Policy and Strategic Framework

Although Guyana’s oil and gas sector is still nascent, it has significant potential to contribute to national development has propelled the sector to the forefront of the country’s development pathway. This is articulated in recently prepared policy document and strategies. However, strategies which predate the development of the oil and gas sector are still considered relevant.

5.1.1 The Green State Development Strategy: Vision 2040²²

The Green State Development Strategy: Vision 2040 (GSDS) was launched by the Government of Guyana (GoG) in 2019. It outlines the Government's twenty-year plan for development that follows a green agenda. The vision of the green agenda is defined by sustainable, low-carbon and resilient development that uses its resources efficiently, and sustained over generations. The main objective of the GSDS is development that provides an improved quality of life for all Guyanese derived from the country's natural wealth in particular its abundant natural resources of land, water, forests, minerals and aggregates, and biodiversity. In addition, the GSDS builds upon existing and previous National Development Strategy, the Poverty Reduction Strategy, and the Low Carbon Development Strategy. The GSDS is also aligned with Guyana's commitment to achieve the 2030 Sustainable Development Goals (SDGs) outlined by the United Nations.

The GSDS anticipates the oil and gas sector will become the largest source of public revenue thereby changing Guyana's fiscal and monetary landscape. To manage these revenues, the GSDS expects fiscal and monetary policy that will transparently manage oil wealth to secure a stable source of future revenues; channel oil wealth into productive public investments to deliver sustainable development; and support the business environment by providing confidence of long-term price stability.

The operation of Baker Hughes LMP and cement facility will facilitate successful oil and gas drilling and production by various operators. In so doing, the company's operations will indirectly contribute to revenues from the oil and gas sector and thereby to national development as envisioned in the GSDS.

5.1.2 Guyana Petroleum Sector Local Content Policy (Draft)²³

The draft Local Content Policy focuses on the participation and development of Guyanese persons and suppliers in the petroleum sector and securing the benefits that arise from expenditure in the sector on labour, goods and services for Guyanese industry, the economy and wider society. Currently, the sector comprises predominantly upstream oil and gas activities and local content under the policy promotes backward economic linkages. Under the draft Policy, Guyanese persons and Guyanese Suppliers should have fair and adequate opportunities and first consideration where capable and competitive to provide labour, goods and services and improve and enhance their capabilities, and in so doing become internationally competitive and progressively provide a greater share of future labour and services to the sector.

Although implementation of the Policy has not commenced, Baker Hughes has committed to incorporating local content into its activities in Guyana. For example, 30 to 50 local jobs will be provided during the construction phase of Phase 1 of the LMP and Cement Bulk Facility.

5.1.3 National Development Strategy²⁴

The National Development Strategy (NDS) was launched in 1997 and outlined objectives and fundamental policy conditions for the country's development process. The promotion of economic growth was central to the implementation of the Strategy. Further, the Strategy outlined four (4) broad national objectives: rapid growth of incomes of the population in general, poverty alleviation, satisfaction of basic social and economic needs, and sustaining a democratic and fully participatory

²² Ministry of the Presidency, 2019. Green State Development Strategy, Vision 2040 Volume 1 – Policy Recommendations, Financial Mechanism & Implementation. Pg 1 to 4; 38 to 39.

²³ Government of Guyana, 2019. Guyana Petroleum Sector Local Content Policy. Making the Most of Our Oil and Natural Gas. A Local Content Policy Framework for Benefits Maximization and Value Retention from Guyana's Petroleum Resources.

²⁴ Government of Guyana, 1997. National Development Strategy. Volume 1 – Chapter 2; Volume 3 – Chapter 18

society. The NDS does not explicitly reference the oil and gas sector. However, the sector does present significant potential for national growth and development and consequently, contribute to the broad objectives of the Strategy.

In addition, Volume 3, Chapter 18 elaborated the overarching national policy framework and priorities for the environment. The environmental policies promoted the sustainable management of natural resources and the preservation of a healthy environment as an integral part of Guyana's development agenda. Environmental protection was included avoiding contamination and cleaning up its after effects and, managing renewable natural resources in a sustainable manner. The Strategy incorporated new guidelines for management of natural resources. Environmental plans and policies covered, inter alia, the areas of liquid and solid waste management, coastal zone management, fisheries management, urban water supply, among others, as well as the institutional and legal aspects related to those issues. It also proposed the establishment of the Environmental Protection Agency (EPA) through the passage of the Environmental Protection Act. Moreover, environmental sustainability was considered as one of the fundamental policy conditions for the development process, the other conditions being fiscal sustainability and institutional sustainability.

5.1.4 National Environmental Action Plan

In the National Environmental Action Plan (NEAP), 1994, the GoG outlined its environmental policy objectives for the sound management of the environment and natural resources. The NEAP outlined several policy objectives, one of which calls for the GoG to ensure that environmental assessments of proposed development activities which may significantly affect the environment are undertaken.

In keeping with this environmental policy objective, the Environmental Protection Act was introduced in June 1996 and the legal framework for authorizing development activities was established. Further, the Act established the EPA and outlines the legal process for undertaking sustainable and effective management of the environment and its natural resources.

Specifically for the industrial sector the NEAP recognized the implications of globalisation, that its influence on trade and industries development dictates that Guyana must clearly define an enlightened trade and industries development strategy which directs and targets the country's development thrust, inform the specific environmental actions that must be perused and fashion export strategies that satisfy international environmental criteria and standards. In this regard the NEAP recommended the following:

- *Complete and ensure promulgation of regulations under the Environmental Protection Act.*
- *Conclude National Policies and strategies of Trade and Industry development, which satisfy international conditionalities on environmental criteria, indicators and standards.*
- *Promote and encourage industry participation in developing guidelines on strict Code of Practice to govern best practices by industry.*
- *Promote and encourage the introduction of environmentally friendly technologies by industry.*
- *Identify incentive mechanisms to aid industry compliance of regulations and standards.*
- *Build institutional capacity and technical skills capabilities to facilitate industrial compliance of Occupational Health and Safety and Environmental Protection Regulations and Standards.*

5.2 National Legal Framework

Several laws guide the operation of the LMP and Cement Facility in Guyana. This body of legislation offers a robust legal framework for the management of the environment and energy sectors.

5.2.1 The Constitution of the Cooperative Republic of Guyana, 1980, and 2003 Reforms

The Constitution of Guyana is the highest governing legal document and supreme law for the country. Articles 25, and 36 of the 1980 Constitution and 149 (J) of the 2003 amendments, outlines Guyana's environment related principles.

The importance of protection and management of the environment features prominently in this act. This is outlined as follows:

- Article 25: *“Every citizen has a duty to participate in activities to improve the environment and protect the health of the nation.”*
- Article 36: *“The wellbeing for the nation depends upon preserving clean air, fertile soils, pure water and the rich diversity of plants, animals.”*
- Article 149J: (1) *“Everyone has the right to an environment that is not harmful to his or her health or wellbeing.”*
- Article 149(J): (2) *“The State shall protect the environment, for the benefit of present and future generations, through reasonable legislative and other measures designed to:*
 - *Prevent pollution and ecological degradation;*
 - *Promote conservation;*
 - *Secure sustainable development and use of natural resources while promoting justifiable economic and social development”*

5.2.2 Environmental Protection Act, 1996

The Environmental Protection Act 1996 is the first comprehensive environmental legislation in Guyana. The Act, and the Environmental Protection Amendment Act 2005, establishes the basic institutional and regulatory framework within which all activities that may significantly impact on the natural, social, and cultural environments are assessed. The Act established the EPA and the goal of the Act is to *“provide for the management, conservation, protection and improvement of the environment, the prevention and/or control of pollution, the assessment of the impact of economic development on the environment, the sustainable use of natural resources and for matters incidental thereto connected therewith”*. The EP Act gives the EPA the mandate for the coordination of environmental management and outlines the legal process for undertaking sustainable and effective management of the natural environment.

The Act outlines the environmental authorization process for new or existing projects being modified. Part IV of the Act addresses Environmental Impact Assessments (EIAs) and outlines the steps in seeking environmental authorization, the determination of whether a project will require an EIA, and the steps to be followed and scope of the EIA. Part IV, section 11(1) of the Act set out that *“A developer of any project listed in the Fourth Schedule²⁵, or any other projects which may significantly affect the environment, shall apply to the Agency for an environmental permit...”*

²⁵ Fourth schedule lists construction of any hotel, guest house or inn above ten rooms; installation for hydroelectric energy production, construction of road, harbours and airfields, dams, installation for treatment of waste water, industrial or domestic, importing of hazardous waste, release or keeping of genetically modified organisms, harvesting and utilisation of forest resources, and the extraction and conversion of mineral resources.

Further, Part V Section 19 (1) states that *“A person shall not (a) Undertake an activity that causes or is likely to cause pollution of the environment unless the person takes all reasonable and practicable measures to prevent or minimize any resulting adverse effect; (b) Discharge or cause or permit the entry into the environment of any contaminant in any amount, concentration or level in excess of that prescribed by the regulations or stipulated by an environmental authorization.”*

In accordance with the provisions of the Act, Baker Hughes applied to the EPA for Environmental Authorization of its LMP and Cement Facility. The EPA determined that an Environmental Impact Assessment (EIA) is not required for the company's operations and the company was granted a Construction Permit for the construction phase of the project. However, Baker Hughes was required to prepare and submit an Environmental Management Plan for its operations to the EPA prior to the issuance of the Environmental Authorization for the operation phase.

5.2.3 Environmental Protection Regulations

The Environmental Protection Act, 1996 comprises several subsidiary Environmental Protection Regulations. Those of direct relevance to the project are:

- The Environmental Protection Authorizations Regulations 2000
- The Environmental Protection Air Quality Regulations 2000
- The Environmental Protection Water Quality Regulations 2000
- The Environmental Protection Noise Management Regulations 2000
- The Environmental Protection Hazardous Wastes Management Regulations 2000
- The Environmental Protection (Litter Enforcement) Regulations 2013
- Environmental Protection (Expanded Polystyrene Ban) Regulations, 2016

These Regulations were developed to regulate and control the activities of development projects during construction and operation. The EPA has the responsibility to ensure the compliance of all new and existing activities to these Regulations by issuing the required authorizations and monitoring their operations.

5.2.3.1 Environmental Protection (Authorizations) Regulations, 2000

The Regulations require development activities/facilities pertaining to industry (e.g. manufacturing, processing, handling, transport, storage, disposal) to be authorized by EPA with specified conditions to avoid, minimize, and mitigate environmental impacts. The EPA determines the types/categories of development that requires environmental authorization. The authorization process for both new and existing facilities including variances are outlined in these Regulations, Part 3, Section 17 and 20. These Regulations outline the requirements which must be fulfilled when applying for an Environmental Authorization to the EPA. Further, the Regulations outline the terms and conditions which may be established by the Agency on a case-by-case basis in each environmental authorization. The Regulations also outline the process by which holders of environmental authorisations report to the Agency and apply for renewals or changes to their environmental authorisations. Finally, the Regulations outline the grounds upon which the EPA may refuse to grant an environmental authorisation, or may cancel, suspend or modify an environmental authorisation during its currency.

As a holder of an environment authorisation, Baker Hughes will be required to comply with the terms and conditions of its Environmental Authorisation in accordance with these Regulations.

5.2.3.2 Environmental Protection (Air Quality) Regulations, 2000

In accordance with these Regulations anyone who emits any air contaminant in the construction, installation, operation, modification or extension of any facility related to industry, commerce, agriculture or any institution shall apply to the EPA for an environmental authorization at least ninety days before the date on which the emission is to commence. In accordance with the Regulations the EPA shall establish the desirable air pollution limits. Currently, there are no nationally determined or established Air Quality standards. However, the Agency is guided by and utilizes the World Health Organization (WHO) and United States Environmental Protection Agency (USEPA) allowable limits. Table 5.2 below shows the WHO Air Quality Standards.

Table 5-2: WHO Air Quality Standards

Element	Averaging Period	Acceptable Limit
Particulate Matter (PM 10)	24-hour	50 g/m ³
Particulate Matter (PM 2.5)	24-hour	25 g/m ³
Sulphur Dioxide	24-hour	20 g/m ³
Ozone (O ₃)	8-hour	100ug/m ³
Nitrogen Dioxide	1-hour	40ug/m ³

5.2.3.3 Environmental Protection (Hazardous Waste Management) Regulations, 2000

These Regulations outline the rules and procedures for transport, storage, treatment and disposal of hazardous wastes and are intended to ensure, through the environmental authorization process, that all operations that generate, transport, treat, store and dispose of hazardous wastes are managed in a manner that protects human health and the environment. The Regulations allow for the provision of information on the types of facilities and quantity of hazardous waste generated, treatment standards and efforts to reduce the waste generated. An Emergency Preparedness Plan is required for anyone who operates a hazardous waste facility. These Regulations also apply to any activity that generates hazardous waste. Hazardous waste is defined and a schedule of materials considered hazardous is provided in these Regulations.

5.2.3.4 Environmental Protection (Noise Management) Regulations, 2000

Under these Regulations operations that emit noise in the execution of various activities such as construction, transport, industry, commerce and any institution are required to apply to the Agency for an environmental authorization. The EPA is responsible for the establishment of standards for permissible noise levels in industry, construction and other areas. The EPA may grant authorization for noise emission unconditionally or subject to conditions and may require environmental audit procedures. The GNBS and the EPA together with other relevant agencies developed standards for noise emissions into the environment. The decibel limits for various types of activities are outlined in Table 5 – 3 below.

Table 5-3: Decibel Limits for Various Activities

Type of Activity	Day Time Limit (dB)	Night Time Limit (dB)
Residential, Institutional, Educational	75	60
Industrial, Transportation	100	80
Commercial	80	65
Construction	90	75
Recreational	100 (18:00 to 01:00hrs)	75 (01:00 to 08:00hrs)

5.2.3.5 Environmental Protection (Water Quality) Regulations, 2000

These Regulations require an environmental authorization for construction, installation, operation, modification/extension of facilities that discharge effluents. Requirements and guidelines on the discharge of effluents and disposal of sludge are provided. The EPA and Guyana National Bureau of Standards (GNBS) developed Interim Guidelines for Industrial Effluent Discharges into the Environment and these are currently being used by the EPA (outlined overleaf). The EPA also adopts the WHO and USEPA standards for surface and potable water quality, when required. The Table below outlines the general guidelines for discharges outlined in the GNBS Interim Guidelines for Industrial Effluent Discharge into the Environment.

Table 5-4: GNBS Interim Industrial Effluent Discharge Limits

Parameter	Acceptable Limits
pH	5.0 – 9.0
Total Suspended Solids	50 mg/L
Dissolved Oxygen	>4 mg/L
Temperature	<40 °C
Oil and Grease	10 mg/L
Nitrate	40 mg/L
Sulfate	1000 mg/L
Nitrogen (Ammonium)	1 mg/L
Kjeldall Nitrogen	<10
Phosphorous	<2
Phenols	<0.5 mg/L
Coliform	<400 MPN
Biological Oxygen Demand	50 mg/L
Chemical Oxygen Demand	250 mg/L

5.2.3.6 Environmental Protection (Litter Enforcement) Regulations, 2013

These Regulations provide for the enforcement against litter offences. It is an offence under these regulations to (a) place litter in a public place; (b) permit or cause another person to litter a public place or; (c) have litter on private premises that pose a health risk. The fine for an individual found littering in a public place is \$50,000, while for body corporate it is \$100,000. A fixed penalty of fifteen thousand dollars (\$15,000) is offered to offenders who accept liability for the offence committed.

5.2.3.7 Environmental Protection (Expanded Polystyrene Ban) Regulations, 2016

The EPA in 2016 established a ban on extended polystyrene (styrofoam) food service containers. The Regulations prohibit the importation, manufacture and sale of expanded polystyrene food service products. Persons or businesses that breach these regulations shall be liable upon summary conviction to a fine of no less than \$50,000. The EPA currently enforces the ban on importation and manufacturing of styrofoam food service containers.

5.2.5 Labour Act, 1942

The Labour Act of 1942 specifies the conditions that an employer must observe in the contracting employees. Part V specifies that the entire wages of the employee must be paid as money and not otherwise. However, in occupations where it is customary to make partial payment of allowances in the form of food, toiletries, housing etc. these are acceptable and not considered illegal, if both the employer and employee are agreed on such terms.

This Act is applicable for daily operations at the LMP and Cement Facility so as to ensure that workers under the project are not mistreated, paid adequately in accordance with the Laws of Guyana and have proper representation.

5.2.6 Occupational Health and Safety Act, 1997

The Occupational Safety and Health Act 1997 defines the responsibilities of management and workers with respect to safety and health and applies to every workplace in Guyana. The Act makes provisions for the registration of industrial establishments, the establishment of an Occupational Safety and Health Authority, the establishment of a National Advisory Council on Occupational Safety and Health, the duties of employers, workers and other persons, treatments of accidents and occupational diseases, and occupational safety and health regulations. The Act authorises Occupational Health and Safety inspectors to enter and inspect workplaces. Moreover, all industrial establishments must be registered under the Act.

Under this Act the employer has a responsibility to establish a joint workplace safety committee. When the workplace has more than fifty (50) persons, the committee should consist of six (6) persons of which at least half the numbers should be workers who do not exercise managerial functions and should be selected by the workers themselves. Employers also have duties of providing protective devices for workers, providing instructions and supervision to ensure the safety of workers, maintaining a medicine chest and establishing an occupational health service for workers.

The Act requires all industrial establishments to keep a General Register containing the particulars of workers younger than the age of eighteen; particulars as to the washing, white washing or odor washing; painting or varnishing of the workplace; and particulars on every accident and industrial disease. Specifically, with respect to the Accident Register, notice should be submitted using the Form in the First Schedule of the Act within four days of the Accident. If the accident results in death, notice of death should be sent to the Authority, the Joint Workplace Safety and Health Committee, and trade unions if applicable, as soon as the employer becomes knowledgeable of the death.

Under the Act, the employer is required to maintain an inventory of hazardous chemicals and physical agents including: toxic properties, including acute and chronic health effects in all parts of the body; chemical or physical characteristics including flammable, explosive, oxidizing and dangerously reactive properties; corrosive and irritant properties; allergenic and sensitizing effects; carcinogenic effects; teratogenic and mutagenic effects; and effects on the reproductive system. Further, employers shall keep readily accessible a floor plan, showing the names of all hazardous chemicals and their locations and shall post a conspicuous notice of where the floor plan is kept. The Act also further details responsibilities of employers in the identification of hazardous chemicals.

Baker Hughes will be required to integrate the provisions of this Act into its daily operations.

5.2.7 Town and Country Planning Act, 1946 (Cap. 20:01, Act 25 of 1946 and amendments)

The Act 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 road works incidental to buildings. The Act is concerned principally with town planning schemes and regional schemes (out of urban areas). Such schemes comprise of buildings, sanitation, coordination of roads, facilities and public services, provision of amenities and the conservation and development of resources. Implementation and enforcement are vested in the Central Housing Planning Authority (CHPA). The Authority, with the approval of the Minister, has the power to make regulations to implement the Act. CHPA, by resolution, may decide to prepare and

adopt a scheme. When a draft scheme is prepared, it is submitted to the Minister for approval. The Minister may approve, modify or require a new scheme to be drafted. The scheme is formally in effect on the date of public notification of approval.

The Act provides for cooperation with local authorities, establishment of a register, permit processing for building operations, land acquisition for schemes, compensation, and enforcement of the provisions of a scheme. There is also provision for zoning and the regulation of building and site design, roads, amenities, public services, transport and communications.

The land use of the project site as well as any building plans for the project will have to be approved by the CHPA.

5.2.8 Sea Defence Act, 1883

This Act authorizes the Sea Defence Board to take any and such actions as to secure the maintenance of sea, rivers, and outer dams of properties that abut on or are near the river or sea shore.

As it regards the Project, the reserve area will need to be maintained to ensure access is available to the Sea Defence Board for inspections, maintenance and repairs of the river defence.

5.3 National Institutional Framework

5.3.1 Environmental Protection Agency

The EPA oversees the effective management, conservation, protection and improvement of the environment and takes the necessary measures to ensure the prevention and control of pollution, assesses the impact of economic development on the environment and the sustainable use of natural resources. The Agency is governed by a Board of Directors but falls under the direct supervision of the Department of Environment, Ministry of the Presidency. The Agency was established in 1996 by the Environmental Protection Act and is responsible for the development and enforcement of national environmental legislations and advises the GoG on the development and implementation of environmental policies and standards. It also undertakes the inspection and enforcement of matters dealing with the environment, conservation and natural resources and administers the environmental permitting process in Guyana.

The EPA is mandated to ensure that any project that may have a significant impact on the environment must acquire an Environmental Authorisation from the EPA. Projects are considered to have an environmental impact when they threaten the health, safety and natural life supporting systems of humans and other living things. The EPA is responsible for the issuance of environmental authorisation for the project through an Environmental Permit, and to monitor compliance in accordance with the provisions of the Environmental Permit.

5.3.2 Ministry of Social Protection, Department of Labour

The Ministry of Social Protection, Department of Labour (MOSP) is responsible for the enforcement of the provisions of the Labour Act (1942).

The MOSP is also responsible for the enforcement of the Occupational Health and Safety Act (1997). Accordingly, inspectors appointed under the Occupational Health and Safety Act (1997) are empowered to enter, inspect and examine industrial establishments; enter and inspect any ship or vessel at a wharf; inspect, examine and copy any of the registers, certificates or notices required under

the Act; examine, inquire or test whether relevant public health provisions are complied with by the establishment; and take tests, require an employer to take tests, of any equipment, machine, device, chemical or physical agent in a workplace.

5.4 International Guidelines

On a voluntary basis, Baker Hughes HSE system conforms to international guidelines from the International Organization for Standardization (ISO), the British Standard for Occupational Health and Safety Assessment Series (BS OHSAS), and standards from the International Association of Oil and Gas Producers (IOGP).

Specifically, the HSE system at Baker Hughes conforms to the following international guidelines:

- ISO 14001: an internationally agreed standard that sets out the requirements for an environmental management system and outlines the framework that can be followed to establish an effective environmental management system.²⁶ It requires consideration of all environmental issues relevant to its operations, such as air pollution, water and sewage issues, waste management, soil contamination, climate change mitigation and adaptation, and resource use and efficiency. It also includes the need for continual improvement of an organization's systems and approach to environmental concerns.²⁷
- BS OHSAS 18001: is a framework for an occupational health and safety management system that outlines the policies, procedures and controls that can be put in place to achieve the best possible working conditions and workplace health and safety, aligned to internationally recognized best practice.²⁸
- IOGP: establishes a comprehensive set of standards for operators, suppliers, contractors and drilling companies in the oil and gas sector so as to enhance technical integrity, improve safety, enable cost reductions and reduce environmental impacts. In 2012, the IOGP and ISO agreed to an Interim Solution which would allow the continuation of the development of prioritized standards under the ISO and the IOGP would also continue to develop and publish draft standards.²⁹ Under the IOGP, a Joint Industry Programme 33 (JIP 33) under which 14 specifications have been prepared to date to standardize the specifications used to purchase equipment.³⁰
- International Atomic Energy Agency (IAEA): The International Atomic Energy Agency (IAEA) is an international organization that seeks to promote the peaceful use of nuclear energy, and to inhibit its use for any military purpose, including nuclear weapons.
- International Maritime Dangerous Goods (IMDG) Code: The objective of the IMDG Code is to enhance the safe transport of dangerous goods while facilitating the free unrestricted movement of such goods. The IMDG Code contains details of all the numerous dangerous cargoes offered for carriage by sea and includes solid, liquid and gaseous substances.
- International Air Transportation Association (IATA): improves understanding of the air transport industry among decision makers and increase awareness of the benefits that aviation

²⁶ ISO, undated. ISO 14000 Family – Environmental Management

²⁷ ISO 2015. ISO 14001: Key Benefits

²⁸ British Standards Institution, 2019. BS OHSAS 18001: Reduce Workplace Hazards and Boost Employee Morale

²⁹ IOGP, undated. International Standards

³⁰ IOGP, 2019. JIP 33 Standardizing Procurement Specifications

brings to national and global economies. Advocating for the interests of airlines across the globe, we challenge unreasonable rules and charges, hold regulators and governments to account, and strive for sensible regulation.

6.0 ENVIRONMENTAL IMPACTS

6.1 Impact Assessment Methodology

The BKR proposed Oilfield Service Facility is planned to be constructed and operated 14 miles south of Georgetown in the Land of Canaan, Guyana. The facility will have a western frontage along the Demerara River, but the Oilfield Service Facility will be set back some 50m from the water's edge. The developed sites footprint will cover approximately 31,577 square meters (m²).

The aim of this chapter is to identify and evaluate the impacts that the project may have on environmental and social receptors. To do this, an analysis was done to identify, quantify and prioritize impacts which could occur as a result of the proposed activities to be performed. The analysis includes two aspects:

- Step #1 of the analysis and assessment was to get a clear understanding of the activities planned for the project, its Area of Influence (AoI), potentially affected parts of the AoI, and regulatory requirements. As described elsewhere, the project's AoI is defined as the footprint of the actual facility to be constructed, plus a fringe of land extending some 50m around the actual site in all directions. As such, the AoI extends westwards from the plant boundary to the edge of the Demerara River. The project's area of influence can be observed in Figure 7-1.
- Step #2 was to identify the activities to be performed as part of the project.

Potential impacts that might reasonably be expected to occur during operation phase of the project and their significance are identified in this chapter. Those considered to have significance will need to be managed, monitored and/or mitigated, to reduce the adverse impacts and enhance positive impacts. Potential impacts that could arise but not as part of planned activities are addressed in the Guyana Emergency Operations Plan (also referred to as the Emergency Response Plan, or ERP).

Figure 6-1: Project's Area of Influence



6.1.1 Impact Identification

The potential impacts of the Oilfield Service Facility operations are those that change existing environmental or socioeconomic conditions within the Area of Influence, be negative or positive. Potential impacts attributable to the project require an understanding of the receiving environment (both natural and human). This understanding was achieved from the baseline environmental and socioeconomic conditions, and described in Chapter 4 of this EMP.

Information on the baseline environmental and socioeconomic conditions was obtained from publicly available resources and primary data collection to fill identified data gaps.

For this analysis, environmental and socioeconomic impacts are considered negative or positive, direct or indirect, and range from localized to international. It is also possible that impacts may be cumulative.

Table 6-1: Impact Definitions Used in this Analysis

Impact Type	Definition
Direct	An impact created as a direct result of the project.
Indirect	An impact which may be caused by the project, but will occur in the future or outside the project's Area of Influence.
Short-term	An impact or activity that is expected to dissipate shortly after the cause ceases
Long-term	An impact or activity that is expected to continue for significant time after the cause ceases
Cumulative	The total impact to a particular resource anticipated to occur as a result of a combination of effects produced together with neighboring projects.
Localized	Impact which is limited to the project's Aol.
Local	Impact which extends outside the project's immediate Aol, but is contained within the general vicinity of the project.
Regional	Impact which has extended to marine waters beyond the vicinity of the project's Aol.

Impacts of routine events were assessed with the presence of the project and its activities. The assessment considered impacts potentially likely to be generated by nearby commercial activities.

6.1.2 Qualitative Evaluation Methodology

Given the relatively limited complexity of the project, and its planned location within an undeveloped area of Guyana, it was decided that a quantitative impact assessment was not warranted, but that a qualitative one would be adequate.

To be able to develop appropriate management and/or monitoring and mitigation measures, it is important to understand the importance of each impact to the receiving environment. The importance of an impact was assessed by combining two impact elements:

- The **significance** of the impact on the resources should the impact occur; and
- The **likelihood** of that impact occurring.

For consistency in the qualitative assessment of projects, a methodical, well-described and documented approach to impact evaluation was used, as described below.

6.1.2.1 Identifying Impact Type

All impacts are not necessarily negative; some actions may have positive impacts on a resource. When first identifying an impact, it was determined whether the impact was beneficial (positive) or adverse (negative) to the receiving resource. When identifying whether or not an impact was adverse or beneficial, only the impact on the resource in question was considered. Definitions of the types of impact are presented on Table 6-1. Cumulative impacts were also considered to the extent applicable and are addressed in Section 6.2.4.

Table 6-2: Project Impact Type

Impact Type	Description
Beneficial (positive)	An impact that results in a positive effect on the receiving environment or resource from activities performed at or by the project.
Adverse (negative)	An impact that results in a negative effect on the receiving environment or resource from activities performed at or by the project.

6.1.2.2 Qualitative Impact Significance Criteria

The following methodology was used to assess the qualitative risk of potential impacts arising from the Oilfield Service Facility on environmental and socioeconomic resources in the Area of Influence.

Risk was determined by first selecting the appropriate significance and likelihood descriptors from the definitions included in Table 6-3. Significance levels reflect the magnitude of potential impacts that exposure to those factors that create impacts from the Oilfield Service Facility would have on identified environmental and socioeconomic resources. In determining the significance level, we considered the potential types of impacts from each project activity relative to existing baseline environmental and socioeconomic conditions.

Table 6-3: Impact Significance Level Descriptors

Significance Level to Potentially Impacted Natural or Cultural Resources				
Negligible	Minor	Moderate	Major	Extreme
Minimal impact in a localized area of little or no consequence.	Low impact in a localized or regional area with a functional recovery within one year.	Medium impact in a localized or regional area with a functional recovery of 1 to 5 years.	High impact in a localized or regional area with a functional recovery within 5 to 10 years.	Very high impact in a broad regional area or area of national significance with functional recovery in greater than 10 years, if at all.

6.1.2.3 Qualitative Impact Likelihood Criteria

Likelihood levels consider the probability for an identified natural or socioeconomic receptor to be impacted by the project. In assessing the likelihood the nature of the Oilfield Service Facility, the natural seasonal and temporal variability within the local environment and the ability of receptors to

move away from potential impact causes were considered. The anticipated likelihood of occurrence of an impact was identified to range from Rare to Certain (Table 6-4).

Table 6-4: Impact Likelihood Levels

Likelihood of Impact to Natural or Cultural Resources				
Rare	Unlikely	Likely	Almost Certain	Certain
Highly unlikely to occur but theoretically possible.	May occur within the life of the Project or activity.	Likely to occur more than once during the life of the Project or activity.	Very likely to occur during the life of the Project or activity.	Expected to occur as a result of the Project or activity.

6.1.2.4 Final Impact Evaluation

Utilizing the outcomes of both the impact significance ranking and the identified likelihood of impact, the effect of each impact causing factor on the receiving environment was evaluated. The risk level (or importance) was assessed by combining the significance column and the probability row in the following Risk Assessment Matrix (Table 6-5).

Table 6-5: Risk Assessment Matrix

		Significance				
		Negligible	Minor	Moderate	Major	Extreme
Likelihood	Rare	Low	Low	Low	Medium	Medium
	Unlikely	Low	Low	Medium	Medium	High
	Likely	Low	Medium	Medium	High	High
	Almost certain	Low	Medium	High	High	Critical
	Certain	Low	Medium	High	Critical	Critical

Note: Where the Significance of an impact is indicated to be positive, the corresponding risk will also be positive.

6.2 Identification and Evaluation of Project Impacts

Possible impacts resulting from activities planned to be performed as part of the project as they relate to each aspect of the abiotic, ecological (i.e. biotic), and socioeconomic environment were evaluated. The following planned activities were judged to have the potential to result in an impact if not managed or mitigated:

- Air emissions (Painting & Engine Emissions);
- Emissions of light and noise from the operation of the Oilfield Service Facility
- Water discharges (raw, untreated stormwater)
- Socioeconomic impact, including project employment
- Cumulative impacts within the project vicinity

During the early stages of this assessment, the activities which were deemed not to have measurable impacts were 'scoped/screened out' because it was judged that for this project and this location they would not have any significance, even without mitigation:

- **Construction-related Impacts:** This EMP is focused only on project operation stage – a separate evaluation of project construction activities was done, including for example noise to be generated by pile driving activities, resulting in the issuance of a Construction Permit by the EPA.
- **Impacts to the Fluvial Environment from Solid Wastes (Domestic or Industrial):** Because there will be no planned discharge of solid wastes (industrial or domestic) to the Demerara River, any impact to River water quality from these substances is anticipated to be zero. Hence **no adverse impacts** associated with solid waste discharges to the River will occur.
- **Impacts to the Marine Environment from Solid Wastes (Domestic or Industrial):** Because there will be no planned discharge of solid wastes (industrial or domestic) to the River, any impact to marine water quality from these substances is anticipated to be zero. Hence **no impacts** associated with solid waste discharges to the marine environment will occur.
- **Impacts to the Water Quality and Fluvial Fauna from Liquid Wastes:** Because the discharge of liquid wastes, both domestic and industrial, including oils and greases, to the River is prohibited, there will not be any discharge of these materials to the River. Toilets and hand basins to be used by the Oilfield Service Facility personnel will be provided and managed by BKR through offsite disposal facilities. Hence, **no impacts** associated with either process or domestic wastewater discharges to the River will occur from the Oilfield Service Facility.
- **Impacts to Coastal and Protected Areas:** Guyana has a single marine protected area – Shell Beach MPA - located some 230km west of the project's Area of Influence along the coast of Guyana. Since there are no protected areas within or near the project's Area of Influence there are **no associated impacts** to be discussed.
- **Impacts to Riverbed Sediments:** The Oilfield Service Facility will be constructed and operated within approximately 50m of the Demerara River. None of the operational activities to be performed at the Oilfield Service Facility are expected or planned to have any direct impact on the sediments lying on the bottom of the River. Because there will be no discharge of used oil, solid wastes or other industrial liquid waste to the river, any impact to water quality from these substances is anticipated to be zero; hence **no adverse impacts** to the surrounding environment will occur.
- **Impacts from Offshore Facilities or Structures:** None of the project facilities will be located offshore, therefore there can be **no impacts** associated with this project from offshore facilities.
- **Impacts to Recreational and Commercial Fishing:** There are recreational or commercial fishing activities occur over 20 kilometers from the Oilfield Service Facility, along the eastern bank of the Demerara River. Sport and commercial fishing take place off-shore from Georgetown. The Oilfield Service Facility will not engage in industrial activities as it relates to the Demerara River some 50m away. The operation of the Oilfield Service Facility is expected to have **no adverse impact** to either recreational fishing along the Demerara River or to commercial fishing offshore.
- **Direct Impacts to Coastal Areas:** The Oilfield Service Facility will be constructed approximately 50m from the east bank of the Demerara River. The area across the River from the site is open marine water, because the River mouth does not extend as far seaward to the west as it does to the east. Discharge from the Demerara River is picked up by the North Brazil current flowing from east to west along the coast of Guyana. However, since

there are no planned discharges of either liquid or solid wastes from the project’s location adjacent to the Demerara River, and because no structures within the River or marine zone are planned as part of the project, it was judged that there will be **no impacts** to coastal areas occurring under normal operating conditions. Therefore, any impacts to coastal areas caused by the project are excluded from this assessment.

This impact assessment evaluates impacts from planned events only (i.e., events that are anticipated as part of the normal operations of the project). Impacts that conceivably could occur from unplanned events (such as accidents and emergencies, including spills) are addressed in the project’s Emergency Response Plan.

6.2.1 Abiotic Environment

6.2.1.1 Air Quality

Activities which hold the possibility of impacting air quality during operation of the Oilfield Service Facility include atmospheric emissions generated by diesel-powered engines that will be used to power emergency electric generators for lighting and other essential equipment and tool painting activities. The calculated emissions of criteria pollutants, greenhouse gases and hazardous air pollutants from the painting activities and power generation engines are shown in Table 6-6 and 6-7, respectively. None of these calculated emissions will come even close to the US EPA permit standards.

Air emissions calculations were done to estimate the emissions to be generated by the project. Atmospheric emissions generated during operation of the Oilfield Service Facility are anticipated to result in an impact to air quality which is **adverse, direct, localized, of negligible significance, while certain to occur**. Overall, the operations are anticipated to result in a **Low Risk of Adverse Impact** to air quality.

Table 6-6: Typical Paint Air Emissions

Shop	Method of Application	Paint	VOCs Emissions (lbs./gal)	Volume Used gal / day	Potential to Emit (lb./day)	Potential to Emit (tons/yr.)
Fishing Completions	Spray	Water Reducible Enamel	2.66	0.25	0.66	0.12
Drilling				0.25	0.66	0.12
Total				0.75	1.99	0.36

A list of potential Hazardous Air Pollutants (HAPs) is provided as part of Table 6-7. Emissions were estimated based on US EPA standards for reciprocating internal combustion engines and calculated using engine rated output (b) (2.45 MMBtu/hr.), actual annual throughput (c) (1470 MMBtu/yr.), potential annual operating hours (d) (8760 hr./yr.) and pollutant emission factors (e) (US EPA Chapter 3).

Table 6-7: Air Emission Calculations from Diesel Powered Engines

Pollutant	Emissions (ton/year)	USEPA ³¹ Permit Limits (Option D) (ton/year)
Criteria Air Pollutants		
Particulate Matter (PM)	0.19	50
PM 10	0.19	50
PM 2.5	0.19	50
Sulphur Oxides (SO _x)	0.18	50
Nitrogen Oxide (NO _x)	2.07	50
Volatile Organic Compounds (VOC)	0.22	50
Carbon Monoxide (CO)	0.58	50
Lead	0.00	0.5
Greenhouse Gas Emissions (GHG)		
Carbon Dioxide (CO ₂)	99.87	
Methane (CH ₄)	0.0041	
Nitrous Oxide (N ₂ O)	0.0008	
GHG Total Carbon Dioxide Equivalent (CO ₂ e)	100.21	50000
Hazardous Air Pollutants (HAP – only listed those with reporting emissions)		
1,3-butadiene	0.0001	
Acetaldehyde	0.0005	
Acrolein	0.0001	
Benzene	0.0006	
Formaldehyde	0.0007	
Naphthalene	0.0001	
PAH	0.0001	
Toluene	0.0003	
Xylene	0.0002	
HAP Individual Maximum	0.0007	5
HAP Total	0.0024	12.5

6.2.1.2 Water Quality

The Oilfield Service Facility Area of Influence is located largely on land but also includes an area of the Demerara River that abut the project site. Publicly available information on the local water quality for the Area of Influence is scarce, with only isolated records of temperature, pH, salinity, depth, dissolved oxygen, conductivity, turbidity and nutrients being available and these were presented in Section 4.1.4.

Rainwater that falls on uncontained (clean) areas of the Oilfield Service Facility will be allowed to flow off the site and to the Demerara River, as it currently does. The impacts to Demerara River water quality from the rain water will depend on the water depth and currents but will be limited to an area around the property. Impacts to water quality in the Demerara River from rain water run-off are anticipated to be **adverse, direct, localized, of negligible significance, and certain to occur**. Hence, rain waters are anticipated to have a **Low Risk of Adverse Impact** to water quality.

The contained and covered washbay area of the Oilfield Service Facility will be surrounded by a reinforced concrete. Wash water is captured by concrete sumps and gravity feed into an oil water separator system. From the oil water separator unit the water is then reclaimed and reused as wash water through a reclamation system. It is expected that once the treated wash water becomes too dirty to reuse, the system will be cleaned and waste water will be disposed of through an approved 3rd party disposal company.

The oil/water separator will be a two (2) stage gravity separation unit and will have a capacity of 1,000 gallons. The oil/water separator will be drained at the rear southern portion of the foundation into a receiving drain. The oil/water separator will process:

³¹ Based on State of Minnesota Option D Permitting Standards

- Wastewater discharged from 6 integral sumps which will be located within the bunded/covered area of the facility. The sumps will have portable sump pumps and have hard piping tied into the oil/water separator.
- Wash water from cleaning of the containment area

Because there will be no discharge of used oil, solid wastes or other industrial liquid waste to the river, any impact to water quality from these substances is anticipated to be zero; hence **no adverse impacts** to the surrounding environment will occur.

6.2.2 Ecological Environment

As described in Chapter 3, the Oilfield Service Facility is to be constructed on vacant land and surrounded by minimal industry. The facility has commercial or industrial facilities to the north, vacant land to the east and south with the Demerara River to the west.

The Oilfield Service Facility will not displace any protected vegetation, nor will it have any connection with surficial soils. Being located at a minimum distance of 50m from the Demerara River, it will have no connection with any water body, including the Demerara River. Operation of the Oilfield Service Facility will have no impact to birds that may fly overhead or perch on or near the site.

While the River contains a variety of aquatic life, the only impacts to them could arise from activities described in the subsections below.

6.2.2.1 Water Discharges

The only water discharges anticipated to be made from the operation of the Oilfield Service Facility are described below.

Run-off of raw (untreated) rain water flowing across non-project land will continue to flow into the nearby Demerara River as it does now, as will run-off from a limited part of the Oilfield Service Facility that is not enclosed or covered. This limited area is expected to store pre-cleaned tools returning from offshore installations. The runoff from these limited storage areas eventually discharges into the Demerara River. Aquatic life occupying the Demerara River adjacent to the Oilfield Service Facility are not expected to be impacted by this run-off any differently than as occurs today, without the project. The potential impacts to aquatic life in the Demerara River from raw or untreated rainwater draining from the Oilfield Service Facility site are anticipated to be **adverse, direct, localized**, and of **negligible significance**, but the probability is considered **likely**. The discharge of raw or untreated rainwater into the Demerara River is anticipated to result in only a **Low Risk of Adverse Impact** to aquatic life.

6.2.2.2 Emissions of Light, Noise and Vibration

During operation of the Oilfield Service Facility the routine noise level is expected to be around 78dB (WSDOT, 2012, slurry plant noise at 50 feet). A Yale University reference notes that noise generated by a vacuum cleaner is 75 dBA (just below the level expected to be generated by operation of the plant, which is less than the 80-90 dBA level at which sustained exposure could cause hearing loss (accessed at: <https://ehs.yale.edu/sites/default/files/files/decibel-level-chart.pdf>)

Therefore, the impact of noise and vibration on aquatic life from the project is anticipated to be **adverse, direct, localized**, of **negligible significance**, and **likely**. Hence, impacts to aquatic life from underwater sound produced by on-land sources are expected to result in a **Low Risk of Adverse Impact**.

Bright artificial light, such as that emitted by lighting fixtures used during operation of the Oilfield Service Facility has become recognized as cause for environmental concern for some wildlife, including migrating birds. As only aquatic life and birds in the immediate vicinity of the Project site could be affected by artificial light emitted at night, the impact of light on aquatic life and birds from the Project is anticipated to be **adverse, direct, localized**, of **negligible significance** but **likely**. Hence, impacts to aquatic life and birds from on-land lighting sources are expected to result in a **Low Risk of Adverse Impact**.

6.2.3 Socioeconomic Environment

6.2.3.1 Public Health and Safety

6.2.3.1.1 Air Emissions

Air emissions resulting from routine activities, such as running engines, trucks, painting, etc., are not anticipated to significantly impact local air quality beyond the Area of Influence of the project, as described in Section 6.2.1.1. As a result, the impact to public health and safety arising from of air emissions from activities associated operation of the Oilfield Service Facility are expected to be **adverse, direct, localized**, of **negligible significance**, but they will also be **certain**, and result in a **Low Risk of Adverse Impact** to public health and safety.

6.2.3.2.2 Emissions of Light, Noise and Vibration

Additional night-time sources of light, noise and vibration can impact human sleep patterns and result in adverse health impacts (such as stress). However, the Project Area of Influence is largely surrounded by industrial or undeveloped area, with no residences. On the west side of the River, the nearest buildings are at least 1,500m away. Lighting from the project is not likely to be visible from residences.

During operation of the Oilfield Service Facility, noise and vibration levels are not expected to exceed ambient levels. During operation the main source of noise are the emergency diesel engines and the power generators, which are equipped with sound attenuation measures such as an engine block that is designed for low noise and vibration, insulated timing case cover, isolated oil pan and improved pump and gear train system. The project is also required to comply with the GNBS noise emission limits, which are 100 dB during the day and 80 dB at nights. Consequently, the impact of noise and vibration on public health and safety from the project is anticipated to be **adverse, direct, localized**, of **negligible significance**, but **certain**. Hence, impacts to health and safety from noise generated at or by the Oilfield Service Facility are expected to result in a **Low Risk of Adverse Impact**.

6.2.3.2.3 Road Traffic

Operation of the Oilfield Service Facility is expected to add as many as twenty to thirty additional vehicle trips into and out of the site per day for workers, plus an additional five to ten delivery trips per day on average. At a peak, operations could generate up to 20-30 round trips for workers plus up to approximately ten for deliveries. This increase is expected to result in a marginal change in traffic congestion in the area. As a result, the impact to road traffic from this project is anticipated to be **adverse, direct, localized** of **minor significance** and **likely** and result in a **Medium Risk of Adverse Impact**.

6.2.3.2.4 Sealed Radioactive Sources

Sealed radioactive sources are used widely in medicine, industry and agriculture. A sealed radioactive source is radioactive material that is permanently sealed in a capsule or bonded and in a solid form. The capsule of a sealed radioactive source is designated to prevent the radioactive material from escaping or being released from encapsulation under normal usage and probable accident conditions.

Sealed radioactive sources are only stored and calibrated at the Oilfield Service Facility. Sealed sources are stored inside their shipping containers and are lead filled and certified by the manufacturer with international agencies and approved through the International Air Transportation Association (IATA). Containers are also compliant with the International Maritime Dangerous Goods (IMDG) Code and certified through the International Atomic Energy Agency (IAEA). As a result, the impact to public health and safety arising from sealed radioactive sources from activities associated operation of the Oilfield Service Facility are expected to be **adverse, direct, localized, of negligible significance**, but they will also be **unlikely**, and result in a **Low Risk of Adverse Impact** to public health and safety.

6.2.3.2.5 Explosives

Explosive storage will be stored and situated at a safe distance from other occupied places. US Bureau of Alcohol Tobacco & Firearms (ATF) distance requirements listed as Table 3-2 will be strictly adhered to and building is built to satisfy US ATF Standards 27 CFR 555.207 and 208. Explosives will be stored at a minimum of 50 feet from volatile/combustible materials.

Proper storage of explosives and accessories is important, not only to make sure that these materials are kept out of the hands of unauthorized persons and to reduce the hazards of accidental explosion, but also to maintain them in good condition. As a result, the impact to public health and safety arising from explosive storage at the Oilfield Service Facility is expected to be **adverse, direct, localized and of negligible significance**, but they will also be **unlikely**, and result in a **Low Risk of Adverse Impact** to public health and safety.

6.2.3.3 Employment and Infrastructure

The project is expected to generate a minor number of permanent jobs. During operation of the Oilfield Service Facility, approximately fifteen to twenty persons are expected to be required initially. It is hoped that over time, this number could be increase. This employment will have a positive but very minor impact on the local economy, one that will last for as long as the project operates. A few of the needed workers are expected to be non-Guyanese, but the majority are expected to be local hires.

Local activities to support the project beyond those directly involved in the construction and operation of the Oilfield Service Facility are expected to be limited to the temporary housing of off-duty non-local workers in area hotels and transport of workers through the local airport. As such, the project may create a few additional temporary jobs; another positive effect for the local economy.

Operation of the Oilfield Service Facility will result in positive but very limited economic impacts. Overall, impacts to employment as a result of the project are anticipated to be **beneficial, direct, and localized**, but of **minor significance**. Although the beneficial impacts are **likely**, overall the project is anticipated to result in **Medium Likelihood of Beneficial Impact** to employment and infrastructure.

6.2.4 Cumulative and Synergistic Impacts

Cumulative, or synergistic impacts refer to the total impact to a particular resource anticipated to occur as a result of:

- Impacts generated from the project;
- Impacts from activities performed in support of exploration and drilling projects; and
- Impacts resulting from other actions and activities that are not related to exploration and drilling projects.

6.2.4.1 External Sources of Impacts

6.2.4.1.1 Nearby Activity

As noted above, the Oilfield Service Facility will be established on vacant land. Other activities being nearby to the property will continue as they do today.

6.3 Environmental Impacts Summary

All planned activities to be performed during operation of the Oilfield Service Facility (as described in Chapter 3) need to be managed to reduce the possibility of adverse impacts occurring and to enhance the likelihood of the work being performed safely.

A summary of the project impacts is presented in Table 6-8. Project activities described in this chapter, but not appearing on the above Table 6-8 pose no identifiable risk. Those impacts identified on Table 6-8 with a risk level of Low do not require mitigation but do require to be managed and may require monitoring (Chapter 10 of this EMP). The impacts whose risk level has been described at Medium Adverse or higher require to be mitigated to reduce to acceptable levels. The mitigation activities are described in Chapter 8.

No planned activity scored a rating higher than Medium, either Adverse or Beneficial. Road traffic scored a Medium Adverse risk along with employment scoring a Medium Beneficial risk.

This assessment does not consider impacts potentially arising from unplanned project activities, such as accidental releases or upsets. They are addressed in the Emergency Response Plan (ERP) and the Spill Prevention and Control Procedure (SPCP).

Table 6-8: Impact Summary

Impact Producing Activity	Operational Controls and Regulatory Compliance	Anticipated Impact	Impact Assessment			Impact Risk	Mitigation Required?
			Type	Significance	Probability		
Abiotic Environment							
Air Quality							
Air Emissions	Compliance with Guyana regulations. Best practices for equipment maintenance	Emissions to air from operation of equipment. Anticipated pollutants include SO _x , NO _x , VOCs, and CO.	Adverse, Direct, Localized	Negligible	Certain	Low Adverse	No
Water Quality							
Storm water run-off	Compliance with Guyana regulations	Run-off from clean parts of the site	Adverse, Direct, Localized	Negligible	Certain	Low Adverse	No
Oil Water Separator & Reclamation System Cleanout	Creation of wash water during clean-out of oil water separator & reclamation system	Spill during transfer	Adverse, Direct, Localized	Negligible	Likely	Low Adverse	No
Aquatic Life and Birds							
Storm water Run-Off	Compliance with Guyana regulations	Run-off from the site	Adverse, Direct, Localized	Negligible	Certain	Low Adverse	No
Ecological Environment							
Water Quality							
Raw Rain Water	Compliance with Guyana regulations	Run-off from the site	Adverse, Direct, Localized	Negligible	Certain	Low Adverse	No
Domestic							
Sanitary	Compliance with Guyana regulations	Spill & runoff from the site	Adverse, Direct, Localized	Negligible	Certain	Low Adverse	No
Emissions Light & Noise							
Noise & Vibration	Compliance with Guyana regulations	Noise and vibration pollution	Adverse, Direct, Localized	Negligible	Certain	Low Adverse	No
Light	Best practices for equipment	Light pollution	Adverse, Direct, Localized	Negligible	Certain	Low Adverse	No

Impact Producing Activity	Operational Controls and Regulatory Compliance	Anticipated Impact	Impact Assessment			Impact Risk	Mitigation Required?
			Type	Significance	Probability		
Socioeconomic Environment							
Public Health and Safety							
Air Emissions	Compliance with Guyana regulations. Best practices for equipment maintenance	Emissions to air from operation of equipment. Anticipated pollutants include SOx, NOx, VOCs, and CO.	Adverse, Direct, Localized	Negligible	Certain	Low Adverse	No
Road traffic	Compliance with Guyana regulations	Increase in road traffic in the vicinity of the Oil Field Service Facility	Adverse, Direct, Localized	Minor	Certain	Medium Adverse	Yes
Noise & Vibration	Compliance with Guyana regulations	Noise and vibration pollution	Adverse, Direct, Localized	Negligible	Certain	Low Adverse	No
Light	Best practices	Light pollution	Adverse, Direct, Localized	Negligible	Certain	Low Adverse	No
Radioactivity	Compliance with International Atomic Energy Agency, Best practices for equipment maintenance	Radiation	Adverse, Direct, Localized	Negligible	Unlikely	Low Adverse	No
Explosives	Compliance with US ATF & US 27 Code of Federal Regulations 555.207 & 208. BH Best Practices.	Explosives	Adverse, Direct, Localized	Negligible	Unlikely	Low Adverse	No
Employment and Infrastructure							
Employment	Compliance with Guyana regulations	The Project is expected to generate 15-20 full time jobs during operation of the Oil Field Service Facility	Beneficial, Direct, Localized	Minor	Likely	Medium Beneficial	Yes - Enhancement

7.0 ENVIRONMENTAL MANAGEMENT PLAN

7.1 Introduction

Environmental protection and safety are more than priorities for BKR; they are a part of the company's culture. BKR is committed to conducting business in a manner that protects our employees, the environment, and the communities in which we work by complying with all applicable safety, health, and environmental laws. We are also committed to partnering with regulators to continue enhancing our HSE Management System program with quick corrective actions to resolve all of these opportunities for improvement. In this regard BKR is incorporating several procedures and policies to minimize the environmental impact of the Oilfield Service Facility. The procedures for each aspect are being developed with local management, HSE Coordinator, and local governmental agencies.

The operations of the Oilfield Service Facility must be carried out in a manner which is in compliance with the legislation and guidelines outlined in Chapter 5 as well as the environmental authorization to be granted by the EPA for the operational phase. In this regard, this EMP has been prepared to guide the project's activities by setting out measures and strategies to address the environmental issues related to the operations phase of the project. The EMP recommends activities to be undertaken in an effort to mitigate the principal adverse effects of the project and describes the way in which the main potential environmental and safety impacts of the project can be managed. Measures are built into the project design to ensure that any potential adverse impacts are mitigated. This EMP is supported by a Contingency and Emergency Response Plan, Water Protection Plan, Spill Prevention & Control Plan, General Baker Hughes Performance Construction Specifications and a Monitoring Plan prepared for the project.

The responsibility for implementation of the EMP is that of the Country Manager. However, the HSE Coordinator, who reports directly to the Country Manager will oversee its implementation with the support of the Facility Operator, supervisors and other support staff.

The management of impacts is presented in Section 7.2, while Section 7.3 outlines orientation and training to be conducted by workers and Section 7.4 presents a Monitoring Plan.

7.2 Impacts Management

Adverse impacts having a negligible significance level and posing a Low Risk based on the Impact Assessment described in Chapter 6 do not require to be mitigated but do require to be managed. Almost all identified impacts fall into this category. Management of these impacts is described in Section 7.2.1. In addition, the company has other management measures built into the project design. These are described in Section 7.2.2.

7.2.1 Impacts to be Managed

The measures recommended for the management of impacts identified by the impact assessment are outlined in this section.

7.2.1.1 Air Quality

The Plant operator will need to ensure that appropriate practices are taken to minimize emissions from the diesel-powered engines used to power the project operations and painting activities. This will include:

- Using clean, low sulfur diesel to the extent available
- Requiring fuel to be provided from a reliable source of clean fuel

- Ensuring regular inspection and maintenance of the engines using the fuel in accordance with the respective original equipment manufacturer recommendations regarding the frequency of oil and filter changes, and the operation of the engines to be in accordance with generally accepted good practices. Records of the maintenance (and repair when necessary) should be maintained in a Log Book retained at the Oilfield Service Facility offices.
- Ensuring regular inspections and maintenance of painting equipment in accordance with their respective manufacturer's recommendations and monitoring paint usage to ensure throughput does not exceed estimated emissions provided as Table 6-6.

7.2.1.2 Water Quality

7.2.1.2.1 Storm Water Run-off from Areas

Almost the entire Oilfield Service Facility will be covered with a limited portion of the property used for outside storage. Tools stored within this portion of the property will be pre-cleaned and monitored for any residual oils. Storm water falling on this outside storage will be allowed to drain off into the Demerara River.

7.2.1.2 Aquatic Life and Birds

7.2.1.2.1 Lighting during Operations

Operation during night-time hours is a potential eventuality that is dependent on demand for the products produced by the Oilfield Service Facility, when lighting would be required. To minimize disruption to aquatic life and birds, lighting shall be shielded so that the light does not shine directly onto the waters of the river, or for the actual light sources to be visible beyond the Area of Influence of the Oilfield Service Facility.

7.2.1.3 Public Health and Safety

7.2.1.3.1 Air Emissions

The Oilfield Service Facility is to be constructed with controls proposed in Section 7.2.1 and considered to be sufficient to reduce possible impacts on human health to acceptable levels.

7.2.1.3.2 Noise

The Oilfield Service Facility noise to be generated by the operation is not likely to exceed the current ambient noise level of the area. Nevertheless, the Facility Operator will be responsible to ensure all noise attenuation measures relating to noisy equipment are implemented and maintained.

7.2.1.3.3 Road Traffic

As noted in the Chapter 3, the incremental volume of road traffic likely to be generated during operation of the Oilfield Service Facility will be of minor significance within the context of traffic in the area. In an effort to mitigate this impact a truck staging area will be used to move trucks off roadway quickly to minimal impact.

7.2.1.4 Employment

Opportunities should be pursued to amplify the positive effects of the small number of employment opportunities to be generated by the project on Guyana's economy. Specifically, the Facility Operator should prioritize the hiring, training and advancement of local Guyanese workers where feasible. Further, the Operator should prioritize procurement of goods and services from local providers wherever possible. These actions should be taken in accordance with Guyana's Local Content Policy

and with support from the Department of Energy's local content resource office and the Centre for Local Business Development.

7.2.2 Environmental Management Measures

The facility is being designed with several integral components and equipment to mitigate possible environmental impacts. These are described as follows:

- **Internal Sumps** - There are sumps located within the washbay area of the facility. The sumps will gravity feed an oil/water separator unit.
- **Oil/Water Separator** - The oil water separator will be a two (2) stage gravity separation unit. The oil/water separator will have a capacity of 1,000 gallons. The oil/water separator will process:
 - ✓ Wastewater discharged from integral sumps which will be located within the washbay area of the Plant. The sumps will gravity feed the oil/water separator.
 - ✓ Wash water from cleaning of the washbay area.
- **Reclamation System** – The reclamation system converts wastewater from the oil water separator unit into reusable water for continued equipment washing.
- **Moisture and Vapor Barrier** - The concrete foundation will have moisture and vapor barriers integral with the walls, expansion joints and wall corners.
- **Maintenance** - Electrical and mechanical equipment, hoses, diesel engines, etc. will be maintained and repaired following specifications of the American Petroleum Institute (API) and the American Society of Mechanical Engineers code (ASME), or their manufacturers' recommendations.
- **Radiation** – Source shipping containers are lead filled and certified by the manufacturer with international agencies. Containers are approved through the International Air Transportation Association (IATA) and Compliant with International Maritime Dangerous Goods (IMDG) Code. Sources capsules are competent authority certified through the International Atomic Energy Agency (IAEA).
- **Explosives** – Explosive storage will be stored and situated at a safe distance from other occupied places. US Bureau of Alcohol Tobacco & Firearms (ATF) distance requirements listed as Table 3-2 will be strictly adhered to and building is built to satisfy US ATF Standards 27 CFR 555.207 and 208. Explosives will be stored at a minimum of 50 feet from volatile/combustible materials.
- **Waste Generation and Disposal** - For a project of this nature, industrial solid waste is primarily generated through the consumption of chemicals for AMO activities that are used during assembly and disassembly of tools. The activities, resource inputs and waste streams to be generated by the project is demonstrated in Table 7-1.

Table 7-1: Activities, Resource Inputs and Waste Streams

Activity	Location(s)	Resource Inputs	Waste Streams
Sump Cleaning	Sump	Dirt & Wastewater	Oily Wastewater Waste Separator Solids
Oil Water Separator and Reclamation System Cleaning	Oil Water Separator & Reclamation System	Dirt & Wastewater	Oily Wastewater Solids
AMO Processes	Scrap Metal Bin	Tools & Equipment	Scrap Metal
Facility Maintenance and AMO Activities	Overall facility	Paints Solvents Parts Inventory Paper and Plant Aerosol Cans Motor Oil & Filters	Paints & Solvent Waste General Trash Aerosol Cans Used Filters Used Motor Oil

BKR will contract approved third party vendors to dispose of all waste streams identified above.

7.3 Orientation and Training

To ensure there is good compliance, it is essential the all workers are trained in their respective tasks and are aware of their role and responsibilities in ensuring good environmental and health and safety practices. It is part of BKR practices to ensure all workers are adequately oriented/trained.

Training should be done as part of workers induction and shall include, but not be limited to the following:

- Environmental requirements and environmental management and health and safety measures as outlined in the EMP and other established BKR procedures;
- Workers' role and responsibilities in environmental management and health and safety;
- First aid, occupational safety and health measures and the use of PPE;
- Emergency response measures;
- Methods for waste and hazardous materials management and disposal;
- Social responsibilities of all personnel working under the project and rules of engagement with stakeholders, in particular the local community; and
- A Code of Conduct for workers.

Any new employee undergoes an orientation program to ensure he/she fully understands the job requirements and employment conditions and is motivated to improve his/her skills. Periodic refresher training is the conducted from time to time, either based on a schedule or as the need arise. On a day-to-day basis, there Tool Box Sessions. Training of employees in health and safety, spill prevention, and emergency response is elaborated on in the project's Emergency Operations Plan included as Appendix A and the Spill Prevention and Control Procedure included as Appendix B.

7.4 Monitoring

To ensure that the mitigation measures are implemented and are effective, monitoring will be conducted by Baker Hughes. Monitoring would also allow for the identification of areas where the project is having an impact on the environment so that the corrective measures can be implemented, or if there are emerging issues to be addressed.

Taking into consideration the principal issues and impacts identified, several issues and parameters will be monitored during operations of the project. Table 7-2 outlines these, the frequency of monitoring and the locations.

Table 7-2: Monitoring Plan

Issue or Parameter	Phase	Frequency of Monitoring	Type of Monitoring	Location of monitoring
Physical Environment				
Air Quality VOCs/NOx/CO/Others	Operations	Annual	Monitor thru-puts	Source Area
Noise	Operations & Construction	Monthly	Inspect Noise Abatement Devices	Project Boundaries
Discharge Water Quality	Operations	Quarterly	Inspect and Maintain Oil/Water Separator and Reclamation System	Source Area
Waste Management	Operations	Monthly	Visual Inspection	Waste Storage Area
Spill Prevention	Operations	Monthly	Visual Inspection	Potential Spill Areas
Explosives Storage	Operations	Monthly	Visual Inspection	Storage Area
Radiation Storage	Operations	Monthly	Visual Inspection	Storage Area
Socio-Economic Environment				
Health and Safety	Operations & Construction	Monthly	Visual Inspection	All operational areas
Local Stakeholders Complaints received	Baker Hughes	Quarterly	Monitor complaints	Surrounding property owners and other stakeholders in the vicinity of the project site

8.0 CONTINGENCY AND EMERGENCY RESPONSE PLAN

BKR has built in several measures into the project design, construction and operation to ensure that the working environment is healthy and safe. These measures were discussed in the preceding chapters. Although the company has undertaken measures to minimise the environmental, safety and health risks, unforeseen events can lead to emergencies. In the event of an emergency, the objectives are to ensure a prompt and effective response, and to minimize the effects. As such, BKR has prepared an Emergency Operations Plan (EOP) for the project. The purpose of this plan is to communicate the response procedures during an emergency situation. The EOP minimizes the hazards to human health and the environment. The EOP is attached as Appendix A. Within the plan detailed instructions are provided for:

- Reporting emergency situations
- Evacuation procedures
- Medical emergencies
- Minor accidents and incidents
- Fires, chemical spills or the release of hazardous materials
- Natural disasters with warning
- Natural disasters without warning
- Thunderstorms, Flash floods, Severe weather travel, Hurricane Preparedness and Earthquakes
- Automobile accident
- Intruders on premises
- Hostage / kidnap
- Suspicious Parcel or object, Bomb threats or Explosions
- Employee training and Emergency evacuation drills

In addition to the EOP, BKR has prepared a Spill Prevention and Control Procedure for the project. This plan is attached as Appendix B and outlines to spill prevention measures, contingency and response measures in place, response procedures, emergency contacts, training of workers, etc.

9.0 CLOSURE AND DECOMMISSIONING

Baker Hughes prides itself on being a good steward to the environment. If environmental damage is determined to be the fault of Baker Hughes, then the company will take every effort to investigate and cleanup. Section 9 provides an outline of our approach but additional details would likely be available once Baker Hughes has operated the facility for one year.

The nature of this project's activities, as a temporary use of land, should not impose any permanent constraints on any future beneficial use of the area, nor have any permanent effects on the local water resources, biodiversity, overall landscape quality and associated socio-economic development.

The purpose of the Oilfield Service Facility will be to prepare tools to be used in drilling and completing offshore oil wells. As such, the operation of the Oilfield Service Facility at the project site is dependent on contracts with oil and gas companies working in Guyana. Given this scenario, the company has to consider options for closure. Within the context of this EMP, the term 'closure' is used to encompass decommissioning, demolition and rehabilitation activities at the time of conclusion of operations. It should be noted that prior to closure a detailed Closure and Decommissioning Plan will be prepared.

9.1 Approach to Closure Planning and Decommissioning

The principal objectives of closure and decommissioning would be to:

1. Identify suitable best practice measures that are appropriate, and are able to meet the requirements of the regulatory agencies, while satisfying international benchmarks and standards for the sector;
2. Contribute to the effective management of environmental and social issues as a means of facilitating effective closure;
3. Return the land as close as possible to pre-project conditions;
4. Minimize the potential for any negative post-closure impacts and liabilities;
5. Minimize the requirements for active management of the post-closure environment; and
6. Maximize the potential for post-closure environmental and social benefits.

9.2 Closure Actions

In addressing the principal closure and decommissioning issues, the Closure Plan is envisaged to include the following actions:

1. Removal of all machinery/equipment from the site.
2. All project components and facilities will be demolished and removed.
3. All waste will be removed from the site.
4. Any contaminated area will be cleaned up.
5. The relevant Government Authorities and the employees/workers will be informed at least three months in advance.
6. NIS and PAYE contributions for staff will be discontinued.
7. Severance pay for employees/workers will be paid, along with all other monetary resources due to them, as required by Guyana's Labour Act and the Termination and Severance Payment Act.
8. All other obligations of the Company, required by the Laws of Guyana, will be settled.

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PROPOSED EMERGENCY OPERATIONS PLAN (EOP)

FOR

Guyana Oilfield Service Facility

Introduction

The purpose of this plan is to communicate the response procedures during an emergency situation. This minimizes the hazards to human health and the environment. Detailed instructions will be given for:

Reporting emergency situations , Evacuation procedures, Medical emergencies, Minor Accidents & incidents, Fires, Chemical spills or the release of hazardous materials, Natural disasters with warning, Natural disasters without warning, Thunderstorms, Flash floods, Severe weather travel, Hurricane Preparedness, Earthquake, Automobile Accident, Intruders on premises, Hostage / kidnap, Suspicious Parcel or object, Bomb threats, Explosions, Employee training and Emergency evacuation drills.

Section 1: Mandatory Response

Evacuate

Personnel Evacuation

- When an evacuation has been announced, employees are to proceed immediately to the nearest safe exit via designated evacuation routes, unless they have been designated to perform critical plant operations before evacuating.
- The individuals who are designated to complete critical plant operations will complete those operations if possible, and then evacuate to the assembly area.
- Follow designated evacuation routes. Do not run. Walk at a rapid, but safe pace.
- Evacuate in a single file line in hallways and corridors. Do not attempt to run past, or push someone out of the way during the evacuation.
- Keep all noise to a minimum. Others may be trying to give or receive important instructions.
- If anyone encounters another employee who is incapacitated, or cannot safely evacuate the building on his or her own, they should help that person evacuate to the assembly area. Get help as necessary.
- If you cannot breathe due to smoke, crawl to the nearest exit.
- All employees are to remain at the evacuation assembly area until the emergency coordinator has told them to do otherwise.
- At the evacuation assembly area, a headcount will be taken. No person is allowed to leave the evacuation assembly area unless told to do so by the emergency coordinator.
- Emergency responders must not re-enter evacuated areas until advised it is safe to do so by the Emergency Response Management Team.
- For Emergency Situation scenarios .

Relocation of Vital Records

- The Product Line Manager (PLM) must be alerted when the facility is considering evacuation.
- All records must be updated and stored on the server prior to evacuation.

- Personnel must be instructed on movement to host locations via the ERMT.

Coordinate Information

Press releases must be managed through the Vice President for Investor Relations (or formally designated backup).

Situation Awareness

Monitoring and reporting of information regarding risk, impact implications and response efforts will be done by the Facility Manager or designate in conjunction with HSE.

Assessment, evaluation and reporting on the impact to company assets and business activity will be done by the Facility Manager or designate.

Regulatory Reporting

Any required Regulatory Reporting will be done by HSE with the consultation of the PLM and Country Manager.

Stakeholder Communication

- Stakeholders will be notified of emergencies which can impact business or revenue via coordinators under the discretion of the PLM.
- Communication to impacted and peripherally impacted employees, dependents and next of kin will be done by the HR department.

Note

Communication with the media must be coordinated through the company media spokesperson.

Compensate for Lost or Damaged Infrastructure

Power

There is a diesel generator onsite in the event of power outage. This generator is capable of supplying power to the facility for a minimum of 12 hours.

Access & Egress

There is 24 hour security personnel onsite. Security personnel will assist the Facility Manager and HSE in determining access and egress points.

Communication

All employees onsite are equipped with mobile phones.

Fuel

The diesel generator is refueled as required.

Heating, Ventilation and Air Conditioning

The diesel generator can supply HVAC needs for a minimum of 12 hours depending on operation.

Information Technology

There are mobile internet hotspots available from the IT department. All records are stored on the base server.

Transportation

Taxi services are available for all employees by Cyril's Taxi Service and Triple D's Transport. Additional vehicles are available upon request.

Security

There is 24 hour security personnel onsite at all times.

Section 2: Organization & Responsibilities

Organization

Management Responsibilities

The Facility Manager is responsible for the overall implementation and activation of any evacuation procedure at the facility. The lead technician is responsible for the shutting down of any equipment prior to an evacuation.

Emergency Operations Center

All personnel on the location will meet in the facility conference room to discuss any potential crises or emergencies that arise.

Emergency Response Management Team

The Emergency Management Response Team (ERMT) is responsible for coordinating the response to emergency incidents. ERMT is responsible for managing emergency responders.

The ERMT trains and maintains emergency responders as required by the EOP.

The ERMT provides liaison to client emergency response teams, when required, provides liaison to emergency services, regulatory organizations and community representatives, when required.

Emergency Responders

Emergency responders are trained and qualified to assist with the EOP and respond to emergencies. Emergency responders must liaise with the emergency services providers, when appropriate.

Responders ensure safe working conditions for team members and provide basic emergency services (First Aid, Fire Warden and HAZMAT) for employees and supplementary personnel.

Regulatory Liaison

This person notifies authorities of any breach in regulatory compliance, specifically for air and water discharge, serious injury or death of employees. HSE will perform this role.

Emergency Services Liaison

This person liaises with external emergency services for ambulance, fire or HAZMAT. The local ambulance and fire services will be utilized for any emergencies at the facility. The HAZMAT service provider is Tiger Tanks Guyana Limited. The Facility Manager will perform this role.

Client Liaison

This person notifies the client of any delays with respect to tools or other equipment due to emergencies at the facility. The Facility Manager will perform this role.

Specific Duties

The responsibilities of Fire Wardens are as follows:

- Conduct daily and monthly visual checks on fire extinguishers, fire alarms, emergency exits and evacuation routes.
- Direct everyone to leave the building using all the appropriate routes and exits (and not inappropriate exits such as lifts).
- Check all accessible spaces in their area, including bathrooms, to make sure everyone has evacuated – this should be done on the way out of the building so that the fire warden isn't putting themselves at risk by re-entering the evacuated area.
- Close the doors to help to isolate the fire.
- Guide everyone to the assembly area and assist in checking that everyone has arrived safely.
- To lead the fire drills and real evacuation procedures.

The responsibilities of First Aiders are as follows:

- Conduct daily checks on the first aid kit contents.
- Manage the incident and ensure the continuing safety of themselves, bystanders and the casualty.
- Assess casualties and find out the nature & cause of their injuries.
- Arrange for further medical help or other emergency services to attend.
- Be able to place an unconscious casualty into the recovery position.
- Know how to perform Cardiopulmonary Resuscitation (CPR)
- Know how to use an automated external defibrillator (AED)
- Know how to stop bleeding using pressure and elevation.

- Be able to keep a fractured limb still.
- Prioritize casualties based upon medical need.
- If able, make notes/observations of casualties
- Provide a handover when further medical help arrives.
- Fill out any paperwork as required.

The responsibilities of HAZMAT personnel are as follows:

- Conduct daily checks on the spill kits.
- Safe evacuation of persons from the building and immediate affected area.
- Respond offensively to minor uncontrolled releases of hazardous substances.
- Liaise with secondary HAZMAT third party for additional support and clean up.

Critical Equipment Operators

In the event of evacuation, the below personnel are responsible for shutting down of critical equipment:

OPERATION	DESIGNATED INDIVIDUAL(S)

Section 3: Communications

Emergency Reporting and Communication

- The first means of reporting an emergency situation will be word of mouth between employees.
- When an emergency situation occurs the nearest alarm is to be sounded & an announcement made to evacuate.
- An emergency announcement shall be of sufficient duration to inform all employees of the emergency situation.
- When the fire alarm system is activated, all employees will immediately stop what they are doing and listen for pertinent instructions.
- If instructed to evacuate the premises, or the fire alarm has been activated, employees will either begin their critical job functions, or immediately proceed to the assembly area via designated evacuation routes.
- In the event of an emergency all personnel must evacuate to the muster point via designated evacuation routes (as seen on evacuation map).
- Outside of working hours, onsite security personnel will notify both the Facility Manager and HSE of any alarms activated onsite.

Communication of EOP to Personnel

The plan shall be communicated with each employee or contract employee, by their supervisor, at the following times:

- Initially when the plan is developed.
- Initially upon assignment (hire).
- Whenever the employees' responsibilities or designated actions under the plan change.
- Whenever the plan is changed.

Any questions regarding this plan can be referred to the Facility Manager or HSE Representative.

Communication of EOP to Other Parties

The plan shall be communicated with all external parties entering the facility by security personnel onsite. This must be done during the initial facility orientation.

Emergency Services Communication

Communication with emergency services will be done by the Facility Manager or his designate. All employees at the facility must be made aware of the outcome of any communication.

Hazardous Substance Information

There are SDS sheets for all hazardous chemicals onsite.

Community Liaison

Liaison with the local emergency services, the community and community organizations are managed by the Facility Manager or his designate.

Section 4: Emergency Response

Medical Emergencies

Medical Providers / Contractors

1. There are certified first aiders onsite for immediate medical treatment. For minor medical treatment outside of the scope for first aiders, employees will be carried to Caribbean Surgeries Incorporated.

First Aid

2. There are trained first aid personnel onsite. There are first aid kits located in the building. The minimum contents of the First aid kit is as follows:

First Aid Kit Contents

Item Type	Minimum Quantity	Size/Volume
Triangular Bandage	1	40in. x 40in. x 56in.
Burn Treatment Cream	6	1/32 oz.
Antiseptic Cream	10	0.14 fl. oz.
Sterile Pads	4	3in. x 3in.
Adhesive Bandages	16	1in. x 3in.
Antibiotic Treatment	6	0.14 fl. oz.
Medical Examination Gloves	2 pairs	N/A
First Aid Guide Booklet	1	N/A
Adhesive Tape Roll	1	3/8 in. x 2.5yd.
Absorbent Compress	1	32 sq. in.
Triangular Bandage	1	40in. x 40in. x 56in.

Fire Prevention and Protection

Fires

When a fire is detected, personnel shall use their judgment with regards to fighting the fire, or evacuating. If the fire can be relinquished by fire extinguishers, put the fire out. Remember, NEVER FIGHT EXPLOSIVE FIRES!!!

1. Activate nearest Fire Alarm (refer to the floor plan for location of fire alarms).
2. The pull stations are easy to activate simply pull down the top of the device.
3. If the fire is small, utilize nearest fire extinguisher to extinguish the fire.
4. If the fire is not immediately extinguished or too large, close the door to room/area where fire is discovered.
5. The fire department is to be notified.
 - Fire Service Response - 912
6. Follow normal evacuation procedures (Refer to Section 1 – Personnel Evacuation).

- **Tips for Using a Fire Extinguisher**

- P - Pull safety pin from handle
- A - Aim at base of fire
- S - Squeeze the trigger
- S - Sweep from side to side

In a large fire do not try to extinguish--GET OUT--close doors to confine the fire.

If caught in smoke

1. Drop to hand and knees and crawl to escape the smoke.
2. Hold your breath as much as possible. Breathe shallowly through your nose and use your shirt as a filter.

If forced to advance through flames

1. Hold your breath.
2. Move quickly
3. Keep head down and covered.
4. Keep eyes closed as much as possible.

If trapped in a room

1. Place cloth around and under door to prevent smoke from entering.
2. Retreat-close as many doors as possible between you and the fire.
3. Be prepared to signal from a window.
4. Never break glass unless absolutely necessary.

Spill Response

- In the event of a chemical spill or release of a hazardous substance, the HAZMAT team will be notified immediately.
- There are spill kits onsite.
- In the event of a spill or release of an aggressive material where evacuation of personnel is needed, or danger of a fire exists, the fire alarm shall be activated and the evacuation commenced.
- Only trained personnel will evaluate and direct the response to a chemical spill or release of a hazardous material.

Floods and Flash Floods

Floodwaters can be extremely dangerous. The force of six inches of swiftly moving water can knock people off their feet. Flash flood waters move at very fast speeds and tear out trees, destroy buildings and obliterate bridges. Automobiles can be swept away in just two feet of moving water. Floods and flash floods occur as a result of heavy thunderstorms.

Flash Flood Guidance

1. The best protection is to leave the area and go to shelter on higher ground.
2. If you are in a vehicle in a flooding area, it should be abandoned. Do not drive through high water.
3. Passengers should climb to higher ground. Do not attempt to cross on foot any flowing stream.
4. Listen to the radio for evacuation information.

After the Flood

1. Do not use food that has come into contact with floodwater.
 2. Check with local health authorities on drinking water purity.
 3. Wells should be pumped out and the water tested before drinking.
 4. Necessary medical, welfare and other services are available at established local evacuation centers.
 5. Do not handle live electrical equipment in wet areas.
 6. Use flashlights--not lanterns or torches--to examine buildings. Flammables may be inside.
 7. Report broken utility lines to appropriate authorities.
- Take photos of damaged effects before discarding the items for proof of your losses.

Severe Weather Travel

Traveling in severe weather conditions can be very hazardous. If travel is absolutely necessary in threatening weather and poor road conditions, be prepared and heed the warning of road reports. (Refer to the Journey Management Procedure).

Before Leaving

Always let a colleague, supervisor or family know you are leaving and include the following information:

1. Where you are going.
2. What route you are taking.
3. Any difficulties you expect.
4. How long you expect to be away.
5. When you expect to reach your destination.
6. When you expect to return.

When Travelling

1. Start with a full tank of gas.
2. Have a current road map.
3. Drive defensively and with caution.
4. Adjust your speed to road conditions.
5. If the going gets rough--don't press on--turn back or seek refuge.
6. Keep on the main roads.

7. Keep your radio tuned to a local station for weather warnings.
8. Call if you will be delayed.

When you arrive at your destination after a long trip, notify relevant parties to let them know that you've arrived. (Call at a prearranged time and call when you return - even at late hours).

If you become aware of a worker's failure to return on time immediately

1. Notify your supervisor.
2. Notify the police of the circumstances, departure time, and anticipated route. Request that they follow up.

Hurricane Preparedness

If a tropical storm or hurricane is within 24 hrs of landfall in your location, the facility should be shut down. Therefore, the employees should be evacuated.

Checklist

This checklist should be implemented in the event of a tropical storm or hurricane making landfall to Guyana.

- Move all collars, mud motors, directional tools, pallets, etc. to the lower racks.
- Cover green mud sample boxes
- Fuel Company pool vehicles, and move to higher ground if possible.
- Break down all stacked boxes.
- Move all pelican cases to covered area or inside
- Secure all picnic tables, trashcans, ashtrays, wooden crates, or any other loose items that could be a projectile. If possible brings these items indoors.
- Make sure all lithium batteries are stored inside and elevated to the second floor, if possible.
- Build back up tools to cover jobs.
- Retrieve sand bags for the front and side entrances.

Outside

- Fuel diesel powered forklifts, and move to higher ground if possible.
- Fuel Company shop vehicles used in this process, and move to higher ground if possible.
- Power down all cabins, and disconnect power cables
- Close and secure all cabins, including window covers.
- Close and seal all support boxes to prevent water invasion.
- Seal and elevate all chemical containers, including waste container.
- Move propane tanks, oxygen and acetylene cylinders inside.
- Lock both entrance gates before leaving the facility

Inside

- Power down and unplug all test equipment, computers.
- Elevate test equipment, multi-outlet strips, power supplies, files, copy machines, printers, fax machines and paper in case of flooding in the building.

- ___ Move equipment and computers from windows that are prone to leaks.
- ___ Remove all equipment away from areas of known roof leaks.
- ___ Turn off lights.
- ___ Lock doors.
- ___ Turn off power supplies and multi-outlet surge protectors.

Earthquakes

During an earthquake

STAY CALM. DO NOT PANIC. BE ALERT

- If inside, stay inside, do not run out of the building.
- If inside, stand in a strong doorway or get under a sturdy desk, table or bed and hold on
- Do not use elevators or stairs.
- Move away from windows, mirrors, glass doors, pictures, bookcases, hanging plants and heavy objects.
- If outside and there are no obvious signs of danger nearby, stay there.
- If outside, stay away from glass buildings, electricity poles, and bridges.
- If in a vehicle, do not stop on or under a bridge.
- Always look out for falling plaster, bricks, lighting fixtures and other objects.

After an earthquake

- Check for broken gas lines and fires.
- Check utilities and switch them off, if necessary.
- Check your house for serious damage and evacuate if the house seems likely to collapse.
- Be prepared for more earthquakes (aftershocks).
- Do not light a match or turn on a light switch; Use a flashlight instead.
- Do not touch fallen power lines.
- Do not attempt to move seriously injured persons unless they are in danger of further injury.

Intruders on the premises

Action to take with Intruders

3. Do not make any sudden movements that may be misconstrued as resistance or a violent response.
4. Try to remain calm and do not speak unless you are asked to speak by the intruder, then only answer the specific questions asked. Do not discuss politics or sensitive issues if you can avoid them. Do not offer to negotiate. Keep your expression neutral.
5. Be co-operative with the intruder. Do not resist. Do not be a hero.
6. If you are removed from immediate contact with the intruder, dial 911, and follow established reporting protocols.
7. In case of any shooting, immediately get down on the floor or ground and stay there.

8. If you can do so without drawing attention to yourself or others, quietly evacuate occupants to a more secure area.
9. Assist the police on arrival.

Assessing the threat

There can generally be three potential types of threats against employees. They are described below in increasing order of threat:

1. Non-Specific threat is received against an employee or the company, or there is some suspicious activity.
2. Specific threat is received, or a nearby security emergency poses a risk to employees or property.
3. Life threatening incident directed at or involving employees, a violent act is an imminent possibility.

Actions

1. Secure the area and attend to any medical issues (if it is safe to do so) according to the medical section included in this brochure. Ask others in the office for assistance.
2. Call the police at 911.
3. Report to your Supervisor.

Hostage/ Kidnap

Assessing the Threat

This procedure applies to situations where a threat or extortion demand of any kind is received which could develop into a kidnap or someone is suspected of being kidnapped, or the evidence is fairly conclusive that a kidnapping has occurred (e.g., an eye witness to the kidnapping, or a demand letter or call being received).

Action to take by person(s) receiving the threat

1. Immediately report any threat to your Supervisor.
2. If the threat is written, put the letter and envelope down and do not handle any further.
3. If the threat was phoned in, the person taking the call should write down exactly what was said and any other information about the call which might help identify the caller or the caller's location (background noises, etc.) referring to the Bomb Threat Checklist (see last tab in this booklet). Give the information to your supervisor.
4. Do not discuss the incident with anyone else. Await further instructions.

Action to take by person(s) taken hostage or kidnapped

1. Obey instructions of the kidnappers.
2. Avoid eye-to-eye contact with kidnapper(s).
3. DO NOT display authority or bring attention to yourself.
4. DO NOT negotiate with the kidnapper(s) unless you are answering their questions and following their instructions.
5. Eat or drink any food offered.

6. DO NOT talk to or trust anyone with information or plans.
7. DO NOT discuss political opinions or other sensitive issues with the kidnapper(s) if you can avoid them.
8. If asked questions about others or security issues, say you are not knowledgeable enough to comment unless your life is threatened.
9. Surrender documents and valuables when asked.
10. If guns are fired get down. Stay down.
11. Obey instructions of rescue team members.

Action to be taken by others

1. Remain calm and DO NOT draw attention to yourself.
2. DO NOT negotiate with the kidnappers.
3. When the kidnapper(s) have left, secure the area.
4. Notify the Country Manager.

Bomb threats

- In the event of evacuation, exit the building quickly and safely. Warn others and provide assistance if necessary. Proceed to the assembly point. If someone is missing, inform Security, Police or the Fire Department upon arrival.
- Management should call a meeting to inform everyone of the situation, unless evacuation has occurred.
- Give this information to your supervisor.
- Do not discuss the incident with anyone else.
- Await further instructions.
- If a bomb threat is received at the facility, the emergency coordinator will be notified immediately.

If the emergency coordinator determines that the employee alarm system should be activated, they will do so, and the evacuation commence.

All employees with company issued cellular phones should bring them to the assembly area, and the proper authorities should be notified.

No one will be allowed to approach the premises until the authorities, or the emergency coordinator gives permission to do so.

Explosion in the building

1. Stay calm.
2. Close doors to contain fire.
3. Exit the building quickly and safely.
4. Warn others and provide assistance if necessary.
5. Follow the instructions of the Fire Warden.
6. Proceed to the assembly point
7. It should be determine if anyone is missing.

8. If someone is missing, inform Security, Police or the Fire Department upon arrival.
 - If an explosion occurs at the facility, all employees able to get out of the vicinity of the damaged area should do so immediately.
 - First aid providers and / or first responders will immediately provide assistance to the injured and stay with them until medical care arrives.
 - Medical support and the fire department should be called in to assist immediately.
 - An assessment of spilled or released hazardous materials will be made, and the containment or cleanup of the materials should begin as soon as possible.
 - Control secondary accidents. Ensure no one enters hazardous environments without the proper PPE.
 - The area of the explosion will remain off limits until an investigation, and structural assessment can be made.

Forklift Incident

- Initiate the emergency response alarm system as outlined in the Emergency Response Plan and have someone (Security Officer/Co-workers) contact the Emergency Response Team and Response Agencies.
- Ensure it is safe to approach the victim and there is no danger to you or others.
- If you are not a trained responder do not attempt to move the victim but stay with the victim until response personnel have arrived.
- If a trained responder in First Aid assess the victim's condition, check for responsiveness and signs of circulation and administer the appropriate care.
- If the victim has no signs of circulation start CPR immediately, send for the AED and use upon availability.
- If the victim is responsive do an assessment for injuries sustained.
- Treat all injuries – control bleeding and dress wounds; splint fractures and immobilize the victim, maintain body temperature (cover with blanket or coat) and await the arrival of Response Agencies (Ambulance/EMT).
- Ensure the victim is accompanied to the medical institution and Human Resources Department is notified of the incident for contacting victim's family.
- Preserve the incident scene pending an investigation to be done by HSE personnel, Facility Manager and any affected persons as requested.

Electrical Incident

Shock/Electrocution

- Initiate the emergency response alarm system as outlined in the Emergency Response Plan and have someone (Security Officer/Co-workers) contact the Emergency Response Team and Response Agencies.
- Ensure it is safe to approach the victim and determine if the victim is in contact with an electrical source. If electrical appliance or system is in use, de-energize the appliance by turning off or removing the plug or isolating the circuit by turning off the breaker.
- Do not attempt to touch the victim until electrical energy is isolated.
- If power transmission lines are involved have someone call Guyana Power at +592 226-2600 and notify them of the incident and keep all personnel away until the arrival of the Guyana Power Emergency Crew
- Trained responders in First Aid upon arrival will assess the victim's condition for responsiveness and signs of circulation and administer the appropriate care.
- If the victim has no signs of circulation start CPR and send for the AED immediately and use upon availability
- If the victim is responsive do an assessment for injuries sustained from the electrical energy subsequent fall
- Treat all injuries and position the victim in the shock (supine position) with legs elevated 8-12 inches above the torso and maintain body temperature (cover with blanket or coat) and await the arrival of Response Agencies (Ambulance/EMT)
- Preserve the incident scene pending an investigation to be done by HSE personnel, Facility Manager and any affected persons as requested.

Fall from Elevation

- Initiate the emergency response alarm system as outlined in the Emergency Response Plan and have someone (Security Officer/Co-workers) contact the Emergency Response Team and Response Agencies.
- Ensure it is safe to approach the victim and determine if the victim is in contact with an electrical source. If electrical appliance or system is in use, de-energize the appliance by turning off or removing the plug or isolating the circuit by turning off the breaker
- If power transmission lines are involved have someone call Guyana Power at +592 226-2600 and notify them of the incident and keep all personnel away until the arrival of the Guyana Power Emergency Crew.
- Trained emergency responders in First Aid upon arrival will assess the victim's condition for responsiveness and signs of circulation and administer the appropriate care.
- If the victim has no signs of circulation start CPR and send for the AED immediately.
- If the victim is unresponsive and breathing do an assessment for injuries sustained from the electrical energy and fall from an elevation.
- Do not move the victim unnecessarily as they may have encountered a spinal injury from the fall. Support the head and use a cervical collar to support the head and neck in the position found.
- Treat the victim's injuries and keep in the position found, maintain body temperature (cover with blanket or coat) and await response agencies (Ambulance Services/EMT).
- Ensure the victim is accompanied to medical institution and Human Resources Department is notified of the incident for contacting victim's family.
- Preserve the incident scene pending an investigation to be done by HSE personnel, Facility Manager and any affected persons as requested.

Electrical Burns

- Initiate the emergency response alarm system as outlined in the Emergency Response Plan and have someone (Security Officer/Co-workers) contact the Emergency Response Team and Response Agencies.
- Ensure it is safe to approach the victim and determine if the victim is in contact with an electrical source. If electrical appliance or system is in use, de-energize the appliance by turning off or removing the plug or isolating the circuit by turning off the breaker.
- If power transmission lines are involved have someone call Guyana Power at +592 226-2600 and notify them of the incident and keep all personnel away until the arrival of the Guyana Power Emergency Crew.
- Trained emergency responders in First Aid upon arrival will assess the victim's condition for responsiveness and signs of circulation and administer the appropriate care.
- If the victim has no signs of circulation start CPR and send for the AED immediately
- If the electrical energy cause burns to the victim, assess the extent of the burn and treat appropriately.
- For electrical burns remove from energy source and cool the burned area (only for 1st and 2nd degree burns only) with cool water for at least 10 minutes.
- Remove clothing and jewellery from the burn area/s, if possible and place sterile dressings and bandages to hold dressings in place and await the arrival of the Response Agencies (Ambulance/EMT).
- Ensure the victim is accompanied to medical institution and Human Resources Department is notified of the incident for contacting victim's family.
- Preserve the incident scene pending an investigation to be done by HSE personnel, Facility Manager and any affected persons as requested.

Overhead Crane Incident

Dropped Object

- Initiate the emergency response alarm system as outlined in the Emergency Response Plan and have someone (Security Officer/Co-workers) contact the Emergency Response Team and Response Agencies.
- Ensure it is safe to approach the victim and there is no danger to you or others.
- If you are not a trained responder do not attempt to move the victim but stay with the victim until response personnel have arrived.
- If a trained responder in First Aid assess the victim's condition, check for responsiveness and signs of circulation and administer the appropriate care.
- If the victim is trapped and has no signs of circulation it may be difficult to administer CPR, send for the AED and use it immediately upon arrival.
- If an alternate lifting device is needed to remove dropped object, do so under the supervision and advice of medical trained personnel.
- If the victim is responsive do an assessment for injuries sustained.
- Isolate the crane at the energy source, following proper BHGE procedures.
- Treat crushing injuries and control bleeding. Do not attempt to move the victim.
- Preserve the incident scene pending an investigation to be done by HSE personnel, Facility Manager and any affected persons as requested.

Environmental Incident

Chemical Spill (Over 55 Gallons Outside of Containment)

- Initiate the emergency response alarm system as outlined in the Emergency Response Plan and have someone (Security Officer/Co-workers) contact Tiger Tanks Guyana Limited.
- Only HAZMAT trained personnel will evaluate and direct the response to a chemical spill or release of a hazardous material.
- Spills or releases shall be contained by using the emergency spill kits onsite.
- In the event that more than one chemical or waste is spilled, the mixing of materials should be prevented by using absorption socks / booms.
- All disposal and / or remedial action will be supervised by HSE to be in compliance with appropriate regulations.
- HSE will report spills or releases to the appropriate agencies per regulatory requirements.

Tsunami

- Initiate the emergency response alarm system as outlined in the Emergency Response Plan and have someone (Security Officer/Co-workers) contact the Emergency Response Team and Response Agencies.
- The designated taxi service will be used for personnel transport.
- Personnel will be transported to the nearest BHGE approved hotel (Mariott Georgetown or Ramada).
- Personnel must get to higher ground (either 2 miles away or 100 ft above sea level).

Section 5: Detection & Alarm Systems

Testing and Maintenance

The fire alarm system will be tested monthly by facility personnel. It is recertified and maintained by a third party service provider biannually. All fire extinguishers on the facility are recertified biannually by a third party provider

Section 6: Monitoring & Reviewing

Drills and Exercises

Emergency drills and exercises are carefully planned and have realistic scenarios to include the following:

- identification of emergency scenario
- employee actions and responses
- site evacuation
- personnel accounting
- medical assistance
- coordination with emergency services (optional, but recommended)
- internal and external notifications
- A copy of all documentation must be retained and includes:
 - names of participating employees.
 - minutes of a drill after action review meeting.
 - action plan and resolution of findings and recommendations.
 - changes to the EOP

Emergency Response Plan Review

Emergency responses, drills and exercises are evaluated and critiqued with an after action review at least biannually or after any change to determine the lessons learned and improvement actions. All relevant parties must be represented in after action reviews, e.g. drill observers, participating employees and supporting agencies. Actions are developed and assigned to address deficiencies and improvements.

Section 6: Appendix

Emergency Contact Phone Numbers

These listings are reviewed annually or if any changes are to be made.

CWI GUYANA EMERGENCY CONTACTS

TITLE	NAME	CONTACT
Technical Service Coordinator		
Dept. Administrator		
Country Manager		
Business Development Manager		

GUYANA EMERGENCY SERVICES

Service	Address	Contact
Police	Providence Police Station Public Road, Providence, East Bank, Demerara	911
Fire	Guyana Fire Service Water Street, Starbroek, Georgetown	912
Ambulance		913
Medical	Caribbean Surgery Inc. 270 Thomas Street	+592-227-2030/4778 (8:00 – 17:00) Emergency 24 hours: +592-641-1239
Hazmat	Tiger Tanks Limited	+592-501-0620 +592-608-9201
Taxi	Cyril Taxi Service	+592-226-6300
	Triple D's Transport	1-868—278-3400
Security	GEB Security Services	+592-233-5023 +592-233-6609

GUYANA UTILITIES

TYPE	EMERGENCY CONTACT NUMBER
Electricity (Guyana Power & Light)	+592 226-2600 Ext 1
Water (Guyana Water Inc.)	+592 328-2656

APPENDIX B: Spill Prevention and Control Procedure - Example

1.0 GENERAL SPILL PREVENTION AND CONTROL PROCEDURES

1.1 Location and Description of Emergency Spill Response Supplies

The facility is prepared to contain and recover a spill on-site. Supplies necessary for spill containment and recoveries are:

- shovels to construct temporary berms and containment depressions;
- secondary containment / barrier materials that will be used to encircle a spill and prevent migration; and
- sorbents such as mats, rags, socks and granules.

This equipment is maintained by the Incident Commander and is located near the potential spill areas identified on **Table 1**. Personnel are prepared to use spill kits properly during a spill event.

In the event that Baker Hughes Guyana facility cannot safely recover or contain the spill, Local contractor (To Be Determined) will be contacted for further assistance. The following information will be required:

- Name;
- Phone number calling from;
- Exact location of emergency; and
- Additional information regarding emergency (amount spilled, extent of impact to environment, fire, etc.)

Local Response Contractor: To Be Determined

1.2 General Application of Spill Response Supplies

The detailed facility Spill Response Procedure is documented in **Section 2.0** and the Emergency Response Contact List is provided in **Section 2.1** of this Plan. The general procedure for immediate response and control of minor spills on land, and the application of spill response supplies in these events is as follows:

- The spill area is evaluated for safety prior to responding.
- Barrier materials, such as spill booms, will be appropriately placed to keep spills from leaving the boundaries of the site and to keep spills pooled.
- Absorbent materials will be placed on the spill as needed to contain spilled material.
- Absorbent and barrier materials and any residual material remaining, will be collected and placed into approved and material compatible drums.
- Proper notifications to facility SPC and management will be verified.
- The drums will be transported by a licensed transporter to an approved disposal site in accordance with local Guyanese laws.

1.3 Personnel Training

The facility is responsible for training its personnel in the operation and maintenance of equipment described in **Table 1** and Section 1.1 and proper transfer procedures described in Section 1.6 to prevent the discharge of oil products. At a minimum, oil-handling personnel are trained in the operation and maintenance of equipment to prevent discharges; discharge procedure protocols; applicable pollution control laws, rules, and regulations; general facility operations; past reportable

discharges and failures; and, the contents of the facility Spill Prevention Plan. Site-specific Spill Prevention Plan training is given to all facility personnel annually, at minimum. The Incident Commander or the facility trainer will maintain training records as part of the company's Learning Management System (LMS).

The training will be conducted as follows:

1.3.1 Training Schedule:

- Initial assignment training for new employees
- Annual refresher training (periodic safety meetings).
- Special training sessions to be conducted for review of spill events or other events that trigger technical amendments to the Spill Prevention Plan.

1.3.2 Training Program Content:

At a minimum, oil-handling personnel will be trained in the following: the operation and maintenance of equipment to prevent discharges described in **Table 1**; transfer procedures described in Section 1.6; spill / discharge procedures and protocols; applicable pollution control laws, rules, and regulations; general facility operations; and contents of the facility Spill Prevention Plan. Annual training will highlight and describe known discharges or failures, malfunctioning components, and any recently developed precautionary measures.

1.3.3 Spill Response:

Any employee who identifies a spill will take action to control the spill and then will notify his/her immediate supervisor who will notify the Incident Commander. Emergency procedures and notifications are detailed in **Section 2.0** of this Plan and are reviewed during annual spill prevention training.

1.4 Storage Procedures

No storage container will be used unless its material and its construction are compatible with the material stored and the conditions of storage such as pressure, temperature, corrosivity, as well as other compatibility considerations. Drain valves for discharge of secondary containment are kept secured and closed when in non-operating or standby status. Pipe supports have been constructed to minimize abrasion and corrosion and to allow for expansion and contraction.

Table 1 provides detail on potential spill areas and secondary containment types and capacities for all oil-containing storage 55 gallons or greater.

1.5 Secondary Containment

Secondary containment is provided for all storage containers and compartments with a capacity of 55 gallons or greater holding oil-containing product (including waste and wastewater). **Table 1** provides detail on potential spill areas and secondary containment types and capacities for all oil-containing storage 55 gallons or greater.

Secondary containment structures and active containment materials are visually inspected on a monthly basis and recorded on the checklist provided. Any deficiencies are reported to management and maintenance and corrective actions assigned.

1.5.1 General Secondary Containment

The Spill Prevention requires General Secondary Containment for the following:

- Mobile refuelers
- Piping / Flowlines
- Transfer areas and associated Equipment
- Treatment / Separation systems
- Oil-filled Operational Equipment
- Oil-filled Manufacturing Equipment (*not flow-through process equipment*)

Areas, equipment and activities at the facility requiring general secondary containment must be designed to the following minimum standards:

- provide appropriate containment and/or diversionary structures to prevent a discharge in quantities that may be harmful and
- address the most likely quantity of oil that would be discharged from the primary containment system (e.g. container, storage tank, oil-filled equipment, tanker truck largest compartment, etc.).

General secondary containment may be either active (monitoring and active control measures) or passive in design (fixed containment).

1.5.2 Sized Secondary Containment

The Spill Prevention requires Sized Secondary Containment for the following:

- Bulk Storage Containers

Sized Secondary Containment is designed to contain a catastrophic failure and must be designed to the following minimum standards:

- Designed to hold 110% of the largest container's or compartment's shell capacity;
- Include displacement of any additional containers, piping, etc. stored in the secondary containment;
- Must be sufficiently impervious to contain discharged oil.

1.6 Transfer Operation Procedures (material loading / unloading)

1.6.1 Terminal Connections

The Guyana facility will cap or flange any terminal connections at the transfer point and mark them as to origin when piping is not in service or is in standby service for an extended period of time.

1.6.2 Design of Pipe Supports

Pipe supports are designed to minimize abrasion and corrosion and allow for expansion and contraction.

1.6.3 Inspection of Aboveground Valves, Piping and Appurtenances

The Guyana facility performs monthly visual inspections of aboveground valves, piping, and appurtenances at the facility. Inspections include the general condition of items, such as flange joints, expansion joints, valve glands and bodies, product transfer pumps, catch pans, pipe supports, locking of valves and metal surfaces. Hoses are replaced on a 6 month basis.

1.6.4 Protection of Aboveground Piping and Other Transfer Operations from Vehicular Traffic

The Guyana facility provides warnings for traffic related to loading/unloading operations at the facility.

Table 1 identifies all Potential Spill Areas to include material transfer areas and secondary containment measures. All facility personnel will ensure that the following general precautionary measures are taken during transfer procedures in all areas of the facility:

- No smoking in the vicinity of flammable and/or explosive tanks, drums or carrier vehicles;
- Transferring vehicle will set parking brake or set wheel chocks to prevent vehicles from departing before complete disconnection of transfer lines;
- Verify that the volume being transferred is less than the unfilled volume of the receiving container;
- Trained personnel will conduct and/or oversee the transfer operation; and
- Clean up any material dripped or spilled during the transfer.

1.7 Overfill Prevention Systems

The Guyana facility constantly attends its operation. Active secondary containment, visual monitoring and communication procedures for transfer operations will be used to ensure fast response to overfill hazards.

1.8 Facility Inspections

Monthly visual inspections of all potential release areas are conducted. These monthly inspections are conducted by an HSE Representative, HSE Area Manager, Facility Manager, Incident Commander, or their designee. Visual inspections of potential oil spill areas include assessment of the physical condition of containment structures, storage containers 55 gallons or greater in capacity, aboveground appurtenances, and transfer equipment.

At minimum, these routine inspections comprise bulk storage containers holding oil-containing materials, applicable oil-containing equipment, associated aboveground valves, piping, appurtenances (including flange joints, expansion joints, valve glands and bodies, catch pans, pipe supports, locking of valves, and metal surfaces), secondary containment structures and closures, discharge control and overfill prevention equipment, active containment and spill control materials (spill kits), and storage container / tank supports and foundations.

Site specific Facility Inspections for Baker Hughes Guyana include the following:

- Bulk Storage tanks
- Drums
- Transfer stations
- Oil Water Separator
- Piping, hoses, and supports
- Loading and unloading areas
- Spill Response Equipment
- Secondary containment structures

The inspector will observe all of the above to confirm they are in good condition and assess the overall integrity of all bulk storage, transfer and loading / unloading areas.

Inspection findings will be reported, at a minimum, to the Facility Manager, Incident Commander and the HSE Area Manager. In the event any leaking or spilled material is observed, facility response and reporting procedures detailed in Section 2.0 will be promptly followed. Any other corrective actions or deficiencies identified during the inspection will be corrected in a timely manner.

1.9 Integrity Evaluation & Testing

The facility conducts non-destructive integrity evaluation / testing for bulk storage containers as required by the following industry standards.

Table 2 details the routine schedule for integrity testing and inspection of aboveground bulk storage containers and tanks at this facility (you may reference a separate document or procedure if the facility has developed a facility integrity testing procedure or plan). In addition to the schedule, inspection will be conducted after any material repairs on bulk storage containers and aboveground tanks, and integrity testing may also be required dependent upon the type of tank and applicable industry standards.

2.0 EMERGENCY PROCEDURES AND NOTIFICATIONS

In this section describe procedures you will use when a discharge occurs in a way that will make them readily usable in an emergency.

2.1 Emergency Response Contact List

Personnel/Agency	Contact
Facility Manager	To be determined LMP Georgetown, Guyana
Incident Commander (IC)	Plant Manager - To be determined LMP Georgetown, Guyana
HSE Area Manager	Anastasia Ramnath 3-3A Sweet Clair St Clair, Port of Spain Phone: (868) 697-4252
HSE Local Representative	To be determined LMP Georgetown, Guyana
BKRG – Environmental Support	Michael Henderson 12645 West Airport Blvd Sugar Land, Texas Phone: (281) 275-7391
Hospital	Caribbean Surgery Inc. 270 Thomas Street Phone: (592) 641-1239
Law Enforcement/Police	911
Fire Department/Ambulance	912
Physician	913
Environmental Protection Agency	Phone: (592) 222-2062
Clean-up Contractor	To be determined

2.2 Spill Countermeasures & Emergency Procedures

The goal with all emergency response is to protect life, health, and the environment.

Several steps must be taken to insure that an incident and the impact of an incident are minimized. However, employees should use their best judgment and, if necessary, take other actions to prevent further damage.

Immediate Response Actions

1. Evacuate / Secure the Site

- Safety first – if needed, remove yourself to a safe location
- Notify a supervisor and or the Incident Commander
- Evaluate the extent of the release and potential impacts to personnel, equipment and off-site environmental receptors.

If serious, sound alarms, contact supervisor, evacuate and account for all personnel

- Determine if outside support is needed and make calls. Direct emergency equipment to the emergency site.
- Immediately secure site from visitors, media, and unauthorized personnel.
- Station yourself at an accessible telephone. Where radio communication exists, station yourself where you may remain in contact via radio and telephone.

2. Identify / Contain / Secure the Source

- Determine pertinent facts, severity and urgency of the problem and check actions that have been implemented. Include the location of the discharge, the type of material discharged, the quantity of material discharged
- Contain product and prevent ignition. Take note of all safety considerations prior to securing the source and do not put personnel in jeopardy to secure the source.
- Review safety hazards and requirements with supervisor and employees.
- Standard operating procedures should be followed for the emergency shutdown of all affected equipment.
- If personnel with adequate training in discharge response are available, contain the discharge to prevent it from reaching navigable waters (such as seas, rivers, lakes, streams, and wetlands), and try to stop the discharge, if possible. Otherwise, summon additional trained personnel to respond to the discharge.

3. Incident Commander (IC)

The IC will review the information available and determine if further action is needed. Management will then notify, as directed by the IC, local emergency response agencies and those agencies requiring immediate verbal notification. The IC will oversee and coordinate the efforts of on-site staff, including Operations, Mechanical, Engineering, Maintenance, Public Relations, Security, and Safety personnel, as well as outside emergency contractors and agencies involved in emergency response and clean-up.

Jointly with emergency responders at the scene, the IC will decide containment and clean-up methods for any spill or release of oil, hazardous materials or hazardous substances. In addition,

the IC will determine if assistance from external emergency response contractors is needed, and if so, the IC will be responsible for making the necessary arrangements.

4. Discharge Notification

All spill reports are documented and can be found in Baker Hughes' incident management database system known as Gensuite. Attachment H contains an example of this spill report and the information that is required.

5. Incident Follow-up – WASTE DISPOSAL

All wastes generated will be managed in compliance with the requirements of Federal (RCRA), State and local health department guidelines. Response Management System, based on the type and location of the discharge, and will be disposed of by qualified personnel.

Specific Incident Mitigation General Steps

1. Equipment Failure

- Shut down any pumps.
- Isolate equipment by closing block valves.
- Identify emergency site locations and make assessment.

2. Tank overfill or failure

- Shut down any deliveries into the tank.
- Check all secondary containment devices, i.e. dikes.
- Transfer out of tank, if conditions are safe.

3. Fire or Explosion

- Contact fire department (912)
- Notify supervisors to shut down any equipment that may be implicated with the fire.
- Notify the Incident Commander.
- Provide assistance to any injured employee or individual. If there is any imminent danger, local law enforcement should be contacted for evacuation of area residents.
- Instruct any contractors on site to discontinue activities. Instruct contractors to stand by their vehicles and wait for instructions to move to safe area, if necessary.
- Shut off pumps.
- Shut off power to electrical panels.
- Close valves for the tanks in the tank farm.
- Extinguish fire – if practical (not beyond incipient state), attempt to control fire with portable equipment on hand until the fire department arrives. Unless specifically trained and current with training requirements, Company personnel are not qualified to fight fires of any significance.
- Stand by at a safe distance to direct the fire department to the scene of the fire and keep personnel and vehicles from entering the danger area.

- After fire has been extinguished, determine possibility of re-ignition.

4. Recovery of Released Product

- Make an initial assessment of the situation and mobilize the necessary company and contract resources to the scene.
- Make arrangements to stop pollution; obtain equipment to build dams, siphons, skimmers, trucks, etc. while awaiting repair crews. Stop potential water pollution by whatever means necessary.
- Review actions which have been taken, contractors, personnel, equipment and repair materials that have been employed. If necessary, dispatch additional personnel to assist.
- Locate contractors, personnel, equipment and repair materials. If necessary, dispatch additional personnel to assist. Check to insure requested equipment and repair material is sufficient to meet requirements.
- Establish meeting points for contractor and personnel and provide directions to site. Require contractor worker training records or proof of sufficient training to be faxed or provided upon arrival.
- Supervise contract help in repairs, recovery of product and clean-up.
- Assemble costs of repair as soon as possible, including cost of company personnel and equipment.

Tables

Table 1 – Inventory: Potential Spill Areas

Area ID & Description	Container Count & Capacity (bbl)	Contents/ Material	Failure Modes	Secondary Containment Method	Secondary Containment Capacity (bbl)	Direction & Rate of Flow (outside of containment)	Transfer Operations & Frequency
Typical Diesel Tank	1 (500 gals)	Diesel	Rupture Spills/ Leaks/ Transfers Overfill	TBD	110%	All fluids on property discharge towards the back	Diesel is transferred using enclosed piping

Table 2 – Integrity Testing & Inspection Schedule: Aboveground Bulk Storage Containers & Tanks

Area ID	Container Count & Capacity (bbl)	Container Type & Material	Date of Install	Type of Integrity Testing & Inspection	Frequency	Testing & Inspection Qualifications	Buried piping and appurtenances
Typical Diesel Tank	1 (500 gal)	AST – Steel - Diesel	TBD	Inspect for visual integrity (Monthly Visual Inspections Checklist)	Monthly	SPCC internal training	N/A

Monthly Visual Inspection Checklist

Facility Visual Inspection Checklist						
Print Inspector's Name:			Inspector's Signature:			
Inspection Date:			Facility Name / Location:			
<u>GENERAL</u>						
Spill Containment and Response equipment is accessible:					Y / N	
SPILL PREVENTION Plan & Facility Emergency contact information is available:					Y / N	
Facility security measures are in place and in good working condition, including fencing, gates, lighting and secure alarm systems:					Y / N	
<u>TANKS / CONTAINERS / BULK STORAGE AREA</u>						
Tank/ Container or Area ID or #:	ID:	ID:	ID:	ID:	ID:	Comments:
Tank/ Containers and visible supports / foundations are in good condition, free of signs of damage, leaking, corrosion, or other deterioration:	Y / N	Y / N	Y / N	Y / N	Y / N	
Tank/ Containers are labelled with contents:	Y / N	Y / N	Y / N	Y / N	Y / N	
Tank/ Containers are compatible with material stored inside:	Y / N	Y / N	Y / N	Y / N	Y / N	
Tank/ Containers are kept closed/ sealed when not in use:	Y / N	Y / N	Y / N	Y / N	Y / N	
Tank/ Container piping, appurtenances are in good condition and inside containment:	Y / N	Y / N	Y / N	Y / N	Y / N	
Gauges are free of moisture:	Y / N	Y / N	Y / N	Y / N	Y / N	
Secondary containment is in good condition, clean and free of residual liquid, staining and debris, and there are no signs of leaks/drips, deterioration or damage:	Y / N	Y / N	Y / N	Y / N	Y / N	
Secondary containment drainage valve is closed / locked and secure:	Y / N	Y / N	Y / N	Y / N	Y / N	
Spill kits are in place and adequately stocked nearby:	Y / N	Y / N	Y / N	Y / N	Y / N	
Tank/ Container vents are visible and free of dents and obstruction:	Y / N / NA	Y / N / NA	Y / N / NA	Y / N / NA	Y / N / NA	
The proper functioning of overfill prevention systems has been verified:	Y / N / NA	Y / N / NA	Y / N / NA	Y / N / NA	Y / N / NA	

TRANSFER AREAS

		Comments:			Comments:
Piping & connections are tight and secure:	Y / N		Area is free of spills:	Y / N	
Piping is free of deterioration, rips, tears, leaking:	Y / N		Loading / unloading Racks are in good condition and free of damages:	Y / N	
Pipes not in service are capped and marked as to origin:	Y / N / NA		The proper functioning of emergency cut-off equipment has been verified:	Y / N	
Nozzles/ valves/ manual closures are secure and closed when not in use:	Y / N / NA		Active discharge containment / control materials are adequately stocked and available for use:	Y / N	

CORRECTIVE ACTIONS

Description of Deficiency	Person Responsible	Corrective Measures Implemented	Date Corrected

Baker Hughes – Guyana
General Performance Specifications
As Amended January 28, 2020

Division 1 - General Requirements

- a. Supervision by experienced Superintendent.
- b. Project and construction management
- c. Builder's risk to full value of construction contract
- d. Errors and omissions insurance for General Contractor and all design professionals.
- e. Quality Assurance Testing – concrete, compaction, standard Proctor density, radiography
- f. Temporary Facilities/utilities
- g. Freight – trucking and couriers
- h. Safety Management – for all personnel and vendors under contract to the Landlord or General Contractor
- i. Architectural / Engineering design in compliance with the federal, state and local building and fire codes. In the event no applicable code governing then International Building Code 2015 will apply.
- j. Building permits in compliance with the federal, state and local building and fire codes.
- k. Development permits.
- l. Geotechnical report.
- m. Legal and topographic survey.
- n. Project management schedule to be provided.
- o. Baker Hughes HS&E, Security, BHBSS IT, and furniture to be involved to provide input on these respective areas.
- p. Obtain approval from Baker Hughes on all items not meeting requirements as per the enclosed list.
- q. Any items not covered in these specifications shall meet local requirements (see enclosed).

Division 2 – Site work

- a. Stripping of top soil and grubbing as required.
- b. Rough grading of site to design subgrade elevations to ensure positive surface drainage.
- c. The future surface slope of future outside areas (yard, parking, etc.) shall not exceed a maximum of 6% and shall not drop below a minimum of 2%.
- d. Stock piling of excess material on areas of the site left vacant for future development and in landscaped areas where permitted. Excess material to be removed from site.
- e. Paving design for light duty (Car Parking) paved areas to be min 5” or in accordance with recommendations of geotechnical report.
- f. Paving for heavy duty paved areas to be at a minimum 8” thick and steel reinforced or developed in accordance with recommendations of geotechnical report and to be designed to meet the loading requirements imposed by loaded 10-ton forklift, aware of special needs.

- g. Provide curbs to protect landscaping in paved areas.
- h. Excavation and backfill of grade beams and other grade level concrete structures.
- i. Utility services line excavation and backfill.
- j. Sub-structure base under concrete floor slabs to meet recommendations of geotechnical report.
- k. Foundations – design and construct to meet geotechnical report.
- l. Landscaping including placement and leveling of native site topsoil for landscaped areas. Quantity and types of trees and shrubs to meet with requirements of the municipality.
- m. Sod and underground sprinkler system in areas immediately around office; hydro seeding of remaining areas of the site.
- n. Perimeter boundary wall/fencing as required.
- o. Approaches to the site in accordance with the requirements of the municipality.
- p. Water service, sanitary sewer service, underground storm sewer service (where available), natural gas service (where applicable), electrical service and telephone service. Landlord responsible to bring to site.
- q. Utility connection fees levied by municipality or utility.

Division 3 – Concrete

- a. Quality assurance testing including slump, strength and air.
- b. Building foundations to accommodate crane loading/column conditions and designed to recommendation of geotechnical report.
- c. Concrete specifications to meet recommendation of geotechnical report.
- d. Water – cement ratios per the structural engineer's requirements.
- e. Oil / water separator sump to process shop effluent by separating oil from water shall meet either Baker Hughes Corporate standards or local code whichever is most stringent. To ensure oil/water separator's concrete specifications to meet requirements for geotechnical report as well.
- f. Air entrainment admixtures per the structural engineer's requirements.
- g. Concrete floor slabs to be minimum 8" thick with steel reinforcement designed in accordance with the geotechnical report and structural engineer. Slab to be flat in workshop and 2-3% in wash down areas.
- h. Sawcuts for crack control in shop floor.
- i. Non-shrink grout on a cementitious basis under structural steel base plates
- j. Chamfer external exposed concrete edges excluding grade beams in buildings.
- k. Sumps to be sized for adequate sediment and oil storage capacity at design flow rates. Trenches are to be 12" clear width with fork lift rated steel grating.
- l. Concrete floor slabs to meet design by structural engineers for breakout machines, vices, push / pull installations.

Division 4 – Masonry

- a. Comply with standards of the local industry trade association and applicable technical standards.
- b. Standard hollow concrete load bearing blocks or equivalent.
- c. Reinforcing and concrete filled cores to the requirements detailed on the structural drawings.
- d. Concrete block serving as part of the building envelope.

Division 5 – Structural Steel and Miscellaneous Metals

1. Building Structure (if applicable and alternate to division 3)
 - a. Column/grid placement to be determined by initial space planning.
 - b. Inspection to local regulatory requirements.
 - c. Frame, deck, and reinforcements to meet structural engineer requirements.
 - d. All exposed steel to receive steel corrosion resistance.
 - e. Eave height set at height required to accommodate specified crane hook height.
2. Miscellaneous Metals
 - a. Roof access ladder.
 - b. Trench and sump grates to be designed for heavy forklift traffic.
 - c. Transformer protection bollards and rail.
 - d. Handrails for stairs and fall protection barrier.
 - e. Concrete filled 8" (200cm) steel pipe protection bollards on interior and exterior of building overhead door openings. Bollards will be buried 4' (120cm) and will project out of the ground 4' (120cm).

Division 6 - Carpentry

1. Millwork
 - a. Coffee and washroom millwork to local industry association standards including upper and lower cabinets with plastic laminate finish.
 - b. Anti-moisture/anti-termite per local practice.
 - c. Counter tops to be engineered solid surface material or natural stone.
2. Rough Carpentry
 - a. Parapets with pressure treated plywood backing.
 - b. Wood backing for wall mounted fixtures and accessories.
 - c. Pressure treated wood backing strips around window openings for securing air and vapor barrier.
 - d. Pressure treated wood curbs for mechanical and architectural roof openings in built up membrane roof systems.

Division 7 – Weather Protection

1. Roofing
 - a. Roofing system type and specifications vary depending on geographic location and building type and local codes. Landlord shall provide a roofing system that has a minimum life of 20 years and meets local trade industry standards with a 5-year industry association guarantee. Roof should have light color.
2. Insulation / Vapor Barrier
 - a. Wall and roof systems construction to be determined depending on local conditions and availability of materials. The insulation value for structural elements and other components (walls / roof, windows, etc.) shall have a minimum K-value subject to local conditions.
 - b. Vapor barrier should also follow local practice. Materials and wall systems to be water resistant.

3. Fire Proofing
 - a. Fire stopping and structural member protection per code requirements, if any.

Division 8 - Doors/Windows

1. Doors
 - a. Minimum 3' X 7' (915mm x 2100mm) hollow metal doors complete with vision panels in pressed steel frames in shop area. Exterior doors will have insulation filled cores.
 - b. Minimum 3' X 7' (915mm x 2100mm) stain grade or plastic laminate office doors on wood or aluminum frames.
 - c. Exterior doors fitted with 3 hinges, closer, check chain, threshold, weather-stripping, lockset and dead bolt with provision for future electric strike.
 - d. Toilet doors fitted with closers, a push, a pull, kick plates and a door stop.
 - e. Interior doors in shop and between shop and office will be fitted with 3 hinges, closer, kick plates, doorstop, threshold and weather stripping.
 - f. Offices will have passage sets except where locksets are required.
 - g. Doors in fire separations to be fire rated and labeled for the separation requirements and complete with a closer.
2. Overhead Shop Doors
 - a. 14' X 16' (4260mm x 4880mm) prefinished full view glass panel steel overhead doors with 3" (75mm) heavy-duty hardware with high lift, as required, complete with electric operator, pneumatic safety switches.
 - b. In buildings without heating systems, or A/C, uninsulated steel roller doors are acceptable.
 - c. High speed roll up doors to be considered.
3. Glazing
 - a. Office windows to be tinted double glazed low E with anodized or powder coated insulated aluminum frame with internal thermal break.
 - b. Exterior windows around office as per design.
 - c. Mirrors are provided for all toilet rooms.
 - d. Window sills at approximately 3'-4' (90-100 cm) above floor.
 - e. Window height approximately 5' (150 cm).
 - f. Windows not openable if building fully air-conditioned.
 - g. Glass-doors and glass-partitions made out of safety glass

Division 9 – Finishes

1. Gypsum Wallboard Systems
 - a. Painted drywall interior steel stud partitions in all office areas including those in the Shop areas. Partition bottom track mounted on floor slab with allowance in top track for reasonable floor movement.
 - b. Conference room, toilet room and change room partitions will be filled with acoustic insulation and extended to the underside of metal deck for industry standard STC rating.
 - c. Fire partitions constructed to required rating.
 - d. Drywall not part of a finished space is unpainted and untapped unless part of a fire separation in which case it will be fire taped.
 - e. Provide sample selection board for finishes selection.

3. Suspended Ceiling Systems – Where Applicable
 - a. Standard off white T-bar ceiling 2'X2' (600mmX600mm) grid system with acoustic ceiling tile 5/8" (15mm) tegular type in private offices, open office areas, conference rooms, meeting rooms and toilet rooms.
 - b. Space between suspended ceiling and structural ceiling (slab) as per MEP requirements
 - c. Minimum ceiling height to be 9' (2.75m).
4. Paint
 - a. Paint partitions.
 - b. Bollards painted safety yellow.
5. Flooring
 - a. Flooring for private offices, open office areas, conference room and meeting rooms will be 28-oz. solution dyed carpet with vinyl base.
 - b. Carpet Selection Shaw Contract – Beyond the Edge / Folded Edge 5T062 – 18"X36"tile – 60764 Global Leather
 - c. Office toilet to have ceramic, quarry tile, or porcelain tiled floors.
 - d. Change rooms to have concrete floors for workshop toilet and change rooms.
 - e. Concrete and sealing for workshop floor.
 - f. Coffee stations, break room, storage and file rooms, shop offices and the network room will have premium VC tile with vinyl base.
 - g. Vinyl Tile Armstrong Premium Execlon- Crown Texture
6. Wall Tile
 - a. All toilet room walls will be surfaced to a minimum 7' (2100mm) above floor with ceramic tile.
 - b. Breakroom cabinet area backsplash to be Daltile Color Wave Glass tile

Division 10 – Specialties

1. Reception Area.
 - a. Signage to be placed behind receptionist. Lobby area to be upgraded and design of reception area to be approved by Baker Hughes.
2. Toilets
 - a. Prefinished toilet partitions.
 - b. Washroom accessories.
 - c. Automatic flushers at urinals
 - d. Automatic sensors for hand wash
 - e. Towel disposal by providing a bin underneath the counter and a hole in the counter.
3. Change Rooms (male & female)
 - a. Prefinished metal lockers; size to be determined
 - b. Locker benches.
4. Miscellaneous
 - a. Access doors.

- b. Fire extinguisher cabinets per code.

5. Building signage (outside façade) to be back lid where applicable

Division 13 - Special Construction

Pre Engineered Structure

- a. Primary Framing: Shop fabricate framing components to indicated size and section with baseplates, bearing plates, stiffeners, and other items required for erection welded into place. Cut, form, punch, drill, and weld framing for bolted field assembly. Finish shall be shop primed "Grey" unless in regions of a corrosive natural in which hot galvanized will be finish
- b. Secondary Framing: Shop fabricate framing components to indicated size and section by roll-forming or break-forming, with baseplates, bearing plates, stiffeners, and other plates required for erection welded into place. Cut, form, punch, drill, and weld secondary framing for bolted field connections to primary framing. All secondary framing to be galvanized.
- c. Eave height set at height required to accommodate specified crane hook height (16' AFF).
- d. Exterior wall panels to be two sided pre-engineered metal insulated sandwich panels. Baker Hughes will accept alternate exterior wall designs – including but not limited to PEMB Panels and vinyl face batt insulation
- e. Roof system to an insulated standing seam system – with wind uploading per local code and insurance requirements. Baker Hughes will accept alternate roof systems including but not limited to screw down PEMB panels with vinyl faced insulation.
- f. Prefabricated gutters and downspouts (heat traced as required by climate)

Division 14 – Hoisting Equipment

- a. The hoist shall be equipped with an electro-mechanical load-limiting device that shall prevent lifting more than 110% of the rated load.
- b. Hoisting motor(s) shall be two-speed 2 / 8 m per min (6 / 26 ft per min)
- c. Hoist cross travel shall be two speed 5 / 20 m per min (16 / 66 ft per min)
- d. Crane travel shall be two speed 6 / 25 m per min (19 / 82 ft per min)
- e. Trolley shall be furnished with an adjustable frequency inverter drive and two-step or infinitely variable speed control for smooth acceleration and deceleration.
- f. Hoist motor brake shall be DC disc type with adequate torque to stop and hold over 125% of the hoist rated load.
- g. Large diameter rope drum with a minimum of 36:1 drum to wire rope diameter ratio. Groove depth shall be at least 35% of rope diameter. The rope drum shall be equipped with a rope guide to help keep the rope aligned in the grooves of the drum. Wire rope shall be constructed from galvanized steel having a minimum safety factor of 5.
- h. Hoist reeving shall be single reeved. Lateral hook drift shall not exceed 1/8 inch per foot of vertical travel on single reeved models.
- i. Hooks shall be made of forged alloy steel and shall be fitted with a spring-loaded flipper-

- type safety latch.
- j. Trolleys shall have safety drop lugs and energy absorbing bumpers.
- k. Power supply for the hoist shall be 480 volt, 3 ph., 60 Hz. All power required for the operation of the hoist, trolley, and end trucks shall be developed from this source.
- l. Runway electrification shall be 4-bar safety type rigid conductors as manufactured by Insul-8, Duct-O-Wire Company or W amplifier. Wall mounted disconnect switch and power to runway conductors provided by Electrical Contractor.
- m. Wireless remote control required
- n. Pendant shall include Start (momentary) button and Emergency Stop (push to maintain, turn to release) that controls a mainline contactor in the bridge control panel.
- o. Six-way operation, plug-in pushbutton pendant suspended from independent festoon track.
- p. Pushbutton shall be clearly marked with hoist, trolley and bridge travel directions.
- q. Hoist shall be 2 speed magnetic reversing type.
- r. Proximity limit switches required

Division 15 - Mechanical

1. Heating & Ventilation

- a. HVAC systems to maintain space temperatures at 22 deg. C with proper zoning to maintain required space temperatures evenly throughout office facility, change rooms, toilets, and workshop at 29 degrees
- b. HVAC controls in office buildings required
- c. R410 is the cooling media.
- d. Heating systems for shop and warehouse to be radiant heaters in local climates where temperatures dictate requirement. Where design heating temperatures are warmer, forced air heating systems are acceptable.
- e. Destratification circulating fans
- f. AC for computer room depends on size and heat load.

2. Plumbing

- a. Roof water to be exhausted via gutter or oversailed details dependent on location.
- b. Shop roof gutter downspouts are piped into the building and drained under slab to the drainage ditch or underground storm sewer drainage system... This is provided to reduce the hazards from ice build-up on the exterior aprons resulting from downspout drips during winter freeze thaw cycles. It will also mitigate potential high plastic native soil heaving effects by transferring roof runoff away from the building and thereby maintaining a more consistent soil moisture content.
- c. Installation of Baker Hughes supplied compressors, one compressed air storage tank and two refrigerated air dryers, including wiring and piping. Compressor capacity to be determined by division. Provide compressed air outlets as required.
- d. Installation of Baker Hughes designed Waste Water & Oil System.
- e. Installation of Baker Hughes supplied pressure washer package including power wiring, control wiring and piping. Installation of Baker Hughes supplied pressure washer wand or pressure hose reels.
- f. Domestic hot water heater to serve the office washrooms, break room and shop change room.
- g. Electric domestic water heater for remote shop locations requiring hot water
- h. Domestic hot water recirculation system in office area.

3. Water, Sanitary Sewer, Storm Sewer

- a. Water, sanitary sewer, storm sewer, etc. service to be provided as required by local codes.
 - b. Fire fighting as required by local code.
4. Ventilation Systems
- a. All occupied areas are ventilated to local industry standards.
5. Mechanical Insulation - Thickness
- a. Domestic cold water piping above finished ceilings –1” (25mm)
 - b. Domestic hot water and hot water recirc. piping – 1” (25mm)
 - c. Combustion and outside air ducts in cold climates – 2’ (50mm)
 - d. Supply air and return air ducts located outside of building envelope in hot and humid climates– 2” (50mm)
 - e. Supply and return plenums attached to roof units and makeup air units – 1” (25mm) acoustic
 - f. Exhaust plenums on exhaust fans mounted outside of building envelope – 1” (25mm) acoustic to mitigate condensation and reduce fan noise.
 - g. Office roof drainage piping for first 3m from roof drain in cold climates– 1” (25mm)
 - h. All exposed pipe and duct insulation is canvassed.

Division 16 - Electrical

1. Service
- a. Provided from service transformer and sized to code requirements.
 - b. Preferred service is 480v 3 phase or equal
 - c. One 8 wire power cable to each group of 6 work stations. Work stations are pre-wired with 4 hot, 2 neutral and 2 ground (earth) for 115Volt-System
 - d. 220V system: 1 circuit for 4 workstations
 - e. Backup Generator power set with automatic transfer switch required in locals with inconsistent power grids.
2. Lighting
- a. Office lighting using 2’X4’ (600mm x 1200mm) recessed energy efficient LED fixtures to 450 lux.
 - b. 2’X4’ (600mm x 1200mm) recessed LED fixtures in change room, work room to 300 lux.
 - c. Lab space (electronic or mechanical) should have 700 lux.
 - d. Washrooms, change rooms, coffee areas and the Break Room lighting using recessed energy efficient LED fixtures.
 - e. Clear area and inventory area lighting using recessed LED fixtures
 - f. Automatic light turnoffs to be provided in Offices.
 - g. In workshop area use energy efficient LED fixtures providing a light intensity of 350 lux.
 - h. Emergency lighting to be provided to the requirements of local codes.
 - i. Exit light to be provided to the requirements of local codes.
 - j. Provide LED site lighting to site storage yard at 34 lux and parking area at 15 lux.
 - k. Provide power to one pedestal, pylon, or building mounted sign as required by local division.
3. Power Conduit and Wiring - Interior
- a. Provide additional service receptacles throughout the office as required.
 - b. Details will be provided by Baker Hughes to contractor on specialist equipment.

- c. Provide floor boxes in meeting / conference rooms
 - d. Computer room fire resistant (walls & door), air-conditioned.
 - e. Computer-data rooms as per layout.
 - f. Power will be provided to the various pieces of Baker Hughes provided equipment
 - g. Provide for all building mechanical loads including air conditioning, shop equipment, crane, etc.
4. Fire Alarm System
- a. An addressable monitored fire alarm system to be supplied installed and tested to the requirements of local codes.
5. Voice and Data -
- a. One voice / data receptacle box will be provided per private office and as further noted on the Utility Drawing. Provide conduit from the box into the ceiling space. Each box to have 4 wire receptacles.
 - b. Other voice / data receptacle boxes to be provided where noted on the Utility drawing.
 - c. Two (2) data and one (1) voice outlet in each office, work station, and receptionist area... Provide all voice and data cabling using Cat 5e or Cat6. Include supply and installation of termination rack (patch panel).
6. Security Conduit – Details will be provided by BH Security
- a. An empty security conduit system to be provided throughout the Office, Lab and Stores areas and Shop to permit wiring for each man door and overhead door contact and card access device and from motion detectors to the security panel located in the Network Room. Conduit will be extended to the yard truck entrance gates.
 - b. A conduit system complete with wire will be provided for a video surveillance system.
7. Typical Equipment - Listed below are some of the tools and equipment typically found in Baker Hughes Facilities.
- **Torque machine 30 to 100 amps (104kva) at 3 phases 480 volt.**
 - **Hydro vise 30 amp (31kva) at 3 phase 480 volt.**
 - **Wash tank 20 amps (21kva) at 3 phase 480 volt.**
 - **Pressure Washer (25kva) at 3 phase 480 volt.**
 - **Blast Cabinet (25kva) at 3 phase 480 volt.**
 - **Overhead doors 20 amp (21kva) at 3 phase 480 volt.**
 - **Overhead Cranes 30 to 60 (63kva) at 3 phase 480 volt per bay.**
 - **Jib cranes 30amps (31kva)at 3 phase 480 volt**
 - **Stream cleaners 60 to 80 amps (83kva) at 3 phase 480 volt**
 - **Air compressor 60 to 200 amps (208kva) at 3 phase 480 volt**
 - **Sump Pump (1.5kva) at 120 volt**
 - **OVENS- numerous sized and voltages. Sizing should be specific to location.**
Typically they are 30 to 100 amps (104kva) at 3 phases 480 volt but can be single

phase 120 or 208 volt.

- **Welder direct connect and outlets, (63kva) at 3 phase 480 volts**
- **Each equipment location SHALL have a double duplex outlet on a dedicated 120 volt circuit for testing and repair use.**
- **A disconnecting means is necessary within sight of and less than 50' of each piece of equipment/tool, High, in-rush motor starting currents, can be common on equipment at or over 100kva, and require special consideration, in the design stage**

APPENDIX D: Total Volumes of Materials Stored in Warehouse

Material	UOM	Volumes of Materials		
		1 Well (Shallow)	1 Well (Deep)	6 Wells (3 Shallow, 3 Deep)
BIO-COTE	gal	128	256	1,152
BIO-LOSE	lb	150	300	1,350
BLACK MAGIC	lb			
BRINEPAC XTS	gal			
BRIDGEFORM	lb			
CALCIUM CHLORIDE PWD 97%	lb	1,200	2,800	12,000
CARBO-GEL	kg	600	1,000	4,800
CARBO-GEL II	lb			
CARBO-TEC S	gal	4	8	36
CAUSTIC POTASH	lb			
CAUSTIC SODA	lb	25	50	225
CHEK-LOSS PLUS	lb	24	48	216
CHEK-LOSS PLUS	lb			
DEEP SWEEP	lb			
DEFOAMER	gal			
DESCO	lb			
ECCO BLOK	lb	200	400	1,800
EVAPORATED SALT	lb	550	1,100	4,950
EVAPORATED SALT	lb			
GT-3000	gal			
HSW 700 (PETROSWEET)	gal			
KOMPRESS	kg			
LC- LUBE	lb			
LC-LUBE FINE	lb			
LD-9	gal			
LIGCO	lb			
LIME	lb	120	240	1,080
MAGMA-TROL	lb	80	160	720
MIL-BAR™	lb			
MIL-BAR™ 410,	lb			
MIL-BAR™ 410, BULK CWT	CWT			
MIL-BAR BULK	CWT	64,000	128,000	576,000
MIL-BAR™ 410 BB 1.5 MT	bbl			
MIL-BAR™ BB 1.5 MT	bbl			
MIL-GARD	lb			
MIL CARB 600	lb			
MIL PLUG MEDIUM	lb			
MIL SEAL (C)	lb			
MIL SEAL (M)	lb			
MIL-CARB	lb			
MIL-CARB 150	lb			
MIL-CARB 150	lb			
MIL-CARB 25	lb	15	30	135
MIL-CARB 25	lb			
MIL-CARB 450	lb			
MIL-CARB 5	lb			
MIL-CARB 50	lb	15	30	135

Material	UOM	Volumes of Materials		
		1 Well (Shallow)	1 Well (Deep)	6 Wells (3 Shallow, 3 Deep)
MIL-CARB 50	lb			
MIL-CARB	lb	15	30	135
MIL-CLEAN	gal			
MILGEL 100 LB BAG	CWT			
MILGEL NT BULK - CWT	lb	2,400	4,800	21,600
LIME HYDRATED, 50 LB BAG	lb	300	600	2,700
MIL-PAC LV PLUS	lb	120	240	1,080
MIL-PAC R PLUS	lb	60	120	540
MIL-SORB	lb			
NF-2	bbl			
NANOSHIELD, 25 LB BAG	lb			
NEW-DRILL 5 GAL CAN	gal			
NEW-DRILL LV (25 KG BAG)	kg	240	480	2,160
OMNI-MUL	gal	9,400	11,750	63,450
OMNI-MUL 2	gal	9,400	11,750	63,450
OMNI-TEC	gal	1,200	1,500	8,100
OS-8 OXYGEN SCAVENGER	ea			
POTASSIUM ACETATE, 25 KG BAG	kg			
RHEO-CLAY PLUS	lb	240	480	2,160
RHEO-LINE HT	gal	1,100	2,200	9,900
SODA ASH	lb			
SODIUM BICARBONATE 50 LB BAG	lb			
SOLU-SQUEEZ, 40 LB SACK	lb			
SOLUFLAKE COARSE 50 LB BAG	lb			
SOLUFLAKE FINE 50 LB BAG	lb			
SOLUFLAKE MEDIUM 50 LB BAG	lb			
TUFF SHIELD, 50 LB BAG	lb			
ULTRA VIS	gal			
Walnut - Medium	lb			
Wo Defoam	gal			
Xan-Plex D	lb	480	840	3,960
XAN-PLEX L2 (5 Gal Bucket)	gal	128	256	1,152
Xan-Plex L2, 275 Gal Tote	gal	30	60	270
X-Cide 102	gal	32	48	240
X-Cide 750	gal			
Escaid 110	gal	378,000	472,500	2,551,500
NEXT-BASE Ec, 1 GAL BULK (SARALINE 185V)	gal			
Delta-Gel™, 50 Lb Bag	lb	240	480	2,160
Delta-Lift™, 55 Gal Drum	gal	44	88	396
Delta-Mod™, 55 Gal Drum	gal	22	44	198
Delta-FI™ St, 55 Lb Bag	lb	120	240	1,080
Delta-Vert™ St, 55 Gal Drum	gal	44	88	396

APPENDIX E: Hazard Classifications for Products

Product Name	Product Code	Identified Uses	Classification of the Substance or Mixture
BIO-COTE™	2006DFUS	Thinner	<ul style="list-style-type: none"> Not considered hazardous by the OSHA Hazard Communication Standard
BIO-LOSE™	1514DF	Filtration Control Agent	<ul style="list-style-type: none"> Not considered hazardous by the OSHA Hazard Communication Standard
BLACK MAGIC™	1645DF	Spotting Fluid	<ul style="list-style-type: none"> Flammable Liquids - Category 4 Serious Eye Damage - Category 1 Carcinogenicity - Category 2 Aquatic Hazard (acute) - Category 3 Aquatic Hazard (long-term) - Category 3
BRINE-PAC™ XT	5007FG	Corrosion inhibitor	<ul style="list-style-type: none"> Flammable Liquids - Category 2 Acute Toxicity (oral) - Category 4 Serious Eye Damage - Category 1
Calcium Chloride	5008DF	Salt	<ul style="list-style-type: none"> Eye Irritation - Category 2A Classification
CARBO-GEL™ II	1845DF	Viscosifier	<ul style="list-style-type: none"> Combustible dusts carcinogenicity - Category 1A Specific target organ toxicity (repeated exposure) (lungs) - Category 2
CARBO-GEL™	1135DF	Viscosifier	<ul style="list-style-type: none"> Combustible dusts
CARBO-TEC™ S	5010DF	Emulsifier	<ul style="list-style-type: none"> Not considered hazardous by the OSHA Hazard Communication Standard
Caustic Potash	7230DF	Alkalinity Control	<ul style="list-style-type: none"> Corrosive to metals - Category 1 Acute toxicity (oral) - Category 4 Skin corrosion - Category 1A Serious Eye Damage - Category 1
Caustic Soda	6062DF	pH Control	<ul style="list-style-type: none"> Corrosive to metals - Category 1 Skin corrosion - Category 1A Serious Eye Damage - Category 1
CHEK-LOSS™ PLUS	7120DF	Lost circulation material	<ul style="list-style-type: none"> Combustible dusts
DEEP SWEEP™	1209DF	Weighting Agent	<ul style="list-style-type: none"> Carcinogenicity - Category 1A

Product Name	Product Code	Identified Uses	Classification of the Substance or Mixture
			<ul style="list-style-type: none"> ▪ Specific target organ toxicity (repeated exposure) (lungs) - Category 2
Defoamer	7319DF	Defoamer	<ul style="list-style-type: none"> ▪ Flammable liquids - Category 2 ▪ Eye irritation - Category 2A ▪ Specific Target Organ Toxicity (Single Exposure) (Narcotic effects) - Category 3
Delta FL	7890DF	Fluid Loss Control	<ul style="list-style-type: none"> ▪ Combustible Dust
Delta Gel	7889DF	Viscosifier	<ul style="list-style-type: none"> ▪ Combustible Dust ▪ Carcinogenicity – Category 1A ▪ Specific Target Organ Toxicity Category 2
Delta Lift	7888DF	Rheological Additive	<ul style="list-style-type: none"> ▪ Skin Irritation – Category 2 ▪ Serious Eye Damage – Category 1
Delta Mod	7887DF	Rheological Additive	<ul style="list-style-type: none"> ▪ Serious Eye Damage – Category 1
Delta Vert	7891DF	Emulsifier	<ul style="list-style-type: none"> ▪ Not Classified
Desco® Deflocculant	1016805	Drilling Mud Additive	<ul style="list-style-type: none"> ▪ Combustible dust ▪ Eye irritation - Category 2A ▪ Skin sensitization - Category 1 ▪ Carcinogenicity - Category 1A
ECCO-BLOCK™	5015DF	Fluid loss control additive	<ul style="list-style-type: none"> ▪ Combustible dusts
ESCAID™ 110 FLUID		Drilling muds, oil-based	<ul style="list-style-type: none"> ▪ Flammable liquid – Category 4 ▪ Aspirant toxicity – Category 1
GT-3000	1606DF	Synthetic drilling fluid base	<ul style="list-style-type: none"> ▪ Aspiration hazard – Category 1
PETROSWEET™ HSW700 SCAVENGER™ (a trademark of Baker Hughes Incorporated)	HSW700	Hydrogen sulfide scavenger	<ul style="list-style-type: none"> ▪ Flammable liquids - Category 3 ▪ Acute toxicity (oral) - Category 4 ▪ Acute toxicity (inhalation) - Category 3 ▪ Skin irritation - Category 2 ▪ Serious eye damage - Category 1 ▪ Skin sensitization - Category 1 ▪ Specific target organ toxicity (single exposure) (optic nerve) - Category 1 ▪ Specific target organ toxicity (repeated exposure) (respiratory tract) - Category 1
KOMPRESS™ Compressive Strength LCM	7602DF	Lost circulation material	<ul style="list-style-type: none"> ▪ Combustible dusts ▪ Skin irritation - Category 2 ▪ Serious eye damage - Category 1 ▪ Skin sensitization - Category 1

Product Name	Product Code	Identified Uses	Classification of the Substance or Mixture
			<ul style="list-style-type: none"> Specific target organ toxicity (single exposure) (Respiratory tract irritation) - Category 3
LC-LUBE™	1144DFUS	Lost circulation material	<ul style="list-style-type: none"> Not considered hazardous by the OSHA Hazard Communication Standard
LD-9	7361DF	Defoamer	<ul style="list-style-type: none"> Not considered hazardous by the OSHA Hazard Communication Standard
LIGCO™	2934DF	Filtration control agent	<ul style="list-style-type: none"> Combustible dusts Carcinogenicity - Category 1A Specific target organ toxicity (repeated exposure) (lungs) - Category 2
Lime, Hydrated	7878DF	Alkalinity control	<ul style="list-style-type: none"> Skin irritation - Category 2 Serious eye damage - Category 1 Carcinogenicity - Category 1A Specific target organ toxicity (single exposure) (Respiratory tract irritation) - Category 3
MAGMA-TROL™	472DF	Fluid loss controller and sag prevention agent	<ul style="list-style-type: none"> Combustible dusts
MIL-BAR™ 410	4017DF	Weighting agent	<ul style="list-style-type: none"> Carcinogenicity - Category 1A Specific target organ toxicity (repeated exposure) (lungs) - Category 2
MIL-BAR™	1151DF	Weighting agent	<ul style="list-style-type: none"> Carcinogenicity - Category 1A Specific target organ toxicity (repeated exposure) (lungs) - Category 2
MIL-CARB™ 5	7100DF	Lost circulation material	<ul style="list-style-type: none"> Carcinogenicity - Category 1A Specific target organ toxicity (repeated exposure) (lungs) - Category 2
MIL-CARB™ 25	7096DF	Lost circulation material	<ul style="list-style-type: none"> Carcinogenicity - Category 1A Specific target organ toxicity (repeated exposure) (lungs) - Category 2
MIL-CARB™ 50	7095DF	Lost circulation material	<ul style="list-style-type: none"> Carcinogenicity - Category 1A Specific target organ toxicity (repeated exposure) (lungs) - Category 2
MIL-CARB™ 150	7097DF	Lost circulation material	<ul style="list-style-type: none"> Carcinogenicity - Category 1A Specific target organ toxicity (repeated exposure) (lungs) - Category 2
MIL-CARB™ 450	7098DF	Lost circulation material	<ul style="list-style-type: none"> Carcinogenicity - Category 1A

Product Name	Product Code	Identified Uses	Classification of the Substance or Mixture
			<ul style="list-style-type: none"> Specific target organ toxicity (repeated exposure) (lungs) - Category 2
MIL-CARB™ 600	7500DF	Lost circulation material	<ul style="list-style-type: none"> Carcinogenicity - Category 1A Specific target organ toxicity (repeated exposure) (lungs) - Category 2
MIL-CARB™	6099DF	Lost circulation material	<ul style="list-style-type: none"> Carcinogenicity - Category 1A Specific target organ toxicity (repeated exposure) (lungs) - Category 2
MIL-CLEAN™	2761DF	Detergents	<ul style="list-style-type: none"> Skin irritation - Category 2 Eye irritation - Category 2A
MIL-GUARD™	1569DF	Hydrogen sulfide scavenger	<ul style="list-style-type: none"> Combustible dusts
MIL-GEL™ NT	4018DF	Viscosifier	<ul style="list-style-type: none"> Combustible dusts Carcinogenicity - Category 1A Specific target organ toxicity (repeated exposure) (lungs) - Category 2
MIL-GEL™	5191DF	Viscosifier	<ul style="list-style-type: none"> Combustible dusts Carcinogenicity - Category 1A Specific target organ toxicity (repeated exposure) (lungs) - Category 2
MIL-PAC™ LV	5201DF	Filtration control agent	<ul style="list-style-type: none"> Combustible dusts
MIL-PAC™ R	5203DF	Filtration control agent	<ul style="list-style-type: none"> Combustible dusts
MIL-PLUG™ (ALL GRADES)	5028DF	Lost circulation material	<ul style="list-style-type: none"> Combustible dusts
MIL-SEAL™ (ALL GRADES)	1112DF	Lost circulation material	<ul style="list-style-type: none"> Not considered hazardous by the OSHA Hazard Communication Standard
MIL-SORB™	7544DF	Absorbent	<ul style="list-style-type: none"> Carcinogenicity - Category 1A Specific target organ toxicity (repeated exposure) (lungs) - Category 2
NANOSHIELD™	7223DF	Wellbore stabilizer and borehole sealant	<ul style="list-style-type: none"> Not considered hazardous by the OSHA Hazard Communication Standard
NEW-DRILL™ LV	1086DF	Deflocculant	<ul style="list-style-type: none"> Not considered hazardous by the OSHA Hazard Communication Standard
NEW-DRILL™	2003DF	Shale control additive	<ul style="list-style-type: none"> Not classified
Next Base eC	7271DF	Synthetic Drilling Fluid Base	<ul style="list-style-type: none"> Aspiration Hazard – Category 1
NF2™	1973DF	Gas hydrate inhibitor	<ul style="list-style-type: none"> Acute toxicity (oral) - Category 4

Product Name	Product Code	Identified Uses	Classification of the Substance or Mixture
			<ul style="list-style-type: none"> Specific target organ toxicity (repeated exposure) (kidneys) - Category 2
OMNI-MUL™ 2	7225DF	Emulsifier/ wetting agent	<ul style="list-style-type: none"> Flammable liquids - Category 4 Skin irritation - Category 2 Serious eye damage - Category 1 Skin sensitization - Category 1B
OMNI-MUL™	1424DFUS	Emulsifier/ wetting agent	<ul style="list-style-type: none"> Aspiration hazard – Category 1
OMNI-TECH™	1559DF	Emulsifier	<ul style="list-style-type: none"> Not classified
Potassium Acetate	5097DF	Chemical reagent	<ul style="list-style-type: none"> Not considered hazardous by the OSHA Hazard Communication Standard
RHEO-CLAY™	1360DF	Rheological additive	<ul style="list-style-type: none"> Combustible dusts Carcinogenicity - Category 1A Specific target organ toxicity (repeated exposure) (lungs) - Category 2
RHEO-LINE™ HT	2905DF	Rheological additive	<ul style="list-style-type: none"> Skin irritation - Category 2 Eye irritation - Category 2B Skin sensitization - Category 1
Soda Ash	5046DF	Alkalinity control	<ul style="list-style-type: none"> Eye irritation - Category 2B
Sodium Bicarbonate	7385DF	Alkalinity control	<ul style="list-style-type: none"> Combustible dusts
SOLUFLAKE™ Coarse	5226DF	Weighting agent/ lost circulation material	<ul style="list-style-type: none"> Combustible dusts Carcinogenicity - Category 1A
SOLUFLAKE™ Fine	5224DF	Weighting agent/ lost circulation material	<ul style="list-style-type: none"> Combustible dusts Carcinogenicity - Category 1A
SOLUFLAKE™ Medium	5225DF	Weighting agent/ lost circulation material	<ul style="list-style-type: none"> Combustible dusts Carcinogenicity - Category 1A
SOLU-SQUEEZE™	1466DF	Lost circulation material	<ul style="list-style-type: none"> Eye irritation - Category 2B Carcinogenicity - Category 1A Specific target organ toxicity (repeated exposure) (lungs) - Category 2
Ultra Vis	7306DF	Viscosifier	<ul style="list-style-type: none"> Not considered hazardous by the OSHA Hazard Communication Standard
W.O.™ DEFOAM	5048DF	Defoamer	<ul style="list-style-type: none"> Flammable liquids - Category 4 Acute toxicity (inhalation) - Category 4 Skin irritation - Category 2 Eye irritation - Category 2A Specific target organ toxicity (single exposure) (Respiratory tract irritation) - Category 3

Product Name	Product Code	Identified Uses	Classification of the Substance or Mixture
Walnut Shells	1543DF	Lost circulation material	<ul style="list-style-type: none"> ▪ Combustible dusts
XAN-PLEX™ L2	7725DF	Viscosifier	<ul style="list-style-type: none"> ▪ Eye irritation - Category 2A
XAN-PLEX™ D	1171DF	Viscosifier	<ul style="list-style-type: none"> ▪ Combustible dusts ▪ Skin sensitization - Category 1
X-CIDE™ 102 INDUSTRIAL BACTERICIDE™ a trademark of Baker Hughes Incorporated	XC102	Industrial Bactericide	<ul style="list-style-type: none"> ▪ Acute toxicity: oral - Category 4 ▪ Acute toxicity: inhalation - Category 3 ▪ Skin corrosion/irritation - Category 1B Serious eye damage/ eye irritation - Category 1 ▪ Respiratory sensitization - Category 1 ▪ Skin sensitization - Category 1 ▪ Specific target organ toxicity (single exposure) [Respiratory tract irritation] - Category 3 ▪ Aquatic hazard (acute) - Category 2 ▪ Aquatic hazard (long-term) - Category 3
X-CIDE™ 750 INDUSTRIAL BIOCIDE™ a trademark of Baker Hughes Incorporated	XC750	Biocide	<ul style="list-style-type: none"> ▪ Acute toxicity: oral - Category 4 ▪ Acute toxicity: inhalation - Category 3 ▪ Serious eye damage/ eye irritation - Category 1 ▪ Skin sensitization - Category 1 ▪ Toxic to reproduction [Fertility] - Category 1B ▪ Toxic to reproduction [Unborn child] - Category 1B ▪ Aquatic hazard (acute) - Category 2 ▪ Aquatic hazard (long-term) - Category 3

APPENDIX F: Radiation Source Safety Data Sheets & Technical Info

 Density Logging Source LWD-WL	 KUTh Exemption Letter.pdf	 PNG Activation Decay Memo.pdf	 PNG Activation OTB.pdf	 S2K MSDS.pdf	 S3D54 MSDS.pdf
 S3T25 MSDS.pdf	 S17C04 MSDS.pdf	 S17S20 MSDS.pdf	 SDS - Cobalt-60 final 13 Feb 2014.pdf	 SDS - DS -Gamma KUTh Calibrator.pdf	 SDS - NCS WL final 13 Feb 2014.pdf
 SDS - NLS LWD 10102013.PDF	 SDS - NLS LWD final 13 Feb 2014.pdf	 SDS - NVS Field (LWD) final 13 Feb 20	 SDS - RPM WL final 13 Feb 20	 SDS - S2K Gamma 1Ray Jig (WL) final 13 F	