

nodal seismic surveys require a combination of larger vessels and additional in-sea equipment, which accounts for a higher emissions output per square kilometer [2.82 mt CO₂e/km² for 3D and 6.34 mt CO₂e/km² for nodal surveys]. The other factors that impact the fuel consumption of a marine survey include weather and sea state, ocean currents, fuel type, survey design, transit time during mobilization periods, and the type and amount of in-sea seismic equipment being towed.

Onshore and Airborne Operations. For onshore and airborne seismic programs, TGS’ field contractors track their fuel consumption data based upon the fuel types and field equipment, which may include helicopters, seismic vibrators, ATV/UTVs, passenger vehicles, etc. A 3D land survey involves laying out a patch of data recording nodes in the ground and using seismic vibrators or other conventional seismic sources to generate a 3D cube of subsurface data. For airborne acquisition, gravity imaging equipment installed aboard the aircraft records enhanced gravity, magnetics and LiDAR data acquired over a predefined grid of flight lines by using a dual propeller aircraft. In these types of surveys, fuel consumption and emissions are impacted by the size of the survey, the equipment and vehicles used, the local environment and geography, and use of helicopters for equipment transport, scouting or portable heli-drilling. In 2021, TGS’ plans to continue the 2020 Horus I eFTG program did not materialize; however, emissions were generated while the crew was on standby and those are reported in the following chart.

2021 Scope 3 Emissions - Summary by Project Type

	CO ₂ e (mt)	CO ₂ (mt)	CH ₄ (mt)	N ₂ O (mt)	SO _x (mt)	NO _x (mt)
2D Marine Seismic	10,367.92	10,242.87	0.48	0.37	15.20	161.27
3D Marine Seismic	95,568.07	94,492.38	5.12	3.13	79.95	1,516.77
OBN/OBC Marine Seismic	27,145.28	26,791.01	0.65	1.13	66.22	393.55
Subtotal Marine Seismic	133,081.26	131,526.26	6.26	4.63	161.37	2,071.59
Subtotal 3D Land Seismic	406.20	399.77	0.02	0.02	-	-
Subtotal Airborne Surveys	1.40	1.34	0.00	0.00	-	-
TOTAL SCOPE 3 EMISSIONS	133,488.86	131,927.37	6.27	4.65	161.37	2,071.59

- Included in the emissions reported for marine survey above are those emissions related to mobilization as well as the support vessels used in the survey. Emission calculations were done in MultiSeis by deriving daily fuel consumption figures into emissions. Calculations and factors are based on the European Commission’s “Quantification of Emissions from Ships Associated with Ship Movements between Ports in the European Community,” July 2002; Econometrica “Greenhouse Gases, CO₂, CO₂e, and Carbon: What do all these Terms Mean?,” August 2012; “Excise Duty on Emissions of NO_x,” 2015 no. 14/2015S; The Greenhouse Gas Protocol; and the EPA’s “Greenhouse Gas Inventory Guidance: Direct Emissions from Stationary Combustion Sources,” December 2020.
- Land and airborne seismic emissions were calculated by converting fuel consumption figures to emissions using the EPA Simplified GHG Emissions Calculator (SGEC) version 3.2 June 2014. Fuel and vehicle type, as well as mileage and fuel usage, were calculated within the “Mobile Sources” tab.

2021 Scope 3 Survey Emissions - Intensity Figures

	Distance Area Acquired	Unit	CO ₂ e (mt/unit)	CO ₂ (mt/unit)	CH ₄ (kg/unit)	N ₂ O (mt)	SO _x (mt)	NO _x (mt)
2D Marine Seismic	16,557.51	km	0.63	0.62	0.03	0.02	0.92	9.74
3D Marine Seismic	33,856.03	sq km	2.82	2.79	0.15	0.09	2.36	44.80
OBN/OBC Marine Seismic	4,280.28	sq km	6.34	6.26	0.15	0.26	15.47	91.94
3D Land Seismic	184.72	sq km	2.20	2.16	0.08	0.11	NA	NA

2.3 Marine Operations

TGS is committed to protecting marine and coastal ecosystems and ensuring that our marine seismic contractors share this commitment. As noted above in our materiality chart, this issue is material to both TGS and to our stakeholders. TGS recognizes that if proper mitigation measures are not imposed or enforced, seismic operations and the towing of acoustic arrays through the marine environment has the potential to disrupt or impact the marine environment through possible unplanned spills, pollution or disruption of marine mammal migration paths, spawning groups or other ecologically sensitive locations. Both the geophysical industry and TGS impose stringent measures to lessen or negate these potential impacts to the environment.

Project Management. When planning and designing surveys, TGS commissions environmental impact assessments (EIAs) to identify marine mammal migration paths, spawning grounds, sanctuary areas or other ecologically sensitive locations that may be present in and around the survey area. TGS engages with stakeholders, such as fisheries and local communities, to understand their concerns and ensure ongoing communication throughout the duration of the seismic surveys. During the acquisition phase of a survey, TGS employs protected species observers (PSOs) and utilizes passive acoustic monitoring (PAM) to ensure that our field operations do not have a negative effect on cetaceans, turtles, marine mammals, etc. When operating in environmentally sensitive areas, such as Brazil and Argentina, TGS employs third-party HSE advisors who are tasked with managing all aspects of health, safety and the environment onboard their respective vessels, ensuring that full compliance with all environmental regulations and permit stipulations is achieved.

Audits and Reporting. To ensure compliance with the International Convention for the Prevention of Pollution from Ships (MARPOL), the Company requires all vessel contractors to report all spills, regardless of quantity and substance, and whether the spill entered the marine environment or was contained onboard a vessel. TGS has consistently met its goal of zero recordable spills and unplanned releases to the marine environment in our offshore operations since 2014, with 2021 being no exception. TGS requires all vessel contractors to comply with all applicable environmental laws and regulations and undergo audits from the International Marine Contractors Association or Offshore Vessel Inspection Database (IMCA or