Letter of Authorization Application – Addendum to G&G Permit Application

Long Form – Assumes proprietary materials of BOEM G&G application are not provided to NMFS

Requested Period of Effectiveness:
Start: August 1st, 2025
Finish: April 20th, 2026

BOEM Permit No.:

A. Type of Survey:

Please indicate which type of survey will be used in the proposed activity
__X_ Deep Penetration Seismic (greater than 1,500 in^3 total airgun array volume) • 2D Seismic-towed Streamer • 2D Seismic-Seafloor Cable or Nodes • 3D Seismic-towed Streamer • 3D Seismic-Seafloor Cable or Nodes • NAZ • WAZ • 4D (Time Lapse) • Vertical Cable • Borehole Seismic (VSP) **___ Shallow Penetration Seismic (less than 1,500 in^3 total airgun array volume)** • Surface Vessel • Surface Vessel and AUV/ROV • Borehole Seismic (VSP) **___ HRG Surveys (no airguns used)** • Surface vessel • AUV/ROV • Both **___ Other** Describe (if Other):

Proxy Selected & Justification: Coil

Viridien is applying for an LOA to acquire a long offset sparse OBN survey.

Sparse OBN and Coil surveys aim to acquire full azimuth (FAZ) and long offset data for better imaging of deep sub-surface structures, while 3D NAZ surveys have limitations in imaging depth due to their narrow azimuth range and shorter offset distances. These differences in survey methodologies affect their suitability for various exploration and production scenarios in the oil and gas industry.

Breakdown of the key points:

1. **Sparse OBN Survey:**
    - Involves acquiring seismic data using ocean bottom nodes placed at relatively large intervals.
    - Utilizes multiple sources towed from different vessels to achieve full azimuth (FAZ) and long offset data.
    - Long offsets typically extend up to 30 km.
    - FAZ allows each receiver to collect data from a full range of azimuths (0° - 360°), providing a clearer image of deep sub-surface geological structures.
2. **Coil Survey:**
    - Utilizes a methodology like sparse OBN surveys but with shorter offsets.
    - Long offsets typically range from 18-20 km.
    - Like sparse OBN, Coil surveys aim to achieve FAZ data to improve imaging of deep geological structures.
3. **3D NAZ Survey:**
    - Involves narrow azimuth and short offset data acquisition.
    - Typically covers azimuths from 150° to 210° relative to the source.
    - Shorter offset distances, typically 8-10 km.
    - Limited azimuth range restricts the imaging capability of deep geological structures compared to FAZ surveys.

B. Survey Area and Operational Plan:

Question:	Response
Overall Duration of the Activity (days):	115 (total) including node deployment/retrieval and 65 days of sound source activation
Areal extent of the survey area: (in OCS lease blocks or km^2) (Attach GIS file(s) of survey lines and/or survey area perimeter)	2,023 OCS blocks Map and perimeter shapefiles provided as separate attachments.
G&G ITR/PEIS Modeling Zone(s) in which the activity will occur (1-7):	Central GoA in intermediate waters 600m -1,500m deep. The proposed survey area is in Zone 6 (100%)
Number of days during the overall activity period on which the sound source(s) listed in Section C will operate: (If the activity will occur in more than one Modeling Zone, provide the number of operating days within each modeling zone.)	65 days

C. Sound Sources:

- List all survey-related instruments that emit acoustic energy into the water column, including but not limited to airgun or airgun arrays, sub-bottom profilers, bubble pulsers, sparkers, side scan sonars, multi-beam sonars, single-beam echosounders, ultra-short baseline (USBL) position systems, pressure inverted echosounder (PIES), etc.

- The design choice of source type to be used during this survey will be a low-frequency (Tuned Pulse Source – TPS) or conventional airgun arrays, as a contingency if the TPS are not available, or the TPSs fail during acquisition. Two source vessels will be used during the survey, with each vessel towing either a dual (2) or triple (3) TPS source array i.e. two or three TPSs per vessel, or if using conventional airguns, two arrays per vessel.

- During acquisition, with either two or three TPS sources towed from each vessel, the sources will be activated in one of the following ways:

    - Two (dual) TPSs towed from one vessel will discharge with a slight offset involving a minimum time delay of 0.5 sec plus a dither window of 1 sec before the next shot in the array "flip-flop". There will be no simultaneous activation of source vessels. Each vessel will activate separately.
        - +/- 1.5s dither 1st shot, 0.5s pause, +1.0s dither window 2nd shot.

    - Three (triple) TPSs towed from one vessel will discharge with a slight offset involving a minimum time delay of 0.5 sec plus a dither window of 1 sec before the next shot in the array "flip-flap-flop". There will be no simultaneous activation of source vessels. Each vessel will activate separately.
        - +/- 1.5s dither 1st shot, 0.5s pause, +1.0s dither window 2nd shot, 0.5s pause, +1.0s dither window 3rd shot.

    - Two TPSs towed from one vessel will discharge at the same time (synchronized mode) so they function as a single 2-element array

    - Note: Triple source will not be activated in synchronized mode.

    - If conventional arrays are deployed on a source vessel, the dual sources will be discharge with a slight offset involving a minimum time delay of 0.5 sec and a maximum time delay of 1.5 sec between shots.

- For conventional airgun arrays, please attach a diagram showing the layout (geometry) of the array and list of airgun sizes.

Energy Source	**Manu-facturer**	**Model**	**Total Array Volume & Number of Elements** (cubic inches or Liters.)	**Source Level (SL) in dB re 1µPa@1m in water** (RMS)	**Source Level (SL) in dB re 1µPa@1m in water** (Peak to Peak)	**Operating Frequency** (Hz, kHz, range)	**Pulse Duration** (seconds, milli-seconds)	**Pulse Rate (or Cycle)** (Pulses per second or minute)	**Towing Depth of the Source** (ft or m)	**Towing Depth of the Receiver(s)** (ft or m)	**Duration of Use** (Number of Days or Percent of Active Sound Source Days)
Air Gun Array	Bolt	LLXT 1900	5,220/42	220 dB	235.7 dB	2-200Hz		1 pulse approx. every 10 seconds	8m	OBN (Seafloor)	65
PIES	Sonardyne	8302	NA	190-202 dB	NA	14-19kHz		Variable; Typically 0.0116		OBN (Seafloor)	85
Tuned Pulse Source (TPS)	Sercel	TPS	28,000ci x 1 element	~222 dB	~241 dB	0.5-128Hz	360 msec	NA	6-15 m	OBN (Seafloor)	65
Echosounder	SIMRAD	EZ600	NA	NA	NA	12-210Hz		1 per minute			
Tuned Pulse Source (TPS)	Sercel	TPS	56,000ci (2 elements x 28,000ci)	~230 dB	~250 dB	0.5-128Hz	360 msec	NA	6-15 m	OBN (Seafloor)	65

Note: The primary seismic source will be a Tuned Pulse Source (TPS), with conventional airgun technology designated as a contingency option. Only a single source type will be utilized at any given time during acquisition.

Acquisition Plan:

A single node-laying vessel and two dual-source vessels will mobilize to the survey area to commence operations. The node-laying vessel will initiate deployment of the ocean bottom nodes (OBNs) in accordance with the planned receiver offset requirements. This initial node deployment phase is estimated to take approximately 25 days to achieve sufficient coverage before the activation of seismic sources can commence.

Upon deployment of the minimum required node spread, both dual-source vessels will commence seismic operations concurrently and remain active throughout the duration of data acquisition.

The node-laying vessel will continue to deploy OBNs in parallel with the ongoing source operations until all nodes are positioned at their designated pre-approved locations. This deployment activity will continue throughout the acquisition phase until the full node array is established.

Following the completion of node deployment and acquisition of the required source coverage, the node-laying vessel will begin retrieval of the earliest-deployed nodes, once the predefined source offset criteria have been met. Upon completion of all seismic source acquisition, the node-laying vessel is expected to require an additional 25 days to complete full node recovery.

Once node recovery is finalized, all vessels will demobilize from the survey area.

D. Take Estimate:

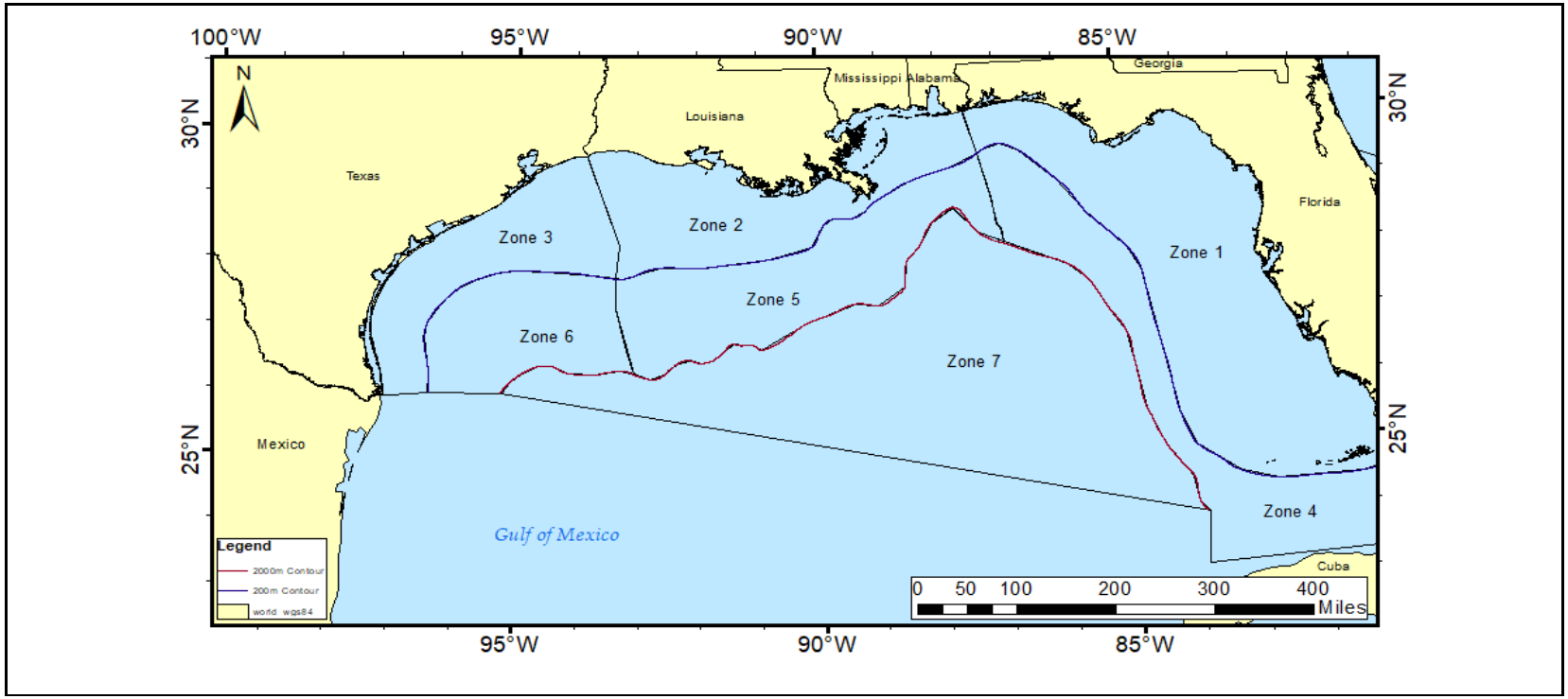
Instructions:

- Select the survey type and zone number (2-7, operations in Zone 1 are not covered by the incidental take regulations) from the drop down lists (click in the cell to see the dropdown a

- Type in the number of days of acquisition per season in the "Schedule" section (Winter: December - March, Summer: April - November)

Report tables are automatically updated based on user selections.

Zone Map:



Viridien is requesting approval for August 1, 2025 through April 20, 2026

Calculation has been generated:

1) 65 days of sound activation in Zones 6.
2) The planned 3D OBN survey will involve up to two source vessels sailing along closely spaced survey lines that are 400 m apart.
3) The source line lengths range from 28 km to 87 km within an overall survey area of 9,359 km2.
4) The vessels will sail along nearby lines in a typical “racetrack” pattern with the second vessel staggered behind the first vessel.
5) At a survey speed of approximately 5.0 knots (9.3 km/hr), the survey area will be covered in approximately 65 days.
6) This results in an average of 144 km2 surveyed per day. Therefore, the Coil Survey Type was selected.

User Selections

Parameters	
Survey Type	*COIL*
Zone Number	*6*
Array	*5110cuin*

# of Days per Month					
jan	0	may	0	sep	30
feb	0	jun	4	oct	19
mar	0	jul	0	nov	0
apr	0	aug	16	dec	0

Exposures by Metric

F.H.G	Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Total (No Level B Scaling)	Total (Including Level B Scaling)
Level A															
LF	Rice's whale	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	**< 0.01**	**0.03**
HF	Kogia spp.[a]	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.53	< 0.01	1.65	3.11	2.63	< 0.01	< 0.01	**7.92**	**43.41**
Level B															
LF	Rice's whale	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.02	< 0.01	0.02	0.05	0.05	< 0.01	< 0.01	**0.13**	**0.03**
MF	Atlantic spotted dolphin	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	204.34	< 0.01	868.65	1,566.33	937.28	< 0.01	< 0.01	**3,576.61**	**1,026.49**
	Bottlenose dolphin	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	119.31	< 0.01	531.35	817.68	360.90	< 0.01	< 0.01	**1,829.24**	**524.99**
	Clymene dolphin	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	112.63	< 0.01	122.88	224.27	351.66	< 0.01	< 0.01	**811.44**	**232.88**
	Beaked whales[b]	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	11.49	< 0.01	53.17	82.52	45.03	< 0.01	< 0.01	**192.21**	**19.41**
	Fraser's dolphin[d]	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	33.04	< 0.01	132.16	247.80	156.94	< 0.01	< 0.01	**569.94**	**163.57**
	Blackfish[c]	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	150.06	< 0.01	291.09	490.72	591.41	< 0.01	< 0.01	**1,523.29**	**449.37**
	Pantropical spotted dolphin	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	656.28	< 0.01	1,949.15	4,159.86	2,927.20	< 0.01	< 0.01	**9,692.49**	**2,781.75**
	Risso's dolphin	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	18.43	< 0.01	100.76	179.37	83.04	< 0.01	< 0.01	**381.60**	**112.57**
	Rough-toothed dolphin[d]	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	81.92	< 0.01	327.69	614.42	389.13	< 0.01	< 0.01	**1,413.17**	**405.58**
	Short-finned pilot whale	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	90.41	< 0.01	534.28	971.12	423.14	< 0.01	< 0.01	**2,018.96**	**595.59**
	Sperm whale	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	31.97	< 0.01	131.43	220.60	124.59	< 0.01	< 0.01	**508.60**	**215.14**
	Spinner dolphin	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.43	< 0.01	1.88	3.47	1.73	< 0.01	< 0.01	**7.51**	**2.16**
	Striped dolphin	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	64.02	< 0.01	78.14	162.55	170.85	< 0.01	< 0.01	**475.56**	**136.49**
HF	Kogia spp.[a]	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	9.02	< 0.01	28.18	53.17	44.88	< 0.01	< 0.01	**135.24**	**43.41**

Level A Colour Legend

	Level A SEL > Level A Peak
	Level A Peak > Level A SEL

[a] Kogia guild density (dwarf & pygmy sperm whale)

[b] Beaked whale guild density (Cuvier's, Blainville's & Gervais' beaked whales)

[c] Blackfish guild density (false killer whale, killer whale, melon-headed whale & pygmy killer whale)

[d] Roberts et al. (2015) dataset (annual density)

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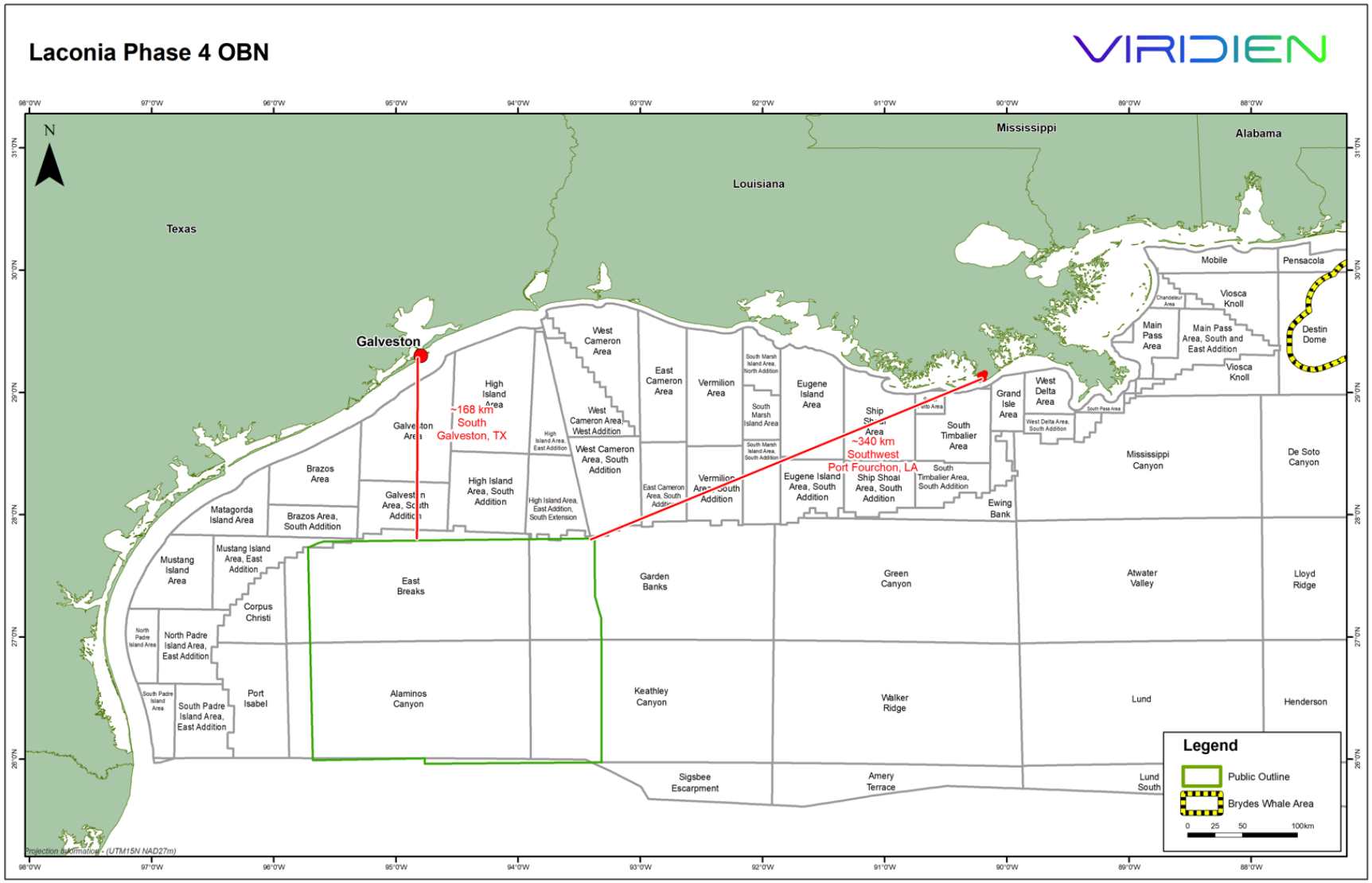
E. Mitigation and Monitoring Efforts:

Question:	Response:
Please indicate which set of monitoring and mitigation measures from the ITR's apply to the planned activity:	All monitoring and mitigation measures in the ITRs applicable to Airgun Surveys with a total volume >1,500 cu in will be followed. See attached list for summary of applicable monitoring and mitigation measures. BOEM NTL 2016-G02 revised 6/19/2020 Appendices A, B, and C to NMFS 2020 BiOp for the GoMex Oil and Gas Program
Confirm that you will apply this set of monitoring and mitigation measures during the activity:	Yes, we will apply these measures during the 3D OBN survey.

Map of Survey Area and Transit Route



Additional Notes:

There will be use of 2 source vessels with a minimum 2,000m separation.

Water depths in the area range from 600m to over 1,500m with most of the activities taking place in waters greater than 1,000m.

The requested dates for the LOA are August 1, 2025 through April 20, 2026.