



GEOPHYSICAL EXPLORATION SUNDRY NOTICE - FORM GE 4

INDUSTRIAL COMMISSION OF NORTH DAKOTA
OIL AND GAS DIVISION
600 EAST BOULEVARD DEPT 405
BISMARCK, ND 58505-0840
SFN 51458 (03-2011)

Received

PERMIT # 97-0324

JAN - 8 2024

ND Oil & Gas
Division

Project Name Basin Electric Research Project 2D Seismic
County Mercer County
Supplemental Information The UND EERC will adjust the preplot to straighten out the center of the line through SW SW Quarter of section 1 in 145N 88W. There will be no sources or receivers placed on the Coteau 1 well pad.

Company University of North Dakota - EERC		Telephone Number (701) 777-5052	
Address 15 N 23rd St, Stop 9018			
City Grand Forks	State ND	Zip Code 58202-9018	
Signature 	Printed Name Trevor Richards		
Title Assistant Director - Geophysics	Date January 8, 2024		
Email Address trichards@undeerc.org			

FOR STATE USE ONLY	
<input checked="" type="checkbox"/> Received	<input type="checkbox"/> Approved
Date 1/8/24	
By 	
Title Mineral Resources Permit Manager	



GEOPHYSICAL EXPLORATION SUNDRY NOTICE - FORM GE 4

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Project Name	Basin Electric Research Project 2D Seismic	ND Oil & Gas
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County	Mercer County	Division
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Supplemental Information

The UND EERC has contracted Explor Geoscience USA Inc. to test two additional non-explosive seismic sources. Explor's PinPoint source and Explor's LightSpeed source technologies will be tested.

We plan to test the PinPoint source at 16 foot intervals along the 2D line. PinPoint requires a 1.5" diameter hole to be drilled 8 to 10 inches into the ground. The tool is placed in the small hole and initiated. The source uses a propellant to create an impulsive source. The shallow, small diameter hole is filled in with sediment leaving virtually no evidence of the operation.

We plan to test the LightSpeed source at 8 foot intervals along the 2D line. The LightSpeed tool is attached to the front of a skid steer via a standard adapter plate. The skid steer presses the baseplate of the tool onto the surface of the earth, and the tool is initiated. An electro-fluidic source contained within a reaction chamber produces the seismic impulse. Other than the temporary marks made by skid steer tracks and a small ~2 square foot area where ground will be slightly compacted from pressing the baseplate to the ground, there is little to no evidence of the operation.

Tech sheets for these technologies are attached to this Notice.

** using same permitted source point locations.*

Company Explor Geoscience USA Inc.		Telephone Number (832) 217-6466	
Address 5850 San Felipe Street, Suite 500			
City Houston		State TX	Zip Code 77057
Signature <i>Allan Chatenay</i>		Printed Name Allan Chatenay	
Title President		Date December 16, 2023	
Email Address al@explor.net			

FOR STATE USE ONLY	
<input type="checkbox"/> Received	<input checked="" type="checkbox"/> Approved
Date 12/18/23	
By <i>Allan Chatenay</i>	
Title Mineral Resources Permit Manager	



PinPoint®: **Lightweight Portable Seismic Source System**
Seismic Source Type: Impulsive
 Chemical energy source: propellant
Class 1.4S: not a high explosive
 Variable cartridge size, configuration, chemistry
Energy Output: Variable: 5 kJ to >24 kJ
Repeatability: Excellent
Deployment Method: Small (2-3 person) teams
Positioning and Timing: Integrated with RTK GNSS or SBAS GNSS



(12) **United States Patent**
Châtenay

(10) **Patent No.:** US 10,247,837 B2
 (45) **Date of Patent:** Apr. 2, 2019

(54) **PORTABLE SEISMIC SURVEY DEVICE AND METHOD**

(71) Applicant: **Explor Geophysical, Ltd.**, Calgary (CA)

(72) Inventor: **Allan Châtenay**, Calgary (CA)

(73) Assignee: **Explor Geophysical Ltd.**, Calgary (CA)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 59 days.

(21) Appl. No.: **15/442,870**

(22) Filed: **Feb. 27, 2017**

(65) **Prior Publication Data**
 US 2018/0246234 A1 Aug. 30, 2018

(51) **Int. Cl.**
G01V 1/104 (2006.01)
G01V 1/00 (2006.01)
E21B 47/00 (2012.01)
E21B 47/022 (2012.01)
E21B 49/00 (2006.01)

(52) **U.S. Cl.**
 CPC **G01V 1/104** (2013.01); **E21B 47/0003** (2013.01); **E21B 47/02208** (2013.01); **E21B 49/00** (2013.01); **G01V 1/003** (2013.01); **G01V 2210/121** (2013.01)

(58) **Field of Classification Search**
 CPC .. G01V 1/104; G01V 1/003; G01V 2210/121; E21B 47/02208; E21B 47/0003; E21B 49/00; F42D 3/06

See application file for complete search history.

(56) **References Cited**
 U.S. PATENT DOCUMENTS

145,000 A	11/1873	McDonald	
3,915,256 A	10/1975	Mc Coy	
4,147,228 A	4/1979	Boyounos	
4,223,759 A	9/1980	Martin	
4,324,310 A *	4/1982	Weiser	G01V 1/104 175/4.55
4,334,591 A	6/1982	Martin	
4,359,131 A	11/1982	Martin	
4,418,786 A	12/1983	Martin	
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(Continued)

FOREIGN PATENT DOCUMENTS

CA	1168347 A1	5/1984
CA	2504119 A1	10/2005

(Continued)

Primary Examiner — Daniel Pihlic
 (74) *Attorney, Agent, or Firm* — David Guerra

(57) **ABSTRACT**
 The present invention is essentially a portable seismic survey device and method using reflection seismology for mapping subterranean formations. The device includes an upper assembly, a firing pin operably associated with a firing pin actuator, a lower assembly including a cartridge holder capable of retaining a blasting cartridge, and a detonation sensor capable of detecting detonation of the blasting cartridge. The detonation sensor transmits a signal to an event marking device to trigger a recordation of detonation time and geographic location of the seismic survey device. A seismic wave is generated upon detonation which is then reflected back toward seismometers. Data from the event marking device and seismometers can then be processed to provide geological formation information.

25 Claims, 7 Drawing Sheets

Figure 1: (Left) 2023 Next Gen Beta version of PinPoint system, weighing less than 1 kg, with STRYDE node for scale. (Right), the front page of the US Patent granted to Allan Châtenay, the inventor of the system.

PinPoint® is a patented single person portable seismic source system developed by Explor®. It is a fully integrated source system that is coupled with GNSS and is designed for autonomous seismic source acquisition in conjunction with seismic recording systems that record continuously.

PinPoint uses cartridges with propellants as its source, eliminating the use of high explosives and reducing risk to workers and the public. The tool is placed into a small hole in the earth so that it is coupled with the earth. The cartridge is initiated when it is under the ground, generating a small seismic pulse.



Figure 2: The new PinPoint system being field tested in a frozen field in Montana, USA, February 2023.

Tens of thousands of PinPoint seismic source points have been safely acquired in the United States, Canada, and the Middle East. PinPoint minimizes risk to workers and the public while improving data quality around critical infrastructure and reducing environmental footprint.

By acquiring seismic data with PinPoint, our clients can obtain images near built up facilities where there would otherwise be gaps in subsurface imaging.





PinPoint eliminates the need to cut trees down to accommodate source equipment.



When acquired at high density, PinPoint can deliver comparable data quality to conventional seismic sources such as vibroseis and dynamite.

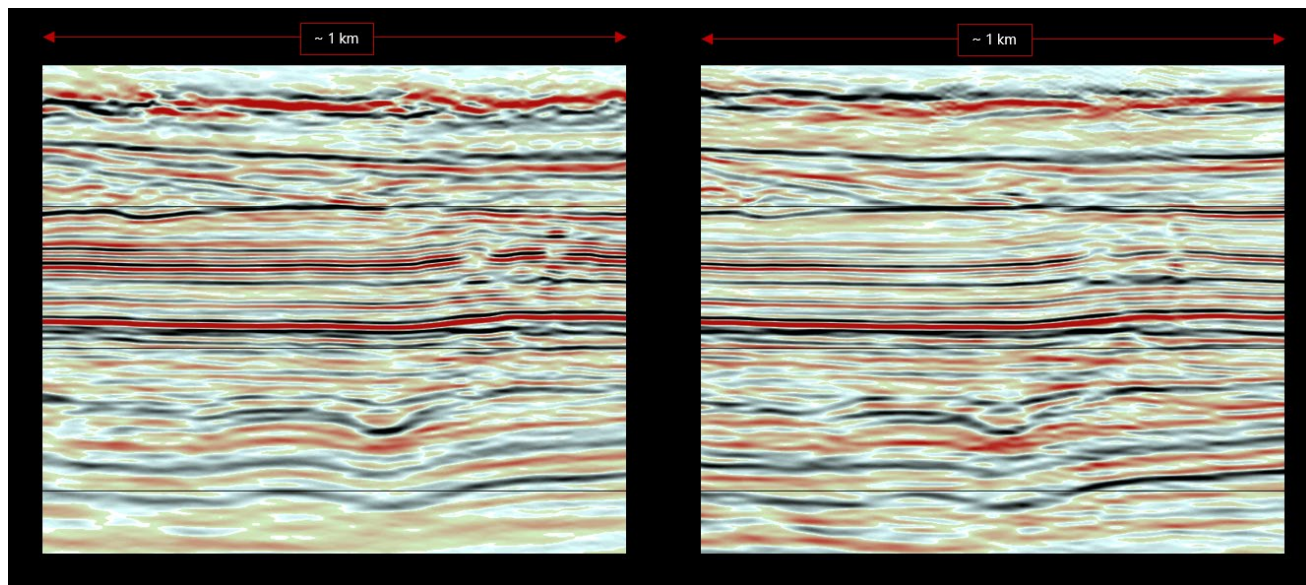










Figure 3: A comparison of high-density 3D vibroseis and PinPoint data. The vibroseis data is 22 million traces per km² at all offsets, the PinPoint is 100 million traces per km² at all offsets. Both datasets are excellent.

By acquiring data with PinPoint, we can deliver the highest seismic trace density with the lowest risk exposure along with a near zero environmental footprint.

		Lowest HSE Risk, Lowest Environmental Footprint, Highest Efficiency, Highest Density								
Project	Recording System	Total Receiver Points (to nearest '00)	Active Spread	Source	Source Points	Positioning and Acquisition Management	Total Traces (All offsets)	Exposure Hours (all workers) ¹	Traces per exposure hour (all workers) ¹	Seconds of Worker Exposure per Trace Acquired
Explor Sparse 3D Project 2014	Cabled Recording System	4,450	Rolling Patch	Explosives (NG Based)	5,500	Stakeless	10,725,000	20,318	528	6.82
Explor HD3D Project 2019	3-piece nodes with cables	4,500	All Live	Vibroseis (ISSN™)	26,800		120,600,000	18,780	6,422	0.56
Explor Sparse Project 2020	3-piece nodes with cables	2,500	All Live	Explosives (NG Based)	2,600		6,500,000	16,438	395	9.10
Explor HD3D Project 2021		19,900	All Live		12,950		257,705,000	3,429	75,155	0.05
ISGS CarbonSAFE ISC 3D		20,000	All Live	Vibroseis (ISSN™)	8,000		160,000,000	4,206	38,041	0.09

Note 1: Includes all workers, including both contractors and Explor employees. Includes line preparation, positioning, receiver deployment and retrieval and source acquisition.



LightSpeed Seismic Source System

Seismic Source Type:	Impulsive Electrofluidic source: no moving parts
Energy Output:	Variable: 5 kJ to >20 kJ
Repeatability:	Excellent
Production Rate:	Open Flat Terrain, <10 m SP interval: ~200 SPs/hr
Deployment Method:	Various (compact tracked loader shown)
Attachment Method:	Various (standard skid steer attachment plate shown)
Tool Dimensions:	1.53m (60") D, 1.25m (50")H, 1.25m (50") W
Tool Weight:	700kg (1543 lbs.)
Hold Down Requirement:	1800 kg (~4000 lbs.)
Positioning and Timing:	Integrated with RTK GNSS or SBAS GNSS
Electricity Requirements:	5000W 240VAC, Single phase





November 24, 2023

Trevor Richards
Assistant Director-Geophysics
UND-Energy & Environmental Research Center
15 N. 23rd Street, Stop 9018
Grand Forks, ND 58202-9018

RE: BASIN ELECTRIC RESEARCH PROJECT 2-D SEISMIC
GEOPHYSICAL EXPLORATION PERMIT #97-0324
MERCER COUNTY
NON-EXPLOSIVE METHODS

Dear Mr. Richards:

Be advised that your Geophysical Exploration permit is conditionally approved; effective for one year from November 24, 2023.

PERMIT STIPULATIONS:

- Pursuant to NDAC 43-02-12-05 (DISTANCE RESTRICTION) Non-explosive exploration methods may not be conducted less than 300 feet from water wells, buildings, underground cisterns, pipelines, and flowing springs.
- In addition, pursuant to NDAC 43-02-12-06 (NOTIFICATION OF WORK PERFORMED), "The director is authorized to suspend operations of the entire geophysical project, or any portion thereof, if further activity will cause excessive damage to the surface of the land".

Review the following conditions for your permit:

1. A pre-program meeting with state seismic inspector Tom Torstenson is required. You must contact him at 701-290-1546 (cell) or 701-227-7436 at least 24 hours prior to any exploration operations. Also, a copy of the entire permit is required for all contractors at the pre-program meeting.
2. All variances for distance restrictions are to be furnished, and a pre-plot map displaying any source points that do not comply with the distance restriction rule must be supplied to the inspector.
3. The following information must be submitted within 30 days of the completion of the project by the Geophysical Company:
 - a. Completion Report,

- b. Completion Affidavit,
 - c. Post Plot Map. It must show all water wells, buildings, underground cisterns, pipelines, and flowing springs that fall within the program area and within one half mile of the perimeter of the program.
 - d. Must provide a GIS layer using NAD83 in an Esri shape file format and an Image file (.img) on a Flash Drive or email: tstorstenson@nd.gov with all source and receiver points,
4. The permit agent shall notify the operator of the land at least seven days before commencement of any geophysical exploration activity, unless waived by mutual agreement of both parties. The notice must include the approximate time schedule and the location of the planned activity.
 5. Information regarding the location of water wells, springs, etc.; refer to the following ND State Water Commission Mapservice website, at: <http://mapservice.swc.state.nd.us/>
 6. The entire permit can be viewed, as well as the status of various seismic projects in the state, at: <https://www.dmr.nd.gov/oilgas/seismic/seismicstats.asp>

Should you have any questions regarding this matter, feel free to contact me at 701-328-8020, or Tom Torstenson at the number listed in paragraph 1.

Sincerely,



Todd L. Holweger
Permit Manager/Geophysical Supervisor



GEOPHYSICAL EXPLORATION PERMIT - FORM GE 1

INDUSTRIAL COMMISSION OF NORTH DAKOTA
 OIL AND GAS DIVISION
 600 EAST BOULEVARD DEPT 405
 BISMARCK, ND 58505-0840
 SFN 51459 (03-2011)

Received

001 23 2023

ND Oil & Gas
Division

1) a. Company University of North Dakota - EERC		Address 15 N 23rd St, Stop 9018, Grand Forks, ND 58202-9018		
Contact Trevor Richards		Telephone (701) 777-5052	Fax	
Surety Company Bank of North Dakota		Bond Amount \$25,000	Bond Number GEO 308	
2) a. Subcontractor(s)		Address		Telephone
b. Subcontractor(s)		Address		Telephone
3) Party Manager Kyle McBride		Address (local) Same as above		Telephone (local) (940) 367-3715
4) Project Name or Line Numbers Basin Electric Research Project - 2D Seismic				
5) Exploration Method (Shot Hole, Non-Explosive, 2D, 3D, Other) Non-Explosive (Betsy Seisgun and Accelerated Weight Drop)				
6) Distance Restrictions (Must check all that apply)				
<input checked="" type="checkbox"/> 300 feet - NonExplosive - Distance setbacks apply to water wells, buildings, underground cisterns, pipelines, and flowing springs.				
<input type="checkbox"/> 660 feet - Shot Hole - Distance setbacks apply to water wells, buildings, underground cisterns, pipelines, and flowing springs.				
7) Size of Hole	Amt of Charge	Depth	Source points per sq. mi.	No. of sq. mi.
3-D				
Size of Hole	Amt of Charge	Depth	Source points per ln. mi.	No. of ln. mi.
2-D		up to 24"	264	3
8) Approximate Start Date December 11, 2023			Approximate Completion Date January 30, 2024	

THE COMMISSION MUST BE NOTIFIED AT LEAST 24 HOURS IN ADVANCE OF COMMENCEMENT OF GEOPHYSICAL OPERATIONS

9) Location of Proposed Project - County Mercer County						
Section(s), Township(s) & Range(s)	Section	34, 35	T.	146N	R.	88W
	Section	7, 18	T.	145N	R.	87W
	Section	1, 2, 11, 12, 13	T.	145N	R.	88W
	Section		T.		R.	
	Section		T.		R.	
	Section		T.		R.	

I hereby swear or affirm that the information provided is true, complete and correct as determined from all available records. Date **10/13/2023**

Signature Printed Name **Trevor Richards** Title **Assistant Director - Geophysics**

Email Address(es)
trichards@undeerc.org

(This space for State office use)		Permit Conditions	
Permit No. 97-0324	Approval Date 11/24/23	* Permit in hand required at pre-program meeting with field inspector and be aware of all NDIC Rules and Regulations (i.e. distance restrictions).	
Approved by 		* See attached letter.	
Title Mineral Resources Permit Manager			

Proposed Sources for Active Seismic

<https://betsygun.com/>



Betsy seisgun (1) with plastic splatter guard, shell holder(2), hammer(3) and shells of various sizes



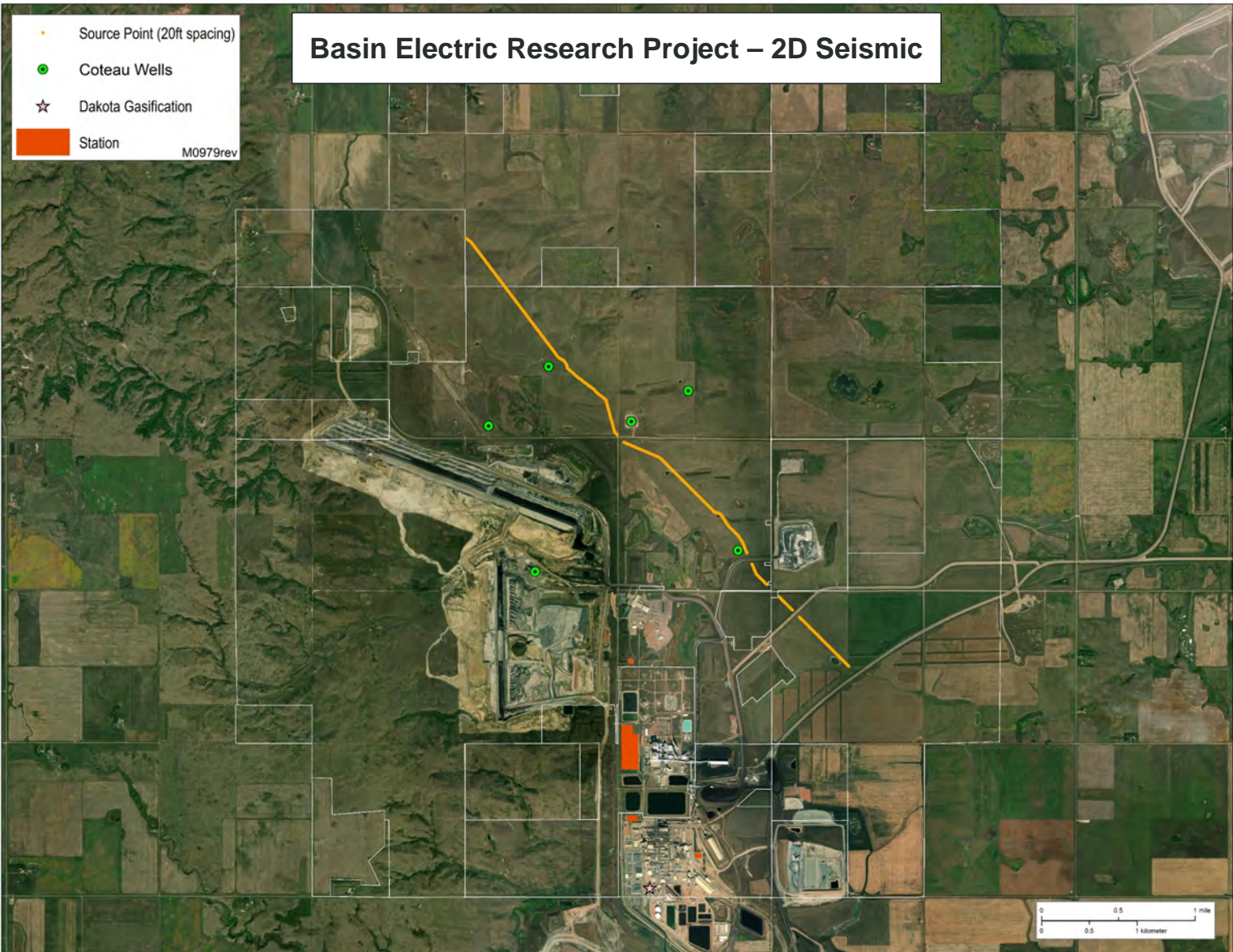
[Click for RT Clark Website](#)

[Weight Drop Seismic Source - YouTube](#)

Critical Challenges. Practical Solutions.

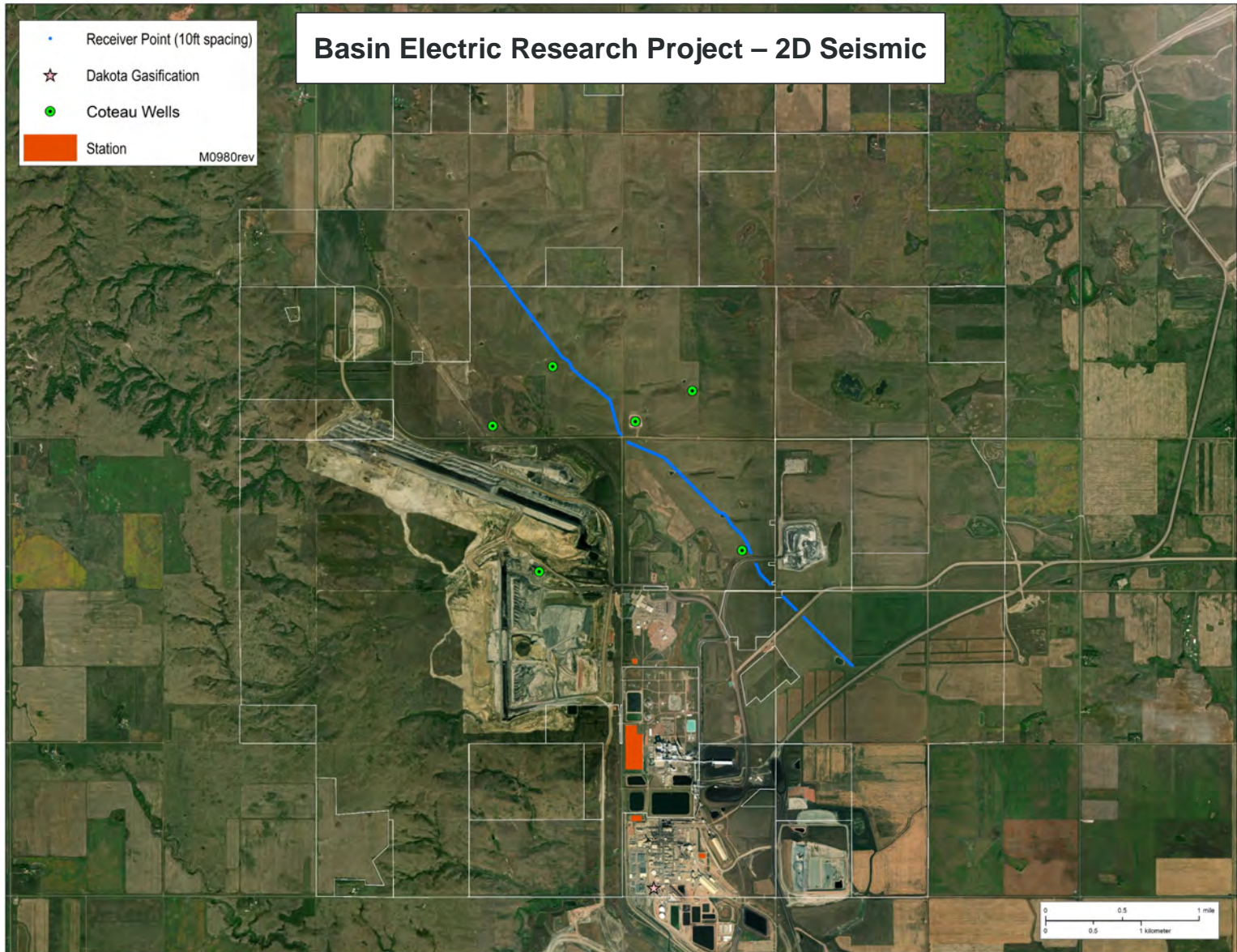
Basin Electric Research Project – 2D Seismic

- Source Point (20ft spacing)
 - Coteau Wells
 - ☆ Dakota Gasification
 - Station
- M0979rev



Basin Electric Research Project – 2D Seismic

- Receiver Point (10ft spacing)
 - ☆ Dakota Gasification
 - Coteau Wells
 - Station
- M0980rev





October 31, 2023

Mr. Todd Holweger
Permit Manager/Geophysical Supervisor
ND Industrial Commission Oil & Gas Division
600 East Boulevard Ave, Dept 405
Bismarck ND 58505

Subject: Geophysical Exploration Permit & Affidavit

Dear Mr. Holweger:

Please accept this letter as an affidavit of compliance for University of North Dakota EERC's proposed geophysical activities.

We look forward to working with you further with regard to this proposed geophysical project. Please contact me with any questions by phone at 701.557.5454 or by email at mmurray@bepc.com.

Sincerely,

A handwritten signature in blue ink that reads "Mike Murray".

Mike Murray, SR/WA, R/W-NAC
Directory of Property & Right of Way

Enclosure

AFFIDAVIT OF MIKE MURRAY

STATE OF NORTH DAKOTA)
) ss
COUNTY OF BURLEIGH)

Mike Murray, being first duly sworn, deposes and states as follows:

1.

I am the Director of Property & Right of Way at Basin Electric Power Cooperative. I also work on matters for Basin Electric Power Cooperative's subsidiary Dakota Gasification Company ("DGC"), located at 1717 East Interstate Avenue, Bismarck, North Dakota 58503.

2.

All landowners within the proposed EERC research on DGC's 45Q Project area have been notified of the approximate schedule and location of the project and provided a written copy of the North Dakota Century Code (NDCC) Section 38-08.1-04.1 (Exploration Permit) and NDCC Chapter 38-11.1 (Oil & Gas Production Damage Compensation). Further, as required by NDCC Section 38-08.1-04.1 (4), landowners within 1/2 mile of the project area were provided written copies of the required NDCC sections 38-08.1-04.1 and chapter 38-11.1.

DATED this 31st day of October, 2023.



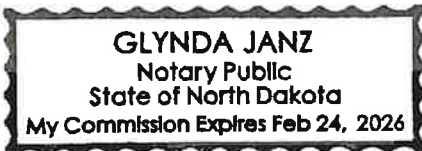
Mike Murray
Director of Property & Right of Way
Basin Electric Power Cooperative

STATE OF NORTH DAKOTA)
) ss
COUNTY OF BURLEIGH)

The foregoing instrument was acknowledged before me this 31st day of October 2023, by Mike Murray of Basin Electric Power Cooperative.



Notary Public
My Commission Expires:





North Dakota Industrial Commission Department of Mineral Resources Oil & Gas Division

FORM GE 1 FILING AUTHORIZATION

COMPANY NAME: University of North Dakota - EERC

ADDRESS: 15 North 23rd Street, Stop 9018

CITY: Grand Forks STATE: ND ZIP: 58202-9018

This form authorizes the person(s) listed below to submit a NDIC Geophysical Exploration Permit – Form GE 1 for approval on behalf of the designated company as listed above.

A new authorization will be required if any changes are to be made to the authorized individuals on the form.

The data submitted from the authorized individuals listed below have been checked and conform to the standards and procedures set forth by the NDIC Department of Mineral Resources.

The authorized individual(s) will ensure that the company, as listed above, and party manager receive a copy of the approved Form GE 1

<u>Authorized Individuals</u>	<u>Phone Number</u>	<u>E-Mail Address</u>
Mike Murray	701-557-5454	mmurray@bepc.com

Company Authorized Signature: *Tobe Larson* Date: 10/12/2023

Printed Name: Tobe Larson Title: Assistant Dir. of Contracts & IP

Phone: 701-777-5271 Email Address: tlarson@undeerc.org

Witness Signature: *Kellie Ebertowski* Date: 10/12/2023

Witness Printed Name: Kellie Ebertowski



Trevor Richards
Assistant Director for Geophysics

trichards@undeerc.org

701-777-5052 (office)

214-557-6282 (mobile)

**Energy & Environmental
Research Center**

University of North Dakota
15 North 23rd Street, Stop 9018
Grand Forks, ND 58202-9018

www.undeerc.org

701.777.5000 (phone)

701.777.5181 (fax)

A wide-angle photograph of a university campus at sunset. The sun is low on the horizon, casting a warm glow over the scene. In the foreground, there are large trees with yellowing leaves. In the background, there are several large, multi-story brick buildings and a parking lot filled with cars.

THANK YOU

Critical Challenges. Practical Solutions.



November 24, 2023

The Honorable Carmen Reed
Mercer County Auditor
P.O. Box 39
Stanton, ND 58571-0039

RE: Geophysical Exploration
Permit Numbers 97-0324

Dear Ms. Reed:

Pursuant to Section 38-08.1-04.2 of the North Dakota Century Code, please be advised that the University of North Dakota Energy & Environmental Research Center was issued the above captioned permit on November 24, 2023, and will remain in effect for a period of one year. The entire permit can be viewed on our website at: <https://www.dmr.nd.gov/oilgas/seismic/seismicstats.asp>

Should you have any questions, please contact our office.

Sincerely,

A handwritten signature in blue ink, appearing to read "Todd L. Holweger".

Todd L. Holweger
Permit Manager/Geophysical Supervisor