



Recommendation for modification of the
surface microseismic monitoring
at Sulphur Mines Salt Dome
(LDNR Compliance Order No. IMD 2022-027)

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A semi-permanent telemetered surface seismic array is currently in operation at Sulphur Mines Salt Dome. The array consists of seven stations installed in early April 2023 (Figure 1). Depending on the background noise level on the stations, the detection threshold of this array is approximately magnitude -0.5 to 0.5. Biweekly monitoring reports are sent to Louisiana Department of Natural Resources. We seek to modify the current seismic network with a new data processing group and different seismic sensors.

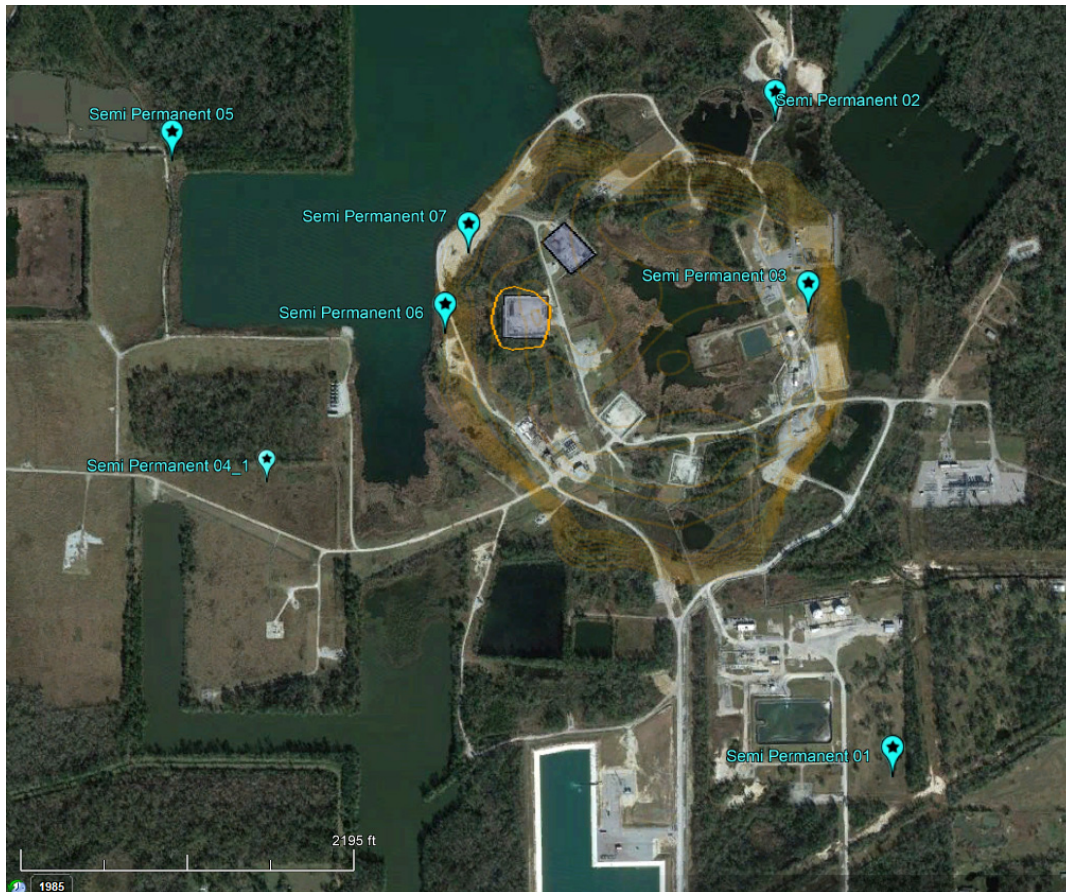


Figure 1. Google map image showing the semi-permanent seismic recording station locations (blue symbols) located near and at the Sulphur Mines Salt Dome. The cap rock outline for the Sulphur Mines salt dome is shown by orange semi-transparent lines. The surface expression of Cavern 7 is shown by orange solid line.

The sensors used in the seismic array are 4.5 Hz HG-6HZ geophones with a sensitivity of 78.9 volts/meter/second sampled at 200 Hz. The data is acquired and processed by Jarpe Data Systems. The lowest frequency the sensor can measure is about 2 Hz (Steve Jarpe, Jarpe Data Systems, personal communication, 2023).

We propose a modification to the semi-permanent surface array, replacing the seven 4.5 Hz sensors with five Nanometrics Trillium Compact (20 second) broadband seismometers. We tentatively plan to place the five Trillium Compact stations at the 4.5 Hz sensor locations at the locations for sites 2, 4, 6 and 7 and either site 1 or 3, depending on discussions with Nanometrics data processing group (Figure 2). Sites 2, 4, 6 and 7 are currently have the lowest background noise levels.

Nanometrics will install the Trillium Compact array, acquire and process continuous ground motion signals. The effective low frequency range of the Trillium compact is 0.05 Hz, which would lower the

measurable frequencies at Sulphur Mines salt dome by about 2 decades. The sensitivity of the Trillium Compact sensor is approximately 750 volts/meter/sec. Information about Nanometrics sensors and data processing can be found at (<https://nanometrics.ca/>).

Previous salt dome monitoring. The Trillium Compact sensors (120 second) were deployed at the Bayou Corne sinkhole by the USGS/University of Memphis prior to and immediately following the formation of the Bayou Corne sinkhole (Ellsworth et al., 2012). Texas Brine replaced the USGS seismic network with 20 second Trillium Compact sensors in a borehole network that ran for several years at Bayou Corne with acquisition and processing performed by Nanometrics (Shemeta et al., 2013).



Figure 2. Google image of Sulphur Mines Dome area with probable locations of the Trillium Compact sensors in yellow. The final sensor locations will be proposed after discussions with the data processing group at Nanometrics. The cap rock outline for the Sulphur Mines salt dome is shown by orange semi-transparent lines. The surface expression of Cavern 7 is shown by orange solid line.

References:

Ellsworth, B., S. Horton, H. Benz, B. Chouet, P. Dawson, S. Hickman, A. Leeds, B. Leith, M. Meremonte, J. Rubinstein, D. Shelly, M. Withers and B. Herrmann, 2012, Tremors in the Bayou: The Events on the Napoleonville Salt Dome, Louisiana, Abstract S51E-2453 presented at 2012 Fall Meeting, AGU, San Francisco, Calif., 3-7 December 2012.

Shemeta, J., M. Leidig and D. Baturan, 2013, Passive Seismic Observations at Grand Bayou, Louisiana, USA Associated with the Failure of Oxy Geismar #3 Solution Cavern, Paper presented at the Solution Mining Research Institute Fall Meeting, 30 September- 1 October 2013, Avignon, France.