Final Report

Review of Blast Documentation Data

White Rock Quarry North (WRQN)

Miami-Dade County Lake Belt

Florida Department of Financial Services

Division of State Fire Marshal

Submitted by

LAMPL HERBERT

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June 12, 2017

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Acronym List

AO	Air Overpressure
BAR	Blasting Activities Reports
COM	City of Miramar
DSFM	Division of the State Fire Marshal
IPS	Inches Per Second
LHC	Lampl-Herbert Consultants
MAR	Monthly Activity Reports
PPV	Peak Particle Velocity
UTC	Coordinated Universal Time
WRQN	White Rock Quarry North

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Executive Summary

The Florida Department of Financial Services, Division of the State Fire Marshal, contracted Lampl-Herbert Consultants (LHC) to perform a review and evaluation of the blasting and seismic records for January-December 2016 from the White Rock Quarry North (WRQN). The materials available included:

1. **Blaster Reports** submitted to WRQN by the blaster in charge (Angelini Blasting, Austin Powder, Dyno Nobel).
2. **Velocity Waveform Analysis sheets** submitted to WRQN by the independent seismologist (GeoSonics, Vibra-Tech).
3. **Blasting Activities Reports (BAR)** prepared by WRQN and submitted to DSFM to report blast variables, compliance seismograph readings, and blast locations.
4. **Velocity Waveform Analysis sheets** submitted by the City of Miramar to DSFM (GeoSonics).
5. **Request for Investigation** of complaints from neighbors prepared by DSFM investigators and submitted to DSFM.

A summary of the data received, reviewed, and analyzed is set out below:

- ❒ Complaints logged in 2016:
  - ○ 239 complaints from 126 individuals.
  - ○ 214 of these complaints were made after April 1st.
  - ○ Of the 10 highest compliance Peak Particle Velocity (PPV) readings only one (1) complaint was made; all 10 were below the <0.50 PPV level limit set by DSFM rules.
  - ○ The north wall of quarry at the key cut generated the highest number of blasting complaints.
  - ○ Only one (1) complaint made when WRQN contractors Angelini Blasting or Austin Powder conducted the blasting.
    - ◆ Angelini and Austin recorded overall higher frequencies and lower PPV levels during blasts.

- Both contractors used or switched to electronic detonators at WRQN during April which may have affected the ignition sequence used.

- ❒ Compliance seismographs were not always placed at the closest non-owned structure as directed by DSFM.
- ❒ On at least 70 occasions, incorrect data were transferred from contractor Blast Reports and/ or Velocity Waveform Analysis sheets to the BAR submitted by WRQN to DSFM including:
  - ❍ PPV levels and Air Overpressure.
  - ❍ Distance to closest structure.
  - ❍ Maximum pounds of explosives per delay.
  - ❍ Blast time and dates.
- ❒ City of Miramar seismograph data collected during August to October were omitted from analysis because of issues with incorrect blast time and an inoperative microphone channel.
- ❒ Calibration issues were noted among instruments used for compliance, WRQN permanent locations, and the City of Miramar sites.
- ❒ Data were sufficient to allow cross-correlation between multiple seismograph stations and evaluation of peak levels for each blast event.
- ❒ Based on the data evaluated, none of the PPV levels exceeded 0.50 IPS in 2016.

Introduction

White Rock Quarry North (WRQN) is one of five aggregate mining companies operating within the Miami-Dade County Lake Belt in south Florida. All of the mining companies use explosives to break the limestone rock for retrieval by dragline. The Florida Department of Financial Services (the Department), Division of the State Fire Marshall (DSFM), regulates the quantity and use of explosives used for blasting and the air blast and ground vibration levels that occur at blasting.[1]

Broward and Miami-Dade Counties residents living adjacent to active mining at WRQN have filed numerous complaints with the Department in recent years alleging damage to homes and violations of state-mandated vibration levels during routine blasting operations.[2] DSFM received 53 complaints in 2013; 22 complaints in 2014, and 63 complaints in 2015 on WRQN activities. DSFM received an unprecedented 239 complaints from 126 individuals in 2016, followed by demands from elected officials and residents alike for state intervention.

The Department subsequently contracted with Lampl Herbert Consultants (LHC), a Tallahassee-based natural resource consulting firm, to collect and review Blasting Activity Reports (BAR) submitted by WRQN to DSFM to:

- ❒ Assess the accuracy of and consistency between individual ***seismographs*** and
- ❒ Identify operational issues that could cause a lack of consistency between seismographic readings.

Seismograph

An instrument used to detect and record the intensity of seismic waves that propagate vibrations emanating from a blast event.

[1] Construction Materials Mining Activities 552.30(1) F.S. - *Notwithstanding the provisions of s. 552.25, the State Fire Marshal shall have the sole and exclusive authority to promulgate standards, limits, and regulations regarding the use of explosives in conjunction with construction materials mining activities. Such authority to regulate use shall include, directly or indirectly, the operation, handling, licensure, or permitting of explosives and setting standards or limits, including, but not limited to, ground vibration, frequency, intensity, blast pattern, air blast and time, date, occurrence, and notice restrictions.*

[2] Construction Materials Mining Activities 69A-2.024(15)(a) F.A.C. - *Based upon the safe level of blasting vibrations for houses ... in United States Bureau of Mines, Report of Investigations 8507, notwithstanding the limits in subsection (4) above, the use of explosives within two miles of an urban development, as defined in paragraph (2)(e) above, shall not exceed a peak particle velocity of more than 0.5 inches per second due to the potential existence of plaster on lath construction.*

Independent Seismologist

An individual who possesses expertise in the use, location, and operation of seismographic equipment and in the analysis of seismographic data; possesses experience in monitoring side effects produced by blasting used in construction materials mining activity as described in 69A-2.024, F.A.C.

On request, WRQN management voluntarily submitted confidential reports prepared by contract blasters and Velocity Waveform Analysis reports prepared by contract ***independent seismologists***. The City of Miramar (COM) submitted Velocity Waveform Analysis reports prepared by contract independent seismologists. See Attachment 1 for a complete list of materials received and reviewed by day and date of the blast event.

Work began December 22, 2016. LHC completed its initial review and analysis March 22, 2017; the Proposed Final Report was submitted May 22, 2017. The Final Report and supplemental materials are submitted in this document. This report is divided into four sections.

- ❒ Section 1 provides an overview of the situation, including conflicts, and, separately, the life cycles of mining operations and individual blast events.
- ❒ Section 2 reviews the blast documentation data to evaluate seismographic instruments, operational issues, and neighborhood complaints. This section includes an analysis of a single blast event for illustrative purposes.
- ❒ Section 3 provides a summary of key findings.
- ❒ Section 4 provides recommendations focused on improvement of reporting, operations, and communication.

Terms considered integral to understanding mining are provided in the margins of the report. "Quarry" and "mines" are use interchangeably throughout the report.

Section 1: The Situation

Land Use Conflicts through 2001

Mining companies began production of limestone for road construction and limited development in backcountry areas of the future Miami-Dade and Broward Counties as early as the 1940s (Vernon 1943). Decades later, developers repurposed mine quarries – and in some cases created their own -- to sell "water front property" in areas rezoned for high density residential units at the edge of the Everglades. Given the difference between mining interests and residential expectations, such actions set the stage for land use conflicts.

By the early 1990s, residents sought relief from the vibration and noise associated with periodic blasts at mines; some residents reported structural damage to homes. Complaints led to a series of independent studies, legal action, and eventually mining companies were regulated by local governments. Such investigations and solutions focused largely on ***Peak Particle Velocity (PPV)*** or ground vibrations as the culprit. Regulation varied by government entity. For example, at one time then-Dade County limited the PPV to 0.75 IPS (inches per second). The City of Plantation set PPV limits at 0.25 IPS. Separately, Dade County eventually reduced PPV limits to a range of 0.38 to 0.50 IPS; during the same period, an individual land developer negotiated with the City of Pembroke Pines to "...keep explosions at 0.25 IPS peak particle velocity – below the city's limit of 0.4 IPS." Governments created boards and/or committees; residents filed complaints with government and claims with insurance companies; companies sued government, and homeowners filed a class action suit. The Florida Legislature ended local regulation of blasting in 2001, assigning responsibility to the Division of the State Fire Marshal (DSFM) within the Department of Financial Services. The current PPV level 0.50 IPS was established by administrative rule in 2004.

Peak Particle Velocity or PPV

A measure of ground vibration. Describes the velocity at which a particle of ground vibrates when excited by a seismic wave

Present Day Conflicts

The continued expansion of WRQN mining operations and of land development in or adjacent to one another brought blasting near homes in the City of Miramar in Broward County and City of Miami Lakes in Miami-Dade County, over the past decade. Complaints from residents in Miramar continue as mining activities move closer to homes, confirming that issues associated with vibration during blasting have not been solved to the satisfaction of residential neighbors. Residents question the accuracy of compliance seismographs and the validity of current PPV levels which represent the single metric used to track vibration levels near mines in Florida.

Mining in Miami-Dade County

Limestone mines occupy a 56-square mile area bounded by the Everglades at the west; U.S. Highway 41 at the south; the Broward County line at the north, and the Florida Turnpike at the east. The Miami and the Tamiami limestone formations of interest for commercial mining occur at a shallow depth, usually six to eight feet below the sand and organic soil overburden. These geologic formations also provide the rock matrix for the Biscayne Aquifer which supplies southeast Florida with freshwater; consequently, the mines in the Miami-Dade area are filled with water.

Mining operations function within a life cycle that typically takes place over 10-30 years or more, depending on company ownership, mine size, quality of the rock, and market demand (Figure 1). The first steps confirm the volume of rock, land acquisition, and regulatory permitting (Vernon, 1943). Projects are most often planned and permitted for the "life of mine" which begins with site clearing, blasting, and excavation and ends with reclamation of the property.

Site clearing work strips the overburden from the surface to the top of the limestone, after which operations begin with excavation of a key cut to create an open water area. Blasting activities are configured to direct the breaking rock into the direction of the cut. Mining activities will continue until the mining equipment reaches the property buffer allowed in the permits. At the end of mining operations, the reclamation plan reconfigures the edge of the lake to provide recreational and

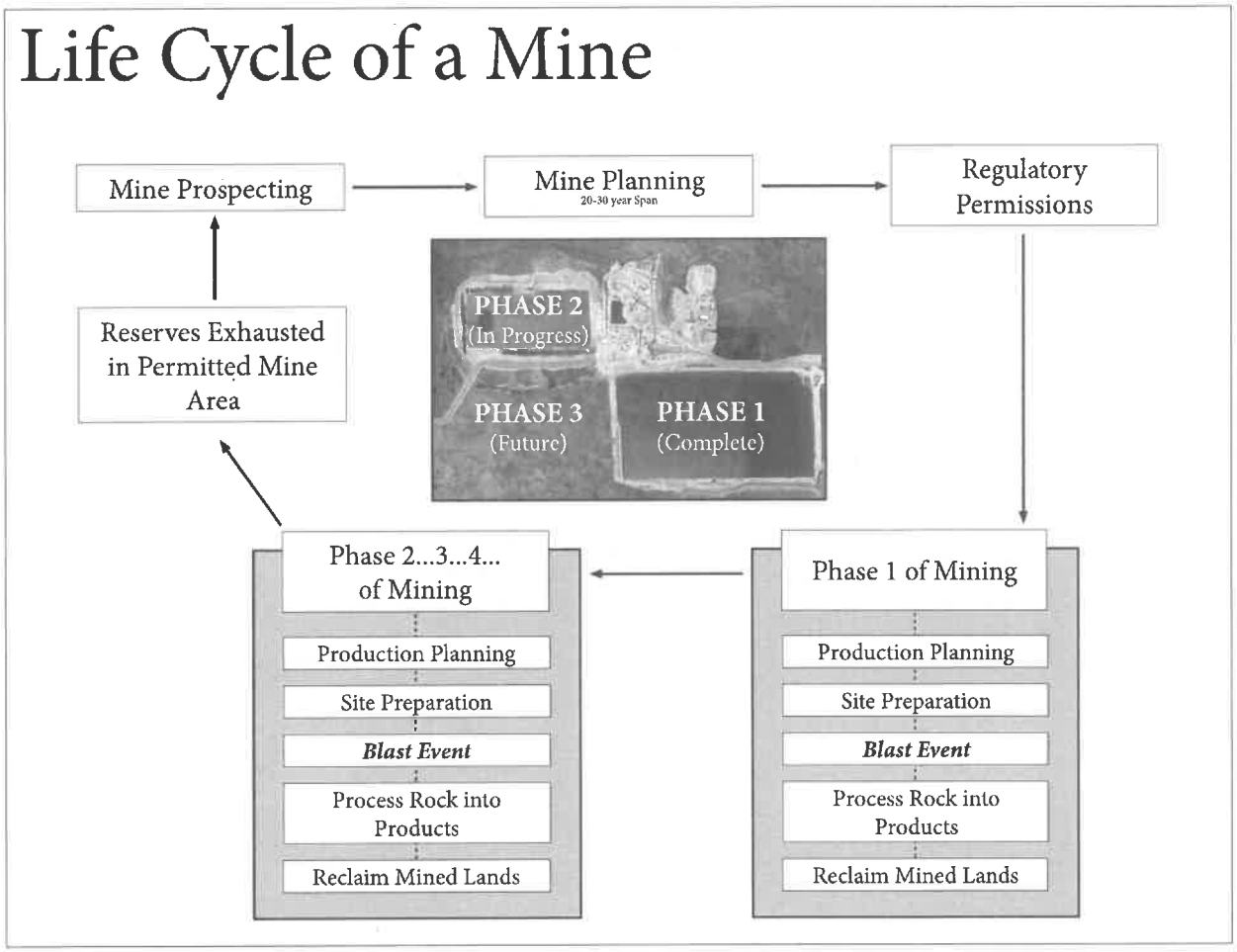

Figure 1: Life Cycle of a Mine

wildlife benefits. Figure 2 illustrates this process. Given the excavation visible in this photo, WRQN blasting operations are in the early stages of key cut development and will move closer to the residents of Miramar and Miami Lakes over the next decade.

Life Cycle of a Blast Event

The Miami and Tamiami limestone formations occur near the surface; the economic value is in the upper 75 feet of the mine. The blasting cycle is of short duration, a three or four-day series of blast hole drilling activities that end with the actual blast event (Figure 3). As noted above, the blast breaks the limestone in the direction of the key cut; the dragline excavates the blast rock, and the next round of blast hole drilling activities start immediately.

Figure 2: WRQN Key Cut for Next Phase of Mining

The dragline works along the top of the limestone on a "bench" or level surface at edge of the lake using the boom and bucket to retrieve broken rock from the previous blast to the surface. At the same time, the blast hole crew is working on the bench to drill the next blast pattern.

Blast holes eventually are drilled to the lowest zone of limestone that can be reached with the dragline which in Miami Dade is about 85 feet. The holes are spaced in a rectilinear pattern determined by the blaster's experience and the results of previous blasts. The main objective is to break the limestone into pieces that can easily be removed with the dragline. The blast holes are loaded with detonators based on the timing sequence required to progressively fracture the rock over the duration of the blast event. The explosives, usually in the form of a thick slurry, are placed in the hole from bottom to top.

Licensed Blaster

A person employed by a user who detonates or otherwise effects the explosion of an explosive.

After the explosives are in place, the ***licensed blaster*** and independent seismologist prepare for the detonation of the charges. The portable compliance seismograph is positioned at the closest off-site structure; the dynamic calibration check is performed by the independent seismologist. The area is cleared of personnel, and explosives

are detonated by the licensed blaster according to the blasting schedule published by the mining company. After the blast, the seismologist downloads the data from the instrument to a computer; the dragline resumes work and the blast hole drilling begins the next cycle.

Each blast at WRQN is monitored by an array of seismographs; the state-required instrument is placed at the structure nearest the blast and a calibration check is run. WRQN maintains up to 11 permanent, computer-linked seismographs that record during each blast event. These additional units perform a dynamic calibration check and record any vibration event above 0.03 inches per second that occurs during the day regardless of the source of the blast. These stations report by modem link to the GeoSonics computer at company headquarters.

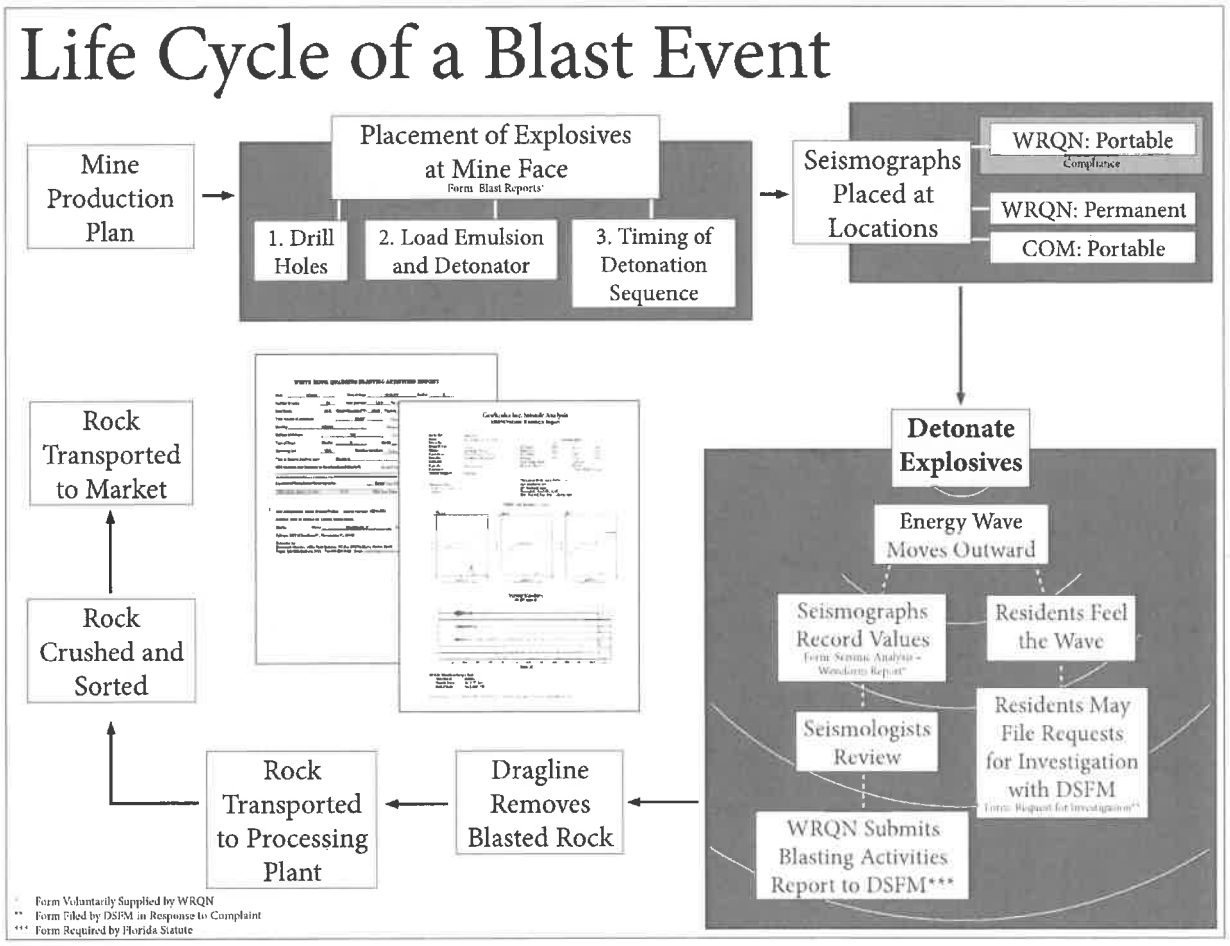

Figure 3: Life Cycle of a Blast Event

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Section 2: Review of Blast Documentation Data

The Data

WRQN, a private mining company, collects information on multiple parameters for internal purposes during each blasting event. Such records are commonly considered confidential; however, WRQN voluntarily provided Blast Reports and Velocity Waveform Analysis data for 2016 to DSFM for this study.[1]

- ❒ Blast Reports are prepared for WRQN for internal purposes by DSFM-licensed blasters employed by the contractors that provide explosives and loading and detonation services to mining companies. Dyno Nobel, Angelini Blasting, and Austin Powder employed individual blasters at WRQN in 2016.
- ❒ Velocity Waveform Analysis sheets are generated from data acquired during the blast event by seismographs[2] set at strategic locations around the active mine site. Vibra-Tech Engineers, Inc. and GeoSonics, Inc. employed independent seismologists to work at WRQN during 2016. The Waveform Analysis sheets include the serial number and date of calibration for each seismograph.
- ❒ DSFM requires placement of at least one seismograph at a built structure (house or other building) closest to the point of detonation during each blasting event.[3] The data recorded by these instruments – commonly referred to as "compliance seismographs" – are downloaded to specialized software[4] for analysis by an independent seismologist. The variables include:

[1] WRQN continues to make these data available to the DSFM. Reports are posted regularly to http://www.myfloridacfo.com/Division/SFM/BFP/mine_blasting.htm

[2] http://www.geosonicsvibratech.com/products/seismographs/

[3] Section 552.112, Florida Statute and 69A-2.024-1 Florida Administrative Code

[4] http://www.geosonicsvibratech.com/products/seismic-analysis-software/

- Peak Particle Velocity (PPV)
- Peak *Air Overpressure*
- Location of the Seismograph, and
- Status of Calibration of seismograph.

Air Overpressure

The airborne shock wave or acoustic transient generated by an explosion. As this air wave (measured in decibels (dBL)) contacts structures, it causes walls to vibrate.

Blasting Activities Report (BAR): All mining companies that use explosives and operate in Florida are required by law to provide a summary of each blast event to DSFM.

- A BAR is prepared by a WRQN employee for each blast event and submitted to DSFM on a daily basis.
- The BAR is a summary of Blast Reports and Velocity Waveform Analysis sheets described above.
- The BAR identifies the date and location of the blasting event.
- The BAR does not report the serial number and/or status of calibration for the compliance seismograph(s).

DSFM collects the BAR which, as noted above, are summaries of the WRQN internal Blast Reports and Velocity Waveform Analysis sheets. DSFM also receives and logs complaints reported by residents. Depending on wishes of the complainant, DSFM may or may not conduct interviews and a site investigation. A Request for Investigation report records comments from the complainant and a review of BAR for the specified event or series of events.

The BAR, log, and Requests for Investigation are subject to Florida's Government-in-the-Sunshine Laws.

The City of Miramar (COM) contracts with an independent seismologist to monitor the PPV levels during individual blasts adjacent to a residential subdivision in Miramar. Velocity Waveform Analysis data are recorded by seismographs set at strategic locations around the active mine site to record information about blast events. GeoSonics, Inc. employed independent seismologists to monitor blast events at WRQN for COM from August-December 2016.

Data Analysis

WRQN conducted 135 blast events in 2016. The LHC team organized key variables from Blasting Activities Reports (WRQN), Blasters' Reports, and Waveform Analysis sheets (WRQN) in an Excel spreadsheet for review. Separately, we gathered the individual reports and analysis sheets into "packets" for analysis by blast date reported by WRQN private contractors for events between July and December. The packets contained the following:

- ❒ Waveform Analysis sheets with locations generated by each Compliance Seismograph set out for DSFM requirements by GeoSonics, Inc. and Vibra-Tech Engineers, Inc.
- ❒ Blast Reports prepared for WRQN by Dyno Nobel, Austin Powder, and Angelini Blasting.
- ❒ Blasting Activity Reports prepared for DSFM by WRQN.
- ❒ Waveform Analysis sheets generated by up to 11 permanent seismographs that record each blast event for WRQN by GeoSonics.

The COM contract for monitoring data began in August; however, August and September data were omitted because the seismograph did not record the correct time of the blast.

Limitations

The research is limited to the materials supplied to Lampl Herbert Consultants by the DSFM. The complete list of document types available for each known blast event are reported by date in Attachment 1.

Evaluation of Seismographic Instruments

Seismographs – The Instrument

The seismographs used to monitor quarry blasting are sensitive electronic instruments that measures the amplitude and frequency of vibration waves of air overpressure and ground vibration levels. The blast generates an energy pressure wave

that moves in all directions away from the point of the blast. The type of earth medium e.g. rock, soil or water has an impact on the speed of the pressure wave and how quickly the energy is dissipated. Persons in the area feel the passage of the pressure wave as a vibration and may hear the blast from the air overpressure.

Figure 4: Typical Frequency Analysis of Longitudinal, Transverse, and Vertical Waves.

The seismograph records vibration wave frequencies on three channels and the amplitude with the peak particle velocity being the maximum movement of the ground as the energy wave moves past the recording device. The channels record separate components of the energy wave generated from a quarry blast longitudinal (L), transverse (T), and vertical (V) directions (Figure 4). The information from the seismographs is used to determine the energy levels and the vibration impact of an individual blast event. The unit of interest for this study is Peak Particle Velocity (PPV) as expressed in inches per second (IPS).

Seismographs at White Rock Quarry North

WRQN uses up to 11 permanent and/or portable seismographs to monitor PPV and air overpressure (AO) at or near its Miami-Dade County operations. The City of Miramar used two portable units to record Velocity Waveform Analysis data during blast events in August 2016. Stated another way, up to 13 seismographs were available to record information on each blast event that occurred at WRQN during the latter half of 2016.

Permanent Seismographs

- ❒ Up to 11 permanent seismographs (Figure 5 and Figure 6) were in operation around the WRQN during 2016.
- ❒ The solar powered, battery operated instruments are protected by stand-alone, weather-proof enclosures. Each unit is connected to GeoSonics' computer network by modem.

- ❒ The seismographs are operational during work days to record any vibration (PPV) event above 0.03 IPS.
- ❒ The instruments initiate a dynamic calibration self-check on start up to insure the seismographic waveform recording channels and the air overpressure microphone will operate within specifications during the next blast event.
- ❒ Each instrument is synchronized with Coordinated Universal Time (UTC) so that blast events are accurately timed.
- ❒ All communication with the permanent seismographs is through the GeoSonics computer network.
- ❒ GeoSonics backs up all data at multiple locations.

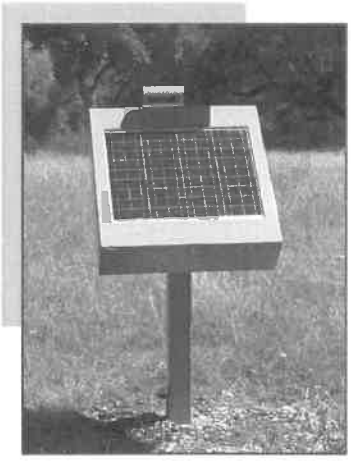


Figure 5: Typical Permanent Seismograph Station Used to Monitor Vibrations at WRQN

Figure 6: Location of Permanent Seismographs at WRQN

Portable Seismographs

- The independent seismologist places at least one portable seismograph (Figure 7) at a structure nearest the blast site before the blast takes place; this instrument is designated as the compliance device required by the DSFM.[5]

Figure 7: A Typical Portable Seismograph Used to Monitoring Vibration Levels at WRQN

- The independent seismologist conducts a manual calibration check on the seismograph waveform recording channels and the air overpressure microphone to determine if the instrument is operating within specifications.
- After the calibration check the unit is ready to receive data from the scheduled blast event.
- After the blast event the independent seismologist returns the portable instrument to the GeoSonics office, and the data are downloaded to the GeoSonics server.
- A WRQN employee transcribes the data from the portable seismograph to the Blasting Activities Report (BAR), along with other data from the event, then forwards the report to the DSFM.

Quality Control Evaluation for Compliance Seismographs

LHC used the Velocity Waveform Analysis sheets and the Certificates of Calibration developed by the independent seismologist and supplied by WRQN as the primary data sources to evaluate the quality control for compliance seismographs used for each blast event. Samples of the Velocity Waveform Analysis and the Certificates of Calibration are provided in Figure 8 and Figure 9.

[5] Section 552.112, Florida Statute and 69A-2.024-1 Florida Administrative Code

The Blasting Activity Report (BAR) data are a compilation of all blast event parameters prepared by the licensed blaster and the independent seismologist. We reviewed BAR data to confirm the correctness and accuracy of the data entries. The PPV and AO values were plotted and inspected to determine if anomalous values were present. The location of instruments was checked for each blast event. Variables of interest focused on the calibration of the instrument, the values recorded for PPV and AO and the location of the instrument.

Two important components related to the calibration of the instrument functions are: the dynamic calibration for permanent and portable units before each blast and the annual calibration by the manufacturer or a testing laboratory. As noted above, the permanently placed instruments initiate a dynamic calibration each day when the unit comes on line. The portable unit undergoes a manual check performed by the independent seismologist after the instrument is in place.

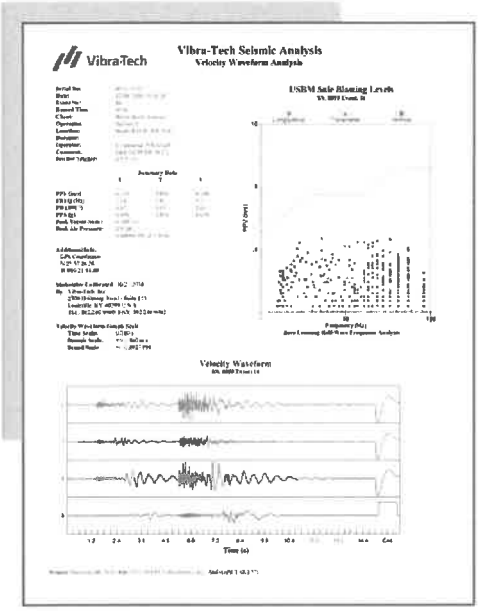
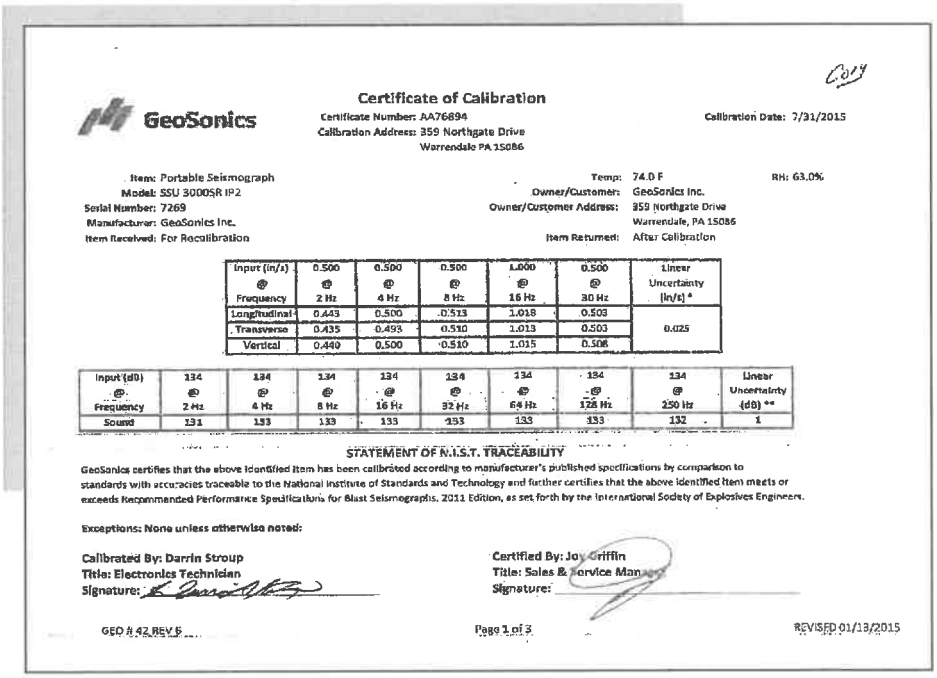


Figure 8: Example of a Waveform Analysis Sheet



GeoSonics

Certificate of Calibration

Certificate Number: AA76894
Calibration Address: 359 Northgate Drive
Warrendale PA 15086

Calibration Date: 7/31/2015

Item: Portable Seismograph
Model: SSU 3000SR IP2
Serial Number: 7269
Manufacturer: GeoSonics Inc.
Item Received: For Recalibration

Temp: 74.0 F RH: 63.0%
Owner/Customer: GeoSonics Inc.
Owner/Customer Address: 359 Northgate Drive
Warrendale, PA 15086
Item Returned: After Calibration

Input (in/s) @ Frequency	0.500 @ 2 Hz	0.500 @ 4 Hz	0.500 @ 8 Hz	1.000 @ 16 Hz	0.500 @ 30 Hz	Linear Uncertainty (in/s) *
Longitudinal	0.443	0.500	0.513	1.018	0.503	0.025
Transverse	0.435	0.493	0.510	1.013	0.503	
Vertical	0.440	0.500	0.510	1.015	0.508	

Input (dB) @ Frequency	134 @ 2 Hz	134 @ 4 Hz	134 @ 8 Hz	134 @ 16 Hz	134 @ 32 Hz	134 @ 64 Hz	134 @ 128 Hz	134 @ 250 Hz	Linear Uncertainty (dB) **
Sound	131	133	133	133	133	133	133	132	1

STATEMENT OF N.I.S.T. TRACEABILITY

GeoSonics certifies that the above identified item has been calibrated according to manufacturer's published specifications by comparison to standards with accuracies traceable to the National Institute of Standards and Technology and further certifies that the above identified item meets or exceeds Recommended Performance Specifications for Blast Seismographs, 2011 Edition, as set forth by the International Society of Explosives Engineers.

Exceptions: None unless otherwise noted:

Calibrated By: Darrin Stroup
Title: Electronics Technician
Signature:

Certified By: Joy Griffin
Title: Sales & Service Manager
Signature:

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Figure 9: Example of a Certificate of Calibration

Data Analysis

Number of Events Providing Data

The compliance information was supplied to the DSFM in the BAR; DSFM in turn scanned the documents and submitted them to LHC. The data were extracted and recorded in an Excel spreadsheet. The draft of this compilation was submitted to the DSFM for review in March in a separate file "Draft Compliance Spreadsheet 3-22-17."

The compliance data were supplemented by information supplied by WRQN from the company seismographic network for blast events beginning in July 2016. Additional information was reviewed from supplemental monitoring conducted for the City of Miramar by GeoSonics beginning in August. All data points were reviewed and data issues and discrepancies were noted. Comments are set out below relative to irregularities in the data sets.

The critical data for review included the time of the blast, explosives information, the location of blast site, the PPV value and the position and distance to the nearest building. These data were supplied in the 135 BAR from DSFM for all blast events in 2016, with a few discrepancies. Supporting data from multiple WRQN seismographs in operation during blasts after July along with City of Miramar (COM) seismographic information after August were available to cross-check information for individual events. The WRQN (permanent) and Miramar (portable) data sets both had discrepancies in instrument calibration and event reporting parameters; the nine to eleven data points available for each blast event provided statistical assurance that all blasts were within the DSFM PPV limit of 0.5 IPS.

The Velocity Waveform Analysis sheets for the 10 permanent seismographs were available for review beginning July 2016. The data from the two additional City of Miramar portable units were available after August 2016. After reviewing the data sets and removing reporting errors so for the last five months of 2016, there were approximately 60 blast events available to triangulate the results so operational issues could be reviewed and analyzed.

Issue: Seismographs Out of Calibration

Seismographs are sensitive instruments that require laboratory calibration every 12 months of service. In addition, seismographs are recalibrated whenever the operator notes readings or a check protocol that is not up to expected standards. The review of the compliance reporting sheets for the eight permanent seismographs and the single portable seismograph supplied by WRQN indicated the following units were out of (annual) calibration with other units failing internal dynamic calibration checks.

- ❒ The DSFM compliance unit No. 8755 failed the dynamic calibration test four times in October upon set-up, yet was used to record the blast for DSFM reporting.
- ❒ Eight WRQN units for those events reported a legal vibration level.

Calibration data for the following WRQN permanent units in operation for 2016 review were either past the annual factory re-calibration date or failed internal dynamic calibration checks. The WRQN seismograph array had redundancy for each blast event; a calibration event on one instrument only means that there are seven units recording verified information rather than eight.

Units with calibration issues included:

- ❒ Unit 7787 was calibrated on July 1, 2015, and was used to record 32 blasts from July 1, 2016, through October 21, 2016.
- ❒ Unit 7280 was calibrated on July 1, 2015, and was used to record blasts from through the end of July, 2016.
- ❒ Unit 9744 failed dynamic calibration check(s) on November 3, 2016, and continued through December. On November 9, 2016, the longitudinal channel was inactive or "dead." There were 13 blasts recorded during this time period.
- ❒ Unit 10691 failed dynamic calibration check(s) on August 16, 2016, and continued through December. The unit recorded 37 blast events.

Issue: Microphone Failing Dynamic Calibration

The seismographs are checked before or after blast events through internal dynamic calibration to determine if all recording channels are functioning properly.

- ❒ On four (4) occasions in October 2016, the GeoSonics employee used unit 8755 as the compliance seismograph, a unit that failed dynamic calibration for the air overpressure audio microphone channel.

Issue: "Dead" Vibration Channel

The compliance data sheets reported that unit 9744 failed the dynamic calibration for the longitudinal channel and was subsequently used.

On November 3, 2016, unit 9744 generated a waveform which showed a longitudinal channel that lost coupling.

- ❒ From November 9, 2016, through December 22, 2016, for 13 blast events the longitudinal channel was inactive or dead meaning no accurate reading was obtained on this vibration channel.

Operational Issues

The reference data used in this analysis were from the Blasting Activities Report (BAR).

Issue: Changes in Seismograph Recording Parameters

The independent seismologist changed data recording parameters without a written explanation by the independent seismologist as to what the change was attempting to accomplish. After reviewing the contract blasters reports, it was discovered the blaster was performing a signature hole in conjunction with the production blast. The changes to the recording parameters are as follow:

- ❒ On at least eight (8) blasts the record time was changed by the operator from 15 seconds to 30 or 35 seconds.

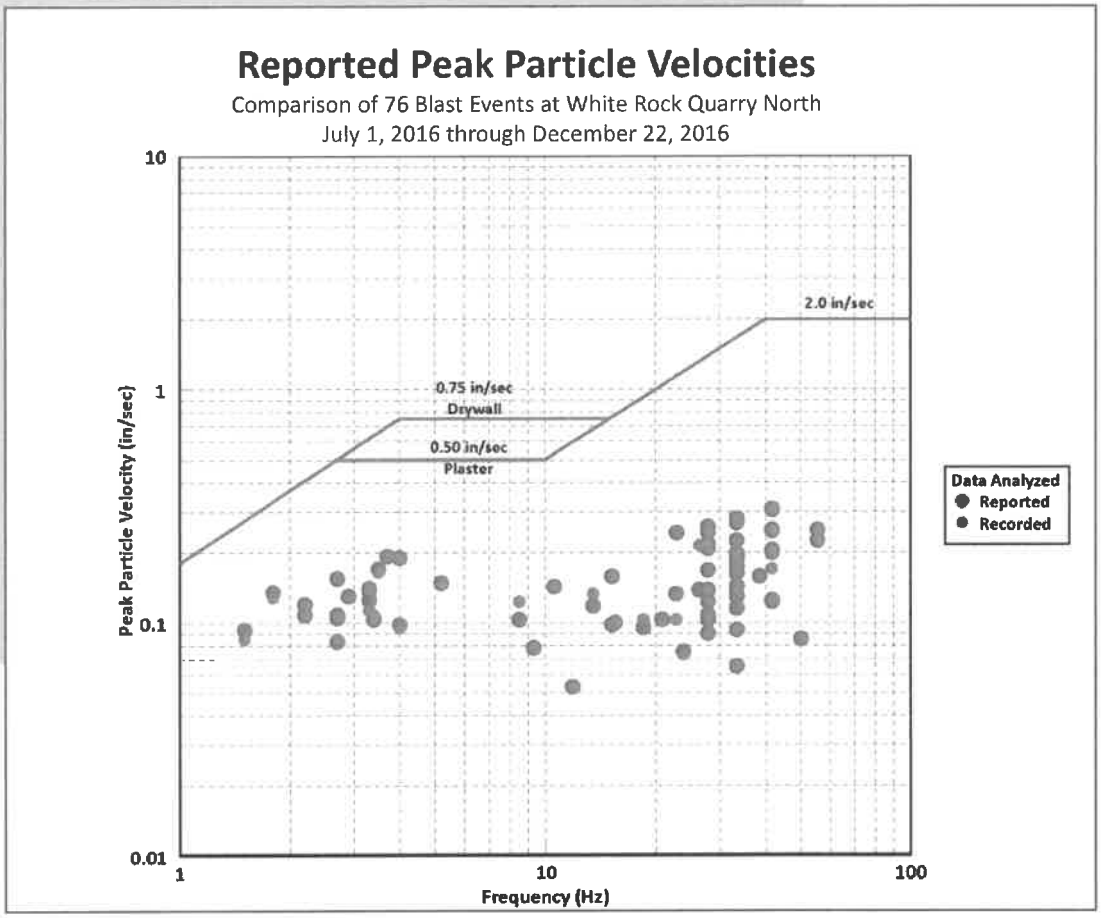


Figure 10: Comparison of Reported Versus Recorded PPV Data

- ❒ The sample rate was also changed from 1024 sps to 1000 sps.
- ❒ Only a select number of the non-compliance seismograph parameters were changed for the signature hole blast.
- ❒ There was no documentation from the independent seismologist explaining the reason for the change in parameters.

Issue: Incorrect PPV or Air Overpressure Readings Reported

- ❒ On numerous occasions, the independent seismologist reported PPV or AO readings to the DSFM that do not match what was recorded on the DSFM compliance seismograph.
- ❒ The reported readings were higher or lower than the value that was recorded for the compliance seismograph with all values well below PPV limits and AO limits, see Figure 10 and Figure 11.

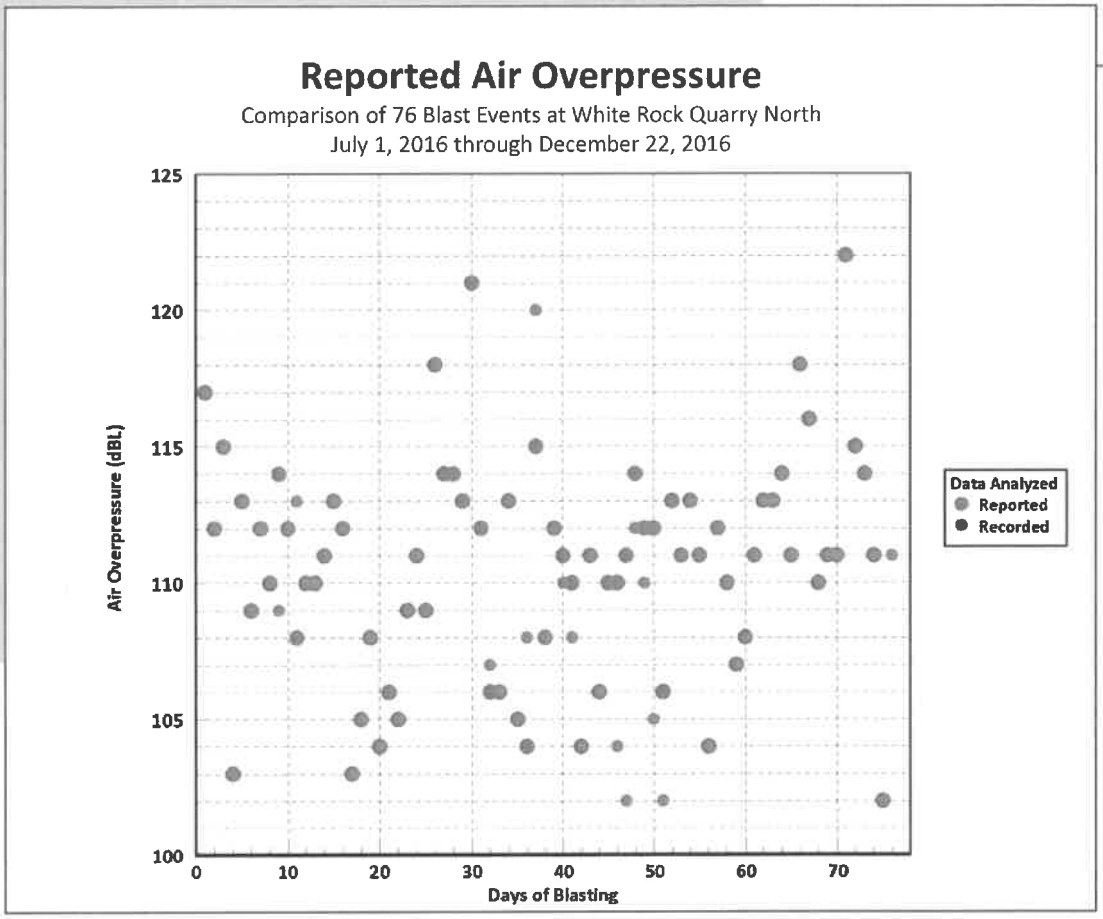


Figure 11: Comparison of Reported Versus Recorded AO Data

- These discrepancies are attributed to human error that occurred when the electronic data were re-entered on to the paper DSFM form.

Issue: Misreported Peak Particle Velocity Values

There were 17 misreported Peak Particle Velocity (PPV) values from July 1, 2016 through December 22, 2016. Eight values were over-reported, nine values were under-reported, and zero values were non-reported. None of the reported or recorded values exceeded the 0.50 IPS limit (Figure 12). The misreported PPV values likely occurred during transcription from Velocity Waveform Analysis sheets (recorded data) to the Blasting Activities Reports (reported data) by WRNQ.

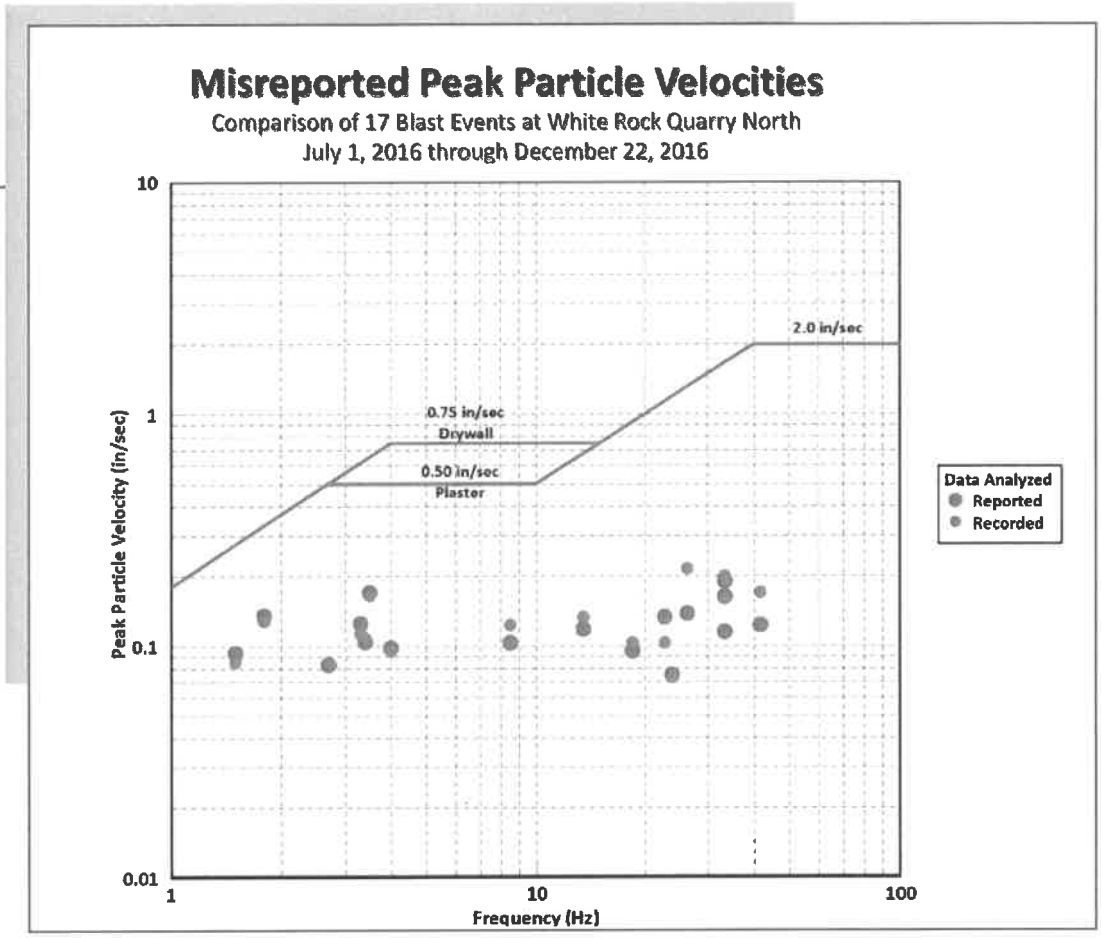


Figure 12: Comparison of Misreported PPV Data

Issue: Misreported Air Overpressure Values

There were 20 misreported Air Overpressure values from July 1, 2016 through December 22, 2016. Nine values were over-reported, five values were under-reported, and six values were non-reported. None of the reported or recorded values exceeded the 121 dBL (Figure 13). The over-reported and under-reported Air Overpressure values likely occurred during transcription from Velocity Waveform Analysis sheets (recorded data) to the Blasting Activities Reports (reported data) by WRNQ. LHC did not receive the Velocity Waveform Analysis Sheets for six blast events, therefore, we cannot verify the reported values.

Issue: Weak Dynamic Calibration Pulse

The dynamic calibration test occurs inside the unit to ensure everything is working properly. The calibration pulse is plotted at the end of the time history on the waveform as a visual calibration check.

- ❒ On August 16, 2016, unit 10691, a WRQN permanent seismograph, displayed a weak dynamic calibration pulse. The pulse should reach from the top of the box to the bottom and would indicate a properly working seismograph.

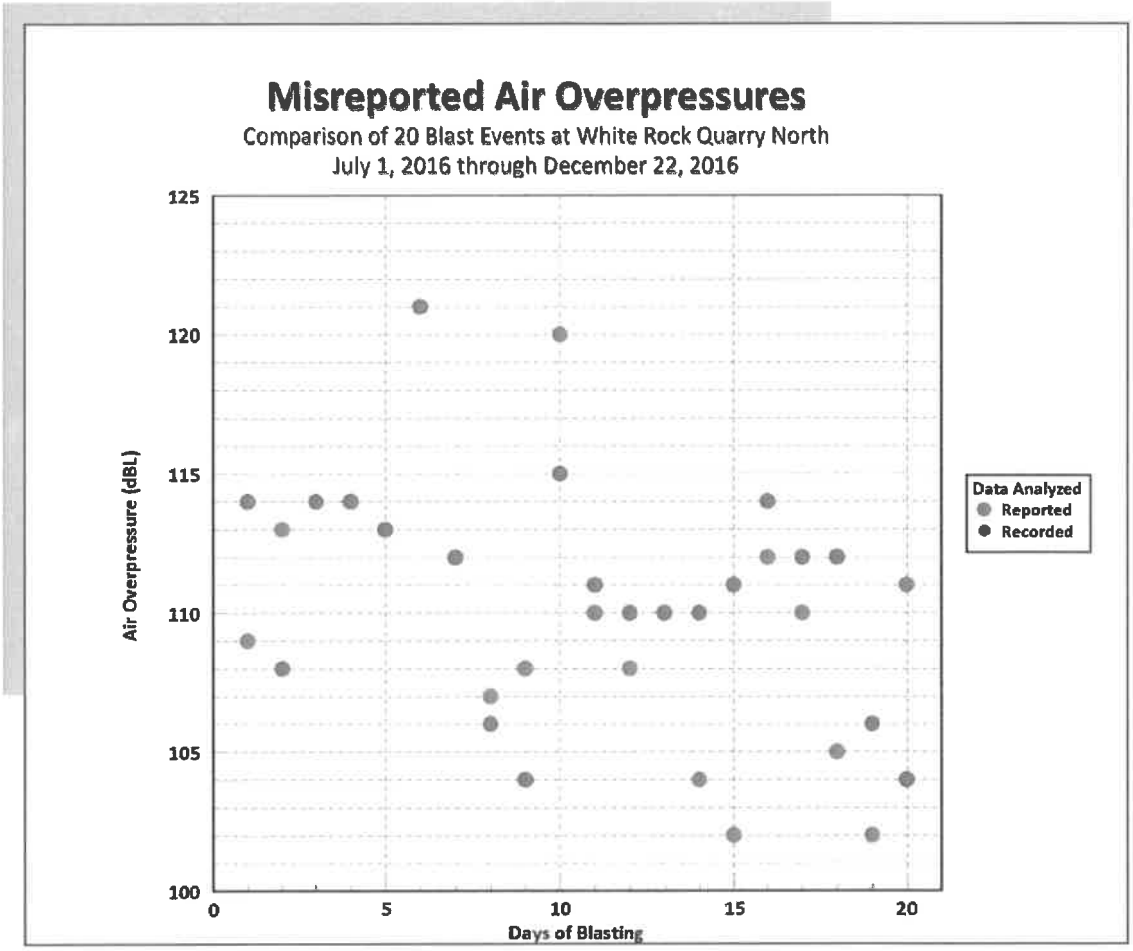


Figure 13: Comparison of Misreported AO Data

- Unit 10691 recorded 37 blast events between August 16, 2016 and December 22, 2016 without evidence of recalibration.

Issue: Incorrect Data on Blasting Activities Report

The compliance monitoring activities reported in the BAR are to provide supporting information to trouble shoot any blast events that may be out-of-compliance or did not perform as expected. Incorrect data entry by the user/blaster on to the DSFM forms seems to be the problem.

- On numerous occasions, the reported max pounds-per-delay was incorrect when verified with the WRQN Blast Report.

- ❒ Inaccurate reports do not allow trouble shooting if BAR entries is not reported correctly.

Issue: Higher Readings on WRQN Seismographs

- ❒ There are over 15 occasions where the highest PPV readings occurred at a WRQN seismograph and not at the DSFM portable seismograph closest to the blast.
- ❒ This means the highest vibration reading did not occur at the closest structure, but at structures farther away.
- ❒ This can be interpreted to mean that the closest point to the blast will not always receive the maximum PPV reading; other factors such as rock conditions, orientation of the blast, timing of the blast or water areas can influence vibration wave propagation.

Issue: City of Miramar Check Seismographs

- ❒ The City of Miramar began monitoring in August 2016, to make an independent assessment of the reliability of WRQN seismograph data using GeoSonics as the consultant.
- ❒ Unfortunately, most of the blast event times for the Miramar data sets beginning August 8, 2016, had clock timing errors.
- ❒ Several blasts in September 2016 did not record the AO. Separately, it does not appear the microphone was attached.
- ❒ In November, the two Miramar seismographs began recording good events (for blast event timing and air overpressure).

Analysis of Complaints as Compared with PPV Data

Neighbors to the WRQN filed a total of 239 complaints with the DSFM office during 2016 (Figure 14 and Figure 15); 214 occurred between April 1 and December 30. Presumably the higher PPV events would be expected to correlate in some manner to the number of homeowner complaints; however, the data do not express this correlation, suggesting other issues may be at work. The PPV data recorded for the last six months of 2016 from three reporting sources during blast events allowed LHC to check timing and wave propagation.

The compilation of the BAR was missing nine reports from the first six months. With a few exceptions, a more complete set of seismograph records were supplied between the dates of July 1, 2016 through December 22, 2016, as discussed above. Notwithstanding the data gaps, LHC was able to cross check homeowner complaints versus PPV data.

The data presented some interesting results and situations to ponder. The blast data analysis brought to light other possible factors leading to complaints even when low PPVs values triggered complaints. For example, of the ten blasts with the highest PPV readings over the year, only one complaint was made for the date of August 15, 2016. In addition, the time of day does not appear to have a direct correlation to complaints in that six of the blasts with the highest PPV readings occurred between 10 am and 3 pm with no complaints filed. The mid-day period may have more residents at work or otherwise out of the house.

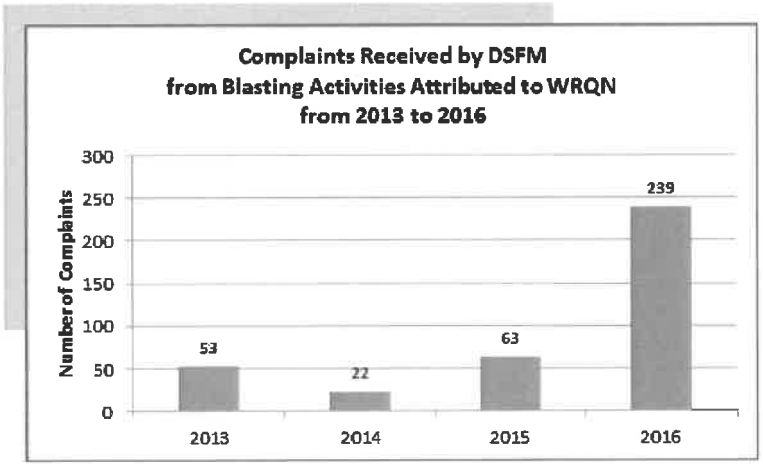


Figure 14: Complaints Received by DSFM from Blasting Activities Attributed to WRQN from 2013 to 2016

There appears to be a correlation between the geometric orientation of the mine face and wave propagation that results. Blasts on the north wall of mine generated the highest number of blasting complaints. The answer here may be the result of the physical orientation of the energy

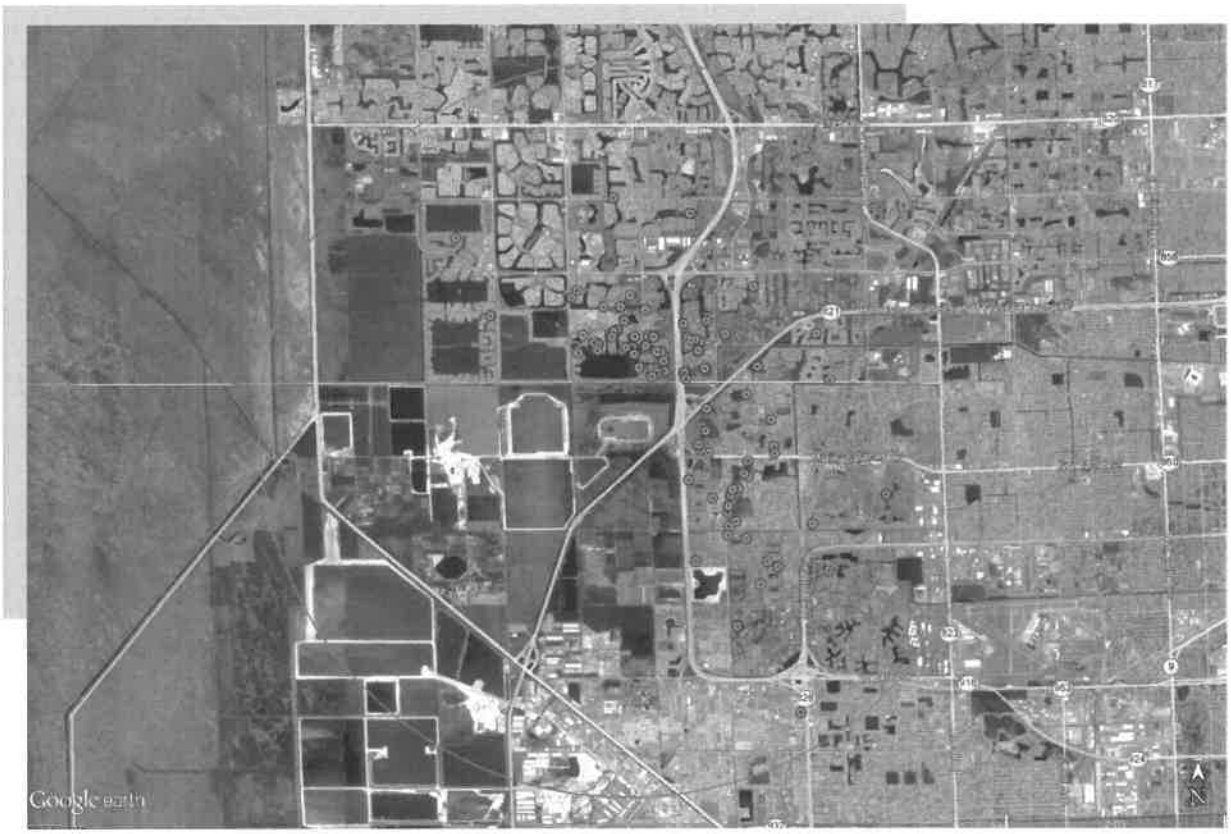


Figure 15: 2016 Complaints within 5 Miles of WRQN

source relative and the mine face and the subsequent wave forms propagating and interacting as they move north into the Miramar residential area.

Three companies were responsible for loading and blasting at WRQN during 2016. Angelini Blasting and Austin Powder conducted 10 of the blast events during (September through December), while Dyno Nobel conducted 39 blast events during the same time period. The evaluation of the data from blast events from the three companies reported one complaint made when Angelini Blasting and Austin Powder were conducting the work. Data from Angelini Blasting and Austin Powder events demonstrated an overall higher frequency level and lower PPV values. This record of non-complaints could be attributed to the initiation sequence used for these blast events, however, but other analysis would be required for a definitive answer.

Analysis of a Single Blast Event – August 15, 2016, at 10:30 am

Each blast event creates a unique data set that is interpreted by the seismologist to quantify the ground vibration effects relative to nearby structures with the intent to verify that the PPV values are within the accepted range. Each blast event has a number of variables related to the explosives, timing of individual detonations, proximity to structures, geologic conditions affecting wave propagation, expanses of open water in the quarry excavation, and quality assurance and control issues relative to the placement and calibration of the seismographic monitoring equipment. The following section is a review of the data from a single blast event that took place August 15, 2016; the data consisted of the DSFM compliance report, WRQN seismographs, and the Miramar check stations.

While the blast event was within the acceptable range below 0.5 IPS, this example illustrates the quality of reporting, which opens the process to scrutiny. A discrepancy was noted in that the closest seismograph was not the portable unit deployed for DSFM compliance but the PPV reading for the portable unit was the highest value reported as shown in Table 1 and Figure 16. Additionally, one of the WRQN seismographs (unit 7787) had not been calibrated according to manufacturer's recommendation of annual calibration.

The SW 54th Court location used as the DSFM compliance seismograph was not placed at the closest structure to the blast. The location of the compliance seismograph did not comply with the state regulations. The closest structure is actually 2,762' east of the blast and adjacent to the Toll Road. Backup data show that the blast was within proper limits.

Illustration of the Range of Events

Table 1. Seismograph Location and Readings for August 15, 2016

Seismograph Location	Seismograph Number	Distance	Readings
Closest Seismograph* (DSFM unit) – Lakes on the Green	7661	3,062	0.143 IPS
Portable Seismograph for DSFM compliance – SW 54th Ct	8773	3,522'	0.315 IPS
Additional Seismograph – Recreational Park	7801	4,858'	0.228 IPS
Additional Seismograph – Preserve	7265	4,382'	0.160 IPS

Figure 16: Seismograph Location and Readings for August 15, 2016

Seismograph Velocity Waveform Analysis Sheets

The seismograph waveform records for the August 15 blast event are from the four locations shown in Figure 17. The SW 54th Street location had the highest PPV levels; as noted above, at a higher level than the Lakes on the Green location that was not the closest structure but, in fact, was 300 feet farther east than the closest structure. No information was presented in the DSFM compliance report as to why the closer structure was not used.

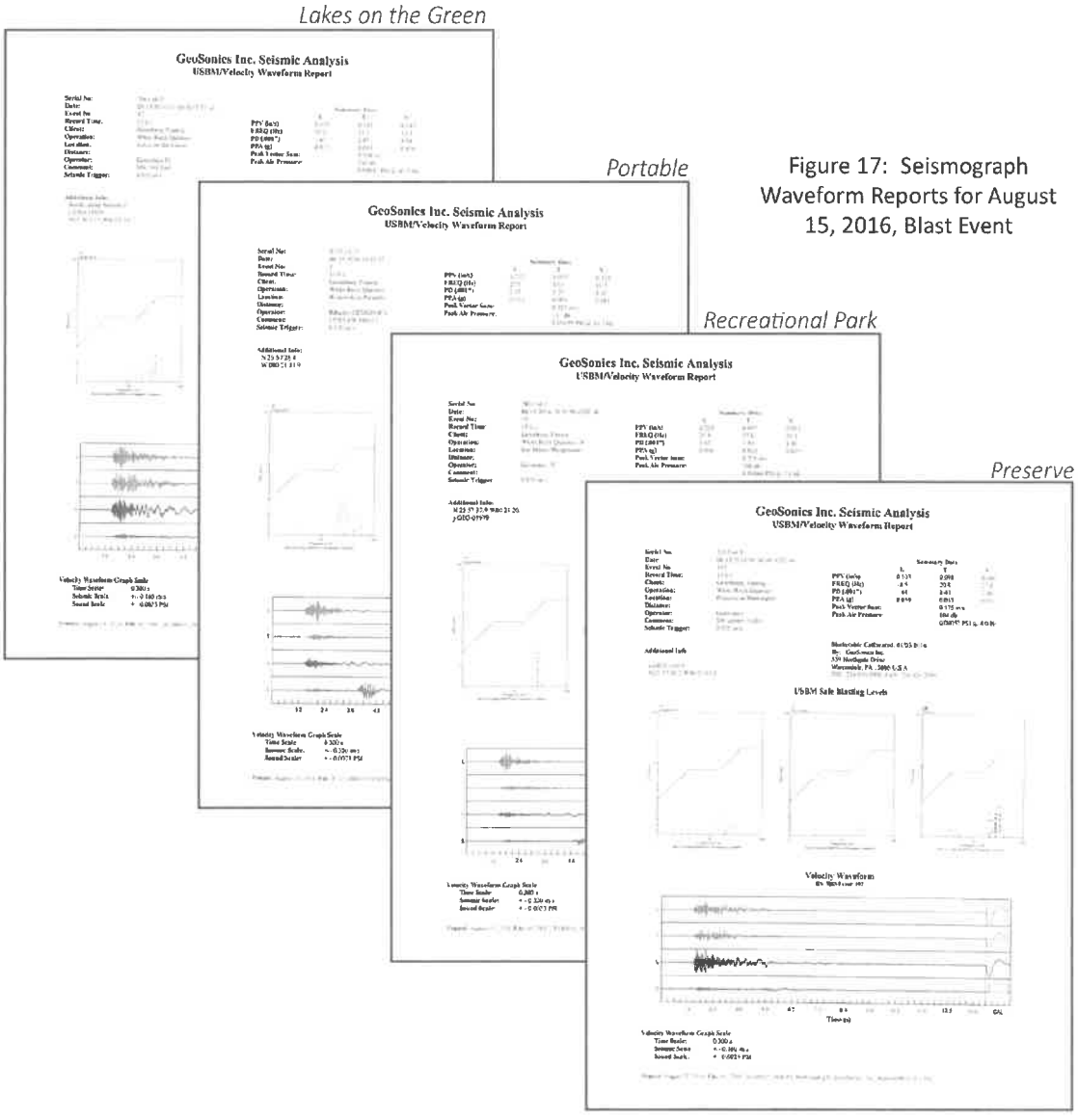
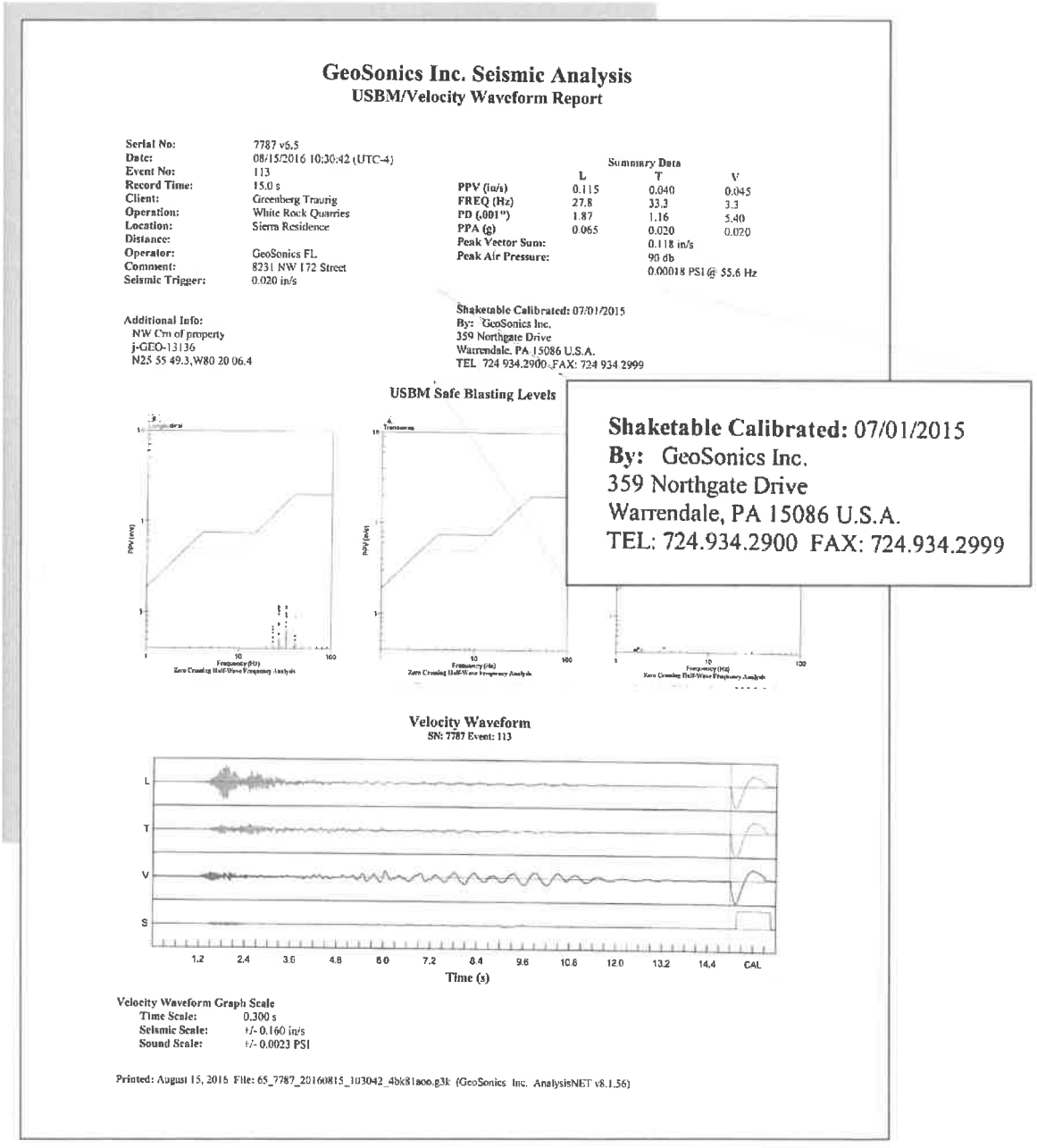


Figure 17: Seismograph Waveform Reports for August 15, 2016, Blast Event

Seismograph Calibration

Seismographs are calibrated on an annual basis. Seismograph 7787 was last calibrated on July 1, 2015; consequently, the instrument was past its calibration date for the blast on August 15, 2016 (Figure 18).



GeoSonics Inc. Seismic Analysis
USBM/Velocity Waveform Report

Serial No:	7787 v5.5
Date:	08/15/2016 10:30:42 (UTC-4)
Event No:	113
Record Time:	15.0 s
Client:	Greenberg Traurig
Operation:	White Rock Quarries
Location:	Sierra Residence
Distance:	
Operator:	GeoSonics FL
Comment:	8231 NW 172 Street
Seismic Trigger:	0.020 in/s

Summary Data

	L	T	V
PPV (in/s)	0.115	0.040	0.045
FREQ (Hz)	27.8	33.3	3.3
PD (.001")	1.87	1.16	5.40
PPA (g)	0.065	0.020	0.020
Peak Vector Sum:		0.118 in/s	
Peak Air Pressure:		90 db	
		0.00018 PSI @ 55.6 Hz	

Additional Info:
NW Crn of property
j-GEO-13136
N25 55 49.3,W80 20 06.4

Shaketable Calibrated: 07/01/2015
By: GeoSonics Inc.
359 Northgate Drive
Warrendale, PA 15086 U.S.A.
TEL 724 934.2900 FAX: 724 934 2999

USBM Safe Blasting Levels

Shaketable Calibrated: 07/01/2015
By: GeoSonics Inc.
359 Northgate Drive
Warrendale, PA 15086 U.S.A.
TEL: 724.934.2900 FAX: 724.934.2999

Velocity Waveform
SN: 7787 Event: 113

L
T
V
S

1.2 2.4 3.6 4.8 6.0 7.2 8.4 9.6 10.8 12.0 13.2 14.4 CAL

Time (s)

Velocity Waveform Graph Scale

Time Scale:	0.300 s
Seismic Scale:	+/- 0.160 in/s
Sound Scale:	+/- 0.0023 PSI

Printed: August 15, 2016 File: 65_7787_20160815_103042_4bk81aoo.g3k (GeoSonics Inc. AnalysisNET v8.1.56)

Figure 18: Waveform Report Showing Out of Date Calibration for August 15, 2016, Blast Event

Issues Related to Miramar Portable Seismographs

- ❒ Trigger level is set at 0.05 IPS when the industry standard is a setting of 0.03 IPS or lower (Figure 19).
- ❒ The time on the waveform does not match the time of the blast; this is the clock timing error noted previously
- ❒ The air overpressure arrival time does not match the monitor distance; this is a microphone not being utilized properly which is noted previously.

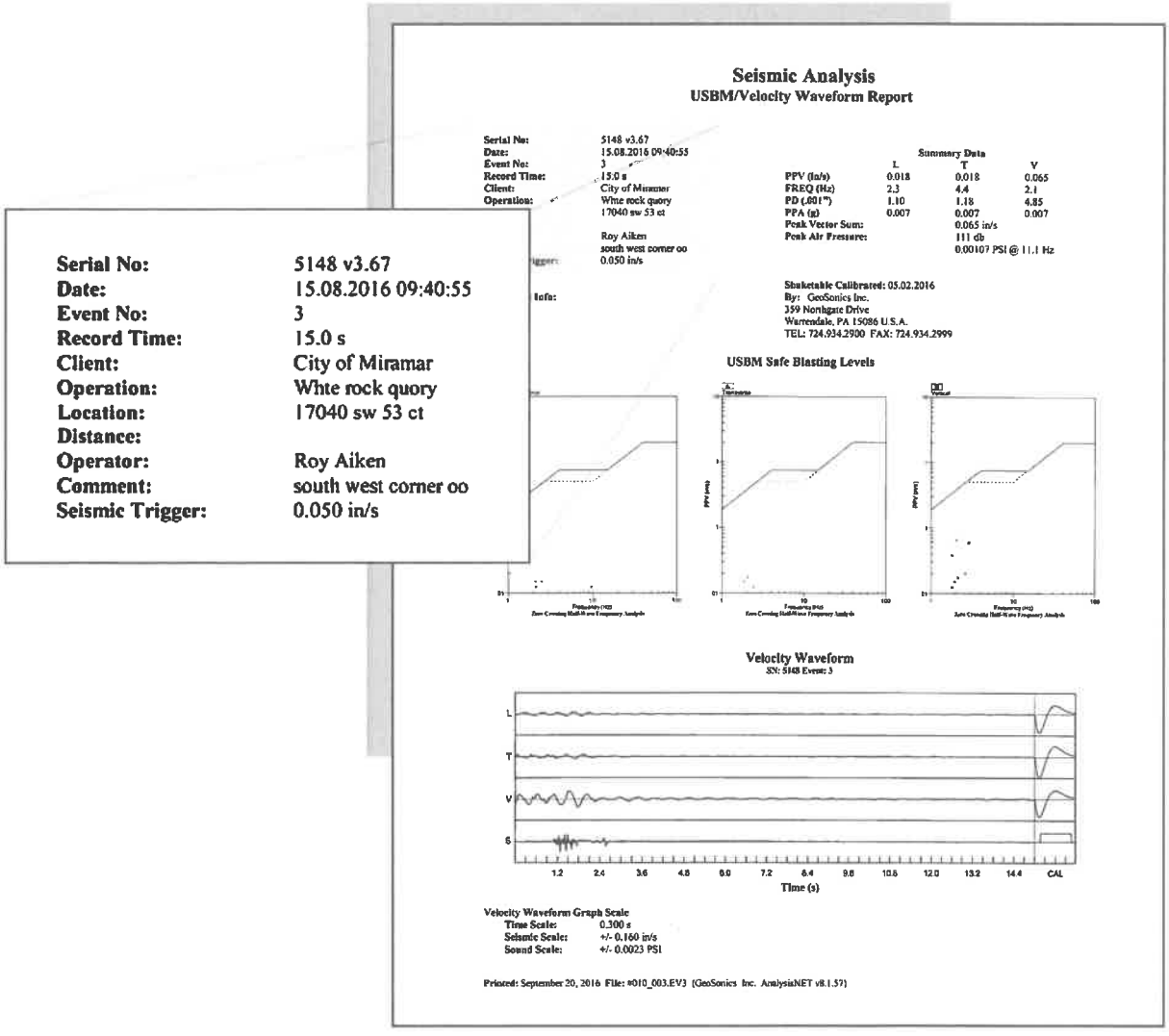


Figure 19: Miramar Portable Seismograph Waveform Report for August 15, 2016, Blast Event

Section 3: Summary of Findings

The Florida Department of Financial Services, Division of the State Fire Marshal, contracted Lampl-Herbert Consultants (LHC) to perform a review and evaluation of the blasting and seismic records for January-December 2016 from the White Rock Quarry North (WRQN). The materials available included:

1. **Blaster Reports** submitted to WRQN by the blaster in charge (Angelini Blasting, Austin Powder, Dyno Nobel).
2. **Velocity Waveform Analysis sheets** submitted to WRQN by the independent seismologist (GeoSonics, Vibra-Tech).
3. **Blasting Activities Reports (BAR)** prepared by WRQN and submitted to DSFM to report blast variables, compliance seismograph readings, and blast locations.
4. **Velocity Waveform Analysis sheets** submitted by the City of Miramar to DSFM (GeoSonics).
5. **Request for Investigation** of complaints from neighbors prepared by DSFM investigators and submitted to DSFM.

A summary of the data received, reviewed, and analyzed is set out below:

- Complaints logged in 2016:
  - 239 complaints from 126 individuals.
  - 214 of these complaints were made after April 1st.
  - Of the 10 highest compliance Peak Particle Velocity (PPV) readings only one (1) complaint was made; all 10 were below the <0.50 PPV level limit set by DSFM rules.
  - The north wall of quarry at the key cut generated the highest number of blasting complaints.
  - Only one (1) complaint made when WRQN contractors Angelini Blasting or Austin Powder conducted the blasting.
    - Angelini and Austin recorded overall higher frequencies and lower PPV levels during blasts.

- Both contractors used or switched to electronic detonators at WRQN during April which may have affected the ignition sequence used.

- ❒ Compliance seismographs were not always placed at the closest non-owned structure as directed by DSFM.
- ❒ On at least 70 occasions, incorrect data were transferred from contractor Blast Reports and/ or Velocity Waveform Analysis sheets to the BAR submitted by WRQN to DSFM including:
  - ❍ PPV levels and Air Overpressure.
  - ❍ Distance to closest structure.
  - ❍ Maximum pounds of explosives per delay.
  - ❍ Blast time and dates.
- ❒ City of Miramar seismograph data collected during August to October were omitted from analysis because of issues with incorrect blast time and an inoperative microphone channel.
- ❒ Calibration issues were noted among instruments used for compliance, WRQN permanent locations, and the City of Miramar sites.
- ❒ Data were sufficient to allow cross-correlation between multiple seismograph stations and evaluation of peak levels for each blast event.
- ❒ Based on the data evaluated, none of the PPV levels exceeded 0.50 IPS in 2016.

Section 4: Recommendations

The following recommendations are based on review of blast documentation data and summary of complaints for 2016 in Miami-Dade County and other areas of the country where similar blasting issues have been raised by residents near mining operations.

We recommend the Division of the State Fire Marshal (DSFM) consider the following options to 1) track activities during blast events and mining operations 2) improve the experience of residential neighbors. The DSFM requests that White Rock Quarry North (WRQN):

Reporting

- ❒ Continue voluntary submittal of data from existing internal seismographs network in and around the mine property.
- ❒ Redesign the Blasting Activities Report (BAR) submitted to DSFM as a searchable database that includes:
  - ❍ A unique file name for each blast data entry.
  - ❍ The unit number and calibration due date for all seismographs used in each blasting event.
  - ❍ Prompts to notify user if data entered are incomplete or invalid.
- ❒ Develop Monthly Analysis Reports (MARs) to submit to DSFM that provide a summary and analysis of monthly blasting activities. The MARs should include:
  - ❍ All reports currently provided voluntarily to DSFM, including Blaster Reports, Velocity Waveform Analysis sheets, and Blasting Activities Reports.
  - ❍ Summary graphs of the monthly ground vibration and air overpressure values.
  - ❍ An analysis of any exceedances in ground vibration values.

Operations

- ❒ Maintain inventory and calibration spreadsheets for each seismograph to ensure all units are calibrated as required by the manufacturer. All seismographs (compliance and non-compliance) should be calibrated on a yearly basis and taken out of service prior to the date of calibration to limit any scrutiny of the proper working order of the seismographs.
- ❒ Develop a Ground Vibration and Air Overpressure Minimization Plan to document potential adjustments and re-configurations to blasting design and layout to reduce or minimize impacts as mine operations move closer to residential areas.

Communication

- ❒ Work with the Town of Miami Lakes, the City of Miramar, and other interested residential communities to develop a "Quarry Commission" to act in a "non-binding" capacity. The Commission's mission would be to foster regular, open communication about mining operations between and amongst communities, neighborhoods, and local governments.[1]
- ❒ Present the Ground Vibration and Air Overpressure Minimization Plan to DSFM and interested residential communities.

[1] See model developed at Garden Ridge, Texas, http://www.ci.garden-ridge.tx.us/index.aspx?NID=109. *"The City Quarry Commission makes recommendations to the City Council. The Quarry Commission serves as an educational resource to the citizens of Garden Ridge, advising them about the Hanson Quarry and its impact, monitoring quarry operations for compliance with city ordinances, recommending needed changes to city ordinances, and developing a quarry grievance process in order to protect the natural and economic environment and the quality of life in the City of Garden Ridge. The Quarry Commission which has no legal or regulatory authority functions as point of contact with the management of Hanson Aggregates Servtex to enhance relations and to work on issues in the best interests of the citizens of Garden Ridge."*

Attachment 1
Summary of Data Types

Date	Blasting Activities Report	Blast Report	Compliance Waveform Analysis	Non Compliance Waveform Analysis	City of Miramar Waveform Analysis	Compliance Seismograph Location and Results	Seismograph Locations and Information (No Compliance Results)	Seismograph Locations and Information (Contains Compliance Results)	Seismograph Locations and Information - NW Miami-Dade County Instruments*
1/8/2016	1								
1/11/2016		1							
1/15/2016		1							
1/19/2016		1							
1/22/2016		1							
1/25/2016		1							
1/27/2016		1							
1/29/2016		1							
2/1/2016		1							
2/2/2016	1	1							
2/4/2016	1	1							
2/5/2016	1	1							
2/8/2016	1	1							
2/11/2016	1	1							
2/12/2016	1	1							
2/19/2016	1	1							
2/22/2016	1	1							
2/25/2016	1	1							
2/26/2016	1	1							
2/29/2016	1	1							
3/2/2016	1	1							
3/7/2016	1	1							
3/9/2016	1	1							
3/11/2016	1	1							
3/15/2016	1	1							
3/18/2016	1	1							
3/21/2016	1	1							
3/23/2016	1	1							
3/28/2016	1	1							
3/29/2016	1	1							

* Seismographs data in these sheets were added to other "Seismograph Locations and Information" sheets beginning in September

Date	Blasting Activities Report	Blast Report	Compliance Waveform Analysis	Non Compliance Waveform Analysis	City of Miramar Waveform Analysis	Compliance Seismograph Location and Results	Seismograph Locations and Information (No Compliance Results)	Seismograph Locations and Information (Contains Compliance Results)	Seismograph Locations and Information - NW Miami-Dade County Instruments*
4/1/2016	1	1							
4/4/2016	1	1							
4/6/2016	1	1							
4/7/2016	1	1							
4/12/2016	1	1							
4/13/2016	1	1							
4/14/2016	1	1							
4/18/2016	1	1							
4/19/2016	1	1							
4/21/2016	1	1							
4/25/2016	1	1							
4/29/2016	1	1							
5/4/2016	1	1							
5/5/2016	1	1							
5/6/2016	1	1							
5/6/2016	1	1							
5/11/2016	1	1							
5/13/2016	1	1							
5/16/2016	1	1							
5/18/2016	1	1							
5/20/2016	1	1							
5/23/2016	1	1							
5/25/2016	1	1							
5/27/2016	1	1							
6/1/2016	1	1							
6/2/2016	1	1							
6/3/2016	1	1							
6/6/2016		1							
6/7/2016	1	1							
6/9/2016	1	1							
6/13/2016	1	1							
6/14/2016	1	1							
6/15/2016	1	1							
6/20/2016	1	1							
6/21/2016	1	1							
6/23/2016	1	1							
6/28/2016	1	1						1	
6/30/2016	1	1							
7/1/2016	1	1	1	7		-	-	1	

Date	Blasting Activities Report	Blast Report	Compliance Waveform Analysis	Non Compliance Waveform Analysis	City of Miramar Waveform Analysis	Compliance Seismograph Location and Results	Seismograph Locations and Information (No Compliance Results)	Seismograph Locations and Information (Contains Compliance Results)	Seismograph Locations and Information - NW Miami-Dade County Instruments*
7/5/2016	1	1	1	6		-	-	1	
7/7/2016	1	1	1	7		-	-	1	
7/8/2016	1	1	1	4		-	-	1	
7/11/2016	1	1	1	6		-	-	1	
1/1/1900	1	1	1	6		-	-	1	
7/15/2016	1	1	1	6		-	-	1	
7/18/2016	1	1	1	6		-	-	1	
7/20/2016	1	1	1	5		-	-	1	
7/22/2016	1	1	1	5		-	-	1	
7/25/2016	1	1	1	5		-	1		
7/26/2016	1	1	2	5		1	1		
7/29/2016	1	1	2	6		1	1		
8/1/2016	1	1	1	7		1	1		1
8/2/2016	1	1	1	10		1	1		1
8/5/2016	1	1	1	7		1	1		1
8/8/2016	1	1	1	7		1	1		1
8/10/2016	1	1	1	9		1	1		1
8/12/2016	1	1	1	10		1	1		1
8/15/2016	1	1	1	9	1	1	1		1
8/16/2016	1	1	1	7	1	1	1		1
8/18/2016	1	1	1	8	3	1	1		1
8/22/2016	1	1	2	8	1	1	1		1
8/23/2016	1								
8/24/2016	1	1	2	10	2	1	1		1
8/29/2016	1	1	2	8	1	1	1		1
8/31/2016	1	1	1	8		1	1		1
9/6/2016	1	1	-	9	2	-	1		
9/7/2016	1	1	-	9	2	-	1		
9/9/2016	1	1	-	9	2	-	1		
9/13/2016	1	1	-	8	2	-	1		
9/15/2016	1	1	-	12	1	-		1	
9/16/2016	1	1	1	9		-	1		
9/19/2016	1	1	1	9	1	-	-	1	
9/21/2016	1	1	1	9	2	-	-	1	
9/23/2016	1	1	1	10		-	-	1	
9/26/2016	1	1	1	9	3	-	-	1	
9/27/2016	1	1	1	9	1	-	-	1	
9/29/2016	1	1	1	10	2	-	-	1	
10/3/2016	1	1	1	9	1	-	-	1	

Date	Blasting Activities Report	Blast Report	Compliance Waveform Analysis	Non Compliance Waveform Analysis	City of Miramar Waveform Analysis	Compliance Seismograph Location and Results	Seismograph Locations and Information (No Compliance Results)	Seismograph Locations and Information (Contains Compliance Results)	Seismograph Locations and Information - NW Miami-Dade County Instruments*
10/5/2016	1	1	1	8		-	-	1	
10/11/2016	1	1	1	7		-	-	1	
10/12/2016	1	1	1	10		-	-	1	
10/13/2016	1	1	1	7		-	-	1	
10/18/2016	1	1	-	9		-	1		
10/19/2016		1	-	9		-	1		
10/20/2016	1	1	1	7				1	
10/21/2016		1	1	8		-	-	1	
10/24/2016	1	1	1	7	2	-	-	1	
10/25/2016	1	1	1	9	1	-	-	1	
10/27/2016	1	1	1	8	1	-	-	1	
10/28/2016	1	1	1	10	1	-	-	1	
10/31/2016	1	1	1	8	1	-	-	1	
11/1/2016	1	1	2	9	1	1	1		
11/3/2016	1	1	2	8	2	1	1		
11/9/2016	1	1	2	11	3	1	1		
11/10/2016	1	1	2	8	2	1	1		
11/14/2016	1	1	1	7	1	1	1		
11/15/2016	1	1	2	8	2	1	1		
11/17/2016	1	1	2	9	3	1	1		
11/18/2016	1	1	-	4		1	1		
11/21/2016	1	1	2	8	2	1	1		
11/22/2016	1	1	1	9	3	1	1		
11/23/2016	1	1	2	9	2	1	1		
11/29/2016	1	1	1	10	3	1	1		
12/1/2016	1	1	1	4	1	1	1		
12/2/2016	1	1	1	8	3	1	1		
12/5/2016	1	1	1	8	4	1	1		
12/6/2016	1	1	1	9	3	1	1		
12/8/2016	1	1	1	8	3	1	1		
12/12/2016	1	1	1	7	3	1	1		
12/13/2016	1	1	1	7	3	1	1		
12/14/2016	1	1	-	9	2	1	1		
12/16/2016	1	1	1	9	3	1	1		
12/19/2016	1	1	1	10	3	1	1		
12/20/2016	1	1	-	9	3	1	1		
12/21/2016	1	1	-	5	2	1	1		
12/22/2016	-	1	-	8	5	-	1		