Results of Testing in Accordance with Sections of MIL-A-22262B(SH)

KTA Project No. 370362

Presented to:

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June 28, 2017

DGC/CMM:tbr

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Appendices

INTRODUCTION

In accordance with KTA-Tator, Inc. (KTA) Proposal No. PN177758 and the subsequent payment via wire transfer received April 20, 2017, KTA has performed testing on one submitted abrasive material for compliance with requirements listed in sections of MIL-A-22262B(SH), "Military Specification Abrasive Blasting Media Ship Hull Blast Cleaning," (April 5, 1993) and the associated Amendment 2 (March 21, 1996), This report describes the testing procedures employed and contains the results obtained.

SUMMARY

"Maxiblast" was analyzed in accordance with MIL-A-22262B(SH) for particle size distribution, moisture content, weight change on ignition, chloride content, free flow, crystalline silica content, specific gravity, carbonates and gypsum, conductivity, oil content, radioactivity, hardness, and shape. The sample met the requirements listed therein.

SAMPLES

The samples listed in Table 1, "Samples" were received from Groupe Thomas Bellemare, Ltd. (Bellemare) on the dates listed. It should be noted that at no time did KTA personnel witness the manufacturing or packaging of the submitted samples.

Table 1 – Samples

KTA ID	Sample Description	Date Received
370362-1	One – plastic bag containing approximately 6 ½ lbs. of black abrasive media labeled "Bellemare Maxiblast"	April 7, 2017
	One – plastic bucket containing approximately 55 lbs. of black abrasive media labeled "Bellemare Maxiblast"	June 6, 2017

LABORATORY INVESTIGATION

The laboratory investigation consisted of testing the abrasive material for particle size distribution, moisture content, weight change on ignition, chloride content, free flow, crystalline silica content, specific gravity, carbonates and gypsum, conductivity, oil content, radioactivity, hardness, and shape in accordance with sections of MIL-A-22262B(SH).

Particle Size Determination (Sieve Analysis)

MIL-A-22262B(SH) Requirement: None (specified by the contracting activity)

Sample Performance: ***See Appendix 1***

A sieve analysis was performed in accordance with ASTM C136-14, "Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates." A 300 gram sample was split into two 150 gram samples, and each were tamped through a series of sieves (screen numbers 14, 16, 18, 20, 30, 40, 70, 100 and a pan at the bottom) for seven minutes using an automated tamper. The

abrasive collected on each screen was collected and weighed. The raw data for the sieve analysis are provided in Appendix 1, "KTA Sieve Analysis Data Forms."

Moisture Content

MIL-A-22262B(SH) Requirement: ***Less than 0.5% by weight***

Sample Performance: ***0.0169% loss; the sample met the requirement***

The moisture content was determined in accordance with Section 4.5.5. Approximately 200 grams of sample was dried at 105 to 110°C until the sample did not show a weight change of more than 0.1 gram. The analysis was performed in duplicate, and the average was determined.

Weight Change on Ignition

MIL-A-22262B(SH) Requirement: ***1.0% loss maximum, 5.0% gain maximum***

Sample Performance: ***1.6647% gain; the abrasive sample met the requirement***

Weight change on ignition testing was performed in accordance with MIL-A-22262B(SH), Section 4.5.6. A representative sample was dried in a convection oven for one hour at 105 ± 5°C. One gram of the dried abrasive was placed into a tarred crucible. The crucible containing the abrasive sample was placed into a muffle furnace at approximately 1000°C for approximately 1 hour, allowed to cool to room temperature and weighed again. The analysis was performed in duplicate. The average percent weight change was then calculated.

Chloride Content

MIL-A-22262B(SH) Requirement: ***<0.03% by weight***

Sample Performance: ***0.011%; the abrasive sample met the requirement***

Chloride content testing was performed in accordance with MIL-A-22262B(SH), Section 4.5.7 and ASTM D1411-09, "Standard Test Methods for Water-Soluble Chlorides Present as Admixtures in Graded Aggregate Road Mixes." In preparation, approximately 400 grams of material was weighed out and combined with a solution consisting of 479 mL deionized (DI) water, 20 mL of ferric ammonium sulfate, and 1 mL of ammonium hydroxide. The mixture was agitated for approximately 12-15 hours and filtered to obtain a testing solution. The following reagents were used to obtain the total chloride percentage of the solution: ammonium thiocyanate standard solution (NH_4SCN), benzyl alcohol, nitric acid (HNO_3), silver nitrate ($AgNO_3$), and volhard indicator solution. The solution was acidified using the concentrated nitric acid and mixed with a known volume (7 mL) of $AgNO_3$, heated to a boil (to coagulate silver chloride), and allowed to cool to room temperature. Once cooled, the benzyl alcohol was added, the solution was shaken vigorously, and reverse titration was performed using the volhard indicator solution. The testing was performed in duplicate. The average percent chloride was calculated using the data obtained.

Free Flow

MIL-A-22262B(SH) Requirement: ***99% minimum free flow of abrasive from cylinder with no apparent solidification or clump formation***

Sample Performance: ***99.63%; No apparent solidification or clump formation was observed; the abrasive sample met the requirement***

Free flow testing was performed in accordance with MIL-A-22262B(SH), Section 4.5.8. Approximately 50 ± 1 g of abrasive was poured into a bronze cylinder fitted with a solid end cap. The cylinder was then filled with DI water and allowed to soak for approximately one hour. After the soaking period, the cap was replaced with a hole bearing cap to allow for drainage of the DI water. The cylinder with the abrasive was then placed horizontally in an oven set to a temperature of approximately 120°C for approximately three hours. Once the heating period was complete, the cylinder was removed, allowed to cool at room temperature and then poured out into a tarred beaker at a 75° angle and weighed again. The free flow was then calculated. The cylinder and cap were examined for clump formation and solidification. The testing was performed in duplicate. The average free flow percent recovery was calculated using the data obtained.

Crystalline Silica Content

MIL-A-22262B(SH) Requirement: ***Maximum of 1.0 percent by weight crystalline silica***

Sample Performance: ***<0.1% quartz and <0.1% cristobalite, <0.1% tridymite for a total of <0.3%; the abrasive sample met the requirement***

The crystalline silica content was subcontracted to Clark Testing, located in Jefferson Hills, Pennsylvania, for determination in accordance with NIOSH Method 7500, analysis via XRD. The Clark Testing report containing the results of testing is provided in Appendix 2, "Clark Testing Crystalline Silica Report."

Specific Gravity

MIL-A-22262B(SH) Requirement: ***2.5 for mineral or slag abrasives, minimum***

Sample Performance: ***Specific gravity of 3.7; the abrasive sample met the requirement***

Specific gravity was determined in accordance with ASTM C128-15, "Standard Test Method for Relative Density (Specific Gravity) and Absorption of Fine Aggregate." ASTM C128 was substituted for ASTM C188 due to applicability to the materials being tested. Briefly, a volumetric flask was used to determine the volume of abrasive and displaced water using the gravimetric (pycnometer) procedure. The testing was performed in duplicate. The average apparent relative density (specific gravity) was calculated and reported.

Carbonates and Gypsum

MIL-A-22262B(SH) Requirement: ***Carbonates and Gypsum shall not be detected***

Sample Performance: ***No gypsum nor carbonates were detected; the sample met the requirements.***

Carbonates and gypsum testing was conducted in accordance with MIL-A-22262B(SH), Section 4.5.1. For this testing, the following reagents were utilized: hydrochloric acid (200 mL of concentrated hydrochloric acid mixed with 200 mL of distilled water), barium chloride (11.7 g of reagent grade barium chloride mixed with 88 mL of distilled water) and lead acetate test paper (approximately 6 mm by 50 mm paper strips soaked in a reagent of 19.0 g of lead acetate mixed with 100 mL of distilled water). Approximately 5 grams of abrasive was combined with 100 mL of the hydrochloric acid reagent in a beaker. There was no initial evolution of a white gas to indicate the presence of carbonates or sulfides. Although no white gas was evolved, the lead acetate paper was soaked in distilled water and was presented to test to verify if the gases produced were not visible. If hydrogen sulfide gas is produced, the white paper will turn black or brown. If the paper does not change to brown or black, this indicates a presence of carbon dioxide. The presence of carbon dioxide would be cause for rejection of the sample. The paper turned brown upon visible gases being produced during the following boiling process, indicating the presence of sulfides as opposed to carbonates. Once the carbonates test was concluded, the mixture was gently boiled for approximately 10 minutes. After boiling, 150 mL of distilled water was added to the mixture and 25 mL of the new slurry was filtered through #40 Whatman filter paper. Approximately 10 mL of barium chloride reagent was added to the solution filtrate. No white precipitate formed, indicating that no gypsum was detected. Testing was performed in duplicate.

Conductivity

MIL-A-2262B(SH) Requirement: ***290 µS/cm, maximum***

Sample Performance: ***50.2µS/cm; the abrasive sample met the requirement***

Conductivity testing was performed in accordance with ASTM D4940-15e1, "Standard Test Method for Conductimetric Analysis of Water Soluble Ionic Contamination of Blasting Abrasives." A slurry of the abrasive was prepared with 300 mL of reverse-osmosis filtered, DI water and 300 mL of sample material, and stirred for one minute. The slurry was allowed to settle for eight minutes and was stirred again, then filtered. The supernatant liquid removed from the slurry was then tested using an Oakton® COND 6+ conductivity meter. The analysis was performed in duplicate on duplicate samples, and the average of the four determinations is reported.

Oil Content

MIL-A-2262B(SH) Requirement: ***<0.030% by weight***

Sample Performance: ***0.0002% residue by weight; the abrasive sample met the requirement***

The oil content was determined in accordance with MIL-A-22262B (SH), Section 4.5.11.5, Alternate Methods. Solvent extraction and infrared spectroscopy were employed. Two beakers, each containing 500 grams of sample material, were each combined with 125 mL of acetone. The samples were stirred, and the solvent was decanted and filtered through Whatman #44 filter paper. The process was repeated with a second 125 mL portion of acetone. A control sample was prepared in the same manner. The solvent was boiled off and the resulting residues were weighed.

Potassium bromide powder was added to a portion of the residue from each beaker and pellets were formed under high pressure. The pellet obtained from the control beaker was used as a background scan. The pellets were placed in the optical path of a Mattson Galaxy Model 3020 Fourier transform infrared spectrometer and a spectrum of the residue was obtained over the range of 4000 to 400 cm^{-1}. The infrared spectrum obtained is provided in Appendix 3, "KTA Oil Content Spectrum." The presence of hydrocarbons was revealed by spectral bands near 2900 cm^{-1}, indicating that the residue contained oil.

Radioactivity

MIL-A-22262B(SH) Requirement: ***No greater than 20.0 pCi/g, maximum***

Sample Performance: ***13.0 (± 2.0) pCi/g; the abrasive sample met the requirement***

Radioactivity testing was subcontracted to Hazen Research, Inc. of Golden, Colorado, for determination in accordance with MIL-A-22262B(SH), Section 4.5.13. The Hazen Research, Inc. report containing the test results is provided in Appendix 4, "Hazen Research, Inc. Radioactivity Report."

Hardness

MIL-A-22262B(SH) Requirement: ***>70% of grains scratch glass, minimum***

Sample Performance: ***80% of grains scratched glass; the abrasive sample met the requirement***

Hardness testing was performed in accordance with MIL-A-22262B(SH), Section 4.5.14. Briefly, to obtain a representative test sample, 5 g of the abrasive sample was examined using a Meiji EMZ TR microscope at 10X magnification. A few grains representing each color and shape were chosen and placed on a glass slide. A second glass slide was then placed on top of the selected abrasive. Moderate pressure was used to push and move the second slide over the abrasive for 10 seconds. The glass slides were then examined for scratches. If more than 70% of the grains are found to scratch the glass slides, then the abrasive is rated as having a minimum hardness of 6 on the Mohs scale.

Shape

MIL-A-22262B(SH) Requirement: ***80% of grains exhibit angular shape, minimum***

Sample Performance: ***Approximately 95% of the particles were determined to be angular; the abrasive sample met the requirement***

Testing for shape was performed in accordance with MIL-A-22262B(SH), Section 4.5.15. Briefly, to obtain a representative test sample, 2 g of the abrasive sample was examined using a Meiji EMZ TR microscope at 10X magnification. Several grains representing each color and shape were chosen and placed on a glass slide and inspected visually. Approximately 95% of the particles were considered to be angular in shape.

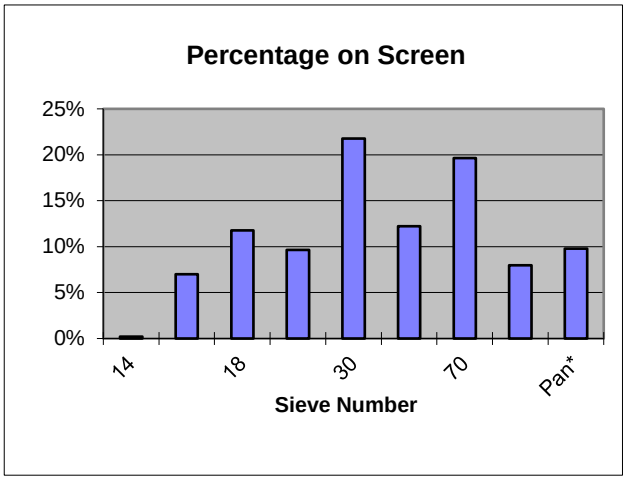
APPENDIX 1

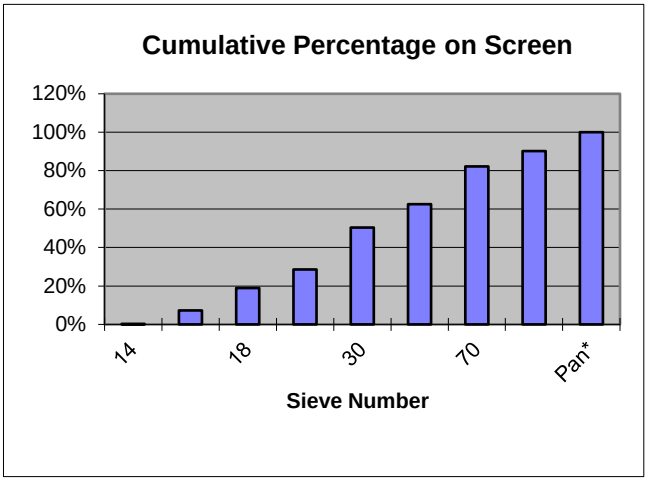
KTA-Tator, Inc. Sieve Analysis Data Form

Sample ID No.:	370362-1	Date:	6/2/2017
Sample Description:	Run 1	Technician:	JMB
Initial Sample Mass (g):	150.15		

US Standard Sieve No.	Retained Sample (g)	% of Total	Cumulative % of Total	Nominal Sieve Opening Size (mm)	Retained Sample (g) * Opening (mm)
14	0.31	0.205%	0.205%	1.400	0.430
16	10.47	6.988%	7.193%	1.180	12.349
18	17.623	11.768%	18.96%	1.000	17.623
20	14.47	9.659%	28.619%	0.850	12.295
30	32.590	21.762%	50.38%	0.600	19.554
40	18.31	12.224%	62.605%	0.425	7.780
70	29.399	19.631%	82.24%	0.212	6.233
100	11.94	7.975%	90.212%	0.150	1.792
Pan*	14.659	9.788%	100.00%	0.038	0.557
Total	149.8			Sum =	78.61

Average particle size (mm) = 0.52



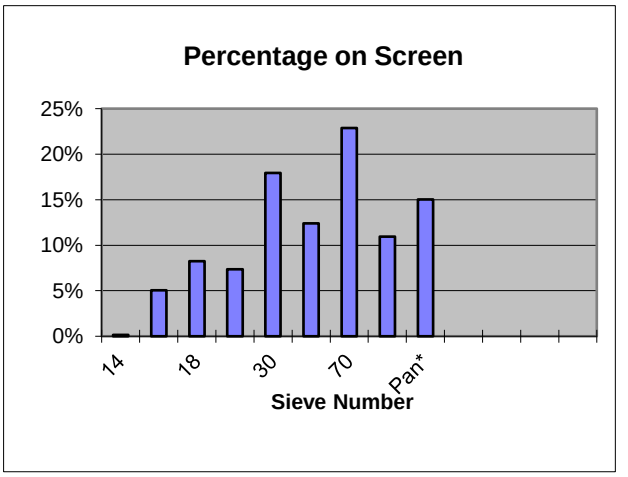


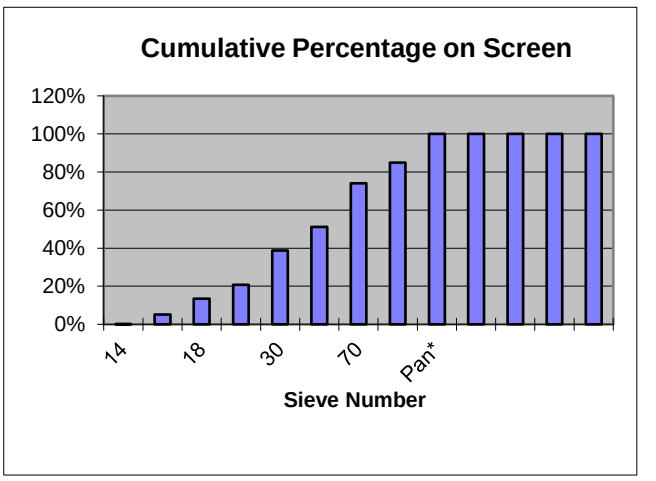
KTA-Tator, Inc. Sieve Analysis Data Form

Sample ID No.:	370362-1	Date:	6/2/2017
Sample Description:	Run 2	Technician:	JMB
Initial Sample Mass (g):	150.1		

US Standard Sieve No.	Retained Sample (g)	% of Total	Cumulative % of Total	Nominal Sieve Opening Size (mm)	Retained Sample (g) * Opening (mm)
14	0.22	0.149%	0.149%	1.400	0.314
16	7.57	5.039%	5.189%	1.180	8.928
18	12.357	8.231%	13.42%	1.000	12.357
20	11.07	7.371%	20.790%	0.850	9.406
30	26.943	17.946%	38.74%	0.600	16.166
40	18.64	12.412%	51.148%	0.425	7.920
70	34.360	22.886%	74.03%	0.212	7.284
100	16.45	10.955%	84.990%	0.150	2.467
Pan*	22.536	15.010%	100.00%	0.038	0.856
		0.000%	100.000%		0.000
		0.000%	100.00%		0.000
		0.000%	100.000%		0.000
		0.000%	100.00%		0.000
		0.000%	100.000%		0.000
Total	150.1			Sum =	65.70

Average particle size (mm) = 0.44





APPENDIX 2

Clark Testing-Analytical Chemistry
1801 Route 51 South
Jefferson H , PA 15025
Phone: 412-387-1012 Fax: 412-387-1012

06/21/2017
Final

Report of Test Results

370362/Pittsburgh, PA

Contact: Dan Chasky
Address: KTA-Tator, Inc.
Dan Chasky
115 Technology Dr.
Pittsburgh, PA 15275

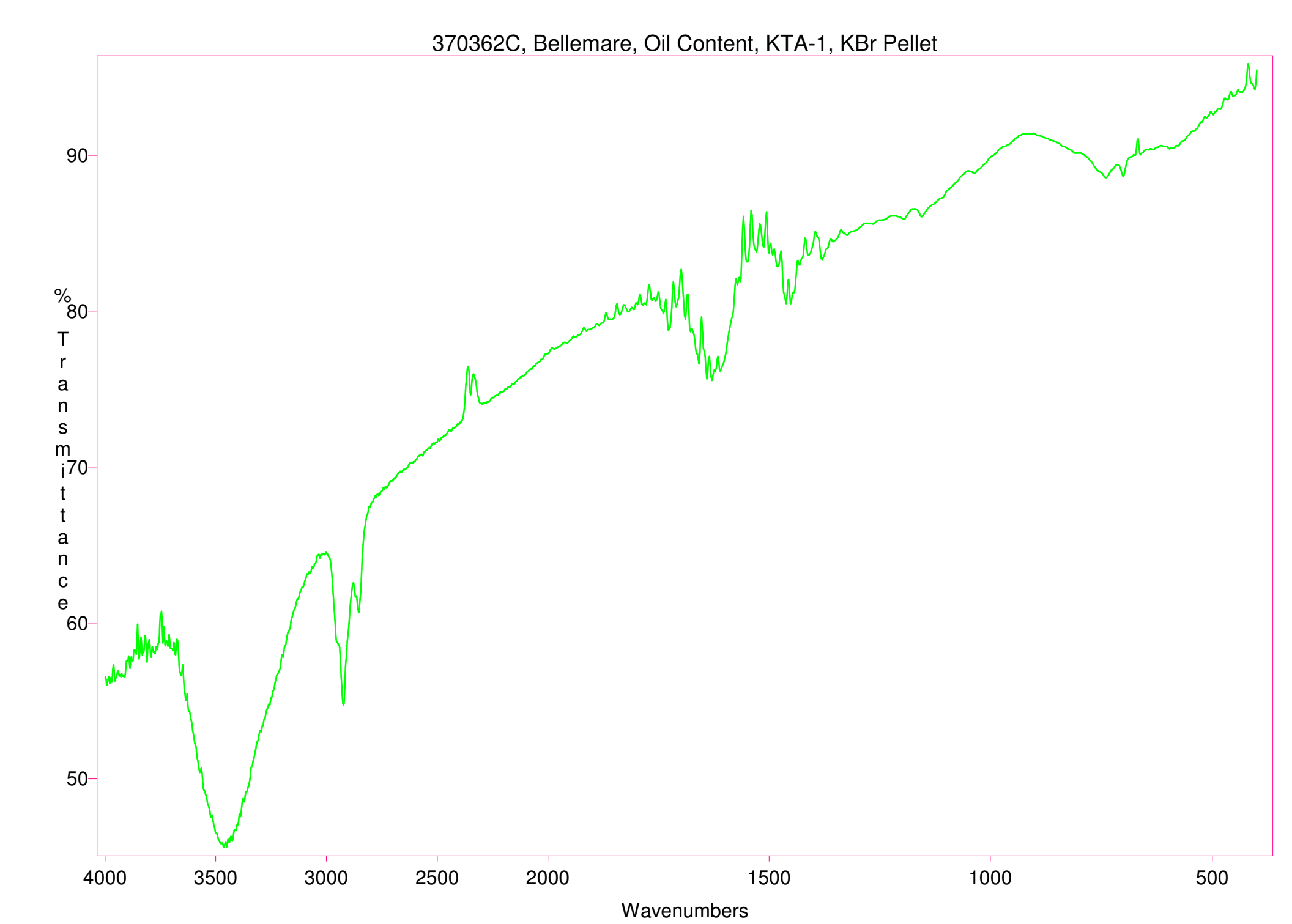
Tracking Sheet Number: 17-16779
Customer P.O. Number: 17PO-290
Date Received: 06/08/2017

Test Name	Test Method	Analyte	Result	Units	Test Date
Sample No: 1766304	**Customer ID:**	370362-1 Abrazive Media			
Crystalline Silica	NIOSH 7500	Cristobalite	< 0.1	wt. %	06/14
	NIOSH 7500	Quartz	< 0.1	wt. %	06/14
	NIOSH 7500	Tridymite	< 0.1	wt. %	06/14

Approved By: _____ **Date:** 6/21/17

end of report

APPENDIX 3



Operator: JMB
Resolution: 4.0

Scans: 32
Date: Tue Jun 13 18:17:04:64 2017

APPENDIX 4

Hazen Research, Inc.
4601 Indiana Street
Golden, CO 80403 USA
Tel: (303) 279-4501
Fax: (303) 278-1528

Lab Control ID: F14417
Received: Jun 06, 2017
Reported: Jun 13, 2017
Purchase Order No.
None Received

Customer ID: 03320Z
Account ID: Z05120

Chasky Daniel
KTA-Tator, Inc.
115 Technology Drive
Pittsburgh, PA 15275

ANALYTICAL REPORT

By:_____
Jessica Axen
Analytical Laboratories Manager

Hazen Research, Inc.
4601 Indiana Street
Golden, CO 80403 USA
Tel: (303) 279-4501
Fax: (303) 278-1528

Lab Control ID: F14417
Received: Jun 06, 2017
Reported: Jun 13, 2017
Purchase Order No.
None Received

Customer ID: 03320Z
Account ID: Z05120

ANALYTICAL REPORT

Chasky Daniel
KTA-Tator, Inc.

Lab Sample ID			F14417-001					
Customer Sample ID			**370362-1**					
Parameter	**Units**	**Code**	Result	Precision* +/-	Detection Limit	Method	Analysis Date / Time	Analyst
Gross Gamma	**pCi/g**	**-**	13	2	2.3	MIL-A-22262 B(SH)	6/7/17 @ 0819	KK

Certification ID's: CO/EPA CO00008; CT PH-0152; KS E-10265; NJ CO008; NYSELAP (NELAC Certified) 11417; RI LAO00284; WI 998376610, TX T104704256-15-6

*Variability of the radioactive decay process (counting error) at the 95% confidence level, 1.96 sigma.

Codes: (T) = Total (D) = Dissolved (S) = Suspended (R) = Total Residual (AR) = As Received < = Less Than

06/06/2017
FEDEX

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KTA-TATOR, INC.

F144

115 Technology Drive, Pittsburgh, PA 15275

205120

KTA-Tator, Inc. JN 370362

Hazen Research, Inc.

Abrasive Testing

- (1) sample to be tested for radioactivity testing (Gross Gamma [Cobalt 60 equivilant]) via MIL-A-22262B, Section 3.4.13. Sample 370362-1, approx. 70 grams provided.

Daniel G. Chasky
dchasky@kta.com
412-788-1300 ext. 188
05/31/17

SAMPLE ID:

370362-1