



Friday, August 03, 2018

Jeremy Adams
Las Vegas Rock Inc.
Po Box 19118
Jean, NV 89019

Re: ALS Workorder: 1806441
Project Name:
Project Number:

Dear Mr. Adams:

Three solid samples were received from Las Vegas Rock Inc., on 6/20/2018. The samples were scheduled for the following analyses:

Gamma Spectroscopy

Inorganics

Isotopic Thorium

Metals

The results for these analyses are contained in the enclosed reports.

The data contained in the following report have been reviewed and approved by the personnel listed below. In addition, ALS certifies that the analyses reported herein are true, complete and correct within the limits of the methods employed.

Thank you for your confidence in ALS Environmental. Should you have any questions, please call.

Sincerely,

ALS Environmental
Marcela M. Hobgood
Project Manager

ALS Environmental – Fort Collins is accredited by the following accreditation bodies for various testing scopes in accordance with requirements of each accreditation body. All testing is performed under the laboratory management system, which is maintained to meet these requirement and regulations. Please contact the laboratory or accreditation body for the current scope testing parameters.

ALS Environmental – Fort Collins	
Accreditation Body	License or Certification Number
AIHA	214884
Alaska (AK)	UST-086
Arizona (AZ)	AZ0742
California (CA)	06251CA
Colorado (CO)	CO01099
Florida (FL)	E87914
Idaho (ID)	CO01099
Kansas (KS)	E-10381
Kentucky (KY)	90137
PJ-LA (DoD ELAP/ISO 170250)	95377
Maryland (MD)	285
Missouri (MO)	175
Nebraska(NE)	NE-OS-24-13
Nevada (NV)	CO000782008A
New York (NY)	12036
North Dakota (ND)	R-057
Oklahoma (OK)	1301
Pennsylvania (PA)	68-03116
Tennessee (TN)	2976
Texas (TX)	T104704241
Utah (UT)	CO01099
Washington (WA)	C1280

ALS -- Fort Collins

Sample Number(s) Cross-Reference Table

OrderNum: 1806441

Client Name: Las Vegas Rock Inc.

Client Project Name:

Client Project Number:

Client PO Number:

Client Sample Number	Lab Sample Number	COC Number	Matrix	Date Collected	Time Collected
DB1-DB5	1806441-1		SOLID	19-Jun-18	8:20
SS1-SS5	1806441-2		SOLID	19-Jun-18	8:20
TH1-TH5	1806441-3		SOLID	19-Jun-18	8:20



1806441

Metals:

The samples were analyzed following SW-846, 3rd Edition procedures. Analysis by ICPMS followed method 6020A and the current revision of SOP 827. Mercury analysis by CVAA followed method 7471A and the current revision of SOP 812.

All acceptance criteria were met.

Inorganics:

The samples were analyzed following SW-846 procedures for the current revision of the following SOP and method:

<u>Analyte</u>	<u>Method</u>	<u>SOP #</u>
Hexavalent chromium	7196A	1122

All acceptance criteria were met.

Gamma Spectroscopy:

The samples were analyzed for the presence of gamma emitting radionuclides according to the current revision of SOP 713.

These samples were prepared according to the current revision of SOP 739. The samples were sealed in steel cans and stored for at least 21 days prior to analysis.

In cases where there are no peaks found in the peak search routine, the software performs a net quantification. This indicates that nuclides are not detected or supported at any level above the reported MDC. Consequently, these nuclides are flagged with an "NQ" qualifier on the final reports. Please refer to the Technical Bulletin Addendum at the end of this report.

All remaining acceptance criteria were met.

Isotopic Thorium:

The samples were analyzed for the presence of isotopic thorium according to the current revision of SOP 714.

All acceptance criteria were met.

Client: Las Vegas Rock Inc.

Date: 03-Aug-18

Project:

Work Order: 1806441

Sample ID: DB1-DB5

Lab ID: 1806441-1

Legal Location:

Matrix: SOLID

Collection Date: 6/19/2018 08:20

Percent Moisture:

Analyses	Result	Qual	Report Limit	Units	Dilution Factor	Date Analyzed
Gamma Spectroscopy Results						
			SOP 713		Prep Date: 7/9/2018	PrepBy: MRL
Ra-226	ND (+/- 0.2)	U	0.35	pCi/g	NA	7/30/2018 10:11
Ra-228	0.53 (+/- 0.39)	NQ	0.53	pCi/g	NA	7/30/2018 10:11
K-40	ND (+/- 0.91)	U	1.85	pCi/g	NA	7/30/2018 10:11
Hexavalent Chromium						
			SW7196		Prep Date: 6/25/2018	PrepBy: AEJ
CHROMIUM VI	ND		0.1	MG/KG	1	6/25/2018
ICPMS Metals						
			SW6020		Prep Date: 7/31/2018	PrepBy: JML
ARSENIC	3.6		0.2	MG/KG	10	7/31/2018 14:32
CADMIUM	ND		0.2	MG/KG	10	7/31/2018 14:32
LEAD	7.8		0.2	MG/KG	10	7/31/2018 14:32
Isotopic Thorium by Alpha Spectroscopy						
			SOP 714		Prep Date: 7/5/2018	PrepBy: SDW
Tracer: Th-229	85.5		30-110	%REC	DL = NA	7/15/2018 12:44
Th-228	0.158 (+/- 0.066)		0.079	pCi/g	NA	7/15/2018 12:44
Th-230	0.228 (+/- 0.091)	M3	0.117	pCi/g	NA	7/15/2018 12:44
Th-232	0.11 (+/- 0.041)		0.027	pCi/g	NA	7/15/2018 12:44
Mercury						
			SW7471		Prep Date: 7/6/2018	PrepBy: KJM
MERCURY	ND		0.031	MG/KG	1	7/9/2018 15:23

Client: Las Vegas Rock Inc.

Date: 03-Aug-18

Project:

Work Order: 1806441

Sample ID: SS1-SS5

Lab ID: 1806441-2

Legal Location:

Matrix: SOLID

Collection Date: 6/19/2018 08:20

Percent Moisture:

Analyses	Result	Qual	Report Limit	Units	Dilution Factor	Date Analyzed
Gamma Spectroscopy Results						
			SOP 713		Prep Date: 7/9/2018	PrepBy: MRL
Ra-226	ND (+/- 0.14)	U	0.28	pCi/g	NA	7/30/2018 10:11
Ra-228	ND (+/- 0.22)	U	0.36	pCi/g	NA	7/30/2018 10:11
K-40	ND (+/- 0.78)	U	1.18	pCi/g	NA	7/30/2018 10:11
Hexavalent Chromium						
			SW7196		Prep Date: 6/25/2018	PrepBy: AEJ
CHROMIUM VI	ND		0.1	MG/KG	1	6/25/2018
ICPMS Metals						
			SW6020		Prep Date: 7/31/2018	PrepBy: JML
ARSENIC	1.6		0.2	MG/KG	10	7/31/2018 14:35
CADMIUM	ND		0.2	MG/KG	10	7/31/2018 14:35
LEAD	4.3		0.2	MG/KG	10	7/31/2018 14:35
Isotopic Thorium by Alpha Spectroscopy						
			SOP 714		Prep Date: 7/5/2018	PrepBy: SDW
Tracer: Th-229	81.7		30-110	%REC	DL = NA	7/15/2018 12:44
Th-228	0.215 (+/- 0.087)	M3	0.111	pCi/g	NA	7/15/2018 12:44
Th-230	0.151 (+/- 0.083)	M3	0.118	pCi/g	NA	7/15/2018 12:44
Th-232	0.18 (+/- 0.057)		0.036	pCi/g	NA	7/15/2018 12:44
Mercury						
			SW7471		Prep Date: 7/6/2018	PrepBy: KJM
MERCURY	ND		0.032	MG/KG	1	7/9/2018 15:25

Client: Las Vegas Rock Inc.

Date: 03-Aug-18

Project:

Work Order: 1806441

Sample ID: TH1-TH5

Lab ID: 1806441-3

Legal Location:

Matrix: SOLID

Collection Date: 6/19/2018 08:20

Percent Moisture:

Analyses	Result	Qual	Report Limit	Units	Dilution Factor	Date Analyzed
Gamma Spectroscopy Results						
			SOP 713		Prep Date: 7/9/2018	PrepBy: MRL
Ra-226	ND (+/- 0.17)	U,G	0.26	pCi/g	NA	7/30/2018 10:48
Ra-228	ND (+/- 0.27)	U,G	0.51	pCi/g	NA	7/30/2018 10:48
K-40	1.31 (+/- 0.91)	G,NQ	1.23	pCi/g	NA	7/30/2018 10:48
Hexavalent Chromium						
			SW7196		Prep Date: 6/25/2018	PrepBy: AEJ
CHROMIUM VI	ND		0.1	MG/KG	1	6/25/2018
ICPMS Metals						
			SW6020		Prep Date: 7/31/2018	PrepBy: JML
ARSENIC	0.65		0.19	MG/KG	10	7/31/2018 14:38
CADMIUM	ND		0.19	MG/KG	10	7/31/2018 14:38
LEAD	2.2		0.19	MG/KG	10	7/31/2018 14:38
Isotopic Thorium by Alpha Spectroscopy						
			SOP 714		Prep Date: 7/5/2018	PrepBy: SDW
Tracer: Th-229	88.4		30-110	%REC	DL = NA	7/15/2018 12:44
Th-228	ND (+/- 0.057)	U	0.087	pCi/g	NA	7/15/2018 12:44
Th-230	0.204 (+/- 0.087)	M3	0.116	pCi/g	NA	7/15/2018 12:44
Th-232	0.118 (+/- 0.041)		0.021	pCi/g	NA	7/15/2018 12:44
Mercury						
			SW7471		Prep Date: 7/6/2018	PrepBy: KJM
MERCURY	ND		0.031	MG/KG	1	7/9/2018 15:27

Client: Las Vegas Rock Inc.

Date: 03-Aug-18

Project:

Work Order: 1806441

Sample ID: TH1-TH5

Lab ID: 1806441-3

Legal Location:

Matrix: SOLID

Collection Date: 6/19/2018 08:20

Percent Moisture:

Analyses	Result	Qual	Report Limit	Units	Dilution Factor	Date Analyzed
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Explanation of Qualifiers

Radiochemistry:

- "Report Limit" is the MDC
- U or ND - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.
- Y2 - Chemical Yield outside default limits.
- W - DER is greater than Warning Limit of 1.42
- * - Aliquot Basis is 'As Received' while the Report Basis is 'Dry Weight'.
- # - Aliquot Basis is 'Dry Weight' while the Report Basis is 'As Received'.
- G - Sample density differs by more than 15% of LCS density.
- D - DER is greater than Control Limit
- M - Requested MDC not met.
- LT - Result is less than requested MDC but greater than achieved MDC.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- L - LCS Recovery below lower control limit.
- H - LCS Recovery above upper control limit.
- P - LCS, Matrix Spike Recovery within control limits.
- N - Matrix Spike Recovery outside control limits
- NC - Not Calculated for duplicate results less than 5 times MDC
- B - Analyte concentration greater than MDC.
- B3 - Analyte concentration greater than MDC but less than Requested MDC.

Inorganics:

- B - Result is less than the requested reporting limit but greater than the instrument method detection limit (MDL).
- U or ND - Indicates that the compound was analyzed for but not detected.
- E - The reported value is estimated because of the presence of interference. An explanatory note may be included in the narrative.
- M - Duplicate injection precision was not met.
- N - Spiked sample recovery not within control limits. A post spike is analyzed for all ICP analyses when the matrix spike and or spike duplicate fail and the native sample concentration is less than four times the spike added concentration.
- Z - Spiked recovery not within control limits. An explanatory note may be included in the narrative.
- * - Duplicate analysis (relative percent difference) not within control limits.
- S - SAR value is estimated as one or more analytes used in the calculation were not detected above the detection limit.

Organics:

- U or ND - Indicates that the compound was analyzed for but not detected.
- B - Analyte is detected in the associated method blank as well as in the sample. It indicates probable blank contamination and warns the data user.
- E - Analyte concentration exceeds the upper level of the calibration range.
- J - Estimated value. The result is less than the reporting limit but greater than the instrument method detection limit (MDL).
- A - A tentatively identified compound is a suspected aldol-condensation product.
- X - The analyte was diluted below an accurate quantitation level.
- * - The spike recovery is equal to or outside the control criteria used.
- + - The relative percent difference (RPD) equals or exceeds the control criteria.
- G - A pattern resembling gasoline was detected in this sample.
- D - A pattern resembling diesel was detected in this sample.
- M - A pattern resembling motor oil was detected in this sample.
- C - A pattern resembling crude oil was detected in this sample.
- 4 - A pattern resembling JP-4 was detected in this sample.
- 5 - A pattern resembling JP-5 was detected in this sample.
- H - Indicates that the fuel pattern was in the heavier end of the retention time window for the analyte of interest.
- L - Indicates that the fuel pattern was in the lighter end of the retention time window for the analyte of interest.
- Z - This flag indicates that a significant fraction of the reported result did not resemble the patterns of any of the following petroleum hydrocarbon products:
 - gasoline
 - JP-8
 - diesel
 - mineral spirits
 - motor oil
 - Stoddard solvent
 - bunker C

ALS -- Fort Collins

Date: 8/3/2018 12:22:

Client: Las Vegas Rock Inc.

QC BATCH REPORT

Work Order: 1806441

Project:

Batch ID: **AS180705-3-2** Instrument ID **AlphaSpec2** Method: **Isotopic Thorium by Alpha Spec**

DUP Sample ID: **1806441-3** Units: **pCi/g** Analysis Date: **7/15/2018 12:44**

Client ID: **TH1-TH5** Run ID: **AS180705-3TH** Prep Date: **7/5/2018** DF: **NA**

Analyte	Result	ReportLimit	SPK Val	SPK Ref Value	%REC	Control Limit	Decision Level	DER Ref	DER	DER Limit	Qual
Th-228	0.108 (+/- 0.068)	0.096						0.072	0.4	2.1	
Th-230	ND	0.137						0.204	0.5	2.1	U,M
Th-232	0.081 (+/- 0.04)	0.038						0.118	0.6	2.1	LT
Tracer: Th-229	6.8	0	8.652		78.1	30-110		7.1			

LCS Sample ID: **AS180705-3** Units: **pCi/g** Analysis Date: **7/15/2018 12:44**

Client ID: Run ID: **AS180705-3TH** Prep Date: **7/5/2018** DF: **NA**

Analyte	Result	ReportLimit	SPK Val	SPK Ref Value	%REC	Control Limit	Decision Level	DER Ref	DER	DER Limit	Qual
Th-230	2.55 (+/- 0.4)	0.03	2.464		103	85-121					P
Tracer: Th-229	1.99	0.01	2.301		86.5	30-110					

MB Sample ID: **AS180705-3** Units: **pCi/g** Analysis Date: **7/15/2018 12:44**

Client ID: Run ID: **AS180705-3TH** Prep Date: **7/5/2018** DF: **NA**

Analyte	Result	ReportLimit	SPK Val	SPK Ref Value	%REC	Control Limit	Decision Level	DER Ref	DER	DER Limit	Qual
Th-228	ND	0.034									U
Th-230	ND	0.04									U
Th-232	ND	0.0078									U
Tracer: Th-229	1.61	0.01	2.301		69.8	30-110					

The following samples were analyzed in this batch:

1806441-1	1806441-2	1806441-3
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Client: Las Vegas Rock Inc.
 Work Order: 1806441
 Project:

QC BATCH REPORT

Batch ID: **GS180711-2-1** Instrument ID **GAMMA** Method: **Gamma Spectroscopy Results**

DUP Sample ID: **1806441-1** Units: **pCi/g** Analysis Date: **7/30/2018 10:48**
 Client ID: **DB1-DB5** Run ID: **GS180711-2A** Prep Date: **7/9/2018** DF: **NA**

Analyte	Result	ReportLimit	SPK Val	SPK Ref Value	%REC	Control Limit	Decision Level	DER Ref	DER	DER Limit	Qual
Ra-226	ND	0.33						0.07	0.8	2.1	U
Ra-228	ND	0.33						0.53	0.6	2.1	U
K-40	ND	2.1						0.01	0.3	2.1	U

LCS Sample ID: **GS180711-2A** Units: **pCi/g** Analysis Date: **7/30/2018 10:48**
 Client ID: Run ID: **GS180711-2A** Prep Date: **7/9/2018** DF: **NA**

Analyte	Result	ReportLimit	SPK Val	SPK Ref Value	%REC	Control Limit	Decision Level	DER Ref	DER	DER Limit	Qual
Ra-226	459 (+/- 54)	3	468.3		98	85-115					P,M3

LCS Sample ID: **GS180711-2** Units: **pCi/g** Analysis Date: **7/30/2018 10:48**
 Client ID: Run ID: **GS180711-2A** Prep Date: **7/9/2018** DF: **NA**

Analyte	Result	ReportLimit	SPK Val	SPK Ref Value	%REC	Control Limit	Decision Level	DER Ref	DER	DER Limit	Qual
Am-241	511 (+/- 60)	5	469.3		109	85-115					P
Co-60	196 (+/- 23)	1	195.9		100	85-115					P
Cs-137	192 (+/- 22)	1	179.2		107	85-115					P

MB Sample ID: **GS180711-2** Units: **pCi/g** Analysis Date: **7/30/2018 10:48**
 Client ID: Run ID: **GS180711-2A** Prep Date: **7/9/2018** DF: **NA**

Analyte	Result	ReportLimit	SPK Val	SPK Ref Value	%REC	Control Limit	Decision Level	DER Ref	DER	DER Limit	Qual
Ra-226	ND	0.37									U
Ra-228	ND	0.64									U
Cs-137	ND	0.127									U
K-40	ND	1.99									U

The following samples were analyzed in this batch:

1806441-1	1806441-2	1806441-3
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Client: Las Vegas Rock Inc.

Work Order: 1806441

Project:

QC BATCH REPORT

Batch ID: **HG180706-5-1**

Instrument ID: **CETAC7500**

Method: **SW7471**

LCS Sample ID: **HG180706-5** Units: **MG/KG** Analysis Date: **7/9/2018 15:20**
 Client ID: Run ID: **HG180709-2A1** Prep Date: **7/6/2018** DF: **1**

Analyte	Result	ReportLimit	SPK Val	SPK Ref Value	%REC	Control Limit	Decision Level	RPD Ref	RPD	RPD Limit	Qual
MERCURY	0.16	0.0333	0.167		96	80-120				20	

MB Sample ID: **HG180706-5** Units: **MG/KG** Analysis Date: **7/9/2018 15:18**
 Client ID: Run ID: **HG180709-2A1** Prep Date: **7/6/2018** DF: **1**

Analyte	Result	ReportLimit	Qual
MERCURY	ND	0.033	

The following samples were analyzed in this batch:

1806441-1	1806441-2	1806441-3
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Client: Las Vegas Rock Inc.

Work Order: 1806441

Project:

QC BATCH REPORT

Batch ID: **IP180731-4-2**

Instrument ID **ICPMS2**

Method: **SW6020**

LCS Sample ID: **IM180731-4** Units: **MG/KG** Analysis Date: **7/31/2018 14:26**

Client ID: Run ID: **IM180731-11A2** Prep Date: **7/31/2018** DF: **10**

Analyte	Result	ReportLimit	SPK Val	SPK Ref Value	%REC	Control Limit	Decision Level	RPD Ref	RPD	RPD Limit	Qual
ARSENIC	9.41	0.2	10		94	80-120				20	
CADMIUM	2.75	0.2	3		92	80-120				20	
LEAD	4.73	0.2	5		95	80-120				20	

MB Sample ID: **IP180731-4** Units: **MG/KG** Analysis Date: **7/31/2018 14:23**

Client ID: Run ID: **IM180731-11A2** Prep Date: **7/31/2018** DF: **10**

Analyte	Result	ReportLimit	Qual
ARSENIC	ND	0.2	
CADMIUM	ND	0.2	
LEAD	ND	0.2	

The following samples were analyzed in this batch:

1806441-1	1806441-2	1806441-3
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Client: Las Vegas Rock Inc.

Work Order: 1806441

Project:

QC BATCH REPORT

Batch ID: CR180625-1-1

Instrument ID Spec

Method: SW7196

LCS		Sample ID: CR180625-1		Units: MG/KG			Analysis Date: 6/25/2018				
Client ID:		Run ID: CR-180625-1A1			Prep Date: 6/25/2018		DF: 1				
Analyte	Result	ReportLimit	SPK Val	SPK Ref Value	%REC	Control Limit	Decision Level	RPD Ref	RPD	RPD Limit	Qual
CHROMIUM VI	2.73	0.1	3		91	80-120				20	

MB		Sample ID: CR180625-1		Units: MG/KG			Analysis Date: 6/25/2018				
Client ID:		Run ID: CR-180625-1A1			Prep Date: 6/25/2018		DF: 1				
Analyte	Result	ReportLimit	Qual								
CHROMIUM VI	ND	0.1									

MS		Sample ID: 1806441-1		Units: MG/KG			Analysis Date: 6/25/2018				
Client ID: DB1-DB5		Run ID: CR-180625-1A1			Prep Date: 6/25/2018		DF: 1				
Analyte	Result	ReportLimit	SPK Val	SPK Ref Value	%REC	Control Limit	Decision Level	RPD Ref	RPD	RPD Limit	Qual
CHROMIUM VI	0.882	0.1	1	0.1	88	75-125				20	

MSD		Sample ID: 1806441-1		Units: MG/KG			Analysis Date: 6/25/2018				
Client ID: DB1-DB5		Run ID: CR-180625-1A1			Prep Date: 6/25/2018		DF: 1				
Analyte	Result	ReportLimit	SPK Val	SPK Ref Value	%REC	Control Limit	Decision Level	RPD Ref	RPD	RPD Limit	Qual
CHROMIUM VI	0.895	0.1	1	0.1	90	75-125		0.882	1	20	

The following samples were analyzed in this batch:

1806441-1	1806441-2	1806441-3
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TECHNICAL BULLETIN ADDENDUM

The library used for analysis defines the gamma emission(s) to be used for analysis of each nuclide. If multiple gamma emissions are used for quantification, then a 'NET' quantification emission (or peak) must be defined in the library. This designation provides for the calculation of nuclide activity concentrations and detection limits in the case of non-presence of the nuclide. When the nuclide is not present, or the software is unable to resolve a peak at the library defined 'NET' energy, the software evaluates the 'NET' region of interest ('NET' peak energy +/- 2 keV) by performing a summation of the net counts above the background level. This 'NET' quantification can result in net negative, zero, or positive activity results, and is highly dependent on the spectral distribution in the region of interest of the 'NET' peak. In cases where only the 'NET' peak is found, and the software performs a net quantification, the nuclide result will be flagged with an 'NQ' qualifier on the final reports. This indicates that the nuclide is not detected or supported at any level above the reported MDC. Results are submitted without further qualification.

All nuclides specified in the library of analysis for gamma spectroscopy are evaluated for positive OR tentative identification on the following criteria:

- The individual abundances for the gamma emissions specified for each nuclide are summed to obtain a total nuclide abundance.
- From the total nuclide abundance, a positive identification criterion is set as 75% of this total nuclide abundance.
- For all nuclide peaks that are not net quantified, those peak abundances are summed. The total non-net quantified peak sum is compared to the calculated 75% abundance criterion. If this sum is greater than the 75% criterion, the nuclide is considered to be positively identified at the reported concentration. If the sum is less than the 75% criterion, the nuclide is tentatively identified at the reported concentration. These results will be flagged with a 'TI' qualifier on the final reports to indicate that the 75% abundance criterion was not met.