


NRC FORM 7 (02-2016) 10 CFR 110		 U. S. NUCLEAR REGULATORY COMMISSION		APPROVED BY OMB: NO. 3150-0027		EXPIRES: 11/30/2018	
APPLICATION FOR NRC EXPORT OR IMPORT LICENSE, AMENDMENT, RENEWAL, OR CONSENT REQUEST(S) (See Instructions on Pages 4 and 5)							
PART A. FOR NRC USE ONLY			<input checked="" type="checkbox"/> PUBLIC OR <input type="checkbox"/> NON-PUBLIC			DATE RECEIVED 8-3-17	
LICENSE NUMBER X5008844			DOCKET NUMBER 11006272			ADAMS ACCESSION NUMBER	
PART B. TO BE COMPLETED FOR ALL LICENSES, AMENDMENTS, RENEWALS, OR CONSENT REQUESTS (If more space is needed to complete any of the items, use Pages 3-4 first, and then attach additional sheets, if necessary.)							
1. NAME AND ADDRESS OF APPLICANT/LICENSEE Southern Ionics Minerals, LLC 13291 Vantage Way, Suite 103 Jacksonville, Florida 32218			1a. NAME OF APPLICANT'S CONTACT James Renner		1b. APPLICANT'S REFERENCE NUMBER		
			1c. PHONE NUMBER 912 580 1235		1d. FAX NUMBER		
			1e. E-MAIL ADDRESS jrenner@simineralsllc.com				
2. TYPE OF ACTION REQUESTED (Check One)							
<input checked="" type="checkbox"/> EXPORT (Parts B, C, E)		<input type="checkbox"/> IMPORT (Parts B, D, E)		<input type="checkbox"/> AMENDMENT/RENEWAL Current License Number:		<input type="checkbox"/> CONSENT REQUEST (Parts B, C) Current License Number:	
3. CONTRACT NUMBER(S)		4. FIRST SHIPMENT DATE October 2017		5. LAST SHIPMENT DATE December 31, 2022		6. PROPOSED EXPIRATION DATE December 31, 2022	
PART C. TO BE COMPLETED FOR EXPORT LICENSES, AMENDMENTS, OR RENEWALS (If more space is needed to complete any of the items, use Pages 3-4 first, and then attach additional sheets, if necessary.)							
7. NAME(S) / ADDRESS(ES) OF SUPPLIERS AND/OR OTHER PARTIES TO THE EXPORT None. Southern Ionics Minerals, LLC is the sole supplier of the Rare Earth Mineral Sand.			8. NAME(S) / ADDRESS(ES) OF INTERMEDIATE FOREIGN CONSIGNEE(S) Eggerding Asia Limited Room 1605,16/F Dominion Centre 43-59 Queen's Road East Wanchai, Hong Kong			9. NAME(S) / ADDRESS(ES) OF ULTIMATE FOREIGN CONSIGNEE(S) Zhan Jiang City Hongri Rare Earth Co Ltd Xinqiao, Suixi City, Guangdong China Mr Zheng Yi Tel: 86 759 7782043, Fax: 86 759 7782043 jiangrong81866338@aliyun.com	
7a. FUNCTION(S) PERFORMED/SERVICE(S) PROVIDED None			8a. INTERMEDIATE USE(S) None			9a. ULTIMATE END USE(S) None for radioactive materials.	
10. DESCRIPTION OF RADIOACTIVE MATERIALS, SEALED SOURCES, NUCLEAR FACILITIES, EQUIPMENT, OR COMPONENTS; FOR NUCLEAR EQUIPMENT INCLUDE TOTAL DOLLAR VALUE OF EQUIPMENT FOR EXPORT Natural uranium and natural thorium as trace constituents of Rare Earth Mineral Sand. See Additional Information.				10a. MAX TOTAL VOLUME / ELEMENT WGT (KG), OR TOTAL ACTIVITY (TBq) Total element weight to be exported: U(nat) 41,392 kg Th(nat) 271,829 kg See Additional Info.		10b. MAX ENRICHMENT OR WGT % No enrichment. Natural uranium and natural thorium.	10c. MAX ISOTOPE WGT (KG) NA
11. FOREIGN OBLIGATIONS (BY COUNTRY AND BY PERCENTAGE OF MAXIMUM TOTAL VOLUME) None							

NRC FORM 7
(02-2016)
10 CFR 110

U. S. NUCLEAR REGULATORY COMMISSION

**APPLICATION FOR NRC EXPORT OR IMPORT
LICENSE, AMENDMENT, RENEWAL, OR CONSENT REQUEST(S) (Continued)**

LICENSE NUMBER <i>KSOU 8844</i>	DOCKET NUMBER <i>11006272</i>	ADAMS ACCESSION NUMBER	<input checked="" type="checkbox"/> PUBLIC OR <input type="checkbox"/> NON-PUBLIC
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PART D. TO BE COMPLETED FOR IMPORT LICENSES, AMENDMENTS, OR RENEWALS
(If more space is needed to complete any of the items, use Pages 3-4 first, and then attach additional sheets, if necessary.)


12. NAME(S) / ADDRESS(ES) OF FOREIGN SUPPLIERS AND/OR OTHER PARTIES TO IMPORT	13. NAME(S) / ADDRESS(ES) OF INTERMEDIATE CONSIGNEE(S)	14. NAME(S) / ADDRESS(ES) OF ULTIMATE U. S. CONSIGNEE(S)	
12a. NRC EXPORT LICENSE NUMBER(S) <i>(if applicable)</i>	13a. LICENSE NUMBER(S) / EXPIRATION DATE(S)	14a. LICENSE NUMBER(S) / EXPIRATION DATE(S)	
	13b. INTERMEDIATE USE(S)	14b. ULTIMATE END USE(S)	
15. DESCRIPTION OF RADIOACTIVE MATERIALS, SEALED SOURCES, NUCLEAR FACILITIES	15a. MAX TOTAL VOLUME / ELEMENT WGT (KG), OR TOTAL ACTIVITY (TBq)	15b. MAX ENRICHMENT OR WGT %	15c. MAX ISOTOPE WGT (KG)

16. FOREIGN OBLIGATIONS (BY COUNTRY AND BY PERCENTAGE OF MAXIMUM TOTAL VOLUME)

PART E. TO BE COMPLETED FOR ALL LICENSES, AMENDMENTS, RENEWALS OR CONSENT REQUEST(S)

17. ADDITIONAL INFORMATION PROVIDED ON PAGES 3, 4, AND/OR ON SEPARATE SHEETS? <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	17a. COPIES OF RECIPIENTS' AUTHORIZATIONS PROVIDED? <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO
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18. CERTIFICATION: I, the applicant's authorized official, hereby certify that this application is prepared in conformity with Title 10, Code of Federal Regulations, and that all information provided is correct to the best of my knowledge.

18a. PRINT NAME AND TITLE OF AUTHORIZED OFFICIAL <i>James F. Renner, P.G. Manager of Environmental Stewardship</i>	18b. SIGNATURE -- AUTHORIZED OFFICIAL 	18c. DATE <i>6/28/2017</i>
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NRC FORM 7
(02-2016)
10 CFR 110

U. S. NUCLEAR REGULATORY COMMISSION

**APPLICATION FOR NRC EXPORT OR IMPORT
LICENSE, AMENDMENT, RENEWAL, OR CONSENT REQUEST(S) (Continued)**

LICENSE NUMBER <i>XSON 8844</i>	DOCKET NUMBER <i>11006272</i>	ADAMS ACCESSION NUMBER	<input checked="" type="checkbox"/> PUBLIC OR <input type="checkbox"/> NON-PUBLIC
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ADDITIONAL INFORMATION (*Reference applicable block numbers from page 1 and/or page 2 for each entry*)

Additional information in support of SIM's Form 7 export license application is provided in 14 attached separate sheets:

Additional Information pages 1 through 7 expressly reference the Form 7 Block number.
Attachment A pages 1 through 7 is a Certificate of Analysis.



SIM

June 28, 2017

Office of International Programs
U.S. Nuclear Regulatory Commission
11555 Rockville, Pike
Rockville, Maryland 20852
Mail Stop: O14-A20

Re: Form 7 Application for Specific License to Export Source Material
Licensee: Southern Ionics Minerals, LLC

Dear Sir / Madam:

Southern Ionics Minerals, LLC ("SIM") hereby submits a completed Form 7 application and corresponding fee in support of a specific license to export rare earth ore to the Peoples Republic of China ("PRC") for non-nuclear end-uses. Because the ore contains naturally occurring uranium and thorium in excess of 0.05 percent by weight and the envisioned export quantities exceed generally licensed amounts, a specific export license is required pursuant to 10 CFR Part 110. Licensable source material is present as an incidental and unavoidable contaminant of rare earth-bearing ores. SIM mines mineral sand deposits in southeast Georgia to produce titanium and zirconium mineral sands for use in various U.S. industries. The rare earth-bearing ores, hereinafter referred to as rare earth mineral sand (REMS), are a co-product of the titanium and zirconium mineral sand separation process, and are produced in accordance with Georgia Radioactive Materials License No. GA 1678-1.

The ultimate consignee in the PRC intends to use REMS as a raw material for production of rare earth oxides. Because there are currently no domestic U.S. processors of rare earth minerals, SIM has no commercial alternative to exporting REMS as a mineral commodity.

We are submitting a check for \$9300 as indicated by the fee schedule in 10 CFR 170.31 and in anticipation that this application will require Executive Branch review.

We appreciate your attention to this matter.

Sincerely,

James F. Renner, P.G.
Manager of Environmental Stewardship
(912) 580-1235 jrenner@simineralslc.com

Attached: NRC Form 7 with Additional Information
Check # 31557 for Export License Application fee

4. First Shipment Date

The first shipment is proposed for October 2017 or as soon as the export license is issued.

5. Last Shipment Date

Shipments will be on-going, subject to production of Rare Earth Mineral Sand by Southern Ionics Minerals. Shipping quantities and the shipment schedule will depend on contract terms. Shipments are expected to occur at least quarterly through December 31, 2022.

8. Names/Addresses of Intermediate Foreign Consignees

Eggerding Asia Limited is the agent/buyer's representative and may act as an intermediate consignee.

Eggerding Asia Limited
Room 1605,16/F
Dominion Centre
43-59 Queen's Road East
Wanchai, Hong Kong
Frederique Van der Linde f.m.vanderlinde@eggerding.com
Jase Chui jase.chui@eggerding.com

8a. Intermediate Uses

Intermediate foreign consignees will receive shipments of Rare Earth Mineral Sand under Chinese government licenses and authorizations and will forward it to the ultimate foreign consignees identified in Block 9. Licensable source material in the form of natural uranium and thorium are incidental constituents of the rare earth minerals monazite and xenotime and will follow these minerals to the ultimate consignee.

9. Names/Addresses of Ultimate Foreign Consignees

Zhan Jiang City Hongri Rare Earth Co Ltd
Xinqiao, Suixi City, Guangdong China
Mr Zheng Yi
Tel: 86 759 7782043,
Fax: 86 759 7782043
jiangrong81866338@aliyun.com

9a. Ultimate end uses

The foreign consignee will process Rare Earth Mineral Sand under Chinese government issued licenses for the purpose of producing rare earth compounds and elements. Non-rare earth zirconium and titanium minerals may be used for producing zirconium and titanium oxides. Naturally occurring uranium and thorium will be disposed of as regulated waste by the foreign consignee.

As described further in Block 10, rare earth elements present in Rare Earth Mineral Sand (REMS) include the "light" rare earths lanthanum, cerium, neodymium, samarium, and gadolinium, as well as the "heavy" rare earths terbium, dysprosium, holmium, erbium, ytterbium and yttrium. The common end uses of the extracted compounds and elements are non-nuclear, and according to the U.S. Geological Survey and published scientific literature, include the following applications:

Cerium Oxide (CeO₂)

- Ceramics.
- To sensitize photosensitive glass.
- As a catalyst.
- To polish glass and stones in lapidary and optical glass applications.
- As an oxidizing species in catalytic converters in automotive and industrial gasoline and diesel engines.
- As a replacement for thorium oxide in incandescent gas lantern mantles.
- Of interest as a possible material for solid oxide fuel cells.

Lanthanum Oxide (La₂O₃)

- Anode material in nickel metal hydride batteries used in hybrid automobiles.
- "Mischmetal" the sparking element in cigarette lighter flints.
- As a substitute for thorium in Tungsten Inert Gas arc welding electrodes.
- Glass manufacturing.
- Water treatment compounds to remove phosphorus.

Neodymium (Nd)

- High-performance magnets used in electric motors of hybrid- or all-electric automobiles and in wind-powered electric generators.

Yttrium (Y)

- Yttrium phosphors are used in energy efficient fluorescent lamps and bulbs.
- Yttrium oxide ("Yttria") is used to create cubic zirconia jewelry, a diamond simulant.
- Neodymium-Yttrium garnet lasers (Nd:YAG) are used commercially in industrial, medical, and graphic arts applications. These laser beams are used for precision cutting, welding, etching, and boring.
- Yttrium-iron garnets (YIG) are used in electronic components.

Samarium (Sm), Gadolinium (Gd), Terbium (Tb), Dysprosium (Dy), Holmium (Ho), Erbium (Er) and Ytterbium (Yb)

- Magnetic applications including data storage.
- Various electronics applications including light-emitting diodes (LEDs).
- Ceramics.
- Medical imaging and lasers, including dental and dermatological lasers.

Scandium (Sc)

- Solid oxide fuel cells (SOFCs).
- Aluminum-scandium alloys.
- Ceramics, electronics, lasers, and lighting.

Non-rare earth minerals present in REMS that are economically important include zircon, and the *titanium* minerals ilmenite, rutile and leucosene.

Zircon (ZrSiO₄)

- Ceramics
- Foundry work, including refractory applications, insulation, and investment casting.
- Production of zirconia (ZrO₂) which is used in oxygen sensors and fuel cells.
- Production of zirconium oxychloride as a raw material for production of zirconium metal and other zirconium chemicals.

Titanium Minerals Ilmenite (FeTiO₃) and Rutile (TiO₂)

- The most important application of the titanium minerals is the production of titanium dioxide for use as a pigment in paints, varnishes and plastics.
- Also used in printing inks, fibers, rubber, cosmetic products and foodstuffs.
- Minor applications include the production of titanium metal, glass and glass ceramics, electrical ceramics, catalysts, and electric conductors and chemical intermediates.

10. Description of Radioactive Materials

The radioactive material to be exported is source material in the form of natural uranium (U-nat) and natural thorium (Th-nat) which is an unintended and unavoidable contaminant in Rare Earth Mineral Sand (REMS), a co-product of the separation of the minerals zircon, rutile, and ilmenite from ancient beach sands. The REMS produced by Southern Ionics Minerals is typically 60% monazite, 5% xenotime, and 35% other minerals (staurolite, quartz, kyanite, zircon, rutile, ilmenite, epidote, etc.).

Uranium and thorium are incidental and unavoidable contaminants of the REMS because they naturally occur in the crystal lattice of the rare earth phosphate minerals, monazite and xenotime. U-nat and Th-nat are concentrated above the 0.05% licensing threshold when the monazite and xenotime are segregated from other minerals to produce the REMS. Because natural thorium and uranium content of REMS exceeds 0.05% by weight, REMS is classified as licensable "source material," and its production, storage and transfer is governed by SIM's Georgia Radioactive Materials License No. GA-1678-1. U-nat and Th-nat also occur as trace constituents of zircon, rutile, and ilmenite, but at concentrations below 0.05%.

Monazite has the typical formula (Ce, La, Nd)PO₄, with other rare earth elements often present in varying proportions. Th-nat can comprise more than 1% in monazite, while U-nat is a lesser constituent. Xenotime has the typical formula YPO₄, with other rare earth elements often present in varying proportions. The typical concentrations of elements of interest in Southern Ionics Minerals' Rare Earth Mineral Sand are (see the Attachment A. Certificate of Analysis):

2010 ppm	U-nat
13,200 ppm	Th-nat
82,600 ppm	Ce
40,000 ppm	La
34,600 ppm	Nd
11,900 ppm	Y
9070 ppm	Pr
6400 ppm	Sm
4390 ppm	Gd
2680 ppm	Dy
1040 ppm	Er
867 ppm	Yb

541 ppm	Tb
421 ppm	Ho
342 ppm	Eu
137 ppm	Tm
131 ppm	Lu

The total quantity of REMS expected to be exported by Southern Ionics Minerals from 2017 through 2022 is 20,600 metric tons (existing stockpile of 3175 metric tons plus additional production of 2900 metric tons/year over 6 years). Individual shipments are expected to range from 500 metric tons to 2500 metric tons. When offered for transportation or transported in the U.S. and internationally, REMS shall be subject to regulations of the U.S. Nuclear Regulatory Commission at 10 C.F.R Part 71, the U.S. Department of Transportation at 49 C.F.R Subtitle B regulations governing Class 7 (radioactive) materials and applicable provisions of the International Maritime Dangerous Goods (IMDG) Code governing transportation by vessel.

10a. Max total element weight (kg) or total activity (TBq)

The total quantity of U-nat and Th-nat to be exported by SIM during the life of the license is based on their concentrations in REMS and the total quantity of REMS to be produced and exported from 2016 through December 31, 2022:

U(nat)	41,392 kg	1.05 TBq
Th(nat)	271,829 kg	2.19 TBq

17a. Copies of Recipients' Authorizations

Southern Ionics Minerals is communicating with the intermediate consignee regarding Chinese import licenses. It is our understanding that the consignees will need two import licenses:

- A quota license from Chinese government
- An import license from the receiving port when an individual shipment bill of lading is prepared.

As part of our due diligence, we have requested relevant permits and licenses from the intermediate and ultimate consignees. The following documents are provided:

- An example (untranslated) of the ultimate consignee's *Enterprise Exit-Entry Inspection and Quarantine Application Filing Form* submitted to the Guangdong customs agency.
- A translation of the above document.
- A translation of the Guangdong Provincial Environmental Protection Agency's environmental opinions regarding radioactive materials management and radiation safety measures of the ultimate consignee's mineral sand mining and processing program.

**Example Enterprise Exit-Entry Inspection and Quarantine Application Filing Form
submitted to the Guangdong customs agency
by ultimate consignee Zhan Jiang City Hongri Rare Earth Co Ltd.
(document provided by Eggerding Asia Limited)**

出入境检验检疫报检企业备案表

编号: 16090218082800000686

备案类别: 自理企业

备案号码: 4408601224

企业名称	中文	湛江市红日稀土有限公司	
	英文	ZHANJIANG CITY HONGRI RARE EARTH CO.,LTD	
住 所	遂溪县新桥 (广东省遂溪县国营氮肥厂内)		
经营场所	遂溪县新桥 (广东省遂溪县国营氮肥厂内)		
企业性质	私营企业	企业类别	有自营权的生产企业
营业执照号		统一社会信用代码 (组织机构代码)	914408007079008751
开户银行	遂溪县附城农村信用合作社	银行账号	80020000002387621
法定代表人/负责人	郑文	有效证件号	
联系人		联系电话	
传 真		电子邮箱	

快件运营企业备案还须填写以下内容

快递业务经营许可证号		经营范围	
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报检专用章印模: (使用报检专用章的需提供, 另附页)

填表前请认真阅读背面的条款, 并由企业法定代表人/负责人签字, 盖章。



**Translation of example Enterprise Exit-Entry Inspection and Quarantine Application Filing Form
 submitted to the Guangdong customs agency
 by ultimate consignee Zhan Jiang City Hongri Rare Earth Co Ltd.
 (Translation by Apex Translations Inc.)**

**Enterprise Exit-Entry Inspection and Quarantine
 Application Filing Form**

Number: 16030218082800000686

Filing Category: Self-managed Enterprise

Filing Number: 4408601221

Enterprise name	Chinese	Zhanjiang City Hongri Rare Earth Co., Ltd		
	English	ZHANJIANG CITY HONGRI RARE EARTH CO., LTD Filing Number:		
Address	Xinqiao Suixi County (inside State-run Nitrogen Fertilizer Factory, Suixi County, Guangdong Province)			
Operating Location	Xinqiao Suixi County (inside State-run Nitrogen Fertilizer Factory, Suixi County, Guangdong Province)			
Ownership	Private	Enterprise Category	Manufacturer with Right of Self-managed Operation	
Business License Number	Uniform Social Credit Code		914408007079098751	
	Organizaion Institution Code			
Bank	Fucheng Countryside Credit Union, Xinqiao Suixi County	Bank Account	69020000002387521	
Legal Person /Representative	Zheng Yi	Valid ID Number		
Contact:		Phone:		
FAX:		Email:		

Express Mail Operating Enterprises are required to fill out the following content:

Express Mail Operation Business License Number	Scope of Operation
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Dedicated Seal for Inspection Filing: (Required by those using Dedicated Seal of Inspection Filing, see appendix
 Please read carefully the clauses on the reverse side before filling out the form, and signed and stamped by the legal representative or person in charge.

Guangdong Bureau of Exit-Entry
 Supervision and Inspection (Special Seal)
 Inspection and Quarantine
 People's Republic of China
 Filing Enterprise Supervision
 Special Seal
 018



Translation of Environmental Opinions
(original document not provided; translation provided by Eggerding Asia Limited)

Guangdong Provincial Environmental Protection Agency About Zhanjiang Hongri Rare Earth Co., Ltd
Coastal sand mine comprehensive recycling project radiation environmental impact
Special review of opinions

Zhanjiang Hongri Rare Earth Co., Ltd
[Zhanjiang Hongri Rare Earth Co., Ltd. - Beach Sand Comprehensive Recovery Project Radiation Environmental Impact
Special Articles] (hereinafter referred to as "The Articles") received, the study review opinions are as follows:

1/. your company beach sand comprehensive recycling project is located in Zhanjiang City Suixi County Huangxiaozhen Yan Village Industrial Park Suixi nitrogen fertilizer plant, the project content: the seaside sand as raw material, the physical separation into titanium iron concentrate, zirconium sand concentrate, monazite concentrate and phosphorus yttrium concentrate and other minerals, after the separation of titanium iron concentrate, zircon sand concentrate directly for sale, monazite concentrate and phosphorus yttrium concentrate by the Company further Smelting into rare earth and chlorinated yttrium rare earth.

2/. The evaluation of the project is clear, the evaluation factors and the evaluation criteria adopted are reasonable, the evaluation conclusion is credible, the proposed radiation safety and pollution prevention and control measures are feasible, basically meet the project radiation environmental management requirements, 'The Article' can be As the main basis for the implementation of the project radioactive pollution control measures and the development of radiation environmental management, therefore, from the perspective of radiation environmental impact, I agreed to your company in accordance 'The Article' in the radiation management and requirements of the project

3/. The project should be strictly implemented 'The Article' in the proposed radiation safety and pollution prevention and control measures, and focus on the following work:

(1) to strengthen the management of radiation and environmental management, establish and improve the management system of radiation safety, improve the contingency plans for radiation accidents, strictly implement the radiation environmental monitoring plan, equipped with monitoring equipment, and commissioned a qualified unit on the workplace where the project is located. Storage, solid waste, soil, drainage and other radioactive monitoring, such as abnormalities should be promptly taken to take effective measures to report to the local environmental protection administrative departments

(2) to strengthen the staff surface dose monitoring and decontamination, contaminated items should be properly stored and treated, the control area staff should wear masks and other protective equipment and personal dosimeters, and quarterly test, the test results reported The local environmental protection administrative department for the record

(3) to do a good job of radioactive solid waste accounting, the radioactive solid waste generated in a timely manner to clean up, to prohibit random chaos, radioactive waste temporary storage of radioactive solid waste to be related to the relevant recycling unit

(4) rain sewage to be collected after the precipitation treatment standards discharge

(5) The effective annual dose management target for the project staff is 5 mSv / year, the remaining staff and the public annual effective dose management target is 0.25 mSv / year

4. Project radioactive environmental investment should be included in the project investment budget and be implemented

5/. projects should be strictly implemented supporting the construction of environmental protection facilities and the main project at the same time design, construction at the same time put into use the environmental protection, three simultaneous system after the completion of the project, your company should be required to apply to the Office of the project radiation environment completed Acceptance of special articles, radiation safety and pollution prevention and control facilities to be qualified after acceptance, the construction project can be put into use, the project daily radiation environmental protection supervision and management work are responsible by the Zhanjiang City Environmental Protection Agency.

Quality Analysis ...



Attachment A. Certificate of Analysis
page 1 of 7
Innovative Technologies

Date Submitted: 09-Jan-17
Invoice No.: A17-00171
Invoice Date: 02-Feb-17
Your Reference: REC Analysis

SOUTHERNIONIC MINERALS
2649 ZERO BAY RD
PATTERSON GA 31557
United States

ATTN: KANDACE COLE

CERTIFICATE OF ANALYSIS

Southern Ionics Minerals Rare Earth Mineral Sand samples

3 Crushed Rock samples were submitted for analysis.

The following analytical package(s) were requested:

Code 8-REE Molycorp-1(element/oxide) Major Elements Fusion ICP(WRA)/Trace Elements Fusion ICP/MS(WRA4B2)

Code 8-REE Molycorp-2(element/oxide) Major Elements Fusion ICP(WRA)/Trace Elements Fusion ICP/MS(WRA4B2)

REPORT **A17-00171**

This report may be reproduced without our consent. If only selected portions of the report are reproduced, permission must be obtained. If no instructions were given at time of sample submittal regarding excess material, it will be discarded within 90 days of this report. Our liability is limited solely to the analytical cost of these analyses. Test results are representative only of material submitted for analysis.

Notes:

Total includes all elements in % oxide to the left of total.

CERTIFIED BY:

A handwritten signature in black ink, appearing to be "Emmanuel Esemé". The signature is written in a cursive style with a large, stylized 'E' and 'S'.

Emmanuel Esemé, Ph.D.
Quality Control

ACTIVATION LABORATORIES LTD.
41 Bittern Street, Ancaster, Ontario, Canada, L9G 4V5
TELEPHONE +905 648-9611 or +1.888.228.5227 FAX +1.905.648.9613
E-MAIL Ancaster@actlabs.com ACTLABS GROUP WEBSITE www.actlabs.com

Results

Activation Laboratories Ltd.

Report: A17-00171

Analyte Symbol	Si	SiO2	Al	Al2O3	Mn	MnO	Mg	MgO	Ca	CaO	Na	Na2O	K	K2O	P	P2O5	Sc	Sc2O3	Ti	TiO2	V	V2O5	Cr
Unit Symbol	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	ppm	ppm	%	%	ppm	ppm	ppm
Lower Limit	0.005	0.01	0.006	0.01	0.0008	0.001	0.006	0.01	0.008	0.01	0.008	0.01	0.009	0.01	0.01	0.01	1	2	0.01	0.001	5	9	20
Method Code	FUS-ICP	FUS-ICP	FUS-ICP	FUS-ICP	FUS-ICP	FUS-ICP	FUS-ICP	FUS-ICP	FUS-ICP	FUS-ICP	FUS-ICP	FUS-ICP	FUS-ICP	FUS-ICP	FUS-ICP	FUS-ICP	FUS-ICP	FUS-ICP	FUS-ICP	FUS-ICP	FUS-ICP	FUS-ICP	FUS-MS
REC_161229_01X	8.585	18.36	10.1	19.05	0.584	0.754	0.369	0.61	1.44	2.02	0.009	0.01	0.141	0.17	4.60	10.53	51	79	1.95	3.248	138	247	130
REC_161229_02X	8.819	18.86	13.5	25.47	0.778	1.004	0.516	0.86	1.02	1.43	<0.008	0.01	0.141	0.17	5.13	11.75	40	61	0.33	0.553	90	161	120
REC_161229_03X	11.86	25.37	16.5	31.23	0.555	0.716	0.643	1.07	1.90	2.66	0.044	0.06	0.090	0.11	2.42	5.56	44	67	0.68	1.138	135	240	140

REC_161229_01X is a composite of the REMS stockpile.
 This analysis is reported in Block 10 and was used for calculation of export quantities of U-nat and Th-nat.
 The other analyses (-02X and -03X) are of REMS produced during various plant operation trials and are not representative of overall REMS production.

Results

Activation Laboratories Ltd.

Report: A17-00171

Analyte Symbol	Cr2O3	Fe	Fe2O3(T)	Ga	Ga2O3	Pb	PbO	U	U3O8	Th	ThO2	Y	Y2O3	La	La2O3	Ce	CeO2	Pr	Pr6O11	Nd	Nd2O3	Sm	Sm2O3
Unit Symbol	ppm	%	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Lower Limit	30	0.007	0.01			5	5	0.1	0.1	0.1	0.1	2	3	0.1	0.1	0.1	0.1	0.05	0.06	0.1	0.1	0.1	0.1
Method Code	FUS-MS	FUS-ICP	FUS-ICP	FUS-MS	FUS-MS	FUS-MS	FUS-MS	FUS-MS	FUS-MS	FUS-MS	FUS-MS	FUS-ICP	FUS-ICP	FUS-MS	FUS-MS	FUS-MS	FUS-MS	FUS-MS	FUS-MS	FUS-MS	FUS-MS	FUS-MS	FUS-MS
REC_161229_01X	180	4.78	6.84			368	396	2010	2367	13200	15020	11900	15110	40000	46900	82600	101400	9070	10960	34600	40310	6400	7420
REC_161229_02X	180	5.99	8.56			361	389	2030	2392	9980	11350	12900	16380	40200	47100	83600	102600	9170	11080	34900	40710	6490	7531
REC_161229_03X	210	7.05	10.07			207	223	1080	1277	7290	8296	7031	8929	21800	25500	44400	54550	4860	5868	19600	22840	3640	4220

REC_161229_01X is a composite of the REMS stockpile.
 This analysis is reported in Block 10 and was used for calculation of export quantities of U-nat and Th-nat.
 The other analyses (-02X and -03X) are of REMS produced during various plant operation trials and are not representative of overall REMS production.

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Analyte Symbol	Eu	Eu2O3	Gd	Gd2O3	Tb	Tb4O7	Dy	Dy2O3	Ho	Ho2O3	Er	Er2O3	Tm	Tm2O3	Yb	Yb2O3	Lu	Lu2O3	Be	BeO	Co	Co2O3	Ni
Unit Symbol	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Lower Limit	0.05	0.06	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.05	0.06	0.1	0.1	0.04	0.05	1	3	1	1	20
Method Code	FUS-MS	FUS-MS	FUS-MS	FUS-MS	FUS-MS	FUS-MS	FUS-MS	FUS-MS	FUS-MS	FUS-MS	FUS-MS	FUS-MS	FUS-MS	FUS-MS	FUS-MS	FUS-MS	FUS-MS	FUS-MS	FUS-ICP	FUS-ICP	FUS-MS	FUS-MS	FUS-MS
REC_161229_01X	342	395.9	4390	5063	541	635.7	2680	3074	421	482.3	1040	1194	137	156.1	867	987.4	131	149.2	11	31	22	31	< 20
REC_161229_02X	350	405.7	4540	5237	573	674.2	2820	3233	450	515.7	1130	1293	151	172.1	942	1073	142	161.4	15	42	31	44	20
REC_161229_03X	197	228.2	2450	2830	313	368.0	1540	1773	251	287.6	627	717.3	85.4	97.51	549	625.2	84.2	95.78	15	43	33	47	100

REC_161229_01X is a composite of the REMS stockpile.
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Analyte Symbol	NiO	Cu	CuO	Zn	ZnO	Ge	GeO2	As	As2O3	Rb	Rb2O	Sr	SrO	Zr	ZrO2	Nb	Nb2O5	Mo	MoO3	Ag	Ag2O	In	In2O3
Unit Symbol	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Lower Limit	30	10	20	30	40			5	7	2	2	2	2	4	5			2	3			0.2	0.2
Method Code	FUS-MS	FUS-MS	FUS-MS	FUS-MS	FUS-MS	FUS-MS	FUS-MS	FUS-MS	FUS-MS	FUS-MS	FUS-MS	FUS-ICP	FUS-ICP	FUS-ICP	FUS-ICP	FUS-MS	FUS-MS	FUS-MS	FUS-MS	FUS-MS	FUS-MS	FUS-MS	FUS-MS
REC_161229_01X	< 30	20	30	2780	3450			173	228	< 2	< 2	111	131	81750	110000			3	5			< 0.2	< 0.2
REC_161229_02X	< 30	10	< 20	3470	4320			175	231	< 2	< 2	60	71	37790	51000			< 2	< 3			< 0.2	< 0.2
REC_161229_03X	130	< 10	< 20	2990	3720			98	129	2	3	138	163	46440	62700			< 2	< 3			< 0.2	< 0.2

REC_161229_01X is a composite of the REMS stockpile.
 This analysis is reported in Block 10 and was used for calculation of export quantities of U-nat and Th-nat.
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Analyte Symbol	Sn	SnO2	Sb	Sb2O3	Cs	Cs2O	Ba	BaO	Bi	Bi2O3	Hf	HfO2	Ta	Ta2O5	W	WO3	Ti	Ti2O	TREO	LOI	Cumax Total	Ta2O5	Nb2O5
Unit Symbol	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	%	%	%	%
Lower Limit	1	1	0.5	0.6	0.5	0.5	3	3	0.4	0.4	0.2	0.2			1	1	0.1	0.1				0.003	0.003
Method Code	FUS-MS	FUS-MS	FUS-MS	FUS-MS	FUS-MS	FUS-MS	FUS-ICP	FUS-ICP	FUS-MS	FUS-MS	FUS-MS	FUS-MS	FUS-MS	FUS-MS	FUS-MS	FUS-MS	FUS-MS	FUS-MS	FUS-MS	FUS-ICP	FUS-ICP	FUS-XRF	FUS-XRF
REC_161229_01X	3	4	< 0.5	< 0.6	< 0.5	< 0.5	18	20	0.7	0.8	1930	2280			6	8	0.1	0.1	23.40	0.40	98.87	< 0.003	0.014
REC_161229_02X	< 1	< 1	< 0.5	< 0.6	< 0.5	< 0.5	11	12	0.6	0.7	874	1030			6	7	< 0.1	< 0.1	23.80	0.25	99.86	< 0.003	< 0.003
REC_161229_03X	3	4	0.8	1.0	< 0.5	< 0.5	10	12	0.5	0.5	1050	1230			9	12	< 0.1	< 0.1	12.90	0.47	99.20	< 0.003	< 0.003

REC_161229_01X is a composite of the REMS stockpile.
 This analysis is reported in Block 10 and was used for calculation of export quantities of U-nat and Th-nat.
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Analyte Symbol	ZrO2
Unit Symbol	%
Lower Limit	0.003
Method Code	FUS- XRF
REC_161229_01 X	10.44
REC_161229_02 X	5.485
REC_161229_03 X	6.414

REC_161229_01X is a composite of the REMS stockpile.

This analysis is reported in Block 10 and was used for calculation of export quantities of U-nat and Th-nat.

The other analyses (-02X and -03X) are of REMS produced during various plant operation trials and are not representative of overall REMS production.