

Appendices

Appendix A - Inspector General report

Appendix B - USGS list of potentially compromised projects

Appendix C - Project numbers under program "Uranium in the Environment"

Appendix D - Certificates of Analysis

Appendix E - Chain of Custody

Appendix F - Written response by Jon Kolak, USGS Energy Resources Program

AZGS Appendix A



OFFICE OF
INSPECTOR GENERAL
U.S. DEPARTMENT OF THE INTERIOR

SCIENTIFIC INTEGRITY INCIDENT AT USGS ENERGY GEOCHEMISTRY LABORATORY



OFFICE OF
INSPECTOR GENERAL
U.S. DEPARTMENT OF THE INTERIOR

JUN 15 2016

Memorandum

To: Suzette Kimball
Director, U.S. Geological Survey

From: Mary L. Kendall *Mary L. Kendall*
Deputy Inspector General

Subject: Final Report – Inspection of Scientific Integrity Incident at USGS Energy
Geochemistry Laboratory
Report No. 2016-EAU-010

The Office of Inspector General has completed an inspection of a scientific integrity incident involving the Inorganic Section of the U.S. Geological Survey's (USGS) Energy Geochemistry Laboratory in Lakewood, Colorado. This laboratory provides scientific support for the Energy Resources Program. Our objective was to determine the impacts of the incident.

During the inspection, we observed operations, analyzed data, and interviewed laboratory workers, managers, and laboratory customers to better understand the quantitative and qualitative impacts of the scientific integrity incident. Our review revealed that the full extent of the impacts are not yet known but, nevertheless, that they will be serious and far ranging. The impacts include publications that were retracted or delayed because of inaccurate information, potential damaged reputations of USGS and individual scientists, and possible lost collaborations with partners. We are making one recommendation to address the situation.

Please provide us with your written response to this report within 30 days. The response should provide information on the actions you have taken or planned to address the recommendation, as well as target dates and titles of the officials responsible for implementing these actions. Please send your response to aie_reports@doioig.gov. If you have any questions about this report, please contact me at 202-208-5745.

The legislation creating the Office of Inspector General requires that we report to Congress semiannually on all audit, inspection, and evaluation reports issued; actions taken to implement our recommendations; and recommendations that have not been implemented.

Table of Contents

Table of Contents	0
Results in Brief	1
Introduction.....	2
Objective	2
Background	2
Findings.....	5
Products Affected.....	5
Customers Affected.....	6
Ultimate Impact on Organizational Integrity	7
Notification of Customers	8
Conclusion and Recommendation	10
Conclusion.....	10
Recommendation Summary	10
Appendix 1: Scope and Methodology.....	11
Scope	11
Methodology	11
Appendix 2: Projects Potentially Impacted.....	13

Results in Brief

We initiated this inspection to determine the impacts of a scientific integrity incident involving a U.S. Geological Survey (USGS) laboratory. The incident specifically concerned accusations of scientific misconduct and data manipulation by a mass spectrometer operator assigned to the Energy Resources Program's (ERP) Energy Geochemistry Laboratory in Lakewood, CO, in the Energy and Minerals Mission Area. The matter was discovered in late 2014, but had been taking place since 2008. This was the second such incident involving the same laboratory.

The Inorganic Section's work has implications for ERP's national and international coal and water quality assessments. Our review revealed that the impacts were far ranging, and included—

- publications that were retracted or delayed because of inaccurate information;
- potential damaged reputations of USGS and individual scientists;
- potential lost collaborations with outside organizations;
- diminished employee morale; and
- reduced public trust of USGS-generated information.

USGS is assessing the full impact of the incident on its research and assessment projects, an undertaking that will take time to complete. In addition, the Bureau has been notifying the affected customers, journals, and other end users, a protracted process that remains incomplete. USGS is pursuing disciplinary actions for the responsible staff.

Our report contains one recommendation.

Introduction

Objective

Determine the impact on U.S. Geological Survey (USGS) customers, products, and organizational integrity resulting from scientific misconduct and data manipulation at the Energy Geochemistry Laboratory's Inorganic Section in Lakewood, CO, including—

- affected products published by the laboratory;
- affected customers, both internal and external;
- ultimate impact of identified issues on organizational integrity; and
- the process USGS will use to notify affected customers.

The scope and methodology are in Appendix 1.

Background

As part of the USGS Energy and Minerals mission area, ERP researches and assesses the energy resources of the Nation and world. ERP's scientific work is supported by two energy centers, one in Virginia and the other in Colorado. The Central Energy Resources Science Center in Lakewood, CO, manages the Energy Geochemistry Laboratory, composed of separate inorganic and organic sections. The laboratory's Inorganic Section, however, closed in February 2016, following the scientific integrity incident that occurred there. The Inorganic Section, and in particular, its mass spectrometer operations, were the focus of this inspection.

The Inorganic Section (also known as the Inorganic Geochemistry Laboratory) functioned as a service lab in that it routinely processed samples for many scientists working on a variety of projects. The lab contained a mass spectrometer, a highly complex scientific instrument that identifies the chemical composition of a substance, as shown in Figure 1.



Figure 1. The mass spectrometer with samples prepared for analysis—the machine converts samples to a plasma state in order to analyze the components. Source: OIG.

A principal feature of a mass spectrometer is its capability to analyze multiple elements in a sample simultaneously and with a high level of precision. In the Inorganic Section, the mass spectrometer analyzed the inorganic chemistry of water samples and of extracts from solid samples such as coal and rock. Scientists used the sampling results to help understand and describe the substances located during their research and assessment projects. One chemist was principally in charge of operating the mass spectrometer for fiscal years (FY) 2008 through 2014 covered by our inspection.

During our inspection, the Inorganic Section employed a staff of three full-time scientists. In addition, a manager and two other employees served both sections of the laboratory.

Financial data associated with the Inorganic Section included—

- funding since FY 2008 totaling \$4.1 million;
- annual funding averaging \$590,000 since FY 2014;
- \$174,000 for a new mass spectrometer purchased in 2011 to replace the original unit for which acquisition documents were unavailable;
- \$144,500 paid to operate the mass spectrometer since 2008, with average annual expenses totaling approximately \$20,000; and
- \$656,100 paid by USGS since 2008 for the services of outside commercial laboratories that were often used instead of the Inorganic Section.

In 2014, OIG evaluated ERP's quality control process, issuing the final report (No. CR-EV-GSV-0003-2014) in May 2015. We found that ERP's system of quality assurance/quality control was insufficient to detect quality-related issues

in its science center laboratories. The report detailed two instances in which mass spectrometer operators in the Energy Geochemistry Laboratory's Inorganic Section had violated established laboratory practices without detection for many years. The initial incident involved scientific misconduct that began in 1996 and continued undiscovered until 2008. The second incident began in 2008 and continued undiscovered until late 2014. This inspection focused on the second incident.

Following discovery of the second incident, ERP management issued a stop work order for the laboratory and began an internal investigation. The USGS Office of Science Quality and Integrity likewise issued a stop work order and initiated an "inquiry" in accordance with departmental policy. As part of the inquiry, USGS convened a Scientific Integrity Review Panel to further investigate the matter. The report of inquiry concluded that the laboratory had a "chronic pattern of scientific misconduct" and that "data produced by the Inorganic Section were intentionally manipulated by the line-chemist in charge." The identified issues predominantly affected coal and water quality research and related assessments.

Once the results of the inquiry became known, USGS closed the Inorganic Section, effective February 25, 2016. Along with the closure, the agency initiated personnel actions, started determining what should be done with the lab equipment, and began notifying end users of potentially suspect data generated in the lab. USGS currently is assessing the full impacts of the incident on affected research and assessment projects, a process that will take some time to complete.

USGS accused the chemist of data manipulation by intentionally changing the results produced by the mass spectrometer. The chemist also failed to preserve the data. Further, the Bureau accused the chemist of failing to operate the mass spectrometer according to established practices, which constituted scientific misconduct.

These two actions created the larger issue of loss of scientific integrity, a concern referenced in USGS' inquiry. Scientific integrity is at the core of the mission of USGS. Also, given the widespread use of USGS data and publications by its many customers, scientific misconduct at the Inorganic Section has serious implications for energy and environmental decisions driven by information developed at the laboratory.

Findings

The recent scientific integrity incident has had numerous real and potential adverse impacts on customers, products, and the organizational integrity of USGS, as these pertain to coal and water quality research and assessments. We noted, among those impacts, that one research paper that was ready for publishing had to be retracted; certain scientists stopped preparation of scientific papers; the lab's data manipulation issues negatively impacted the reputation of numerous researchers; and the loss of scientific integrity potentially may damage the stature of USGS, both nationally and internationally. The results of USGS' internal inquiry are consistent with our own findings.

Products Affected

In conducting research and assessment projects, scientists rely on the accuracy of information provided by ERP's laboratories. Since ERP data is used to support both scientific decision-making and understanding, inaccurate data has significant scientific consequences. The affected coal and water quality related work products from this scientific integrity incident included the following:

- Twenty-four research and assessment projects that have national and global interest were potentially affected by erroneous information. A list of each project is contained in Appendix 2. These affected projects represented about \$108 million in funding from FY 2008 through 2014. ERP officials stated that they were in the process of assessing the impacts on each project for determining future actions. Among the projects—
 - toxic trace metals analysis of water in the greater Everglades ecosystem in Florida;
 - assessment of uranium in the environment in and around Grand Canyon National Park in Arizona for possible groundwater restoration;
 - analysis of coal combustion byproducts relating to the nationwide Geochemistry of Solid Fuels project; and
 - analysis of metals released into waters associated with coalbed natural gas production activities in Alaska.
- At least seven reports have been delayed and, to date, one report has been retracted. The retracted report was on air quality studies relating to feed coals in South African boilers as part of a United Nations Environmental Program study.

ERP's publications serve an important role in understanding domestic and international energy resources, and can directly influence energy-related decisions and strategies of its diverse stakeholders, who include universities, the public, and Government agencies.

In addition, customers of the lab expressed frustration that the lab required an inordinate amount of time to process the samples they had submitted. The

Inorganic Section's mass spectrometer processed approximately 3,800 samples since 2008. The customers complained that processing times were often 6 months or longer, versus the more customary turn-around time for service labs of about 30 days.

Customers Affected

The USGS mission is to provide the Nation with reliable scientific information, and the Bureau highly values the reputation it has built. This incident of scientific misconduct and data manipulation in a major USGS laboratory, however, potentially undermines the Bureau as a trusted scientific organization. Although management discovered the incident in late 2014, our review disclosed that employees had suspected quality-related problems with the laboratory for many years. In our interviews, USGS employees consistently voiced their distrust of the lab. The employees also expressed their preference not to use the inorganic laboratory and, instead, to use other USGS laboratories or outside commercial laboratories.

The people most directly affected by the scientific integrity incident were the researchers who submitted samples to the inorganic laboratory for analysis. The incident at the lab placed at risk the validity of the determinations and conclusions made by these scientists.



Figure 2. Samples arrived at the Inorganic Section to be prepared for analysis by the mass spectrometer. Source: OIG.

Thirty-three individuals submitted samples processed by the Inorganic Section's mass spectrometer, as shown in Figure 2. Most of these were USGS scientists stationed in the science center in Reston, VA, with a smaller number from the center in Lakewood, CO. Several customers worked for other organizations, including the National Geospatial-Intelligence Agency, the State geological survey offices of Pennsylvania and Wyoming, and Southern Illinois University. We interviewed 16 customers, nearly all of whom expressed disappointment,

anger, and/or distrust of the lab. Many stated in very strong terms they would not use the lab if it reopened. These individuals also cited—

- reduced confidence of collaborators in USGS-generated data, as well as providing fuel for critics of USGS;
- Bureau embarrassment, especially since similar issues have occurred twice in the same laboratory;
- upset in the Organic Section because of the perceived connection between the Inorganic and Organic Sections;
- undermining of public trust, as well as that of other scientific organizations;
- impact on morale of scientists, in spite of reassurances after the first incident that such a situation would not occur again; and
- personal impact on post-doctoral researchers working for USGS.

In a broader sense, the affected customer base comprises all end users of ERP's products. The end users are numerous and diverse. ERP's strategic plan lists more than 200 specific customers, partners, and cooperators of the program. For simplification, we grouped these stakeholders into the following categories—

- U.S. Department of the Interior bureaus and other Federal agencies;
- other USGS program areas;
- State geological surveys and other State agencies;
- general public;
- American Indians;
- domestic and international energy industry community;
- news media;
- environmental community;
- nongovernmental organizations;
- domestic and foreign academia; and
- U.S. Congress

Within the above categories, the strategic plan lists numerous agencies, offices, businesses, universities, and institutions. Depending on the stakeholder, ERP's publications can be used by the public for general informational purposes; by academics to further the understanding of energy resources; by specialists to provide input for industry business decisions; or by the Government for policy, regulation, and rule making.

Ultimate Impact on Organizational Integrity

Along with the aforementioned effects on products and customers resulting from the scientific integrity incident, we determined that the scientific misconduct and data manipulation at the lab also impacted USGS organizational integrity in ways

that are still unfolding and challenging to quantify. We did identify the following ultimate impacts—

- unreliable scientific publications generated from research and assessment projects that relied on the laboratory; projects often take five or more years to complete and may result in multiple publications;
- delayed completion of ERP’s research and assessment projects, including, for example, coal assessments in the Appalachian Basin in the eastern United States;
- permanent loss of unique rock and water samples collected in the field—because of access restrictions to some areas and the sometimes short-lived nature of substances, USGS researchers may be unable to obtain replacement samples (e.g., a scientist who acquired samples from Jackson Dome, Mississippi, said she cannot return to the area because of landowner access issues);
- diminished public trust in Federally-led scientific endeavors;
- lost time and effort of scientists who worked on the affected projects;
- wasted time and expense associated with reprocessing salvaged samples, reassessing the results, and reissuing publications;
- damaged personal reputation of scientists; and
- possible weakened or lost collaborations with Federal and state agencies, universities, and foreign nations.

Notification of Customers

In a memo to the USGS Director dated January 19, 2016, the Southwest Regional Director announced several actions regarding the Inorganic Section:

- USGS would close the Inorganic Section, effective February 25, 2016.
- End users of the Inorganic Section were being notified that the data was suspect and any publications should be evaluated and possibly retracted.
- ERP was working with the USGS Office of Communications to develop an announcement for the Bureau’s website about the suspect data and lab closure.
- **USGS was developing proposed disciplinary actions for employees of the Inorganic Section.**

If ERP’s impact assessment shows that incorrect conclusions were reported, ERP stated that it will directly contact journals that published the papers, as well as any collaborator.

In addition, we noted that USGS has taken a long time to inform its many stakeholders about this scientific integrity incident. To date, only the direct lab customers as well as selected scientist collaborators and related journals have been notified. Considering that the incident was discovered in October 2014 and that its serious nature became apparent shortly thereafter, USGS has had ample

time to make a public announcement. Many organizations rely on USGS publications and could potentially make decisions or policy based on flawed information.

Recommendation

We recommend that USGS:

- I. Complete the notification to stakeholders of the scientific integrity incident.

Conclusion and Recommendation

Conclusion

This scientific integrity incident has had numerous real and potential adverse impacts on customers, products, and the organizational integrity of USGS, as these pertain to coal and water quality research and assessments. Nevertheless, quick and decisive action on our recommendation will help restore confidence in the Bureau.

Recommendation Summary

We recommend that USGS:

1. Complete the notification to stakeholders of the scientific integrity incident.

Appendix I: Scope and Methodology

Scope

Our scope covered the impacts of the scientific integrity incident in the Inorganic Section of the Energy Geochemistry Laboratory as it relates to USGS customers, products, outside agencies, and others, including the extent of the impact and the products affected.

Our inspection covered the period from FY 2008 through 2015.

Methodology

The USGS Office of Science Quality and Integrity officially referred this misconduct incident to OIG in October 2015.

To fully develop the findings, the team—

- identified the products potentially impacted by scientific misconduct/data manipulation;
- identified affected customers both internal and external to USGS;
- identified requests for analysis sent to, or completed by, the Inorganic Section since 2013 (2 years prior to suspension of the laboratory);
- identified other reports issued that pertained to laboratory deficiencies;
- interviewed the USGS Director and key management officials of ERP and its science centers in Reston, VA, and Lakewood, CO;
- interviewed the Office of Science Quality and Integrity's director and his assistant;
- interviewed selected employees and customers of the inorganic lab; and
- toured the inorganic lab to observe its operations.

Our work focused on understanding the full impacts of the scientific integrity breach on USGS customers, products, and organizational credibility; understanding USGS' process for addressing product misinformation; and determining actions that USGS will take regarding the laboratory.

We visited the following USGS offices as necessary to accomplish the objective:

- Headquarters, Reston, VA;
- Energy Resources Program, Reston, VA;
- Office of Science Quality and Integrity, Reston, VA;
- Eastern Energy Resources Science Center, Reston, VA; and
- Central Energy Resources Science Center, Lakewood, CO (location of the Energy Geochemistry Laboratory).

We also made telephone contacts with individuals stationed in other locations, including all four members of the Scientific Integrity Review Panel.

We conducted our inspection in accordance with the Quality Standards for Inspection and Evaluation as put forth by the Council of the Inspectors General on Integrity and Efficiency. We believe that the work performed provides a reasonable basis for our conclusions and recommendations.

Appendix 2: Projects Potentially Impacted

Project Name	Project ID	Collaborators
Coal Util. & Critical Coal Quality Issues	7330-53573 & 8930-0IG80 (Brownfield)	N/A
Link land, air, water in Florida	2920-CTFWO; GxI Inm00-CTFWOO; Shark River 2011; 2920-0H704; Sulfur Toxics/29; Greater Everglades Priority Ecosystems; FL_Canals_April_2012; Florida Canals & Transects_July 2012	N/A
EPA Palos Verdes	EPA Sproul Cruis	U.S. Geological Survey, Reston, VA; S.S. Papadopoulos & Associates, Bethesda, MD; U.S. Geological Survey, Menlo Park, CA; U.S. Geological Survey, Santa Cruz, CA; U.S. Geological Survey, Woods Hole, MA; Civil & Environmental Engineering, Stanford University, Stanford, CA; Department of Environmental Sciences, Xi'an Jiaotong-Liverpool University, Jangsu Province, PRC; Center for Geomicrobiology, Aarhus University, Aarhus, Denmark
Afghanistan Coal Assessment	Afghanistan Coal Assessment	Afghan Geological Survey; USAID
Coal Resource Assessment Methodology	2920-0HEBC Task	N/A
CGS Colorado ROMs	CGS Colorado ROMs	N/A
PATASIC / Pa. Geological Survey (PAGS), DCNR	PATASIC	N/A
ERIC GCM11MI009Z	ERIC GCM11MI009Z	N/A
NGA-IBG	NGA-IBG	N/A

Project Name	Project ID	Collaborators
Southern Illinois University	Southern Illinois University	N/A
7230-53573	7230-53573	N/A
8932-ANX22 / NIST 8932-ANX2	8932-ANX22 / NIST 8932-ANX2	N/A
Petroleum Processes Research	Petroleum Processes Task 4; 2920-C4510; Origin and controls on natural gas	N/A
Energy Geochemistry Laboratory (EGL); Geochemistry Laboratories	Canspex	N/A
Health Effects of Energy Resources	Gx11nm00-DN4200; Gx11nm00-DN42000; 2920-0H600; 2920-0H704; Health Effects o; Mussels Project; WV_DEC_2012; GX13NM00DN42000; GX13NM00FH40100; BEN 2011 / GX12NM00DN42000; WVA – August 2011 / GX12NM00DN42000; WV Dec 2011; WV_Feb_2012; WV_May_2012; WV August 2012	N/A
Alaska Rural Energy	Alaska Rural Energy	N/A
Geochemistry of Solid Fuels	AC0000M MENDENHALL; NM00EAH; South African Coals; WoCQI - Tanzania; GX13NM00EAH7000; 8930-c4e6a; Afghanistan Coal Assessment; EAH4000 – Geochemistry of solid fuels	UNEP; ESKOM; ADAES, Inc.; IEA Clean Coal Centre; U.S. Geological Survey, Reston, VA; University of Texas at Dallas, Richardson, TX; Craton Resources (Pty) Ltd., Lobatse, Botswana; Department of Geological Survey, Economic Geology Division, Lobatse, Botswana; Universidade Federal do Rio Grande do Sul, Porto Alegre, Brazil; Kiwira Coal Mines, Mbeya, Tanzania; University of

Project Name	Project ID	Collaborators
		Zambia, Lusaka, Zambia; Minufiya University, Sadat City, Egypt; Ministry of Energy and Minerals, Dodoma, Tanzania; University of Botswana, Gaborone, Botswana; Afghan Geological Survey
Uranium in the Environment	8930-C5G1A/Otton; ISL Samples, XRD; Uranium Environmental Task; GX11RM00DZ51A00; Uranium 8930-DZ5; Mendenhall_8930-AEW2F	CSM student
Gulf Coast Framework Studies	2920-BNVGC – Gul; Gulf of Mexico Oil and Gas Asst.	Genesis Gas & Oil LLC, Kansas City, MO
National Assessment of Oil and Gas Resources (NOGA)	89300IE National Assessment of Oil and Gas Resources; 8930-com01	Hess Corp.
US Coal Resources and Reserves Assessment	US Coal Assessment Project, Task 2	N/A
State Co-ops	29200HF20	N/A
Produced Waters	Produced Waters	N/A
Geologic CO2 Sequestration	Carbon Sequestration-Geologic Research & Assessment	Denbury Resources

Appendix B

Listing of Potentially Affected Analytical Jobs (2008-2014) for the Inorganic Section of the Energy Geochemistry Laboratory

Abbreviations:

ICP-MS: inductively coupled plasma-mass spectrometry

RE: rare earths

Record ID	OrderID	Matrix	Sample Count	Analysis / Test	Order Date	Analysis Date	Results Entered Date
C28	E120804	Water	3	ICPMS TraceForLiquids	8/17/2012	9/24/2012	11/14/2012
C32	E130204	Water	3	ICPMS TraceForLiquids	2/25/2013	3/19/2013	3/22/2013
C38	E130901	Water	2	ICPMS TraceForLiquids	9/3/2013	9/26/2013	9/26/2013
C41	E140204	Water	2	ICPMS TraceForLiquids	2/18/2014	9/29/2014	9/29/2014
C46	E140804	Water	2	ICPMS TraceForLiquids	8/19/2014	9/11/2014	9/26/2014
E1	E100806	Water	5	ICPMS TraceForLiquids	8/27/2010	10/5/2010	10/15/2010
E2	E100807	Water	85	ICPMS TraceForLiquids	8/27/2010	10/5/2010	11/8/2010
E3	E110102	Water	14	ICPMS TraceForLiquids	1/11/2011	2/1/2011	2/23/2011
E4	E110103	Water	65	ICPMS TraceForLiquids	1/11/2011	2/4/2011	2/23/2011
E5	E110104	Water	23	ICPMS TraceForLiquids	1/11/2011	2/18/2011	5/3/2011
E6	E110105	Water	7	ICPMS TraceForLiquids	1/11/2011	2/17/2011	5/3/2011
E7	E110502	Water	4	ICPMS TraceForLiquids	5/3/2011	6/14/2011	6/16/2011
E8	E110503	Water	1	ICPMS TraceForLiquids	5/3/2011	6/14/2011	6/16/2011
E9	E110504	Water	35	ICPMS TraceForLiquids	5/3/2011	6/13/2011	6/13/2011
E10	E110701	Water	31	ICPMS TraceForLiquids	7/1/2011	7/11/2011	7/11/2011
E11	06525	Water	11	ICPMS TraceForLiquids	3/6/2006	8/31/2010	9/7/2010
E12	06526	Water	30	ICPMS TraceForLiquids	3/6/2006	8/31/2010	9/7/2010
E13	06536	Water	82	ICPMS TraceForLiquids	6/19/2006	8/31/2010	9/7/2010
E14	06537	Water	10	ICPMS TraceForLiquids	6/20/2006	8/31/2010	9/7/2010
E15	06538	Water	7	ICPMS TraceForLiquids	6/20/2006	8/31/2010	9/7/2010
E16	06539	Water	4	ICPMS TraceForLiquids	6/20/2006	8/31/2010	9/7/2010
E17	06540	Water	14	ICPMS TraceForLiquids	6/20/2006	8/31/2010	9/7/2010
E18	07021	Water	120	ICPMS TraceForLiquids	5/29/2007	10/6/2010	10/6/2010
E19	E0709014	Water	3	ICPMS TraceForLiquids	9/19/2007	5/29/2009	5/29/2009
E25	E0711003	Water	5	ICPMS TraceForLiquids	11/28/2007	1/10/2008	5/29/2009
E27	E0905001	Water	39	ICPMS TraceForLiquids	5/5/2009	5/6/2009	6/4/2009
E30	E110901	Water	15	ICPMS TraceForLiquids	9/1/2011	9/13/2011	9/14/2011
E35	E121104	Water	6	ICPMS TraceForLiquids	11/28/2012	5/17/2013	5/22/2013
E38	E121105	Water	10	ICPMS TraceForLiquids	11/28/2012	5/20/2013	5/22/2013
E40	E121106	Water	6	ICPMS TraceForLiquids	11/28/2012	4/18/2013	5/2/2013
E48	E140401	Water	11	ICPMS TraceForLiquids	4/1/2014	9/25/2014	9/30/2014
E68	E130402	Water	26	ICPMS TraceForLiquids	4/3/2013	5/31/2013	6/4/2013
E69	E130503	Water	7	ICPMS TraceForLiquids	5/30/2013	6/10/2013	6/12/2013
E70	E130504	Water	4	ICPMS TraceForLiquids	5/30/2013	6/10/2013	6/12/2013
E71	E130705	Water	79	ICPMS TraceForLiquids	7/23/2013	8/15/2013	2/19/2014
E72	E130706	Water	89	ICPMS TraceForLiquids	7/23/2013	8/27/2013	8/30/2013
E73	E130707	Water	2	ICPMS TraceForLiquids	7/23/2013	8/27/2013	8/30/2013
E74	E130906	Water	8	ICPMS TraceForLiquids	9/24/2013	9/26/2013	2/19/2014
E75	E130907	Water	9	ICPMS TraceForLiquids	9/24/2013	9/26/2013	2/19/2014
E76	E140101	Water	80	ICPMS TraceForLiquids	1/7/2014	5/5/2014	6/5/2014
E77	E140102	Water	4	ICPMS TraceForLiquids	1/7/2014	9/22/2014	9/24/2014
E78	E140502	Water	3	ICPMS TraceForLiquids	5/7/2014	9/8/2014	9/25/2014
E79	E140503	Water	7	ICPMS TraceForLiquids	5/7/2014	9/8/2014	9/25/2014
E80	E140504	Water	24	ICPMS TraceForLiquids	5/7/2014	9/8/2014	9/25/2014
E81	E140604	Water	7	ICPMS TraceForLiquids	6/27/2014	9/25/2014	9/25/2014
E82	E140605	Water	8	ICPMS TraceForLiquids	6/27/2014	9/25/2014	9/25/2014
R22	E091105	Water	27	ICPMS TraceForLiquids	11/23/2009	11/30/2009	12/18/2009
R27	05503	Water	22	ICPMS TraceForLiquids	2/13/2006	8/31/2010	9/7/2010
O1	E140403	Water	12	ICPMS TraceForLiquids	4/9/2014	9/30/2014	9/30/2014
O6	E120101	Water	75	ICPMS TraceForLiquids	1/9/2012	3/6/2012	3/7/2012
O7	E120102	Water	16	ICPMS TraceForLiquids	1/9/2012	3/6/2012	3/7/2012

O8	E120103	Water	18	ICPMS TraceForLiquids	1/9/2012	3/6/2012	3/7/2012
O9	E120107	Water	18	ICPMS TraceForLiquids	1/25/2012	3/6/2012	3/7/2012
O10	E120505	Water	25	ICPMS TraceForLiquids	5/3/2012	6/26/2012	6/26/2012
O11	E120507	Water	23	ICPMS TraceForLiquids	5/10/2012	6/26/2012	6/26/2012
O12	E120612	Water	23	ICPMS TraceForLiquids	6/29/2012	7/18/2012	7/23/2012
O13	E120706	Water	56	ICPMS TraceForLiquids	7/27/2012	8/28/2012	8/28/2012
O14	E121101	Water	18	ICPMS TraceForLiquids	11/13/2012	12/12/2012	12/14/2012
O16	E101105	Water	3	ICPMS TraceForLiquids	11/9/2010	11/15/2010	11/17/2010
O18	E110404	Water	3	ICPMS TraceForLiquids	4/19/2011	6/13/2011	6/13/2011
E31	E111005	Soil	8	ICPMS TraceForSolids	10/27/2011	3/5/2012	3/5/2012
E61	E120202	Soil	6	ICPMS TraceForSolids	2/9/2012	3/30/2012	3/30/2012
C21	E110111	Shale	6	ICPMS TraceForSolids	1/21/2011	6/24/2011	7/6/2011
E56	E110202	Shale	5	ICPMS TraceForSolids	2/9/2011	2/22/2011	2/23/2011
O28	E111104	Shale	19	ICPMS TraceForSolids	11/28/2011	4/20/2012	4/26/2012
C20	E110111	Sediment	6	ICPMS TraceForSolids	1/21/2011	6/29/2011	6/30/2011
E23	E0711002	Sediment	4	ICPMS TraceForSolids	11/28/2007	7/10/2009	7/22/2009
E33	E111005	Sediment	12	ICPMS TraceForSolids	10/27/2011	3/5/2012	3/5/2012
E46	E0804002	Sediment	30	ICPMS TraceForSolids	4/9/2008	3/19/2009	5/5/2009
E51	E0904002	Sediment	20	ICPMS TraceForSolids	4/14/2009	7/8/2009	7/22/2009
R28	E0802001	Sediment	2	ICPMS TraceForSolids	2/14/2008	6/4/2009	6/4/2009
O17	E110601	Sediment	10	ICPMS TraceForSolids	6/15/2011	9/29/2011	9/29/2011
C2	E120902	Rock	36	ICPMS TraceForSolids	9/14/2012	7/25/2013	7/29/2013
C9	E130201	Rock	1	ICPMS TraceForSolids	2/13/2013	1/25/2013	9/26/2014
C19	E110111	Rock	17	ICPMS TraceForSolids	1/21/2011	6/30/2011	7/6/2011
C30	E121004	Rock	4	ICPMS TraceForSolids	10/26/2012	12/7/2012	12/7/2012
C35	E130404	Rock	4	ICPMS TraceForSolids	4/19/2013	5/28/2013	6/4/2013
C39	E130908	Rock	4	ICPMS TraceForSolids	9/26/2013	11/25/2013	11/25/2013
C42	E140306	Rock	4	ICPMS TraceForSolids	3/28/2014	9/30/2014	9/30/2014
C43	E140307	Rock	4	ICPMS TraceForSolids	3/28/2014	9/30/2014	9/30/2014
E28	E101205	Rock	4	ICPMS TraceForSolids	12/22/2010	3/7/2011	3/14/2011
E32	E111005	Rock	6	ICPMS TraceForSolids	10/27/2011	3/5/2012	3/5/2012
E34	E111006	Rock	1	ICPMS TraceForSolids	10/27/2011	3/5/2012	3/5/2012
E41	E121110	Rock	4	ICPMS TraceForSolids	11/29/2012	4/18/2013	5/2/2013
E42	E121111	Rock	11	ICPMS TraceForSolids	11/29/2012	5/17/2013	5/22/2013
E43	E0903002	Rock	18	ICPMS TraceForSolids	3/2/2009	7/10/2009	7/23/2009
E66	ERP-00451	Rock	20	ICPMS TraceForSolids	10/19/2004	4/15/2009	6/2/2009
R4	07018	Rock	16	ICPMS TraceForSolids	6/5/2007	7/8/2008	12/15/2008
R18	E0806001	Rock	90	ICPMS TraceForSolids	6/2/2008	1/28/2009	3/14/2011
R19	E0905004	Rock	30	ICPMS TraceForSolids	5/28/2009	9/15/2009	9/18/2009
E55	E101004	Plant	1	ICPMS TraceForSolids	10/12/2010	11/29/2010	12/3/2010
E24	E0711003	Other	67	ICPMS TraceForSolids	11/28/2007	1/10/2008	5/29/2009
E26	E0805005	Other	28	ICPMS TraceForLiquids	5/12/2008	6/5/2008	10/6/2008
R1	07017	Other	1	ICPMS TraceForSolids	4/16/2007	10/4/2008	12/12/2008
R5	07018	Other	4	ICPMS TraceForSolids	6/5/2007	7/8/2008	12/15/2008
R10	07019	Other	2	ICPMS TraceForSolids	6/26/2007	11/6/2008	12/15/2008
E29	E110703	Leachate	17	ICPMS TraceForLiquids	7/19/2011	7/25/2011	7/26/2011
E36	E121104	Leachate	12	ICPMS TraceForLiquids	11/28/2012	5/17/2013	5/22/2013
E37	E121105	Leachate	16	ICPMS TraceForLiquids	11/28/2012	5/20/2013	5/22/2013
E39	E121106	Leachate	30	ICPMS TraceForLiquids	11/28/2012	4/18/2013	5/2/2013
E45	E120402	Leachate	24	ICPMS TraceForLiquids	4/18/2012	5/15/2012	5/21/2012
E52	E090602	Leachate	120	ICPMS TraceForLiquids	6/15/2009	6/17/2009	7/13/2009
R23	E100702	Leachate	18	ICPMS TraceForLiquids	7/7/2010	7/26/2010	9/16/2010
C3	ERP-00049	Coal Combustion Byproduct	29	ICPMS TraceForSolids	9/30/1999	11/3/2009	11/12/2009
C4	ERP-00050	Coal Combustion Byproduct	24	ICPMS TraceForSolids	9/30/1999	11/10/2009	6/22/2010
C5	ERP-00051	Coal Combustion Byproduct	32	ICPMS TraceForSolids	9/30/1999	6/2/2010	6/22/2010
C7	ERP-00367	Coal Combustion Byproduct	28	ICPMS TraceForSolids	4/28/2003	8/10/2010	8/18/2010
C8	ERP-00368	Coal Combustion Byproduct	29	ICPMS TraceForSolids	4/28/2003	8/11/2010	10/8/2010
C10	E0903001	Coal Combustion Byproduct	4	ICPMS TraceForSolids	3/2/2009		3/25/2009
C11	E0905003	Coal Combustion Byproduct	4	ICPMS TraceForSolids	5/27/2009	6/8/2009	6/10/2009
C12	E0905005	Coal Combustion Byproduct	33	ICPMS TraceForSolids	5/28/2009	9/28/2009	10/1/2009
C13	E090804	Coal Combustion Byproduct	4	ICPMS TraceForSolids	8/27/2009	8/31/2009	9/8/2009

C14	E091008	Coal Combustion Byproduct	4	ICPMS TraceForSolids	10/23/2009	11/20/2009	9/16/2010
C15	E100301	Coal Combustion Byproduct	8	ICPMS TraceForSolids	3/18/2010	3/31/2010	9/16/2010
C16	E100706	Coal Combustion Byproduct	4	ICPMS TraceForSolids	7/23/2010	8/30/2010	9/16/2010
C17	E100707	Coal Combustion Byproduct	4	ICPMS TraceForSolids	7/23/2010	8/30/2010	9/16/2010
C22	E110405	Coal Combustion Byproduct	4	ICPMS TraceForSolids	4/20/2011	6/28/2011	6/30/2011
C23	E110704	Coal Combustion Byproduct	4	ICPMS TraceForSolids	7/21/2011	9/12/2011	9/14/2011
C24	E110705	Coal Combustion Byproduct	4	ICPMS TraceForSolids	7/21/2011	12/6/2011	12/6/2011
C25	E120301	Coal Combustion Byproduct	4	ICPMS TraceForSolids	3/2/2012	3/30/2012	3/30/2012
C26	E120401	Coal Combustion Byproduct	4	ICPMS TraceForSolids	4/13/2012	5/31/2012	6/4/2012
C27	E120610	Coal Combustion Byproduct	4	ICPMS TraceForSolids	6/28/2012	8/28/2012	8/28/2012
C29	E120805	Coal Combustion Byproduct	4	ICPMS TraceForSolids	8/17/2012	12/5/2012	12/7/2012
C31	E130102	Coal Combustion Byproduct	4	ICPMS TraceForSolids	1/15/2013	4/8/2013	4/18/2013
C34	E130403	Coal Combustion Byproduct	4	ICPMS TraceForSolids	4/19/2013	5/28/2013	6/4/2013
C36	E130711	Coal Combustion Byproduct	4	ICPMS TraceForSolids	7/31/2013		9/26/2014
C37	E130712	Coal Combustion Byproduct	4	ICPMS TraceForSolids	7/31/2013	11/25/2013	11/25/2013
C40	E140201	Coal Combustion Byproduct	4	ICPMS TraceForSolids	2/4/2014	9/29/2014	9/29/2014
C44	E140308	Coal Combustion Byproduct	4	ICPMS TraceForSolids	3/31/2014	9/30/2014	9/30/2014
C45	E140801	Coal Combustion Byproduct	4	ICPMS TraceForSolids	8/7/2014	9/11/2014	9/16/2014
E20	E130304	Coal Combustion Byproduct	4	ICPMS TraceForSolids	3/25/2013	7/25/2013	7/29/2013
E44	E120402	Coal Combustion Byproduct	20	ICPMS TraceForSolids	4/18/2012	5/22/2012	7/31/2012
E54	E101004	Coal Combustion Byproduct	15	ICPMS TraceForSolids	10/12/2010	11/29/2010	12/3/2010
E58	E111103	Coal Combustion Byproduct	34	ICPMS TraceForSolids	11/14/2011	4/10/2012	4/10/2012
E59	E120108	Coal Combustion Byproduct	10	ICPMS TraceForSolids	1/25/2012	3/30/2012	3/30/2012
R3	07017	Coal Combustion Byproduct	49	ICPMS TraceForSolids	4/16/2007	10/4/2008	12/12/2008
R7	07018	Coal Combustion Byproduct	44	ICPMS TraceForSolids	6/5/2007	7/8/2008	12/15/2008
R9	07019	Coal Combustion Byproduct	36	ICPMS TraceForSolids	6/26/2007	11/6/2008	12/15/2008
R12	E0709002	Coal Combustion Byproduct	85	ICPMS TraceForSolids	9/18/2007	6/21/2011	6/23/2011
R15	E0805009	Coal Combustion Byproduct	95	ICPMS TraceForSolids	5/23/2008	5/26/2009	6/2/2009
R17	E0901001	Coal Combustion Byproduct	100	ICPMS TraceForSolids	1/9/2009	8/12/2009	3/3/2010
R21	E101104	Coal Combustion Byproduct	2	ICPMS TraceForSolids	11/8/2010	12/7/2011	12/8/2011
O3	EA13	Coal Combustion Byproduct	30	ICPMS TraceForSolids	7/7/2007	8/20/2009	9/2/2009
C1	E120902	Coal	6	ICPMS TraceForSolids	9/14/2012	7/25/2013	7/29/2013
C6	ERP-00364	COAL	25	ICPMS TraceForSolids	4/23/2003	8/9/2010	8/18/2010
C18	E110111	Coal	270	ICPMS TraceForSolids	1/21/2011	6/30/2011	7/6/2011
C33	E130401	Coal	20	ICPMS TraceForSolids	4/1/2013	6/12/2013	8/15/2013
E21	E140107	Coal	4	ICPMS RE	1/24/2014	11/26/2014	9/24/2014
E22	E140107	Coal	4	ICPMS TraceForSolids	1/24/2014	9/30/2014	9/30/2014
E47	E130902	Coal	50	ICPMS TraceForSolids	9/11/2013	4/21/2015	4/23/2015
E49	E0709017	Coal	71	ICPMS TraceForSolids	9/27/2007	7/1/2009	8/17/2009
E50	E0904001	Coal	15	ICPMS TraceForSolids	4/14/2009	7/6/2009	7/22/2009
E53	E101004	Coal	7	ICPMS TraceForSolids	10/12/2010	11/29/2010	12/3/2010
E57	E111103	Coal	6	ICPMS TraceForSolids	11/14/2011	4/10/2012	4/10/2012
E60	E120108	Coal	1	ICPMS TraceForSolids	1/25/2012	3/30/2012	3/30/2012
E62	E120609	Coal	9	ICPMS TraceForSolids	6/22/2012	8/28/2012	8/28/2012
E63	E120705	Coal	59	ICPMS TraceForSolids	7/26/2012	10/15/2012	10/15/2012
E64	E130205	Coal	10	ICPMS TraceForSolids	2/26/2013	6/11/2013	6/12/2013
E65	E130405	Coal	7	ICPMS TraceForSolids	4/23/2013	8/15/2013	8/20/2013
E67	E100104	Coal	26	ICPMS TraceForSolids	1/12/2010	3/2/2010	3/3/2010
E83	E0710005	Coal	15	ICPMS TraceForSolids	10/30/2007	2/27/2008	6/2/2009
R2	07017	Coal	33	ICPMS TraceForSolids	4/16/2007	6/4/2009	7/16/2009
R6	07018	Coal	46	ICPMS TraceForSolids	6/5/2007	7/8/2008	12/15/2008
R8	07019	Coal	13	ICPMS TraceForSolids	6/26/2007	11/6/2008	12/15/2008
R11	E0709002	Coal	17	ICPMS TraceForSolids	9/18/2007	6/20/2011	6/23/2011
R13	E0803004	Coal	20	ICPMS TraceForSolids	3/17/2008	7/9/2009	7/22/2009
R14	E0805009	Coal	42	ICPMS TraceForSolids	5/23/2008	2/24/2009	6/2/2009
R16	E0901001	Coal	24	ICPMS TraceForSolids	1/9/2009	8/11/2009	11/20/2009
R20	E101104	Coal	47	ICPMS TraceForSolids	11/8/2010	12/7/2011	12/8/2011
R24	E100805	Coal	20	ICPMS TraceForSolids	8/20/2010	3/1/2011	3/8/2011
R25	E130103	Coal	120	ICPMS RE	1/16/2013	11/26/2014	9/24/2014
R26	E130103	Coal	120	ICPMS TraceForSolids	1/16/2013	12/3/2014	12/12/2014
R29	E120105	Coal	3	ICPMS TraceForSolids	1/19/2012	6/4/2012	6/4/2012

O2	EA12	Coal	11	ICPMS TraceForSolids	7/7/2007	4/13/2010	5/25/2010
O4	EA35	Coal	12	ICPMS TraceForSolids	7/7/2007	4/13/2010	5/25/2010
O5	E120808	Coal	17	ICPMS TraceForSolids	8/27/2012	4/18/2013	5/2/2013
O15	E100907	Coal	6	ICPMS TraceForSolids	9/21/2010	3/2/2011	3/8/2011
O19	E0807007	Coal	6	ICPMS TraceForSolids	7/28/2008	1/21/2009	2/12/2009
O20	E091007	Coal	10	ICPMS TraceForSolids	10/23/2009	2/1/2010	9/16/2010
O21	E110702	Coal	18	ICPMS TraceForSolids	7/6/2011	11/4/2011	8/13/2014
O22	ERP-00077	Coal	36	ICPMS TraceForSolids	3/24/2000	10/26/2010	1/21/2011
O23	E0807009	Coal	20	ICPMS TraceForSolids	7/30/2008	2/9/2009	2/13/2009
O24	E0807010	Coal	48	ICPMS TraceForSolids	7/30/2008	4/9/2010	9/16/2010
O25	E091204	Coal	26	ICPMS TraceForSolids	12/18/2009	2/1/2010	2/16/2010
O26	E110110	Coal	38	ICPMS TraceForSolids	1/20/2011	8/19/2011	8/24/2011
O27	E110401	Coal	32	ICPMS TraceForSolids	4/1/2011	5/10/2012	5/17/2012
R30	E120105	Biological Material	2	ICPMS TraceForSolids	1/19/2012	6/4/2012	6/4/2012

Appendix C. USGS work orders for chemical analyses potentially affected by laboratory misconduct

Record ID	Order ID	ProjectID	Project/Task Title	Matrix	Sample Count	Test	Order Date	Analysis Date	Results Entered Date
E26	E0805005	8930-C5G1A/Otton	Uranium in the environment	Other	28	ICPMS_TraceForLiquids	5/12/2008	6/5/2008	10/6/2008
E27	E0905001	8930-C5G1A/Otton	Uranium in the environment	Water	39	ICPMS_TraceForLiquids	5/5/2009	5/6/2009	6/4/2009
R22	E091105	Uranium 8930-DZ5	Uranium Resources and the Environment	Water	27	ICPMS_TraceForLiquids	11/23/2009	11/30/2009	12/18/2009
R23	E100702	Mendenhall_8930-AEW2F	7901AEW/Mendenhall	Leachate	18	ICPMS_TraceForLiquids	7/7/2010	7/26/2010	9/16/2010
E28	E101205	ISL Samples, XRD	Uranium in the environment	Rock	4	ICPMS_TraceForSolids	12/22/2010	3/7/2011	3/14/2011
E29	E110703	GX11RM00DZ51A00	Uranium in the environment	Leachate	17	ICPMS_TraceForLiquids	7/19/2011	7/25/2011	7/26/2011
E30	E110901	GX11RM00DZ52A00	Uranium in the environment	Water	15	ICPMS_TraceForLiquids	9/1/2011	9/13/2011	9/14/2011
E31	E111005	GX11RM00DZ52A00	Uranium in the environment	Soil	8	ICPMS_TraceForSolids	10/27/2011	3/5/2012	3/5/2012
E32	E111005	GX11RM00DZ52A00	Uranium in the environment	Rock	6	ICPMS_TraceForSolids	10/27/2011	3/5/2012	3/5/2012
E33	E111005	GX11RM00DZ52A00	Uranium in the environment	Sediment	12	ICPMS_TraceForSolids	10/27/2011	3/5/2012	3/5/2012
E34	E111006	GX11RM00DZ52A00	Uranium in the environment	Rock	1	ICPMS_TraceForSolids	10/27/2011	3/5/2012	3/5/2012
E35	E121104	Uranium Environmental Task	Uranium in the environment	Water	6	ICPMS_TraceForLiquids	11/28/2012	5/17/2013	5/22/2013
E36	E121104	Uranium Environmental Task	Uranium in the environment	Leachate	12	ICPMS_TraceForLiquids	11/28/2012	5/17/2013	5/22/2013
E37	E121105	Uranium Environmental Task	Uranium in the environment	Leachate	16	ICPMS_TraceForLiquids	11/28/2012	5/20/2013	5/22/2013
E38	E121105	Uranium Environmental Task	Uranium in the environment	Water	10	ICPMS_TraceForLiquids	11/28/2012	5/20/2013	5/22/2013
E39	E121106	Uranium Environmental Task	Uranium in the environment	Leachate	30	ICPMS_TraceForLiquids	11/28/2012	4/18/2013	5/2/2013
E40	E121106	Uranium Environmental Task	Uranium in the environment	Water	6	ICPMS_TraceForLiquids	11/28/2012	4/18/2013	5/2/2013
E41	E121110	Uranium Environmental Task	Uranium in the environment	Rock	4	ICPMS_TraceForSolids	11/29/2012	4/18/2013	5/2/2013
E42	E121111	Uranium Environmental Task	Uranium in the environment	Rock	11	ICPMS_TraceForSolids	11/29/2012	5/17/2013	5/22/2013



Certificate of Analysis

Work Order: TO107471A

To: **David E. Detra**
U.S. Geological Survey
Mineral Resources Program
P.O. Box 25046 M.S. 973
Bldg. 20 DENVER FEDERAL CENTRE
DENVER, COLORADO 80225-0046
U.S.A.

Date: Sep 28, 2009

P.O. No. : x0003746/01127,8928-2501
Project No. : 00CRCN0044
No. Of Samples : 98
Date Submitted : Sep 11, 2009
Report Comprises : Pages 1 to 16
(Inclusive of Cover Sheet)

Distribution of unused material:

STORE:

Comments:

The detection limit for Cs was increased to 5 ppm due to the inconsistency of its concentration levels in the reagents used.

Certified By :

Gavin McGill
Operations Manager

SGS Minerals Services (Toronto) is accredited by Standards Council of Canada (SCC) and conforms to the requirements of ISO/IEC 17025 for specific tests as indicated on the scope of accreditation to be found at <http://www.scc.ca/en/programs/lab/mineral.shtml>

Footnote:
L.N.R. = Listed not received
n.a. = Not applicable
I.S. = Insufficient Sample
-- = No result
*INF = Composition of this sample makes detection impossible by this method
M after a result denotes ppb to ppm conversion, % denotes ppm to % conversion
Methods marked with an asterisk (e.g. *NAA08V) were subcontracted
Methods marked with the @ symbol (e.g. @AAS21E) denote accredited tests

This document is issued by the Company under its General Conditions of Service accessible at http://www.sgs.com/terms_and_conditions.htm. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein.

NOTICE: The sample(s) to which the findings recorded herein (the "Findings") relate was (were) drawn and / or provided by the Client or by a third party acting at the Client's expense. The Findings constitute no warranty of the sample's representativity of the goods and strictly relate to the sample(s). The Company accepts no liability with regard to the origin of the sample(s) from which the sample(s) is/are said to be extracted. The findings report on the samples provided by the client and are not intended for commercial or contractual settlement purposes. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.



Certificate of Analysis

Work Order: TO107472A

To: David E. Detra
U.S. Geological Survey
Mineral Resources Program
P.O. Box 25046 M.S. 973
Bldg. 20 DENVER FEDERAL CENTRE
DENVER, COLORADO 80225-0046
U.S.A.

Date: Sep 29, 2009

P.O. No. : x0003746/01127,8928-2501
Project No. : 00CRCN0044
No. Of Samples : 98
Date Submitted : Sep 11, 2009
Report Comprises : Pages 1 to 16
(Inclusive of Cover Sheet)

Distribution of unused material:

STORE:

Comments:

The detection limit for Cs was increased to 5 ppm due to the inconsistency of its concentration levels in the reagents used.

Certified By :

Gavin McGill
Operations Manager

SGS Minerals Services (Toronto) is accredited by Standards Council of Canada (SCC) and conforms to the requirements of ISO/IEC 17025 for specific tests as indicated on the scope of accreditation to be found at <http://www.scc.ca/en/programs/lab/mineral.shtml>

Report Footer:

L.N.R. = Listed not received
n.a. = Not applicable

I.S. = Insufficient Sample
-- = No result

*INF = Composition of this sample makes detection impossible by this method
M after a result denotes ppb to ppm conversion, % denotes ppm to % conversion
Methods marked with an asterisk (e.g. *NAA08V) were subcontracted
Methods marked with the @ symbol (e.g. @AAS21E) denote accredited tests

This document is issued by the Company under its General Conditions of Service accessible at http://www.sgs.com/terms_and_conditions.htm. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein.

WARNING: The sample(s) to which the findings recorded herein (the "Findings") relate was (were) drawn and / or provided by the Client or by a third party acting at the Client's direction. The Findings constitute no warranty of the sample's representativity of the goods and strictly relate to the sample(s). The Company accepts no liability with regard to the origin or source from which the sample(s) is/are said to be extracted. The findings report on the samples provided by the client and are not intended for commercial or contractual settlement purposes. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.



Certificate of Analysis

Work Order: TO107473A

To: **David E. Detra**
U.S. Geological Survey
Mineral Resources Program
P.O. Box 25046 M.S. 973
Bldg. 20 DENVER FEDERAL CENTRE
DENVER, COLORADO 80225-0046
U.S.A.

Date: Sep 29, 2009

P.O. No. : x0003746/01127,8928-2501
Project No. : 00CRCN0044
No. Of Samples : 18
Date Submitted : Sep 11, 2009
Report Comprises : Pages 1 to 6
(Inclusive of Cover Sheet)

Distribution of unused material:

STORE:

Comments:

The detection limit for Cs was increased to 5 ppm due to the inconsistency of its concentration levels in the reagents used.

Certified By :

Gavin McGill
Operations Manager

SGS Minerals Services (Toronto) is accredited by Standards Council of Canada (SCC) and conforms to the requirements of ISO/IEC 17025 for specific tests as indicated on the scope of accreditation to be found at <http://www.scc.ca/en/programs/lab/mineral.shtml>

Report Footer:

L.N.R. = Listed not received
n.a. = Not applicable

I.S. = Insufficient Sample
-- = No result

*INF = Composition of this sample makes detection impossible by this method
M after a result denotes ppb to ppm conversion, % denotes ppm to % conversion
Methods marked with an asterisk (e.g. *NAA08V) were subcontracted
Methods marked with the @ symbol (e.g. @AAS21E) denote accredited tests

This document is issued by the Company under its General Conditions of Service accessible at http://www.sgs.com/terms_and_conditions.htm. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein.

WARNING: The sample(s) to which the findings recorded herein (the "Findings") relate was (were) drawn and / or provided by the Client or by a third party acting at the Client's direction. The Findings constitute no warranty of the sample's representativity of the goods and strictly relate to the sample(s). The Company accepts no liability with regard to the origin or source from which the sample(s) is/are said to be extracted. The findings report on the samples provided by the client and are not intended for commercial or contractual settlement purposes. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.



Certificate of Analysis

Work Order: TO107994

To: **David E. Detra**
U.S. Geological Survey
Mineral Resources Program
P.O. Box 25046 M.S. 973
Bldg. 20 DENVER FEDERAL CENTRE
DENVER, COLORADO 80225-0046
U.S.A.

Date: Oct 28, 2009

P.O. No. : x0004950/01131, 8928-2345
Project No. : 00CRCN0044
No. Of Samples : 17
Date Submitted : Oct 14, 2009
Report Comprises : Pages 1 to 6
(Inclusive of Cover Sheet)

Distribution of unused material:

STORE:

Comments:

The detection limit for Cs was increased to 5 ppm due to the inconsistency of its concentration levels in the reagents used.

Certified By :

Gavin McGill
Operations Manager

SGS Minerals Services (Toronto) is accredited by Standards Council of Canada (SCC) and conforms to the requirements of ISO/IEC 17025 for specific tests as indicated on the scope of accreditation to be found at <http://www.scc.ca/en/programs/lab/mineral.shtml>

Report Footer: L.N.R. = Listed not received I.S. = Insufficient Sample
n.a. = Not applicable -- = No result
*INF = Composition of this sample makes detection impossible by this method
M after a result denotes ppb to ppm conversion, % denotes ppm to % conversion
Methods marked with an asterisk (e.g. *NAA08V) were subcontracted
Methods marked with the @ symbol (e.g. @AAS21E) denote accredited tests

This document is issued by the Company under its General Conditions of Service accessible at http://www.sgs.com/terms_and_conditions.htm. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein.

WARNING: The sample(s) to which the findings recorded herein (the "Findings") relate was (were) drawn and / or provided by the Client or by a third party acting at the Client's direction. The Findings constitute no warranty of the sample's representativity of the goods and strictly relate to the sample(s). The Company accepts no liability with regard to the origin or source from which the sample(s) is/are said to be extracted. The findings report on the samples provided by the client and are not intended for commercial or contractual settlement purposes. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.

Central Region Mineral Resources Team

Chain of Custody

COC-00039

of Pages

Submitted By: Jim Otton Number of Samples: 22
 Received By: Dave Walters Sample Media: Soil
 Date/Time Received: 8/31/09 10 AM Job Number: COC-00039 Lab Number:

C-332713 to C-332734

List Sample Identification Numbers

GC09KNS50	GC09KNS01	GC09KNS11	
GC09KNS51	GC09KNS02	GC09KNS12	
GC09KNS52	GC09KNS03		
GC09KNS53	GC09KNS04		
GC09KNS54	GC09KNS05		
GC09KNS55	GC09KNS06		
GC09KNS56	GC09KNS07		
GC09KNS57	GC09KNS08		
GC09KNS58	GC09KNS09		
GC09KNS59	GC09KNS10		

Custodial Locations

Received By: (Time and Date)	Purpose:	Location:	Returned To: (Time and Date)
Dave Walters 8/31/09; 10 AM	Fed Ex receiving	Bldg 20, Rm H1536	
Brad Van Gosen 8/31/09; 10 AM	Lab processing	Bldg 20, Rm H1536	

Central Region Mineral Resources Team

Chain of Custody

COC-00041

_____ of _____ Pages
 Submitted By: Jim Otton Number of Samples: 30
 Received By: Dave Walters Sample Media: soil
 Date/Time Received: 10AM 8/31/09 Job Number: COC-00041 Lab Number: _____
C-332906 - to C-332935

List Sample Identification Numbers

GC09PS61	GC09PS71	GC09PS80	
GC09PS62	GC09PS72	GC09PS81	
GC09PS63	GC09PS73	GC09PS82	
GC09PS64	GC09PS74	GC09PS83	
GC09PS65	GC09PS75	GC09PS84	
GC09PS66	GC09PS75a	GC09PS85	
GC09PS67	GC09PS76	GC09PS86	
GC09PS68	GC09PS77	GC09PS87	
GC09PS69	GC09PS78	GC09PS88	
GC09PS70	GC09PS79	GC09PS89	

Custodial Locations

Received By: (Time and Date)	Purpose:	Location:	Returned To: (Time and Date)
10AM 8/31/09 Dave Walters	Fed Ex delivery	ms928, Bldg 20 room #1536	
10AM 8/31/09 A Brad Van Gosen	lab processing	Bldg 20, room 1538	

APPENDIX F

Written response from Jon Kolak, Associate Program Coordinator, USGS Energy Resources Program, Reston VA, July 6, 2016 [unedited]

(1) General/overview ---

For more info on the lab data quality issue in general, there's a public notice (5/25/2016) on our web site, available at:

<http://energy.usgs.gov/GeochemistryGeophysics/GeochemistryLaboratories/GeochemistryLaboratoriesNotice.aspx>

The excel table and PDF (same material in both) on this notice are a listing of lab analysis jobs for ICP-MS during the affected time frame, the types of samples analyzed, etc.

(2) Uranium ---

Regarding the 2010 USGS SIR, Hydrological, Geological, and Biological Site Characterization of Breccia Pipe Uranium Deposits in Northern Arizona", Scientific Investigations Report 2010-5025, ---

<http://pubs.usgs.gov/sir/2010/5025/> .

There is no connection between the data quality issue in the Inorganic Section of the Energy Geochemistry Lab (EGL) and this USGS report, for two reasons:

(a) When notifying USGS scientists of potentially affected analyses from the data quality incident, we asked for their assistance in identifying potentially affected publications. The lead scientist for the Uranium and the Environment samples/work responded that no data from this lab had been published in USGS/journal publications on this topic.

(b) Within the 2010 USGS SIR (above) there is no mention of using the Inorganic section of the Energy Geochemistry Lab. Instead, other USGS labs and university labs were used to analyze samples collected for this study:

--- Soils and sediment samples collected (Chapter B) were sent to another USGS lab (Minerals) – see Sample Processing and Bulk Chemical Analysis sections on p. 61 --- these refer to Minerals labs *(note added by Jon Spencer - On page 61 it is stated that "The other split was sent to a contract laboratory for whole-rock analysis to determine total elemental composition." This is the only information provided regarding the laboratory that determined total elemental composition. Bulk Chemical Analysis was done by SGS Minerals Services in Toronto, Canada. There is no mention of SGS Minerals Services in Chapter B, a fact that can be readily determined by doing a search on "SGS" in the pdf file. The statement above by Jon Kolak that the samples were sent "to another USGS lab (Minerals)" gives the impression that he had not actually read page 61.)*

--- Water samples (Chapter C) were sent to several USGS labs (but not EGL) and to Northern Arizona University (see Table 2, p.151, for a listing of all the labs used)

--- Biological data (Chapter D) – no new samples collected; compiled available information (see p.287)