M E M O R A N D U M

Date:	November 4, 2008
To:	Alan Kuhn/Albuquerque
From:	Scott Dwyer/Seattle
cc:	NA
Project Number:	83088
Subject:	Ecological Screening of Raffinate Process Water

PURPOSE AND SCOPE

Kleinfelder has prepared this ecological screening of raffinate process water to address concerns about waterfowl exposure to the mill process water or raffinate. Dissolved concentrations of certain elements (e.g., arsenic, cadmium, copper, selenium) in the low-pH process water exceed levels of toxicological concern for waterfowl. However, dissolved metal concentrations in the process water are highly dependent on pH and decline for most metals with increasing pH, thus neutralization may reduce the potential ecological hazard of the raffinate process water.

This screening study was conducted to determine if neutralization of the raffinate process water could reduce the potential toxicity to wildlife. The study evaluates the raffinate at its original pH of 1.8, a partially neutralized pH of 4.5, and a fully neutralized pH of 7.5. Dissolved concentrations of 21 elements in raffinate process water at these three pH levels were measured. The concentrations were then compared to ecological screening levels to determine the relative toxicity of the raffinate process water at the three pH levels.

METHODS

Laboratory Testing and Analysis. J.E. Litz & Associates (Litz) performed amenability studies on representative ore samples from five mines in the Uravan Mineral Belt (Litz 2008). At the conclusion of these tests, filtrate samples (representative of pregnant process solution) from the Packrat and Pandora ores were further tested by Litz to determine the levels of soluble metals present in the solvent extraction raffinate before and after neutralization to 4.5 and 7.5 pH. The Packrat and Pandora ores had head grades of 0.527% and 0.266% U_3O_8 and 3.73 and 1.63% V_2O_5, respectively, which are

within the normal range of ore grades expected to be processed at the Piñon Ridge Mill. The Packrat Mine is part of the Whirlwind Mine complex and is located in Mesa County, Colorado near the town of Gateway. The Pandora Mine is located in San Juan County, Utah near the town of La Sal.

The bulk of the vanadium and uranium in the filtrate samples was stripped using a solvent consisting of ten percent alamine and three percent decyl alcohol in kerosene. This was done to more closely approximate the chemical makeup of the barren raffinate solution. An aliquot was collected from each stripped raffinate prior to neutralization. The pH of the filtrates was then gradually increased by adding a slurry of hydrated lime. Aliquots of the solution were collected after the pH stabilized at both 4.5 and 7.5 standard units. The six collected aliquots were submitted to Energy Laboratories, Inc. of Casper, Wyoming where metal concentrations were measured using inductively-coupled plasma mass spectrometry. The Energy Laboratories report for these analyses is provided in Attachment A.

Data Evaluation. Analytical data were evaluated for use in the ecological screening based on EPA guidance for assessing the usability of analytical data for health risk assessment (EPA 1992). In summary, data are evaluated on six criteria:

- Data sources
- Documentation
- Analytical methods and detection limits
- Data quality indicators
- Data review
- Reports to risk assessors

Data used in this ecological screening evaluation were reviewed based on the six criteria and meet a level of quality appropriate for use in a health risk assessment (Table 1).

Ecological Screening Evaluation. Dissolved process water concentrations for most of the analytes were compared to National Ambient Water Quality Criteria for acute duration exposures of ecological receptors to surface water (RAIS 2008) (Table 2). These criteria were not available for all 21 analytes; therefore, three other ecological screening values were applied, based on the following hierarchy:

- Tier II Secondary Acute Values (SAV),
- EPA Region 4 Surface Water Screening Benchmark values, and
- NAWQC for chronic duration exposure to surface water (Table 2).

The Tier II SAVs are developed using methodology similar to the acute duration NAWQC but require fewer data. If a Tier II SAV was not available, then EPA Region 4 benchmark values were selected as an appropriate surrogate for Tier II SAVs because these values are also developed to address acute duration exposures in surface water.

The NAWQC for chronic duration exposure to surface water was selected only for iron based on the lack of other values but similar derivation as the acute duration NAWQC.

Sixteen other ecological screening criteria were also considered for use in this evaluation. The four selected, however, appeared to be most appropriate because they were developed by regulatory agencies in the United States, they are based on acute duration exposures in surface water, and are intended to protect 95% of the species that may be exposed. A summary of the four selected ecological screening criteria is presented in Attachment B.

RESULTS

Dissolved water concentrations were reported for 21 analytes without neutralization of the acidic process water outflow and with neutralization to pH 4.5 and pH 7.5 (Table 3). For most metals, neutralization significantly decreased the dissolved concentration, in some cases to below the laboratory reporting limit. Neutralization did not affect barium, boron, manganese, nickel, and selenium concentrations as significantly as for other elements. Three elements were not detected in any sample: antimony, mercury, and thallium.

Although neutralization significantly reduces the concentrations of most elements in the raffinate process water, approximately one-third of the elements remain at concentrations that exceed the ecological screening levels applied in this evaluation (Table 3). The most notable was selenium, which had concentrations of 5.93 and 1.84 milligrams per liter (mg/L) in the Pack Rat and Pandora pH 7.5 samples, respectively. This level is approximately two orders of magnitude greater than the EPA surface water screening benchmark for acute duration exposure of 0.02 mg/L.

CONCLUSIONS AND DISCUSSION

Based on a comparison of the concentrations of 21 elements in raffinate process water to ecological screening levels, neutralization of the acidic raffinate process waters before discharge to surface impoundments may not be adequate to protect waterfowl. The dissolved concentrations of boron, cadmium, copper, manganese, selenium, and uranium concentrations exceed ecological screening levels even at neutral pH while several other metals (barium, nickel and zinc) were elevated above screening levels in the pH 7.5 Pandora sample, but below screening levels in the pH 7.5 Pack Rat sample. The selenium concentrations observed in the neutralized process water are of most concern given their elevated concentrations compared to the screening level. Should the neutralized water support fish and other aquatic organisms, the selenium in the water could also be further concentrated in the food organisms eaten by waterfowl

LIMITATIONS

The ecological screening values applied in this evaluation are not specific for waterfowl. Ecological screening values for the protection of aquatic life (i.e., NAWQC, Tier II SAVs,

and EPA Region 4 surface water benchmarks) are generally based on aquatic organisms that remain submerged or mostly submerged for their lifetimes, including benthic organisms, fish, and aquatic plants. Waterfowl, however, live only a portion of their lives actually in contact with surface water and are rarely totally immersed. Waterfowl also typically visit and spend time at other surface water bodies; therefore, the magnitude of waterfowl exposure to raffinate process water is likely to be less than for organisms that reside in the water column and the ecological screening values used in this assessment may overestimate the actual hazard to waterfowl.

REFERENCES

EPA. 1992. Final Guidance for Data Useability in Risk Assessment (Part A). OSWER Directive 9285.7-09A. Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency. Washington DC. June 2.

Litz. 2008. Amenability of Uravan Mineral Belt Ore Samples to Pinon Mill Leach Conditions. J. E. Litz & Associates, L.L.C., Golden, CO. October 31, 2008.

Risk Assessment Information System (RAIS). 2008. Available on-line at: http://rais.ornl.gov/. Accessed October 31, 2008.

ATTACHMENTS

A – Energy Laboratories, Inc. Analytical Report
B – Summary of Ecological Screening Criteria

TABLE 1. DATA USABILITY EVALUATION FOR ANALYSIS OF RAFFINATE PROCESS WATER

Data Usability Criteria	Importance	Action
Data Sources	Data sources must be comparable if data are combined for quantitative use in risk assessment.	All data developed for the evaluation of raffinate process water were based on one set of samples collected by a single team and analyzed by one laboratory. Thus, all data are assumed to be comparable.
Documentation	Deviations from the SAP and SOPs must be documented to identify potential limitations in the data set.	No deviations from the investigation work plan were noted in the laboratory case narrative; therefore, no limitations were noted for this data set.
Analytical Methods and Detection Limits	The method chosen must test for the chemical of potential concern at a detection limit that will meet the concentration levels of concern in applicable matrices.	Inductively coupled plasma-mass spectrometry was used to analyze each of the raffinate process water samples evaluated in the ecological screening. This method is an industry standard for analysis of metals in environmental media. Laboratory reporting limits (RLs) for the 21 metals were equivalent to, or less than, the highest ecological screening level identified for this evaluation (RAIS 2008). Therefore, the RLs were sufficiently sensitive to identify concentrations of ecological concern.

TABLE 1. DATA USABILITY EVALUATION FOR ANALYSIS OF RAFFINATE PROCESS WATER (continued)

Data Usability Criteria	Importance	Action
Data Quality Indicators	Completeness – this criterion addresses the possibility of lost or compromised samples that prevent the inclusion of a given sample in the data set. Comparability – if more than one data set is used in a risk assessment, the data must be from comparable sources (see Data Sources) Representativeness – Sample data must accurately reflect the site characteristics to effectively represent the site's risk to human health and the environment. Hot spots and exposure area media must have representative data. Precision – If reported concentrations are near the concentration of concern then it is necessary to be as precise as possible in order to quantify the likelihood of false negatives and false positives. Accuracy – Quantitative accuracy information is critical when results are reported near the level of concern. Contamination in the field, during shipping, or in the laboratory may bias the analytical results. Instruments that are not calibrated or tuned according to Statement of Work requirements may also bias results.	Completeness – No samples were noted as lost or compromised in the laboratory case narrative. Comparability – Only one data set was used for the evaluation of compliance with variance conditions. Thus, no issue of comparability between data sets had to be addressed. Representativeness – Two water samples were collected from the raffinate process outflow identified as "Pandora Raffinate" and "Pack Rat Raffinate." Two additional samples were collected from each of these sources, one neutralized to a pH of 4.5 and another neutralized to a pH of 7.5. Thus, six water samples from the two sources were evaluated. This approach should provide a representative profile of raffinate process water with and without neutralization. Precision – The relative percent differences (RPD) between the matrix spike sample and the matrix spike duplicate sample, were well within acceptable limits indicating an acceptable level of precision. Accuracy – The accuracy of the analytical data was addressed using a laboratory control sample (LCS) spiked with 18 of the 21 elements for which analysis was performed. All recovery measurements were within control limits indicating an acceptable level of accuracy.

TABLE 1. DATA USABILITY EVALUATION FOR ANALYSIS OF RAFFINATE PROCESS WATER (continued)

Data Usability Criteria	Importance	Action
Data Review	Use of preliminary data or partially reviewed data can conserve time and resources by allowing modification of the sampling plan while an investigation is in process. Critical analytes and samples used for quantitative risk assessment require a full data review.	Only process water analyses reported in the final report from Energy Laboratories, Inc., were used in the evaluation described in this report. Data review included method blanks, laboratory control samples, matrix spikes/duplicates, reporting limits, data qualifiers, and raw data.
Reports to Risk Assessors	Data reviewer should report data in a format that provides readability as well as clarifying information. SQLs, a narrative, and qualifiers that are fully explained reduce the time and effort required in interpreting and using the analytical results. Limitations can be readily identified and documented in the risk assessment report.	Report from laboratory was adequate and sufficient to perform an ecological screening evaluation.

TABLE 2
ECOLOGICAL SCREENING VALUES USED TO ASSESS RAFFINATE PROCESS WATER AT THREE PH LEVELS

Parameter	Acute NAWQC[a]	Tier II SAV Surface Water Screening Benchmark[b]	EPA Region 4[c]	Chronic NAWQC[d]
Aluminum	X	-	-	-
Antimony	-	X	-	-
Arsenic	X	-	-	-
Barium	-	X	-	-
Beryllium	-	X	-	-
Boron	-	X	-	-
Cadmium	X	-	-	-
Chromium	X	-	-	-
Copper	X	-	-	-
Iron	-	-	-	X
Lead	X	-	-	-
Manganese	-	X	-	-
Mercury	X	-	-	-
Molybdenum	-	X	-	-
Nickel	X	-	-	-
Selenium	-	-	X	-
Silver	X	-	-	-
Thallium	-	X	-	-
Uranium	-	X	-	-
Vanadium	-	X	-	-
Zinc	X	-	-	-

[a] National Ambient Water Quality Criteria for acute duration exposure to analytes in surface water (RAIS 2008).
[b] Tier II Secondary Acute Value (SAV) developed by the same method but using fewer data than acute NAWQC (RAIS 2008).
[c] EPA Region 4 surface water screening benchmark for acute duration exposure (RAIS 2008).
[d] National Ambient Water Quality Criteria for chronic duration exposure to analytes in surface water (RAIS 2008). Expected to be more protective (i.e., lower concentration) than acute duration exposure NAWQC.

TABLE 3
COMPARISON OF DISSOLVED RAFFINATE PROCESS WATER CONCENTRATIONS OF 21 ELEMENTS TO ECOLOGICAL SCREENING CONCENTRATIONS[a]

Elements	Pandora Raff (PR)	PR pH 4.5	PR pH 7.5	Pack Rat Raff (PRR)	PRR pH 4.5	PRR pH 7.5	Acute NAWQC	Tier II SAV	EPA Region 4	Chronic NAWQC
Aluminum	**2100**	**12.6**	0.5	**5960**	**5.6**	0.6	0.75	-	-	-
Antimony	<0.05	<0.05	<0.05	<0.5	<0.05	<0.05	-	0.18	-	-
Arsenic	**11.5**	0.031	<0.001	**58.9**	<0.001	<0.001	0.34	-	-	-
Barium	**0.3**	**0.3**	**0.3**	**0.5**	**0.3**	0.1	-	0.11	-	-
Beryllium	**0.2**	<0.01	<0.01	**0.28**	<0.01	<0.01	-	0.035	-	-
Boron	**2.7**	**1.3**	**1.1**	**1.5**	**0.8**	**0.2**	-	0.03	-	-
Cadmium	**1.19**	**0.94**	**0.82**	**3.67**	**1.04**	**0.06**	0.002	-	-	-
Chromium	**3.27**	**2.48**	<0.05	**2.56**	<0.05	<0.05	0.57	-	-	-
Copper	**3.96**	**0.33**	**0.14**	**5.62**	**0.26**	**0.11**	0.013	-	-	-
Iron	**2760**	0.36	0.13	**2190**	**8.09**	0.62	-	-	-	1
Lead	**3.07**	<0.05	<0.05	**0.52**	<0.05	<0.05	0.065	-	-	-
Manganese	**259**	**227**	**192**	**45.6**	**23.2**	**2.63**	-	2.3	-	-
Mercury	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.0014	-	-	-
Molybdenum	0.2	<0.1	<0.1	0.4	<0.1	<0.1	-	16	-	-
Nickel	**7.96**	**4.97**	**4.5**	**8.83**	**2.51**	0.06	0.47	-	-	-
Selenium	**5.49**	**2.02**	**1.84**	**14**	**7.68**	**5.93**	-	-	0.02	-
Silver	**0.34**	**0.03**	<0.01	**0.53**	<0.01	<0.01	0.0032	-	-	-
Thallium	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	0.11	-	-
Uranium	**366**	**60.2**	**2.36**	**369**	**15.6**	**0.568**	-	0.046	-	-
Vanadium	**97.9**	**0.6**	<0.1	**195**	**0.4**	0.2	-	0.28	-	-
Zinc	**48.4**	**25.3**	**9.35**	**40.6**	**3.48**	0.07	0.12	-	-	-

[a] Only ecological screenings that were used for comparison to analytical results are reported here to maintain consistency with Table 2. All concentrations are presented in milligrams per liter (mg/L)

BOLD/SHADED concentrations indicate that the ecological screening level is exceeded.

ATTACHMENT A

ENERGY LABORATORIES, INC. ANALYTICAL REPORT

ENERGY LABORATORIES, INC. • 2393 Salt Creek Highway (82601) • P.O. Box 3258 • Casper, WY 82602
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ANALYTICAL SUMMARY REPORT

October 07, 2008

Energy Fuels Resources Corporation
31525 Hwy 90
Nucla, CO 81424

Workorder No.: C08080093

Project Name: Pinon

Energy Laboratories, Inc. received the following 6 samples from Energy Fuels Resources Corporation on 8/4/2008 for analysis.

Sample ID	Client Sample ID	Collect Date	Receive Date	Matrix	Test
C08080093-001	Pandora Raff	07/31/08 15:00	08/04/08	Aqueous	Metals by ICP/ICPMS, Total Mercury, Total Metals Preparation by EPA 200.2
C08080093-002	Pandora-4.5 pH	07/31/08 15:00	08/04/08	Aqueous	Same As Above
C08080093-003	Pandora-7.5 pH	07/31/08 15:00	08/04/08	Aqueous	Same As Above
C08080093-004	Pack Rat Raff	07/31/08 15:00	08/04/08	Aqueous	Same As Above
C08080093-005	Pack Rat-4.5 pH	07/31/08 15:00	08/04/08	Aqueous	Same As Above
C08080093-006	Pack Rat-7.5 pH	07/31/08 15:00	08/04/08	Aqueous	Same As Above

As appropriate, any exceptions or problems with the analyses are noted in the Laboratory Analytical Report, the QA/QC Summary Report, or the Case Narrative.

If you have any questions regarding these tests results, please call.

Report Approved By: STEVE CARLSTON

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LABORATORY ANALYTICAL REPORT

Revised Date: 10/07/08
Report Date: 08/26/08
Collection Date: 07/31/08 15:00
DateReceived: 08/04/08
Matrix: Aqueous

Client: Energy Fuels Resources Corporation
Project: Pinon
Lab ID: C08080093-005
Client Sample ID: Pack Rat-4.5 pH

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
METALS - TOTAL							
Aluminum	5.6	mg/L		0.1		E200.7	08/07/08 15:00 / cp
Antimony	ND	mg/L		0.05		E200.8	08/08/08 01:27 / ts
Arsenic	ND	mg/L		0.001		E200.8	08/08/08 01:27 / ts
Barium	0.3	mg/L		0.1		E200.8	08/08/08 01:27 / ts
Beryllium	ND	mg/L		0.01		E200.8	08/08/08 01:27 / ts
Boron	0.8	mg/L		0.1		E200.7	08/07/08 15:00 / cp
Cadmium	1.04	mg/L		0.01		E200.8	08/08/08 01:27 / ts
Chromium	ND	mg/L		0.05		E200.8	08/12/08 02:49 / sml
Copper	0.26	mg/L		0.01		E200.8	08/08/08 01:27 / ts
Iron	8.09	mg/L		0.03		E200.7	08/07/08 15:00 / cp
Lead	ND	mg/L		0.05		E200.8	08/08/08 01:27 / ts
Manganese	23.2	mg/L		0.01		E200.8	08/08/08 01:27 / ts
Mercury	ND	mg/L		0.001		E245.1	08/06/08 15:01 / eli-b
Molybdenum	ND	mg/L		0.1		E200.8	08/08/08 01:27 / ts
Nickel	2.51	mg/L		0.05		E200.8	08/08/08 01:27 / ts
Selenium	7.68	mg/L	D	0.002		E200.8	08/08/08 01:27 / ts
Silver	ND	mg/L		0.01		E200.8	08/12/08 02:49 / sml
Thallium	ND	mg/L		0.1		E200.8	08/08/08 01:27 / ts
Uranium	15.6	mg/L		0.0003		E200.8	08/08/08 01:27 / ts
Vanadium	0.4	mg/L		0.1		E200.8	08/08/08 01:27 / ts
Zinc	3.48	mg/L		0.01		E200.8	08/08/08 01:27 / ts

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix interference.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

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LABORATORY ANALYTICAL REPORT

Revised Date: 10/07/08
Report Date: 08/26/08
Collection Date: 07/31/08 15:00
DateReceived: 08/04/08
Matrix: Aqueous

Client: Energy Fuels Resources Corporation
Project: Pinon
Lab ID: C08080093-006
Client Sample ID: Pack Rat-7.5 pH

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
METALS - TOTAL							
Aluminum	0.6	mg/L		0.1		E200.7	08/07/08 15:04 / cp
Antimony	ND	mg/L		0.05		E200.8	08/08/08 01:34 / ts
Arsenic	ND	mg/L		0.001		E200.8	08/08/08 01:34 / ts
Barium	0.1	mg/L		0.1		E200.8	08/08/08 01:34 / ts
Beryllium	ND	mg/L		0.01		E200.8	08/08/08 01:34 / ts
Boron	0.2	mg/L		0.1		E200.7	08/07/08 15:04 / cp
Cadmium	0.06	mg/L		0.01		E200.8	08/08/08 01:34 / ts
Chromium	ND	mg/L		0.05		E200.8	08/08/08 01:34 / ts
Copper	0.11	mg/L		0.01		E200.8	08/08/08 01:34 / ts
Iron	0.62	mg/L		0.03		E200.7	08/07/08 15:04 / cp
Lead	ND	mg/L		0.05		E200.8	08/08/08 01:34 / ts
Manganese	2.63	mg/L		0.01		E200.8	08/08/08 01:34 / ts
Mercury	ND	mg/L		0.001		E245.1	08/06/08 15:03 / ell-b
Molybdenum	ND	mg/L		0.1		E200.8	08/08/08 01:34 / ts
Nickel	0.06	mg/L		0.05		E200.8	08/08/08 01:34 / ts
Selenium	5.93	mg/L		0.001		E200.8	08/12/08 02:55 / sml
Silver	ND	mg/L		0.01		E200.8	08/12/08 02:55 / sml
Thallium	ND	mg/L		0.1		E200.8	08/08/08 01:34 / ts
Uranium	0.0568	mg/L		0.0003		E200.8	08/14/08 22:09 / sml
Vanadium	0.2	mg/L		0.1		E200.8	08/08/08 01:34 / ts
Zinc	0.07	mg/L		0.01		E200.8	08/08/08 01:34 / ts

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

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CLIENT: Energy Fuels Resources Corporation
Project: Pinon
Sample Delivery Group: C08080093

Date: *07-Oct-08*

CASE NARRATIVE

The following Case Narrative contains exceptions or comments pertaining to the analysis of samples submitted by Energy Fuels Resources Corporation on 8/4/2008 09:30:00. These samples were assigned ELI Workorder Number C08080093.

REVISED/SUPPLEMENTAL REPORT
The attached analytical report has been revised from a previously submitted report due to a request from Zach Rogers to change sample ID's for sample -005 from Pandora-4.5pH to Pack Rat-4.5pH and Sample -006 from Pandora-7.5pH to Pack Rat 7.5pH.

ORIGINAL SAMPLE SUBMITTAL(S)
All original sample submittals have been returned with the data package.

SAMPLE TEMPERATURE COMPLIANCE: 4°C (±2°C)
Temperature of samples received may not be considered properly preserved by accepted standards. Samples that are hand delivered immediately after collection shall be considered acceptable if there is evidence that the chilling process has begun.

GROSS ALPHA ANALYSIS
Method 900.0 for gross alpha and gross beta is intended as a drinking water method for low TDS waters. Data provided by this method for non potable waters should be viewed as inconsistent.

RADON IN AIR ANALYSIS
The desired exposure time is 48 hours (2 days). The time delay in returning the canister to the laboratory for processing should be as short as possible to avoid excessive decay. Maximum recommended delay between end of exposure to beginning of counting should not exceed 8 days.

SOIL/SOLID SAMPLES
All samples reported on an as received basis unless otherwise indicated.

ATRAZINE, SIMAZINE AND PCB ANALYSIS USING EPA 505
Data for Atrazine and Simazine are reported from EPA 525.2, not from EPA 505. Data reported by ELI using EPA method 505 reflects the results for seven individual Aroclors. When the results for all seven are ND (not detected), the sample meets EPA compliance criteria for PCB monitoring.

SUBCONTRACTING ANALYSIS
Subcontracting of sample analyses to an outside laboratory may be required. If so, ENERGY LABORATORIES will utilize its branch laboratories or qualified contract laboratories for this service. Any such laboratories will be indicated within the Laboratory Analytical Report.

BRANCH LABORATORY LOCATIONS
eli-b - Energy Laboratories, Inc. - Billings, MT
eli-g - Energy Laboratories, Inc. - Gillette, WY
eli-h - Energy Laboratories, Inc. - Helena, MT
eli-r - Energy Laboratories, Inc. - Rapid City, SD
eli-t - Energy Laboratories, Inc. - College Station, TX

CERTFICATIONS:
USEPA: WY00002; FL-DOH NELAC: E87641; Arizona: AZ0699; California: 02118CA
Oregon: WY200001; Utah: 3072350515; Virginia: 00057; Washington: C1903

ISO 17025 DISCLAIMER:
The results of this Analytical Report relate only to the items submitted for analysis.

ENERGY LABORATORIES, INC. - CASPER,WY certifies that certain method selections contained in this report meet requirements as set forth by the above accrediting authorities. Some results requested by the client may not be covered under these certifications. All analysis data to be submitted for regulatory enforcement should be certified in the sample state of origin. Please verify ELI's certification coverage by visiting www.energylab.com

ELI appreciates the opportunity to provide you with this analytical service. For additional information and services visit our web page www.energylab.com.

THIS IS THE FINAL PAGE OF THE LABORATORY ANALYTICAL REPORT.

ATTACHMENT B

SUMMARY OF ECOLOGICAL SCREENING CRITERIA
(from RAIS 2008)

National Ambient Water Quality Criteria (NAWQC). These criteria are calculated by the EPA as half the Final Acute Value (FAV), which is the fifth percentile of the distribution of 48- to 96-hour LC50 values or equivalent median effective concentration (EC50) values for each criterion chemical (Stephan et al. 1985). The acute NAWQC are intended to correspond to concentrations that would cause less than 50% mortality in 5% of exposed populations in a brief exposure. They may be used as a reasonable upper screening benchmark because waste site assessments are concerned with sublethal effects and largely with continuous exposures, rather than the lethal effects and episodic exposures to which the acute NAWQC are applied. The chronic NAWQC are the FAVs divided by the Final Acute-Chronic Ratio (FACR), which is the geometric mean of quotients of at least three LC50/CV ratios from tests of different families of aquatic organisms (Stephan et al. 1985). It is intended to prevent significant toxic effects in chronic exposures and is used as a lower screening benchmark. NAWQC for several metals are functions of water hardness. Values for hardness-dependent metals default to 100 mg CaCO3/L, but equations are provided to obtain values based on site-specific hardness values. Recommended values for metals are expressed in terms of dissolved metal in the water column.

EPA. 2002. National Recommended Water Quality Criteria. EPA Publication Number EPA 822-R-02-047. Office of Water, U.S. Environmental Protection Agency, Washington, D.C. November.

EPA Region 4 Surface Water Screening Benchmark (Acute). These benchmarks, derived by the EPA's Southeastern region, are criteria or test endpoints divided by a factor of 10. The Region IV surface water screening values were obtained from Water Quality Criteria documents and represent the chronic ambient water quality criteria values for the protection of aquatic life. They are intended to protect 95% of the species, 95% of the time. If there was insufficient information available to derive a criterion, the lowest reported effect level was used with the application of a safety factor of ten to protect for a more sensitive species. A safety factor of ten was also used to derive a chronic value if only acute information was available. Since these numbers are based on conservative endpoints and sensitive ecological effects data, they represent a preliminary screening of site contaminant levels to determine if there is a need to conduct further investigations at the site. Note that equations for hardness dependent metals do not match those in EPA (2002). The EPA Region 4 Acute criteria are available on-line at:

www.epa.gov/region04/waste/ots/ecolbul.htm#tbl1.

Tier II Secondary Acute Value (SAV). Tier II values were developed so that aquatic benchmarks could be established with fewer data than are required for National Ambient Water Quality Criteria. The Tier II SAV is derived by taking the lowest genus mean acute value from data meeting specified criteria and dividing it by a Final Acute Value Factor whose value depends on the number of acute data requirements that are met. Values provided here are from Suter and Tsao (1996).

Suter, G.W. , II, and C.L. Tsao. 1996. Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota: 1996 Revision. Publication Number ES/ER/TM-96/R2. Oak Ridge National Laboratory, Oak Ridge, TN. June.

Chronic National Ambient Water Quality Criteria. These criteria are calculated by the EPA as half the Final Acute Value (FAV), which is the fifth percentile of the distribution of 48- to 96-hour LC50 values or equivalent median effective concentration (EC50) values for each criterion chemical (Stephan et al. 1985). The acute NAWQC are intended to correspond to concentrations that would cause less than 50% mortality in 5% of exposed populations in a brief exposure. They may be used as a reasonable upper screening benchmark because waste site assessments are concerned with sublethal effects and largely with continuous exposures, rather than the lethal effects and episodic exposures to which the acute NAWQC are applied. The chronic NAWQC are the FAVs divided by the Final Acute-Chronic Ratio (FAC), which is the geometric mean of quotients of at least three LC50/CV ratios from tests of different families of aquatic organisms (Stephan et al. 1985). It is intended to prevent significant toxic effects in chronic exposures and is used as a lower screening benchmark. NAWQC for several metals are functions of water hardness. Values for hardness-dependent metals default to 100 mg CaCO3/L, but equations are provided to obtain values based on site-specific hardness values. Recommended values for metals are expressed in terms of dissolved metal in the water column.

EPA. 2002. National Recommended Water Quality Criteria :2002. Office of Water, U.S. Environmental Protection Agency, Washington, D.C. November. EPA 822-R-02-047.