ATTACHMENT C:

TOXICITY TEST RESULTS

ENVIRONMENTAL RISK LIMITE
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August 23, 2005

Ms. Jennifer McAltine
GeoLabs, Inc.
Environmental Laboratories
45 Johnson Lane
Rocsam Industrial Park
Braintree, MA 02184

RE: Chronic Toxicity Test Results
P.J. Keating Effluent
Permit Number: MA0029297
ERL Project Number: 07740-04

Dear Ms. McAltine:

This report describes the results of modified chronic toxicity tests performed on effluent from the P.J. Keating Company. P.J. Keating has been issued a National Pollutant Discharge Elimination System (NPDES) Permit MA0029297. The toxicity monitoring requirements of this permit include effluent testing using modified acute and chronic toxicity protocols once during the second week of July 2005.

Effluent Sampling

Samples of P.J. Keating effluent and Acushnet River diluent were collected on July 11, 13 and 15, 2005. Unfortunately, the third set of samples was received three days late due to a courier error. Therefore, the test was discontinued on day 4 and a retest was scheduled. Grab samples of P.J. Keating effluent were collected by the QA Supervisor, Larry Andrews, on July 24, 26 and 28, 2005. Grab samples of Acushnet River water were collected upstream of the discharge by Mr. Andrews on those same days. The samples were transported in insulated shipping containers with ice-packs to maintain sample integrity. The remainder of this report deals with the results of this second round of testing.

Aquatic Toxicity Analysis

The bioassay procedures were performed on the effluent samples using *Ceriodaphnia dubia* (*Ceriodaphnia*) and *Pimephales promelas* (fathead minnows) as the standard test organisms. The test procedures used were those described in the United States Environmental Protection Agency (USEPA) Region I Biomonitoring Protocols (revised December, 1995). The test protocols described in "Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Water to Freshwater Organisms", Third Edition (EPA-600-4-91-002) were also followed.

Several chemical characteristics of the samples of PJ Keating effluent and Acushnet River water were analyzed upon receipt at ERL's laboratory. The analyses included determination of dissolved oxygen, hardness, alkalinity, temperature, specific conductance, pH and total residual chlorine. The results of these analyses are included in Tables 1 and 2.

The Acushnet River water samples were used as the diluent in the tests. The dilution series consisted of two sets of controls, one of Acushnet River water and the other of ERL synthetic soft water reconstituted in the ERL lab to a hardness of approximately 40 to 48 mg/L as $CaCO_3$. The effluent concentrations tested were 6.25%, 12.5%, 25%, 50% and 100% effluent. All test conditions, i.e. temperature and lighting regime, follow USEPA requirements. The complete Aquatic Toxicity Test Methodology is included in Attachment A.

Data collection during the bioassay procedures included organism survival and reproduction of the *Ceriodaphnia*, and survival and dry weights of the fathead minnow larvae. Water quality for each concentration was monitored daily. The raw data and statistical analyses for the tests are included in Attachment B.

Quality Assurance

The ERL laboratory conducts monthly chronic standard toxicant tests on the organisms used in the bioassay procedures. These tests are conducted in laboratory water reconstituted to approximately 40 to 48 ppm as $CaCO_3$. The standard toxicant used is reagent grade potassium chloride.

The results of the most recent standard toxicant tests on these species are shown in Table 3. These results include a 48-hour acute LC50 (the concentration of effluent lethal to 50 percent of the test organisms) and a 7-day Chronic No Observable Effect Concentration (C-NOEC = the highest concentration in the dilution series at which no significant adverse effect was observed). These tests measure the sensitivity of the stock organisms to a reference toxicant and yield data evaluated to ensure the organisms are healthy and non-stressed. The data were in the acceptable range of values normally determined with these test species using potassium chloride as the standard toxicant. Control charts for both species are included in Attachment C.

In addition, ERL conducts daily calibration of dissolved oxygen, pH, and conductivity meters. All instruments are routinely maintained and records of maintenance and calibration are kept at the ERL laboratory. All materials used for the bioassay procedures are critically cleaned prior to use.

Results and Conclusions

P.J. Keating's permit includes a discharge limitation for acute toxicity of ≥100% effluent concentration. This means that the concentration which causes mortality in 50% of the test organisms (LC50) must be 100% effluent (or greater). The discharge limitation for chronic no observed effect concentration (C-NOEC) is 100%. This means that in order to pass the chronic limits for this test there must be no observable adverse effect on growth or survival of the organisms in any of the test concentrations.

The results of these tests, which are summarized in Table 4, indicate that the 48-hour LC50 was >100% for both the *Ceriodaphnia* and the fathead minnow. Since the LC50 for both species (>100%) met the permit limit (≥ 100%), P.J. Keating has passed the acute aquatic toxicity testing portion of their permit requirements. The 7-day NOEC was 100% for both species. Since the C-NOEC (100%) was equal to the permit limit (100%), P.J. Keating has passed the chronic aquatic toxicity testing portion of their permit requirements for both species.

The LOEC values (lowest observed effect concentrations) are summarized in Table 4, although there is no permit limit for the LOEC. USEPA Toxicity Test Summary Sheets are included at the beginning of this report. The original data sheets for the discontinued test are included in Attachment E. Please contact the Lab Manager, Susan Luchina, at (860) 242-9933 if you have any questions concerning these results.

Very truly yours,

ENVIRONMENTAL RISK LIMITED

Melanie Cruff

Melanie Cruff
Environmental Technician

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Attachment(s)

TOXICITY TEST SUMMARY SHEET

Facility Name: P.J. Keating Company Test Start Date: 7/26/
NPDES Permit Number: MA0029277 Pipe Number: ____

Test Type
- ___ Acute
- ___ Chronic
- ✓ Modified (Chronic reporting acute values)
- ___ 24 Hour Screening

Test Species
- ___ Fathead Minnow
- ✓ Ceriodaphnia
- ___ Daphnia Pulex
- ___ Mysid Shrimp
- ___ Sheepshead
- ___ Menidia
- ___ Sea Urchin
- ___ Champia
- ___ Selenastrum
- ___ Other ____

Sample Type
- ___ Prechlorinated
- ___ Dechlorinated
- ___ Chlorine Spiked in Lab
- ___ Chlorinated on Site
- ___ Unchlorinated

Sample Method
- ___ Grab
- ✓ Composite
- ___ Flowthru
- ___ Other

Dilution Water
- ✓ receiving water collected at a point upstream of or away from the discharge, free from toxicity or other sources of contamination; (Receiving water name: Acushnet River)
- ___ alternate surface water of known quality and a hardness, etc. to generally reflect the characteristics of the receiving water; (Surface water name: ____)
- ___ synthetic water prepared using either Millipore Mill-Q or equivalent deionized water and reagent grade chemicals; or deionized water combined with mineral water;
- ___ or artificial sea salts mixed with deionized water;
- ___ deionized water and hypersaline brine; or
- ___ other ____

Effluent sampling date(s): ~~7/23-24/05~~ ~~7/25-26/05~~ ~~7/27-28/05~~ SR

Effluent concentrations tested (in %): 0 6.25 12.5 25 50 100
*(Permit limit concentration): 100

Was effluent salinity adjusted? NO
If yes, to what value? ____ ppt
With sea salts? ____ hypersaline brine solution? ____

Actual effluent concentrations tested after salinity adjustment (in %): ____ ____ ____ ____ ____ ____

Reference Toxicant test date: 7/21/05

(CONTINUED OPPOSITE SIDE)

Ceriodaphnia

PERMIT LIMITS & TEST RESULTS

Test Acceptability Criteria

Mean Dilvent Survival: 100%
MEAN CONTROL SURVIVAL: 100%
MEAN CONTROL WEIGHT: ____

Mean Dilvent Reproduction: 27.6 [illegible]
MEAN CONTROL REPRODUCTION: 28.9 [illegible]
MEAN CONTROL CELL COUNT: ____

	Limits		Results
LC50	≥100%	LC50	>100%
		UPPER VALUE	F.D
		LOWER VALUE	100%
		DATA ANALYSIS METHOD USED	Graphical
A-NOEC		A-NOEC	100%
C-NOEC	100%	C-NOEC	100%
		LOEC	>100%
IC25		IC25	—
IC50		IC50	—

TOXICITY TEST SUMMARY SHEET

Facility Name: P.J. Keating Company Test Start Date: 7/26/05
NPDES Permit Number: MA0029297 Pipe Number: ___

Test Type	Test Species	Sample Type	Sample Method
___ Acute	✓ Fathead Minnow	___ Prechlorinated	___ Grab
___ Chronic	___ Ceriodaphnia	___ Dechlorinated	✓ Composite
✓ Modified (Chronic reporting acute values)	___ Daphnia Pulex	___ Chlorine Spiked in Lab	___ Flowthru
___ 24 Hour Screening	___ Mysid Shrimp	___ Chlorinated on Site	___ Other
	___ Sheepshead	___ Unchlorinated	
	___ Menidia		
	___ Sea Urchin		
	___ Champia		
	___ Selenastrum		
	___ Other ___		

Dilution Water

✓ receiving water collected at a point upstream of or away from the discharge, free from toxicity or other sources of contamination; (Receiving water name: Acushnet River)

___ alternate surface water of known quality and a hardness, etc. to generally reflect the characteristics of the receiving water; (Surface water name: ___)

___ synthetic water prepared using either Millipore Mill-Q or equivalent deionized water and reagent grade chemicals; or deionized water combined with mineral water;

___ or artificial sea salts mixed with deionized water;

___ deionized water and hypersaline brine; or

___ other ___

Effluent sampling date(s): ~~7/23-24/05~~ ~~7/25-26/05~~ ~~7/27-28/05~~ see

Effluent concentrations tested (in %): 0 6.25 12.5 25 50 100
*(Permit limit concentration): 100

Was effluent salinity adjusted? NO
If yes, to what value? — ppt
With sea salts? — hypersaline brine solution? —

Actual effluent concentrations tested after salinity adjustment (in %): — — — — — —

Reference Toxicant test date: 7/21/05

(CONTINUED OPPOSITE SIDE)

Pimephales

PERMIT LIMITS & TEST RESULTS

Test Acceptability Criteria

Mean Diluent Survival: 97.5%
MEAN CONTROL SURVIVAL: 100% MEAN CONTROL REPRODUCTION: —
MEAN CONTROL WEIGHT: 0.692 mg MEAN CONTROL CELL COUNT: —
Mean Diluent Weight: 0.56875 mg

	Limits		Results
LC50	≥100%	LC50	>100%
		UPPER VALUE	∞
		LOWER VALUE	100%
		DATA ANALYSIS METHOD USED	Graphical
A-NOEC		A-NOEC	100%
C-NOEC	100%	C-NOEC	100%
		LOEC	>100%
IC25		IC25	
IC50		IC50	