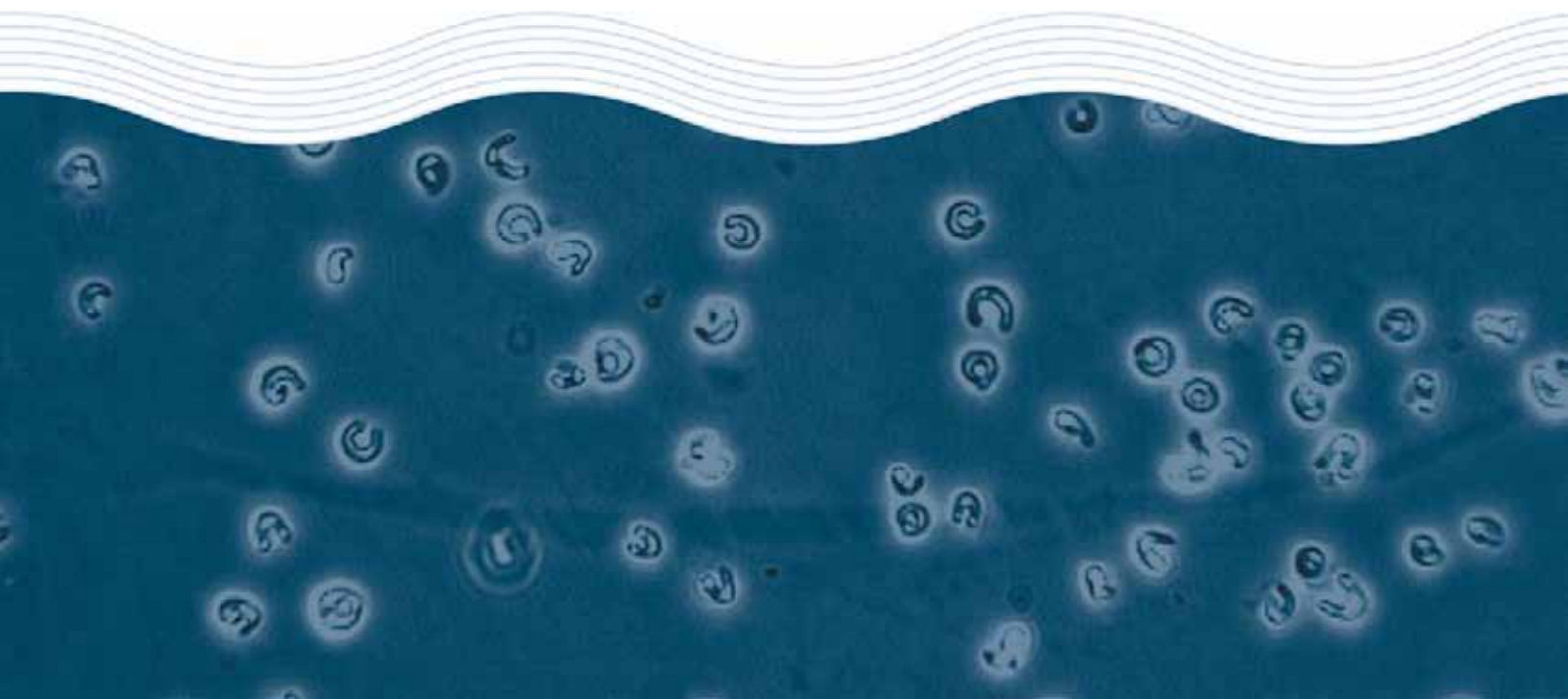


**Toxicity Assessment of Chlorate
to the Brown Macro-alga
*Hormosira banksii***

Gunns Limited

Test Report

June 2006



**Toxicity Assessment of Chlorate
to the Brown Macro-alga
*Hormosira banksii***

Gunns Limited

Test Report

June 2006

Toxicity Test Report: TR0177/1

(page 1 of 1)

Client:	Gunns Tasmania PO Box 985 Launceston TAS 7250	ESA Job #:	PR0177
Attention:	Mr Richard Fawkes	Date Sampled:	N/A
Contract #:		Date Received:	N/A
		Sampled By:	N/A

Lab ID No.:	Sample Name:	Sample Description:
N/A	Sodium chlorate	99+% ACS Reagent, Sigma-Aldrich

Test Performed:	72-hr Macroalgal germination test using <i>Hormosira banksii</i>
Test Protocol:	ESA SOP 116, based on Gunthorpe <i>et al.</i> (1997) and Kevekordes and Clayton (1996)
Deviations from Protocol:	Nil
Source of Test Organisms:	Field collected from Bilgola Beach on 20 June 2006
Test Initiated:	20 June 2006 at 1230 h

Sample: Sodium chlorate		Vacant	Vacant
Nominal Concentration (mg ClO ₃ /L)	% Germinated (Mean ± SD)		
0 (control)	92.8 ± 1.9		
0.0784	96.5 ± 1.3		
0.235	94.3 ± 2.1		
0.784	97.8 ± 1.7		
2.35	98.3 ± 1.3		
7.84	97.3 ± 1.7		
23.5	96.8 ± 1.5		
78.4	96.0 ± 4.1		
235	95.0 ± 1.8		
784	94.8 ± 2.6		
EC50 = >784 mg ClO₃/L			
NOEC = 784 mg ClO₃/L			
LOEC = >784 mg ClO₃/L			

There was no reduction in *Hormosira* germination success in any of the chlorate treatments tested (Dunnetts Test, 1-tailed, P=0.05, df= 9,30).

QA/QC Parameter	Criterion	This Test	Criterion met?
Control minimum % germinated	>70 %	92.8%	Yes
Test Temperature limits	18.0 ± 1 °C	18.5°C	Yes
Reference Toxicant within cusum chart limits	10.3-197.8 µg/L	178.1 µg/L	Yes

Test Report Authorised by:



Dr Rick Krassoi, Director on 30 June 2006

Results are based on the samples in the condition as received by ESA. This report shall not be reproduced except in full.

**Statistical Printouts for the Acute
Hormosira Cell Germination Test**

Macroalgal Germination Test-Germination

Start Date:	20/06/06 12:30	Test ID:	PR0177/1	Sample ID:	Chlorate
End Date:	23/06/06 12:30	Lab ID:	n/a	Sample Type:	Chlorate
Sample Date:		Protocol:	ESASOP116	Test Species:	HB-Hormosira banksii
Comments:	Concentrations are nominal values in mg ClO3/L				

Conc-mg/L	1	2	3	4
FSW Control	0.9000	0.9300	0.9400	0.9400
0.078	0.9700	0.9500	0.9600	0.9800
0.235	0.9600	0.9200	0.9600	0.9300
0.784	0.9600	1.0000	0.9800	0.9700
2.35	1.0000	0.9800	0.9800	0.9700
7.84	0.9500	0.9900	0.9800	0.9700
23.5	0.9600	0.9800	0.9800	0.9500
78.4	0.9800	0.9000	0.9700	0.9900
235	0.9400	0.9300	0.9700	0.9600
784	0.9600	0.9500	0.9100	0.9700

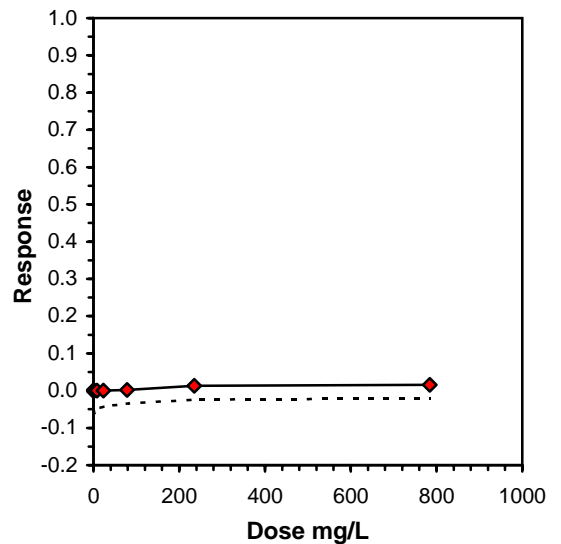
Conc-mg/L	Mean	N-Mean	Transform: Arcsin Square Root				N	t-Stat	1-Tailed Critical	MSD	Isot Mean
			Mean	Min	Max	CV%					
FSW Control	0.9275	1.0000	1.2997	1.2490	1.3233	2.700	4				0.9621
0.078	0.9650	1.0404	1.3851	1.3453	1.4289	2.598	4	-2.184	2.540	0.0993	0.9621
0.235	0.9425	1.0162	1.3315	1.2840	1.3694	3.342	4	-0.813	2.540	0.0993	0.9621
0.784	0.9775	1.0539	1.4290	1.3694	1.5208	4.609	4	-3.306	2.540	0.0993	0.9621
2.35	0.9825	1.0593	1.4438	1.3967	1.5208	3.705	4	-3.686	2.540	0.0993	0.9621
7.84	0.9725	1.0485	1.4104	1.3453	1.4706	3.751	4	-2.831	2.540	0.0993	0.9621
23.5	0.9675	1.0431	1.3931	1.3453	1.4289	3.048	4	-2.390	2.540	0.0993	0.9621
78.4	0.9600	1.0350	1.3863	1.2490	1.4706	6.953	4	-2.215	2.540	0.0993	0.9600
235	0.9500	1.0243	1.3481	1.3030	1.3967	3.165	4	-1.239	2.540	0.0993	0.9500
784	0.9475	1.0216	1.3444	1.2661	1.3967	4.185	4	-1.143	2.540	0.0993	0.9475

Auxiliary Tests	Statistic	Critical	Skew
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.979025	0.919	-0.36144
Bartlett's Test indicates equal variances (p = 0.82)	5.109842	21.66599	

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob
Dunnett's Test	784	>784			0.059345	0.06393	0.008283	0.003059	0.019436

Linear Interpolation (200 Resamples)

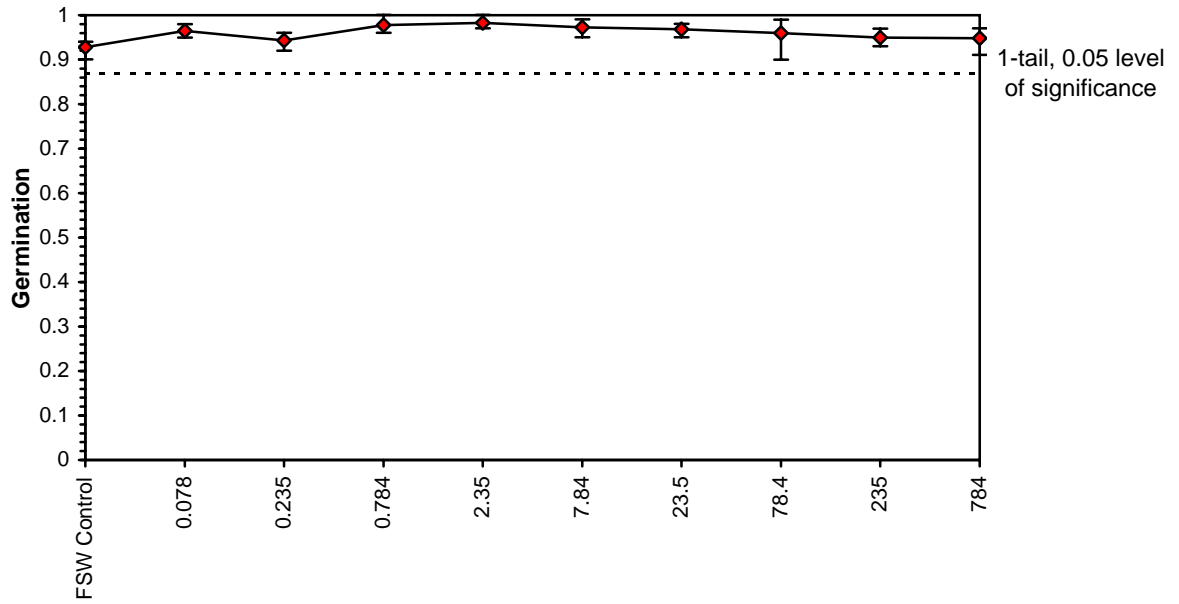
Point	mg/L	SD	95% CL(Exp)	Skew
IC05	>784			
IC10	>784			
IC15	>784			
IC20	>784			
IC25	>784			
IC40	>784			
IC50	>784			



Macroalgal Germination Test-Germination

Start Date: 20/06/06 12:30 Test ID: PR0177/1 Sample ID: Chlorate
End Date: 23/06/06 12:30 Lab ID: n/a Sample Type: Chlorate
Sample Date: Protocol: ESASOP116 Test Species: HB-Hormosira banksii
Comments: Concentrations are nominal values in mg ClO₃/L

Dose-Response Plot



Macroalgal Germination Test-Germination

Start Date:	20/06/06 12:30	Test ID:	PR0177/1	Sample ID:	Chlorate
End Date:	23/06/06 12:30	Lab ID:	n/a	Sample Type:	Chlorate
Sample Date:		Protocol:	ESASOP116	Test Species:	HB-Hormosira banksii
Comments:	Concentrations are nominal values in mg ClO3/L				

Auxiliary Data Summary

Conc-mg/L	Parameter	Mean	Min	Max	SD	CV%	N
FSW Control	% Germinated	92.75	90.00	94.00	1.89	1.48	4
0.078		96.50	95.00	98.00	1.29	1.18	4
0.235		94.25	92.00	96.00	2.06	1.52	4
0.784		97.75	96.00	100.00	1.71	1.34	4
2.35		98.25	97.00	100.00	1.26	1.14	4
7.84		97.25	95.00	99.00	1.71	1.34	4
23.5		96.75	95.00	98.00	1.50	1.27	4
78.4		96.00	90.00	99.00	4.08	2.10	4
235		95.00	93.00	97.00	1.83	1.42	4
784		94.75	91.00	97.00	2.63	1.71	4
FSW Control	Temp C	18.50	18.50	18.50	0.00	0.00	1
0.078		18.50	18.50	18.50	0.00	0.00	1
0.235		18.50	18.50	18.50	0.00	0.00	1
0.784		18.50	18.50	18.50	0.00	0.00	1
2.35		18.50	18.50	18.50	0.00	0.00	1
7.84		18.50	18.50	18.50	0.00	0.00	1
23.5		18.50	18.50	18.50	0.00	0.00	1
78.4		18.50	18.50	18.50	0.00	0.00	1
235		18.50	18.50	18.50	0.00	0.00	1
784		18.50	18.50	18.50	0.00	0.00	1
FSW Control	pH	8.10	8.10	8.10	0.00	0.00	1
0.078		8.10	8.10	8.10	0.00	0.00	1
0.235		8.10	8.10	8.10	0.00	0.00	1
0.784		8.10	8.10	8.10	0.00	0.00	1
2.35		8.10	8.10	8.10	0.00	0.00	1
7.84		8.10	8.10	8.10	0.00	0.00	1
23.5		8.10	8.10	8.10	0.00	0.00	1
78.4		8.10	8.10	8.10	0.00	0.00	1
235		8.10	8.10	8.10	0.00	0.00	1
784		8.20	8.20	8.20	0.00	0.00	1
FSW Control	Salinity ppt	36.40	36.40	36.40	0.00	0.00	1
0.078		36.60	36.60	36.60	0.00	0.00	1
0.235		36.60	36.60	36.60	0.00	0.00	1
0.784		36.60	36.60	36.60	0.00	0.00	1
2.35		36.60	36.60	36.60	0.00	0.00	1
7.84		36.60	36.60	36.60	0.00	0.00	1
23.5		36.60	36.60	36.60	0.00	0.00	1
78.4		36.70	36.70	36.70	0.00	0.00	1
235		36.80	36.80	36.80	0.00	0.00	1
784		37.00	37.00	37.00	0.00	0.00	1
FSW Control	DO mg/L	99.70	99.70	99.70	0.00	0.00	1
0.078		99.10	99.10	99.10	0.00	0.00	1
0.235		99.50	99.50	99.50	0.00	0.00	1
0.784		98.50	98.50	98.50	0.00	0.00	1
2.35		98.70	98.70	98.70	0.00	0.00	1
7.84		97.40	97.40	97.40	0.00	0.00	1
23.5		96.70	96.70	96.70	0.00	0.00	1
78.4		95.50	95.50	95.50	0.00	0.00	1
235		97.80	97.80	97.80	0.00	0.00	1
784		97.30	97.30	97.30	0.00	0.00	1