



**ALS Laboratory Group**  
Environmental

Royce Water Technologies  
Chemscan UV2150/S  
Performance Testing

March 2010

**CERTIFICATE OF APPROVAL FOR ISSUE OF DOCUMENTS**

Report Title: Performance Testing  
 Document No: CQ211353-Royce-2010-001  
 Project Title: Chemscan UV2150/S  
 Comments:

Document Status: Final  
 Date of Issue:  
 Client: Royce Water Technologies

	Position	Name	Signature	Date
<b>Prepared by:</b>	Principal Consultant – Water Quality	C. Pipe-Martin		19/4/2010
<b>Approved by:</b>	Qld Manager	G. Bennison		23/4/2010

For further information on this report, contact:

Name: Christopher Pipe-Martin  
 Title: Principal Consultant – Water Quality  
 Address: PO Box 3216 Yeronga 4104

Phone: 07 3859 7896

Mobile: 0409 633449

E-mail: cpipe-martin@ecowise.com.au

**Document Revision Control**

Version	Description of Revision	Person Making Issue	Date	Approval
1	0	C. Pipe-Martin	19/4/2010	

© ALS Water Resources Group

This proposal and the information, ideas, concepts, methodologies, technologies and other material remain the intellectual property of WRG Environmental Pty Ltd. It is provided to prospective clients on a strict commercial-in-confidence basis, and at no time should any information about our proposal be divulged to other parties.

**Disclaimer**

This document has been prepared for the Client named above and is to be used only for the purposes for which it was commissioned. No warranty is given as to its suitability for any other purpose.

ALS Water Resources Group ABN 94 105 060 320

<b>Table of Contents</b>	<b>page</b>
<b>1 Introduction</b>	<b>1</b>
1.1 Rationale	1
1.2 Scope	1
1.3 Methodology	1
<b>2 Data</b>	<b>3</b>
<b>3 Review and Discussion</b>	<b>5</b>
<b>4 Conclusions</b>	<b>9</b>

#### **List of tables**

Table 1 Total Chlorine	3
Table 2 Chloramine	3
Table 3 Total Ammonia	4
Table 4 Free Ammonia	4
Table 5 Chlorine / Total Ammonia Data Summary	5
Table 6 Free Ammonia Data Summary	5
Table 7 Total chlorine, chloramine, total ammonia correlation data	5
Table 8 Free ammonia correlation data	6

## *Executive Summary*

ALS Water Resources Group (WRG) was engaged by Royce Water Technologies to assess the performance of a Chemscan UV2150/S analyser in relation to laboratory testing. The review assessed:

- *The correlation of Chemscan UV2150/S chlorine, chloramine and total ammonia test results for spiked townwater samples with Hach DR890 test results for the same samples*
- *The correlation of Chemscan UV2150/S free ammonia test results for spiked townwater samples with ALS's NATA accredited laboratory test results for the same samples*

*The Chemscan UV2150/S analyzer uses multiple UV wavelength technology to detect chloramine in water. Free ammonia is converted to chloramine to allow detection.*

*The Chemscan UV2150/S analyser converts chloramine into nitrogen trichloride prior to determination of total ammonia, which represents free ammonia in water as well as ammonia present as chloramine, using multiple UV wavelength technology.*

*Tests for chlorine, chloramine and total ammonia were run on 18 March 2010 using a Chemscan UV2150/S analyzer installed to monitor Brisbane townwater. The analyzer used manufacturer supplied calibration data. Townwater samples were spiked with preformed chloramine to allow testing over the operating range of the instrument. Chemscan results were compared to results from a Hach DR890 colorimeter.*

*Tests for free ammonia were run on 23 March 2010 using a Chemscan UV2150/S analyzer installed to monitor Brisbane townwater. The analyzer used manufacturer supplied calibration data. Townwater samples were spiked with ammonia to allow testing over the operating range of the instrument. Chemscan results were compared to results from WRG's laboratory.*

*Good correlations between the Chemscan UV2150/S and onsite Hach DR890 results for total chlorine, chloramine and total ammonia were obtained. The Chemscan UV2150/S produced comparable results to the colorimeter with strong linearity. Required adjustments to slope and offset to correct for townwater matrix effects appear to be minor.*

*Good correlations between the Chemscan UV2150/S and WRG laboratory results free ammonia were obtained. The Chemscan UV2150/S produced comparable results to laboratory analysis with strong linearity. Required adjustments to slope and offset to correct for townwater matrix effects appear to be minor.*

# 1 Introduction

---

## 1.1 Rationale

Royce Water Technologies distributes a number of on-line instruments for measuring water quality. The Chemscan UV2150/S is capable of measuring total chlorine, chloramine, total ammonia and free ammonia in water. A Chemscan UV2150/S analyser has been installed Royce's Brisbane office to assess accuracy and stability of the instrument. Parallel testing of townwater and spiked townwater samples was conducted using the Chemscan UV2150/S, on site testing with a Hach DR890 colorimeter and WRG's laboratory. Results for all analytes over the operating range of the instrument were obtained.

## 1.2 Scope

The scope of work for the project was for ALS Water Resources Group (WRG) to:

- Test the performance of the Chemscan UV2150/S analyser by comparing analyser readings with the results of samples tested on site and sent for laboratory analysis.
- Analyse data to assess Chemscan UV2150/S performance
- Report findings

## 1.3 Methodology

### 1.3.1 Briefing and planning

WRG discussed the scope of the project with a representative of the instruments distributor, Royce Water Technologies (RWT). Arrangements were made to obtain spiking solutions and sampling consumables from WRG's laboratory.

### 1.3.2 Sampling

Testing occurred on 18 March 2010 for total chlorine, chloramine and total ammonia. WRG and RWT staff accessed and checked the operation of the analyser. Standard supplier calibrations were used with no adjustments for the matrix used (Brisbane townwater).

A set of 3 consecutive readings were taken from the Chemscan UV2150/S for the townwater stream. Samples were taken at the time of the Chemscan readings. Samples were analysed immediately using a Hach DR890 colorimeter for total and free chlorine, chloramine and ammonia.

Samples of townwater were then spiked with preformed chloramine to allow determination of total chlorine, chloramine and total ammonia over the range of the instrument. A manual calibration line was used to allow spiked samples to be introduced into the Chemscan UV2150/S. Spiked sample was tested in triplicate by the Chemscan and in duplicate by the Hach DR890.

Free ammonia tests were conducted on 23 March 2010. WRG and RWT staff accessed and checked the operation of the analyser. Standard supplier calibrations were used with no adjustments for the matrix used. Samples of each spiked townwater sample were taken for laboratory analysis at the same time as the sample was introduced into the analyser. The samples for laboratory analysis were membrane filtered, chilled and delivered for analysis within 6 hours. The spiked samples were tested in triplicate by the Chemscan UV2150/S.

### 1.3.3 Task 4 - Data review and reporting

WRG received the results of comparison testing and correlated the mean on-site and laboratory results with the mean Chemscan UV2150/S test results. An assessment of the error for each mean was calculated using the “t” distribution.

## 2 Data

### 2.1 Analysed parameters

Parameters included in comparison testing were total chlorine, chloramine, total ammonia and free ammonia. Test data for these parameters are contained in tables 1 to 4. Units for all data in this report are mg/L.

**Table 1 Total Chlorine test 18 March 2010**

Sample	Hach DR890 Lab	Chemscan UV2150/S Analyser
townwater	0.08	0.22
townwater	0.08	0.22
townwater	-	0.22
Townwater spike1	0.98	1.2
Townwater spike1	0.95	1.19
Townwater spike1	0.9	1.17
Townwater spike 2	1.8	2.16
Townwater spike 2	1.79	2.14
Townwater spike 2	1.72	2.13
Townwater spike 3	2.7	3.05
Townwater spike 3	2.7	3.04
Townwater spike 3	2.64	3.02
Townwater spike 4	3.62	4.19
Townwater spike 4	3.74	4.17
Townwater spike 4	-	4.12

**Table 2 Chloramine test 18 January 2010**

Sample	Hach DR890 Lab	Chemscan UV2150/S Analyser
Townwater	0.05	<0.09
Townwater	0.06	<0.09
Townwater	-	<0.09
Townwater spike1	0.92	1.09
Townwater spike1	0.86	1.08
Townwater spike1	-	1.06
Townwater spike 2	1.81	2.07
Townwater spike 2	1.77	2.02
Townwater spike 2	-	2.01
Townwater spike 3	2.56	2.93
Townwater spike 3	2.51	2.92
Townwater spike 3	-	2.89
Townwater spike 4	3.65	4
Townwater spike 4	3.68	4
Townwater spike 4	-	3.96

**Table 3 Total Ammonia test 18 March 2010**

Sample	Hach DR890 free	Hach DR890 combined*	Hach DR890 total*	Chemscan UV2150/S Analyser
Townwater	0.04	0.01	0.050	0.14
Townwater	0.04	0.012	0.052	0.13
Townwater	-	-	-	0.14
Townwater spike1	0.12	0.184	0.304	0.44
Townwater spike1	0.13	0.172	0.302	0.43
Townwater spike1	-	-	-	0.44
Townwater spike 2	0.18	0.362	0.542	0.72
Townwater spike 2	0.18	0.354	0.534	0.73
Townwater spike 2	-	-	-	0.73
Townwater spike 3	0.31	0.512	0.822	1.01
Townwater spike 3	0.27	0.502	0.772	1.01
Townwater spike 3	-	-	-	1.01
Townwater spike 4	0.36	0.73	1.090	1.35
Townwater spike 4	0.32	0.736	1.056	1.32
Townwater spike 4	-	-	-	1.32

\* calculated from chloramine data

**Table 4 Free ammonia test 23 March 2010**

Sample	ALS Lab	Chemscan UV2150/S Analyser
townwater	0.02	0.02
townwater	0.05	
townwater	0.05	
Townwater spike1	0.19	0.20
Townwater spike1	0.2	
Townwater spike1	0.21	
Townwater spike 2	0.52	0.46
Townwater spike 2	0.51	
Townwater spike 2	0.53	
Townwater spike 3	1.02	0.92
Townwater spike 3	1.01	
Townwater spike 3	1.02	

### 3 Review and Discussion

#### 3.1 Correlations

The replicate testing employed enabled a mean result and associated error to be determined for each set of Chemscan UV2150/S results. The data summaries are presented in tables 5 and 6.

**Table 5 Chlorine / total ammonia data summary**

Chemscan UV2150/S						Hach DR890			
Total chlorine		Monochloramine		Total ammonia		Total chlorine	Free chlorine	Mono-chloramine	Total ammonia
mean	error	mean	error	mean	error	mean	mean	mean	mean
0.22	<0.01	0.05	<0.01	0.14	0.01	0.08	0.01	0.05	0.052
1.19	0.04	1.07	0.04	0.44	0.01	0.94	0.06	0.89	0.303
2.14	0.04	2.03	0.08	0.73	0.01	1.77	0.1	1.79	0.538
3.03	0.04	2.91	0.05	1.01	0.01	2.68	0.1	2.53	0.797
4.16	0.09	3.99	0.06	1.33	0.04	3.68	0.13	3.67	1.073

**Table 6 Free ammonia data summary**

Chemscan UV2150/S		ALS Laboratory
Free ammonia		Free ammonia
mean	error	
0.04	0.04	0.02
0.2	0.02	0.2
0.52	0.02	0.46
1.02	0.01	0.92

Correlations between the mean results of the on-site tests and Chemscan UV2150/S mean results for total chlorine, chloramine and total ammonia were plotted. In all cases the correlations were linear. The correlations are shown in figures 1 to 3.

The slope, intercept and  $R^2$  of the correlations contained in table 7 indicate that there is good agreement between the onsite laboratory results and the Chemscan UV2150/S.

**Table 7 Total chlorine, chloramine, total ammonia correlation data**

Parameter	Correlation slope	Correlation intercept	Correlation fit
			( $R^2$ )
Total chlorine	1.09	0.16	0.999
Chloramine	1.09	0.06	0.999
Total ammonia	1.16	0.09	0.999

Correlations between the mean results of the laboratory free ammonia tests and the Chemscan UV2150/S mean results were also plotted and demonstrated a linear correlation. The correlation is shown in figure 4.

The slope, intercept and  $R^2$  of the correlation indicates good agreement between the laboratory results and the Chemscan UV2150/S for free ammonia.

**Table 8 Free ammonia correlation data**

Parameter	Correlation slope	Correlation intercept	Correlation fit
			( $R^2$ )
Free ammonia	1.1	0.003	0.998

**Figure 1 Total chlorine correlation**

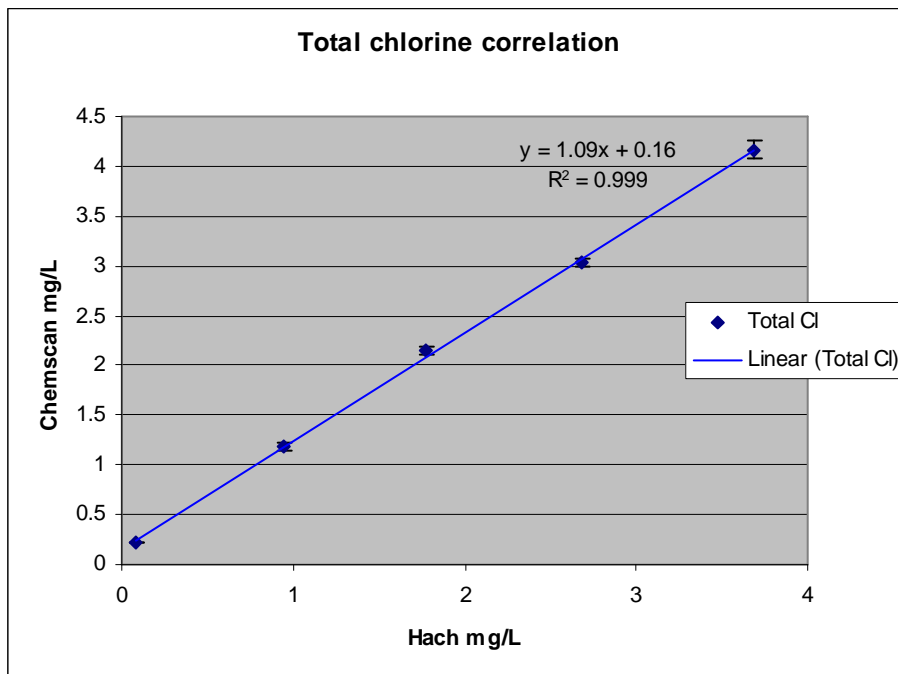


Figure 2 Monochloramine correlation

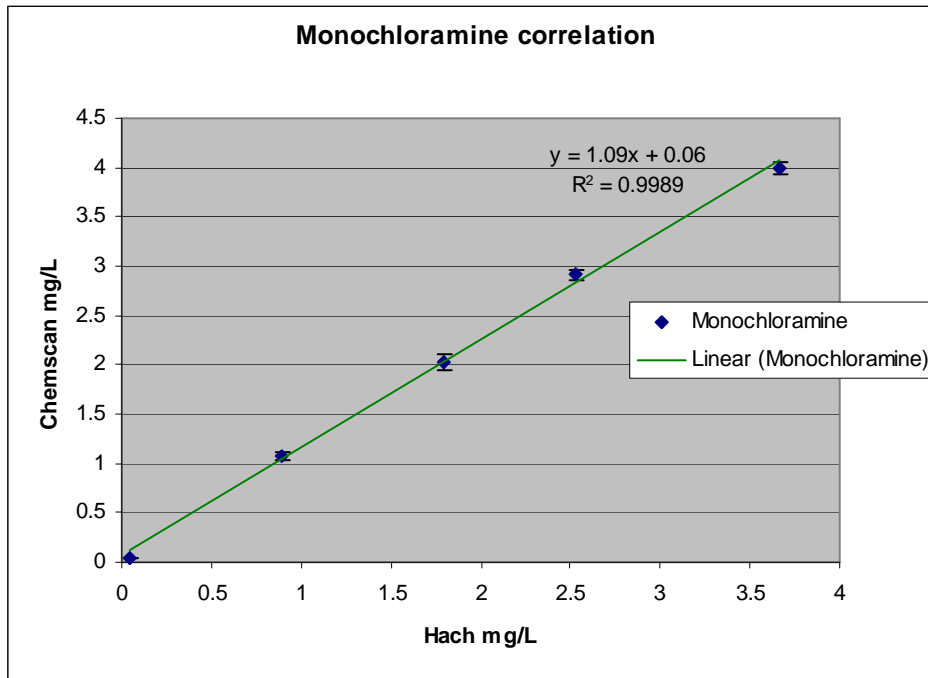


Figure 3 Total ammonia correlation

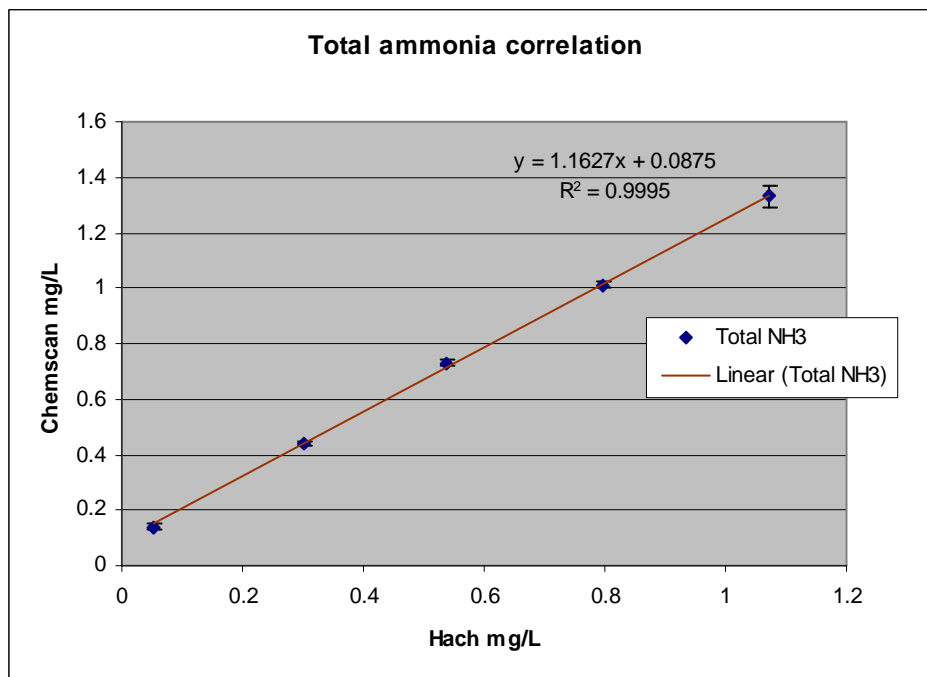
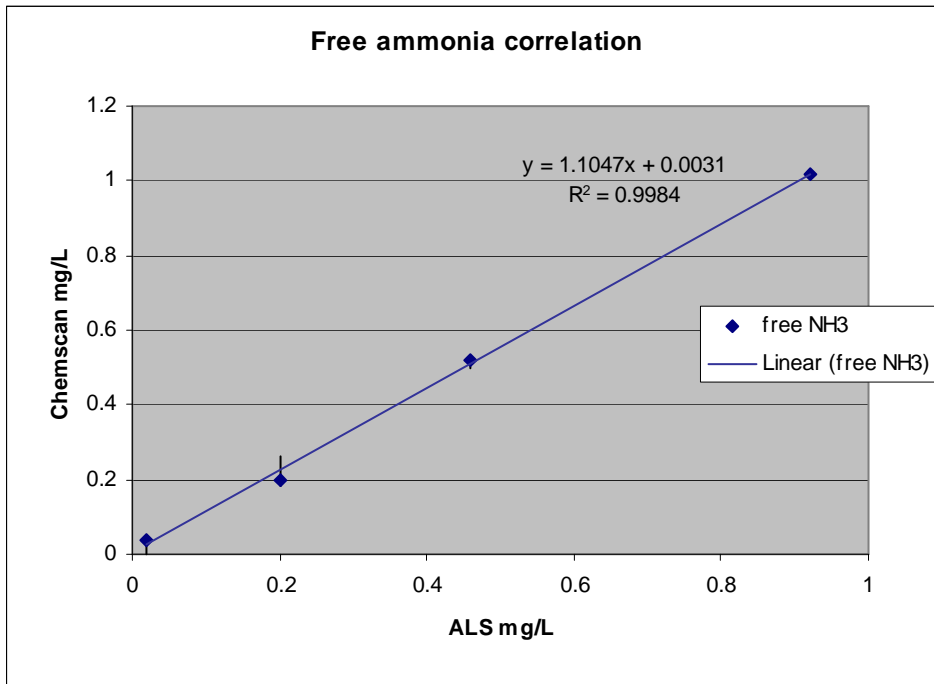


Figure 4 Free ammonia correlation



## 4 Conclusions

---

The Chemscan UV2150/S analyser produced test results for total chlorine, monochloramine, total ammonia and free ammonia with a strong linear correlation with laboratory based and other test methods accepted by Australian and US authorities. The Chemscan UV2150/S produced test result values which were consistent with laboratory based tests despite the analyser using manufacturer supplied calibration data with no tailoring for local conditions and matrix.

Adjustments to the Chemscan UV2150/S calibration slope and offset to cater for matrix effects are recommended prior to putting the instrument into service. It appears from this study that the adjustments required will be minor.

---