

**Review of intake seawater character - analyse weekly monitoring
licence conditions for the Adelaide Desalination Plant:
June 2014**

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AdelaideAqua Pty Ltd
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EXECUTIVE SUMMARY

Purpose

This document represents a report on the extent to which monitoring of weekly seawater character from selected sites in the vicinity of Port Stanvac meets with the EPA Licence Conditions for the construction and operation of the Adelaide Desalination Plant (ADP) over the period February 2009 to 12-Dec-2013. The monitoring reports were associated with the construction (including commissioning) of the desalination plant (by AdelaideAqua D&C Consortium – AAD&C) from February 2009 to 12-Dec-2012 and to the operation of the desalination plant (AdelaideAqua Pty Ltd) from 12-Dec-2012 to 12-Dec-2013.

Background

AdelaideAqua Pty Ltd is the operator of the Adelaide Desalination Plant at Port Stanvac South Australia. Operation of the ADP requires the discharge of reject water to the marine environment; this activity was originally conducted under a licence issued to AAD&C by the Environment Protection Authority of South Australia (EPA Licence Number 26902) and subsequently under another licence issued to AAPL (EPA Licence Number 39143). These licences authorised AAD&C and AAPL to undertake a series of activities of environmental significance under Schedule 1 Part A of the Environment Protection Act 1993 (the Act). The licences had specific requirements in relation to “Discharges to Marine Waters” that are the subject of this report.

Section 14 (305-626) of the licence requires that the licensee must ensure that:

1. An independent review of all marine monitoring is conducted by independent specialist(s) as approved in writing by the EPA prior to the review commencing;
2. All marine monitoring from the period commencing with the issue of the licence and ending 12 months after project handover of the 100 GL desalination plant is included in the review; and
3. The full results of the review are provided to the EPA not more than 18 months after project handover of the 100 GL desalination plant.

The EPA has also advised that prior to appointment, the independent reviewer must be able to demonstrate to the EPA that:

1. They will use their own professional judgment;
2. They will take appropriate specialised advice when the issue is outside their expertise;
3. Their opinions will be reached independently;
4. In forming opinions, they will not be unduly influenced by the views or actions of others who may have an interest in the outcome of the review; and
5. They must declare any real or apparent conflict of interest.

With the approval of the EPA, Anthony Cheshire (the author of this report) was selected by AdelaideAqua Pty Ltd (AAPL) to undertake this review.

Approach

This review of intake seawater character - analyse weekly monitoring encompassed a study of all documentation provided by AdelaideAqua Pty Ltd which comprised a series of 30 monitoring reports each of which was produced by staff at AAD&C, AAPL or by experts contracted by the parties for that purpose.

Each report has been critically reviewed and key issues that pertain to compliance with the licence conditions have been aggregated into a summary that has been presented in this report.

Specific requirements

To consider the work done against the Scheduled Marine Monitoring Requirements detailed in Attachment A to Licences 26902 and 39143. These being:

EPA Licence 26902: Analyse for metals (Al, Cd, Cr, Cu, Fe, Pb, Mn, Hg, Ni, Zn - soluble & total), Total nitrogen (as N), Total phosphorus (as P) & suspended solids weekly [24 hour flow weighted composite sample]

EPA Licence 39143: Analyse for metals (Al, Cd, Cr, Cu, Fe, Pb, Mn, Hg, Ni, Zn - soluble & total), Total nitrogen (as N), Total phosphorus (as P) & suspended solids weekly [24 hour flow weighted composite sample]

General requirements

In addition the EPA require that the Independent Reviewer is to undertake a technical review of all marine monitoring results from the commencement date of the Licence 26902 (D&C) until 12 December 2013 (12 months after plant handover) in order to assess the environmental impact of the desalination plant. This matter will be addressed in a subsequent report.

Conclusion

The specific requirements for this condition are to make weekly measurements on intake seawater for a series of metals (Al, Cd, Cr, Cu, Fe, Pb, Mn, Hg, Ni, Zn - soluble & total), Total Nitrogen and Total Phosphorus and suspended solids using 24 hour flow weighted composite samples.

Overall data coverage (i.e. the number of weekly records as a percentage of those expected based on weekly observations) was good at 86%.

Data was recorded over the 30 month period 01-Jul-2011 to 31-Dec-2013. Over this time there were 20 months with full data coverage (including 2 months with no production where no data were expected) and another 5 months where data coverage was better than 75% (i.e. nominally missing only 1 week). Nevertheless, there were a number of periods where data were insufficient notably:

1. There was no data coverage in March 2012.
2. Data coverage was 25% or less in July and September 2012.
3. Data coverage was 60% in March 2013.

In most cases the data coverage for metals (88%) was marginally better than for Total N (84%), Total P (85%) or suspended solids (87%).

LICENCE CONDITION: SEAWATER CHARACTER - ANALYSE WEEKLY MONITORING

In the following the specific requirements pertaining to the licence condition (intake seawater character - analyse weekly) are summarised along with information about the documents that have been reviewed.

Documents reviewed for this licence condition:

Document Name	Reference
EPA_July_MM_Condition 9 verified.xlsm	AdelaideAqua, (2011). Weekly Seawater Characteristics (metals, N, P and suspended solids) Data for July 2011. AdelaideAqua Pty Ltd.
EPA_August_MM_condition 9 verified.xlsm	AdelaideAqua, (2011). Weekly Seawater Characteristics (metals, N, P and suspended solids) Data for August 2011. AdelaideAqua Pty Ltd.
EPA_September_MM_condition 9 verified.xlsm	AdelaideAqua, (2011). Weekly Seawater Characteristics (metals, N, P and suspended solids) Data for September 2011. AdelaideAqua Pty Ltd.
EPA_October_MM_Condition_9 verified.xlsm	AdelaideAqua, (2011). Weekly Seawater Characteristics (metals, N, P and suspended solids) Data for October 2011. AdelaideAqua Pty Ltd.
EPA_November_MM_Condition_9 verified.xlsm	AdelaideAqua, (2011). Weekly Seawater Characteristics (metals, N, P and suspended solids) Data for November 2011. AdelaideAqua Pty Ltd.
EPA_December_MM_condition 9 verified.xlsm	AdelaideAqua, (2011). Daily volume of seawater intake for December 2011. AdelaideAqua Pty Ltd.
2012_1 EPA_January_intake seawater characteristics_Condition_9.xlsm	AdelaideAqua, (2012). Weekly Seawater Characteristics (metals, N, P and suspended solids) Data for January 2012. AdelaideAqua Pty Ltd.
2012_2 EPA_February_Intake seawater characteristics_Condition_9 verified.xlsm	AdelaideAqua, (2012). Weekly Seawater Characteristics (metals, N, P and suspended solids) Data for February 2012. AdelaideAqua Pty Ltd.
2012_3 EPA_March_Intake seawater characteristics_Condition_9.xlsm	AdelaideAqua, (2012). Weekly Seawater Characteristics (metals, N, P and suspended solids) Data for March 2012. AdelaideAqua Pty Ltd.
2012_4_EPA_April_MM_Condition_9 verified.xlsm	AdelaideAqua, (2012). Weekly Seawater Characteristics (metals, N, P and suspended solids) Data for April 2012. AdelaideAqua Pty Ltd.
2012_5_EPA_May_Condition 9.xlsm	AdelaideAqua, (2012). Weekly Seawater Characteristics (metals, N, P and suspended solids) Data for May 2012. AdelaideAqua Pty Ltd.
2012_6_EPA_JUNE_MM_CONDITION_9 VERIFIED.XLSM	AdelaideAqua, (2012). Weekly Seawater Characteristics (metals, N, P and suspended solids) Data for June 2012. AdelaideAqua Pty Ltd.
2012_7 EPA_JULY_MM_CONDITION_9 intake seawater characteristics.XLSM	AdelaideAqua, (2012). Weekly Seawater Characteristics (metals, N, P and suspended solids) Data for July 2012. AdelaideAqua Pty Ltd.
2012_8 _AUGUST_intake seawater characteristics_condition 9.XLSM	AdelaideAqua, (2012). Weekly Seawater Characteristics (metals, N, P and suspended solids) Data for August 2012. AdelaideAqua Pty Ltd.
2012_9 Sep Intake seawater characteristics_condition 9.XLSM	AdelaideAqua, (2012). Weekly Seawater Characteristics (metals, N, P and suspended solids) Data for September 2012. AdelaideAqua Pty Ltd.

Document Name	Reference
2012_10_EPA_October_c_9.xlsm	AdelaideAqua, (2012). Weekly Seawater Characteristics (metals, N, P and suspended solids) Data for October 2012. AdelaideAqua Pty Ltd.
2012_11_EPA_November_c_9.xlsm	AdelaideAqua, (2012). Weekly Seawater Characteristics (metals, N, P and suspended solids) Data for November 2012. AdelaideAqua Pty Ltd.
2012_12_EPA_December_c_9.xlsm	AdelaideAqua, (2012). Weekly Seawater Characteristics (metals, N, P and suspended solids) Data for December 2012. AdelaideAqua Pty Ltd.
2013_01_EPA_January_c_9.xlsx	AdelaideAqua, (2013). Weekly Seawater Characteristics (metals, N, P and suspended solids) Data for January 2013. AdelaideAqua Pty Ltd.
2013_02_EPA_February_c_9.xlsx	AdelaideAqua, (2013). Weekly Seawater Characteristics (metals, N, P and suspended solids) Data for February 2013. AdelaideAqua Pty Ltd.
2013_03_EPA_March_c_9.xlsx	AdelaideAqua, (2013). Weekly Seawater Characteristics (metals, N, P and suspended solids) Data for March 2013. AdelaideAqua Pty Ltd.
2013_04_EPA_April_c_9.xlsx	AdelaideAqua, (2013). Weekly Seawater Characteristics (metals, N, P and suspended solids) Data for April 2013. AdelaideAqua Pty Ltd.
2013_05_EPA_May_c_9.xlsx	AdelaideAqua, (2013). Weekly Seawater Characteristics (metals, N, P and suspended solids) Data for May 2013. AdelaideAqua Pty Ltd.
2013_06_EPA_June_c_9.xlsx	AdelaideAqua, (2013). Weekly Seawater Characteristics (metals, N, P and suspended solids) Data for June 2013. AdelaideAqua Pty Ltd.
2013_07_EPA_July_c_9.xlsx	AdelaideAqua, (2013). Weekly Seawater Characteristics (metals, N, P and suspended solids) Data for July 2013. AdelaideAqua Pty Ltd.
2013_08_EPA_August_c_9.xlsx	AdelaideAqua, (2013). Weekly Seawater Characteristics (metals, N, P and suspended solids) Data for August 2013. AdelaideAqua Pty Ltd.
2013_09_EPA_September_c_9.xlsx	AdelaideAqua, (2013). Weekly Seawater Characteristics (metals, N, P and suspended solids) Data for September 2013. AdelaideAqua Pty Ltd.
2013_10_EPA_October_c_9.xlsx	AdelaideAqua, (2013). Weekly Seawater Characteristics (metals, N, P and suspended solids) Data for October 2013. AdelaideAqua Pty Ltd.
2013_11_EPA_November_c_9.xlsx	AdelaideAqua, (2013). Weekly Seawater Characteristics (metals, N, P and suspended solids) Data for November 2013. AdelaideAqua Pty Ltd.
2013_12_EPA_December_c_9.xlsx	AdelaideAqua, (2013). Weekly Seawater Characteristics (metals, N, P and suspended solids) Data for December 2013. AdelaideAqua Pty Ltd.

Specific requirement (see Attachment A – Marine Monitoring Schedule):

EPA Licence 26902: Analyse for metals (Al, Cd, Cr, Cu, Fe, Pb, Mn, Hg, Ni, Zn - soluble & total), Total nitrogen (as N), Total phosphorus (as P) & suspended solids weekly [24 hour flow weighted composite sample]

EPA Licence 39143: Analyse for metals (Al, Cd, Cr, Cu, Fe, Pb, Mn, Hg, Ni, Zn - soluble & total), Total nitrogen (as N), Total phosphorus (as P) & suspended solids weekly [24 hour flow weighted composite sample]

Overall summary in relation to intake seawater character - analyse

Samples were collected weekly by a flow weighted composite sampler over 24 hour periods and submitted to a NATA accredited laboratory for analysis of the following parameters:

- Metals (Al, Cd, Cr, Cu, Fe, Pb, Mn, Hg, Ni, Zn, both soluble and total)
- Total nitrogen (as N)
- Total phosphorus (as P)
- Suspended solids

All sampling was conducted by field sampling units with the following accreditation:

- Collection of samples for chemical (organic/inorganic), biology, microbiology as per AS/NZ 5667
- Field tests for the determination of Free and Combined Chlorine, Dissolved Oxygen, pH and Conductivity

All analyses were performed by a NATA accredited laboratory using industry best practice method and contract requirements; the standards used were:

1. D 4195-Standard Guide for Water Analysis for Reverse Osmosis Applications and ASTM Standard Test Methods.
2. The methods of the AWWA/APHA Standard Methods for the Examination of Water and Wastewater.
3. D 4516 – Standardizing RO Performance Data
4. D 4692 – Calculation and Adjustment of Sulphate Scaling Salts for RO
5. D 4582 – Calculation and adjustment of the Stiff and Davis Stability Index for RO
6. D 4194 – Operating Characteristics of RO Devices

For the purposes of this Licence condition the data have been validated against a series of reasonableness criteria; values that do not meet those criteria have been excluded. Percentage coverage has been determined based on the number of valid data records obtained as a percentage of the number of records expected based on the assumption that one data record would be required for each parameter for every week of operation.

Consistent with other water quality licence conditions, data has been recorded since July 2011 and thereby includes early phase testing through to full production (Appendix A)

No attempt has been made to interpret the data other than to report the coverage the various parameters (noting that data were provided for review in a series of EXCEL files as detailed above).

Data provided broadly comprise estimates of the concentrations of the various metals, N, P and suspended solids over the period 1-Jul-2011 to 31-Dec-2013. There are a number of periods during which data were only available for a proportion of the time and these are detailed in Table 1 which also provides an index of overall data coverage and therein compliance with this licence condition.

Overall data coverage for intake seawater character (Table 1) was good¹ comprising an average coverage of 86%. In most cases the data coverage for metals (88%) was marginally better than for Total N (84%), Total P (85%) or suspended solids (87%).

Across the 30 month period (01-Jul-2011 to 31-Dec-2013) there were 25 months where data coverage was complete (20 months) or better than 75% (5 months; i.e missing no more than one week of data). Nevertheless, there were a number of periods where data were insufficient notably:

1. There was no data coverage in March 2012.
2. Data coverage was 25% or less in July and September 2012.
3. Data coverage was 60% in March 2013.

¹ Qualitative evaluation of the data coverage has been based on the following scale; Excellent $\geq 90\%$, Good $\geq 75\%$, Fair $\geq 60\%$, Materially deficient $< 60\%$.

Table 1 – Condition 9 metals, nitrogen, phosphorus and suspended solids within intake water.

Year month	File	Observations expected	Observations recorded	Metals %	Total N %	Total P %	Suspended solids %	Overall %	Notes
2012-07	EPA_July_MM_Condition 9 verified.xlsm	3	3	100%	100%	100%	100%	100%	
2012-08	EPA_August_MM_condition 9 verified.xlsm	4	4	100%	100%	100%	100%	100%	
2012-09	EPA_September_MM_condition 9 verified.xlsm	4	4	100%	75%	100%	100%	94%	
2012-08	EPA_October_MM_Condition_9 verified.xlsm	4	4	100%	100%	100%	100%	100%	
2012-11	EPA_November_MM_Condition_9 verified.xlsm	2	2	100%	100%	100%	100%	100%	
2012-12	EPA_December_MM_condition 9 verified.xlsm	0	0						1
2012-01	2012_1 EPA_January_intake seawater characteristics_Condition_9.xlsm	2	1	50%	50%	50%	50%	50%	
2012-02	2012_2 EPA_February_Intake seawater characteristics_Condition_9 verified.xlsm	4	4	100%	75%	75%	100%	88%	
2012-03	2012_3 EPA_March_Intake seawater characteristics_Condition_9	5	0	0%	0%	0%	0%	0%	2
2012-04	2012_4_EPA_April_MM_Condition_9 verified	0	0						1
2012-05	2012_5_EPA_May_Condition 9.xlsm	5	5	92%	100%	100%	100%	98%	
2012-06	2012_6_EPA_JUNE_MM_CONDITION_9 VERIFIED.XLSM	4	4	100%	100%	100%	100%	100%	
2012-07	2012_7 EPA_JULY_MM_CONDITION_9 intake seawater characteristics.xlsm	4	3	66%	0%	0%	25%	23%	
2012-08	2012_8_AUGUST_intake seawater characteristics_condition 9.XLSM	5	5	100%	100%	100%	100%	100%	
2012-09	2012_9 Sep Intake seawater characteristics_condition 9.XLSM	4	1	25%	25%	25%	25%	25%	
2012-10	2012_10_EPA_October_c_9.xlsm	5	4	80%	80%	80%	80%	80%	
2012-11	2012_11_EPA_November_c_9.xlsm	4	4	100%	100%	100%	100%	100%	
2012-12	2012_12_EPA_December_c_9.xlsm	3	3	100%	100%	100%	100%	100%	
2013-01	2013_01_EPA_January_c_9.xlsx	4	9	100%	100%	100%	100%	100%	3
2013-02	2013_02_EPA_February_c_9.xlsx	4	4	100%	100%	100%	100%	100%	
2013-03	2013_03_EPA_March_c_9.xlsx	5	3	60%	60%	60%	60%	60%	
2013-04	2013_04_EPA_April_c_9.xlsx	2	2	100%	100%	100%	100%	100%	
2013-05	2013_05_EPA_May_c_9.xlsx	5	5	100%	80%	100%	100%	95%	
2013-06	2013_06_EPA_June_c_9.xlsx	2	2	100%	100%	100%	100%	100%	

Year month	File	Observations expected	Observations recorded	Metals %	Total N %	Total P %	Suspended solids %	Overall %	Notes
2013-07	2013_07_EPA_July_c_9.xlsx	4	4	100%	100%	100%	100%	100%	
2013-08	2013_08_EPA_August_c_9.xlsx	3	3	100%	100%	100%	100%	100%	
2013-09	2013_09_EPA_September_c_9.xlsx	3	3	100%	100%	100%	100%	100%	
2013-10	2013_10_EPA_October_c_9.xlsx	5	5	100%	100%	100%	100%	100%	
2013-11	2013_11_EPA_November_c_9.xlsx	4	4	100%	100%	100%	100%	100%	
2013-12	2013_12_EPA_December_c_9.xlsx	4	4	100%	100%	100%	100%	100%	
Compliance performance (totals and other statistics)		90	77	88%	84%	85%	87%	86%	

Notes to Table 1:

- 1 The plant did not produce drinking water over this period - no data expected
- 2 Data in file are the last two weeks of February
- 3 This month included a series of non-routine measurements which have not been included in the totals
- 4 "Observations expected" number of weeks that the plant was operating in a given month
- 5 "Observations recorded" number of weeks for which valid data have been recorded
- 6 "%" values represent the number of valid observations recorded as a percentage of the number of observations expected

Appendix A KEY DATES IN PLANT CONSTRUCTION AND OPERATION

The following provides a list of key dates in the construction and operation of the plant. This material provides background to the review and in particular places the analysis and interpretation of each of the monitoring reports into context with the activities that were occurring on-site in the period leading up to the monitoring event.

Date	Activity
01-Feb-2009	Construction activities commenced
16-Nov-2009	Maritime platform arrived on site
08-Jul-2010	Maritime platform completed operations
01-Jun-2011	First discharge and first intake of seawater
14-Oct-2011	First Water – plant production was (30 MLD)
21-Mar-2012	SP1 – Full production from first half the plant (150 MLD)
31-May-2012	SP2 – Full production from second half of the plant (150 MLD)
24-Oct-2012	Performance test – plant running at full production for 7 days (150 MLD)
07-Nov-2012	Performance test – plant running at full production for 7 days (150 MLD)
21-Nov-2012	Reliability test – continuous running at various production rates
12-Dec-2012	Plant handover from commissioning