Department of Planning, Housing and Infrastructure

NSW Planning ref: DA401-11-2002-i-PA-76

Mr Greg Johnson
Senior Environmental Business Partner
BORAL CEMENT LIMITED
13/10/2025

Sent via the Major Projects Portal only

Subject: Berrima Cement Works – Non-Standard Fuels Pollutant Tracking Reports 2024-2025

Dear Mr Johnson

I refer to the Non-Standard Fuels Pollutant Tracking Reports dated October 2024 and March 2025 (the Tracking Reports), for Boral Cement Berrima Kiln 6 (the development), submitted for the Planning Secretary's consideration, in accordance with Schedule 2, Condition 3.23 of development consent DA 401-11-2002-i, as modified (the consent).

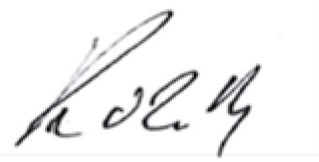
The NSW Department of Planning, Housing and Infrastructure considers that the Tracking Reports, generally satisfied Condition 3.23 of the consent. Please note that approval of these Tracking Reports is not endorsement of the compliance status of the development.

I note that the results of stack testing undertaken on 8 October 2024 and 18 March 2025 complied with the limits specified in the Environment Protection Licence 1698.

Please make the copy of the Tracking Reports available on the company website, including any other documents as required under Schedule 2, Condition 5.1 and also ensure that these documents are up-to-date.

Should you have any enquiries in relation to this matter, please contact Georgia Dragicevic, Senior Compliance Officer, on (02) 4247 1852 or by email to Georgia.Dragicevic@planning.nsw.gov.au.

Yours sincerely



Katrina O'Reilly
Team Leader - Compliance
Compliance
As nominee of the Planning Secretary

Boral Cement Limited
Berrima Works

Non-Standard Fuels Pollutant Tracking
First Half Year Report

March 2025

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1. Introduction

In July 2015, Boral sought approval to modify the consent for the Berrima Cement Works to enable the use of Solid Waste Derived Fuel (SWDF) as an energy source. Modification 9 to the consent DA 401-11-2002 was subsequently approved which included a number of additional monitoring and management conditions covering the use of these alternative fuels. The consent also separated the use of standard fuels, being traditional coal and coal derivatives along with diesel for start-up and non-standard fuels being derived from waste. Non-Standard Fuels (NSF) is the broad term now used to cover the various waste derived fuels approved to be used in the cement plant.

Boral commenced using two types of NSF in August 2018, including Wood Waste (WW) and Refuse Derived Fuels (RDF) known as Solid Waste Derived Fuels (SWDF). Both materials have undergone separation and screening processes to remove contaminants such as, glass and metals. Product specifications have been established and Quality Assurance/Quality Control (QA/QC) procedures implemented.

As per condition 3.22 of the DA, Boral are required to implement a tracking program to undertake:

a) Batch analysis of non-standard fuels received at the development as provided by suppliers and the results of any check analysis carried out by the applicant as part of the quality control management procedures
b) A mass inventory of each pollutant entering the process in raw materials, conventional fuels and non-standard fuels, with particular attention to, but not limited to chlorine, mercury cadmium and chromium.
c) Calculate emission factors for each pollutant based on inputs, outputs and measured air emissions and a variance in the emission factors from period to period.
d) Any adjustments that may be necessary to non-standard fuel specifications from the tracking analysis.

The initial period of use of SWDF was part of a Proof of Performance Trial which included the submission of monthly reports and a Proof of Performance Trial Consolidated Six Month Report for Solid Waste Derived Fuels on 28 February 2019. On the 23 April 2019 the Department of Planning and Environment approved the ongoing use of SWDF following consultation with the EPA subject to:

a) Limiting the amount of SWDF to be fired in Kiln 6 to 40%, as a percentage of total fuel
b) Periodic stack testing being undertaken every three months for the first 12 months of use of SWDF. The monitored pollutants must be consistent with the requirements of the Environment Protection Licence (EPL 1698)
c) Provision of a monitoring report that outlines the results of quarterly stack testing required in (a) and provides an assessment of compliance against the air emissions limits for the facility, to the satisfaction of the Secretary
d) Periodic measurements of hydrogen chloride (HCL) taken every 3 months until such time the Secretary agrees the accuracy of the HCL CEMS is confirmed through successful calibration audits undertaken in accordance with USEPA Performance Specification 18.

Condition 3.23 of the DA required Boral Cement to submit a report that assesses the results of the tracking program every 3 months in the first year of operating non-standard fuels under this consent to be synchronised with stack testing and every six months thereafter.

The following report is covering details findings from the non-standard fuels Pollutant Tracking Program for the first biannual testing following the approval for continual use of SWDF. This report incorporates the requirements of Condition 3.23.

As part of the tracking program we consolidate all raw material and fuel specification testing against quantities used and compare this to actual stack testing to determine an emission factor by unit of input by chemical.

1.1 Stack Testing Result

On 18th March 2025 stack testing undertaken at Berrima Cement was compliant with the licence limits as summaries in Table 1 below. A copy of the full report numbered R018557 is attached. Metals and Chlorine are outlined in the pollutant tracking discussion. Emissions were in compliance with the Environment Protection Licence 1698.

Parameter	Unit	Limits	30/06/2025 R018557
Mercury	mg/m3	0.05	0.0039
Type 1 and type 2 substances	mg/m3	0.5	<0.035
Solid particles	mg/m3	50	15
Nitrogen oxides	mg/m3	1250	810
Cadmium and Thallium	mg/m3	0.05	<0.0022
Chlorine	mg/m3	50	0.09
Dioxine and Furans (I-TEQ middle bound)	ng/m3	0.1	0.0053
Hydrogen chloride (HCl)*	mg/m3	10	6.6
Hydrogen fluoride	mg/m3	1	0.04
Sulfur dioxide	mg/m3	50	<0.01
Sulfuric acid mist and sulfur trioxide	mg/m3	50	0.14
Volatiles organic compounds	mg/m3	40	1.5

*Note that HCl is well below the limit of 10mg/m3.

1.2 Raw Material Inputs

The raw materials used within Kiln 6 include Limestone, Yellow Shale, Blue Shale, Fibreboard, Steel Slag and Granulated Blast Furnace Slag. Table 2 summaries the percentage of each raw material input used, the chemical properties of each of the raw material inputs, and the total chemical properties of the raw feed combined in use during the stack testing in March 2025.

Table 2 – Raw Material Input Quantities and Chemical Properties

Raw Material - Input								
Chemical Properties		Feed Source1 Limestone	Feed Source2 Yellow Shale	Feed Source3 Blue Shale	Feed Source4 Fibreboard	Feed Source5 Steel Slag	Feed Source3.1 GBFS	Final Feed
	Set Point %	84.21%	4.58%	4.88%	0.91%	2.25%	3.17%	100.00%
Arsenic	As (mg/kg)	2.4	11.7	5.1	5.0	1.4	1.5	2.93
Beryllium	Be (mg/kg)	0.2	1.0	1.2	1.3	0.3	6.0	0.48
Cadmium	Cd (mg/kg)	0.2	0.1	0.1	0.1	0.1	0.1	0.18
Chromium	Cr (mg/kg)	7.3	35.8	20.6	36.0	2150	60.2	59.40
Cobalt	Co (mg/kg)	2.2	12.4	15.4	13.7	1.7	0.8	3.36
Copper	Cu (mg/kg)	2.6	16.0	49.0	46.7	29.0	7.1	6.62
Mercury	Hg (mg/kg)	0.1	0.1	0.1	0.1	0.1	0.1	0.10
Manganese	Mn (mg/kg)	226	250	948	1060	32100	3060	1076.93
Nickel	Ni (mg/kg)	8.0	15.8	25.6	25.5	13.0	1.9	9.29
Lead	Pb (mg/kg)	2.0	13.5	23.1	22.6	1.6	2.5	3.75
Antimony	Sb (mg/kg)	0.2	1.8	0.3	0.4	0.1	0.1	0.27
Selenium	Se (mg/kg)	1	4	5	4	2	10	1.67
Tin	Sn (mg/kg)	0.1	1.5	0.6	0.8	1.6	0.1	0.23
Vanadium	V (mg/kg)	8	31	50	104	4040	171	107.86
Thallium	Th (mg/kg)	0.1	0.2	0.1	0.1	0.1	0.1	0.10
Chlorine	Cl (mg/kg)	20	40	10	30	10	510	35.827
kg mat/kg clinker								1.55

To interpret the table, 84.21% of the raw material is limestone. Within limestone there is 2.4 mg/kg of Arsenic (As), while yellow shale used at 4.58% contained 11.7 mg/kg of As. Combined with the other raw materials of blue shale, fibreboard, steel slag and granulated blast furnace slag, the total As of raw feed is 2.93 mg/kg.

To produce 1 kg of clinker, 1.55 kg of raw materials are required.

1.3 Kiln Fuel Inputs

The fuel in use at Berrima during normal operating conditions i.e. excluding start-up conditions includes Coal and Solid Waste Derived fuels Wood Waste and Refuse Derived Fuel.

Table 3 – Kiln Fuel Input Quantities and Chemical Properties

		Kiln Fuel - Input				
Chemical Properties		**Fuel Source 1 Coal**	**Fuel Source 2 Wood Benedict**	**Fuel Source 3 RDF Bingo**	**Fuel Source 4 Wood Brandown**	**Final Fuel - Kiln**
	Set Point %	42.70%	24.86%	28.65%	3.78%	100.00%
Arsenic	As (mg/kg)	0.4	19	11	1	8.1
Beryllium	Be (mg/kg)	0.5	1	1	1	0.8
Cadmium	Cd (mg/kg)	0.1	1	1	1	0.6
Chromium	Cr (mg/kg)	1.2	35	25	22	17.2
Cobalt	Co (mg/kg)	0.5	2	2	6	1.5
Copper	Cu (mg/kg)	8.2	42	20	16	20.3
Mercury	Hg (mg/kg)	0.1	0.05	0.05	0.05	0.1
Manganese	Mn (mg/kg)	162	57	39	99	98.3
Nickel	Ni (mg/kg)	0.6	2	11	4	4.1
Lead	Pb (mg/kg)	10.2	42	32	9	24.3
Antimony	Sb (mg/kg)	0.1	11	1	2	3.1
Selenium	Se (mg/kg)	2	1	1	1	1.4
Tin	Sn (mg/kg)	0.2	1	1	32	1.8
Vanadium	V (mg/kg)	2	2	2	4	2.1
Thallium	Th (mg/kg)	0.1	1	1	1	0.6
Chlorine	Cl (mg/kg)	10	0.19	0.05	0.62	4.355
kg fuel/kg clinker		0.0790	0.0460	0.053	0.0070	0.185

Table 3 details the inventory of fuel input and the percentage of each fuel used. As can be seen 42.7% of the fuel in use was coal, with SWDF accounting for 57.3% total fuel, split between RDF and Wood.

Taking As as an example, coal contains 0.4 mg/kg and RDF 11 mg/kg. As makes up 8.1 mg/kg in the total fuel.

To produce 1kg of Clinker a total of 0.185 kg of fuel is consumed.

1.4 Total Fuel Inputs and Associated Emission Factors

Table 4 collates the raw material and fuel inputs comparing to stack emissions to calculate an emission factor per unit of chemical input.

Table 4 – Emissions Factors per unit of input for raw materials and fuel

	Total Input	Stack Emissions		Emission factor
	Raw material + Fuel			
	mg/kg clk	mg/Nm3	mg/kg clk	from input
Arsenic	6.04	0.002	0.00491	0.00081
Beryllium	0.89	0.0007	0.00172	0.00193
Cadmium	0.40	0.0002	0.00049	0.00123
Chromium	95.26	0.001	0.00245	0.00003
Cobalt	5.49	0.001	0.00245	0.00045
Copper	14.01	0.0029	0.00712	0.00051
Mercury	0.17	0.0039	0.00957	0.05691
Manganese	1687.41	0.003	0.00736	0.00000
Nickel	15.16	0.0049	0.01203	0.00079
Lead	10.31	0.0027	0.00663	0.00064
Antimony	1.01	0.005	0.01227	0.01219
Selenium	2.85	0.006	0.01473	0.00517
Tin	0.69	0.002	0.00491	0.00708
Vanadium	167.57	0.001	0.00245	0.00001
Thallium	0.28	0.002	0.00491	0.01779
Chlorine	56.338	0.03	0.07364	0.00131

Taking As as an example, the total As concentration for inputs into the kiln per kg of clinker produced is calculated by (raw material chemical/kg X kg materials/kg clinker) + (Kiln fuel chemical/kg X kiln fuel kg/kg clinker).

(2.93*1.55) + (8.1*0.185) = 6.04 mg/kg clinker

The emission factor per unit of input for As is calculated by dividing the calculated emissions per kg of clinker by the total As input.

0.00491/6.04 = 0.00081

Table 5 is similar to Table 4 but calculates an emission factor based on the fuel only.

Table 5 – Emissions Factor fuel only

	Total Input	Stack Emissions		Emission factor
	Fuel only			
	mg/kg clk	mg/Nm3	mg/kg clk	from input
Arsenic	1.50	0.002	0.00491	0.00328
Beryllium	0.15	0.0007	0.00172	0.01181
Cadmium	0.11	0.0002	0.00049	0.00431
Chromium	3.18	0.001	0.00245	0.00077
Cobalt	0.28	0.001	0.00245	0.00878
Copper	3.75	0.0029	0.00712	0.00190
Mercury	0.01	0.0039	0.00957	0.72521
Manganese	18.18	0.003	0.00736	0.00041
Nickel	0.75	0.0049	0.01203	0.01603
Lead	4.50	0.0027	0.00663	0.00147
Antimony	0.58	0.005	0.01227	0.02113
Selenium	0.26	0.006	0.01473	0.05579
Tin	0.34	0.002	0.00491	0.01449
Vanadium	0.38	0.001	0.00245	0.00639
Thallium	0.11	0.002	0.00491	0.04310
Chlorine	0.806	0.03	0.07364	0.09139

Any variance to the Emissions Factors in Table 4 & Table 5 can be used to determine the contribution from either raw materials, standard and non-standard fuels.

1.5 Alternate Fuel Inputs and Total Inputs Raw Material and Fuel

Table 6 show the Alternate Fuel inputs against the total raw material and fuel inputs per unit of clinker produced.

Table 6 – Alternate Fuels inputs compared to total inputs from Raw materials and Fuels

	Input		
	Total Input		
	Raw material + Fuel	Alternative Fuels	
	mg/kg clk	mg/kg clk	% input from AF
Arsenic	6.04	1.46	24.25%
Beryllium	0.89	0.11	11.88%
Cadmium	0.40	0.11	26.54%
Chromium	95.26	3.09	3.24%
Cobalt	5.49	0.24	4.37%
Copper	14.01	3.10	22.16%
Mercury	0.17	0.01	3.15%
Manganese	1687.41	5.38	0.32%
Nickel	15.16	0.70	4.64%
Lead	10.31	3.69	35.80%
Antimony	1.01	0.57	56.93%
Selenium	2.85	0.11	3.72%
Tin	0.69	0.32	46.60%
Vanadium	167.57	0.23	0.13%
Thallium	0.28	0.11	38.41%
Chlorine	56.34	0.02	0.03%

Taking As as an example, the total As concentration for inputs into the kiln per kg of clinker produced is 6.04 mg/kg clinker (see calculation for table 4)

The total As concentration for inputs from Alternate fuel is 1.46 mg/kg clinker. This represents 24.25% of the total As input in the process.

1.46/6.04 *100 = 24.25%