

Table 3.1: Boral Cement Berrima - 2016 Annual Noise Assessment - Site Sound Levels for Kiln 6 Upgrade

Sound levels at measurement locations

Area	Location	File No.	Date	Start Time	Period hh:mm:ss	Statistical Sound Level - dBA							Comment
						LAeq	LAMax	LA01	LA10	LA90	LCeq	LC-LA eq	
PHT	PHT L8 Lower platform	223	21/07/2016	1:57 PM	Dd 00:01:00	78	79	79	78	77	90	13	2 tones 200 & 160 Hz. Wind 0-2m/s N. Noise from stack and BE drive behind
	PHT L8 Top platform level with top of stack	224	21/07/2016	1:59 PM	Dd 00:00:47	80	81	81	80	79	92	12	Gearbox behind
	PHT L8 Top platform EL16 Gbox @ 1m to coupling NW side	226	21/07/2016	2:03 PM	Dd 00:00:43	81	82	81	81	80	88	8	EL16 gearbox looks new
	PHT L8 Top platform EL16 Gbox @ 1m to coupling SW side	227	21/07/2016	2:04 PM	Dd 00:00:30	82	83	83	82	82	89	7	Flender B3 SH9B 1500 - 36.67 / min 53 kW
	PHT L8 Top platform EL16 Gbox @ 2m to motor S side	228	21/07/2016	2:05 PM	Dd 00:00:30	78	79	79	79	78	88	10	-
	PHT L8 Top platform EL16 Gbox @ 1m to NE side	229	21/07/2016	2:05 PM	Dd 00:00:40	79	81	80	80	79	90	10	-
	PHT L8 Top platform EL16 Gbox @ 3m to N side	230	21/07/2016	2:07 PM	Dd 00:01:12	76	77	77	76	75	88	12	-
	PHT L8 proper FA263 motor & casing @ 1m	231	21/07/2016	2:10 PM	Dd 00:00:39	85	86	86	85	84	93	8	-
	PHT L8 proper 1m to vent on FA263 filter room	232	21/07/2016	2:11 PM	Dd 00:00:33	74	75	74	74	73	88	15	Noise from fan 263 around corner
	PHT L8 centre tower W side	233	21/07/2016	2:12 PM	Dd 00:00:31	76	78	77	77	75	89	13	-
	PHT L8 centre tower N side	234	21/07/2016	2:13 PM	Dd 00:00:31	71	72	72	71	71	85	14	-
	PHT L8 centre tower E side	235	21/07/2016	2:13 PM	Dd 00:00:38	71	72	72	71	70	84	14	-
	PHT L8 centre tower S side	236	21/07/2016	2:15 PM	Dd 00:00:46	67	78	77	67	66	83	16	Air purge 78
	PHT L7 New S side centre	237	21/07/2016	2:17 PM	Dd 00:00:30	70	71	70	70	69	82	12	-
	PHT L7 New E side centre	238	21/07/2016	2:17 PM	Dd 00:00:34	72	73	73	72	72	83	11	-
	PHT L7 New N side centre	239	21/07/2016	2:18 PM	Dd 00:00:31	71	72	72	72	71	85	14	-
	PHT L7 New centre between towers	240	21/07/2016	2:19 PM	Dd 00:00:32	75	76	76	75	74	89	14	-
	PHT L7 Old S side centre	241	21/07/2016	2:20 PM	Dd 00:00:37	75	76	76	75	74	88	13	Noise from FA 260 below on RM Silo top & EL13
	EL13 platform W side 0.5m	242	21/07/2016	2:21 PM	Dd 00:00:32	75	79	78	77	74	89	14	-
	EL13 platform SW side motor & EL & coupling @ 1m	243	21/07/2016	2:22 PM	Dd 00:00:22	79	81	80	80	79	91	11	-
	EL13 platform E side Gbox & coupling @ 0.5m	244	21/07/2016	2:23 PM	Dd 00:00:20	81	82	81	81	80	91	10	-
	EL13 platform motor end @ 1m	245	21/07/2016	2:24 PM	Dd 00:00:31	78	79	79	78	77	88	10	-
	EL13 platform N side GB end & side EL @ 1m	246	21/07/2016	2:24 PM	Dd 00:00:31	77	79	78	78	77	89	12	-
	PHT L7 under EL13 platform E side	247	21/07/2016	2:25 PM	Dd 00:00:26	75	77	77	76	74	90	15	-
	PHT L7 old NW corner 1.5m to stack	248	21/07/2016	2:27 PM	Dd 00:00:41	71	73	73	72	71	88	17	-
	PHT L7 old centre N side	249	21/07/2016	2:28 PM	Dd 00:00:31	74	77	76	75	73	91	16	-
	PHT L7 old centre N side on new platform	250	21/07/2016	2:28 PM	Dd 00:00:30	69	71	70	70	69	88	19	-
	PHT L6 RM silo Top FA260 NE side @ 1m casing & motor	251	21/07/2016	2:32 PM	Dd 00:01:57	89	91	91	90	89	94	4	Is also 3m to discharge baghouse below
	PHT L6 RM silo above baghouse discharge @ 2m at base of stairs to EL	252	21/07/2016	2:34 PM	Dd 00:00:26	87	90	89	88	87	96	9	-
	PHT L6 RM Silo top EL15 platform motor side 0.6m	253	21/07/2016	2:37 PM	Dd 00:00:20	80	82	81	81	80	89	9	Noise also from baghouse discharge
	EL15 W side @ 1m	254	21/07/2016	2:38 PM	Dd 00:00:21	74	76	75	75	74	87	13	-
	EL15 S side Gbox @ 1m	255	21/07/2016	2:38 PM	Dd 00:00:30	80	81	80	80	79	87	7	-
	EL15 E side Gbox @ 0.5m	256	21/07/2016	2:39 PM	Dd 00:00:23	80	81	81	81	80	88	8	-
	RM Silo top E side 12m to FA260	257	21/07/2016	2:40 PM	Dd 00:01:23	74	76	76	75	74	84	10	-
	RM silo top baghouse fan discharge @ 1.5m	258	21/07/2016	2:42 PM	Dd 00:00:21	88	90	90	89	87	99	10	-
	PHT L6 centre W side	259	21/07/2016	2:43 PM	Dd 00:00:28	72	74	74	73	72	83	11	-
	PHT L6 NW corner 1m to stack	260	21/07/2016	2:44 PM	Dd 00:00:30	75	77	76	76	75	87	12	-
	PHT L6 stack test port 100mm diam @ 200mm	261	21/07/2016	2:45 PM	Dd 00:00:31	86	87	87	86	85	95	10	-
	PHT L6 centre N side by platform	263	21/07/2016	2:49 PM	Dd 00:00:30	72	73	73	73	72	84	12	-
	PHT L6 centre between towers	264	21/07/2016	2:49 PM	Dd 00:00:36	73	78	77	73	72	83	11	Air discharge 78
	PHT L6 new E side centre	265	21/07/2016	2:50 PM	Dd 00:00:39	74	77	75	74	73	83	10	Above kiln
	PHT L6 new N side centre	266	21/07/2016	2:51 PM	Dd 00:00:39	73	76	74	73	73	83	10	-
	PHT L6 new S side centre	267	21/07/2016	2:52 PM	Dd 00:01:24	86	107	102	72	71	86	1	RM Silo top E doors open fully, Air discharge 107, air cannon 92
	RM Silo top inside centre	268	21/07/2016	2:55 PM	Dd 00:01:20	89	95	94	91	87	94	5	Squeal from screws, plus fans
	RM silo top outside S man door	269	21/07/2016	2:57 PM	Dd 00:00:29	74	75	75	74	73	84	11	RM silo top outside S man door
	RM silo top inside E doors open	270	21/07/2016	2:58 PM	Dd 00:00:54	84	88	86	85	82	91	7	Screw noise
	PHT Level 5 old centre S side by stairs	271	21/07/2016	3:01 PM	Dd 00:00:42	74	78	76	74	73	83	9	-
	PHT Level 5 old centre W side by gas valves @ 1m	272	21/07/2016	3:02 PM	Dd 00:00:41	78	79	79	79	78	84	6	Gas valve noise
	PHT Level 5 old NW corner @ 1m to stack	273	21/07/2016	3:03 PM	Dd 00:00:34	74	77	75	74	73	85	11	Gas valve noise
	PHT Level 5 old centre N side	274	21/07/2016	3:04 PM	Dd 00:00:31	73	75	74	74	73	86	12	-
	PHT Level 5 centre between towers	275	21/07/2016	3:04 PM	Dd 00:00:34	73	74	74	73	73	83	10	-
	PHT Level 5 New centre N side	276	21/07/2016	3:05 PM	Dd 00:00:30	73	74	74	73	73	84	11	-
	PHT Level 5 New centre E side above kiln	277	21/07/2016	3:06 PM	Dd 00:00:39	75	77	76	75	74	84	9	KSCFs & air cannons

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						LAeq	LAMax	LA01	LA10	LA90	LCeq	LC-LA eq	
	PHT Level 5 New centre S side	278	21/07/2016	3:07 PM	Dd 00:00:35	70	72	72	71	70	81	11	-
	PHT Level 4 old centre S side by stairs	279	21/07/2016	3:09 PM	Dd 00:00:40	77	92	87	76	75	86	9	Air cannon 92
	PHT Level 4 old SW corner by water pumps SV09 @ 1m N	280	21/07/2016	3:10 PM	Dd 00:00:39	79	81	80	79	79	87	7	-
	PHT Level 4 old centre W side	281	21/07/2016	3:11 PM	Dd 00:00:31	76	87	84	76	75	86	10	Air discharge 88
	PHT Level 4 old NW corner @ 1.2m to stack	282	21/07/2016	3:12 PM	Dd 00:00:32	75	76	75	75	74	87	13	-
	ESP Centre E side top walkway looking E to PHT	283	21/07/2016	3:13 PM	Dd 00:00:40	74	75	75	74	73	84	11	-
	ESP top NE corner at barrier	284	21/07/2016	3:14 PM	Dd 00:00:31	70	77	73	70	69	82	13	-
	ESP top SE corner at barrier	285	21/07/2016	3:16 PM	Dd 00:00:35	75	76	76	75	74	84	10	Screws below 74
	PHT Level 4 old centre N side	286	21/07/2016	3:18 PM	Dd 00:00:30	72	73	73	73	72	83	11	-
	PHT Level 4 centre between towers by air cannon	287	21/07/2016	3:18 PM	Dd 00:01:00	77	98	89	73	72	85	8	Air cannon 98 @ 3m included
	PHT Level 4 new centre N side	288	21/07/2016	3:20 PM	Dd 00:00:31	73	75	75	74	73	84	11	-
	PHT Level 4 new centre E side above kiln	289	21/07/2016	3:21 PM	Dd 00:00:36	75	76	75	75	74	84	9	-
	PHT Level 4 new centre S side	290	21/07/2016	3:21 PM	Dd 00:00:33	72	78	76	72	72	83	11	Air cannon 98 @ 2m
	PHT Level 3 old centre W side above FA39	291	21/07/2016	3:24 PM	Dd 00:00:31	78	80	80	79	78	93	14	-
	PHT Level 3 old NW corner by stack @ 1.5m above FA39	292	21/07/2016	3:24 PM	Dd 00:00:31	78	81	80	78	77	90	12	-
	PHT Level 3 old centre N side above FA39	293	21/07/2016	3:25 PM	Dd 00:00:30	76	84	82	76	75	87	12	Air cannon 83
	PHT Level 3 old centre E side above kiln	294	21/07/2016	3:26 PM	Dd 00:00:35	76	83	81	77	76	87	11	-
	PHT Level 2.5 by DC31 drives @ 1m	295	21/07/2016	3:29 PM	Dd 00:00:25	87	88	88	88	87	103	16	-
	PHT Level 2.5 by DC31 discharge @ 1m @ 1m	296	21/07/2016	3:30 PM	Dd 00:00:39	87	94	90	88	87	105	17	-
	PHT Level 2.5 by main shaft @ 2m	297	21/07/2016	3:31 PM	Dd 00:00:56	81	91	87	83	79	95	14	-
	PHT Level 2.25 by Radicon Gbox drive E end @ 1m	298	21/07/2016	3:33 PM	Dd 00:00:44	88	98	94	90	85	93	5	Noise is from other sources, air cannons 98
	PHT Level 2.25 by centre by kiln entry	299	21/07/2016	3:35 PM	Dd 00:00:33	86	92	90	88	84	97	11	-
	PHT Level 2 by E side drive coupling & casing DC70 FA03	300	21/07/2016	3:36 PM	Dd 00:00:47	86	105	97	85	84	97	11	Low Frequency noise form FA39 stack entry duct
	PHT Level 2 FA03 discharge @ 1.5m	301	21/07/2016	3:38 PM	Dd 00:00:31	89	92	91	90	89	109	19	Strong tone @ 63 Hz
	PHT Level 2 @ 1m to FA39 stack entry duct	302	21/07/2016	3:39 PM	Dd 00:00:29	85	88	88	86	84	98	13	Influence from FA03
	PHT Level 2 FA65 inlet filter @ 1m in front	303	21/07/2016	3:41 PM	Dd 00:00:38	87	90	89	88	86	102	15	Standing waves at 63 Hz probably FA03
	PHT Level 2 FA65 rear side 1m	304	21/07/2016	3:43 PM	Dd 00:00:30	86	89	88	87	85	104	18	High levels of 63 Hz
	PHT Level 1 RM silo fan 92 motor @ 1m to side	305	21/07/2016	3:45 PM	Dd 00:00:33	81	82	82	81	80	90	10	-
	PHT Level 1 RM silo fan 92 casing & inlet @ 1m to side	306	21/07/2016	3:46 PM	Dd 00:00:44	76	78	77	77	76	89	12	-
	PHT Level 1 RM Silo base inlet filter front @ 1m to S	307	21/07/2016	3:47 PM	Dd 00:00:30	73	74	74	73	73	87	14	-
	PHT Level 1 RM silo base blower room N side man door @ 1m	308	21/07/2016	3:48 PM	Dd 00:00:30	79	82	81	80	78	91	12	-
FA39	FA39 E side at concrete line 5.4m to motor	309	21/07/2016	3:49 PM	Dd 00:01:28	87	88	88	88	86	93	7	-
	FA39 under discharge duct @ 1m	310	21/07/2016	3:51 PM	Dd 00:00:37	85	87	86	85	83	98	14	-
	FA39 under discharge duct @ 1m	311	21/07/2016	3:52 PM	Dd 00:00:25	84	86	85	85	83	98	14	Record
	FA 39 N side on kerb	312	21/07/2016	3:53 PM	Dd 00:00:31	80	82	81	81	79	90	10	-
	FA39 W side at metal strip 5.25m to motor	313	21/07/2016	3:54 PM	Dd 00:00:59	88	91	90	89	86	94	6	-
	Centre between FA38 & FA39	314	21/07/2016	3:55 PM	Dd 00:00:44	91	93	93	92	89	94	3	Peaks at 1.25k & 1.6k Hz
FA38	FA38 @ 3.9m to E side	315	21/07/2016	3:56 PM	Dd 00:00:57	93	96	96	94	91	95	2	-
	FA38 @ 3m to N side	316	21/07/2016	3:57 PM	Dd 00:00:32	87	90	90	89	85	93	6	-
	FA38 @ 5m to NW side at column	317	21/07/2016	3:58 PM	Dd 00:01:04	88	92	91	90	86	92	4	-
	In centre opening of wall on S side of road	318	21/07/2016	3:59 PM	Dd 00:00:30	82	84	83	83	80	88	6	-
	56' Road kerb N side opp. Opening to FA38	319	21/07/2016	4:00 PM	Dd 00:00:40	77	79	79	78	75	86	10	-
	57 Road N side opp FA38 doorway	320	21/07/2016	4:01 PM	Dd 00:00:40	79	81	80	80	77	88	10	Fans behind are off
	58 Road N side between FA38 & FA39	321	21/07/2016	4:02 PM	Dd 00:00:27	79	81	80	80	78	89	10	-
Admin	Admin Building Roof S side centre opp RM6 E side	322	21/07/2016	4:20 PM	Dd 00:01:00	69	74	71	70	68	79	10	-
Building	Admin Building Roof SE corner side centre opp FA38 & ESP	323	21/07/2016	4:21 PM	Dd 00:01:16	70	73	71	70	69	79	10	Air cannon 73
Roof	Admin Building Roof SE corner opp FA38 & ESP	324	21/07/2016	4:23 PM	Dd 00:01:09	79	82	81	80	79	79	0	TAS 618 90C
	Admin Building Roof NE corner opp FA502 & CM7	325	21/07/2016	4:25 PM	Dd 00:01:09	78	80	79	79	77	78	0	TAS 619 90C
	Admin Building Roof NE corner opp FA502 & CM7	326	21/07/2016	4:26 PM	Dd 00:01:00	68	72	69	69	68	78	10	-

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						LAeq	LAMax	LA01	LA10	LA90	LCeq	LC-LA eq		
RM6	1 RM6 W door @ 1m	327	21/07/2016	4:31 PM	Dd 00:00:57	78	80	80	79	77	84	6	-	
	1' RM6 W door at kerb W side @ 13.3m	328	21/07/2016	4:32 PM	Dd 00:00:50	70	72	72	71	70	80	9	-	
RM7	2' RM7 at roadside kerb ~32m	329	21/07/2016	4:34 PM	Dd 00:01:11	69	72	71	70	69	80	10	More noise form RM6 S wall conveyor opening	
	2 Rm7 @ 14.6m to W door	330	21/07/2016	4:36 PM	Dd 00:00:48	72	74	74	73	71	83	12	-	
	3 RM7 W wall door @ 1m	331	21/07/2016	4:37 PM	Dd 00:01:02	79	82	81	80	77	87	8	-	
	4 RM7 NE corner wall vents 2 1m	332	21/07/2016	4:38 PM	Dd 00:00:31	81	84	84	82	79	89	8	-	
	5 RM7 N side NW roll door @ 1m	333	21/07/2016	4:39 PM	Dd 00:00:36	79	82	81	80	79	89	9	-	
	6 RM7 N wall vents centre next to door	334	21/07/2016	4:40 PM	Dd 00:00:31	82	84	84	83	81	90	8	-	
	7 RM7 N wall man door	335	21/07/2016	4:41 PM	Dd 00:00:46	83	86	85	84	81	91	8	Screw noise from ESP	
	8 RM7 E wall vents NE corner @ 1m	336	21/07/2016	4:42 PM	Dd 00:00:38	85	88	88	87	84	92	7	-	
Boundary	Lake Breed South logger location	337	21/07/2016	5:01 PM	Dd 00:05:06	55	64	57	56	54	68	13	-	
	Store Yard Close	338	10/08/2016	9:17 AM	Dd 00:15:00	58	76	69	59	53	76	18	Sky 6/8 mid level CN, wind 3-5 m/s NW-NNW, 15oC. Quiet ambient 54	
	Northern Boundary	341	10/08/2016	10:09 AM	Dd 00:10:00	53	68	60	55	49	69	17	Quiet 47 to 50. Taylor Ave Traffic, birds 60+, wind is low here. Trucks on Taylor 64 higher than site road trucks. No stack tone significant but audible when quiet.	
	Lake Breed South logger location	342	10/08/2016	10:28 AM	Dd 00:10:01	58	72	64	60	56	73	15	Plant fans - coal mill, PHT, trains, traffic Moss Vale Road, birds. Ambient 55 to 62. Wind is W from PHT to here 2 to 6m/s	
RM7	3 RM7 W wall door @ 1m	344	10/08/2016	11:03 AM	Dd 00:00:30	80	85	83	81	79	87	6	Ambient 80 + squeaks to 87	
	4 RM7 NE corner wall vents 2 1m	345	10/08/2016	11:04 AM	Dd 00:00:44	81	87	84	83	80	88	7	80 to 83 mostly to 88	
	5 RM7 N side NW roll door @ 1m	346	10/08/2016	11:05 AM	Dd 00:00:41	81	83	83	82	80	89	8	80 to 82 including screw noise	
	6 RM7 N wall vents centre next to door	347	10/08/2016	11:06 AM	Dd 00:00:40	84	86	86	85	83	90	6	83 to 86 av 85	
	7 RM7 N wall man door	348	10/08/2016	11:07 AM	Dd 00:00:42	83	86	85	84	82	90	7	81 to 84 inc. screw conveyor squeals	
	8 RM7 E wall vents NE corner @ 1m	349	10/08/2016	11:08 AM	Dd 00:00:41	85	88	87	86	84	91	6	84 to 87 av 86 equal inside RM7 & screw conveyors	
	9 RM7 E side under duct	350	10/08/2016	11:09 AM	Dd 00:00:50	81	85	82	81	80	89	9	-	
	10 RM7 By E door Hydraulics room open	351	10/08/2016	11:10 AM	Dd 00:00:40	74	76	75	75	73	84	10	Hydraulics on but low	
	11 RM7 Centre Compressor room door @ 1m closed	352	10/08/2016	11:12 AM	Dd 00:00:31	74	75	75	74	73	84	10	-	
	12 RM7 Under inlet for switchroom fan	353	10/08/2016	11:12 AM	Dd 00:00:32	84	85	85	84	83	92	9	-	
	FA249	13 FA249 under inlet duct W side	354	10/08/2016	11:14 AM	Dd 00:00:35	78	80	80	79	78	90	11	Screw conveyor noise
		14 FA249 2m W side ground level	355	10/08/2016	11:15 AM	Dd 00:00:36	82	84	84	82	81	91	10	-
15 FA249 1m motor end		356	10/08/2016	11:17 AM	Dd 00:00:32	82	85	84	83	81	90	8	-	
14' FA249 motor platform fan coupling & casing W side @ 1m		357	10/08/2016	11:19 AM	Dd 00:00:37	82	84	83	83	82	91	9	Screw conveyor & reverse pulse	
14" FA249 motor platform W side centre @ 1m		358	10/08/2016	11:19 AM	Dd 00:00:22	83	84	84	83	82	90	7	-	
17' FA249 motor platform E side centre 1m		359	10/08/2016	11:20 AM	Dd 00:00:31	82	84	84	83	82	91	8	-	
17 FA249 motor platform E side coupling & casing 1m		360	10/08/2016	11:21 AM	Dd 00:00:37	84	88	88	85	83	94	9	Screw conveyor 86	
16 FA249 end at column 4.3m N of motor plinth		361	10/08/2016	11:22 AM	Dd 00:01:02	80	86	84	82	79	90	10	Screw conveyor noise	
18 FA249 Platform S side centre @ 1m		362	10/08/2016	11:24 AM	Dd 00:00:30	78	79	79	78	78	87	9	-	
18' FA249 platform S side under discharge duct E side		363	10/08/2016	11:24 AM	Dd 00:00:34	74	77	76	75	74	85	11	Screw conveyor noise	
19 FA249 S side @ 5m		364	10/08/2016	11:25 AM	Dd 00:00:53	73	75	74	73	72	84	12	-	
20 FA 249 S side @ 10m	365	10/08/2016	11:27 AM	Dd 00:00:35	73	75	74	73	72	86	13	Other sources are cause of level, not fan		
21 FA249 E side of fan casing ground level @ 2m	366	10/08/2016	11:28 AM	Dd 00:00:44	76	79	79	77	75	89	12	-		
FA250	22 FA250 S side 4m to motor end	367	10/08/2016	11:31 AM	Dd 00:00:44	83	92	89	86	79	90	6	Screw conveyors above 80 to 90	
	22' FA250 Motor end S side @ 1m	368	10/08/2016	11:32 AM	Dd 00:00:33	84	90	88	86	81	90	7	-	
	23 FA250 E side platform coupling & casing	369	10/08/2016	11:33 AM	Dd 00:00:33	86	92	90	88	84	95	9	84 to 88	
	24 FA250 E side centre motor @ 1m	370	10/08/2016	11:34 AM	Dd 00:00:30	84	90	88	86	82	92	8	82 to 85	
	25 FA250 coupling & casing W side 1m S	371	10/08/2016	11:35 AM	Dd 00:00:44	86	91	89	87	84	95	10	84 to 88	
	26 FA250 W side casing @ 1m & coupling @ 3m	372	10/08/2016	11:36 AM	Dd 00:00:31	83	90	89	86	80	90	7	-	
	27 FA250 W side 1m under inlet casing expansion joint	373	10/08/2016	11:36 AM	Dd 00:00:39	83	90	89	85	79	90	7	79-88 screw conveyors & reverse pulse	
	28 FA250 N side casing shaft platform 2 1m	374	10/08/2016	11:37 AM	Dd 00:00:37	85	89	89	86	83	92	8	Air discharges from Conditioning Tower base & screw conveyors	
	29 FA250 E side under discharge duct	375	10/08/2016	11:39 AM	Dd 00:01:00	82	90	88	83	79	91	9	Quiet 79, other noise above from Conditioning Tower & screw conveyors	
RM7 Roof Platform	Lower platform E side 1m to Magnete plate	376	10/08/2016	11:44 AM	Dd 00:00:30	86	90	89	88	85	90	3	-	
	Lower platform S side @ 1m to magnete plate	377	10/08/2016	11:45 AM	Dd 00:00:31	89	93	92	90	87	91	2	-	
	Lower platform W side @ 1m to magnete plate	378	10/08/2016	11:46 AM	Dd 00:00:30	86	93	89	88	85	90	4	-	
	Lower platform N side @ 1m to magnete plate	379	10/08/2016	11:46 AM	Dd 00:00:30	88	93	91	89	86	91	4	Door/cover is open 15mm at top	
	Lower platform N side @ 1m to BE casing	380	10/08/2016	11:47 AM	Dd 00:00:31	83	87	85	84	82	90	7	-	
	Lower platform E side @ 1m to BE casing	381	10/08/2016	11:48 AM	Dd 00:00:30	83	86	85	84	82	90	8	-	

Table 3.1: Boral Cement Berrima - 2016 Annual Noise Assessment - Site Sound Levels for Kiln 6 Upgrade

Sound levels at measurement locations

Area	Location	File No.	Date	Start Time	Period	Statistical Sound Level - dBA							Comment
						LAeq	LAMax	LA01	LA10	LA90	LCeq	LC-LA eq	
	Upper Platform Gbox @ 1m E side & 0.5m casing	382	10/08/2016	11:49 AM	Dd 00:00:31	80	82	81	81	79	89	9	-
	Upper Platform Gbox @ 1m N side	383	10/08/2016	11:50 AM	Dd 00:00:30	81	82	82	81	80	89	9	-
	Upper Platform motor end @ 1m W side	384	10/08/2016	11:50 AM	Dd 00:00:30	80	83	82	81	80	89	9	-
	Upper Platform BE casing @ 0.5m W side	385	10/08/2016	11:51 AM	Dd 00:00:30	78	81	80	79	77	92	15	-
	Upper Platform BE casing @ 1m S side	386	10/08/2016	11:52 AM	Dd 00:00:35	84	90	87	85	82	97	13	Cover over access plate/door removed
	Upper Platform BE casing @ 1m E side	387	10/08/2016	11:52 AM	Dd 00:00:26	79	82	81	80	79	88	9	Magnete needs a cover or damping
	Platform S of Magnete 2m to S side	388	10/08/2016	11:54 AM	Dd 00:00:30	85	88	87	86	83	88	3	-
	On tower to baghouse top S side above FA249 same level as roof RM7	389	10/08/2016	11:55 AM	Dd 00:00:39	74	78	77	75	72	84	10	-
	On tower to baghouse top S side above FA249 top level	390	10/08/2016	11:56 AM	Dd 00:00:31	70	74	73	71	69	86	16	-
	Baghouse S doorway open	391	10/08/2016	11:57 AM	Dd 00:00:33	81	96	93	79	73	86	5	Reverse pulse every 10 seconds
	Inside centre baghouse top	392	10/08/2016	11:58 AM	Dd 00:01:02	82	98	96	74	70	84	2	Ambient 70, reverse pulses
RM7 Inside	Top floor E open doorway	393	10/08/2016	12:02 PM	Dd 00:00:30	85	90	89	87	83	91	5	-
	Centre top 2m N of BE casing	394	10/08/2016	12:03 PM	Dd 00:00:34	89	93	93	91	87	94	5	88 to 90
	Top level 1m E side entry of conveyor to chute	395	10/08/2016	12:04 PM	Dd 00:00:38	90	96	94	92	88	94	4	-
	Top level in doorway of conveyor from RM6	396	10/08/2016	12:05 PM	Dd 00:00:30	86	90	89	87	85	92	7	-
	On conveyor walkway on centre from RM6	397	10/08/2016	12:05 PM	Dd 00:00:33	78	83	81	79	77	87	9	Screw conveyor squeals
	Top level by top of RM7	398	10/08/2016	12:06 PM	Dd 00:00:30	94	101	99	96	92	97	3	-
	Top level W side of chute entry of conveyor	399	10/08/2016	12:07 PM	Dd 00:00:31	92	97	95	94	90	95	3	-
	Top level centre W side platform	400	10/08/2016	12:08 PM	Dd 00:00:30	89	94	92	90	87	93	4	-
	Level 3 2m N of BE casing	401	10/08/2016	12:09 PM	Dd 00:00:32	90	93	92	91	89	96	5	-
	Level 3 1m E side of chute to mill top	402	10/08/2016	12:10 PM	Dd 00:00:41	93	101	99	95	91	97	4	90 - 100
	Level 3 between chute & duct on top of Mill	403	10/08/2016	12:11 PM	Dd 00:00:30	94	101	99	96	92	98	4	-
	Level 2 2m N side of BE casing	404	10/08/2016	12:12 PM	Dd 00:00:31	90	95	93	92	89	96	5	-
	Level 2 1m N of cone top of Mill	405	10/08/2016	12:13 PM	Dd 00:00:42	92	98	95	93	90	97	5	90-95
	Level 1 2m N of BE casing is work bench	406	10/08/2016	12:14 PM	Dd 00:00:39	91	95	94	92	90	96	4	-
	Level 1 2m to RM7 body N side	407	10/08/2016	12:15 PM	Dd 00:00:48	93	100	97	95	92	98	5	-
	Level 1 2m W side of RM7 on platform	408	10/08/2016	12:16 PM	Dd 00:00:34	94	106	100	95	91	98	4	90-100
	Ground Floor 3m N of BE casing	409	10/08/2016	12:18 PM	Dd 00:00:36	95	98	97	96	92	98	3	90-96
	Inside man door N side	410	10/08/2016	12:18 PM	Dd 00:00:40	94	97	96	95	92	98	4	-
	Inside N wall vent @ 1m	411	10/08/2016	12:19 PM	Dd 00:01:22	91	95	93	92	90	95	4	-
	Inside NW corner @ 2m to walls	412	10/08/2016	12:21 PM	Dd 00:00:31	91	95	94	92	89	95	5	-
	Inside W roll door @ 1m	413	10/08/2016	12:22 PM	Dd 00:00:50	92	98	96	93	90	96	4	90-92
	Drive motor N @ 2m to W end	414	10/08/2016	12:23 PM	Dd 00:00:31	93	96	96	94	92	98	5	-
	Drive motor N @ 2m to N side	415	10/08/2016	12:24 PM	Dd 00:00:42	94	98	97	95	93	98	4	-
	1m W side of feeder VF100 & entry chute	416	10/08/2016	12:24 PM	Dd 00:00:38	96	99	98	97	94	99	4	95-96
	Drive motor S side @ 2m and RM7 body @ 2m	417	10/08/2016	12:25 PM	Dd 00:00:42	93	98	97	94	91	97	4	-
	RM7 body S side @ 2m	418	10/08/2016	12:26 PM	Dd 00:00:41	93	99	97	95	91	98	5	-
	RM7 body E side @ 2m	419	10/08/2016	12:27 PM	Dd 00:00:31	93	98	96	94	91	98	5	-
	1m E side of feeder VF100 inlet chute & RM7 body	420	10/08/2016	12:28 PM	Dd 00:00:37	95	100	99	97	94	99	4	-
	In open man door E side	421	10/08/2016	12:29 PM	Dd 00:00:30	89	95	93	91	87	94	5	-
RM7 baghouse	On screw conveyor SC212 platform Level 1 W end side by fan motor @ 1m	422	10/08/2016	12:31 PM	Dd 00:00:31	81	88	85	83	80	89	8	70 to 80 on squeals
	Centre S side of screw in line with motor FA250	423	10/08/2016	12:32 PM	Dd 00:00:30	80	86	84	81	78	90	10	-
	E end of SC212 body @ 2m and other N-S aligned screw	424	10/08/2016	12:33 PM	Dd 00:00:36	95	99	98	97	92	97	2	Squeals 95 from SC212, quiet is 80
	Main platform of baghouse hopper screws S end chute W side between SC211 & gate valve	425	10/08/2016	12:35 PM	Dd 00:00:32	85	95	94	90	78	88	3	Squeals SC211 78-90
	Centre W side	426	10/08/2016	12:35 PM	Dd 00:00:31	91	100	100	96	80	92	1	Squeals SC211 80-100
	N end Sc211 but S of duct	427	10/08/2016	12:36 PM	Dd 00:00:35	84	94	92	88	78	89	5	78-90
	Centre E side - off	428	10/08/2016	12:37 PM	Dd 00:00:33	83	93	91	87	78	87	4	E side Screw appears off. Squeals W side 80-90
	By FA252 @ 1m shaft , casing & discharge box	429	10/08/2016	12:38 PM	Dd 00:00:41	83	87	86	84	82	92	9	Discharge box grill clogged - needs cleaning
	By FA252 discharge box grill @ 0.8m	430	10/08/2016	12:39 PM	Dd 00:00:20	87	89	89	88	86	94	8	-
	By FA252 @ 1m shaft , casing & inlet & discharge box	431	10/08/2016	12:40 PM	Dd 00:00:29	84	89	88	85	83	93	9	-
	FA252 motor casing & inlet E side	432	10/08/2016	12:40 PM	Dd 00:00:30	82	87	86	82	81	90	8	-
	Baghouse hopper platform level N end	433	10/08/2016	12:42 PM	Dd 00:00:31	80	90	88	84	76	87	7	Squeals 78-90
	Baghouse hopper centre platform	434	10/08/2016	12:43 PM	Dd 00:00:31	81	89	88	85	75	88	7	74-88

Table 3.1: Boral Cement Berrima - 2016 Annual Noise Assessment - Site Sound Levels for Kiln 6 Upgrade

Sound levels at measurement locations

Area	Location	File No.	Date	Start Time	Period hh:mm:ss	Statistical Sound Level - dBA							Comment	
						LAeq	LAMax	LA01	LA10	LA90	LCeq	LC-LA eq		
Kiln 6 Coal Road	30 Coal Road S side in line W side RM7	435	10/08/2016	1:59 PM	Dd 00:01:01	66	68	68	67	65	78	12	-	
	31 Coal Road S side in-line E side RM7	436	10/08/2016	2:01 PM	Dd 00:01:05	66	72	68	67	66	79	13	-	
	32 Coal Road S side in-line FA249	437	10/08/2016	2:02 PM	Dd 00:01:01	68	71	70	69	67	82	14	-	
	33 Coal Road S side Centre Blending Silo	438	10/08/2016	2:04 PM	Dd 00:01:00	68	72	69	68	67	82	14	Air cannon 71	
	34 Coal Road S side E side PHT	439	10/08/2016	2:05 PM	Dd 00:01:02	67	69	69	68	67	82	14	-	
	35 Coal Road S side E side new PHT	440	10/08/2016	2:06 PM	Dd 00:01:01	68	72	69	69	68	81	13	-	
	36 Coal Road S side E side drive platform	441	10/08/2016	2:07 PM	Dd 00:01:00	69	72	71	69	68	82	13	Air cannon 71	
	37 Coal Road S side centre column W support duct	442	10/08/2016	2:09 PM	Dd 00:01:00	69	71	71	70	69	81	12	-	
	38 Coal Road S side centre pedestal	443	10/08/2016	2:10 PM	Dd 00:01:00	69	74	72	70	68	88	19	-	
	39 Coal Road S side Between centre & E pedestal	444	10/08/2016	2:12 PM	Dd 00:01:00	69	71	71	70	68	81	12	-	
	40 Coal Road S side E pedestal	445	10/08/2016	2:13 PM	Dd 00:01:00	69	72	70	69	68	81	13	-	
	41 Coal Road S side W end Firing floor building	446	10/08/2016	2:16 PM	Dd 00:01:17	68	71	70	69	67	80	12	Coal truck in area	
	42 Coal Road S side opposite grate	447	10/08/2016	2:18 PM	Dd 00:00:28	69	70	70	69	68	80	12	-	
	43 Coal Road S side W side coal receival bin 25m to truck	448	10/08/2016	2:20 PM	Dd 00:01:01	67	70	69	68	66	79	12	-	
	43' South fence line opp CM fan discharge	449	10/08/2016	2:23 PM	Dd 00:01:00	61	66	64	62	60	80	19	Wind 3-4m/s W, bird 64	
	39' South fence at corner post opp E duct support	450	10/08/2016	2:24 PM	Dd 00:01:00	65	67	66	65	64	79	14	-	
	35' South Fence by E end new building	451	10/08/2016	2:26 PM	Dd 00:01:00	61	65	63	62	60	75	14	-	
	43A Kerb E side CM opp CM fan discharge	452	10/08/2016	2:31 PM	Dd 00:01:00	80	83	82	81	79	87	7	-	
	44 CM fan room door @ 2m	453	10/08/2016	2:32 PM	Dd 00:00:39	84	86	85	85	84	92	7	CM fan discharge above is main source	
	44' CM S wall door opp mill motor drive is open	454	10/08/2016	2:34 PM	Dd 00:01:07	83	87	85	83	82	89	7	-	
	45 CM S roll door and wall vent @ 10m S side	455	10/08/2016	2:36 PM	Dd 00:00:31	78	79	78	78	77	86	8	-	
	46 CM room wall vent @ 2m	456	10/08/2016	2:37 PM	Dd 00:00:30	82	82	82	82	81	91	9	-	
	Kerb S side of Kiln	47A Centre between CM Room and grate	457	10/08/2016	2:39 PM	Dd 00:00:31	79	81	81	80	79	88	8	-
		47 Opp FA264 @ 8m	458	10/08/2016	2:40 PM	Dd 00:00:55	80	81	80	80	79	88	9	-
47C Between FA264 & FA200		459	10/08/2016	2:41 PM	Dd 00:00:30	80	82	81	80	80	88	8	-	
47D FA 200 S Side @ 5m		460	10/08/2016	2:42 PM	Dd 00:00:41	82	83	82	82	81	89	8	-	
48 Opp. E pedestal roller		461	10/08/2016	2:43 PM	Dd 00:00:33	81	82	82	81	80	88	7	-	
49 Half way between centre & E pedestals		462	10/08/2016	2:43 PM	Dd 00:00:35	81	82	82	82	81	89	7	-	
50 Opp. Centre pedestal		463	10/08/2016	2:44 PM	Dd 00:00:30	81	82	81	81	80	87	7	-	
51 Half way between Centre & Western pedestals		464	10/08/2016	2:45 PM	Dd 00:00:28	77	79	78	77	77	86	9	-	
52A Opp E end of kiln drive platform		465	10/08/2016	2:46 PM	Dd 00:00:46	78	80	79	78	77	86	9	-	
52 Opp W pedestal roller		466	10/08/2016	2:47 PM	Dd 00:00:31	76	80	78	77	75	87	11	-	
Kiln Drive platform	53 Kiln drive platform Centre E end on platform	467	10/08/2016	3:00 PM	Dd 00:00:34	87	89	88	88	86	94	7	-	
	E side of S drive motor @ 1.5m, 2m to Gbox	468	10/08/2016	3:01 PM	Dd 00:00:34	86	87	87	86	86	93	7	-	
	S side of S Gbox @ 1.5m	469	10/08/2016	3:02 PM	Dd 00:00:30	87	88	88	87	86	94	7	-	
	S side of S drive ring	470	10/08/2016	3:03 PM	Dd 00:00:30	80	84	83	81	79	90	9	-	
	Between Gboxes	471	10/08/2016	3:03 PM	Dd 00:00:33	88	89	89	88	87	95	8	-	
	N side of N drive & Gbox @ 1.5m	472	10/08/2016	3:04 PM	Dd 00:00:30	86	88	87	87	86	94	7	-	
Kerb N side Kiln 6	54 W end RM6	473	10/08/2016	3:08 PM	Dd 00:00:37	70	72	72	71	69	81	11	-	
	55 Centre RM6	474	10/08/2016	3:09 PM	Dd 00:00:36	72	73	73	72	71	82	11	-	
	56 E End RM6	475	10/08/2016	3:09 PM	Dd 00:00:51	76	79	79	78	75	85	9	-	
	56' Between RM6 & New wall for FA38	476	10/08/2016	3:11 PM	Dd 00:00:30	82	85	85	83	80	88	6	80-83 screw squeals	
	57 Door opp FA38	477	10/08/2016	3:12 PM	Dd 00:01:03	79	83	82	80	77	88	9	Fans behind off	
	58 Half way between FA38 & FA39	478	10/08/2016	3:13 PM	Dd 00:00:42	79	82	82	80	78	89	10	-	
	59 Opp FA39 end	479	10/08/2016	3:14 PM	Dd 00:00:31	79	81	81	80	78	89	10	-	
	59A 2m N of FA39 motor	480	10/08/2016	3:15 PM	Dd 00:00:36	82	85	85	83	81	92	9	-	
	59B 5m E of FA39 motor on concrete line	481	10/08/2016	3:16 PM	Dd 00:00:36	83	85	84	84	83	93	10	-	
	59C 5.3m W of FA39 motor at steel plate	482	10/08/2016	3:16 PM	Dd 00:01:11	88	92	91	89	86	93	6	-	
	60 Opp Conditioning Tower	483	10/08/2016	3:18 PM	Dd 00:00:32	80	81	81	80	79	89	10	-	
	60' Opp. Stack	484	10/08/2016	3:19 PM	Dd 00:00:32	78	80	80	79	78	89	10	-	
	61 Opp centre PHT	485	10/08/2016	3:19 PM	Dd 00:00:31	77	78	78	78	77	88	11	-	
	61' Opp E side of old PHT	486	10/08/2016	3:20 PM	Dd 00:00:32	76	79	78	77	76	87	11	-	
	63 Opp E side new PHT	487	10/08/2016	3:21 PM	Dd 00:00:31	77	82	80	78	77	88	11	-	

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Sound levels at measurement locations

Area	Location	File No.	Date	Start Time	Period	Statistical Sound Level - dBA							Comment
						LAeq	LAMax	LA01	LA10	LA90	LCeq	LC-LA eq	
	64 E end drive platform	488	10/08/2016	3:22 PM	Dd 00:00:52	79	81	80	80	79	88	8	New KSCFs under E and W sides of centre pedestal
	65 Opp column for return duct W side	489	10/08/2016	3:23 PM	Dd 00:00:31	81	83	82	82	81	88	7	-
	66 Opp centre pedestal	490	10/08/2016	3:24 PM	Dd 00:00:32	85	86	86	85	85	91	6	-
	67 Half way between centre & e pedestals	491	10/08/2016	3:25 PM	Dd 00:00:33	85	86	85	85	84	91	7	Some KSCFs not on.
	Opp E pedestal	492	10/08/2016	3:26 PM	Dd 00:00:31	86	87	86	86	86	93	7	-
	69 Centre courtyard	493	10/08/2016	3:27 PM	Dd 00:00:30	89	89	89	89	88	96	8	-
	FA201 @ 2m	494	10/08/2016	3:28 PM	Dd 00:00:30	90	91	91	90	90	97	7	-
	Between FA201 & 203 & 202	495	10/08/2016	3:28 PM	Dd 00:00:47	93	94	94	94	93	99	6	-
	FA203 inlet & casing @ 2m	496	10/08/2016	3:29 PM	Dd 00:00:27	89	90	89	89	88	97	8	-
	Between inlet filters 205 & 206	497	10/08/2016	3:30 PM	Dd 00:00:30	85	87	86	85	85	95	10	-
Radicon Cooler	RC L1 centre fan @ 1m	498	10/08/2016	3:32 PM	Dd 00:00:30	91	92	91	91	90	100	9	-
	RC L1 N fan @ 1m	499	10/08/2016	3:33 PM	Dd 00:00:30	90	91	91	91	90	100	10	-
	RC L1 S fan @ 0.5m	500	10/08/2016	3:33 PM	Dd 00:00:21	92	93	93	92	91	103	11	-
	RC L2 centre fan @ 1m	501	10/08/2016	3:34 PM	Dd 00:00:30	94	95	95	94	94	102	8	-
	RC L2 S fan @ 0.7m	502	10/08/2016	3:35 PM	Dd 00:00:24	95	96	96	95	94	103	8	-
	RC L2 N fan @ 1m	503	10/08/2016	3:36 PM	Dd 00:00:32	95	96	96	96	95	103	7	-
	RC L3 Centre fan @ 1m	504	10/08/2016	3:37 PM	Dd 00:00:30	95	95	95	95	94	102	8	-
	RC L3 S fan @ 0.7m	505	10/08/2016	3:37 PM	Dd 00:00:25	93	94	94	94	93	103	10	-
	RC L3 N fan @ 1m	506	10/08/2016	3:38 PM	Dd 00:00:35	94	96	95	95	94	103	8	-
	RC L4 Centre fan @ 1m	507	10/08/2016	3:39 PM	Dd 00:00:36	92	94	93	93	92	102	9	-
	RC L4 S fan @ 0.7m	508	10/08/2016	3:40 PM	Dd 00:00:23	91	94	93	92	91	102	10	-
	RC L4 N fan @ 1m	509	10/08/2016	3:41 PM	Dd 00:00:31	93	94	94	93	93	102	9	-
	RC L5 face E	510	10/08/2016	3:42 PM	Dd 00:00:30	84	85	84	84	83	94	11	-
	RC L5 face W	511	10/08/2016	3:42 PM	Dd 00:00:32	85	86	86	85	84	94	9	-
	RC rear centre @ 2m	512	10/08/2016	3:45 PM	Dd 00:00:40	86	87	86	86	85	96	10	-
	RC rear centre @ 7.7m	513	10/08/2016	3:46 PM	Dd 00:00:46	84	85	84	84	83	94	11	-
	RC rear centre @ 13.3m	514	10/08/2016	3:47 PM	Dd 00:00:44	81	82	81	81	80	92	11	-
	RC rear centre @ 18m	515	10/08/2016	3:48 PM	Dd 00:00:38	78	79	79	78	78	90	12	-
Kiln firing floor	Centre N side opening	516	10/08/2016	3:50 PM	Dd 00:00:32	82	82	82	82	81	91	9	-
	Centre S side opening	517	10/08/2016	3:51 PM	Dd 00:00:31	82	93	90	82	81	87	5	Air cannon 93
	FA210 Kiln Discharge Seal Fan S inlet	518	10/08/2016	3:52 PM	Dd 00:00:21	94	96	95	95	94	96	2	Is too high - review condition
	FA200 inlet side @ 1m	519	10/08/2016	3:54 PM	Dd 00:00:30	85	87	86	86	85	93	8	-
	Kiln floor centre E S of duct/clinker elevator	520	10/08/2016	3:56 PM	Dd 00:00:30	79	80	80	80	79	87	8	-
	FA209 Kiln Discharge Seal Fan N inlet	521	10/08/2016	3:57 PM	Dd 00:00:30	92	93	93	93	92	97	5	Influence from KSCFs
	Firing floor S side opening to S centre	522	10/08/2016	3:58 PM	Dd 00:00:30	76	78	77	76	75	84	9	-
FA215	Motor S end @ 2.5m	523	10/08/2016	3:59 PM	Dd 00:00:30	80	81	81	81	80	89	8	-
	Platform E side drive coupling @ casing @ 1m	524	10/08/2016	4:00 PM	Dd 00:00:31	85	86	86	85	85	91	6	-
	W side platform @ 1m to coupling & casing	525	10/08/2016	4:01 PM	Dd 00:00:39	85	86	86	86	85	91	6	-
	Under expansion joint discharge duct to stack @ 1m	526	10/08/2016	4:02 PM	Dd 00:00:31	79	80	79	79	79	89	11	-
	N side inlet box platform @ 1m to discharge duct & inlet box	527	10/08/2016	4:03 PM	Dd 00:00:31	77	78	77	77	76	89	13	-
	Platform centre N side inlet box	528	10/08/2016	4:03 PM	Dd 00:00:30	76	77	76	76	75	87	12	-
	Under Inlet box W side entry duct	529	10/08/2016	4:04 PM	Dd 00:00:30	79	80	80	80	79	90	10	-
	Inlet box N side ground level 2 1m	530	10/08/2016	4:05 PM	Dd 00:00:20	75	76	76	75	75	88	13	-
	Coal Mill Building N roll door @ 2m	531	10/08/2016	4:06 PM	Dd 00:00:30	84	85	84	84	84	91	8	Door open on bottom 100mm
	Centre between Grate & CM blower room roll door	532	10/08/2016	4:07 PM	Dd 00:00:33	86	87	87	87	86	93	7	-
Admin Building	Roof SW corner opp E end RM6	533	10/08/2016	4:16 PM	Dd 00:01:13	69	71	71	70	68	80	11	-
	SE corner opp FA38	534	10/08/2016	4:18 PM	Dd 00:01:00	71	73	73	71	70	81	10	-
	NE corner opp FA520	535	10/08/2016	4:19 PM	Dd 00:01:00	71	73	73	72	70	80	9	Locos, train

Table 3.1A: Boral Cement Berrima - 2016 Annual Noise Assessment - Site Sound Levels for Kiln 6 Upgrade

Tonality of Sound levels at measurement locations

Pink shaded cells with red text have tonality values exceeding the criteria

File	Area	Location	Tonality in LAeq 1/3 Octave Band Sound Level - dBA in Frequency Band Hz																													
			31.5 Hz	40 Hz	50 Hz	63 Hz	80 Hz	100 Hz	125 Hz	160 Hz	200 Hz	250 Hz	315 Hz	400 Hz	500 Hz	630 Hz	800 Hz	1 kHz	1.25 kHz	1.6 kHz	2 kHz	2.5 kHz	3.15 kHz	4 kHz	5 kHz	6.3 kHz	8 kHz	10 kHz	12.5 kHz	16 kHz		
527		N side inlet box platform @ 1m to discharge duct & inlet box	3	5	5	2	3	3	3	4	0	1	1	1	2	1	0	0	1	0	1	0	1	0	1	4	2	0	0	0	1	1
528		Platform centre N side inlet box	3	4	1	3	0	0	2	2	1	2	1	0	1	0	1	0	1	0	1	2	0	5	0	0	0	1	1	0		
529		Under Inlet box W side entry duct	2	3	1	1	2	0	2	0	1	0	0	0	1	1	0	0	1	1	1	1	1	4	2	1	0	2	2	1		
530		Inlet box N side ground level 2.1m	4	3	1	3	2	1	0	2	0	1	1	0	0	1	0	0	0	0	1	1	3	2	0	1	0	1	1			
531		Coal Mill Building N roll door @ 2m	4	4	1	3	1	0	2	2	1	0	0	0	0	1	2	0	0	1	1	1	1	1	1	1	1	1	2	0		
532		Centre between Grate & CM blower room roll door	2	3	0	1	1	1	2	3	3	3	3	5	3	2	1	1	0	1	1	1	1	0	1	0	0	1	0	1		
533	Admin Building	Roof SW corner opp E end RM6	1	1	2	2	0	1	0	1	0	2	0	1	0	0	1	1	0	3	1	0	0	1	0	1	1	1	0	0		
534		SE corner opp FA38	2	2	2	1	0	1	1	4	1	3	1	1	1	1	0	1	0	2	1	0	1	1	0	1	1	1	1	2		
535		NE corner opp FA520	1	1	0	1	0	1	0	2	0	2	0	2	1	1	1	0	0	1	0	1	1	0	2	2	1	0	0	2		

Table 3.2: Boral Cement Berrima - 2016 Annual Noise Assessment - Site Sound Levels for Kiln 6 Upgrade
Comparison and difference with results for previous years for the same locations

Area	Location	File No.	Date	Start Time	Period	Statistical Sound Level - LAeq dBA										Difference to 2016 = 2016 - 20XX dB							Comment			
						LAeq 2016	LA90	LAeq 2015	LAeq 2014	LAeq 2013	LAeq 2012	LAeq 2011	LAeq 2010	LAeq 2009	LAeq 2006	2015	2014	2013	2012	2011	2010	2009		2006		
																2015	2014	2013	2012	2011	2010	2009		2006		
	8 RM7 E wall vents NE corner @ 1m	336	21/07/2016	4:42 PM	0d 00:00:38	85	84	84	83	84	85	82	83	84		2	2	1	0	3	2	1		-		
	8 RM7 E wall vents NE corner @ 1m	349	10/08/2016	11:08 AM	0d 00:00:41	85	84																	84 to 87 av 86 equal inside RM7 & screw conveyors		
	9 RM7 E side under duct	350	10/08/2016	11:09 AM	0d 00:00:50	81	80	81	79	81	82	81	80	80		0	1	0	-1	0	1	1		-		
	10 RM7 By E door Hydraulics room open	351	10/08/2016	11:10 AM	0d 00:00:40	74	73	73	73	72	74	74	73	74		1	1	2	0	1	1	0		Hydraulics on but low		
	11 RM7 Centre Compressor room door @ 1m closed	352	10/08/2016	11:12 AM	0d 00:00:31	74	73	74	73	71	72	71	73		0	1	3	2	3	1						
	12 RM7 Under inlet for switchroom fan	353	10/08/2016	11:12 AM	0d 00:00:32	84	83	87	83							-4	1									
FA249	13 FA249 under inlet duct W side	354	10/08/2016	11:14 AM	0d 00:00:35	78	78	78	80	80						0	-2	-2						Screw conveyor noise		
	14 FA249 2m W side ground level	355	10/08/2016	11:15 AM	0d 00:00:36	82	81	80	80	80						2	2	2								
	15 FA249 1m motor end	356	10/08/2016	11:17 AM	0d 00:00:32	82	81	81	80	81	81					2	2	1	1							
	14' FA249 motor platform fan coupling & casing W side @ 1m	357	10/08/2016	11:19 AM	0d 00:00:37	82	82	82	80	81	82	81	79	79		0	2	1	1	2	3	3			Screw conveyor & reverse pulse	
	14" FA249 motor platform W side centre @ 1m	358	10/08/2016	11:19 AM	0d 00:00:22	83	82																			
	17' FA249 motor platform E side centre 1m	359	10/08/2016	11:20 AM	0d 00:00:31	82	82																			
	17 FA249 motor platform E side coupling & casing 1m	360	10/08/2016	11:21 AM	0d 00:00:37	84	83	82	81	82	84	82	89	83		2	4	2	1	2	-5	1			Higher levels may be from screws	
	16 FA249 end at column 4.3m N of motor plinth	361	10/08/2016	11:22 AM	0d 00:01:02	80	79	79	77	79	81	82	82			2	3	1	0	-1	-2				Level depends on screw conveyor squeals	
	18 FA249 Platform S side centre @ 1m	362	10/08/2016	11:24 AM	0d 00:00:30	78	78	78	78	78	76	77	83	79		0	0	0	2	1	-5	-1				
	18' FA249 platform S side under discharge duct E side	363	10/08/2016	11:24 AM	0d 00:00:34	74	74																		Screw conveyor noise	
	19 FA249 S side @ 5m	364	10/08/2016	11:25 AM	0d 00:00:53	73	72	72	72	73	73	73	74			0	1	-1	-1	0	-2					
	20 FA 249 S side @ 10m	365	10/08/2016	11:27 AM	0d 00:00:35	73	72	72	72	73	73	73				0	1	0	-1	-1					Other sources are cause of level, not fan	
21 FA249 E side of fan casing ground level @ 2m	366	10/08/2016	11:28 AM	0d 00:00:44	76	75	76	76	76	77	76	79			0	0	1	-1	0	-3						
FA250	22 FA250 S side 4m to motor end	367	10/08/2016	11:31 AM	0d 00:00:44	83	79	79	78							4	5								Screw conveyor noise main source in 2016	
	22' FA250 Motor end S side @ 1m	368	10/08/2016	11:32 AM	0d 00:00:33	84	81	82	80	82	83	82	83			2	3	2	1	2	1					
	23 FA250 E side platform coupling & casing	369	10/08/2016	11:33 AM	0d 00:00:33	86	84	84	83	83	85	84				2	2	3	0	2						
	24 FA250 E side centre motor @ 1m	370	10/08/2016	11:34 AM	0d 00:00:30	84	82	85	80	85	86					-1	4	-1	-2						Screw noise 82 to 85	
	25 FA250 coupling & casing W side 1m S	371	10/08/2016	11:35 AM	0d 00:00:44	86	84	84	80	85	86					2	6	1	0						Screw noise 84 to 88	
	26 FA250 W side casing @ 1m & coupling @ 3m	372	10/08/2016	11:36 AM	0d 00:00:31	83	80	81	79	83	83	84	85	81		2	4	0	0	-1	-2	2				
	27 FA250 W side 1m under inlet casing expansion joint	373	10/08/2016	11:36 AM	0d 00:00:39	83	79	80	78	85	84					3	4	-3	-1						79-88 screw conveyors & reverse pulse	
	28 FA250 N side casing shaft platform 2 1m	374	10/08/2016	11:37 AM	0d 00:00:37	85	83	84	84	91	86	85	93	83		0	1	-6	-2	0	-8	2			Air discharges from Conditioning Tower base & screw conveyors	
	29 FA250 E side under discharge duct	375	10/08/2016	11:39 AM	0d 00:01:00	82	79	82								-1									Quiet 79, other noise above from Conditioning Tower & screw conveyors	
	RM7 Roof Platform	Lower platform E side 1m to Magnete plate	376	10/08/2016	11:44 AM	0d 00:00:30	86	85	89	83	88	87	85	88	90		-2	4	-2	0	2	-2	-4			Levels depend on flow rate
Lower platform S side @ 1m to magnete plate		377	10/08/2016	11:45 AM	0d 00:00:31	89	87	90	82	91	91	87	91	93		-1	7	-2	-3	2	-2	-4				
Lower platform W side @ 1m to magnete plate		378	10/08/2016	11:46 AM	0d 00:00:30	86	85	88	81	87	85					-2	5	-1	2							
Lower platform N side @ 1m to magnete plate		379	10/08/2016	11:46 AM	0d 00:00:30	88	86										4	-4	4	3	4	2			Door/cover is open 15mm at top	
Lower platform N side @ 1m to BE casing		380	10/08/2016	11:47 AM	0d 00:00:31	83	82	84	83	86	81					-1	0	-3	2							
Lower platform E side @ 1m to BE casing		381	10/08/2016	11:48 AM	0d 00:00:30	83	82	85								-2										
Upper Platform Gbox @ 1m E side & 0.5m casing		382	10/08/2016	11:49 AM	0d 00:00:31	80	79	81	77	80	79					-2	2	0	1							
Upper Platform Gbox @ 1m N side		383	10/08/2016	11:50 AM	0d 00:00:30	81	80	83	81	83						-2	-1	-3								
Upper Platform motor end @ 1m W side		384	10/08/2016	11:50 AM	0d 00:00:30	80	80	81								0										
Upper Platform BE casing @ 0.5m W side		385	10/08/2016	11:51 AM	0d 00:00:30	78	77	79	78	81	79	78	81	82		-1	0	-3	-1	-1	-3	-4				
Upper Platform BE casing @ 1m S side		386	10/08/2016	11:52 AM	0d 00:00:35	84	82	81	83	85	83	78	80	85		3	1	-1	1	6	4	-1				Cover over access plate/door removed
Upper Platform BE casing @ 1m E side		387	10/08/2016	11:52 AM	0d 00:00:26	79	79	79								0										Magnete needs a cover or damping
Platform S of Magnete 2m to S side		388	10/08/2016	11:54 AM	0d 00:00:30	85	83	87								-2										Distance 2016 @ 2m, 2015 @ 1.5m
On tower to baghouse top S side above FA249 same level as roof RM7		389	10/08/2016	11:55 AM	0d 00:00:39	74	72	70	69	70	71	71				4	5	4	3	3						May be slightly different location
On tower to baghouse top S side above FA249 top level		390	10/08/2016	11:56 AM	0d 00:00:31	70	69	69	71	68						1	-1	1								
Baghouse S doorway open	391	10/08/2016	11:57 AM	0d 00:00:33	81	73	80	78	72	87	96	73			1	3	9	-6	-15	8				Level depends on reverse pulse number and operation (was every 10 seconds)		
Inside centre baghouse top	392	10/08/2016	11:58 AM	0d 00:01:02	82	70	83	81							-2	1								Ambient 70, reverse pulses		
RM7 Inside	Top floor E open doorway	393	10/08/2016	12:02 PM	0d 00:00:30	85	83	86								-1										
	Centre top 2m N of BE casing	394	10/08/2016	12:03 PM	0d 00:00:34	89	87	92								-3									88 to 90	
	Top level 1m E side entry of conveyor to chute	395	10/08/2016	12:04 PM	0d 00:00:38	90	88	89								1										
	Top level in doorway of conveyor from RM6	396	10/08/2016	12:05 PM	0d 00:00:30	86	85	86	85	88	88					-1	1	-3	-2							
	On conveyor walkway on centre from RM6	397	10/08/2016	12:05 PM	0d 00:00:33	78	77	78	76	79	78	87	88	84		0	2	-2	-1	-9	-10	-6				
	Top level by top of RM7	398	10/08/2016	12:06 PM	0d 00:00:30	94	92	92	94	96	98	95	93	94		2	0	-2	-4	-1	1	0				
	Top level W side of chute entry of conveyor	399	10/08/2016	12:07 PM	0d 00:00:31	92	90	93	92	94						-1	0	-2								
Top level centre W side platform	400	10/08/2016	12:08 PM	0d 00:00:30	89	87	91								-2											

Table 3.2: Boral Cement Berrima - 2016 Annual Noise Assessment - Site Sound Levels for Kiln 6 Upgrade
Comparison and difference with results for previous years for the same locations

Differences highlighted pink if greater than 3 dB

Area	Location	File No.	Date	Start Time	Period hh:mm:ss	Statistical Sound Level - LAeq dBA										Difference to 2016 = 2016 - 20XX dB						Comment	
						LAeq 2016	LA90	LAeq 2015	LAeq 2014	LAeq 2013	LAeq 2012	LAeq 2011	LAeq 2010	LAeq 2009	LAeq 2006	2015	2014	2013	2012	2011	2010		2009
FA215	Motor S end @ 2.5m	523	10/08/2016	3:59 PM	Dd 00:00:30	80	80	81	87	85	85	86	85	84		-1	-6	-4	-5	-6	-5	-4	
	Platform E side drive coupling @ casing @ 1m	524	10/08/2016	4:00 PM	Dd 00:00:31	85	85	85	85	85						0	1	0					
	W side platform @ 1m to coupling & casing	525	10/08/2016	4:01 PM	Dd 00:00:39	85	85	86	87	85	86	87				-1	-2	1	-1	-1			
	Under expansion joint discharge duct to stack @ 1m	526	10/08/2016	4:02 PM	Dd 00:00:31	79	79	80	81	78	81	80	78	79		-1	-2	0	-2	-1	1	0	
	N side inlet box platform @ 1m to discharge duct & inlet box	527	10/08/2016	4:03 PM	Dd 00:00:31	77	76	79	79	75						-3	-2	2					
	Platform centre N side inlet box	528	10/08/2016	4:03 PM	Dd 00:00:30	76	75	79	79	74	78	78	78	74		-3	-3	2	-3	-2	-2	2	
	Under Inlet box W side entry duct	529	10/08/2016	4:04 PM	Dd 00:00:30	79	79	81	83							-2	-3						
	Inlet box N side ground level 2 1m	530	10/08/2016	4:05 PM	Dd 00:00:20	75	75	78	77							-3	-2						
	Coal Mill Building N roll door @ 2m	531	10/08/2016	4:06 PM	Dd 00:00:30	84	84	84	90	88						0	-6	-4					
Centre between Grate & CM blower room roll door	532	10/08/2016	4:07 PM	Dd 00:00:33	86	86	89	89	92						-3	-3	-5						
Admin Building Roof S side centre opp RM6 E side	322	21/07/2016	4:20 PM	Dd 00:01:00	69	68	71								-2								
Admin Building	Roof SW corner opp E end RM6	533	10/08/2016	4:16 PM	Dd 00:01:13	69	68																
	Admin Building Roof SE corner side centre opp FA38 & ESP	323	21/07/2016	4:21 PM	Dd 00:01:16	70	69																
	SE corner opp FA38	534	10/08/2016	4:18 PM	Dd 00:01:00	71	70																
	Admin Building Roof NE corner opp FA502 & CM7	326	21/07/2016	4:26 PM	Dd 00:01:00	68	68	69								0							
	NE corner opp FA520	535	10/08/2016	4:19 PM	Dd 00:01:00	71	70																



Figure 3.5: Coal Mill fan room door open, southern side of Coal Mill Building

One grate cooler fan measurement location on the northern side was higher than 2013 and earlier levels but the same as 2014 and 2015 – a slightly different measurement location is the likely reason for this difference.

For the Radicon cooler, sound levels were mostly 4 to 11 dB higher than in 2015. This is compared to 2015 being 9 to 10 dB lower compared to some previous measurements. Sound levels depend on the load and associated variable speed of the fans. The sound levels at the rear of the fans on the eastern side of the cooler were the same as 2015 but higher by 0 to 7 dB compared to previous but this will not affect any residential receivers.

At the kiln firing floor the southern kiln discharge seal fan FA210 had a significantly higher sound level than in 2014 and higher sound level than the similar northern side fan FA209 (which is influenced by Kiln Shell Cooler Fan emissions). It is recommended that this fan and its silencer be reviewed for maintenance condition.

Sound levels on the PHT were similar to or slightly lower than those of the past. The emissions from the top of the Raw Meal silo where baghouse emissions through the roof of the silo occur remain high but were lower than in 2015 (Figure 3.6 shows photos of this area). As noted in 2015, this may be a different location change in condition of the fan or silencer but they are recommended to be reviewed for maintenance condition.

Compliance Assessment for Kiln 6 Upgrade Items

Sound levels from Kiln 6 Upgrade sources which were more than 3 dB higher than previously measured results as shown in Table 3.2, have been collated in Table 3.3 to determine their potential significance for compliance with the environmental noise objectives for the upgrade. Also given in this table are the distance of the measurement and the distance to receiver locations at:

- Adelaide Street
- Brisbane Street
- Melbourne Street
- Argyll Street
- Southern side receivers (~1460m south of the site). This was added in 2013 to ensure these receivers are considered, although they are not in the licence or approvals.)

The objective contribution sound levels for those receivers are also given at the top of the table section. The table then provides an initial screening test to determine the significance of the increase in sound level. It calculates the attenuation occurring over distance only to each of the receivers, allowing for directivity but not including potential barrier attenuation from intervening buildings, external walls or atmospheric absorption, all of which will add to the calculated sound level reduction. This initial distance attenuation is shown in red text in Table 3.3. The calculations also include octave band frequency spectra in assessing directivity effects for sources directing sound in specific directions, then adds the distance attenuation between the source location in the plant and the receiver location. The resulting source contribution sound level at the receiver location is calculated and is shown in blue text in the table. If the calculated receiver



Figure 3.6: Area on top of the Raw Meal Silo Building near FA260 where noise from the baghouse fan below causes elevated sound levels

**Table 3.3: Boral Cement Berrima Works
Noise Assessment Kiln 6 Upgrade: July - August 2016 Annual Compliance Assessment
Measurement locations with increase in sound level > 3 dB and calculated contribution sound level at receivers**

Location	Year	Time	Period d:h:m:s	Sound Level dB(A) L _{AEQ,t}	Comments	Distance measured	Distance to Receivers				
							Distance Attenuation to receiver				
							Calculated LAEQ level at receiver distance only				
							Adelaide	Brisbane	Melbourne	Argyle	Sth
Kiln 6 Upgrade						Objective	37	37	37	37	37
PHT Level 8 FA263 motor & casing F231	2016	2:10 PM	00d 00:00:39	85	Distance	1	666	754	745	890	1506
	2012			81	Source after directivity		75	75	78	78	80
<i>Difference 2016 - 2012</i>			<i>Difference</i>	4	Distance reduction		-56	-58	-57	-59	-64
					<i>Calculated SPL without barriers</i>		19	18	20	19	17
PHT Level 2.25 by centre by kiln entry F299	2016	3:35 PM	00d 00:00:33	86	Distance	3	666	754	745	890	1506
	2014			82	Source after directivity		65	66	66	68	66
<i>Difference 2016 - 2014</i>			<i>Difference</i>	5	Distance reduction		-47	-48	-48	-49	-54
					<i>Calculated SPL without barriers</i>		18	18	18	18	12
PHT Level 2 DC70 FA03 discharge @ 1.5m F301	2016	3:38 PM	00d 00:00:31	89	Distance	1.5	666	754	745	890	1506
	2014			85	Source after directivity		87	89	89	89	83
<i>Difference 2016 - 2014</i>			<i>Difference</i>	4	Distance reduction		-53	-54	-54	-55	-60
					<i>Calculated SPL without barriers</i>		34	35	35	34	23
RM7 FA249 17 FA249 motor platform E side coupling & casing 1m F360	2016	11:21 AM	00d 00:00:37	84	Distance	1	703	792	772	907	1455
	2014			81	Source after directivity		75	74	72	71	72
<i>Difference 2016 - 2014</i>			<i>Difference</i>	4	Distance reduction		-57	-58	-58	-59	-63
					<i>Calculated SPL without barriers</i>		18	16	15	12	9
RM7 22 FA250 S side 4m to motor end F367	2016	11:31 AM	00d 00:00:44	83	Distance	4	677	765	751	885	1483
	2014			78	Source after directivity		60	60	61	63	83
<i>Difference 2016 - 2014</i>			<i>Difference</i>	5	Distance reduction		-45	-46	-45	-47	-51
					<i>Calculated SPL without barriers</i>		15	15	16	16	32
RM7 25 FA250 coupling & casing W side 1m S F371	2016	11:35 AM	00d 00:00:44	86	Distance	1	677	765	751	885	1483
	2014			80	Source after directivity		75	78	80	80	80
<i>Difference 2016 - 2014</i>			<i>Difference</i>	6	Distance reduction		-57	-58	-58	-59	-63
					<i>Calculated SPL without barriers</i>		19	20	23	21	17
RM7 Roof Lower platform E side 1m to Magnete plate F376	2016	11:44 AM	00d 00:00:30	86	Distance	1	692	778	758	886	1459
	2014			83	Source after directivity		72	70	68	66	68
<i>Difference 2016 - 2014</i>			<i>Difference</i>	4	Distance reduction		-57	-58	-58	-59	-63
					<i>Calculated SPL without barriers</i>		15	12	10	7	5
RM7 Roof Lower platform S side @ 1m to magnete plate F377	2016	11:45 AM	00d 00:00:31	89	Distance	1	692	778	758	886	1459
	2014			82	Source after directivity		58	59	60	62	89
<i>Difference 2016 - 2014</i>			<i>Difference</i>	7	Distance reduction		-57	-58	-58	-59	-63
					<i>Calculated SPL without barriers</i>		1	1	2	3	26
RM7 Roof Lower platform W side @ 1m to magnete plate F378	2016	11:46 AM	00d 00:00:30	86	Distance	1	692	778	758	886	1459
	2014			81	Source after directivity		72	75	79	79	79
<i>Difference 2016 - 2014</i>			<i>Difference</i>	5	Distance reduction		-57	-58	-58	-59	-63
					<i>Calculated SPL without barriers</i>		15	18	21	20	16
RM7 Roof Lower platform N side @ 1m to magnete plate F379	2016	11:46 AM	00d 00:00:30	88	Distance	1	692	778	758	886	1459
	2014			84	Source after directivity		88	88	88	88	61
<i>Difference 2016 - 2014</i>			<i>Difference</i>	4	Distance reduction		-57	-58	-58	-59	-63
					<i>Calculated SPL without barriers</i>		31	30	30	29	-2
RM7 Roof Upper Platform BE casing @ 1m S side F 386	2016	11:52 AM	00d 00:00:35	84	Distance	1	692	778	758	886	1459
	2010			78	Source after directivity		63	63	64	65	84
<i>Difference 2016 - 2010</i>			<i>Difference</i>	6	Distance reduction		-57	-58	-58	-59	-63
					<i>Calculated SPL without barriers</i>		6	6	6	6	21
RM7 On tower to baghouse top S side above FA249 same level as roof RM7 F389	2016	11:55 AM	00d 00:00:39	74	Distance	3	703	792	772	907	1455
	2014			69	Source after directivity		53	54	54	56	74
<i>Difference 2016 - 2014</i>			<i>Difference</i>	5	Distance reduction		-47	-48	-48	-50	-54
					<i>Calculated SPL without barriers</i>		6	5	6	6	20
RM7 Baghouse S doorway open F391	2016	11:57 AM	00d 00:00:33	81	Distance	1	677	765	751	885	1483

**Table 3.3: Boral Cement Berrima Works
Noise Assessment Kiln 6 Upgrade: July - August 2016 Annual Compliance Assessment
Measurement locations with increase in sound level > 3 dB and calculated contribution sound level at receivers**

Location	Year	Time	Period d:h:m:s	Sound Level dB(A) L _{AEQ,t}	Comments	Distance measured	Distance to Receivers				
							Distance Attenuation to receiver				
							Calculated LAEQ level at receiver distance only				
Adelaide	Brisbane	Melbourne	Argyle	Sth							
Kiln 6 Upgrade						Objective	37	37	37	37	37
	2013			72	Source after directivity		52	52	53	55	81
<i>Difference 2016 - 2013</i>			<i>Difference</i>	9	Distance reduction		-57	-58	-58	-59	-63
					<i>Calculated SPL without barriers</i>		-5	-5	-4	-4	17
RM7 Baghouse Centre W side F426	2016	12:35 PM	00d 00:00:31	91	Distance	1	677	765	751	885	1483
	2014			78	Source after directivity		73	77	80	80	80
<i>Difference 2016 - 2014</i>			<i>Difference</i>	13	Distance reduction		-57	-58	-58	-59	-63
					<i>Calculated SPL without barriers</i>		17	19	23	21	17
RM7 Baghouse by FA252 discharge box grill @ 0.8m F 430	2016	12:39 PM	00d 00:00:20	87	Distance	1	677	765	751	885	1483
	2015			81	Source after directivity		87	87	87	87	87
<i>Difference 2016 - 2015</i>			<i>Difference</i>	6	Distance reduction		-57	-58	-58	-59	-63
					<i>Calculated SPL without barriers</i>		30	29	29	28	23
RM7 Baghouse hopper platform level N end F433	2016	12:42 PM	00d 00:00:31	80	Distance	1	677	765	751	885	1483
	2014			76	Source after directivity		80	80	80	80	80
<i>Difference 2016 - 2014</i>			<i>Difference</i>	5	Distance reduction		-57	-58	-58	-59	-63
					<i>Calculated SPL without barriers</i>		24	23	23	21	17
RM7 Baghouse hopper centre platform F434	2016	12:43 PM	00d 00:00:31	81	Distance	1	677	765	751	885	1483
	2014			76	Source after directivity		81	81	81	81	81
<i>Difference 2016 - 2014</i>			<i>Difference</i>	5	Distance reduction		-57	-58	-58	-59	-63
					<i>Calculated SPL without barriers</i>		25	23	24	22	18
K6 Grate Cooler Fan Courtyard Between FA201 & 203 & 202 F495	2016	3:28 PM	00d 00:00:47	93	Distance	1	671	772	775	937	1557
	2013			87	Source after directivity		93	93	93	93	68
<i>Difference 2016 - 2013</i>			<i>Difference</i>	6	Distance reduction		-57	-58	-58	-59	-64
					<i>Calculated SPL without barriers</i>		37	36	36	34	4
					Significant barriers in place for all receivers						
Radicon Cooler RC L3 S fan @ 0.7m F505	2016	3:37 PM	00d 00:00:25	93	Distance	0.7	672	773	778	942	1562
	2013			83	Source after directivity		85	87	88	91	85
<i>Difference 2016 - 2013</i>			<i>Difference</i>	11	Distance reduction		-60	-61	-61	-63	-67
					<i>Calculated SPL without barriers</i>		26	26	27	28	18
Radicon Cooler rear centre @ 2m F512	2016	3:45 PM	00d 00:00:40	86	Distance	2	672	773	778	942	1562
	2014			79	Source after directivity		66	64	61	57	64
<i>Difference 2016 - 2014</i>			<i>Difference</i>	7	Distance reduction		-51	-52	-52	-53	-58
					<i>Calculated SPL without barriers</i>		16	12	9	4	6
FA210 Kiln Discharge Seal Fan S inlet F518	2016	3:52 PM	00d 00:00:21	94	Distance	1	674	773	775	936	1544
	2014			85	Source after directivity		85	64	88	91	85
<i>Difference 2016 - 2014</i>			<i>Difference</i>	9	Distance reduction		-57	-58	-58	-59	-64
					<i>Calculated SPL without barriers</i>		28	6	31	32	21

sound level is greater than the objective contribution sound level by more than 3 dB, the cell in the table is highlighted pink. (The same approach has been used in Table 3.7 for CM7 sources.)

There were 21 Kiln 6 Upgrade source locations with increased sound levels identified in 2016. Many of these were from screw conveyor squeaks and high-pitched sound which occurs occasionally. Of the 21 locations, when the directivity and distance attenuation were added to the source sound levels none exceeded the contribution objective of 37 dBA. One source equalled the contribution and this was the location near fans 201, 203 and 202 in the grate cooler fan courtyard. This location has barriers in the propagation pathway to all receivers in the form of the adjacent compressor house building on the northern side of the courtyard; therefore it is expected that sound levels from this area will have a lower contribution than calculated in the table. All other locations were calculated to have contribution sound levels well below the objective.

The locations and sources shown in Table 3.3 are described as follows:

- PHT Level 8 FA263 motor & casing
- PHT Level 2.25 centre by the kiln entry duct
- PHT Level 2 by DC70 Fan FA03 discharge
- RM7 FA249 Location 17 motor platform East side
- RM7 FA250 location 22 4m South of the fan motor
- RM7 FA250 location 25 fan coupling and casing West side
- RM7 Roof Lower platform East side @ 1m to the magnete plate
- RM7 Roof Lower platform South side @ 1m to the magnete plate
- RM7 Roof Lower platform West side @ 1m to the magnete plate
- RM7 Roof Lower platform North side @ 1m to the magnete plate
- RM7 Roof Upper Platform BE casing @ 1m on the South side
- RM7 On tower to baghouse top South side above FA249 same level as roof RM7
- RM7 Baghouse South doorway open
- RM7 Baghouse Centre West side
- RM7 Baghouse by FA252 discharge box grill @ 0.8m
- RM7 Baghouse hopper platform level North end
- RM7 Baghouse hopper centre platform
- K6 Grate Cooler Fan Courtyard Between FA201 & 203 & 202
- Radicon Cooler RC Level 3 South fan @ 0.7m
- Radicon Cooler rear centre @ 2m

- FA210 Kiln Discharge Seal Fan South inlet

These locations and the associated sources are described below.

- **PHT Level 8 FA263 motor & casing**

Sound levels at this fan location were similar or lower than those in 2013 to 2015 but 4 dB higher than in 2012. This may have been caused by a different location to 2012. The calculated contribution level in Table 3.3 is more than 15 dB below the objective at any of the locations.

- **PHT Level 2.25 centre by the kiln entry duct**

Air cannon operation affected sound levels in this location. Calculated contribution levels were 19 dB below the objective.

- **PHT Level 2 by DC70 Fan FA03 discharge**

There was a strong tone at 63 Hz near this fan, which may be related to a different location or different conditions in the nearby stack entry duct from FA39. The calculated contribution sound levels were in the range 34 to 35 dBA at the New Berrima residences, which is below the objective. There is a partial barrier of the stack between the fan discharge and some of the residences which would result in lower sound levels than calculated.

- **RM7 FA249 Location 17 motor platform East side**
- **RM7 FA250 location 22 4m South of the fan motor**
- **RM7 FA250 location 25 fan coupling and casing West side**

Sound levels around the fans FA249 and FA250 were affected by noise from the screw conveyors on the baghouse squealing. If the sound levels were assumed to come from the source adjacent to the measurement location, the calculated contribution levels in each case were below the objectives.

- **RM7 Roof Lower platform East side 1m to Magnete plate**
- **RM7 Roof Lower platform South side @ 1m to Magnete plate**
- **RM7 Roof Lower platform West side @ 1m to Magnete plate**
- **RM7 Roof Lower platform North side @ 1m to Magnete plate**

RM7 roof lower platform sound levels are higher than in 2014 by 4 to 6 dB. This is impact noise from the feed material on the separator impact plate. Calculated receiver contribution sound levels were all less than the objective – highest levels were for the northern side location with calculated contribution sound levels of up to 31 dBA at 72 Taylor Avenue. These levels would be further attenuated by the partial barrier of the ESP and RM7 in the path of the emissions. Reduction of noise from this area could be achieved by closing the open inspection hatch and lining the outside of the impact plate with vibration damping material.

- **RM7 Roof Upper Platform BE casing @ 1m South side**

Sound levels in this area are 6 dB above those of 2011. The acoustic cladding on the area around the inspection hatch has been removed by an increased area from 2015, which would

add to the noise emission. The calculated contribution sound levels at receivers in any direction are more than 15 dB below the objectives and 30 dB below objectives for New Berrima receivers. Replacement of the acoustic cladding would reduce the emission.

- **RM7 On tower to baghouse top South side above FA249 same level as roof RM7**

Sound levels at this location were 4 to 5 dB above those of previous years'. This may be from a slightly different location. The sound levels are relatively low and the calculated contribution levels are well below the objectives.

- **RM7 Baghouse South doorway open**

Sound levels at this location are dependent on the number of reverse pulses measured in the period and how close their emission point is to the door. On this occasion the sound levels were 9 dB above those measured in 2013. The calculated contribution sound levels were less than 0 dB in New Berrima receivers and less than 20 dB for the southern receiver location, well below the objectives.

- **RM7 Baghouse Centre West side**
- **RM7 Baghouse by FA252 discharge box grill @ 0.8m**
- **RM7 Baghouse hopper platform level North end**
- **RM7 Baghouse hopper centre platform**

RM7 baghouse sound levels were all elevated by 4 to 12 dB, caused by screw conveyor squealing, the higher increases occurring when the location was close to a source. Calculated contribution sound levels were all less than 30 dBA at residential receivers which is well below the objectives. These would be further reduced by the barrier of the ESP and RM6 in the pathway of the noise.

- **K6 Grate Cooler Fan Courtyard Between FA201 & 203 & 202**

Sound levels measured at this location were 4 to 6 dB above those measured between 2010 and 2013, but no different to 2014 and 2015. This indicates potentially a slightly different location. Calculated contribution sound levels equalled the objective at the New Berrima receivers. These levels would be further reduced by the barrier effects of the compressor building which is in the pathway of the sound propagation.

- **Radicon Cooler RC L3 South fan @ 0.7m**
- **Radicon Cooler rear centre @ 2m**

Radicon Cooler sound levels depend on the variable fan speed – the faster they operate the higher the sound level and this is dependent on the cooling load. In some years the speed is higher, in others it is lower. 2016 sound levels were 4 to 11 dB above those of 2015 but lower than those of 2013. Calculated contribution sound levels were 26 to 28 dBA at New Berrima receiver locations. There are no barriers in the propagation path but these levels do not include additional attenuation from air or ground absorption. Despite this they are 9 dB or more below the objectives.

Sound levels from the rear of the cooler were lower than 2015 but higher than 2014 by 7 dB, which is interesting given the different situation for the front of the cooler. Calculated contribution sound levels were all more than 20 dB below the objectives.

- **FA210 Kiln Discharge Seal Fan South inlet**

Sound levels from the southern kiln discharge seal fan FA210 were 3 dB higher than in 2014 and 2 dB higher than the similar fan on the northern side FA209 which is also affected by kiln shell cooler fan noise. Calculated contribution sound levels from this fan were up to 32 dBA at Argyle St, 5 dB below the objective but this did not include the additional attenuation likely from the body of the kiln which is in the propagation path. It has been recommended that this fan and silencer be reviewed for maintenance condition.

Table 3.4 uses the information from Table 2.3 and compares the measured levels for major upgrade items with objectives.

Table 3.4: Kiln 6 Upgrade Plant Items - Objective Sound Power Levels and Sound Pressure Levels required to achieve compliance with objective sound levels and measured sound pressure levels

Source	Sound Power Level – dB(A)	Sound Pressure Level dB(A)		
		Objective	Measured 2005	Measured 2016
Coal Mill and Clinker cooler fans	117	100 @ 3m	93 @ 2m	Coal mill wall vent 82 @ 2m Courtyard clinker cooler fans 85 to 93 @ 1m from 3
New Radicon Cooler	103	92 @ 1m	81 @ 1m West 80 @ 2m East	90 to 95 @ 1m West/front 86 @ 2m East/rear
New Pre-heater fan FA249	97	89 @ 1m	77 @ 2m	74 - 84 @ 1m
New Baghouse fan FA250	102	94 @ 1m	82 @ 2m	84 – 86 @ 1m
Raw Mill 7 Building	117	100 @ 3m	Vents 83 to 86 @ 1m	Doors & Vents 79 to 85 @ 1m Roof items 80 to 89 @ 1m

On the basis of the measurements and calculated contribution sound levels, it is considered that the Kiln 6 Upgrade items are achieving compliance with objective sound levels of the licence conditions.

A review of emissions from a small number of sources is recommended to assess if silencer and source conditions are appropriate. These include:

- Raw meal silo DC30 discharge
- RM7 Roof magnetite plate cover
- FA252 discharge box grill
- FA210 kiln discharge seal fan south

3.2 Cement Mill No.7

Figure 3.7 shows a plan view of the area around the Cement Mill No.6 (CM6) and Cement Mill No.7 (CM7) cement mills area. Figure 3.7a shows this on an aerial view. Sound levels measured around Cement Mill No.7 are shown in Table 3.5. Measurements were taken with CM7 mill operating, along with the rest of the cement plant on 10 August 2016. At some locations, especially on the northern, southern and western sides of CM7, other sources are the main source of noise at the location – for example the kiln shell cooling fans, PHT fans and fan emissions from CM5 and CM6 buildings.

The difference between the 2016 operating sound levels and 2009 to 2015 operating sound levels of CM7 are shown in Table 3.6. If the differences in sound levels between 2015 and those of previous years are greater than 3 dB, the difference is highlighted, as done for the Kiln 6 Upgrade assessment.

Differences in sound level from previous measurements show they were mostly the same or less than previous measurements results or within measurement variation error (+/- 2 to 3 dB). Some locations had higher sound levels compared to 2012 or earlier measurements. Where levels were higher they were mostly considered to be not caused by CM7 emissions. Emissions from fan FA502 in the western wall of the CM5 building were noted to be higher than in the-pre 2015 measurements at locations on the western and northern side of the CM7 building.

Measurement locations with sound levels greater than 3 dB above previous sound level measurements have been collated into Table 3.7 and a similar screening calculation made for contribution sound levels at receivers due to distance attenuation alone (similar to that done for Kiln 6 Upgrade in Table 3.3)

Ten locations were identified through this process and are shown in Table 3.7. These are described below.

Location D, on the north-western corner some 20m distance from the building northern and western side

Location G, 13.5m north of the compressor house and in line with the western wall of CM7 and the northern wall of Transfer House #3.

Location K, 13.5m north of the compressor house wall centre, and in line with the northern wall of Transfer House #3

Location O, 13.5m north of the compressor house and in line with the eastern wall of the compressor house and the northern wall of Transfer House #3.

Location K', 6.9m north of the compressor house wall, in-line with the western wall of the compressor house and CM7.

Location H, outside the main western wall roller door

Location M, 1m north of the compressor room filter room wall, between wall vents for locations L and N.

Location Q, 1m outside the eastern man-door of the compressor house.

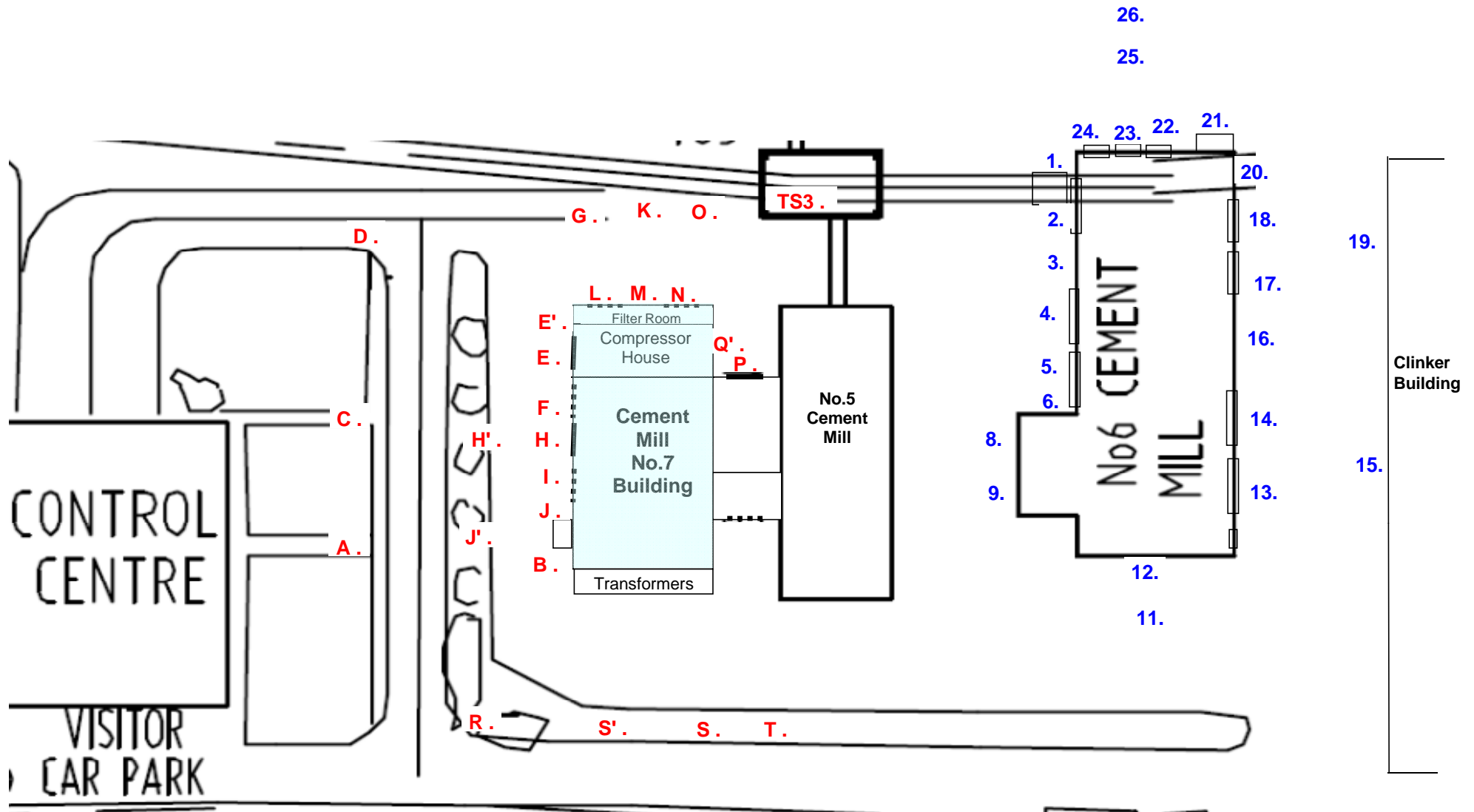


Figure 3.7: Blue Circle Southern Cement Berrima CM7 Noise Assessment - Plan view of external measurement locations around Cement Mill No.7 and Cement Mill No.6



Figure 3.7A: Aerial view of Cement Mills 6 and 7 and measurement locations

Table 3.5: Boral Cement Berrima - 2016 Annual Noise Assessment - Site Sound Levels for Cement Mill No.7 and No.6

Sound levels at measurement locations

Area	Location	File No.	Date	Start Time	Period hh:mm:ss	Statistical Sound Level - dBA							Comment
						LAeq	LAMax	LA01	LA10	LA90	LCeq	LC-LA eq	
CM7	A Top of stairs	536	10/08/2016	4:24 PM	Dd 00:00:30	72	74	73	73	72	85	13	-
	C Top of stairs S	537	10/08/2016	4:25 PM	Dd 00:00:35	72	74	74	73	71	83	11	Noise from K6 & CM7 & FA250
	B' 6.5m to discharge fan CM7 drive motor cooling	538	10/08/2016	4:26 PM	Dd 00:00:46	77	78	78	77	77	88	11	-
	B 2m to doors E of drive motor	539	10/08/2016	4:27 PM	Dd 00:00:29	74	76	76	75	74	89	15	-
	B 2m to doors E of drive motor	540	10/08/2016	4:28 PM	Dd 00:00:30	74	77	77	75	74	90	15	-
	D At corner N of Admin	541	10/08/2016	4:29 PM	Dd 00:00:30	72	74	74	73	71	82	9	Noise from Fan FA502 dominates
	E' Man door to compressor filter room@ 1m	542	10/08/2016	4:30 PM	Dd 00:00:30	69	71	71	70	69	82	13	-
	E Compressor room door @ 1m	543	10/08/2016	4:31 PM	Dd 00:00:30	71	73	72	71	71	83	12	-
	F Wall vents N on W side @ 1m	544	10/08/2016	4:32 PM	Dd 00:00:30	76	77	77	77	76	86	10	-
	H W roller door @ 1m	545	10/08/2016	4:33 PM	Dd 00:00:30	81	82	82	81	81	89	8	Open 80mm at bottom
	H' Edge of concrete 9.3m to W roll door	546	10/08/2016	4:33 PM	Dd 00:00:42	75	76	75	75	74	84	9	-
	I Vent S of door @ 1m	547	10/08/2016	4:34 PM	Dd 00:00:35	77	78	78	78	77	88	10	-
	J Vents N of baghouse	548	10/08/2016	4:35 PM	Dd 00:00:33	78	79	78	78	77	90	12	-
	J' Edge of concrete opp, J.	549	10/08/2016	4:36 PM	Dd 00:00:31	74	74	74	74	73	84	11	-
	J" under baghouse & 1m to wall vent	550	10/08/2016	4:37 PM	Dd 00:00:32	80	81	81	80	80	91	11	-
	L N wall vent W side @ 1m	551	10/08/2016	4:38 PM	Dd 00:00:31	73	74	74	73	72	81	9	-
	M Between wall vents @ 1m to wall	552	10/08/2016	4:39 PM	Dd 00:00:30	71	74	73	72	70	81	10	-
	N Wall vents N wall E side @ 1m	553	10/08/2016	4:40 PM	Dd 00:00:31	72	73	73	72	71	83	11	-
	G Line N side of transfer house 13.5m to it, in-line W edge CM7	554	10/08/2016	4:41 PM	Dd 00:01:09	75	77	76	76	74	82	7	FA502
	K Line level with G centre of compressor house	555	10/08/2016	4:42 PM	Dd 00:00:31	72	74	73	73	72	82	10	-
	O Line E side of Comp House 13.5m to control point	556	10/08/2016	4:43 PM	Dd 00:00:34	73	75	75	74	73	83	10	-
	O' 6.9m from Compressor house wall in-line E wall Comp House	557	10/08/2016	4:44 PM	Dd 00:00:46	74	76	75	74	73	84	10	-
	K' 6.9m from centre of N wall comp house	558	10/08/2016	4:45 PM	Dd 00:00:30	74	75	75	74	73	83	9	-
	G' Line 6.9m N of W wall CM7	559	10/08/2016	4:46 PM	Dd 00:00:31	76	78	78	77	74	83	7	-
	P 1m N roll door CM7	560	10/08/2016	4:47 PM	Dd 00:00:32	81	82	82	82	81	89	8	-
	Q 1m E man-door CM7 Comp. House	561	10/08/2016	4:48 PM	Dd 00:00:31	78	79	78	78	77	88	11	Can't hear fan in CM5 Annex N side - W wall fan CM6 is overpowering it
	Transfer Station #TS3 Level 1 N side opening	562	10/08/2016	4:51 PM	Dd 00:00:32	71	74	72	71	70	84	14	-
	TS3 Platform opp fan discharge	563	10/08/2016	4:53 PM	Dd 00:00:35	75	76	76	75	75	84	10	Can't hear fan in CM5 Annex N side - W wall fan CM6 is overpowering it
	R corner SW of CM7	565	10/08/2016	5:01 PM	Dd 00:00:31	76	77	77	76	75	87	11	CM7 fans & K6 KSCFs
	S' Kerb Opp W wall CM7	566	10/08/2016	5:02 PM	Dd 00:00:32	74	75	75	75	74	86	12	-
	S" Kerb Opp. W side CM7 & fan discharge	567	10/08/2016	5:02 PM	Dd 00:00:41	75	76	76	75	74	86	11	-
	S Kerb opp E side CM7 tower	568	10/08/2016	5:03 PM	Dd 00:00:31	75	76	76	75	75	86	11	-
	T Kerb Opp W wall CM5	569	10/08/2016	5:04 PM	Dd 00:00:33	75	75	75	75	74	85	11	-
CM6	11 9.8m from S wall	570	10/08/2016	5:05 PM	Dd 00:00:39	78	80	79	79	77	85	7	-
	13 E side S roll door @ 1m	571	10/08/2016	5:07 PM	Dd 00:00:45	75	79	77	76	74	84	9	Noise from TS N of CM6 chute
	14 CM6 E side centre door @ 1m	572	10/08/2016	5:08 PM	Dd 00:00:31	76	77	76	76	75	86	10	-
	15 2m from Clinker Building opp 13 & 14	573	10/08/2016	5:09 PM	Dd 00:00:37	73	75	73	73	72	82	10	-
	16 E wall centre @ 2m	574	10/08/2016	5:10 PM	Dd 00:00:31	73	74	74	74	73	84	11	-
	17 E roll door opp Mill	575	10/08/2016	5:10 PM	Dd 00:00:30	82	83	83	83	82	88	6	Door open 80mm at bottom
	18 Door opp Comp Room @ 1m	576	10/08/2016	5:11 PM	Dd 00:00:30	76	78	77	77	76	84	7	-
	19 Clinker Building @ 2m opp 18	577	10/08/2016	5:12 PM	Dd 00:00:32	72	74	73	73	72	82	10	-
	20 Man door - open 100mm	578	10/08/2016	5:13 PM	Dd 00:00:35	73	74	74	74	73	82	9	Door won't close
	21 1m Outside vent fan filter	579	10/08/2016	5:14 PM	Dd 00:00:31	72	73	72	72	71	83	11	-
	22 E side N wall vent @ 1m	580	10/08/2016	5:15 PM	Dd 00:00:32	82	83	83	82	82	89	7	-
	23 Centre N wall vent @ 1m	581	10/08/2016	5:15 PM	Dd 00:00:30	83	84	84	84	83	90	7	-
	24 W side N wall vent @ 1m	582	10/08/2016	5:16 PM	Dd 00:00:30	80	81	81	80	79	88	8	-
	25 11m N of CM6	583	10/08/2016	5:17 PM	Dd 00:00:42	74	75	75	75	74	84	9	-
	26 22.6m N of CM6	584	10/08/2016	5:18 PM	Dd 00:01:00	80	98	94	77	70	83	3	train behind so use L90. W side has Vacuum truck so can't measure 1 to 9
	Door platform near CM6 W wall fan @ 5.7m	564	10/08/2016	4:55 PM	Dd 00:01:01	87	89	88	88	86	99	12	CM6 western wall fan discharges

Table 3.5A: Boral Cement Berrima - 2016 Annual Noise Assessment - Site Sound Levels for Cement Mill 7

Tonality of Sound levels at measurement locations

Pink shaded cells with red text have tonality values exceeding the criteria

File	Area	Location	Tonality in LAeq 1/3 Octave Band Sound Level - dBA in Frequency Band Hz																												
			31.5 Hz	40 Hz	50 Hz	63 Hz	80 Hz	100 Hz	125 Hz	160 Hz	200 Hz	250 Hz	315 Hz	400 Hz	500 Hz	630 Hz	800 Hz	1 kHz	1.25 kHz	1.6 kHz	2 kHz	2.5 kHz	3.15 kHz	4 kHz	5 kHz	6.3 kHz	8 kHz	10 kHz	12.5 kHz	16 kHz	
536	CM7	A Top of stairs	0	5	5	3	1	1	0	3	1	3	0	4	0	1	0	0	0	1	0	1	0	1	0	1	0	0	1	0	
537		C Top of stairs S	1	1	2	4	1	1	0	2	1	0	3	3	3	2	0	0	0	1	0	1	1	1	0	1	1	0	0	0	
538		B' 6.5m to discharge fan CM7 drive motor cooling	2	5	5	3	0	2	1	0	2	1	2	2	2	0	0	1	0	1	0	2	0	0	0	0	0	0	0	1	2
539		B 2m to doors E of drive motor	0	5	3	1	3	3	1	3	0	3	2	0	1	0	0	1	1	2	0	1	1	1	0	1	0	1	0	0	
540		B 2m to doors E of drive motor	0	5	3	0	3	3	1	3	1	3	2	0	0	0	0	1	1	2	1	1	1	1	0	1	1	1	1	0	
541		D At corner N of Admin	2	1	1	2	1	0	1	1	2	0	2	2	3	0	1	1	0	0	0	0	1	1	0	0	0	0	1	1	
542		E' Man door to compressor filter room@ 1m	2	2	1	1	1	0	0	1	0	0	1	0	2	1	0	1	1	2	1	0	0	1	4	2	1	0	1	0	
543		E Compressor room door @ 1m	0	2	1	1	1	1	1	1	2	1	1	1	1	0	0	0	0	2	1	0	1	0	1	3	3	1	2	1	
544		F Wall vents N on W side @ 1m	0	2	1	3	2	1	1	2	0	0	0	0	1	1	1	0	1	2	0	0	0	2	1	0	0	0	0	0	
545		H W roller door @ 1m	1	3	1	2	0	0	0	3	0	2	1	1	0	1	1	0	1	0	0	1	0	1	1	1	1	1	0	1	
546		H' Edge of concrete 9.3m to W roll door	1	2	1	1	0	1	1	2	0	2	0	1	1	1	1	0	1	1	0	0	1	1	0	1	0	0	0	0	
547		I Vent S of door @ 1m	2	3	1	3	1	1	0	2	0	0	0	1	0	1	0	0	1	1	1	1	0	1	1	1	1	1	1	0	
548		J Vents N of baghouse	4	3	2	2	1	1	1	1	3	3	1	0	1	1	1	1	1	1	0	1	1	1	1	0	1	2	1	1	
549		J' Edge of concrete opp. J.	1	1	0	1	1	2	1	1	2	0	0	1	0	1	0	1	2	0	0	1	1	0	0	0	0	1	0	0	
550		J'' under baghouse & 1m to wall vent	2	2	0	0	2	0	1	2	0	3	2	0	1	1	1	1	1	1	0	1	0	1	2	1	1	3	1	0	
551		L N wall vent W side @ 1m	2	0	0	1	0	1	0	1	2	2	1	5	2	1	2	1	1	0	1	0	3	0	1	0	0	0	0	1	
552		M Between wall vents @ 1m to wall	2	2	1	2	1	2	3	1	2	1	2	0	4	1	3	2	0	0	0	1	0	2	0	0	1	0	1	0	
553		N Wall vents N wall E side @ 1m	3	1	2	1	2	4	4	1	1	4	3	0	1	0	1	1	1	0	1	0	0	2	0	0	1	1	0	0	
554		G Line N side of transfer house 13.5m to it, in-line W edge CM7	2	0	1	1	1	1	3	1	0	0	1	2	6	0	4	3	1	1	1	0	0	1	0	1	0	1	0	0	
555		K Line level with G centre of compressor house	1	0	1	0	1	1	1	0	0	2	3	1	3	0	1	1	0	0	1	0	0	2	1	0	1	1	0	1	
556		O Line E side of Comp House 13.5m to control point	2	1	3	1	1	0	0	1	2	2	5	4	3	2	1	1	0	0	0	0	0	1	0	0	0	0	1	1	
557		O' 6.9m from Compressor house wall in-line E wall Comp House	4	1	1	1	0	1	0	1	3	0	4	3	1	1	2	1	0	0	1	0	0	1	1	0	0	2	1	1	
558		K' 6.9m from centre of N wall comp house	4	0	1	1	0	1	1	1	0	3	6	3	1	3	3	2	1	0	0	0	0	1	1	0	0	1	0	1	
559		G' Line 6.9m N of W wall CM7	2	0	1	0	0	2	1	3	1	0	3	0	7	3	2	2	0	1	1	0	1	1	1	1	0	1	0	1	
560		P 1m N roll door CM7	2	0	2	0	1	1	1	2	0	1	1	0	1	1	1	0	0	0	0	1	0	1	0	0	1	1	1	0	
561		Q 1m E man-door CM7 Comp. House	1	1	1	0	2	2	1	1	1	1	1	2	2	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	
562		Transfer Station #TS3 Level 1 N side opening	5	2	9	4	2	3	1	1	1	3	2	0	0	1	0	0	1	0	0	1	0	0	0	1	1	1	1	1	
563		TS3 Platform opp fan discharge	1	0	2	0	3	1	1	1	1	1	2	0	1	2	1	0	0	0	0	0	1	1	0	1	0	1	1	1	
564		Door platform near CM6 W wall fan @ 5.7m	5	2	2	1	3	1	1	0	1	0	2	1	4	2	1	2	4	0	1	2	1	2	0	0	2	1	0	1	
565		R corner SW of CM7	1	5	6	5	1	2	0	4	2	4	4	2	2	4	3	1	1	0	0	0	1	1	1	0	0	0	1	0	
566		S' Kerb Opp W wall CM7	2	5	6	4	1	1	0	3	1	3	3	0	2	2	0	1	2	1	1	1	1	0	0	0	1	1	1	1	
567		S'' Kerb Opp. W side CM7 & fan discharge	1	2	3	3	1	1	1	4	2	2	5	2	2	1	1	1	0	1	1	0	1	1	1	1	0	0	1	0	
568		S Kerb opp E side CM7 tower	1	3	5	5	1	2	0	3	1	2	2	2	1	0	0	0	0	1	1	0	1	1	0	0	0	0	0	1	
569		T Kerb Opp W wall CM5	1	2	3	2	1	0	1	4	1	1	2	1	0	1	1	0	1	1	0	0	1	1	1	1	0	0	1	0	
570	CM6	11 9.8m from S wall	0	1	1	4	1	2	1	2	0	1	0	0	1	3	3	4	2	1	0	3	2	2	2	1	1	1	0	0	
571		13 E side S roll door @ 1m	1	1	1	2	1	1	0	1	0	4	10	4	1	1	2	3	1	1	1	0	1	0	0	0	1	1	1	0	
572		14 CM6 E side centre door @ 1m	0	1	1	1	1	1	0	1	0	1	3	2	0	0	0	0	0	0	0	0	1	0	0	2	0	1	1	1	
573		15 2m from Clinker Building opp 13 & 14	1	1	1	1	1	1	0	2	0	1	2	1	1	0	1	2	0	1	1	0	1	1	0	0	1	1	0	1	
574		16 E wall centre @ 2m	3	0	2	1	0	1	0	1	1	0	0	1	1	1	1	0	0	0	1	0	1	1	1	0	1	0	0	0	
575		17 E roll door opp Mill	3	1	1	0	0	1	1	1	0	1	1	0	0	0	1	1	1	0	0	1	0	0	0	0	0	1	1	1	
576		18 Door opp Comp Room @ 1m	1	1	3	2	1	2	1	1	0	1	2	2	2	0	3	5	3	1	0	4	5	0	2	1	2	2	3	1	
577		19 Clinker Building @ 2m opp 18	1	0	1	2	3	0	1	0	2	1	0	0	1	0	0	1	0	0	0	1	1	2	0	0	0	2	1	0	
578		20 Man door - open 100mm	1	1	1	1	0	1	0	1	0	1	2	1	0	1	0	0	0	0	0	1	0	0	1	0	1	2	1	2	
579		21 1m Outside vent fan filter	1	3	3	1	2	1	1	0	1	2	2	1	0	1	1	0	0	0	1	2	0	0	0	1	2	0	1	1	
580		22 E side N wall vent @ 1m	0	1	0	3	5	2	0	2	0	2	2	1	0	0	0	1	0	0	1	0	0	1	2	1	2	1	1	2	
581		23 Centre N wall vent @ 1m	1	1	0	2	4	2	0	1	1	2	1	1	1	1	0	1	0	1	0	1	0	1	1	1	1	0	3	0	
582		24 W side N wall vent @ 1m	1	0	1	0	2	3	1	1	2	1	1	1	1	0	0	0	1	0	0	0	1	2	0	2	1	1	2	1	
583		25 11m N of CM6	1	4	7	5	2	1	1	0	1	1	1	1	1	0	0	1	0	1	1	1	2	3	1	3	0	1	4	0	
584		26 22.6m N of CM6	1	2	4	2	0	0	0	1	0	1	1	0	0	0	0	0	1	0	1	2	9	2	17	8	5	6	0	0	
585	Residential	4 Melbourne St	1	2	3	2	1	2	0	1	1	1	1	0	0	0	0	1	1	2	1	1	1	0	1	1	1	1	0	0	
588		12 Brisbane St	0	0	3	3	2	2	1	1	0	1	1	1	1	1	1	1	1	3	2	3	2	0	0	0	0	0	0	0	
589		Adelaide St near Taylor	1	0	1	3	6	1	2	3	0	1	1	0	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	0	
592		Argyll St 30m to Taylor Ave	0	0	1	1	1	0	0	1	0	0	1	0	1	0	1	1	0	0	1	0	0	1	1	1	2	0	1	0	

Table 3.6: Boral Cement Berrima - 2016 Annual Noise Assessment - Site Sound Levels for Cement Mill No.7 and No.6
Comparison and difference with results for previous years for the same locations

Area	Location	File No.	Date	Start Time	Period hh:mm:ss	Statistical Sound Level - LAeq dBA										Difference to 2016 = 2016 - 20XX dB							Comment	
						LAeq 2016	LA90	LAeq 2015	LAeq 2014	LAeq 2013	LAeq 2012	LAeq 2011	LAeq 2010	LAeq 2009	LAeq 2006	2015	2014	2013	2012	2011	2009	2006		
						CM7	A Top of stairs	536	10/08/2016	4:24 PM	Dd 00:00:30	72	72	73	73	72	71	73	69	70	70	-1		0
	B' 6.5m to discharge fan CM7 drive motor cooling	538	10/08/2016	4:26 PM	Dd 00:00:46	77	77																	
	B 2m to doors E of drive motor	539	10/08/2016	4:27 PM	Dd 00:00:29	74	74	76	78	75	77	78	76	77	77	-2	-4	-1	-3	-3	-2	-3	-3	
	B 2m to doors E of drive motor	540	10/08/2016	4:28 PM	Dd 00:00:30	74	74																	
	C Top of stairs S	537	10/08/2016	4:25 PM	Dd 00:00:35	72	71	73	71	71	71	71	70	72	72	0	1	1	2	1	2	0	0	Noise from K6 & CM7 & FA502
	D At corner N of Admin	541	10/08/2016	4:29 PM	Dd 00:00:30	72	71	72	72	70	69	68	67	73	73	0	0	2	3	4	5	-1	-1	No change for 5 years
	E' Man door to compressor filter room @ 1m	542	10/08/2016	4:30 PM	Dd 00:00:30	69	69	71	70	69	71	71	69	74	73	-1	-1	0	-2	-2	0	-5	-4	
	E Compressor room door @ 1m	543	10/08/2016	4:31 PM	Dd 00:00:30	71	71	72	74	73	74	75	76	76	75	-1	-3	-2	-3	-4	-5	-5	-4	
	F Wall vents N on W side @ 1m	544	10/08/2016	4:32 PM	Dd 00:00:30	76	76	76	77	77	77	75	76	77	78	0	-1	-1	0	1	0	-1	-2	
	H W roller door @ 1m	545	10/08/2016	4:33 PM	Dd 00:00:30	81	81	80	80	81	80	77	78	78	77	1	1	1	1	4	3	3	4	No change for 5 years. Door open bottom 80mm
	H' Edge of concrete 9.3m to W roll door	546	10/08/2016	4:33 PM	Dd 00:00:42	75	74	74	75	75	76	74	75	74	74	0	0	-1	-1	1	0	1	1	
	I Vent S of door @ 1m	547	10/08/2016	4:34 PM	Dd 00:00:35	77	77	78	78	79	79	87	78	78	85	-1	-1	-1	-2	-9	-1	-1	-8	
	J Vents N of baghouse	548	10/08/2016	4:35 PM	Dd 00:00:33	78	77	77	79	80	86	89	83	83	86	0	-1	-2	-9	-12	-6	-6	-9	
	J' Edge of concrete opp, J.	549	10/08/2016	4:36 PM	Dd 00:00:31	74	73	75	74	75	78	84	77	80	74	-1	-1	-1	-5	-11	-4	-7	-1	
	J'' under baghouse & 1m to wall vent	550	10/08/2016	4:37 PM	Dd 00:00:32	80	80	81	82	81						-1	-2	-2						
	L N wall vent W side @ 1m	551	10/08/2016	4:38 PM	Dd 00:00:31	73	72	74	73	72	70	79	71	76	76	-1	-1	1	3	-6	2	-3	-3	
	M Between wall vents @ 1m to wall	552	10/08/2016	4:39 PM	Dd 00:00:30	71	70	71	71	69	69	67	70	76	75	0	1	2	3	4	1	-5	-4	Levels depend on other activities in area such as train loading or locos
	N Wall vents N wall E side @ 1m	553	10/08/2016	4:40 PM	Dd 00:00:31	72	71	73	73	72	71	69	71	78		-1	-1	0	1	3	1	-6		
	G - Line N side of transfer house 13.5m to it, in-line W edge CM7	554	10/08/2016	4:41 PM	Dd 00:01:09	75	74	75	74	72	70	68	69	78	81	0	1	2	5	7	6	-3	-6	No change since 2013 but influenced by FA502
	K Line level with G centre of compressor house	555	10/08/2016	4:42 PM	Dd 00:00:31	72	72	74	72	71	72	68	69	78		-2	0	1	0	5	3	-6		
	O Line E side of Comp House 13.5m to control point	556	10/08/2016	4:43 PM	Dd 00:00:34	73	73	75	73	72	70	67	67			-1	0	2	4	6	6			Influence from FA502
	O' 6.9m from Compressor house wall in-line E wall Comp House	557	10/08/2016	4:44 PM	Dd 00:00:46	74	73	74	74	72						0	0	2						
	K' 6.9m from centre of N wall comp house	558	10/08/2016	4:45 PM	Dd 00:00:30	74	73	75	75	72	69	79				-1	-1	2	4	-5				Influence from FA502
	G' Line 6.9m N of W wall CM7	559	10/08/2016	4:46 PM	Dd 00:00:31	76	74	76	75	73						0	1	3						
	P 1m N roll door CM7	560	10/08/2016	4:47 PM	Dd 00:00:32	81	81	81	80	81	81	76	79	87		0	1	0	0	5	2	-6		Noise is from wall & door. No significant change for 4 years
	Q 1m E man-door CM7 Comp. House	561	10/08/2016	4:48 PM	Dd 00:00:31	78	77	78	78	78	78	68	68	87		0	0	-1	0	9	9	-10		
	Transfer Station #TS3 Level 1 N side opening	562	10/08/2016	4:51 PM	Dd 00:00:32	71	70	71								-1								
	TS3 Platform opp fan discharge	563	10/08/2016	4:53 PM	Dd 00:00:35	75	75	75	77	75	77	75	74			0	-2	0	-2	0	1			
	Door platform near CM6 W wall fan @ 5.7m	564	10/08/2016	4:55 PM	Dd 00:01:01	87	86	85	84	88			81			1	3	-1			6			Levels depend on silencer condition
	R corner SW of CM7	565	10/08/2016	5:01 PM	Dd 00:00:31	76	75	75								1								CM7 fans & K6 KSCFs
	S' Kerb Opp W wall CM7	566	10/08/2016	5:02 PM	Dd 00:00:32	74	74	74								0								
	S'' Kerb Opp. W side CM7 & fan discharge	567	10/08/2016	5:02 PM	Dd 00:00:41	75	74	76								-1								
	S Kerb opp E side CM7 tower	568	10/08/2016	5:03 PM	Dd 00:00:31	75	75	76								-1								
	T Kerb Opp W wall CM5	569	10/08/2016	5:04 PM	Dd 00:00:33	75	74	76								-1								
CM6	11 9.8m from S wall	570	10/08/2016	5:05 PM	Dd 00:00:39	78	77	76	78	77	79		77			2	0	1	-1		1			
	13 E side S roll door @ 1m	571	10/08/2016	5:07 PM	Dd 00:00:45	75	74	80	81	82	82		83			-4	-6	-6	-6		-8			Noise from TS N of CM6 chute
	14 CM6 E side centre door @ 1m	572	10/08/2016	5:08 PM	Dd 00:00:31	76	75	74	75	77	74		74			2	1	-2	2		1			
	15 2m from Clinker Building opp 13 & 14	573	10/08/2016	5:09 PM	Dd 00:00:37	73	72	78	78	89	79		77			-5	-6	-16	-6		-5			
	16 E wall centre @ 2m	574	10/08/2016	5:10 PM	Dd 00:00:31	73	73	74	75	80	74		72			0	-1	-6	-1		1			
	17 E roll door opp Mill	575	10/08/2016	5:10 PM	Dd 00:00:30	82	82	74	75	78	77		75			8	7	4	6		7			Door open 80mm at bottom
	18 Door opp Comp Room @ 1m	576	10/08/2016	5:11 PM	Dd 00:00:30	76	76	82	83	85	82		85			-6	-7	-9	-6		-9			
	19 Clinker Building @ 2m opp 18	577	10/08/2016	5:12 PM	Dd 00:00:32	72	72	77	77	75	77		76			-4	-5	-3	-5		-4			
	20 Man door - open 100mm	578	10/08/2016	5:13 PM	Dd 00:00:35	73	73	75	75	78	73		72			-2	-2	-5	0		1			Man door unable to fully close
	21 1m Outside vent fan filter	579	10/08/2016	5:14 PM	Dd 00:00:31	72	71	73	75	72	74		74			-2	-3	-1	-3		-3			
	22 E side N wall vent @ 1m	580	10/08/2016	5:15 PM	Dd 00:00:32	82	82	82	84	81	83		85			0	-2	1	-1		-3			
	23 Centre N wall vent @ 1m	581	10/08/2016	5:15 PM	Dd 00:00:30	83	83	84	86	84	85		86			-1	-3	-1	-1		-3			
	24 W side N wall vent @ 1m	582	10/08/2016	5:16 PM	Dd 00:00:30	80	79	78	81	81	81		83			1	-2	-1	-2		-3			
	25 11m N of CM6	583	10/08/2016	5:17 PM	Dd 00:00:42	74	74	74	75	74						1	-1	1						
	26 22.6m N of CM6	584	10/08/2016	5:18 PM	Dd 00:01:00	80	70	71	72	74	75		77			9	8	6	5		3			

**Table 3.7.: Boral Cement Berrima Works
Noise Assessment CM7 Project July August 2016 Annual Compliance Assessment
Measurement locations with increase in sound level > 3 dB and calculated contribution sound level at receivers**

Location	Year	Time	Period d:h:m:s	Sound Level dB(A) L _{AEQ,t}	Comments	Distance measured metres	Distance to Receivers				
							Distance Attenuation to receiver				
							Calculated LAEQ level at receiver distance only				
							Adelaide	Brisbane	Melbourne	Argyle	South
CM7						Objective Night	40	40	40	40	37
CM7 D At corner N of Admin F 541	2016	4:29 PM	00d 00:00:30	72	Distance	25	517	611	610	773	541
	2010			67	Source after DIR		72	72	72	72	38
<i>Difference 2016 - 2010</i>			<i>Difference</i>	5	Distance reduction		-26	-28	-28	-30	-27
					<i>Calculated SPL without barriers</i>		46	45	45	42	11
					Noise is from other sources, not just CM7						
CM7 H W roller door @ 1m F545	2016	4:33 PM	00d 00:00:30	81	Distance	1	546	636	628	791	1615
	2011			77	Source after DIR		64	67	70	72	68
<i>Difference 2016 - 2011</i>			<i>Difference</i>	4	Distance reduction		-55	-56	-56	-58	-64
					<i>Calculated SPL without barriers</i>		10	11	14	14	4
CM7 M Between wall vents @ 1m to wall F552	2016	4:39 PM	00d 00:00:30	71	Distance	1	517	611	610	773	1647
	2011			67	Source after DIR		71	71	71	67	38
<i>Difference 2016 - 2011</i>			<i>Difference</i>	4	Distance reduction		-54	-56	-56	-58	-64
					<i>Calculated SPL without barriers</i>		17	16	16	9	-27
CM7 G - Line N side of transfer house 13.5m to it, in-line W edge CM7	2016	4:41 PM	00d 00:01:09	75	Distance	13.5	517	611	610	773	1647
	2011			68	Source after DIR		75	75	75	72	39
<i>Difference 2016 - 2011</i>			<i>Difference</i>	7	Distance reduction		-32	-33	-33	-35	-42
					<i>Calculated SPL without barriers</i>		43	42	42	37	-3
					No change since 2013 but influenced by FA502 and dependent on other sources e.g. K6						
CM7 K Line level with G centre of compressor house F555	2016	#####	4:42 PM	72	Distance	13.5	517	611	610	773	1647
	2011			68	Source after DIR		72	72	72	71	38
<i>Difference 2016 - 2011</i>			<i>Difference</i>	5	Distance reduction		-32	-33	-33	-35	-42
					<i>Calculated SPL without barriers</i>		40	39	39	36	-4
CM7 O Line E side of Comp House 13.5m to control point F556	2016	#####	4:43 PM	73	Distance	13.5	517	611	610	773	1647
	2011			67	Source after DIR		73	73	73	72	39
<i>Difference 2016 - 2011</i>			<i>Difference</i>	6	Distance reduction		-32	-33	-33	-35	-42
					<i>Calculated SPL without barriers</i>		42	40	40	37	-3
CM7 K' 6.9m from centre of N wall comp house F558	2016	#####	4:45 PM	74	Distance	6.9	517	611	610	773	1647
	2012			69	Source after DIR		74	74	74	72	38
<i>Difference 2016 - 2011</i>			<i>Difference</i>	4	Distance reduction		-37	-39	-39	-41	-48
					<i>Calculated SPL without barriers</i>		36	35	35	31	-9
CM7 P 1m N roll door CM7 F560	2016	4:47 PM	00d 00:00:32	81	Distance	1	528	625	620	783	1637
	2011			76	Source after DIR		81	81	81	80	46
<i>Difference 2016 - 2011</i>			<i>Difference</i>	5	Distance reduction		-54	-56	-56	-58	-64
					<i>Calculated SPL without barriers</i>		27	25	25	22	-19
CM7 Q 1m E man-door CM7 Comp. House F561	2016	4:48 PM	00d 00:00:31	78	Distance	1	528	625	620	783	1637
	2011			68	Source after DIR		67	64	62	59	62
<i>Difference 2016 - 2011</i>			<i>Difference</i>	9	Distance reduction		-54	-56	-56	-58	-64
					<i>Calculated SPL without barriers</i>		13	8	6	2	-2

Non-Upgrade areas or items with increased sound levels											
CM6 17 E roll door opp Mill	2016	5:10 PM	00d 00:00:30	82	Distance	1	541	653	658	833	1660
	2015			74	Source after DIR		59	56	53	49	59
<i>Difference 2016 - 2015</i>			<i>Difference</i>	8	Distance reduction		-55	-56	-56	-58	-64
					<i>Calculated SPL without barriers</i>		4	0	-4	-10	-5
					Significant barriers also to each receiver						
CM6 26 22.6m N of CM6	2016	5:18 PM	00d 00:01:00	80	Distance	22.6	525	626	639	812	1677
	2015			71	Source after DIR		80	80	80	78	37
<i>Difference 2016 - 2015</i>			<i>Difference</i>	9	Distance reduction		-27	-29	-29	-31	-37
					<i>Calculated SPL without barriers</i>		53	51	51	47	0
					Noise included from sources other than CM6						
CM7 Door platform near CM6 W	2016	4:55 PM	00d 00:01:01	87	Distance	5.7	0	0	0	0	0
	2010			81	Source after DIR		77	81	81	84	81
<i>Difference 2016 - 2010</i>			<i>Difference</i>	6	Distance reduction		-39	-41	-41	-43	-49
					<i>Calculated SPL without barriers</i>		38	40	40	40	31
					Significant barriers also to each receiver						

Location P, 1m outside the main northern roller door of CM7 building.

These locations and the sources contributing to the sound levels and calculated contribution levels at the residential receivers, without allowing for topography or air absorption, have been calculated in Table 3.7 and are detailed below.

Location D, on the north-western corner some 25m distance from the building northern and western side, had sound levels that were 5 dB higher than in 2010. The sound levels were the same as in 2015 and 2014 and lower than in 2006 and 2009. This was considered to be caused by other process fans (western wall fans of CM6 and CM5, and Kiln 6) and train movements north of the site at the rail dump station and locomotives. Similar effects occurred at most of the locations on the northern side of the mill building with increases ranging from 3 to 7 dBA. These were **locations G, K, K', M and O**.

Calculated contribution sound levels at receivers from these locations given in Table 3.7 assuming all of the noise was from CM7, had all receiver sound levels in New Berrima above the objectives by 2 to 6 dB. For three measurement locations – G, K and O, the calculated receiver levels at Adelaide St above the objective by 0 to 3 dB. At other receiver locations the calculated levels were up to 2 dB above the objectives. The measured sound levels for these locations included the rail dump station noise as well as the other sources.

Measurements were also taken on 9 June without the kiln operating. Results of these measurements are shown in Table 3.8 and Appendix H. During those measurements for location D, sound levels were 1 dB lower than in August, however there were also rail movements and dump station operation during those measurements.

Sound levels at location K', 6.9m from the compressor house, were also 72 dBA, the same as at Location D which is more than double this distance from the compressor building and CM7. This indicates that the sound levels at Location D and other locations north of the CM7 building and its compressor house are caused by other sources – if CM7 was the cause the levels would be up to 11dB lower at Location D than Location K'. The contributions from CM7 are therefore considered to be below the objectives for the measurement locations D, G, K, O, and K'.

Location H, 1m outside the main western roller door of CM7 building. Sound levels were 4 dB higher than in 2011. This may have been caused by the bottom of the door being open less than 80mm. The calculated contribution for this sound level at the receivers was 25 to 30 dB below the contribution objectives.

Location M, 1m from the centre of the northern wall of the compressor house filter room, between the wall vents into the filter room. Sound levels were 4 dB above those of 2011. They could have also been influenced by rail movement noise and CM6 western wall fan noise. Calculated contribution sound levels at the receivers for this location were 20 dB or more below the objectives.

Location P, outside the main northern roller door for CM7. Sound levels were 5 dB above those of 2011 but have not changed in the past 4 years. The major source of noise appeared to be the wall and door emissions. The calculated contribution sound levels at

the receiver locations were 13 to 18 dB below the objectives, without allowing for partial barriers of TS3 building and air absorption.

Location Q outside the eastern door of the compressor room. Sound levels were 9 dB higher than measured in 2010 and 2011. This was considered to have been from contributions from the northern wall and door and have not changed since 2012. While the difference to 2011 is high, the actual level of 78 dBA is relatively low and the calculated contribution sound level at the residential receivers is more than 20 dB below the objectives and would not be discernible.

It is considered that sound levels from CM7 have not increased significantly since commissioning.

Measurements of Cement Mill #7 with the Kiln off on 9 June 2016

Sound levels were measured during a period with the kiln shutdown on 9 June 2016. Results for several measurement locations during this period are shown in Table 3.8. Results comparisons show an increase in sound levels at most locations close to the CM7 building of up to 5 dB on the kiln (southern) side of CM7. For the Store Yard Close and Northern Boundary environmental monitoring locations there was a 2 to 3 dB increase in LA90 sound levels with the kiln on compared to off.

It is considered that CM7 is in compliance with the noise objectives set for the Project.

3.3 CM6 Operation

During the monitoring period, CM6 was also operating. Measurements were obtained around this building on 14 July. Results are also provided in Table 3.5 with comparisons to those measured in previous years also shown. Locations along the western side of the CM6 building were not measured as a vacuum truck was operating there at the time of the measurements.

Measured sound levels can be increased around open doorways or doorways which are slightly open at the bottom. Where doorway openings were not an influence, sound levels were the same or lower than previous measurements.

The largest increase at any location compared to measurements from previous years 8 dBA outside the doorway to the main mill area of the building (location 17 of the measurements). During this measurement the roller door was open 80mm at the bottom and this allowed increased sound levels. Sound levels 26m north of the CM6 building were also higher by 9 dB compared to those of other years. This was because of there being a train behind the measurement location. The L90 sound level was 10 dB lower than the LEq value which means there was not any significant increase compared to previous.

Therefore it is considered that emissions from CM6 have not increased significantly to affect the total received sound level from the plant in residential receiver locations.

Table 3.8: Boral Cement Berrima - 2016 Annual Noise Assessment - Site Sound Levels for Kiln 6 Upgrade

Sound levels at measurement locations on 9 June - Kiln 6 off - compared to Kiln On 21 July6 or 10 August 2016

Area	Location	File No.	Start Time	Period hh:mm:ss	Statistical Sound Level - dBA Kiln Off						Statistical Sound Level - dBA Kiln On 10/8/16						Increase from Kiln Off to On						Comment For Kiln Off measurement		
					LAeq	LAMax	LA01	LA10	LA90	LCeq	File	LAeq	LAMax	LA01	LA10	LA90	LCeq	LAeq	LAMax	LA01	LA10	LA90		LCeq	LC-LA eq
CM7	CM7 Loc A top of stairs	163	8:43 AM	d 00:01:01	70	72	72	71	68	80	536	72	74	73	73	72	85	3	2	2	2	3	5	10	Wind 1-3m/s NNW
	CM7 Loc R corner SE of mill	165	8:48 AM	d 00:00:54	74	76	75	75	73	86	565	76	77	77	76	75	87	2	1	1	2	2	0	12	Main noise is discharge fan
	CM7 Loc S' Road S of fan discharge	166	8:50 AM	d 00:01:01	72	75	74	73	71	85	567	75	76	76	75	74	86	3	2	2	3	4	1	13	
	CM7 Loc S road opp E side CM7	169	8:56 AM	d 00:00:51	72	75	74	73	71	84	568	75	76	76	75	75	86	3	1	2	2	4	2	12	FA702 discharge noise + crossway CM7 to CM5 above
	CM7 Loc T opp W side CM5 bld	170	8:57 AM	d 00:00:50	70	72	72	71	69	82	569	75	75	75	75	74	85	5	3	4	4	5	3	12	Noise from E side crossway CM7 to CM5
	CM7 A' Base of stair opp baghouse W	171	8:59 AM	d 00:00:53	69	71	70	70	69	84	536	72	74	73	73	72	85	3	3	3	3	3	1	14	
	CM7 C' Base of stair opp W side CM7	172	9:01 AM	d 00:00:32	71	73	72	71	70	80	537	72	74	74	73	71	83	1	2	2	2	1	2	10	Opposite FA502
	CM7 D NW cnr	173	9:02 AM	d 00:00:31	71	73	73	72	69	81	541	72	74	74	73	71	82	1	1	1	1	2	1	10	
	CM7 G 13m N of W side comp shed	175	9:04 AM	d 00:01:14	74	77	76	75	73	82	554	75	77	76	76	74	82	1	0	0	1	1	0	8	
	CM7 O 13m N E side comp shed	176	9:06 AM	d 00:00:33	73	76	75	74	72	83	556	73	75	75	74	73	83	0	0	0	0	0	0	10	
	CM7 P N roll door @ 1m	177	9:07 AM	d 00:00:35	82	82	82	82	81	89	560	81	82	82	82	81	89	0	0	0	0	0	-1	8	
	CM7 E 1m to W comp house door	178	9:08 AM	d 00:00:37	76	79	78	76	75	84	543	71	73	72	71	71	83	-4	-6	-6	-5	-4	-1	8	
	CM7 F outside centre N vents	179	9:09 AM	d 00:00:31	78	79	78	78	78	87	544	76	77	77	77	76	86	-1	-1	-1	-1	-1	-1	9	
	CM7 F' edge concrete 9m W of F	180	9:10 AM	d 00:00:31	73	74	74	74	73	85														11	
	CM7 H' edge conc 9m W of main W roll	181	9:11 AM	d 00:01:12	75	76	75	75	74	85	546	75	76	75	75	74	84	0	-1	0	0	0	-1	10	
	CM7 H Main W roll door @ 1m	182	9:13 AM	d 00:00:33	82	83	82	82	81	90	545	81	82	82	81	81	89	-1	-1	-1	-1	0	-1	9	
	CM7 I centre vents S of roll door	183	9:13 AM	d 00:00:30	78	79	79	78	77	88	547	77	78	78	78	77	88	-1	-1	-1	-1	-1	0	10	
	CM7 J vents S of I & N of baghouse W	184	9:14 AM	d 00:00:30	78	79	78	78	77	91	548	78	79	78	78	77	90	0	0	0	0	0	-2	13	
	CM7 J' edge concrete 9m W of vents J	185	9:15 AM	d 00:00:31	75	76	76	75	75	85	549	74	74	74	74	73	84	-1	-1	-1	-1	-1	0	10	
CM7 J" Under baghouse	186	9:16 AM	d 00:00:36	81	82	82	81	81	91	550	80	81	81	80	80	91	-1	-1	-1	-1	-1	-1	10		
Boundary	Northern Boundary	187	9:31 AM	d 00:05:00	51	58	55	53	49	69	212	52	62	57	53	50	69	1	4	1	0	2	0	18	Wind 1-3m/s NNW from here to CM7. Very
	Store Yard Close	189	9:55 AM	d 00:05:20	56	76	66	57	51	75	215	61	79	75	58	52	75	5	3	8	1	1	-1	20	Wind 2-4 m/s NNW from here to CM7. Quiet ambient 50-51. Train moving
	Store Yard Close	190	10:01 AM	d 00:10:00	54	76	62	56	50	77	338	58	76	69	59	53	76	4	0	7	4	3	-1	23	Wind 2-4 m/s NNW from here to CM7. Quiet ambient 50-51. Train moving
Admin	Admin Build Roof SE corner	191	10:38 AM	d 00:01:08	69	74	73	71	66	82	534	71	73	73	71	70	81	2	-1	0	1	4	-1	13	FA502 main source & ESP screw conveyors
	Admin Build Roof SE corner									323	70	73	71	70	69	79	1	-1	-2	-1	3	-3			
	Admin Build Roof NE corner	192	10:40 AM	d 00:01:02	68	71	70	69	66	81	535	71	73	73	72	70	80	3	2	3	3	4	-1	13	FA502 and CM6 W wall fan
	Admin Build Roof NE corner	193	10:41 AM	d 00:01:01	67	73	70	68	66	81	326	68	72	69	69	68	78	1	-1	-1	0	1	-3	14	FA502 and CM6 W wall fan
	4 Melbourne St	201	11:13 AM	d 00:05:00	60	75	72	63	50	73	216	59	76	71	61	47	71	-2	1	-1	-2	-2	-2	12	Wind 1-5 m/s NW-W from here to mills. WITN, traffic. No plant noise audible. WITN to 57, cars 63-65, trucks 68-75, dogs 51

Table 3.9: Boral Cement Berrima - 2016 Annual Noise Assessment - Site Sound Levels for Kiln 6 Upgrade

Sound levels at measurement locations on 9 June - Kiln 6 off - Tonality

Area	Location	File No.	Date	Start Time	Period hh:mm:ss	Tonality Sound Level -dB for Leq in One-third Octave Band Frequency Hz																													
						31.5 Hz	40 Hz	50 Hz	63 Hz	80 Hz	100 Hz	125 Hz	160 Hz	200 Hz	250 Hz	315 Hz	400 Hz	500 Hz	630 Hz	800 Hz	1 kHz	1.25 kHz	1.6 kHz	2 kHz	2.5 kHz	3.15 kHz	4 kHz	5 kHz	6.3 kHz	8 kHz	10 kHz	12.5 kHz	16 kHz		
CM7	CM7 Loc A top of stairs	163	9/06/2016	8:43 AM	d 00:01:01	0	0	0	1	0	1	0	1	2	1	1	1	3	1	0	0	0	1	1	1	1	1	0	1	1	1	0	1	1	0
	CM7 Loc R corner SE of mill	165	9/06/2016	8:48 AM	d 00:00:54	2	7	5	0	1	0	1	1	3	3	5	2	3	6	3	0	0	0	0	1	0	1	0	0	1	0	0	1	0	
	CM7 Loc S' Road S of fan discharge	166	9/06/2016	8:50 AM	d 00:01:01	3	8	6	0	0	1	0	0	1	4	4	1	3	4	0	0	1	0	2	1	1	0	0	0	1	0	1	0	1	
	CM7 Loc S road opp E side CM7	169	9/06/2016	8:56 AM	d 00:00:51	2	7	6	1	1	0	1	0	2	1	3	1	0	0	0	0	1	2	1	0	0	1	0	0	2	0	0	1		
	CM7 Loc T opp W side CM5 bld	170	9/06/2016	8:57 AM	d 00:00:50	1	5	4	1	1	0	1	0	0	2	2	1	0	0	0	0	2	2	1	0	0	0	1	0	0	4	1	1	1	
	CM7 A' Base of stair opp baghouse W	171	9/06/2016	8:59 AM	d 00:00:53	1	7	4	1	1	1	0	2	2	1	2	1	0	0	0	0	0	1	1	1	1	0	0	1	4	1	1	2		
	CM7 C' Base of stair opp W side CM7	172	9/06/2016	9:01 AM	d 00:00:32	0	2	1	1	0	1	0	1	1	1	0	1	4	3	1	1	1	1	1	1	1	1	1	2	1	1	0	2		
	CM7 D NW cnr	173	9/06/2016	9:02 AM	d 00:00:31	0	3	1	0	1	1	1	0	4	1	1	0	0	1	2	2	1	1	0	0	2	0	1	1	1	1	1	2		
	CM7 G 13m N of W side comp shed	175	9/06/2016	9:04 AM	d 00:01:14	4	0	2	0	1	0	2	1	0	1	0	1	7	3	2	2	1	1	0	0	1	0	1	0	0	1	1	1		
	CM7 O 13m N E side comp shed	176	9/06/2016	9:06 AM	d 00:00:33	3	1	3	1	0	0	0	2	2	2	5	3	3	3	1	1	0	1	1	0	1	1	0	1	1	1	1	2		
	CM7 P N roll door @ 1m	177	9/06/2016	9:07 AM	d 00:00:35	3	1	0	3	2	2	2	2	1	1	2	1	2	1	0	1	0	0	0	1	0	1	0	1	1	1	1	1		
	CM7 E 1m to W comp house door	178	9/06/2016	9:08 AM	d 00:00:37	0	3	1	1	1	1	2	1	0	1	0	0	0	0	1	0	1	0	1	1	0	1	1	3	2	0	1	1		
	CM7 F outside centre N vents	179	9/06/2016	9:09 AM	d 00:00:31	0	4	1	3	2	0	1	1	0	0	0	0	1	0	0	0	1	2	0	0	1	1	1	0	4	1	2	1		
	CM7 F' edge concrete 9m W of F	180	9/06/2016	9:10 AM	d 00:00:31	1	4	4	1	3	1	0	2	0	3	2	1	0	0	1	0	0	1	1	0	1	1	0	2	1	7	4	1		
	CM7 H' edge conc 9m W of main W roll	181	9/06/2016	9:11 AM	d 00:01:12	0	4	2	1	1	0	0	2	0	3	3	0	0	0	1	0	0	1	0	0	1	1	1	3	1	0	0	1		
	CM7 H Main W roll door @ 1m	182	9/06/2016	9:13 AM	d 00:00:33	2	6	4	1	2	2	0	3	0	3	1	1	1	0	1	1	0	0	0	1	0	2	1	1	1	0	1	1		
	CM7 I centre vents S of roll door	183	9/06/2016	9:13 AM	d 00:00:30	2	4	1	3	0	1	0	1	0	1	1	0	0	0	0	0	1	1	1	0	0	1	0	0	1	0	0	1		
	CM7 J vents S of I & N of baghouse W	184	9/06/2016	9:14 AM	d 00:00:30	3	8	5	0	1	1	1	1	2	2	2	1	1	1	0	0	1	1	0	0	1	1	1	0	2	1	1			
	CM7 J' edge concrete 9m W of vents J	185	9/06/2016	9:15 AM	d 00:00:31	1	5	3	2	1	1	0	1	0	5	5	0	1	1	1	0	1	1	0	0	1	1	0	0	1	1	1	1		
	CM7 J'' Under baghouse	186	9/06/2016	9:16 AM	d 00:00:36	1	5	4	2	2	0	2	2	0	4	4	1	1	1	0	1	0	1	1	2	0	1	3	2	0	4	1	0		
Boundary	Northern Boundary	187	9/06/2016	9:31 AM	d 00:05:00	2	1	2	1	0	1	0	1	0	2	1	1	1	0	1	0	0	0	0	0	0	0	0	0	1	1	1	1		
	Store Yard Close	189	9/06/2016	9:55 AM	d 00:05:20	2	3	1	0	0	1	1	0	0	0	0	1	1	1	0	0	0	0	0	0	1	1	2	1	2	1	1	1		
	Store Yard Close	190	9/06/2016	10:01 AM	d 00:10:00	1	2	0	0	1	0	0	0	0	1	0	0	1	1	0	0	0	0	1	0	0	0	3	6	2	0	0	0		
Admin Build Roof	Admin Build Roof SE corner	191	9/06/2016	10:38 AM	d 00:01:08	0	2	1	0	0	0	1	2	1	0	2	3	2	2	2	4	2	0	0	0	0	2	0	0	0	0	1	1		
	Admin Build Roof SE corner	192	9/06/2016	10:40 AM	d 00:01:02	1	3	0	1	1	0	0	2	0	2	2	3	2	1	1	1	0	0	1	1	1	1	0	0	0	0	1	0		
	Admin Build Roof NE corner	193	9/06/2016	10:41 AM	d 00:01:01	1	2	0	2	1	1	0	1	0	2	1	2	2	0	1	1	0	0	1	1	0	1	1	1	1	0	1	1		
	4 Melbourne St	201	9/06/2016	11:13 AM	d 00:05:00	0	0	2	3	0	2	2	0	1	1	2	2	0	1	0	1	1	0	0	1	2	0	0	1	0	1	2	1		

4. Review of residential receiver sound levels for 2015

Environmental noise is measured in residential receiver areas near the site in New Berrima. Measurements are by a combination of attended monitoring (with an experienced person taking the measurements with a portable sound level meter), and unattended measurements over periods of up to two-weeks with remote sound level logging instruments. The results of these measurements are described in this section.

4.1 Unattended statistical sound levels

Results for 2016

Unattended sound levels were monitored at six locations from 5 to 19 August 2014. These locations are shown in Figure 1.2 and are:

- 4 Melbourne Street (Appendix A);
- 72 Taylor Avenue near the corner with Adelaide Street (Appendix B);
- 12 Brisbane Street (Appendix C);
- Plant Northern Boundary Fence next to the Stores yard (Appendix D);
- Stores Yard close (Appendix E)
- Lake Breed – south east boundary (Appendix F);

Monitoring at farm houses east of the plant has not continued since 2015 when those residences were acquired for industrial projects and the houses demolished or abandoned. Other locations east of the plant are more than 2km distant and were used as background measurements for Kiln 6 upgrade noise impact studies. Locations to the north-east of the plant will be more affected by emissions from the proposed quarry.

An additional monitoring location was added in 2015 inside the Northern Boundary on an internal road in the external storage yard area, named Stores Yard Close. This was selected because the Northern Boundary location is influenced by noise emissions from vehicles using Taylor Avenue. This internal location is closer to the sources and less influenced by external traffic noise. Results for this location are included in this report.

A new location was added for this survey in 2016, on the southern side of Lake Breed. This was to provide a south-eastern boundary location as a baseline should the proposed rail line to the Hume Coal Project, shown in Figure 2.1, ever be built. Figure 4.1 shows the measurement locations in this survey.

Monitoring occurred from 21 July to 10 August. The loggers at the residential locations obtained results for up to two weeks or 16 days, depending on memory or battery life. The Store Yard Close location logger obtained 19 days of continuous data. The loggers at the Northern Boundary and Lake Breed only obtained data for 3 days before battery failure occurred.

During the measurement period, Kiln 6 (and associated plant) had a period of shut-down during the third week of monitoring for the final two days, so this did not affect residential receiver measurements. Cement Mill 7 had periods of non-operation of two consecutive

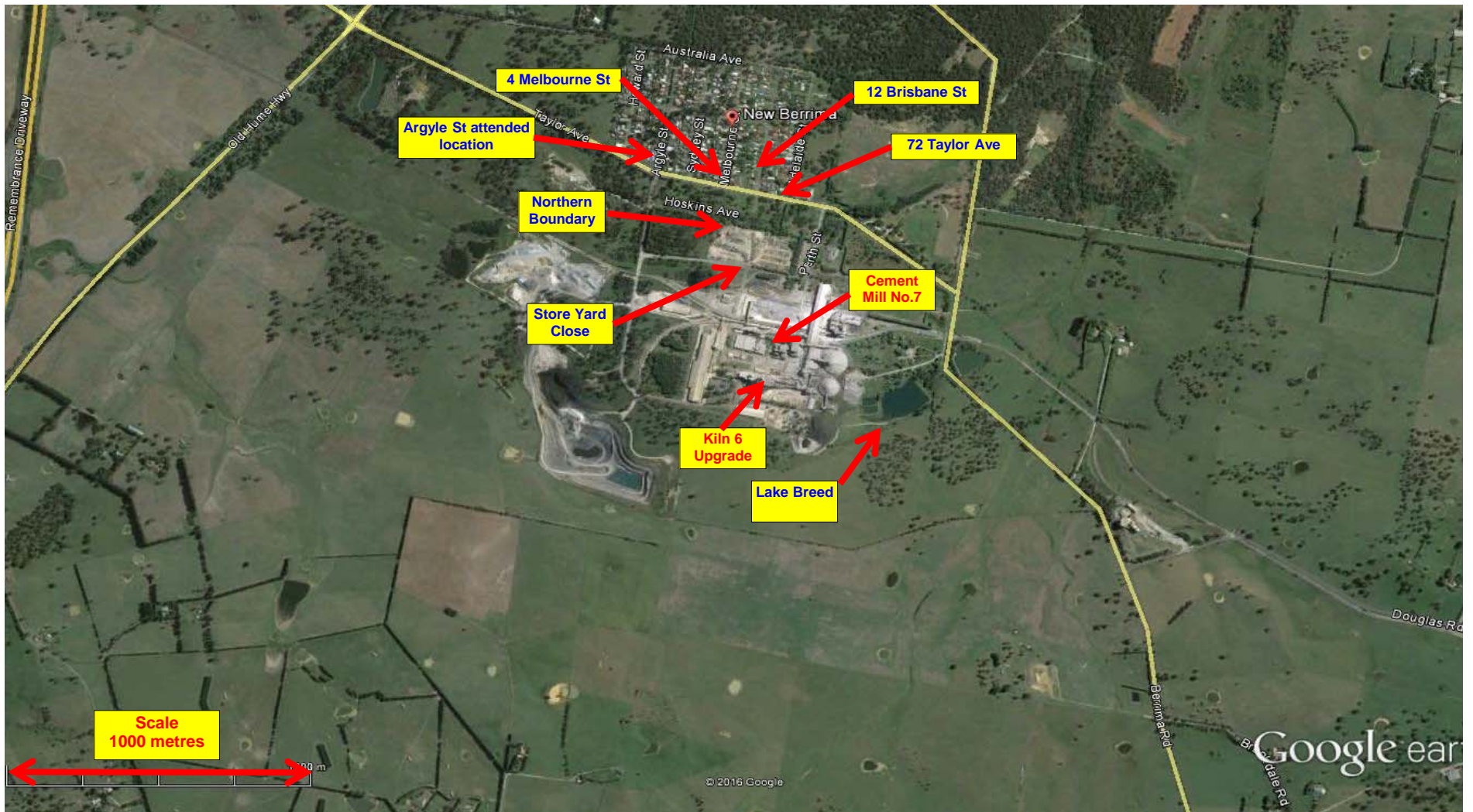


Figure 4.1: Boral Cement - Berrima Cement Works - Aerial view of site, surrounds and long-term and residential logger monitoring locations

days during the first week and two separate days during the second week. Raw Mill 7 also had a period of non-operation of four days between day 5 and day 9 of the monitoring period (26 to 30 July) and only the Cement Mills were operating. Figure 4.2 shows the times of non-operation of the plant items over the monitoring period.

Weather conditions during the measurement periods

Weather is monitored at the Cement Plant weather station. Data for wind speed, wind direction and rainfall for the period of monitoring have been graphed in Figures 4.3A, B and C. Wind directions are significant for sound levels in receiver locations near the plant, especially if they are from the southerly direction.

During the measurement period there were a number of days with relatively high wind speeds of 5 to 10 m/s (at the met. mast elevation of 10m), especially during the first week of monitoring. During these periods the wind direction was consistently westerly. Sound levels were affected by wind in vegetation noise at these times. At other times of lower wind speeds, the direction was mainly northerly. Periods of low wind speeds had wind directions including southerly.

During the measurement period temperatures ranged from low to high for the season, at times down to -1°C on 24 July and 18 to 19°C on 22 July and 10 August. Humidity was generally high from 50 to 60% during the day to 95% at nights. Rain occurred briefly on seven days, with 3mm on the night of 22 July and 2mm on the afternoon of 7 August.

Southerly winds have the highest potential to cause higher sound levels in New Berrima from plant emissions, depending upon location – locations along Taylor Avenue, such as 72 Taylor Avenue, are mainly influenced by traffic noise rather than plant emissions. During this monitoring period, there was a period of consistent southerly winds of 4 to 6m/s and these caused an increase in sound levels of approximately 4 dB in the LA90 measured at the Store Yard location and close to 10 dB at 4 Melbourne St and 12 Brisbane St. Other location monitoring had generally ended by the period of those winds.

Residential receiver sound levels for L_{Aeq} do not appear to have been affected by Cement Mill 7 stoppages and the kiln shutdown occurred after the monitoring had ended at the residential locations.

Figure 4.2: Boral Cement Berrima Annual Noise Assessment 2016 - Major Plant Item Idle Times
Note Time on graph is when plant item is idle

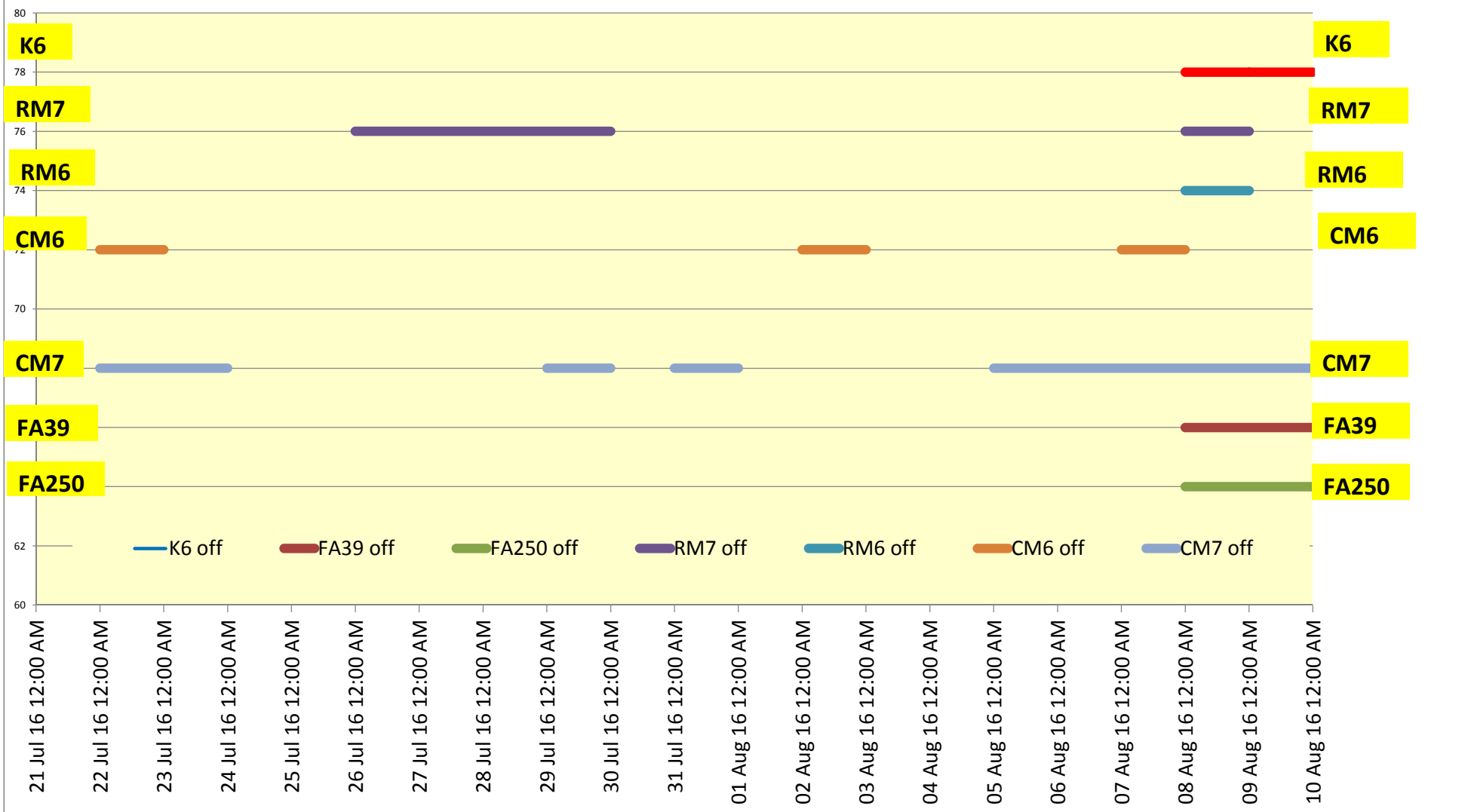
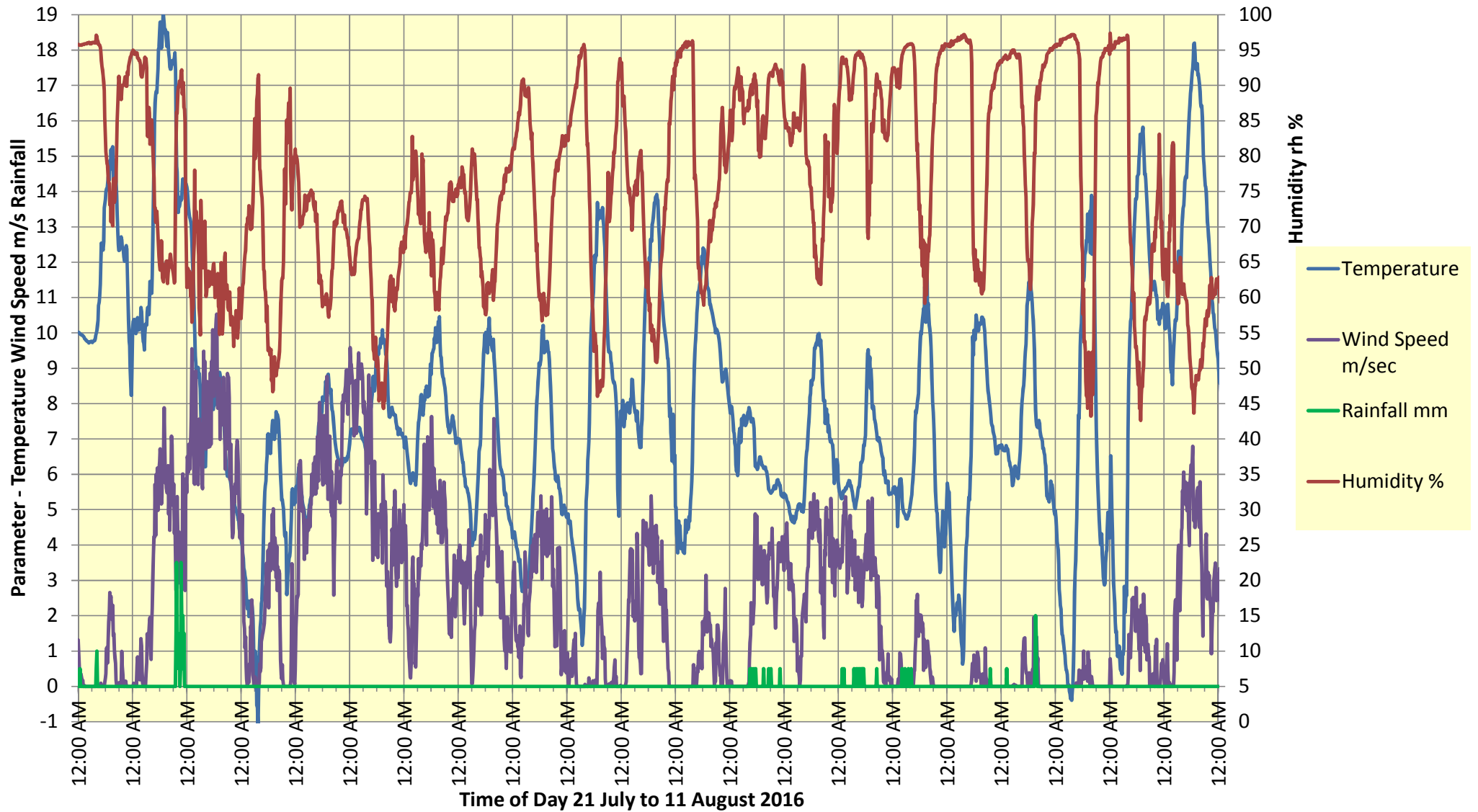


Figure 4.3C: Boral Cement Berrima - Weather 21 July to 11 August 2016



Full statistical results of the measurements and graphs of the two-day 15-minute sound level results are given in Appendices A to F. Graphs of the two-day sound levels include wind speed on the top graph of the page and wind direction on the bottom graph. The top graph on those pages also includes times when the major plant items at the cement works were operating.

Table 4.1 provides a summary of the statistical results for all residential receiver sites and the Northern Boundary and Store Yard Close locations monitored in 2016. This includes all periods monitored. Data presented is period averages of L_{Aeq} , L_{A90} and 10% L_{A90} . Table 4.1A shows results with data from rain periods removed. Table 4.1B shows the difference between rain periods included and removed.

For the rain period removed data, considering the average night-time levels which are of the most potential concern for annoyance, receiver period L_{Aeq} sound levels ranged from 43 to 68 dBA, the highest being for 72 Taylor Avenue and the lowest for 12 Brisbane St. Average of all night period L_{Aeq} sound levels ranged from 48 dBA at 12 Brisbane St to 58 dBA at 72 Taylor Avenue. L_{Aeq} is considered to not be an effective measurement for most locations in this study because of the contribution from traffic noise. L_{A90} is considered a better parameter for assessment of environmental noise in this case, although it is still affected to some extent by traffic noise.

For the average night period L_{A90} sound levels, the values ranged from 44 dBA at 12 Brisbane St to 48 dBA at 72 Taylor Ave. The average $L_{A90,night}$ sound levels were 50 dBA at the Store Yard Close location and 49 dBA at the Northern Boundary.

Table 4.1 : Boral Cement Berrima - Annual Environmental Noise Compliance - residential and boundary receiver locations

Comparison of Period LAEQ, Period Average LA90 and Period 90% LA90 Results

Summary of Statistical Data

LAEQ.15min	Day			Evening			Night			24 hour		
	Max L _{AEQ,Day}	Min L _{AEQ,Day}	Ave L _{AEQ,Day}	Max L _{AEQ,Eve.}	Min L _{AEQ,Eve.}	Ave L _{AEQ,Eve.}	Max L _{AEQ,Night}	Min L _{AEQ,Night}	Ave L _{AEQ,Night}	Max L _{AEQ,24hr}	Min L _{AEQ,24hr}	Ave L _{AEQ,24hr}
4 Melbourne St, New Berrima NSW	59	52	56	58	49	53	56	47	52	57	50	54
72 Taylor Ave, New Berrima NSW	68	58	63	65	52	58	68	51	58	57	45	50
12 Brisbane St, New Berrima NSW	57	51	53	55	45	49	55	43	48	55	49	51
Northern Fence, New Berrima NSW	61	49	53	57	50	53	56	51	52	59	49	53
Plant - Store Yard Close	62	52	58	59	51	53	61	50	53	60	52	57
Plant - Lake Breed South side	65	56	59	61	56	57	61	57	58	63	56	59

L90.15-min 10%	Day				Evening				Night			
	Max L _{A90,Day}	Min L _{A90,Day}	Ave L _{A90,Day}	Median L _{A90,Day}	Max L _{A90,Eve.}	Min L _{A90,Eve.}	Ave L _{A90,Eve.}	Median L _{A90,Eve.}	Max L _{A90,Night}	Min L _{A90,Night}	Ave L _{A90,Night}	Median L _{A90,Night}
4 Melbourne St, New Berrima NSW	52	42	46	45	51	41	45	45	51	41	45	43
72 Taylor Ave, New Berrima NSW	53	44	47	47	50	44	46	46	53	44	46	45
12 Brisbane St, New Berrima NSW	51	38	45	44	49	36	43	43	49	36	42	41
Northern Fence, New Berrima NSW	53	45	48	47	50	46	48	47	48	46	47	47
Plant - Store Yard Close	56	46	52	52	56	47	49	51	56	46	49	51
Plant - Lake Breed South side	59	54	56	56	57	52	54	54	57	55	56	55

L90.15-min	Day				Evening				Night			
	Max L _{A90,Day}	Min L _{A90,Day}	Ave L _{A90,Day}	Median L _{A90,Day}	Max L _{A90,Eve.}	Min L _{A90,Eve.}	Ave L _{A90,Eve.}	Median L _{A90,Eve.}	Max L _{A90,Night}	Min L _{A90,Night}	Ave L _{A90,Night}	Median L _{A90,Night}
4 Melbourne St, New Berrima NSW	53	43	48	47	52	42	46	46	52	43	46	45
72 Taylor Ave, New Berrima NSW	56	46	50	49	52	44	48	47	56	45	48	47
12 Brisbane St, New Berrima NSW	52	41	47	46	51	37	45	44	51	39	44	43
Northern Fence, New Berrima NSW	55	47	49	48	52	48	49	48	51	48	49	48
Plant - Store Yard Close	57	47	53	53	57	48	50	52	56	49	50	52
Plant - Lake Breed South side	60	54	57	56	58	53	55	55	58	56	56	56

Table 4.1A : Boral Cement Berrima - Annual Environmental Noise Compliance - residential and boundary receiver locations

Comparison of Period LAEQ, Period Average LA90 and Period 90% LA90 Results - rain period data removed

Summary of Statistical Data

LAEQ.15min	Day			Evening			Night			24 hour		
	Max L _{AEQ,Day}	Min L _{AEQ,Day}	Ave L _{AEQ,Day}	Max L _{AEQ,Eve.}	Min L _{AEQ,Eve.}	Ave L _{AEQ,Eve.}	Max L _{AEQ,Night}	Min L _{AEQ,Night}	Ave L _{AEQ,Night}	Max L _{AEQ,24hr}	Min L _{AEQ,24hr}	Ave L _{AEQ,24hr}
4 Melbourne St, New Berrima NSW	59	52	56	56	49	52	56	47	52	60	55	58
72 Taylor Ave, New Berrima NSW	68	58	63	65	52	58	68	51	58	57	45	50
12 Brisbane St, New Berrima NSW	57	51	53	53	45	49	55	43	48	55	49	51
Northern Fence, New Berrima NSW	60	49	53	57	50	52	56	51	52	60	55	58
Plant - Store Yard Close	62	52	58	59	51	55	61	50	56	60	52	57
Plant - Lake Breed South side	65	56	59	61	56	57	61	57	58	63	56	59

L90.15-min 10%	Day				Evening				Night			
	Max L _{A90,Day}	Min L _{A90,Day}	Ave L _{A90,Day}	Median L _{A90,Day}	Max L _{A90,Eve.}	Min L _{A90,Eve.}	Ave L _{A90,Eve.}	Median L _{A90,Eve.}	Max L _{A90,Night}	Min L _{A90,Night}	Ave L _{A90,Night}	Median L _{A90,Night}
4 Melbourne St, New Berrima NSW	52	42	46	45	51	41	45	45	51	41	45	43
72 Taylor Ave, New Berrima NSW	53	44	47	47	50	44	46	46	53	44	46	45
12 Brisbane St, New Berrima NSW	51	38	45	44	49	36	43	43	49	36	42	41
Northern Fence, New Berrima NSW	53	45	48	47	50	46	48	47	48	46	47	47
Plant - Store Yard Close	56	46	52	52	56	47	49	51	56	46	49	51
Plant - Lake Breed South side	59	54	56	56	57	52	54	54	57	55	56	55

L90.15-min	Day				Evening				Night			
	Max L _{A90,Day}	Min L _{A90,Day}	Ave L _{A90,Day}	Median L _{A90,Day}	Max L _{A90,Eve.}	Min L _{A90,Eve.}	Ave L _{A90,Eve.}	Median L _{A90,Eve.}	Max L _{A90,Night}	Min L _{A90,Night}	Ave L _{A90,Night}	Median L _{A90,Night}
4 Melbourne St, New Berrima NSW	53	43	48	47	52	42	46	45	52	43	46	45
72 Taylor Ave, New Berrima NSW	56	46	50	49	52	44	48	47	56	45	48	47
12 Brisbane St, New Berrima NSW	52	41	47	46	51	37	44	44	51	39	44	43
Northern Fence, New Berrima NSW	55	47	49	48	52	46	49	48	51	48	49	48
Plant - Store Yard Close	57	47	53	53	57	48	50	52	56	49	50	52
Plant - Lake Breed South side	60	54	57	56	58	53	55	55	58	56	56	56

Table 4.1B: Boral Cement Berrima - Annual Environmental Noise Compliance - residential and boundary receiver locations

Comparison of Period LAEQ, Period Average LA90 and Period 90% LA90 Results - difference between results for rain period data removed and not removed

Summary of Statistical Data

LAEQ.15min	Max L _{AEQ,Day}	Min L _{AEQ,Day}	Ave L _{AEQ,Day}	Max L _{AEQ,Eve.}	Min L _{AEQ,Eve.}	Ave L _{AEQ,Eve.}	Max L _{AEQ,Night}	Min L _{AEQ,Night}	Ave L _{AEQ,Night}	Max L _{AEQ,24hr}	Min L _{AEQ,24hr}	Ave L _{AEQ,24hr}
	4 Melbourne St, New Berrima NSW	-0.1	0.0	0.0	-1.4	0.0	-0.4	0.0	0.0	-0.1	2.7	4.8
72 Taylor Ave, New Berrima NSW	-0.3	0.0	0.0	0.0	0.0	-0.3	0.0	0.0	0.0	0.0	0.0	0.0
12 Brisbane St, New Berrima NSW	-0.2	0.0	0.0	-2.1	0.0	-0.4	0.0	0.0	-0.1	-0.3	0.0	-0.1
Northern Fence, New Berrima NSW	-0.5	0.0	-0.1	0.0	-0.7	-1.1	0.1	0.0	0.0	1.1	5.7	4.9
Plant - Store Yard Close	-0.1	0.0	0.0	0.0	-0.1	2.4	0.0	0.0	2.6	0.0	0.0	-0.2
Plant - Lake Breed South side	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

L90.15-min 10%	Day				Evening				Night			
	Max L _{A90,Day}	Min L _{A90,Day}	Ave L _{A90,Day}	Median L _{A90,Day}	Max L _{A90,Eve.}	Min L _{A90,Eve.}	Ave L _{A90,Eve.}	Median L _{A90,Eve.}	Max L _{A90,Night}	Min L _{A90,Night}	Ave L _{A90,Night}	Median L _{A90,Night}
4 Melbourne St, New Berrima NSW	-0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
72 Taylor Ave, New Berrima NSW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12 Brisbane St, New Berrima NSW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Northern Fence, New Berrima NSW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.1	0.0
Plant - Store Yard Close	0.0	0.0	0.0	0.0	0.0	-0.1	0.0	0.0	0.0	0.0	0.0	0.0
Plant - Lake Breed South side	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

L90.15-min	Day				Evening				Night			
	Max L _{A90,Day}	Min L _{A90,Day}	Ave L _{A90,Day}	Median L _{A90,Day}	Max L _{A90,Eve.}	Min L _{A90,Eve.}	Ave L _{A90,Eve.}	Median L _{A90,Eve.}	Max L _{A90,Night}	Min L _{A90,Night}	Ave L _{A90,Night}	Median L _{A90,Night}
4 Melbourne St, New Berrima NSW	0.0	0.0	0.0	0.0	0.0	0.0	-0.3	-1.1	0.0	0.0	0.0	0.0
72 Taylor Ave, New Berrima NSW	-0.3	0.0	0.0	0.0	0.0	0.0	-0.4	-0.3	0.0	0.0	0.0	0.0
12 Brisbane St, New Berrima NSW	-0.3	0.0	0.0	0.0	0.0	0.0	-0.2	-0.3	0.0	0.0	0.0	0.0
Northern Fence, New Berrima NSW	-0.3	0.0	-0.1	0.0	0.0	-1.7	-0.6	0.0	0.0	0.0	0.0	0.0
Plant - Store Yard Close	0.0	0.0	0.0	0.0	0.0	0.0	-0.2	0.0	0.0	0.0	0.0	0.0
Plant - Lake Breed South side	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

2016 results compared to previous results

Sound levels have been measured at residential receiver locations since 2002. These measurements have included attended monitoring for 15-minute intervals in daytime and night-time, and unattended monitoring over typically two-week periods. Monitoring was done by Hatch from 2002 to 2007, and 2010 to 2014. For June and December 2008, the monitoring was done by Heggies Pty Ltd.

The site with the most number of measurements and regular surveys has been in the front of No.4 Melbourne Street. The number of long-term measurements at each location is as follows:

- 4 Melbourne St 24 occasions
- 70/72 Taylor Avenue 17 occasions;
- 12 Brisbane Street. 8 occasions
- Northern boundary 14 occasions
- Store Yard Close 3 occasions

Many of the measurements have been during operational periods, while some have occurred during plant shut-downs in summer months.

A review of the comparison of sound levels measured regularly at all locations has been made. This is shown in Table 4.2 (for all data) and Table 4.2A (with rain periods removed), and graphed for each location monitored in 2016 in Figures 4.4 to 4.13. The results given in the table and figures are:

$L_{Aeq,period\ average}$	this is the energy average of the period (day, evening or night) L_{Aeq} for all of the periods monitored
$L_{A90,average}$	this is the arithmetic average of the average period $L_{A90,15-min}$ for the periods monitored.
$10\%L_{A90,average}$	this is the median of the period $10\% L_{A90,15-min}$ for the monitoring period

Range of results for different periods and parameters – rain periods removed

Average daytime period L_{Aeq} values were in the range 53 to 63 dBA – the highest being at Taylor Avenue near Adelaide St. The highest result at 72 Taylor Avenue is expected as the location is within 10m of the road where many trucks and other vehicles pass by. The lowest result was at 12 Brisbane St and the Northern Boundary both with 53 dBA – this is 3 dB lower than 2015.

Daytime average L_{A90} sound levels ranged from 47 to 50 dBA. 12 Brisbane St had the lowest levels, with 47 dBA. Highest of the residential receivers was 50 dBA at 72 Taylor Ave, with 49 dBA at the Northern Boundary and 53 dBA at the Store Yard Close location. These daytime average L_{A90} sound levels are about 3 dB higher than in 2015, possibly because of the higher wind speeds.

Average Evening period L_{Aeq} values were in the range 49 to 58 dBA, the highest being at 72 Taylor Ave. The lowest was 49 dBA at 12 Brisbane St. The Store Yard Close location

Table 4.2: Boral Cement - Berrima Works - Environmental Noise Review: Comparison of statistical sound levels 2002 to 2016

Receiver Location 4 Melbourne Street

Parameter	Period	Survey Dates																				Statistics									
		Sep-02	Jan-03	Feb-03	Feb-04	Mar-04	Apr-04	May-04	Sep-04	Jan-06	Feb-06	Jun-06	Apr-07	Jun-08	Dec-08	Sep-10	Jun-11	Jul-11	Jul-12	Oct-12	Oct-12	Sep-13	Aug-14	Jul-15	Apr-16	May-16	Jul-16	Max	Min	Ave	SD
LAEQ.ave	Day	57	50	54	55	54	56	54	54	56	58	56	55	57	56	52	56	56	55	56	53	56	57			56	58	50	55	1.8	
	Evening	53	48	54	54	65	53	51	50	60	57	53	52	54	59	53	52	51	51	50	52	50	53	52			53	65	48	53	3.7
	Night	53	44	49	47	49	50	51	49	51	51	51	52	51	56	52	50	50	51	49	51	51	52	52			52	56	44	51	2.2
LA90.ave	Day	46	40	43	43	44	45	45	44	44	45	47	46	47	50	47	45	46	46	43	45	43	48	48			48	50	40	45	2.2
	Evening	44	39	42	42	42	44	45	43	45	46	47	46	46	49	46	39	39	45	40	39	42	47	46			46	49	39	44	3.0
	Night	44	37	41	39	40	44	45	43	42	46	46	46	45	50	46	38	38	44	36	40	42	47	45			46	50	36	43	3.6
10%LA90.med	Day	44	38	41	39	41	43	43	42	43	43	45	45	45	43	45	42	44	43	40	43	41	45	46			45	46	38	43	2.1
	Evening	42	37	40	40	39	42	44	42	43	43	45	44	45	46	43	38	41	42	33	34	41	45	44			45	46	33	42	3.4
	Night	42	35	39	37	37	42	43	41	42	43	44	44	44	44	44	38	40	41	29	34	40	44	43			43	44	29	41	3.9
LAEQ	Day	INP Acceptable*			Kiln 6 Contribution			CM7 Contribution			NL Rec PRP7 20		Most OffMost on										Ave L90 from attended for Jun & Dec 2008								
	Evening	60			43			43			46																				
	Night	50			43			43			42																				

* Based on Suburban/Industrial Interface from NSW INP Table 2.1

Receiver Location 72 Taylor Ave near Adelaide St

Parameter	Period	Survey Dates																				Statistics									
		Sep-02	Jan-03	Feb-03	Feb-04	Mar-04	Apr-04	May-04	Jan-06	Feb-06	Feb-06	Jun-06	Apr-07	Jun-08	Dec-08	Sep-10	Jun-11	Jul-11	Jul-12	Oct-12	Oct-12	Sep-13	Aug-14	Jul-15	Apr-16	May-16	Jul-16	Max	Min	Ave	SD
LAEQ.ave	Day								61	62	54	63	62	63	63	60	57	60	60	60	59	61	61	52			63	63	52	60	3.2
	Evening								57	58	50	59	57	59	59	56	57	53	55	54	48	57	55	47			58	59	47	55	3.7
	Night								56	56	49	58	56	59	58	56	55	56	55	52	48	60	55	50			58	60	48	55	3.5
LA90.ave	Day								47	45	41	48	48	49	49	47	46	47	49	45	48	50	47	49			50	50	41	47	2.3
	Evening								46	44	40	47	46	46	47	45	37	42	48	40	41	49	47	46			48	49	37	45	3.4
	Night								45	42	40	47	46	45	48	46	36	42	47	38	41	47	47	46			48	48	36	44	3.7
10%LA90.ave	Day								45	43	39	47	46	47	45	45	43	43	46	42	46	48	46	47			47	48	39	45	2.3
	Evening								45	42	40	46	45	46	44	44	39	44	46	39	40	49	46	44			46	49	39	44	2.9
	Night								44	41	39	46	45	46	43	43	38	42	46	35	39	45	46	45			45	46	35	43	3.3
LAEQ	Day	INP Acceptable*			Kiln 6 Contribution			CM7 Contribution			NL Rec PRP7 20		Most OffMost on										Ave L90 from attended for Jun & Dec 2008								
	Evening	60			43			43			48																				
	Night	50			43			43			44																				

Receiver Location 4 Northern Boundary

Parameter	Period	Survey Dates																				Statistics									
		Sep-02	Jan-03	Feb-03	Feb-04	Mar-04	Apr-04	May-04	Sep-04	Jan-06	Feb-06	Jun-06	Apr-07	Jun-08	Aug-10	Sep-10	Jun-11	Jul-11	Jul-12	Oct-12	Oct-12	Sep-13	Aug-14	Jul-15	Apr-16	May-16	Jul-16	Max	Min	Ave	SD
LAEQ.ave	Day	52												63	53	50	52	55	52	49	50	51	51	52	51	54	53	49	53	3.3	
	Evening	52												54	51	49	49	51	50	45	49	50	50	51	50	51	53	54	45	50	2.1
	Night	53												54	51	50	47	52	51	44	50	49	51	52	51	52	52	54	44	51	2.5
LA90.ave	Day	48												53	49	47	47	51	48	43	46	44	47	49	49	51	49	53	43	48	2.6
	Evening	50												53	48	47	45	49	48	41	47	47	48	48	48	50	49	53	41	48	2.6
	Night	50												53	49	47	43	49	48	39	47	46	48	48	46	50	49	53	39	47	3.3
10%LA90.ave	Day	46												51	48	46	44	49	46	41	45	46	46	47	47	49	47	51	41	47	2.3
	Evening	48												51	47	46	42	49	46	40	46	45	47	47	46	49	47	51	40	46	2.7
	Night	48												51	47	47	42	48	46	37	45	44	47	48	48	49	47	51	37	46	3.3

Receiver Location 12 Brisbane Street

Parameter	Period	Survey Dates																				Statistics										
		Sep-02	Jan-03	Feb-03	Feb-04	Mar-04	Apr-04	May-04	Sep-04	Jan-06	Feb-06	Jun-06	Apr-07	Jun-08	Aug-10	Sep-10	Jun-11	Jul-11				Sep-13	Aug-14	Jul-15	Apr-16	May-16	Jul-16	Max	Min	Ave	SD	
LAEQ.ave	Day																															
	Evening																															
	Night																															
LA90.ave	Day																															
	Evening																															
	Night																															
10%LA90.ave	Day																															
	Evening																															
	Night																															

Receiver Location Store Yard Close from 2015

Parameter	Period	Survey Dates																				Statistics										
		Sep-02	Jan-03	Feb-03	Feb-04	Mar-04	Apr-04	May-04	Sep-04	Jan-06	Feb-06	Jun-06	Apr-07	Jun-08	Aug-10	Sep-10	Jun-11	Jul-11				Sep-13	Aug-14	Jul-15	Apr-16	May-16	Jul-16	Max	Min	Ave	SD	
LAEQ.ave	Day																															
	Evening																															
	Night																															
LA90.ave	Day																															
	Evening																															
	Night																															
10%LA90.ave	Day																															
	Evening																															
	Night																															

Table 4.2A: Boral Cement - Berrima Works - Environmental Noise Review: Comparison of statistical sound levels 2002 to 2014 - Rain periods removed

Receiver Location 4 Melbourne Street

Parameter	Period	Survey Dates																				Statistics				Difference to Non rain removed									
		Sep-02	Jan-03	Feb-03	Feb-04	Mar-04	Apr-04	May-04	Sep-04	Jan-06	Feb-06	Jun-06	Apr-07	Jun-08	Dec-08	Sep-10	Jun-11	Jul-11	Jul-12	Oct-12	Oct-12	Sep-13	Aug-14	Jul-15	Apr-16	May-16	Jul-16	Max	Min	Ave	SD	Max	Min	Ave	SD
LAEQ.ave	Day	57	50	54	55	54	56	54	54	56	56	58	56	55	57	56	52	56	56	55	56	53	56	57			56	58	50	55	1.8	0.0	0.0	-0.1	-0.1
	Evening	53	48	54	54	65	53	51	50	60	57	53	52	54	59	53	52	51	51	50	52	50	52	49			52	65	48	53	3.8	0.0	0.0	-0.2	0.1
	Night	53	44	49	47	49	50	51	49	51	51	51	52	51	56	52	50	50	51	49	51	50	51	52			52	56	44	50	2.2	0.0	0.0	-0.1	0.0
LA90.ave	Day	46	40	43	43	44	45	45	44	44	45	47	46	47	50	47	45	46	46	43	45	43	46	47			48	50	40	45	2.1	0.0	0.0	-0.1	-0.1
	Evening	44	39	42	42	42	44	45	43	45	46	47	46	46	49	46	39	39	45	40	39	42	46	46			46	49	39	44	2.9	0.0	0.0	0.0	0.0
	Night	44	37	41	39	40	44	45	43	42	46	46	46	45	50	46	38	38	44	36	40	41	45	45			46	50	36	43	3.6	0.0	0.0	-0.1	-0.1
10%LA90.med	Day	44	38	41	39	41	43	43	42	43	43	45	45	45	43	45	42	44	43	40	43	41	44	46			45	46	38	43	2.0	0.0	0.0	0.0	0.0
	Evening	42	37	40	40	39	42	44	42	43	43	45	44	45	46	43	38	41	42	33	34	41	45	43			45	46	33	42	3.4	0.0	0.0	0.0	0.0
	Night	42	35	39	37	37	42	43	41	42	43	44	44	44	44	44	38	40	41	29	34	40	43	44			43	44	29	41	3.9	0.0	0.0	0.0	0.0
LAEQ	Day	INP Acceptable*				Kiln 6 Contribution				CM7 Contribution				NL Rec PRP7 20				Ave L90 from attended for Jun & Dec 2008				Most OffMost on				Most OffMost on									
	Evening	60				43				43				46				46				46													
	Night	45				40				40				43				40				40													

* Based on Suburban/Industrial Interface from NSW INP Table 2.1

Receiver Location 72 Taylor Ave near Adelaide St

Parameter	Period	Survey Dates																				Statistics				Difference to Non rain removed									
		Sep-02	Jan-03	Feb-03	Feb-04	Mar-04	Apr-04	May-04	Jan-06	Feb-06	Feb-06	Jun-06	Apr-07	Jun-08	Dec-08	Sep-10	Jun-11	Jul-11	Jul-12	Oct-12	Oct-12	Sep-13	Aug-14	Jul-15	Apr-16	May-16	Jul-16	Max	Min	Ave	SD	Max	Min	Ave	SD
LAEQ.ave	Day								61	62	54	63	62	63	63	60	57	60	60	60	59	61	61	52			63	63	52	60	3.2	0.0	0.0	0.0	0.0
	Evening								57	58	50	59	57	59	59	56	57	53	55	54	48	57	55	47			58	59	47	55	3.7	0.0	0.0	0.0	0.0
	Night								56	56	49	58	56	59	58	56	55	56	55	52	48	60	55	50			58	60	48	55	3.5	0.0	0.0	0.0	0.0
LA90.ave	Day								47	45	41	48	48	49	49	47	46	47	49	45	48	50	47	49			50	50	41	47	2.3	0.0	0.0	0.1	0.1
	Evening								46	44	40	47	46	46	47	45	37	42	48	40	41	49	47	46			48	49	37	45	3.5	0.0	0.0	0.1	0.1
	Night								45	42	40	47	46	45	48	46	36	42	47	38	41	47	47	46			48	48	36	44	3.7	0.0	0.0	0.1	0.1
10%LA90.med	Day								45	43	39	47	46	47	45	45	43	43	46	42	46	48	46	47			47	48	39	45	2.3	0.0	0.0	0.1	0.1
	Evening								45	42	40	46	45	46	44	44	39	44	46	39	40	49	46	44			46	49	39	44	2.9	0.0	0.0	0.1	0.0
	Night								44	41	39	46	45	46	43	43	38	42	46	35	39	45	46	45			45	46	35	43	3.2	0.0	0.0	0.0	0.0
LAEQ	Day	INP Acceptable*				Kiln 6 Contribution				CM7 Contribution				NL Rec PRP7 20				Ave L90 from attended for Jun & Dec 2008				Most OffMost on				Most OffMost on									
	Evening	60				43				43				48				44				44													
	Night	45				40				40				43				43				43													

Receiver Location 4 Northern Boundary

Parameter	Period	Survey Dates																				Statistics				Difference to Non rain removed											
		Sep-02	Jan-03	Feb-03	Feb-04	Mar-04	Apr-04	May-04	Sep-04	Jan-06	Feb-06	Jun-06	Apr-07	Jun-08	Aug-10	Sep-10	Jun-11	Jul-11	Jul-12	Oct-12	Oct-12	Sep-13	Aug-14	Jul-15	Apr-16	May-16	Jul-16	Max	Min	Ave	SD	Max	Min	Ave	SD		
LAEQ.ave	Day															63	53	50	52	55	52	49	50	51	51	52	51	54	53	3.3	0.0	0.0	0.0	0.0			
	Evening															54	51	49	49	51	50	45	49	50	51	50	51	52	52	54	45	50	2.0	0.0	0.0	-0.1	-0.1
	Night															54	51	50	47	52	51	44	50	49	51	52	52	54	44	51	2.5	0.0	0.0	0.0	0.0		
LA90.ave	Day															53	49	47	47	51	48	43	46	47	47	49	49	51	49	53	43	48	2.3	0.0	0.0	0.2	-0.3
	Evening															53	48	47	45	49	48	41	47	47	48	48	49	49	53	41	48	2.6	0.0	0.0	0.0	0.0	
	Night															53	49	47	43	49	48	39	47	46	48	49	49	53	39	48	3.3	0.0	0.0	0.1	0.0		
10%LA90.med	Day															51	48	46	44	49	46	41	45	46	46	47	47	49	47	51	41	47	2.3	0.0	0.0	0.0	0.0
	Evening															51	47	46	42	49	46	40	46	45	47	47	46	49	47	51	40	46	2.7	0.0	0.0	0.0	0.0
	Night															51	47	47	42	48	46	37	45	44	47	48	48	49	47	51	37	46	3.3	0.0	0.0	0.0	0.0

Receiver Location 12 Brisbane Street

Parameter	Period	Survey Dates																				Statistics				Difference to Non rain removed										
		Sep-02	Jan-03	Feb-03	Feb-04	Mar-04	Apr-04	May-04	Sep-04	Jan-06	Feb-06	Jun-06	Apr-07	Jun-08	Aug-10	Sep-10	Jun-11	Jul-11				Sep-13	Aug-14	Jul-15	Apr-16	May-16	Jul-16	Max	Min	Ave	SD	Max	Min	Ave	SD	
LAEQ.ave	Day															51	50	52	52																	
	Evening															46	46	48	47																	
	Night															48	47	45	46																	
LA90.ave	Day															44	44	43	45																	
	Evening															42	43	41	42																	
	Night															44	42	38	42																	
10%LA90.med	Day															42	42	40	42																	
	Evening															41	41	37	41																	
	Night															39	41	35	40																	

Receiver Location Store Yard Close

Parameter	Period	Survey Dates																				Statistics				Difference to Non rain removed										
		Sep-02	Jan-03	Feb-03	Feb-04	Mar-04	Apr-04	May-04	Sep-04	Jan-06	Feb-06	Mar-07	May-07	Jun-08	Dec-08				Jul-12			Sep-13	Aug-14	Jul-15	Apr-16	May-16	Jul-16	Max	Min	Ave	SD	Max	Min	Ave	SD	
LAEQ.ave	Day																																			
	Evening																																			
	Night																																			
LA90.ave	Day																																			
	Evening																																			
	Night																																			
10%LA90.ave	Day																																			
	Evening																																			
	Night																																			

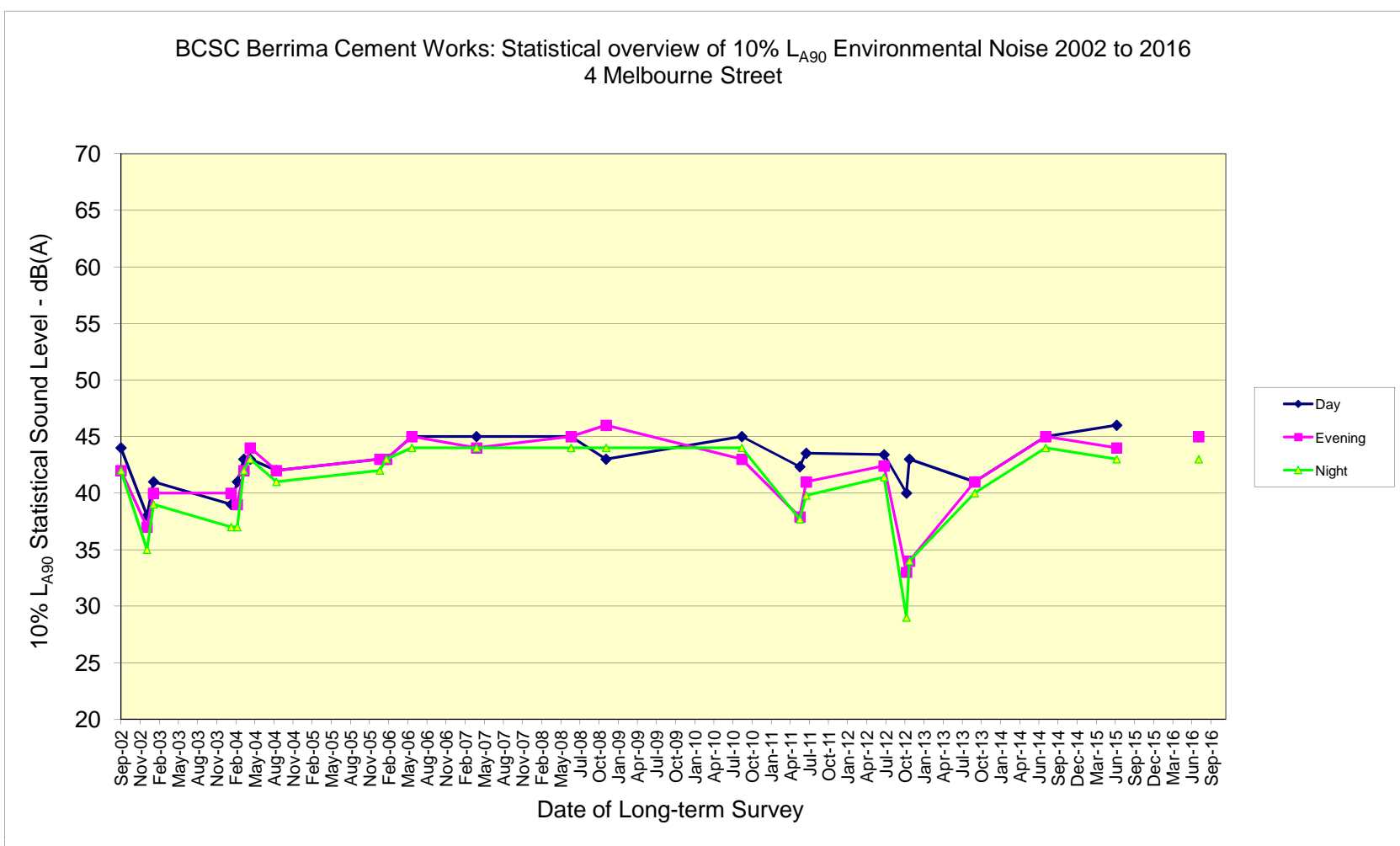
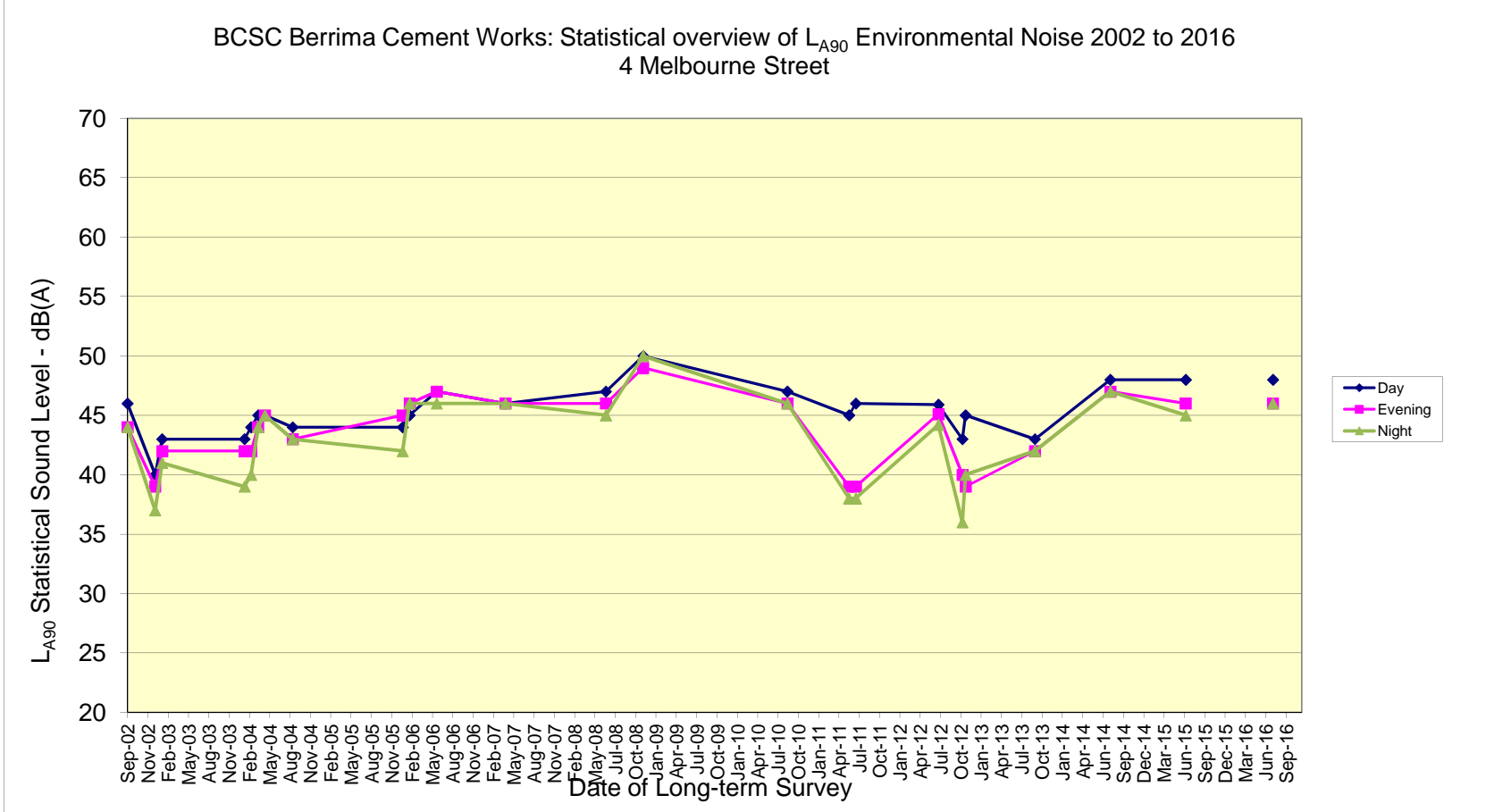
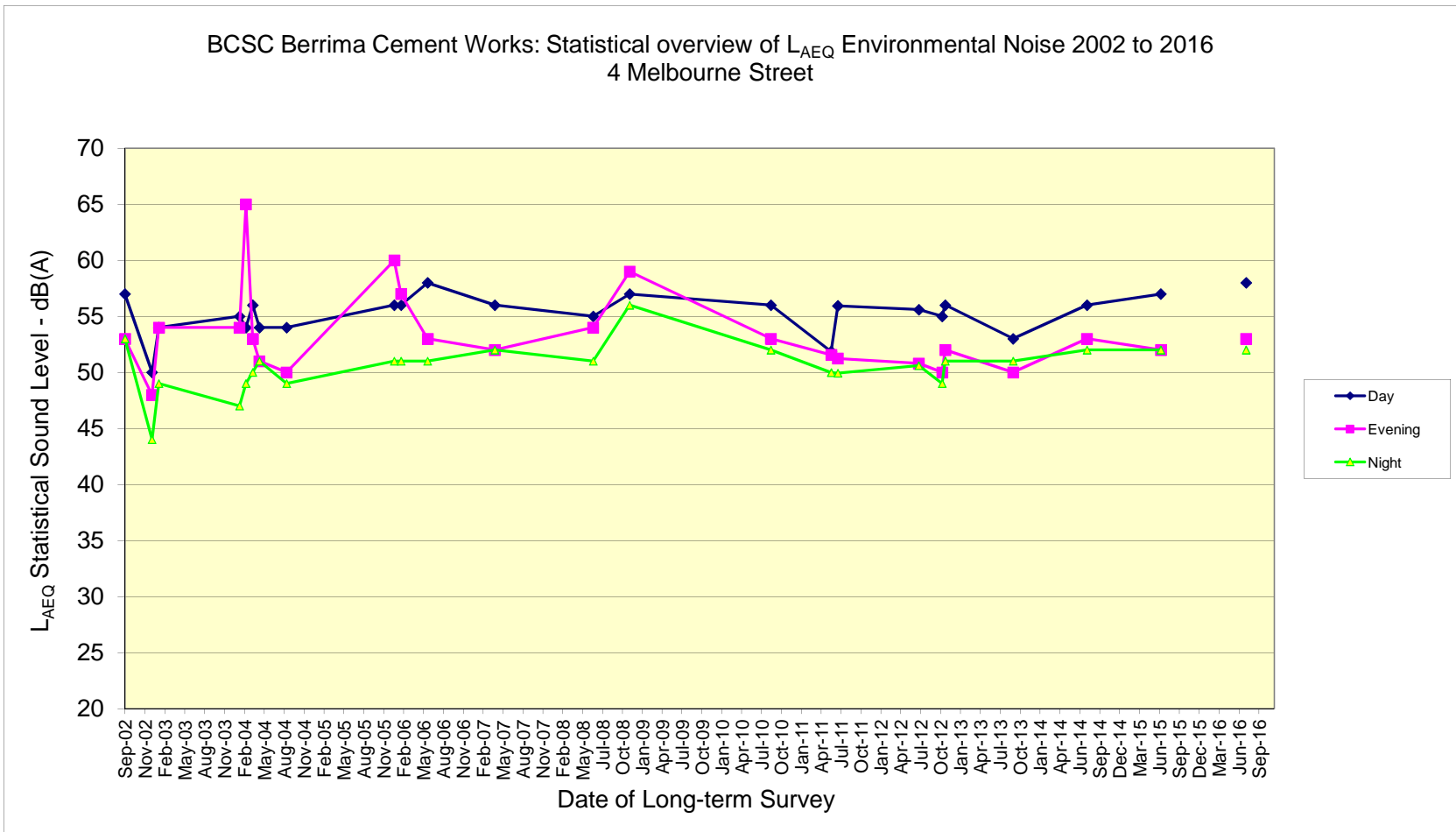
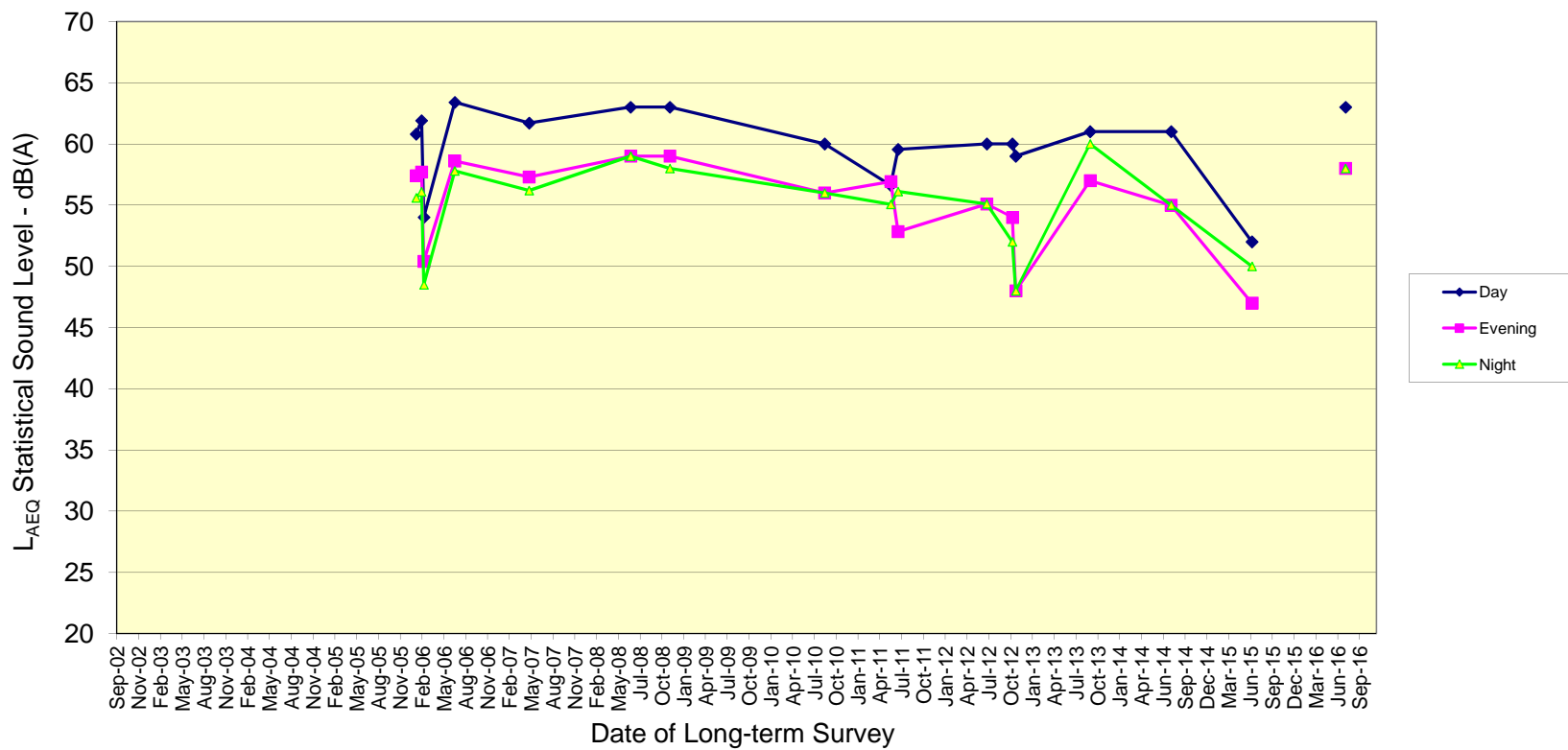
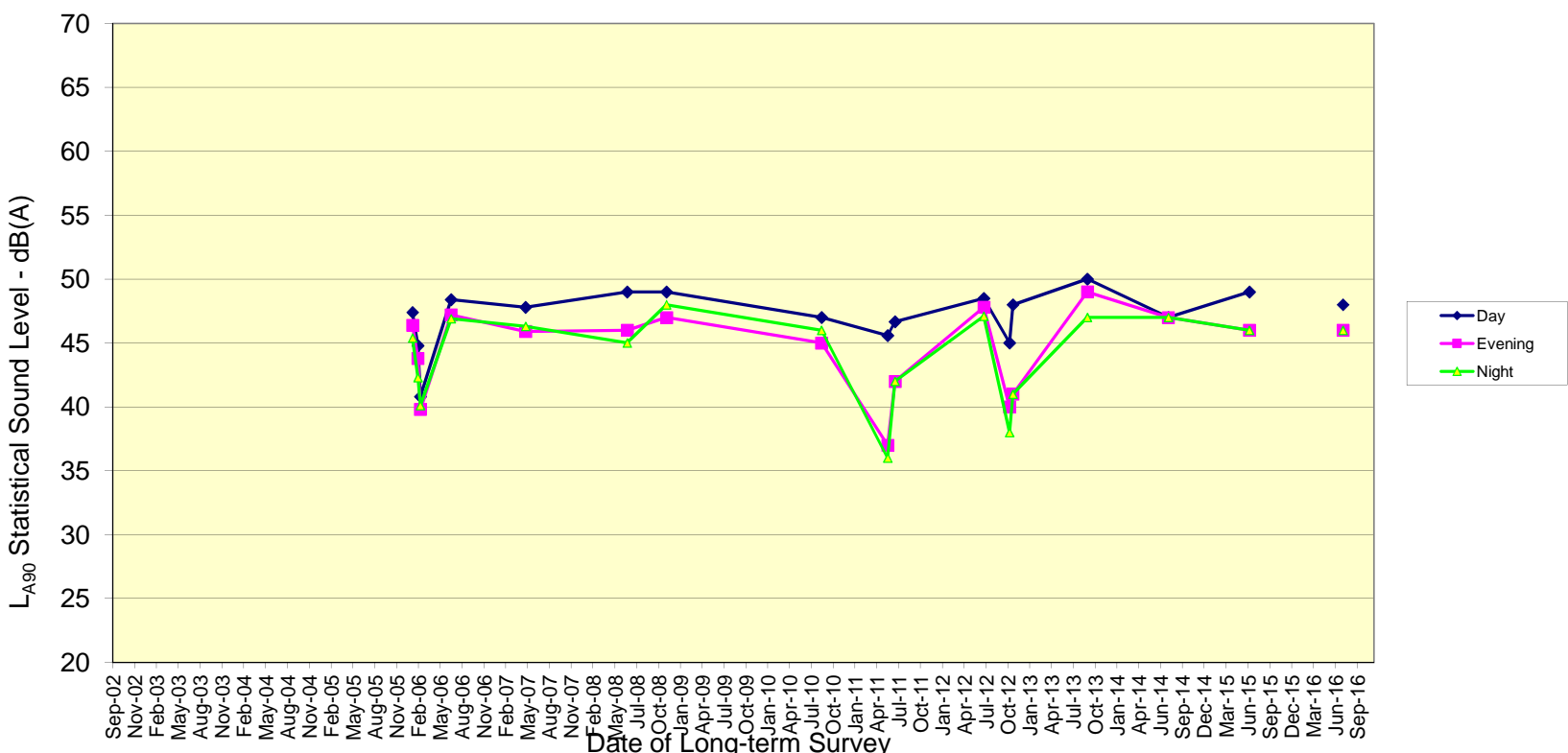


Figure 4.4: Comparison of statistical sound levels for 4 Melbourne Street location

BCSC Berrima Cement Works: Statistical overview of L_{AEQ} Environmental Noise 2002 to 2016
 Corner Adelaide Street and Taylor Avenue - then 72 Taylor Ave



BCSC Berrima Cement Works: Statistical overview of L_{A90} Environmental Noise 2002 to 2016
 Corner Adelaide Street and Taylor Avenue - then 72 Taylor Ave



BCSC Berrima Cement Works: Statistical overview of 10% L_{A90} Environmental Noise 2002 to 2016
 Corner Adelaide Street and Taylor Avenue - then 72 Taylor Ave

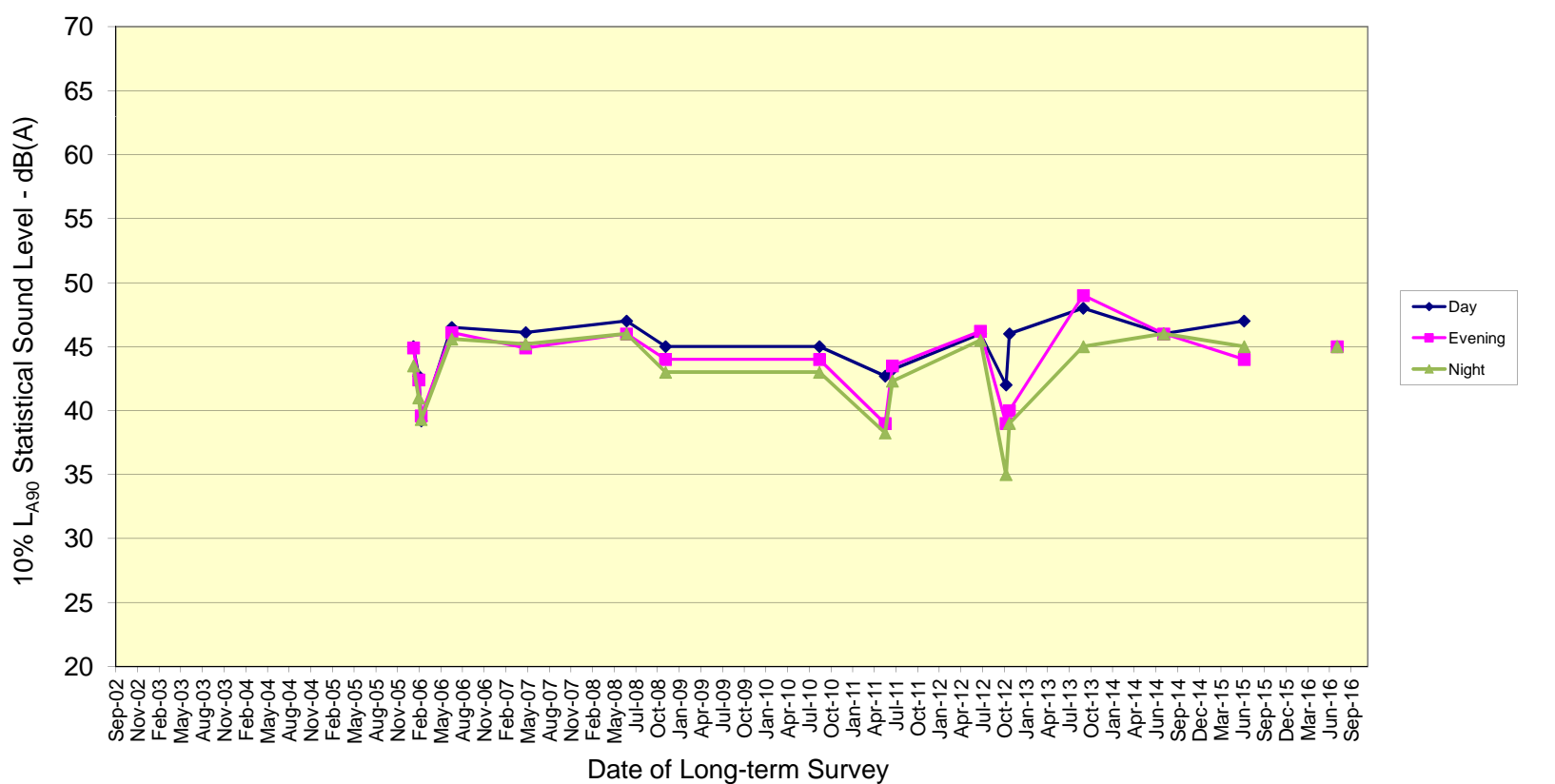


Figure 4.6: Comparison of statistical sound levels for 72 Taylor Ave location

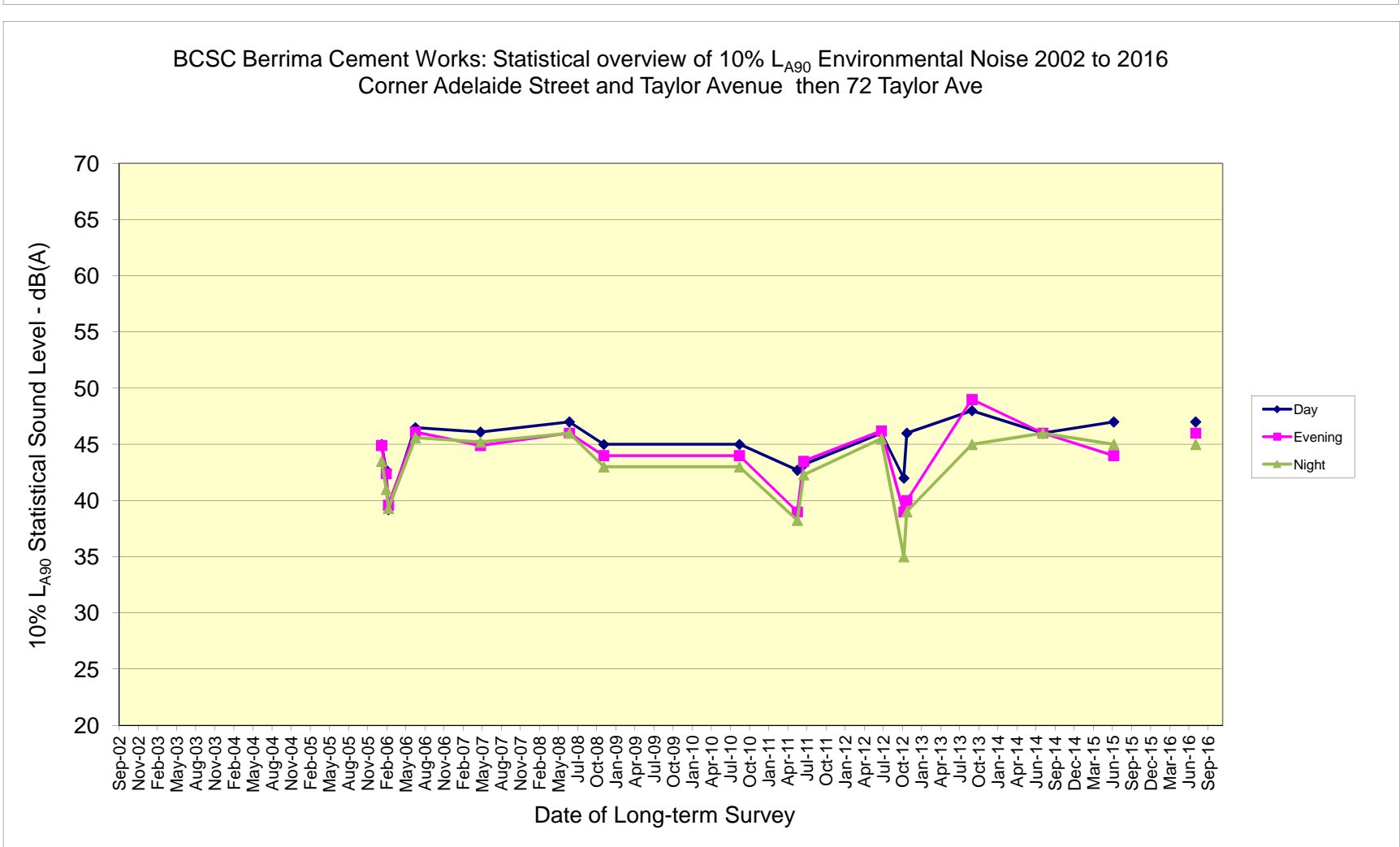
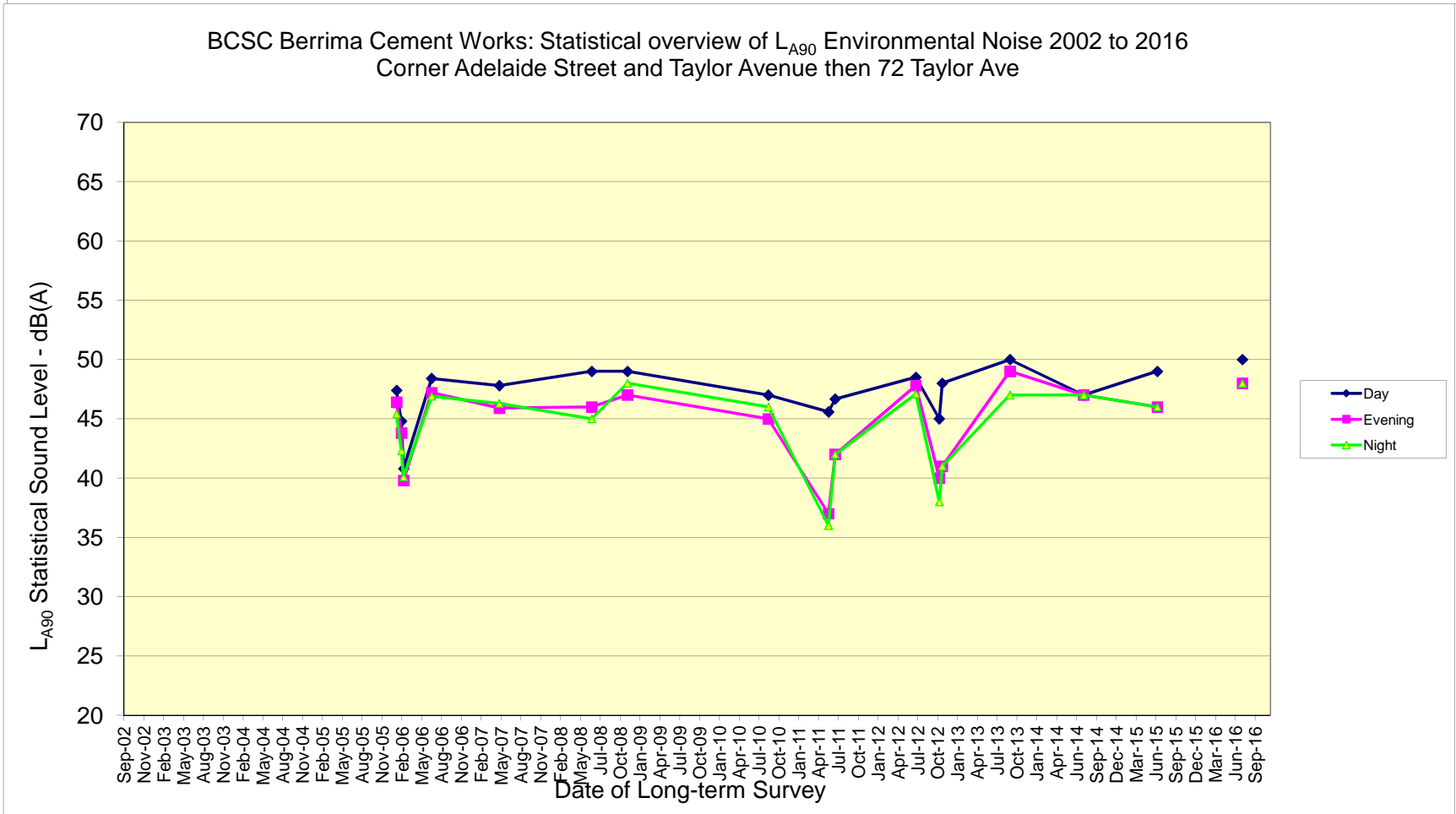
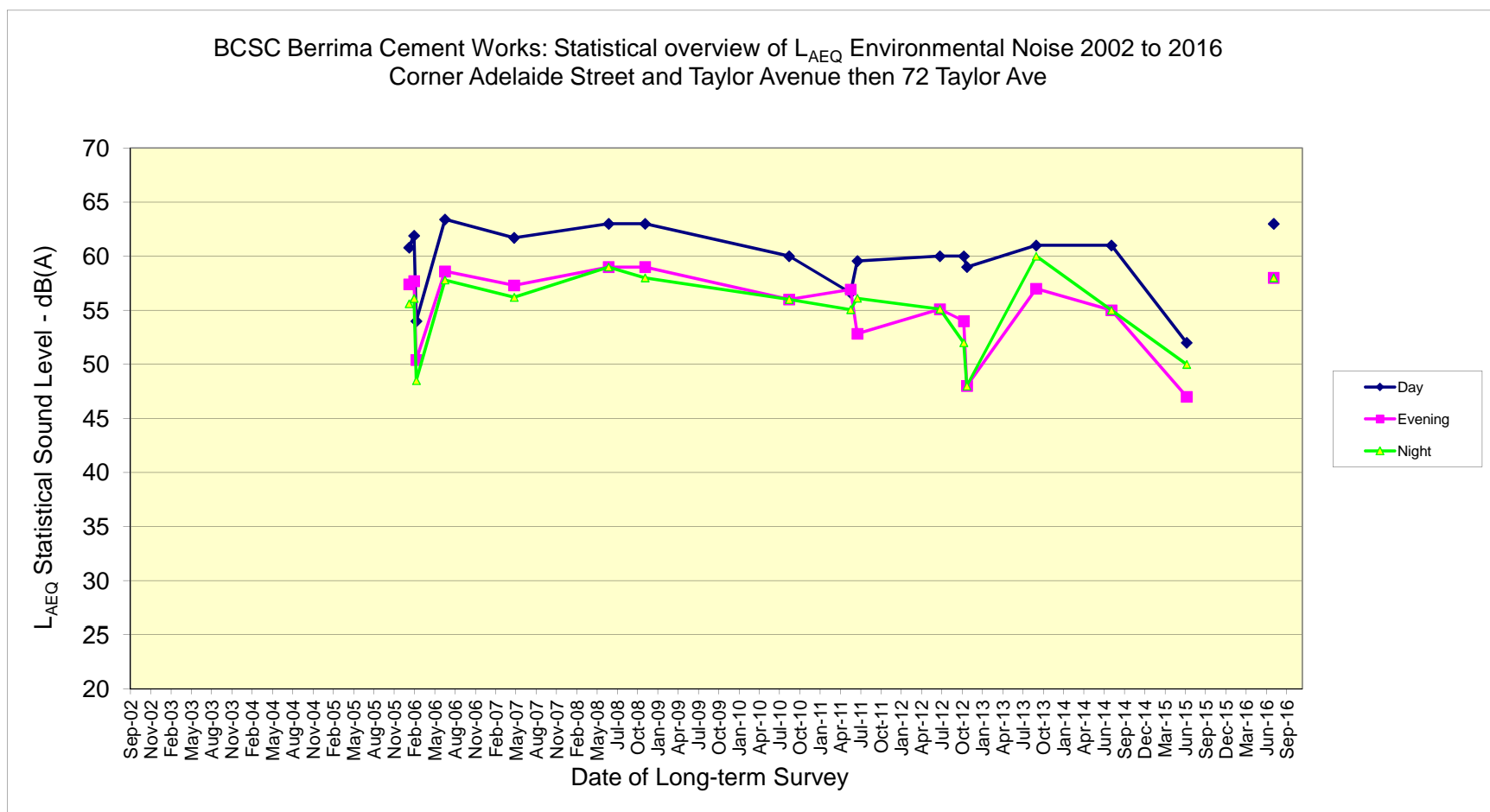
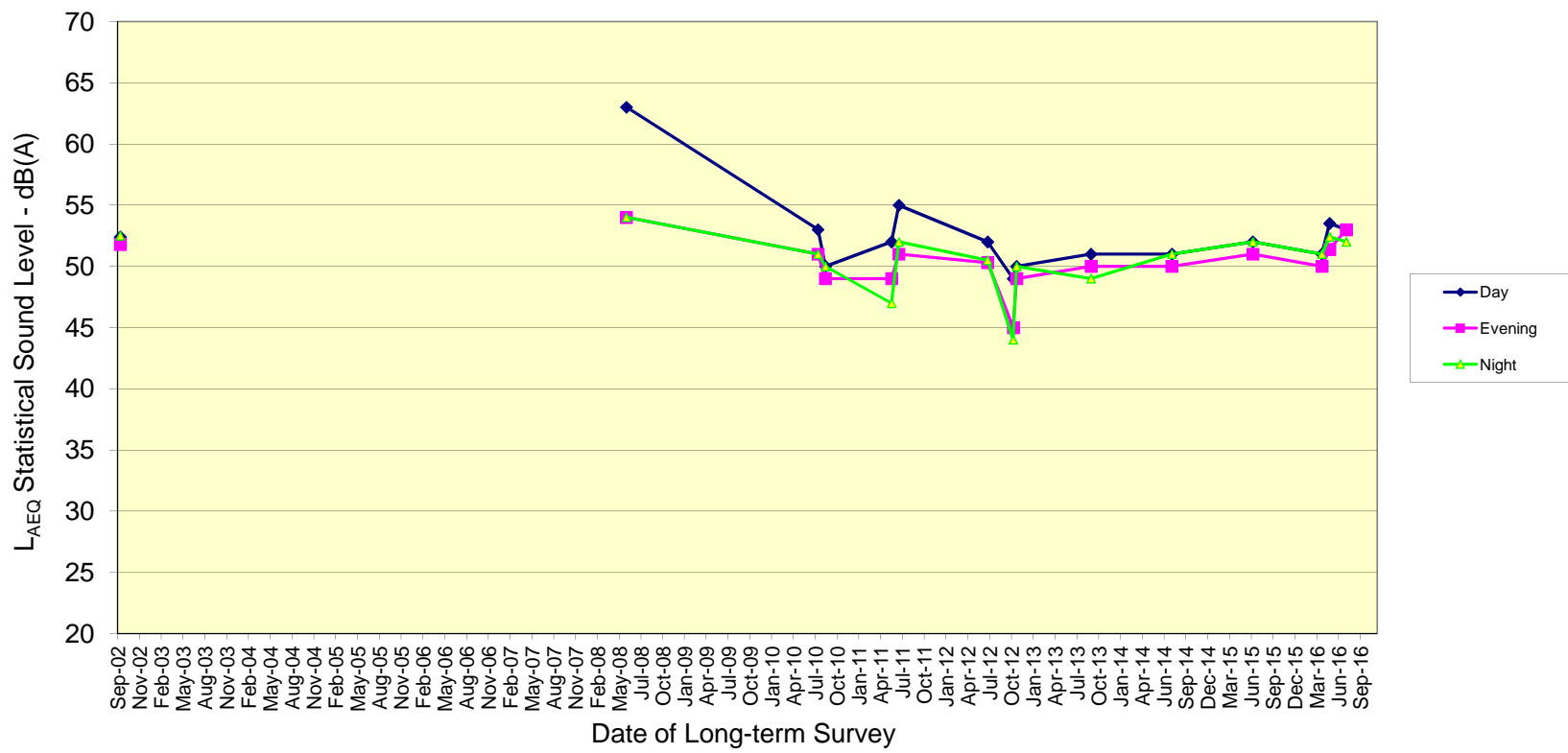
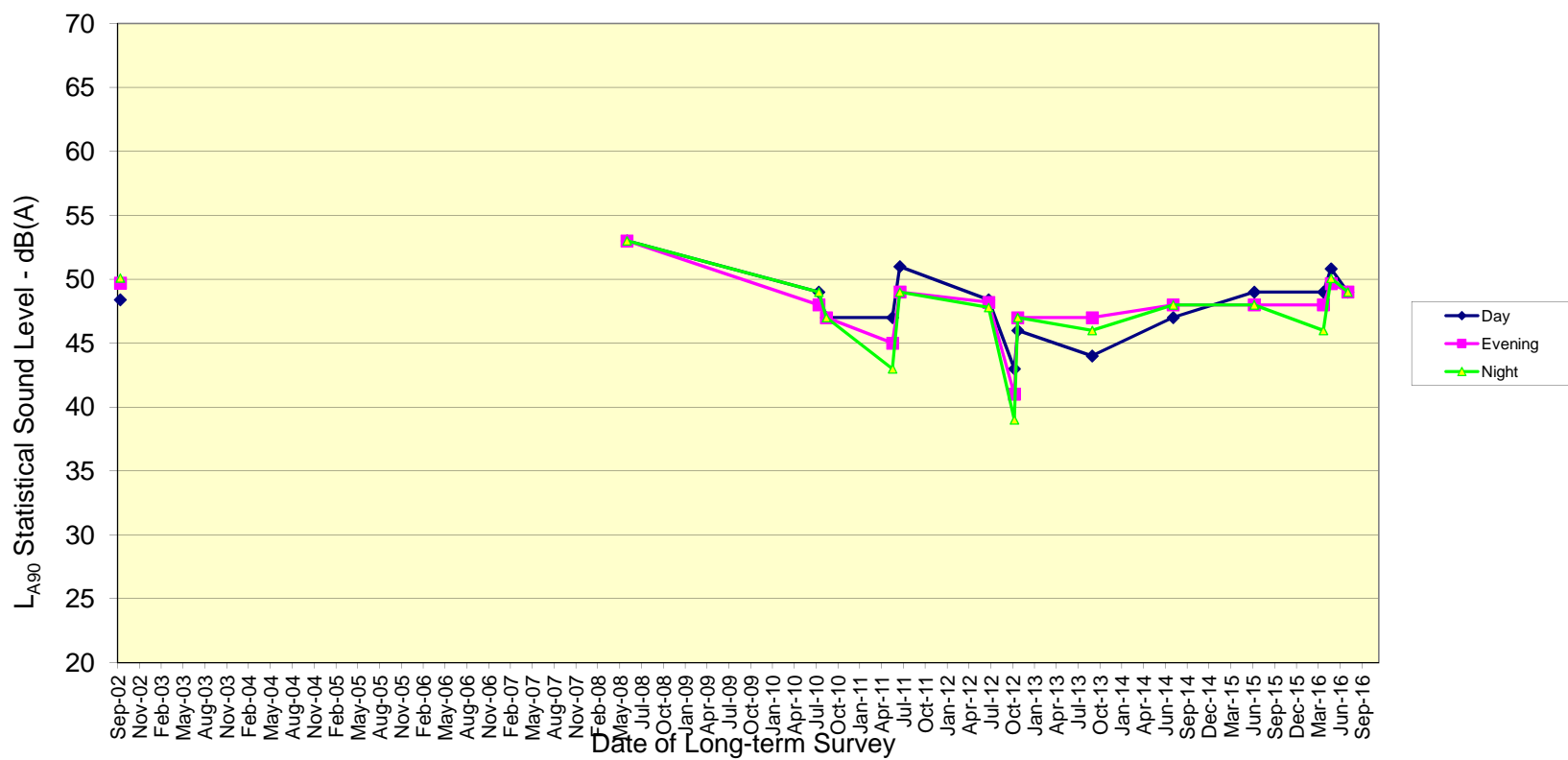


Figure 4.7: Comparison of statistical sound levels for 72 Taylor Ave (rain periods removed)

Boral Berrima Cement Works: Statistical overview of L_{Aeq} Environmental Noise 2002 to 2016
Northern Boundary Fence



Boral Berrima Cement Works: Statistical overview of L_{A90} Environmental Noise 2002 to 2016
Northern Boundary Fence



Boral Berrima Cement Works: Statistical overview of 10% L_{A90} Environmental Noise 2002 to 2016
Northern Boundary Fence

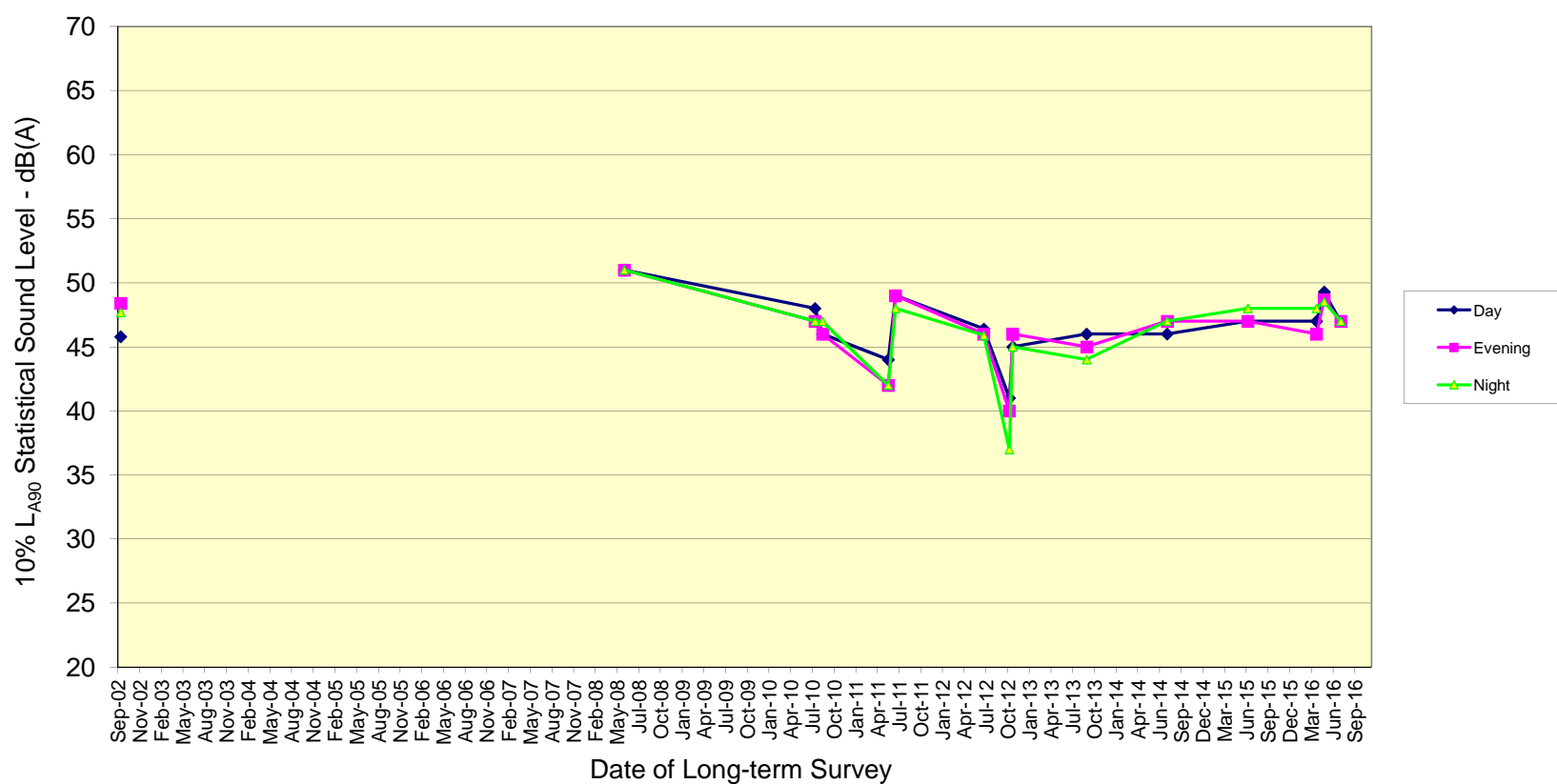
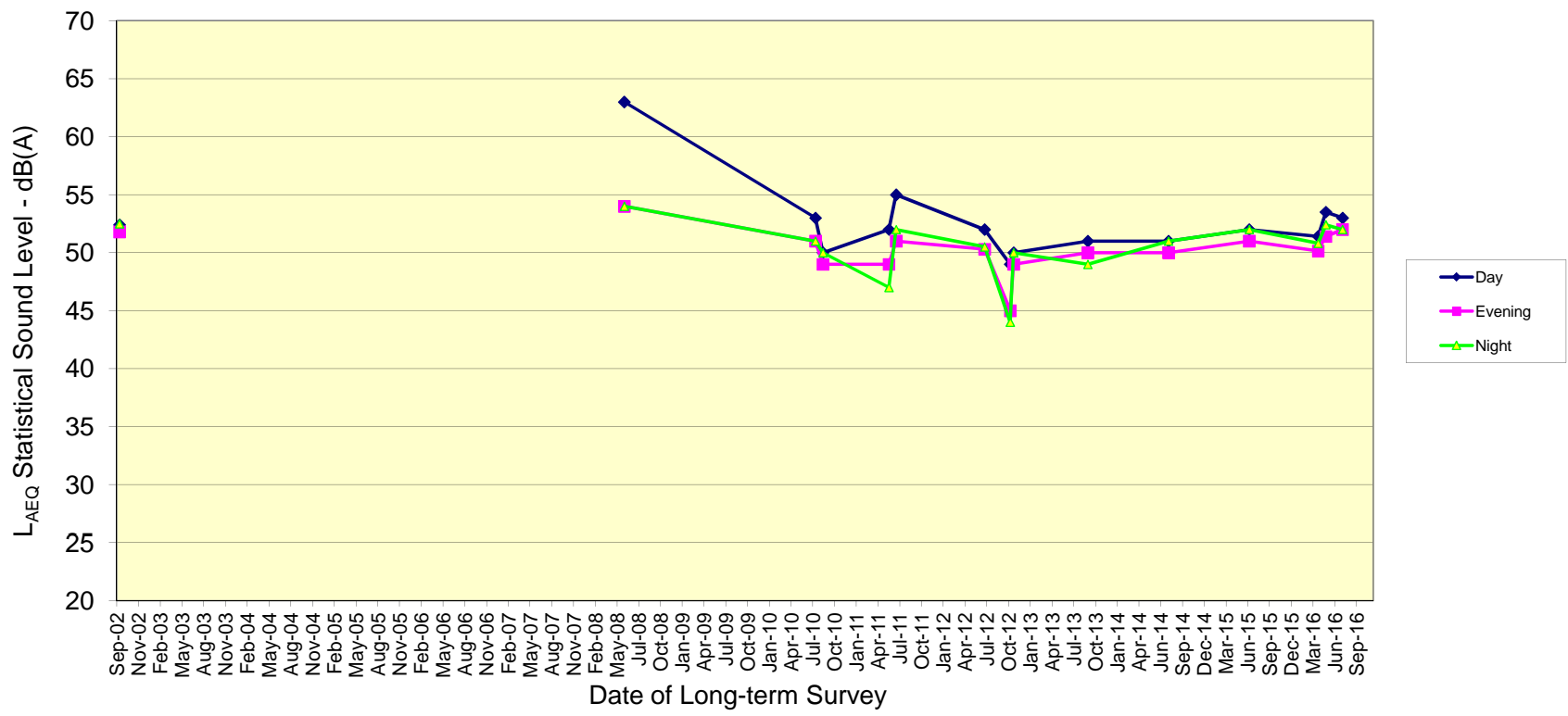
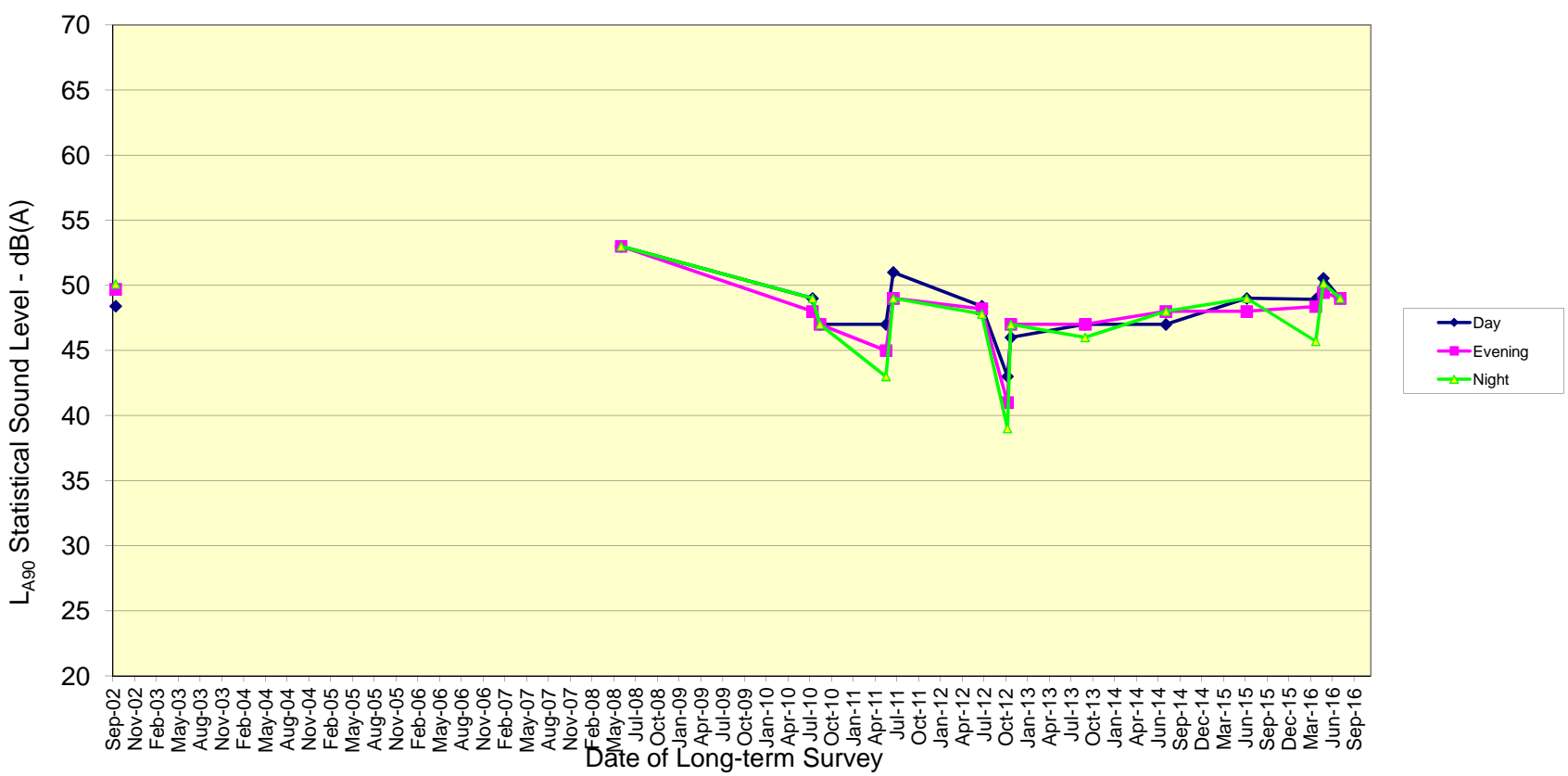


Figure 4.8: Comparison of statistical sound levels for Northern Boundary Fence location

BCSC Berrima Cement Works: Statistical overview of L_{AEQ} Environmental Noise 2002 to 2016
Northern Boundary Fence



BCSC Berrima Cement Works: Statistical overview of L_{A90} Environmental Noise 2002 to 2016
Northern Boundary Fence



BCSC Berrima Cement Works: Statistical overview of 10% L_{A90} Environmental Noise 2002 to 2016
Northern Boundary Fence

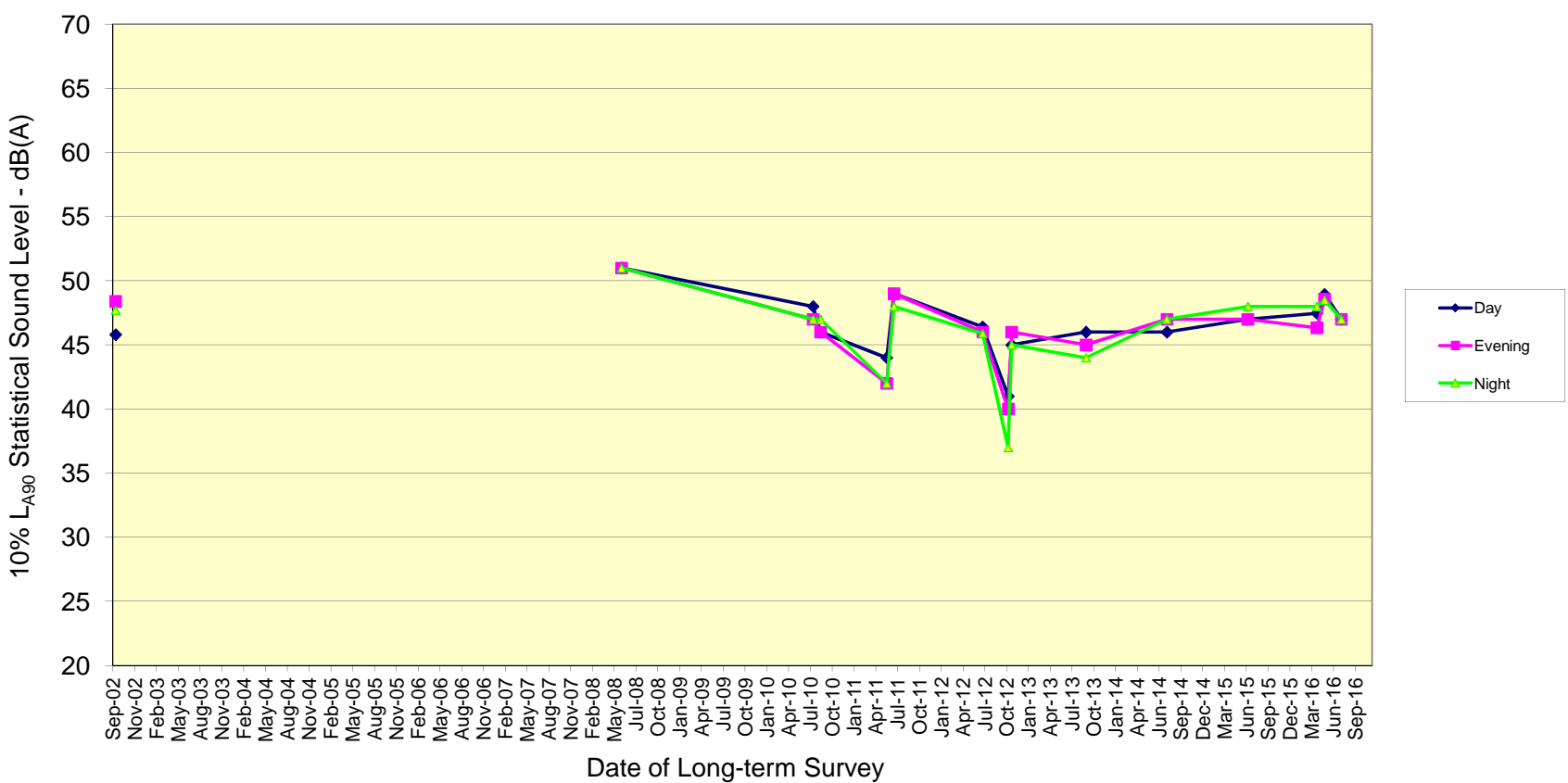
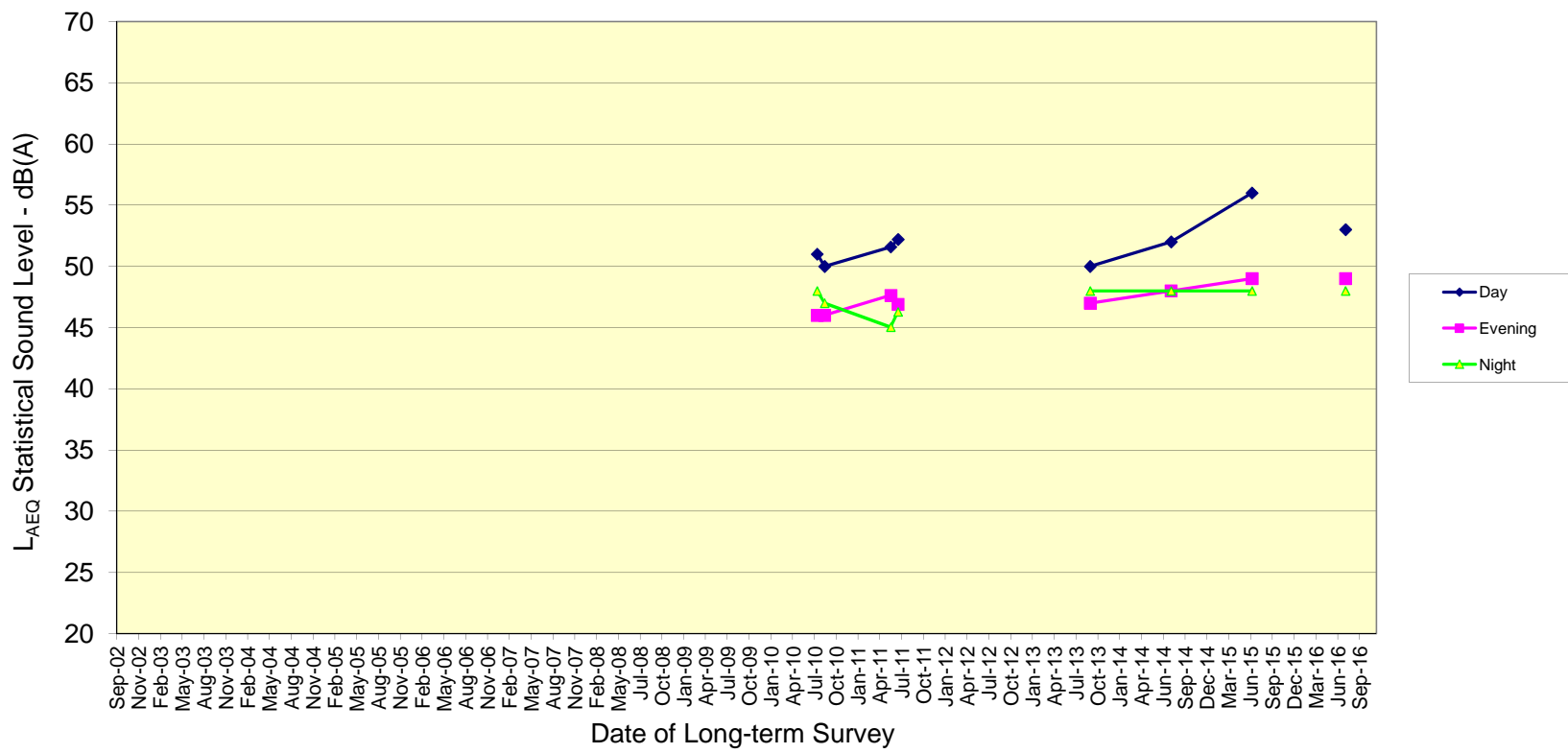
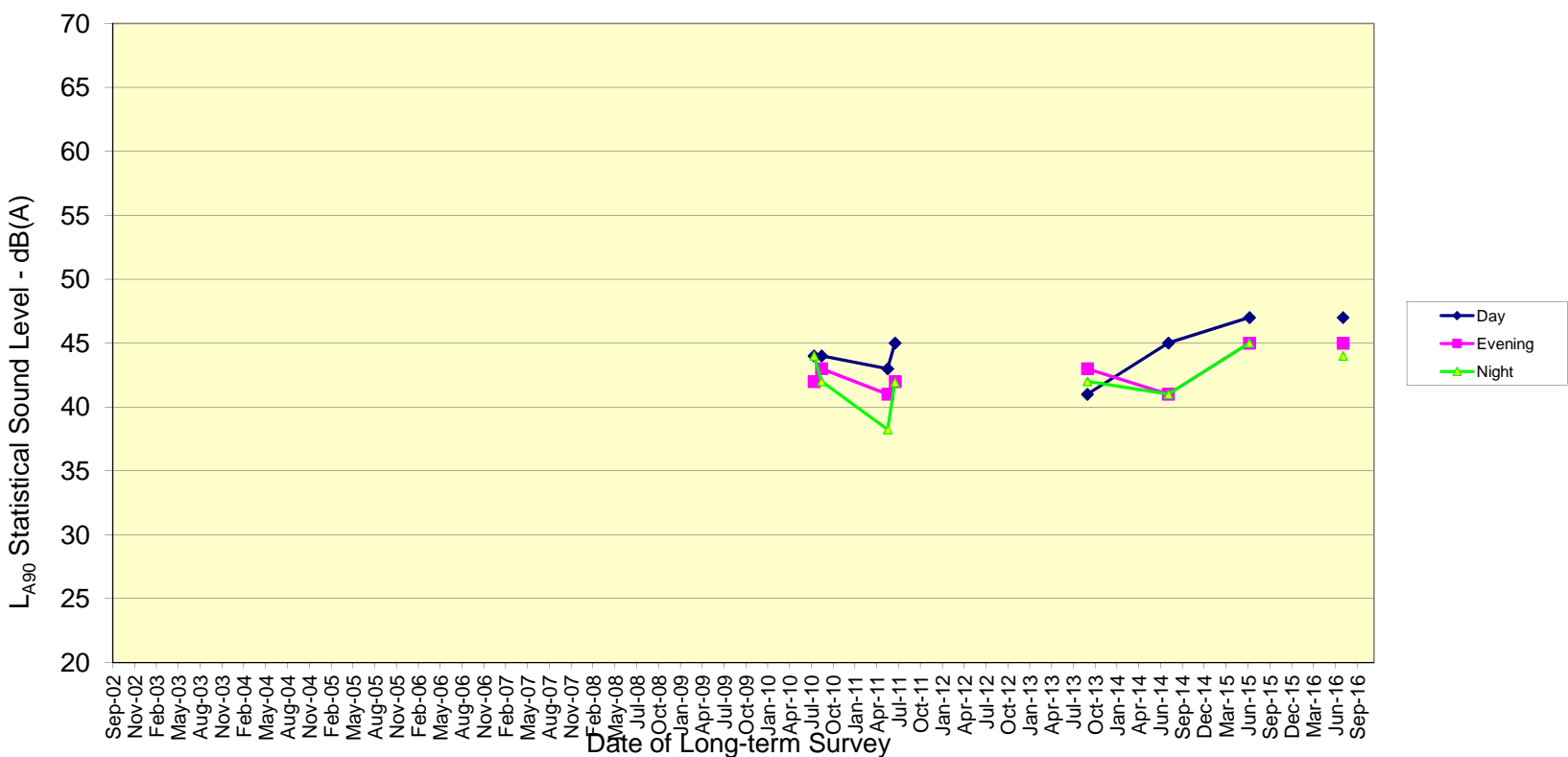


Figure 4.9: Comparison of statistical sound levels for Northern Boundary Fence (rain periods removed)

BCSC Berrima Cement Works: Statistical overview of $L_{A_{EQ}}$ Environmental Noise 2010 to 2016
12 Brisbane Street



BCSC Berrima Cement Works: Statistical overview of $L_{A_{90}}$ Environmental Noise 2010 to 2016
12 Brisbane Street



BCSC Berrima Cement Works: Statistical overview of 10% $L_{A_{90}}$ Environmental Noise 2010 to 2016
12 Brisbane Street

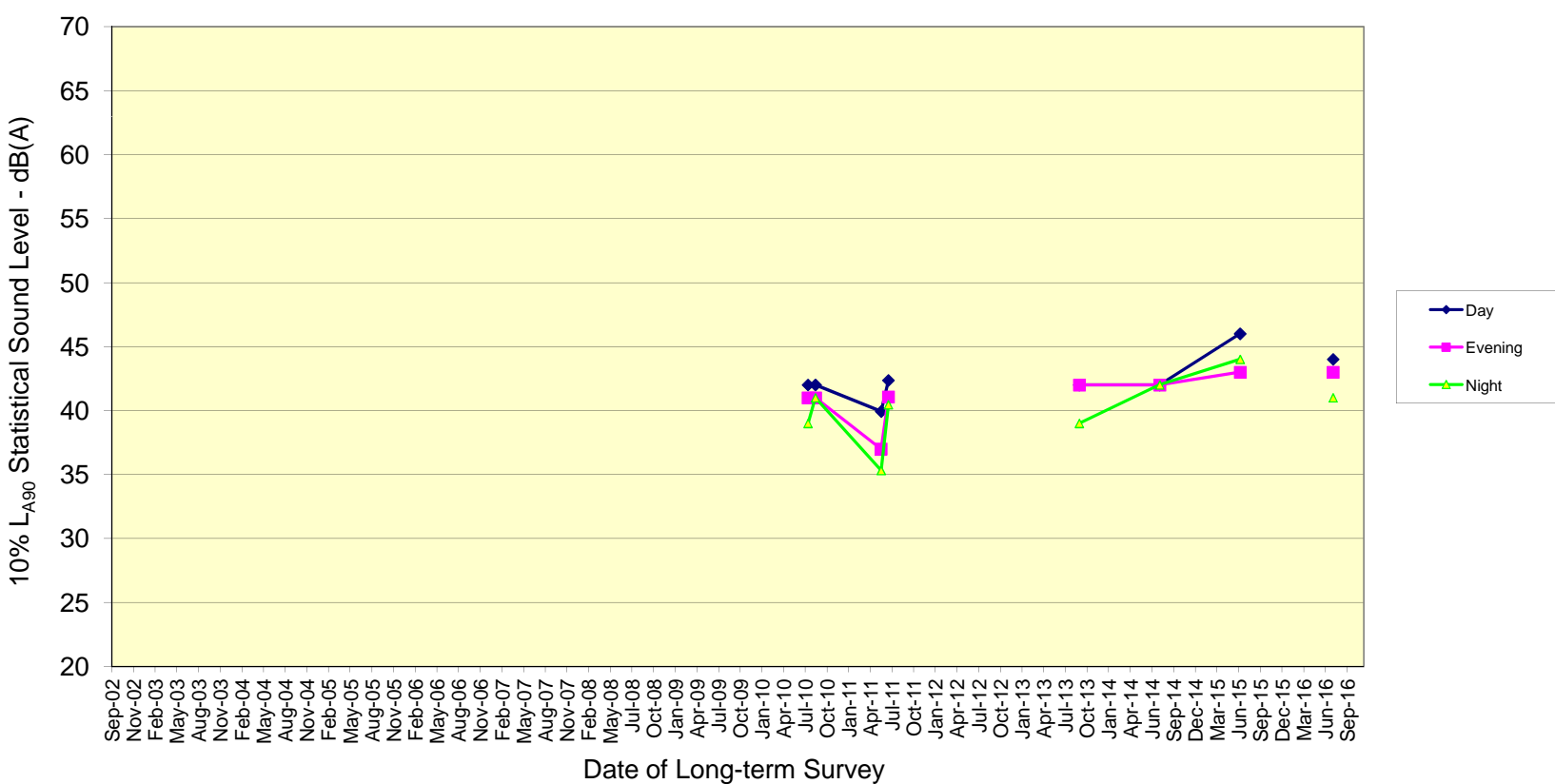


Figure 4.10: Comparison of statistical sound levels for 12 Brisbane Street location

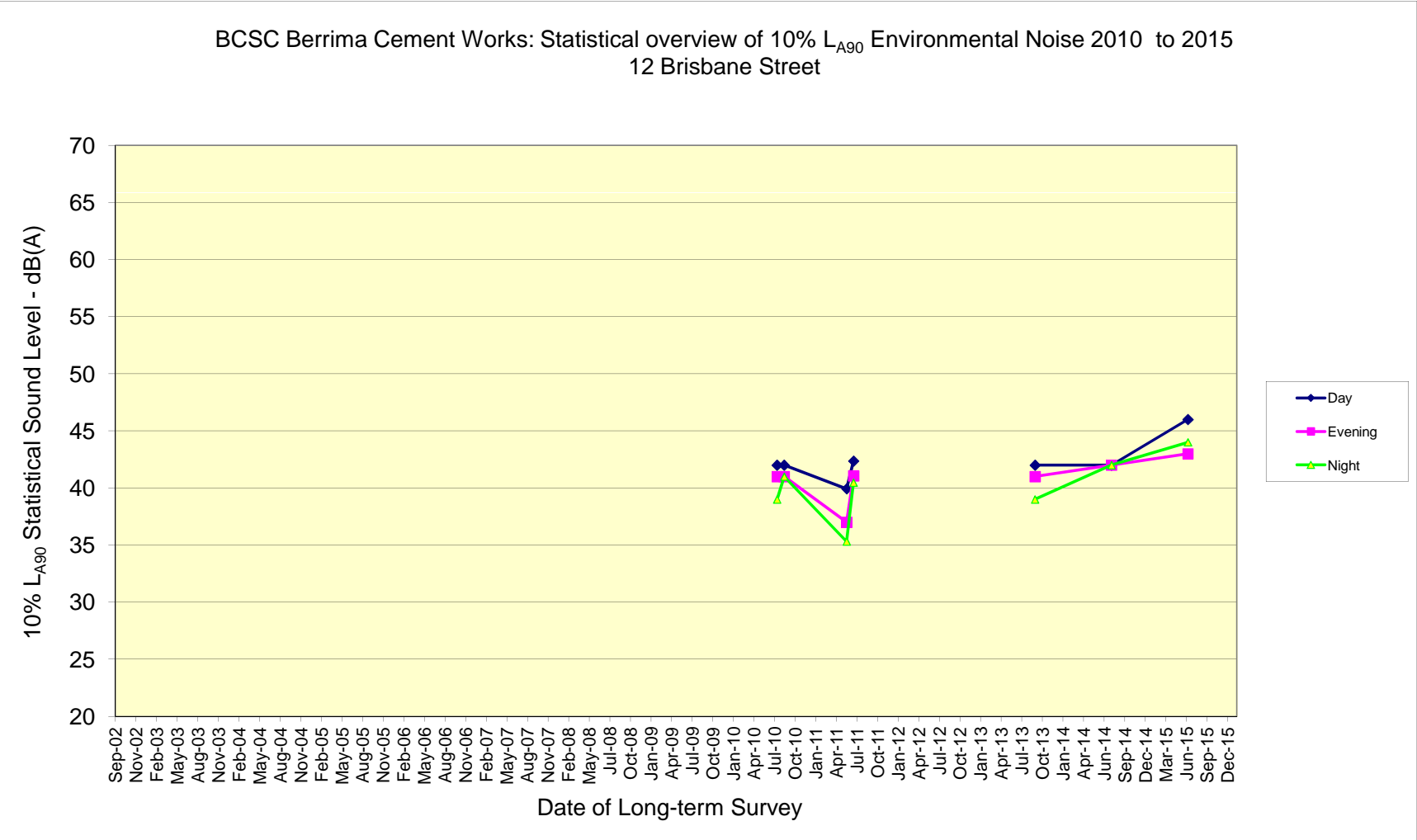
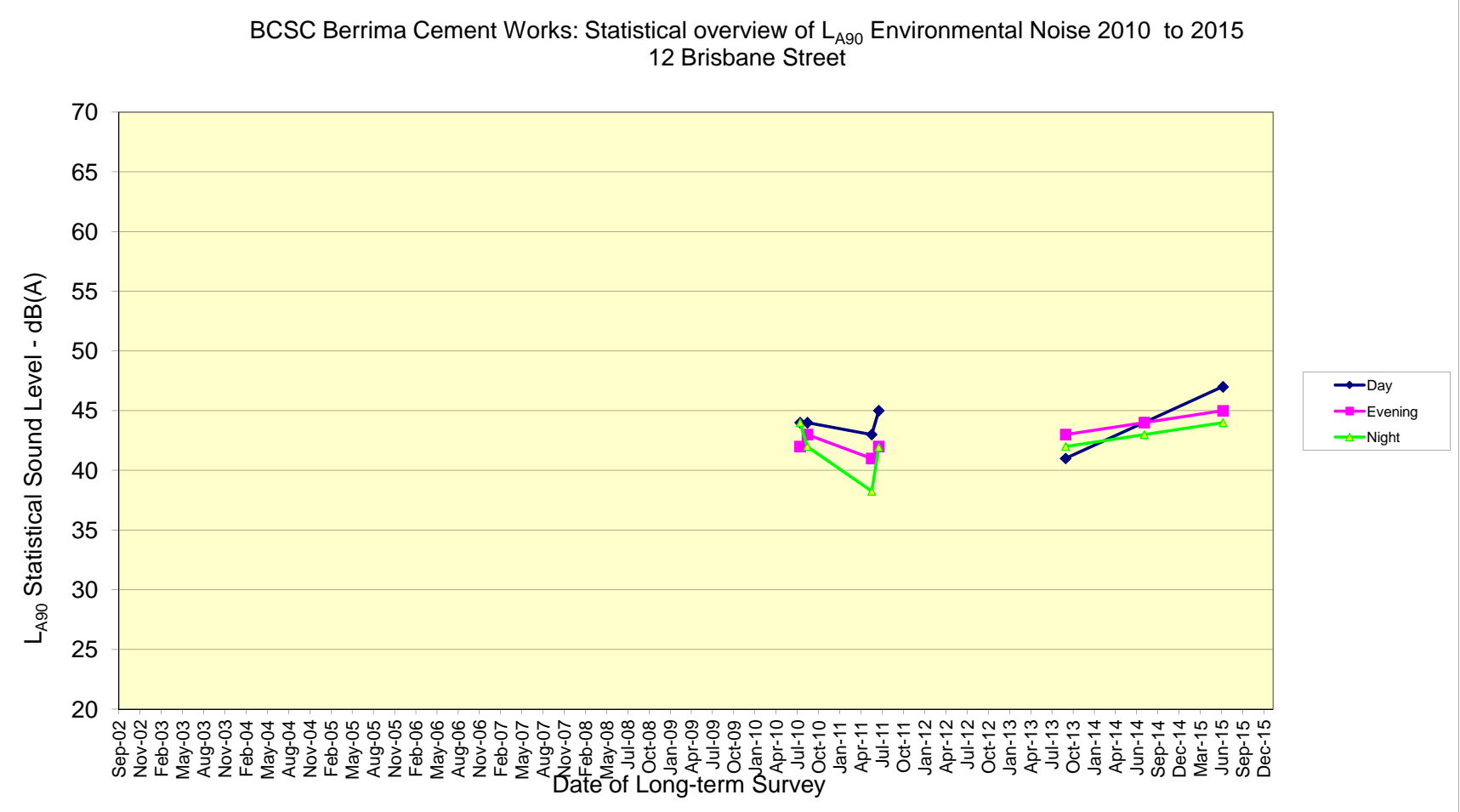
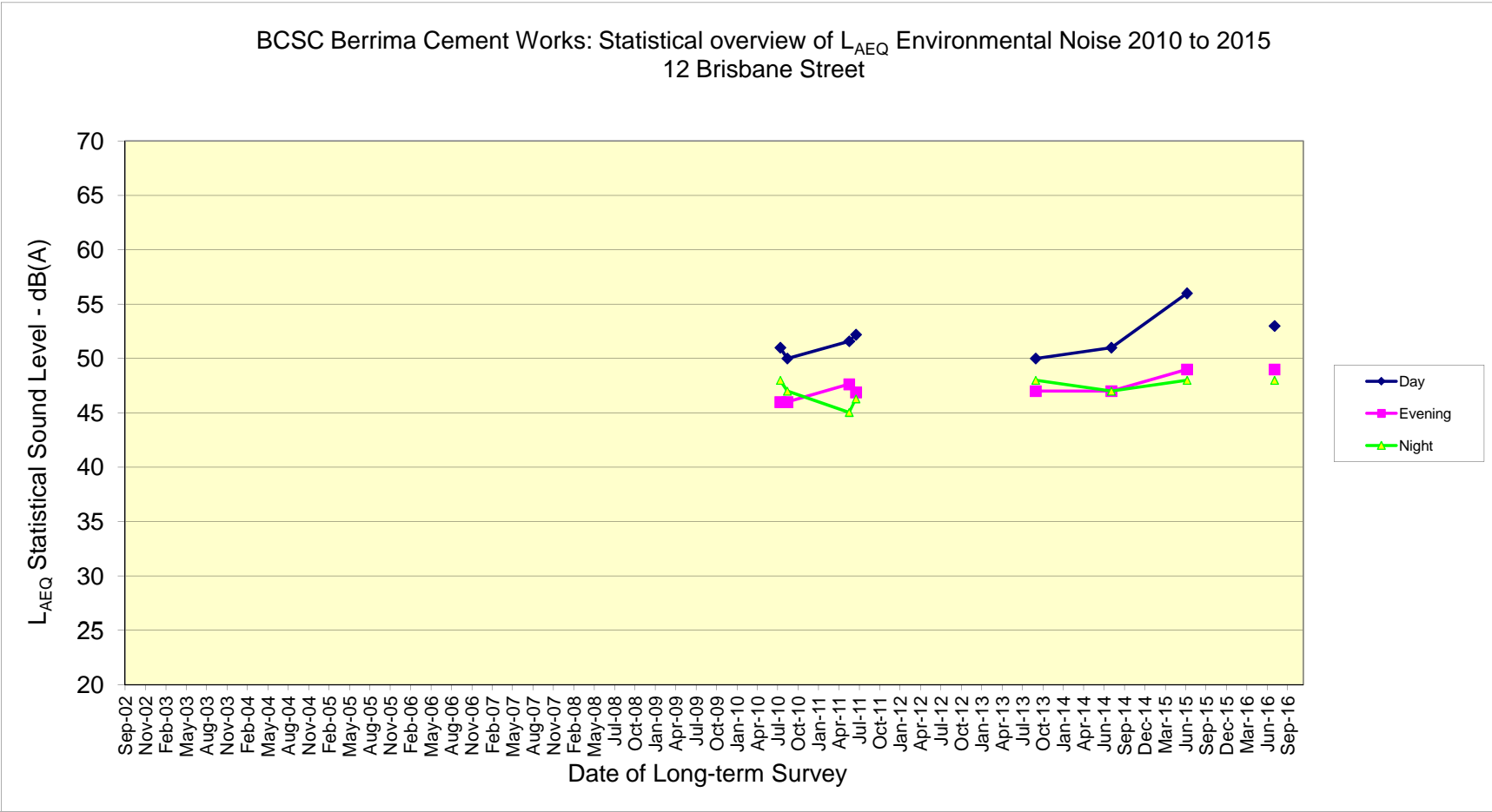


Figure 4.11: Comparison of statistical sound levels for 12 Brisbane Street location (rain periods removed)

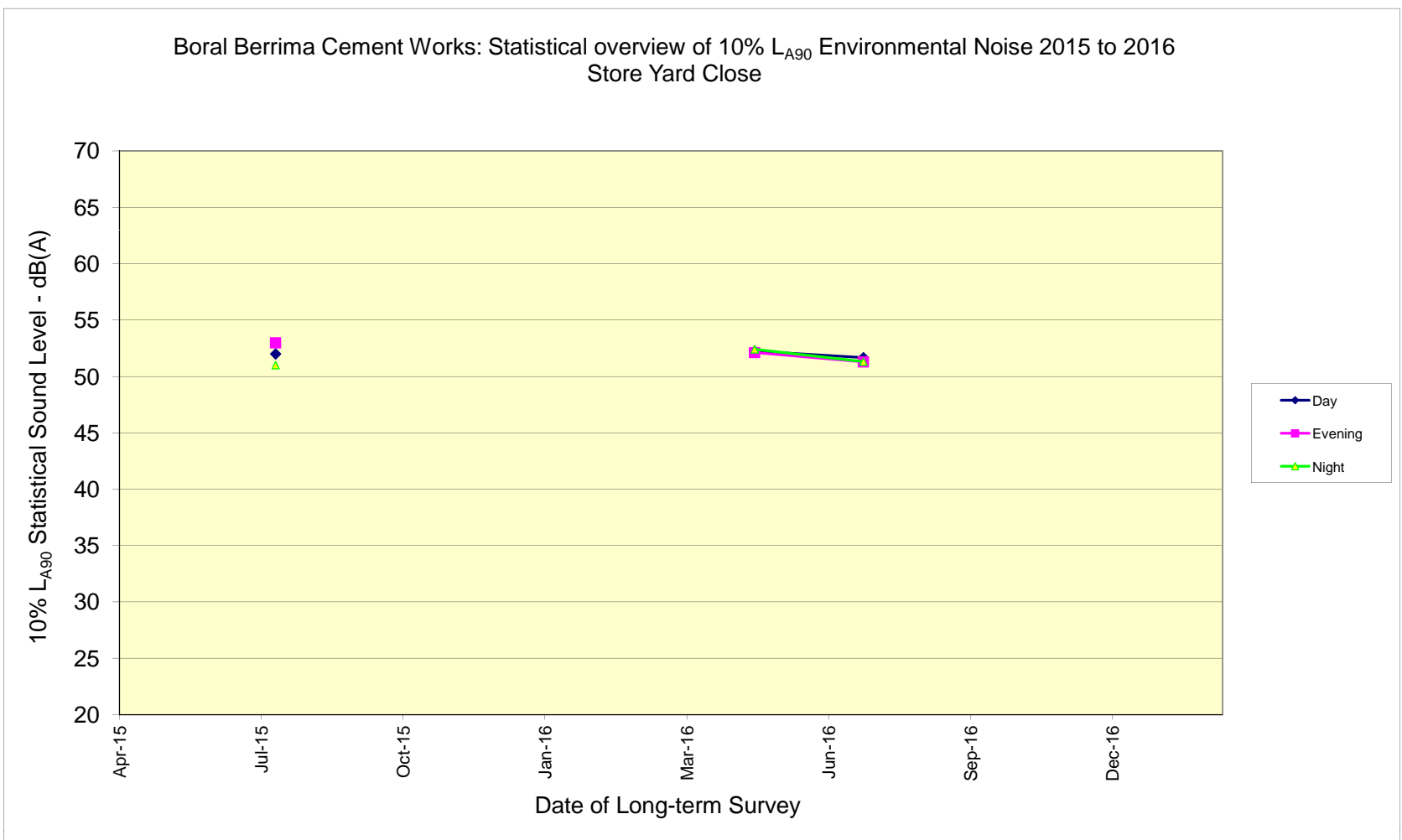
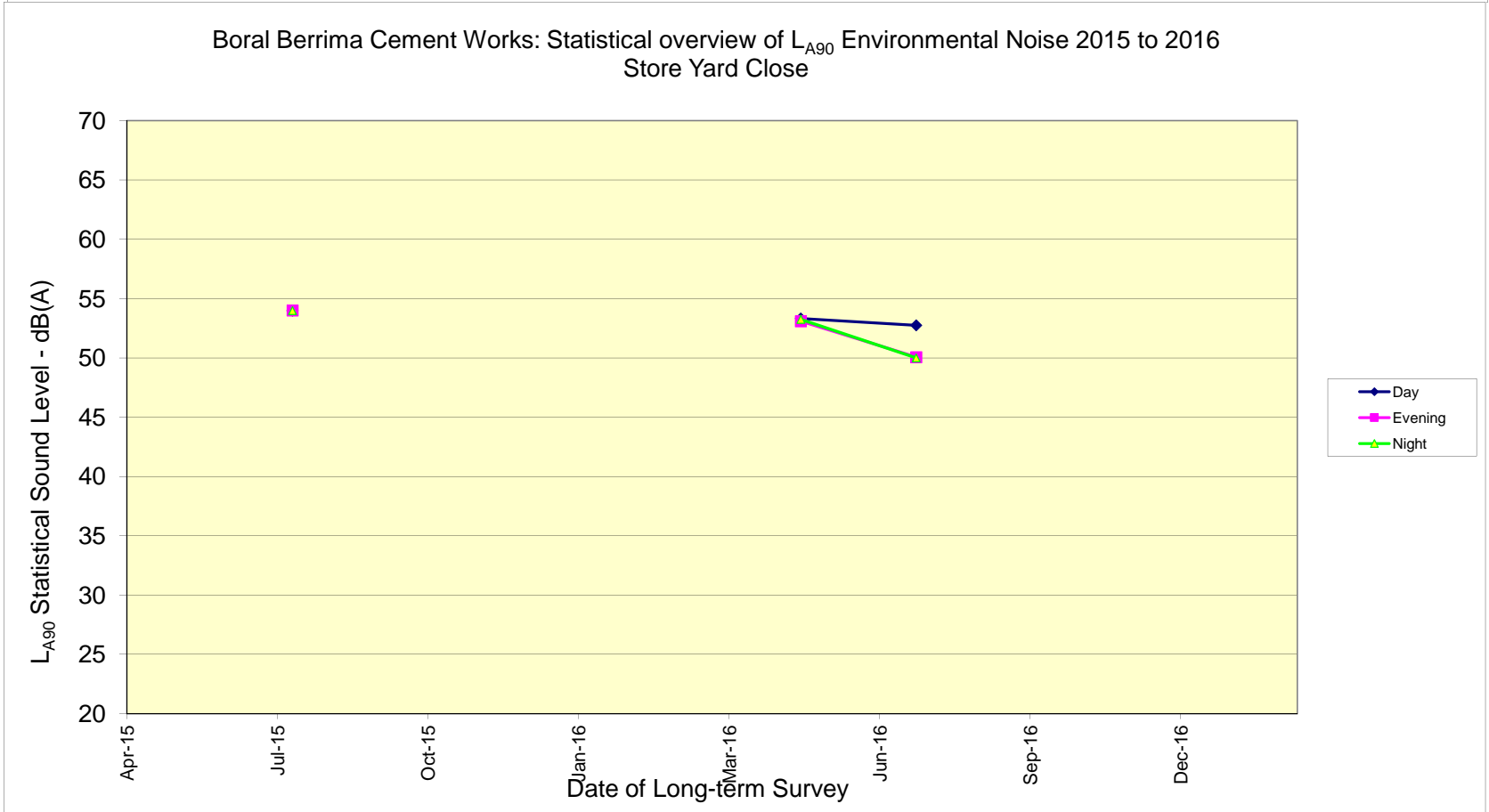
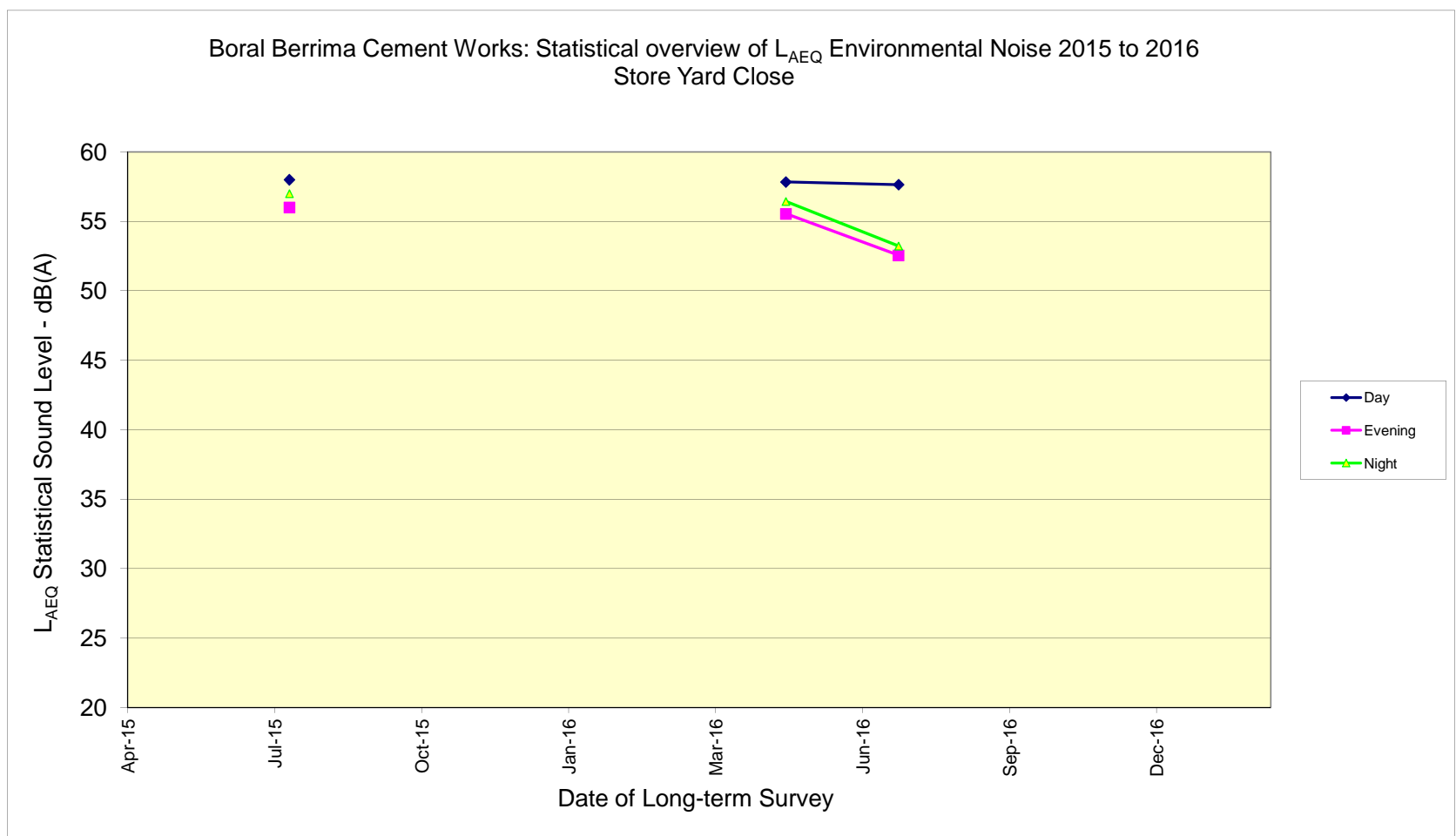


Figure 4.12: Comparison of statistical sound levels for Store Yard Close location

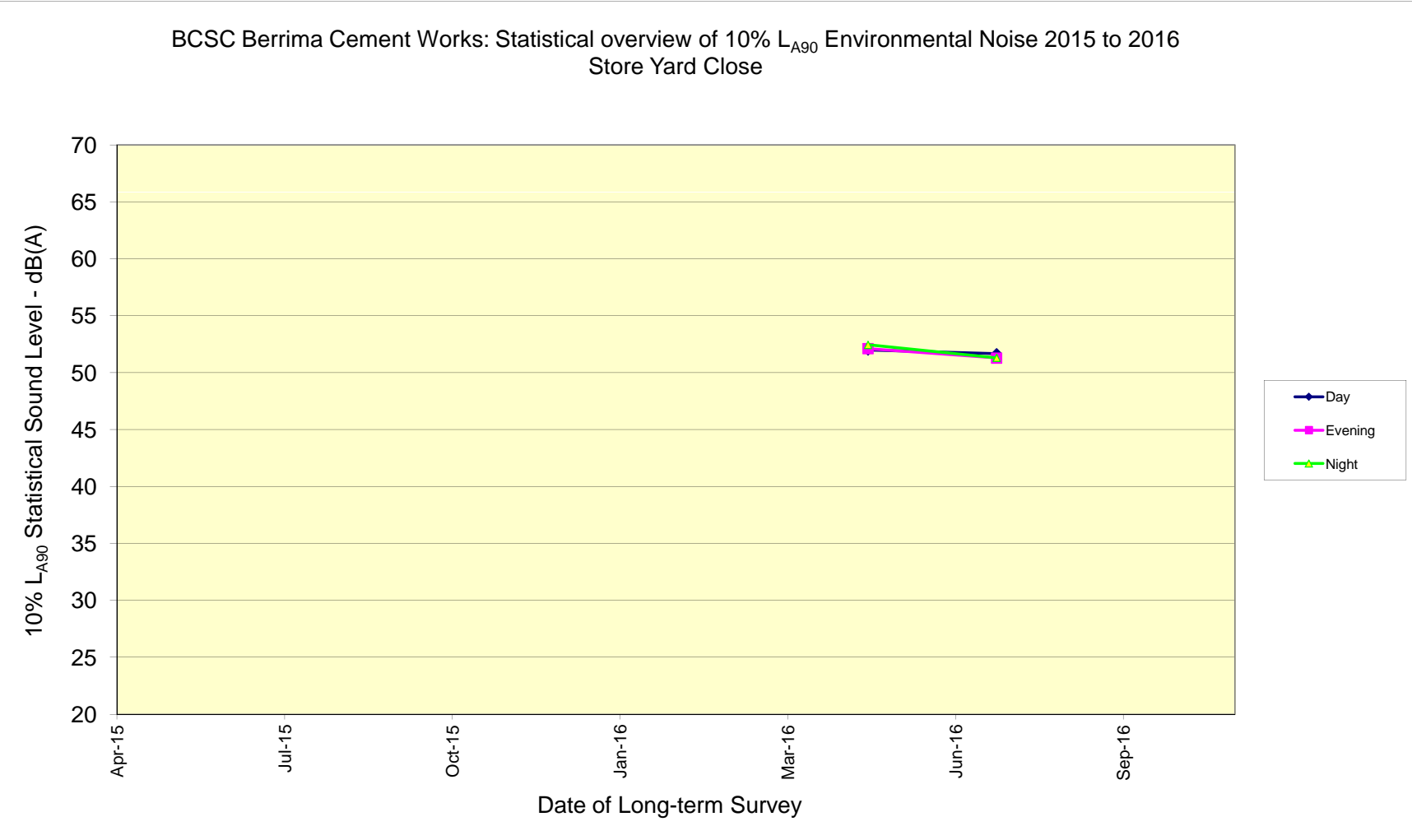
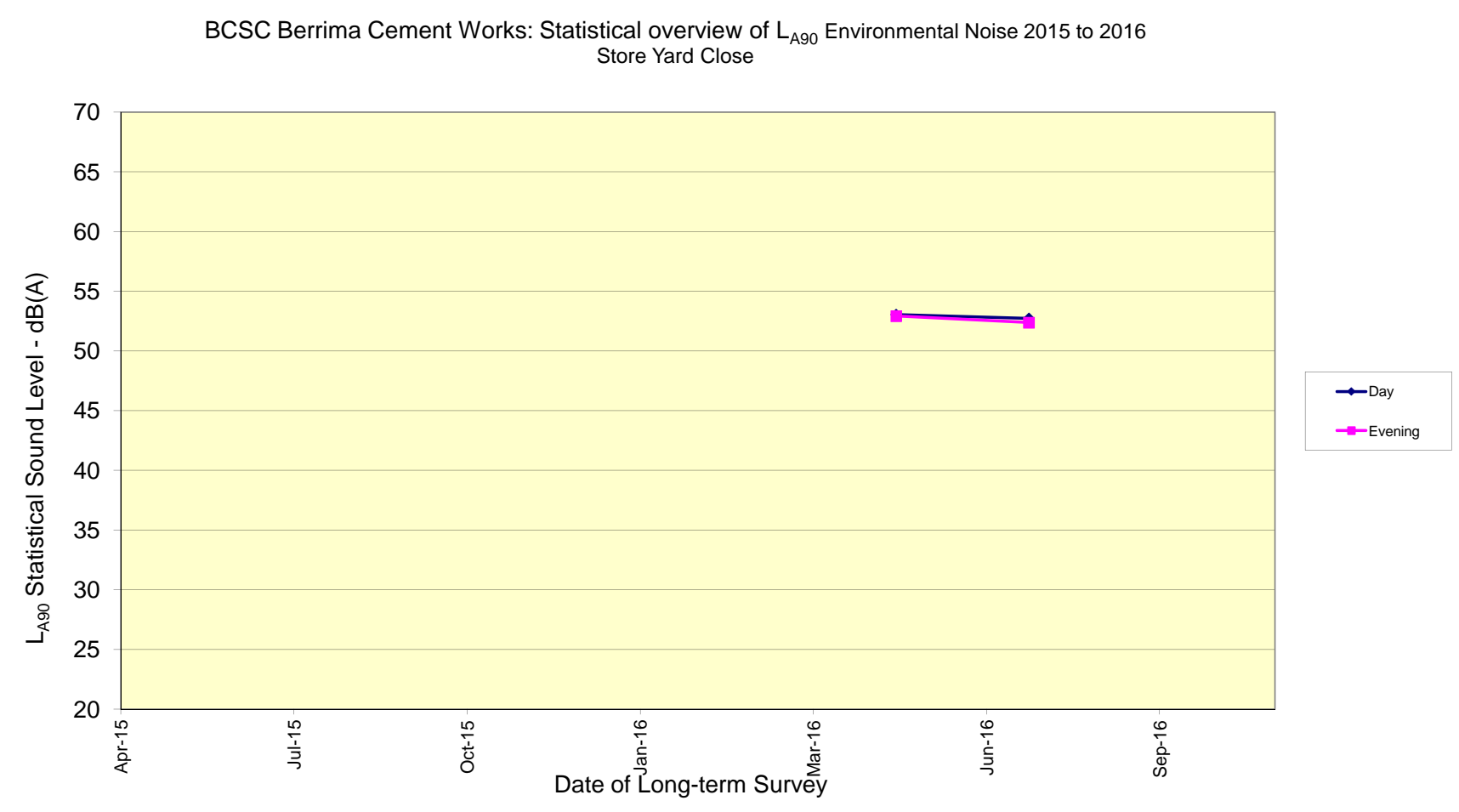
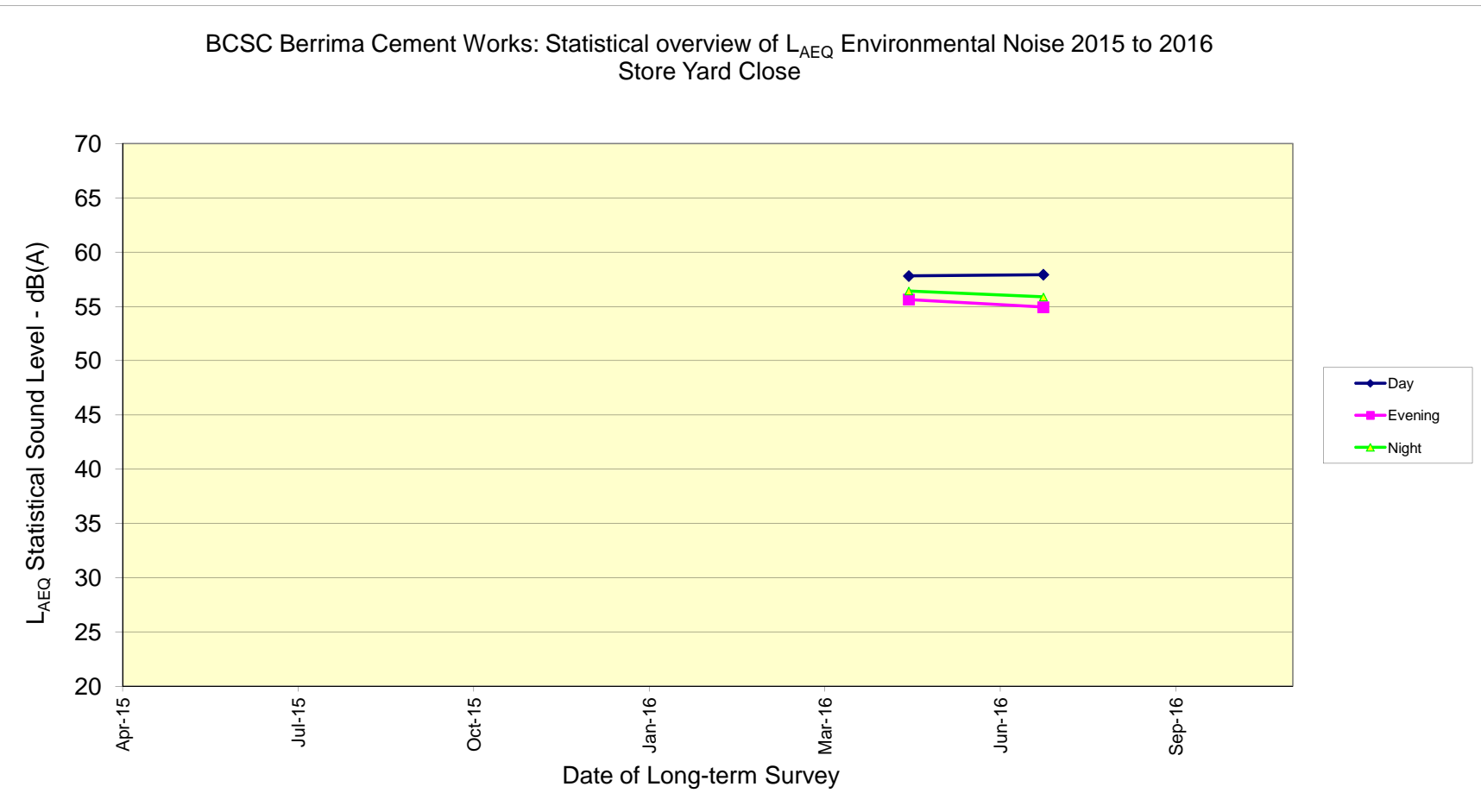


Figure 4.13: Comparison of statistical sound levels for Store Yard Close location (rain periods removed)

average was 55 dBA, below that of 72 Taylor Ave. Average evening L_{A90} values ranged from 44 dBA at 12 Brisbane St to 49 dBA at the Northern Boundary location and 50 dBA at the Store Yard Close location.

In all cases, average period L_{Aeq} sound levels at 72 Taylor Ave. near Adelaide St are higher than the sound levels at the plant northern boundary by 6 to 10 dB. This is the same as in previous years and shows the influence of road traffic noise on receiver sound levels is greater than that of the plant for 72 Taylor Avenue residents. For L_{A90} sound levels, the Northern Boundary averages are 1 dB higher than at 72 Taylor Ave in evening and night-time and 1 dB lower in daytime.

From Table 4.2A and figures 4.4 to 4.13, the following comparisons have been made with the long-term averages (2002 or first measurement to 2016) of all periods measured, including 2016:

- For 4 Melbourne St, the average L_{Aeq} and L_{A90} values are slightly higher or similar to the long-term average.
- For 72 Taylor Avenue near Adelaide St, the average L_{Aeq} values are higher for all periods than most of the past measurements. This may reflect changing traffic movements or the higher wind speeds. Average L_{A90} values are slightly higher than previous and long-term average levels by 3 dB.
- For 12 Brisbane St, the average L_{Aeq} were lower than 2015 for daytime but similar to those of 2015 and the long-term averages for evening and night-time. For average L_{A90} values, all period average levels were similar to those of 2015 and slightly above the long-term average. This may also reflect a higher traffic noise from Taylor Ave during the day.
- For the Northern Boundary, the all averages were within 1 to 2dB of the long-term average for the past 4 years. This indicates that there has not been any significant increase in plant noise emissions, however the location is also affected by traffic noise from Taylor Avenue.
- For the Store Yard Close location, only three periods have been monitored since 2015. July 2016 results are the same in daytime as the other measurements but 3 dB lower for evening and night-time.

As a summary of the unattended monitoring statistical averages, all close and medium distance locations had similar sound levels to previous. For locations closer to Taylor Avenue the daytime sound levels appear to have increased slightly. This may reflect a higher traffic related noise.

Overall, environmental noise is considered to be not significantly different to the results of previous years, indicating no significant change in emissions from Berrima Cement plant.

4.2 Attended measurements

Attended measurements were obtained at the receiver locations on 21st July for daytime and 10 August for evening measurements. Other attempts for measurements had high wind speeds making measurements not possible.

Results of the measurements and comments about sources and conditions are given in Table 4.3 and summarised in Table 4.4. Appendix G has full spectrum results. Values given in the tables include statistical A-weighted sound level parameters and differences between C-weighted and A-weighted sound levels as this can be a measure of the content of low-frequency within the measured sound – the higher the difference the greater the low-frequency content, unless wind is significant and then it is unreliable because the C-weighted levels include some wind effects. The EPA has one objective within the Industrial Noise Policy for low-frequency sound with the C-A weighted difference being preferably not greater than 15 dB.

Generally at the residential receivers, cement plant noise was not significant and only partially audible underneath other noise sources, depending on the time of day. Plant noise was more discernible at Adelaide St near Taylor Ave than at 12 Brisbane St as it is much closer and there is no shielding from intervening houses.

C-weighted – A-weighted sound levels were all greater than 15 dB for L₉₀ and L₉₉ values but several L_{eq} comparisons were less than 15 dB. It is considered that these differences are not caused by the emissions from the Cement Plant.

One-third octave band sound levels were measured at each receiver location during attended monitoring to assess tonality. These are given in Table 4.5 for L_{Aeq} values and shown also with LA90 values for each location in Figures 4.14 to 4.20. Tonality was assessed according to the Industrial Noise Policy for 15-minute L_{Aeq} spectrum sound levels. Results of the tonality analysis are shown in Table 4.6 and graphed in Figure 4.21. None of the residential receiver sound levels had tonality exceeding limits in the range of frequencies emitted from the plant. The graphs show the spectra are relatively smooth and well below tonality limits in all frequencies. Some spectra have a peak in the 160 Hz band which may be related to harmonics of diesel engine noise from traffic.

Table 4.7 collates the attended results and compares them to PRP objectives. Only 12 Brisbane St has measured sound levels lower than the objectives (L_{A90,15-min.})

Administration Building Roof

Measurements have been taken on the roof of the Administration Building since 2014 as a regular comparison of noise from the fans FA38 and FA39 and the Preheater Tower and kiln. Three locations are now used – south-west corner, south-east corner and north-east corner. The 2016 sound levels were within 1 dB of those of 2015, while they were approximately 6 dB higher in 2015 compared to 2014 across most frequencies. Spectra are shown in Figures 4.22 and 4.23. Appendix H includes the measurements from June 2016 with the kiln off but fan FA39 still operating. At that time the roof south east had sound levels of 69 dBA, compared to 69 to 71 with the kiln on and 65 dBA in 2014 with the kiln off.

**Table 4.3: Boral Cement Berrima Annual Environmental Noise Assessment 2016
Residential Receiver & Boundary Sound Levels 21 July and 10 August 2016**

Location	File No.	Date	Start Time	Period hh:mm:ss	Weighting A or C	Statistical Sound Level - dBA									Comment
						LAeq	LAMax	LA01	LA10	LA90	LCeq	LC-LA eq	LC-LA 90	LC-LA 99	
Northern Boundary	212	21/07/2016	10:40 AM	d 00:15:00	A	52	62	57	53	50	69	17	16	13	Overcast, low cloud wind < 0.5m/s, ambient 50, internal traffic & plant
Stores Yard Close	215	21/07/2016	11:12 AM	d 00:10:12	A	61	79	75	58	52	75	14	15	15	Quiet 52, scaffold drop 70, silo 63, truck pass 80
4 Melbourne St	216	21/07/2016	11:32 AM	d 00:15:00	A	59	76	71	61	47	71	12	16	16	Ambient 48, truck pass 68-75, birds 72, no tones from plant
12 Brisbane St	219	21/07/2016	12:09 PM	d 00:15:00	A	49	70	63	50	35	61	12	23	23	Wind calm to 0.5m/s N, quiet 33-37, fans at bottom, dogs 60, birds 60+, truck on Taylor 60+ on bumps, car 47
Adelaide St near Taylor	220	21/07/2016	12:43 PM	d 00:15:00	A	64	81	77	67	45	74	10	18	19	Dogs barking 70, plant 46, truck Taylor 73-78 80+ on bumps, car 65-70, car pass Adelaide 68-75. Lot of trucks out of plant
Store Yard Close	338	10/08/2016	9:17 AM	d 00:15:00	A	58	76	69	59	53	76	18	16	16	Sky 6/8 mid level CN, wind 3-5 m/s NW-NNW, 15oC. Quiet ambient 54
Northern Boundary	341	10/08/2016	10:09 AM	d 00:10:00	A	53	68	60	55	49	69	17	16	16	Quiet 47 to 50. Taylor Ave Traffic, birds 60+, wind is low here. Trucks on Taylor 64 higher than site road trucks. No stack tone significant but audible when quiet.
Lake Breed South	342	10/08/2016	10:28 AM	d 00:10:01	A	58	72	64	60	56	73	15	14	14	Plant fans - coal mill, PHT, trains, traffic Moss Vale Road, birds. Ambient 55 to 62. Wind is W from PHT to here 2 to 6m/s
4 Melbourne St	585	10/08/2016	6:30 PM	d 00:15:00	A	56	80	69	56	45	68	12	16	16	Wind 1-3m/s NW, ~15C clear, amb 45-50, distant traffic, fan noise from kiln. Quiet 40 on wind
12 Brisbane St	588	10/08/2016	6:53 PM	0:13:00	A	52	76	64	47	40	62	10	19	19	Traffic noise from Freeway higher than plant which is lower freq. Wind is lower here as shielded. Ambient 38-40 is freeway traffic
Adelaide St near Taylor	589	10/08/2016	7:08 PM	0:10:01	A	51	67	64	51	44	66	15	18	18	Wind 1-3m/s Distant traffic & passing traffic, plant higher than Brisbane as closer and unshielded. Location level with rear of houses facing Taylor. Quiet is 45, no significant tones from plant
Argyle St 30m to Taylor Ave	592	10/08/2016	7:25 PM	d 00:10:09	A	49	71	60	52	43	66	16	16	15	Wind 2-4 m/s W, mainly freeway, plant barely audible. Hammering in house across street. Location is behind back of E side houses but half way to W side houses, on W side

**Table 4.4: Boral Cement Berrima Annual Environmental Noise Assessment 2016
Residential Receiver & Boundary Sound Levels 21 July and 10 August 2016 - collated results**

Location	File No.	Date	Start Time	Period hh:mm:ss	Time of Day	Statistical Sound Level - dBA								Comment	
						LAeq	LAMax	LA01	LA10	LA90	LCEq	LC-LA eq	LC-LA 90		LC-LA 99
4 Melbourne St	216	21/07/2016	11:32 AM	d 00:15:00	Daytime	59	76	71	61	47	71	12	16	16	Ambient 48, truck pass 68-75, birds 72, no tones from plant
4 Melbourne St	585	10/08/2016	6:30 PM	d 00:15:00	Evening	56	80	69	56	45	68	12	16	16	Wind 1-3m/s NW, ~15C clear, amb 45-50, distant traffic, fan noise from kiln. Quiet 40 on wind
Adelaide St near Taylor	220	21/07/2016	12:43 PM	d 00:15:00	Daytime	64	81	77	67	45	74	10	18	19	Dogs barking 70, plant 46, truck Taylor 73-78 80+ on bumps, car 65-70, car pass Adelaide 68-75. Lot of trucks out of plant
Adelaide St near Taylor	589	10/08/2016	7:08 PM	0:10:01	Evening	51	67	64	51	44	66	15	18	18	Wind 1-3m/s Distant traffic & passing traffic, plant higher than Brisbane as closer and unshielded. Location level with rear of houses facing Taylor. Quiet is 45, no significant tones from plant
12 Brisbane St	219	21/07/2016	12:09 PM	d 00:15:00	Daytime	49	70	63	50	35	61	12	23	23	Wind calm to 0.5m/s N, quiet 33-37, fans at bottom, dogs 60, birds 60+, truck on Taylor 60+ on bumps, car 47
12 Brisbane St	588	10/08/2016	6:53 PM	0:13:00	Evening	52	76	64	47	40	62	10	19	19	Traffic noise from Freeway higher than plant which is lower freq. Wind is lower here as shielded. Ambient 38-40 is freeway traffic
Argyle St 30m to Taylor Ave	592	10/08/2016	7:25 PM	d 00:10:09	Evening	49	71	60	52	43	66	16	16	15	Wind 2-4 m/s W, mainly freeway, plant barely audible. Hammering in house across street. Location is behind back of E side houses but half way to W side houses, on W side
Northern Boundary	212	21/07/2016	10:40 AM	d 00:15:00	Daytime	52	62	57	53	50	69	17	16	13	Overcast, low cloud wind < 0.5m/s, ambient 50, internal traffic & plant
Northern Boundary	341	10/08/2016	10:09 AM	d 00:10:00	Evening	53	68	60	55	49	69	17	16	16	Quiet 47 to 50. Taylor Ave Traffic, birds 60+, wind is low here. Trucks on Taylor 64 higher than site road trucks. No stack tone significant but audible when quiet.
Stores Yard Close	215	21/07/2016	11:12 AM	d 00:10:12	Daytime	61	79	75	58	52	75	14	15	15	Quiet 52, scaffold drop 70, silo 63, truck pass 80
Store Yard Close	338	10/08/2016	9:17 AM	d 00:15:00	Evening	58	76	69	59	53	76	18	16	16	Sky 6/8 mid level CN, wind 3-5 m/s NW-NNW, 15°C. Quiet ambient 54
Lake Breed South	342	10/08/2016	10:28 AM	d 00:10:01	Daytime	58	72	64	60	56	73	15	14	14	Plant fans - coal mill, PHT, trains, traffic Moss Vale Road, birds. Ambient 55 to 62. Wind is W from PHT to here 2 to 6m/s

Table 4.5: Boral Cement Berrima Annual Environmental Noise Assessment 2016
One-third Octave Band Spectra of Boundary or Residential Receiver sound levels

Location	File No.	Total L _{Ceq}	Total LA _{eq}	LA _{eq} 1/3 Octave Band Sound Level - dBA in Frequency Band Hz																																
				12.5 Hz	16 Hz	20 Hz	25 Hz	31.5 Hz	40 Hz	50 Hz	63 Hz	80 Hz	100 Hz	125 Hz	160 Hz	200 Hz	250 Hz	315 Hz	400 Hz	500 Hz	630 Hz	800 Hz	1 kHz	1.25 kHz	1.6 kHz	2 kHz	2.5 kHz	3.15 kHz	4 kHz	5 kHz	6.3 kHz	8 kHz	10 kHz	12.5 kHz	16 kHz	20 kHz
Northern Boundary	212	69	52	-4	6	11	18	22	30	32	37	36	38	36	39	37	35	38	41	42	42	42	43	40	40	36	35	33	28	28	26	21	12	9	4	0
Stores Yard Close	215	75	61	-3	6	12	17	23	30	33	45	48	42	45	51	51	49	49	49	48	46	48	47	49	50	48	47	44	42	39	36	32	28	24	12	4
4 Melbourne St	216	71	59	-3	4	9	16	22	26	33	40	37	39	43	45	45	44	46	47	48	49	49	49	48	46	44	43	43	45	41	36	32	26	24	15	10
12 Brisbane St	219	61	49	-6	1	5	12	16	20	21	25	29	28	29	33	33	33	34	35	39	37	38	38	39	37	34	37	38	40	37	31	25	19	11	4	-1
Adelaide St near Taylor	220	74	64	-2	7	12	21	26	28	33	41	47	44	47	48	48	48	50	50	51	53	54	54	53	53	52	52	52	52	49	46	42	37	32	22	13
Store Yard Close	338	76	58	11	18	22	27	30	33	35	39	40	40	43	45	45	45	45	46	47	47	47	47	47	46	45	44	42	41	39	36	32	29	22	12	4
Northern Boundary	341	69	53	1	8	14	20	24	29	30	34	38	36	40	40	37	35	36	39	40	42	42	42	41	42	44	39	36	35	34	33	30	26	21	14	5
Lake Breed	342	73	58	7	14	19	23	27	30	34	39	40	42	43	43	42	43	49	52	50	48	46	46	45	44	42	42	39	36	34	30	25	23	16	10	3
4 Melbourne St	585	68	56	5	10	14	19	21	25	26	32	34	33	37	41	42	42	44	43	45	46	46	46	46	45	46	43	42	39	37	34	31	24	18	10	2
12 Brisbane St	588	62	52	-5	2	8	15	16	17	19	26	28	25	28	32	33	34	34	35	39	40	43	45	44	42	39	40	38	30	27	24	20	16	12	6	1
Adelaide St near Taylor	589	66	51	-5	2	9	21	20	21	22	26	36	34	34	38	36	34	34	35	38	39	42	43	42	40	38	36	34	31	29	26	24	20	14	8	2
Adelaide St near Taylor	590	64	64	46	50	51	60	56	53	52	49	48	49	50	51	47	39	38	38	38	39	40	41	39	36	32	30	27	24	21	18	15	11	6	2	-2
Argyll St 30m to Taylor Ave	591	67	67	56	58	59	59	57	56	53	51	49	47	45	44	41	36	34	36	39	38	38	35	31	29	28	27	25	24	21	18	15	11	8	2	-2
Argyle St 30m to Taylor Ave	592	66	49	3	8	13	17	20	22	25	26	29	30	32	33	33	33	33	35	38	39	41	41	40	39	36	35	34	32	29	24	21	14	9	4	0

Figure 4.14: Boral Cement Berrima Annual Environmental Noise Assessment 2016 Residential Receiver & Boundary Spectra - 4 Melbourne St

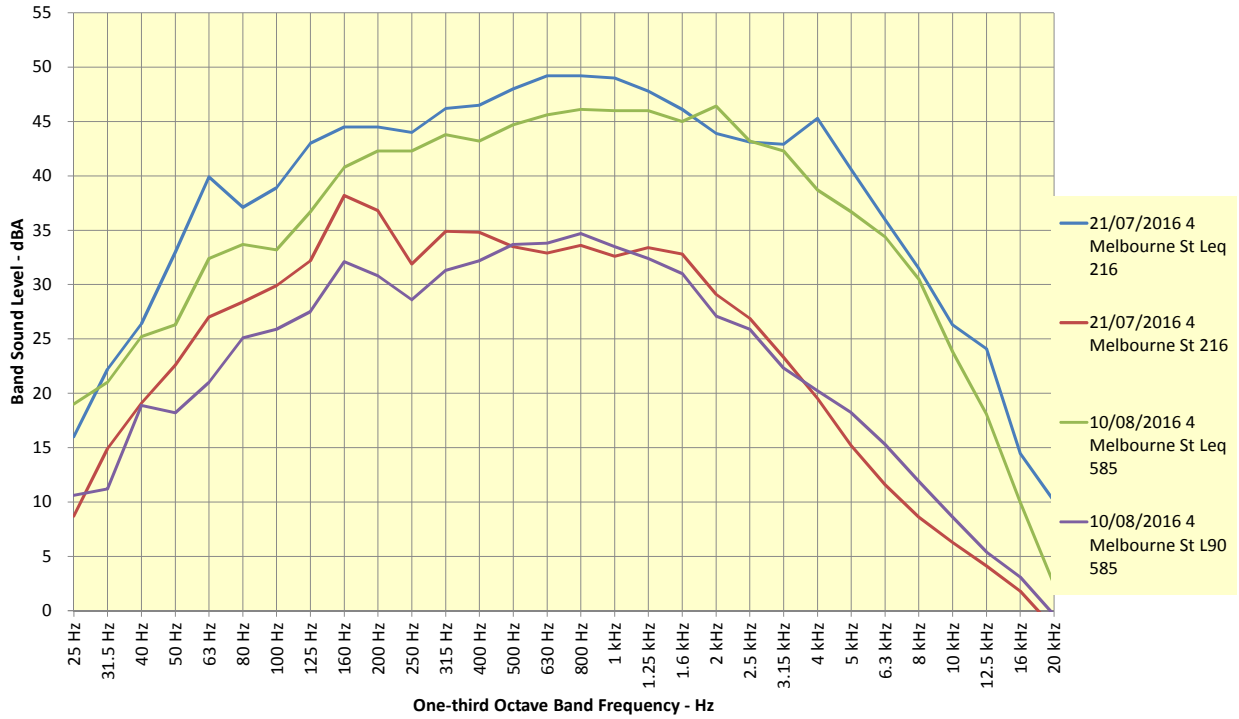


Figure 4.15: Boral Cement Berrima Annual Environmental Noise Assessment 2016 Residential Receiver & Boundary Spectra - Adelaide St near Taylor Avenue

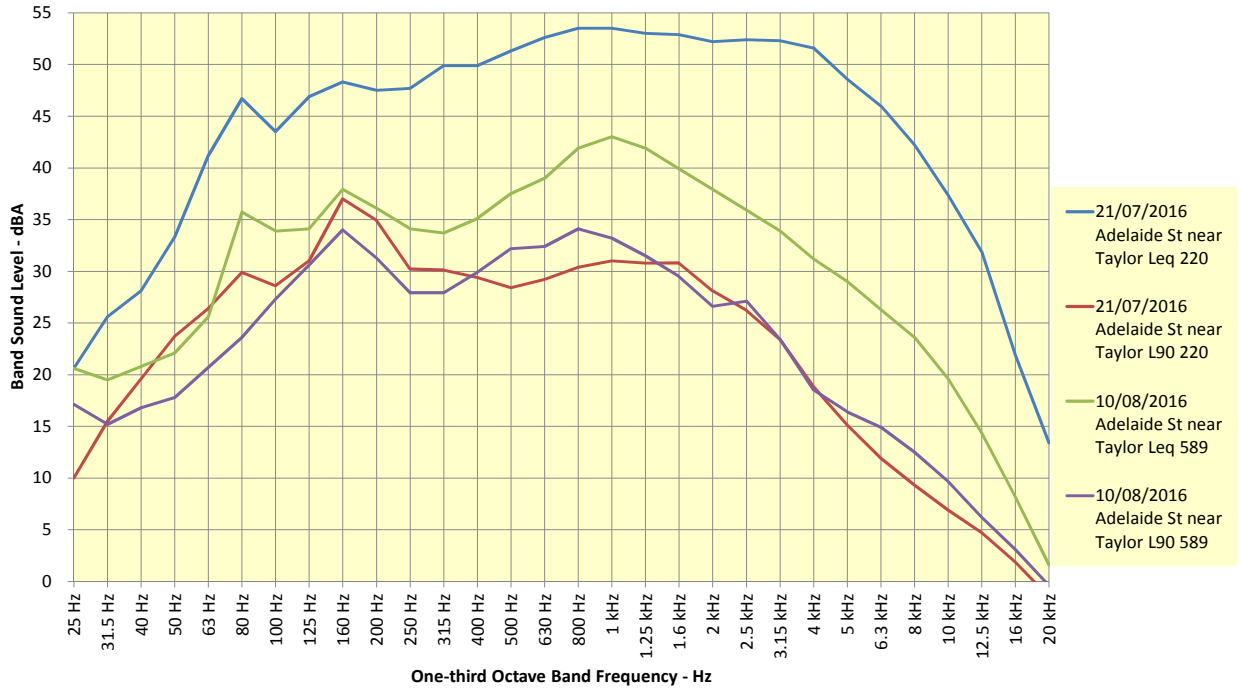


Figure 4.16: Boral Cement Berrima Annual Environmental Noise Assessment 2016 Residential Receiver & Boundary Spectra - 12 Brisbane St

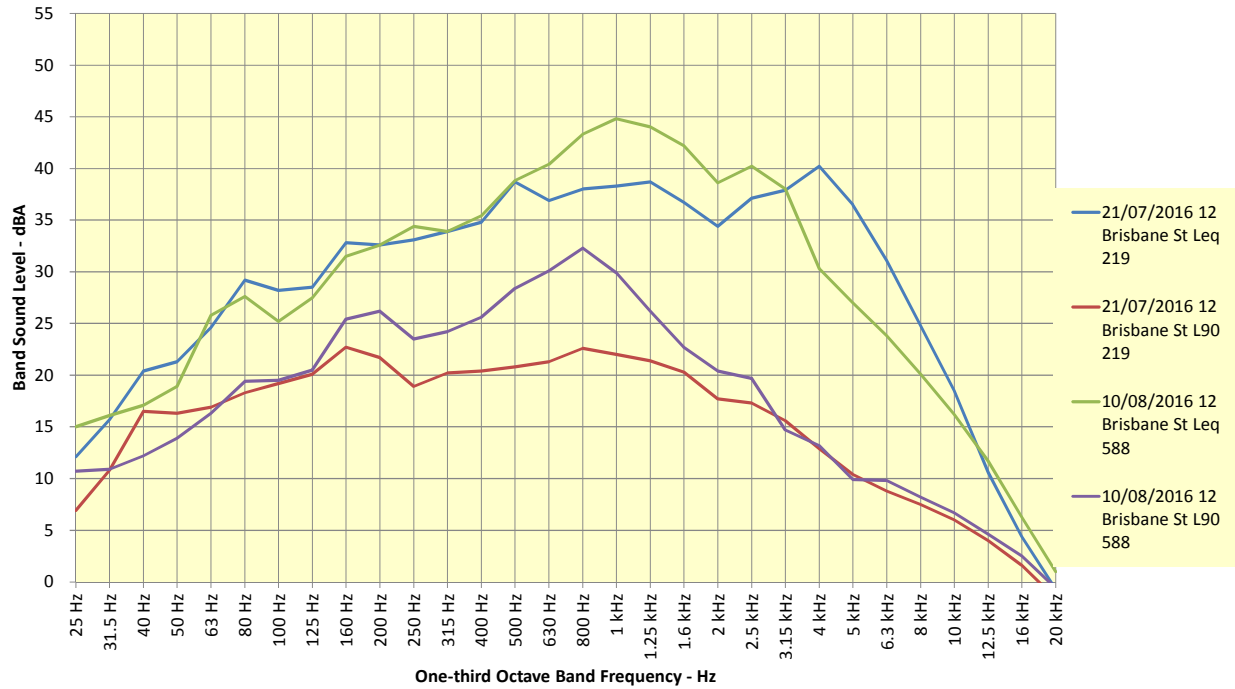


Figure 4.17: Boral Cement Berrima Annual Environmental Noise Assessment 2016 Residential Receiver & Boundary Spectra - Northern Boundary

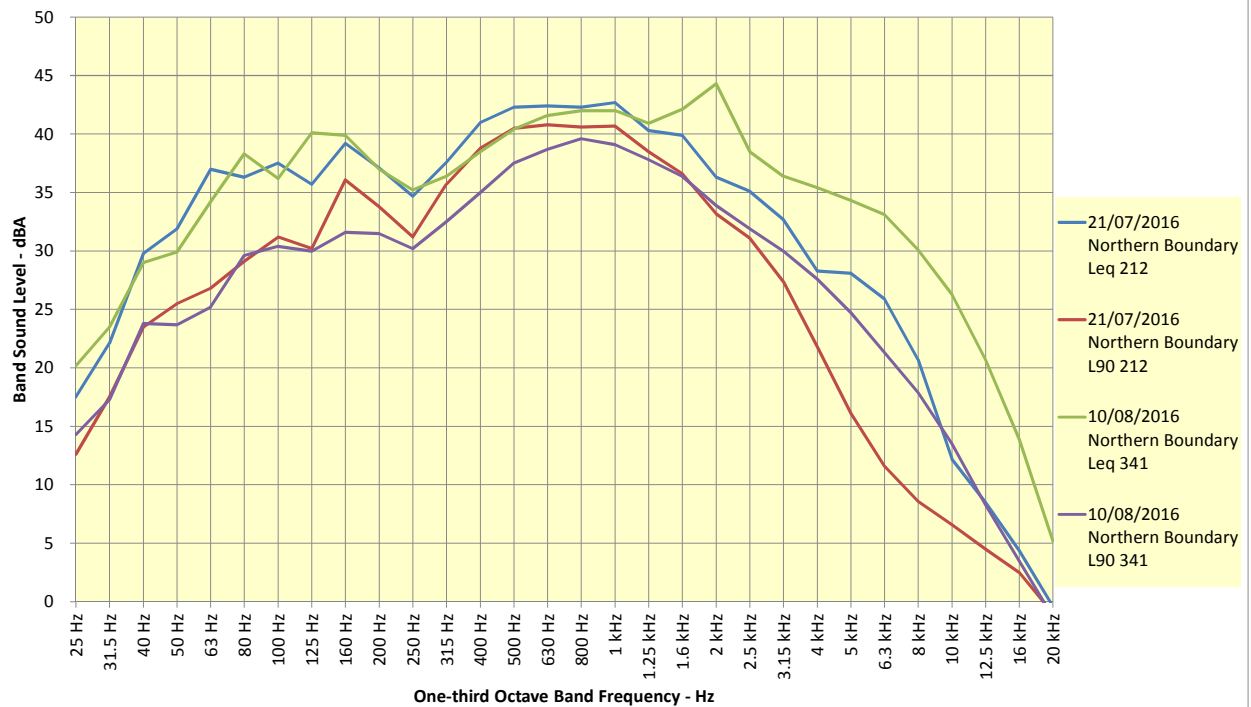


Figure 4.18: Boral Cement Berrima Annual Environmental Noise Assessment 2016 Residential Receiver & Boundary Spectra - Store Yard Close

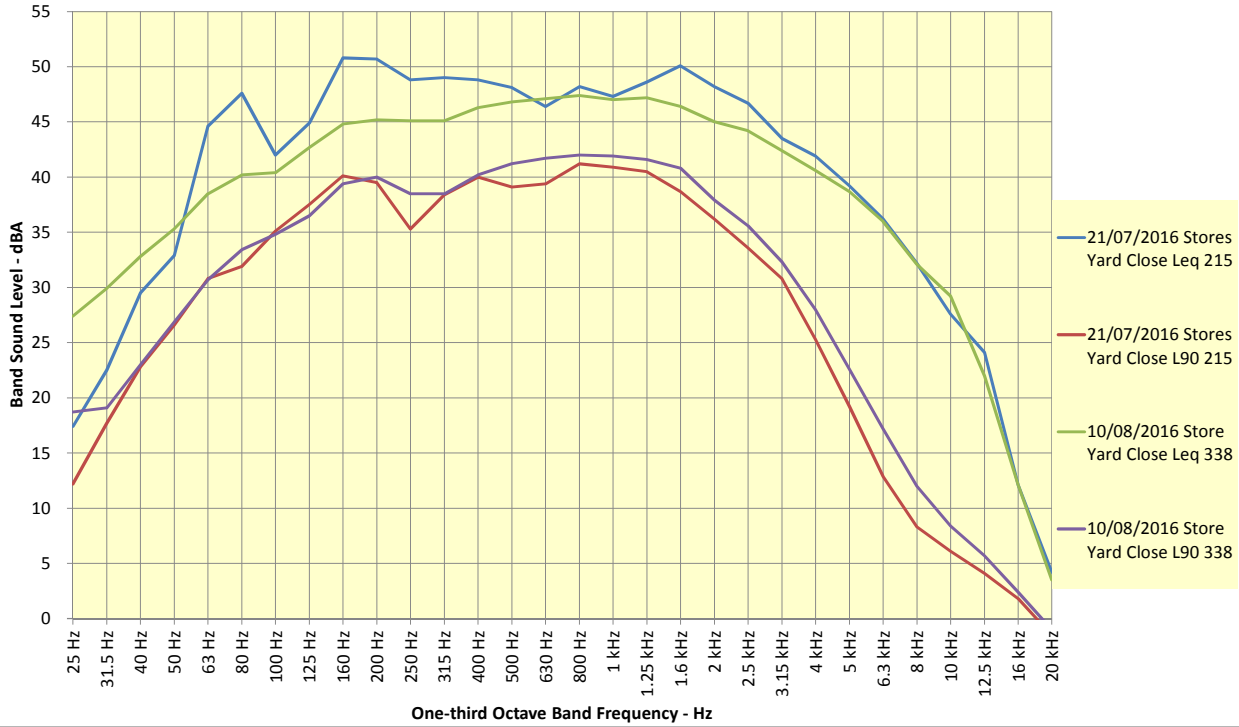


Figure 19: Boral Cement Berrima Annual Environmental Noise Assessment 2016 Residential Receiver & Boundary Spectra - Argyle St near Taylor Avenue

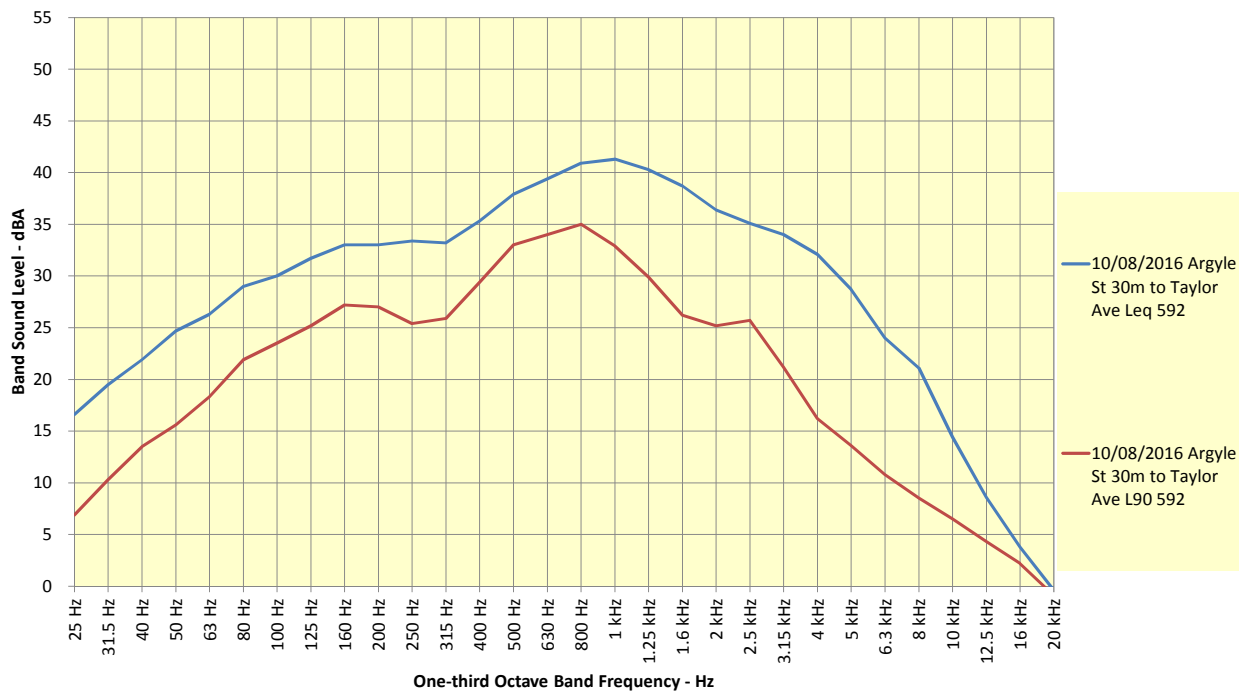
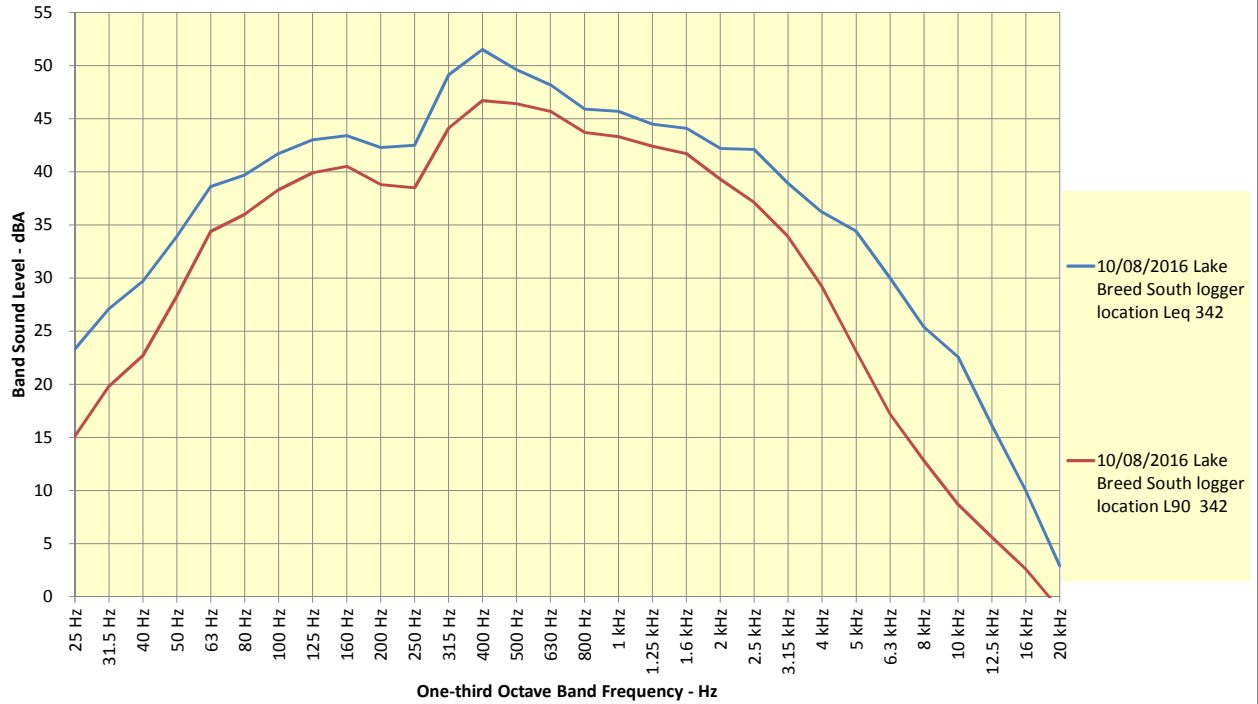


Figure 4.20: Boral Cement Berrima Annual Environmental Noise Assessment 2016 Residential Receiver & Boundary Spectra - Lake Breed South Logger



**Figure 4.21: Boral Cement Berrima - 2016 Annual Environmental Noise Assessment
Tonality assessment of residential and boundary location spectra**

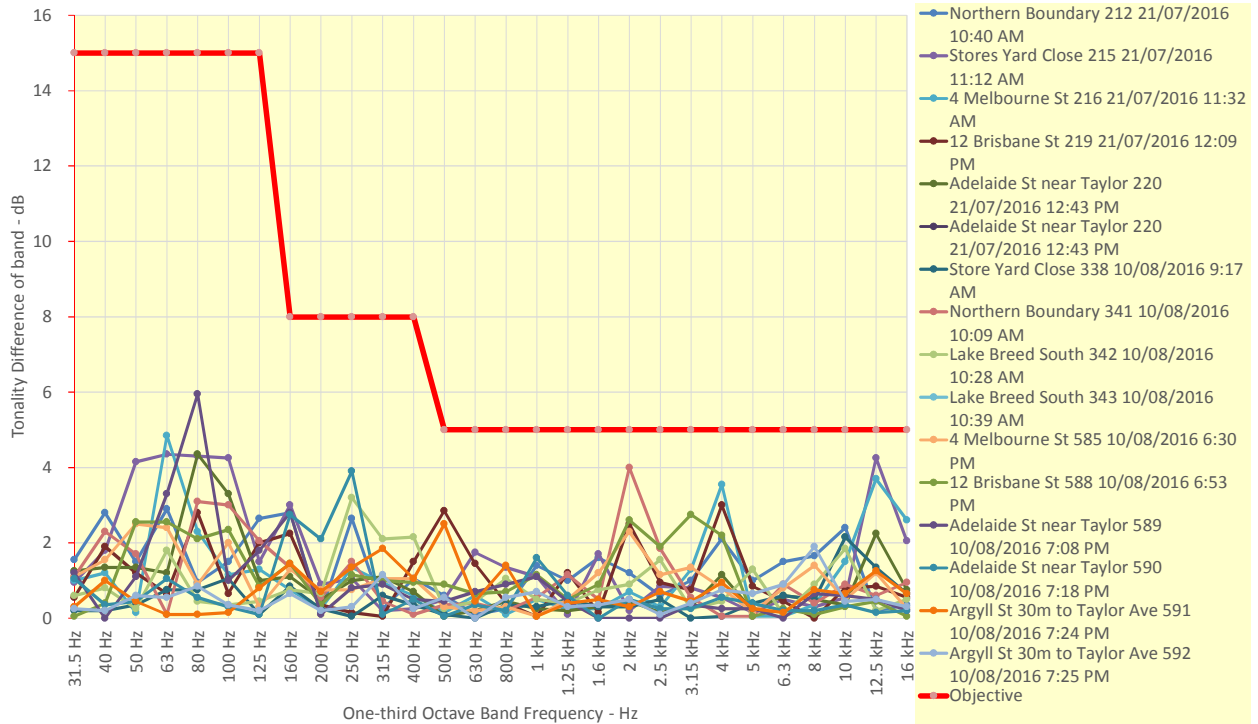


Table 4.6: Boral Cement Berrima Annual Environmental Noise Assessment 2016

One-third Octave Band Spectra of Boundary or Residential Receiver sound levels - Tonality Assessment Cell shaded pink if tonality criterion exceeded

Location	File No.	Date	Start Time	Tonality in LAeq 1/3 Octave Band Sound Level - dBA in Frequency Band Hz																											
				31.5 Hz	40 Hz	50 Hz	63 Hz	80 Hz	100 Hz	125 Hz	160 Hz	200 Hz	250 Hz	315 Hz	400 Hz	500 Hz	630 Hz	800 Hz	1 kHz	1.25 kHz	1.6 kHz	2 kHz	2.5 kHz	3.15 kHz	4 kHz	5 kHz	6.3 kHz	8 kHz	10 kHz	12.5 kHz	16 kHz
Northern Boundary	212	21/07/2016	10:40 AM	1.6	2.8	1.5	2.9	1.0	1.5	2.7	2.8	0.1	2.7	0.3	1.1	0.6	0.1	0.3	1.4	1.0	1.6	1.2	0.6	1.0	2.1	1.0	1.5	1.7	2.4	0.2	0.4
Stores Yard Close	215	21/07/2016	11:12 AM	0.9	1.8	4.2	4.4	4.3	4.3	1.5	3.0	0.9	1.1	0.2	0.3	0.5	1.8	1.4	1.1	0.1	1.7	0.2	0.9	0.8	0.5	0.2	0.5	0.3	0.6	4.3	2.1
4 Melbourne St	216	21/07/2016	11:32 AM	1.0	1.2	0.1	4.9	2.3	1.2	1.3	0.8	0.3	1.4	1.0	0.6	0.1	0.6	0.1	0.5	0.3	0.3	0.7	0.3	1.3	3.6	0.0	0.0	0.4	1.5	3.7	2.6
12 Brisbane St	219	21/07/2016	12:09 PM	0.6	1.9	1.2	0.6	2.8	0.7	2.0	2.3	0.4	0.1	0.1	1.5	2.9	1.5	0.4	0.1	1.2	0.2	2.5	1.0	0.8	3.0	0.8	0.5	0.0	0.8	0.9	0.6
Adelaide St near Taylor	220	21/07/2016	12:43 PM	1.3	1.4	1.4	1.2	4.4	3.3	1.0	1.1	0.5	1.0	1.1	0.7	0.0	0.2	0.5	0.3	0.2	0.3	0.4	0.1	0.3	1.2	0.2	0.6	0.5	0.4	2.3	0.8
Store Yard Close	338	10/08/2016	9:17 AM	0.2	0.2	0.4	0.8	0.8	1.1	0.1	0.8	0.3	0.1	0.6	0.3	0.1	0.0	0.4	0.3	0.5	0.3	0.3	0.5	0.0	0.1	0.4	0.6	0.5	2.2	1.4	0.7
Northern Boundary	341	10/08/2016	10:09 AM	1.1	2.3	1.7	0.1	3.1	3.0	2.1	1.4	0.5	1.5	0.5	0.1	0.4	0.4	0.2	0.5	1.2	0.5	4.0	1.8	0.6	0.1	0.0	0.9	0.4	0.9	0.6	1.0
Lake Breed	342	10/08/2016	10:28 AM	0.6	0.8	0.3	1.8	0.5	0.4	0.5	0.8	0.7	3.2	2.1	2.2	0.3	0.5	1.1	0.5	0.4	0.8	0.9	1.6	0.3	0.4	1.3	0.1	0.9	1.9	0.2	0.5
4 Melbourne St	585	10/08/2016	6:30 PM	1.1	1.6	2.5	2.4	0.9	2.0	0.3	1.3	0.8	0.8	1.1	1.1	0.3	0.2	0.3	0.0	0.5	1.2	2.3	1.1	1.3	0.8	0.2	0.8	1.4	0.5	1.2	0.3
12 Brisbane St	588	10/08/2016	6:53 PM	0.1	0.4	2.6	2.6	2.1	2.4	0.9	1.5	0.4	1.2	1.0	0.9	0.9	0.6	0.7	1.2	0.5	0.9	2.6	1.9	2.8	2.2	0.1	0.3	0.1	0.3	0.4	0.0
Adelaide St near Taylor	589	10/08/2016	7:08 PM	1.2	0.0	1.1	3.3	6.0	1.0	1.8	2.8	0.1	0.8	0.9	0.5	0.5	0.7	0.9	1.1	0.4	0.0	0.0	0.0	0.4	0.3	0.3	0.0	0.6	0.6	0.5	0.2
Adelaide St near Taylor	590	10/08/2016	7:18 PM	1.1	0.4	0.5	1.1	0.5	0.3	0.1	2.8	2.1	3.9	0.1	0.5	0.0	0.4	0.2	1.6	0.6	0.0	0.5	0.3	0.3	0.5	0.4	0.2	0.2	0.4	0.2	0.2
Argyll St 30m to Taylor Ave	591	10/08/2016	7:24 PM	0.3	1.0	0.5	0.1	0.1	0.2	0.8	1.5	0.7	1.3	1.9	1.1	2.5	0.4	1.4	0.0	0.4	0.5	0.3	0.7	0.5	0.9	0.3	0.2	0.7	0.6	1.3	0.7
Argyll St 30m to Taylor Ave	592	10/08/2016	7:25 PM	0.3	0.2	0.6	0.6	0.9	0.4	0.2	0.6	0.2	0.3	1.1	0.3	0.6	0.0	0.6	0.7	0.3	0.4	0.5	0.1	0.4	0.8	0.6	0.9	1.9	0.5	0.5	0.3

Table 4.7: Boral Cement Berrima Annual Environmental Noise Assessment 2016

Residential Receiver & Boundary Sound Levels 21 July and 10 August 2016 - collated results compared with recommended PRP objectives

Location	File No.	Date	Start Time	Period	Time of Day	Statistical Sound Level - dBA											
						LAeq	PRP Leq Obj	LAMax	LA01	PRP L01 Night Obj	LA10	LA90	PRP L90 Obj	LCeq	LC-LA eq	LC-LA 90	LC-LA 99
4 Melbourne St	216	21/07/2016	11:32 AM	d 00:15:00	Daytime	59	46	76	71	56	61	47	41	71	12	16	16
4 Melbourne St	585	10/08/2016	6:30 PM	d 00:15:00	Evening	56	42	80	69	56	56	45	39	68	12	16	16
Adelaide St near Taylor	220	21/07/2016	12:43 PM	d 00:15:00	Daytime	64	48	81	77	58	67	45	43	74	10	18	19
Adelaide St near Taylor	589	10/08/2016	7:08 PM	0:10:01	Evening	51	44	67	64	58	51	44	39	66	15	18	18
12 Brisbane St	219	21/07/2016	12:09 PM	d 00:15:00	Daytime	49	51	70	63	56	50	35	46	61	12	23	23
12 Brisbane St	588	10/08/2016	6:53 PM	0:13:00	Evening	52	45	76	64	56	47	40	40	62	10	19	19
Argyle St 30m to Taylor Ave	592	10/08/2016	7:25 PM	d 00:10:09	Evening	49	42	71	60	56	52	43	39	66	16	16	15
Northern Boundary	212	21/07/2016	10:40 AM	d 00:15:00	Daytime	52	52	62	57	60	53	50	47	69	17	16	13
Northern Boundary	341	10/08/2016	10:09 AM	d 00:10:00	Evening	53	50	68	60	60	55	49	46	69	17	16	16

Note: Use PRP recommendation for Melbourne St at Argyle St

Figure 4.22: Boral Cement Berrima - Annual Environmental Noise Assessment 2015 - Compare Control Building Roof spectra LAeq 2015 to 2014

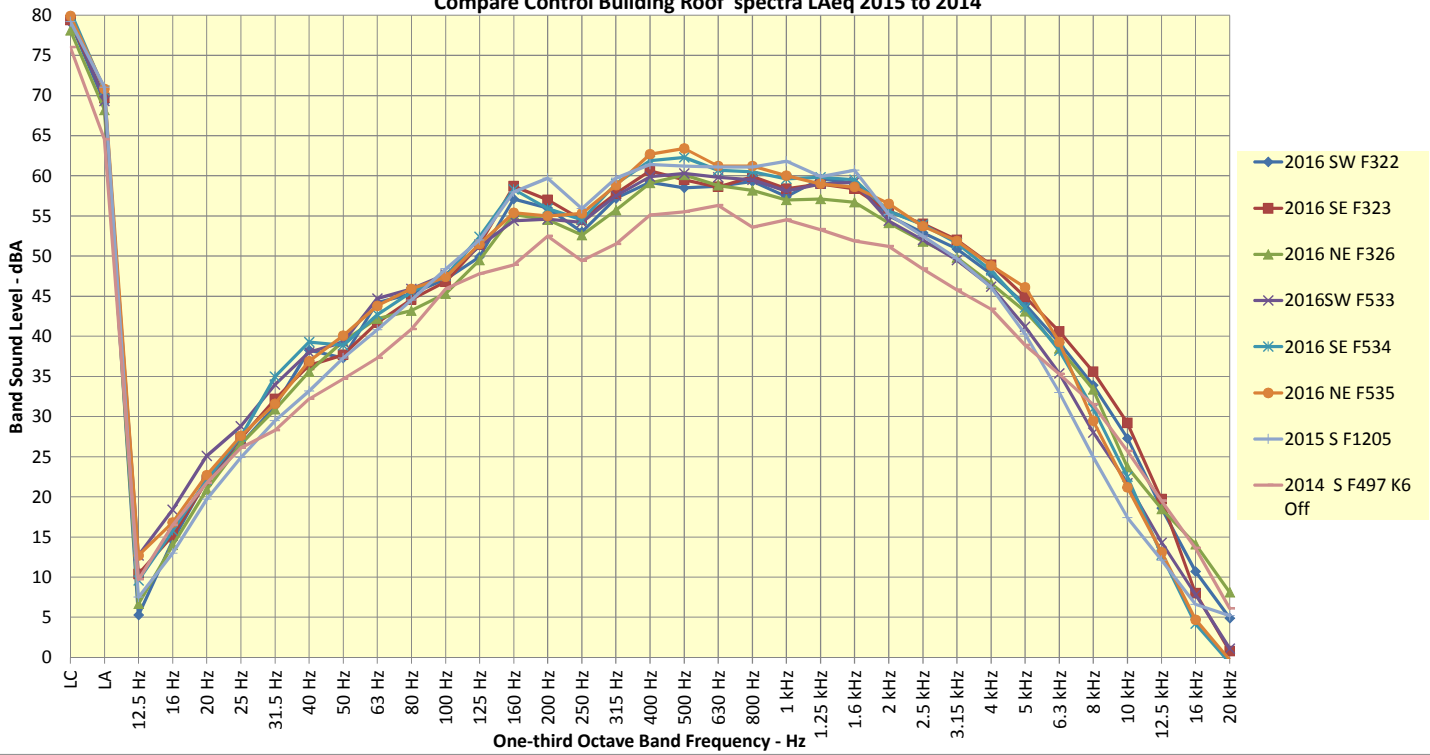
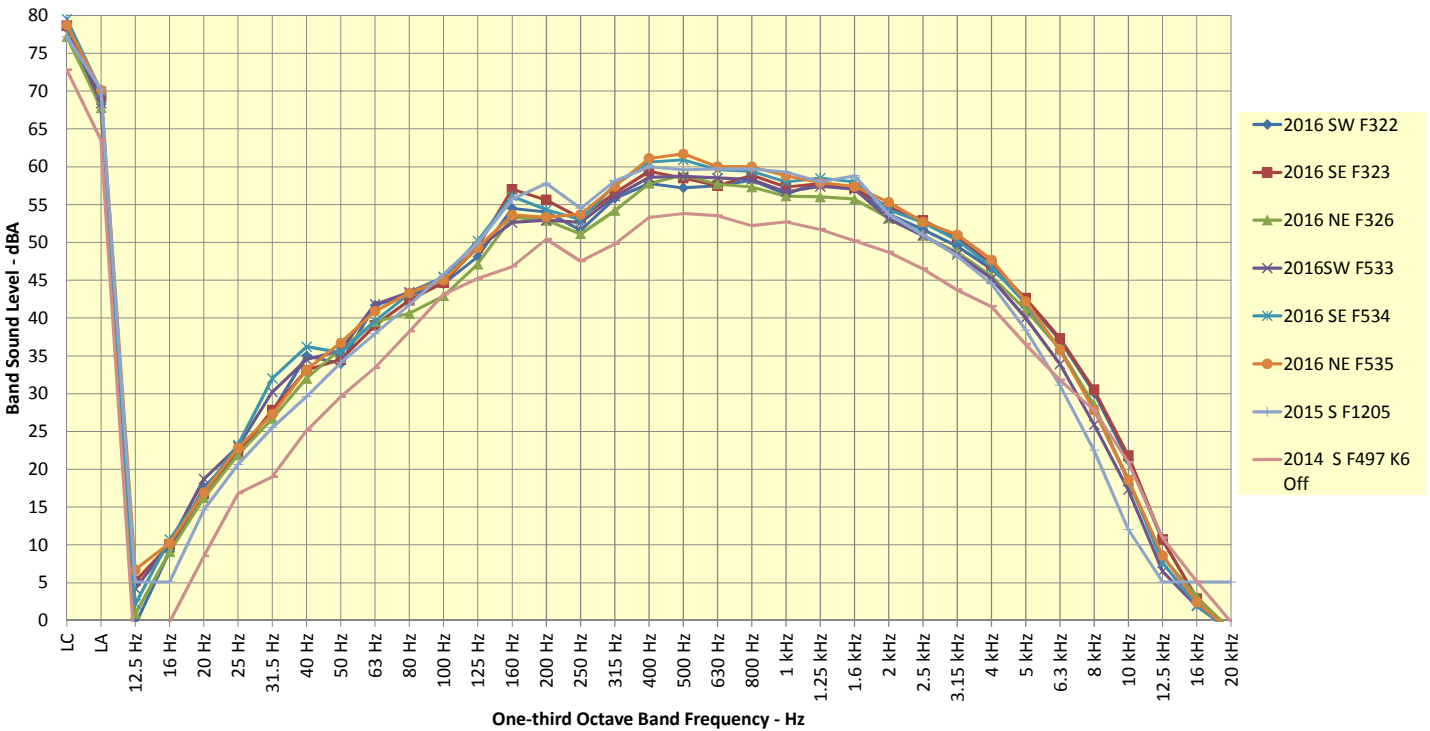


Figure 4.23: Boral Cement Berrima - Annual Environmental Noise Assessment 2015 - Compare Control Building Roof spectra LA90 2015 to 2014



4.3 Measurement Site Results

4.3.1 4 Melbourne St.

The 4 Melbourne St. location provides the longest continuous series of data measured for the site. Long-term average results are shown in Figures 4.4 and 4.5. Unattended measurements were obtained for the period 21 July to 5 August. Results are given in Appendix A. Attended measurements were obtained on 21 July and 10 August.

General industrial noise was audible from the site during both day and evening attended periods. In the evening measurements traffic noise from the freeway to the west was the main source. Fans were the main ambient sound from the plant but were not significantly above the ambient sound. This lower relative sound level than in the past was caused by the predominantly north-westerly winds during the monitoring period. The measured evening L_{A90} sound level was 45 dBA. This included a contribution from the Hume Freeway traffic to the west. Quiet periods with low traffic noise and low wind speed had a sound level of 40 dBA. The long-term average L_{A90} from unattended monitoring at night-time during the monitoring period was 46 dBA. This can be compared to the recommended PSNL inferred L_{A90} of 35 dBA.

Long-term average L_{Aeq} levels were the same as in 2015 and 1dB higher than measured in 2014 and 2012. The average night-time L_{A90} sound level of 46 dBA was 1 dB higher than in 2015 and 2014, but the night-time Median 10% L_{A90} sound level was 1 dB less than in 2015 and the same as in 2014 less than in 2014 but above those measured from 2011 to 2013. Graphs in Appendix A show sound levels were influenced slightly by wind speed and direction. The range of sound levels was 15 dB for both $L_{Aeq,15-min}$ sound levels and $L_{A90,15-min}$ sound levels. Period L_{Aeq} sound levels were lower than those for 72 Taylor Ave in all periods and generally lower but sometime the same or higher than those for the Store Yard Close location. Period L_{A90} sound levels were lower than those for the Store Yard Close location by 5 to 10 dB and lower than 72 Taylor Ave by 1 to 6 dB.

The difference between the average L_{Aeq} and average L_{A90} for night-time was 6 dB, the same as in 2014 but 1 dB below that of 2015.

Traffic noise continues to have a significant effect on measurement results for this location.

For 4 Melbourne St, the location can be considered as an industrial interface area between the industrial site of the Cement Works and the residential area. Objective L_{Aeq} night-time sound levels are inferred from the INP as 45 dBA acceptable and 50 dBA maximum. From these, objective average period night-time L_{A90} sound levels would be 40 dBA acceptable and 45 dBA maximum. This is compared to the measured long-term average L_{A90} night-time for 2016 of 46 dBA.

From the PRP-7 study in 2011, the recommended PSNL for night-time was 40 dBA L_{Aeq} as a contribution level. Measured average total sound levels were 12 dB above this. The recommended $L_{A90,15-min}$ for night-time recommended in the PRP study was 35 dBA. Measured total average $L_{A90,15-min}$ sound levels were 11 dB above this. This was 1 dB higher than in 2014 and 2015.

One-third octave band spectra are shown in Figure 4.14. There is a peak in the 160 Hz band in both measurements and this is likely to be related to a harmonic of truck exhaust noise or the stack discharge but none were tonal.

Narrow band frequency analysis was also made of recorded sound in each attended measurement. These are shown in Figures 4.24 to 4.27. Fast Fourier Transform (FFT) analysis used a typical measurement period of 60 seconds or longer and had a 1-Hz resolution. For the Melbourne St measurements the main peaks occur at 176 Hz on 21 July or 174 Hz on 10 August, which is likely to be related to FA39 blade pass frequency and 351 or 348 Hz, which is likely to be its first harmonic. The peak height of 18 dB above the adjacent spectrum level for the highest peak in a 1-Hz resolution spectrum is not considered to be significantly tonal although it is audible. Typically a peak height of greater than 20 to 25 dB would be likely to be tonal. The peak related to FA250 which is expected to be close to 200 Hz does not appear in the spectra.

4.3.2 72 Taylor Ave. near Adelaide St. (Unattended) and Adelaide St near Taylor Avenue (attended)

Attended measurements were obtained on 21st July and 10 August. Unattended measurements were obtained for the period 21 to 30 July.

Major sources of noise identified were road traffic and small business noise with plant noise discernible in quiet periods during the day, and at night-time road traffic noise (especially trucks on road bumps), wind in tree noise and plant fixed and mobile sources.

For this location, traffic noise is the major contributor to L_{Aeq} and L_{A90} sound levels. This can be seen by the large difference between the L_{Aeq} and L_{A90} sound levels in the time-history graphs of Appendix B, which is typically 10 to 15 dB. The scatter graphs in Appendix B show a typical value of L_{Aeq} during the day is 53 to 68 dBA. For night-time, the range is 48 to 60 dBA. These ranges are higher and wider than for 4 Melbourne St. These results are higher than in 2015 and may be a result of the higher wind speeds or different traffic noise regime. The L_{A90} results have a slightly smaller range, from 45 to 55 dBA in daytime and 43 to 53 dBA at night-time.

This site is considered to have characteristics relevant to an industrial and traffic interface location, so objective sound levels would be the same as for Melbourne St. These are night-time L_{Aeq} of 45 dBA acceptable and 50 dBA maximum. From these, objective average period night-time L_{A90} sound levels would be 40 dBA acceptable and 45 dBA maximum. PRP7 recommended PSNLs were 43 dBA at night-time as a contribution L_{Aeq} .

Calculated total average L_{Aeq} sound levels were 58 dBA at night-time, 8 dB higher than that of 2015, 3 dB above 2014 and 2 dB below 2013. This is also 3 dB above the long-term 2002 to 2016 average. Average night-time L_{A90} sound levels were 48 dBA compared to the long-term average of 44 dBA, at night-time and 46 dBA in 2015 and 47 dBA in 2013 and 2014.

The variation in average night-time sound levels for L_{Aeq} and L_{A90} of 2 dB from 2013 to 2016 is not considered significant and is likely to relate to variations in traffic flow and wind speeds and directions. Night-time median 10% L_{A90} s of 45 were the same as 2015

and 2013 and 1 dB lower than 2014, indicating that sound levels at the location are able to be as quiet as they have been in the past.

The one-third octave band spectra were shown in Figure 4.15. All spectra were non-tonal and the peak in the 160 Hz band was slightly lower than at Melbourne St. The narrow band spectra are shown in Figures 4.28 to 4.31. The main peak is again at 175-176 Hz but with no 351 Hz on 10 August. The relative peak heights are also lower than measured at Melbourne St at only 10 to 12 dB, possibly reflecting a higher general sound level at this location.

4.3.3 12 Brisbane Street sound levels

Sound levels were measured at 12 Brisbane St with an unattended logger from the 21st July to 5 August, and with attended measurements on the day of 21 July and evening of 10 August. Major sources of noise identified were road traffic on Taylor Avenue, especially trucks bumping over road holes and edges, birds, dogs barking and Cement plant noise as the background. In the evening measurement the noise from the freeway traffic was assessed to be audibly higher in sound level than noise from the cement plant which had a lower frequency sound. $L_{A90.15\text{-min}}$ sound levels were 35 dBA in the daytime and 40 dBA in the evening measurement. The higher evening measurement is from the increased wind speed at the time. Results of the unattended monitoring are shown in Appendix D.

One-third octave band spectra are shown in Figure 4.16. These are reasonably smooth and do not show any significant peaks. Narrow band analyses are shown in Figures 4.32 to 4.35. The main peaks are 176 and 351 Hz on 21 July and 174 Hz on 10 August. Peak heights for these were 10 to 11 dB and indicate low significance of the frequencies as tones.

Review of Appendix D results show there was a variation between L_{Aeq} and L_{A90} sound levels was in the range 3 to 8 dB, much lower than for Taylor Avenue because the traffic noise is further away. No difference has been identified between periods of CM7 or other plant being off or on. The Kiln was not off during the monitoring period at this location.

As in the past, the influence from wind speed and direction remains significant and lower wind speeds generally provide lower sound levels. The wind direction was predominantly westerly for the period of the monitoring giving $L_{A90.15\text{-min}}$ around 45 dBA, but periods of north-westerly winds gave slightly lower sound $L_{A90.15\text{-min}}$ levels by 3 to 5 dB, while periods of south to south-easterly winds on 2 to 3 August gave higher sound levels of 48 to 52 dBA.

Background graphs show period average L_{Aeq} sound levels are lower than the 4 Melbourne St location for most periods but not all, as would be expected from its further distance from Taylor Avenue, but period L_{A90} sound levels are very similar or lower;

The scatter graph ranges are similar at 10 dB for both parameters for all periods. Both parameters show a slightly higher sound level with southerly winds and lower level with northerly winds and increased levels with higher wind speeds.

Average L_{Aeq} sound levels for the full period were 53, 49 and 48 dBA for daytime, evening and night-time respectively. These are the same (or within 1 dB) for evening and night-time as in 2015 and 2014 and 2013. Average L_{A90} sound levels were 47, 44 and 44 dBA for daytime, evening and night-time respectively, and were again within 1dB of 2014 and 2015 and 2 dB of 2011 and 2012. These results indicate no significant change of long-term sound level over the past 5 years.

The receiver location is considered to be a Residential noise amenity area in the INP and would have L_{Aeq} noise objectives of 40 dBA acceptable and 45 dBA maximum at night-time. Periods of low ambient sound levels without discernible traffic noise were measured to be 40 dBA in the evening measurement period.

The recommended PSNLs for this receiver are contribution sound levels of 51, 45 and 40 dBA for daytime, evening and night-time respectively.

4.3.4 Northern boundary fence

This location does not have any residential receivers but is used to assess boundary sound level variations and as the baseline for assessing industrial interface locations. Sound levels at this location have a narrower range and are more constant level compared to other locations, because it is more distant from road traffic, and there is often less than 3 dB difference between L_{Aeq} and L_{A90} sound levels. However the location is also affected by noise from road traffic on Taylor Avenue. Taylor Avenue trucks were noted to be higher in sound level than in-plant trucks.

Measurements of unattended sound levels occurred during the period 21 July to 24 July before meter memory failure. Attended sound levels were 52 to 53 dBA $L_{Aeq,15-min}$ and 49 to 50 $L_{A90,15-min}$ during daytime.

One-third octave band spectra are shown in Figure 4.17 The L_{Aeq} and L_{A90} values are closer together than at other sites and there is a slight peak at 160 Hz seen at some other locations. Narrow band spectra are shown in Figures 4.36 to 4.39. The peak at 176 Hz is evident and has a relative peak height of 10 dB.

Results of the long-term unattended monitoring are given in Appendix C. The graphs of sound levels for the first period show diurnal variation in sound levels on some days and hardly any variation on other days, as has been observed in previous measurements. As in past years they show only 2 to 5 dB difference between the period $L_{Aeq,15-min}$ and $L_{A90,15-min}$ sound levels. Periods of high wind speeds caused sound levels to be 10 dB or more higher than low wind speeds (45 compared to 55 to 57 dBA L_{A90}).

Period sound levels for L_{Aeq} are lower than those at 72 Taylor Ave by 5 to 10 dB while L_{A90} are the same as those for 72 Taylor Avenue for most periods monitored.

Average sound levels for each of the three parameters are graphed in Figure 4.8 and 4.9 and shown in Tables 4.2 and 4.2A. Additional results for April and May are included in the figures and tables. Night-time L_{Aeq} averages are 3 dB of results since 2012 and 1 dB above the long-term average. For average L_{A90} values, the July 2016 results were 49 dBA for all three periods which is 1 dB above those of the long term average and within 3 dB of results for the periods with plant operating since 2010. No significant changes have

occurred in sound levels at this boundary location, indicating no significant changes in source sound levels.

If the location was required to have PSNLs assigned, based on PRP-7 measurements, they would be period L_{Aeq} values of 52, 50 and 48 dBA for day, evening and night-time respectively. In comparison, the average total measured L_{Aeq} results for 2016 were 53, 52 and 52 dBA for the same respective periods – these are within 1 dB of the recommended PSNL value for day but 2 to 4 dB above that for evening and night.

4.4 Store Yard Close location

Sound levels were measured at the Store Yard Close location between 21 July and 10 August. Results of the attended monitoring are given in Table 4.3 and Appendix E. This location is proposed for regular monitoring to demonstrate sound levels from the plant are not increasing and remain below an agreed recommended long-term average sound level of $L_{A90,period}$ of 56 dBA for day, evening and night. The location has been selected because it is closer to the plant and therefore receives a higher sound level than the Northern Boundary location, and is further from Taylor Avenue and so receives less influence from Taylor Avenue road traffic noise. The location is much closer to internal truck traffic which is why the $L_{A90,period}$ has been recommended for use and not $L_{Aeq,period}$.

Attended sound levels in Table 4.3 were 61 dBA and 58 $L_{Aeq,15-min}$ and 52 and 53 dBA $L_{A90,period}$.

One-third octave band spectra are shown in Figure 4.18. These are relatively smooth and show no tonal aspects. The narrow-band spectra are shown in Figures 4.40 to 4.43. Peaks in the spectra are at 176 Hz (assumed from the stack) and 404 Hz for which the source is not known.

The results in Appendix E show that during the day the $L_{Aeq,15-min}$ and $L_{A90,15-min}$ are within 5 to 6 dB of each other and at night approach to within 1 to 2 dB of each other – this is because internal truck traffic reduces during night-time, as it does on external roads. Most of the time the $L_{A90,15-min}$ are within the range 50 to 55 dBA and higher periods within that range are associated with higher wind speeds. For the period with mainly north-westerly winds on 1 to 2 August the $L_{A90,15-min}$ were 48 to 50 dBA. When the winds were southerly to south-easterly from 2 to 5 August, the $L_{A90,15-min}$ were higher at 55 to 58 dBA. With CM7 off and lower wind speeds but still south-easterly the $L_{A90,15-min}$ sound levels were averaging approximately 50 dBA. When the Kiln was also off with CM7 off and low wind speeds on 8 and 9 August, the $L_{A90,15-min}$ sound levels were 46 to 48 dBA. When CM7 was on they rose to 53 to 55 dBA.

The Period graphs show $L_{Aeq,15-min}$ sound levels are lower than at 72 Taylor Avenue in most periods while the $L_{A90,15-min}$ sound levels were similar in daytime but higher in other periods.

The scatter graphs show the range of $L_{A90,15-min}$ results are mostly in the range 47 to 57 dBA and $L_{Aeq,15-min}$ are 48 to 63 dBA. There is a slight increase in both parameters with wind speed and the south to south-easterly quadrant has higher sound levels than westerly winds, depending on speed.

Long-term average values in Table 4.2 are the same as the previous two occasions for daytime L_{Aeq} but lower for evening and night. For $L_{A90,15-min}$ they are 1 to 3 dB lower than the previous measurements.

The recommended objectives proposed for this location has been long-term average $L_{A90,period}$ 56 dBA over a measurement period of 7 days. If a single 15-minute period is measured, then the objective limit is raised to 59 dBA to allow for individual differences, with no influence from passing vehicles within that period. In the three weeks of measurements in this report period, one 15-minute period had a 60 dBA $L_{A90,15-min}$ value and this may well have included a truck passing as it had an $L_{Aeq,15-min}$ for the same period of 68 dBA, 4 to 5 dBA above adjacent periods. Therefore it is considered that the measurements at this location meet the recommended objectives.

4.5 Lake Breed monitoring location

This location was added to provide ambient sound levels for future comparison should the proposed Hume Coal railway extension be built. Results are given in Table 4.3 and Appendix F. Attended sound levels were affected by high wind speeds on the 10 August and unable to be done on 21 July. Low-wind period sound levels were 54 dBA. The Cement plant was the main source but traffic on Moss Vale Road was also audible.

Unattended monitoring occurred from 21 to 24 July when the instrument battery failed. $L_{Aeq,15-min}$ and $L_{A90,15-min}$ sound levels were mostly within 1 dB of each other except for periods of high winds where the difference was 5 dB. This narrow difference is expected for continuous source sound levels as occurs at the Cement plant. No objective is required for this location and the results are only for commencing a baseline.

4.6 Store-Yard Close $L_{A01.1-minute}$ values

The PRP-11 study included criteria for assessment of sleep disturbance. The basic approach of the EPA for sleep disturbance is a criterion value at night-time of:

$L_{A01.1-minute} - L_{A90,15-minutes}$ not greater than 15 dB.

Through the PRP-11 study the $L_{A01.1-minute}$ was set at 60 dBA for the Northern Boundary location. On this occasion the instrument which measured $L_{A01.1-min}$ was at the Store Yard Close location. Higher values could be expected for this location as it is within 10m of passing trucks and closer to the plant noise sources.

Figure 4.44 shows the values for $L_{A01.1-minute}$, $L_{A90,15-minutes}$, and the calculated $L_{A01.1-minute} - L_{A90,15-minutes}$. These values are also graphed in Figures 4.45 and 4.46 separately. The results show that there are a significant number of periods where the $L_{A01.1-minute}$ and $L_{A01.1-minute} - L_{A90,15-minutes}$ objectives are exceeded.

Figures 4.47 and 4.48 show an analysis comparing $L_{A01.15-minute}$ values at the Store Yard Close location and Northern Boundary location. There is not a consistent difference and wind speed has a significant effect – probably from wither wind on the microphone or wind-in-vegetation noise.

Therefore it is proposed to repeat the $L_{A01.1-minute}$ monitoring at the Northern Boundary for comparison with the objectives.

Figure 4.24: TAS612 4 Melb. St 21/7/2016 11:48 725m to stack

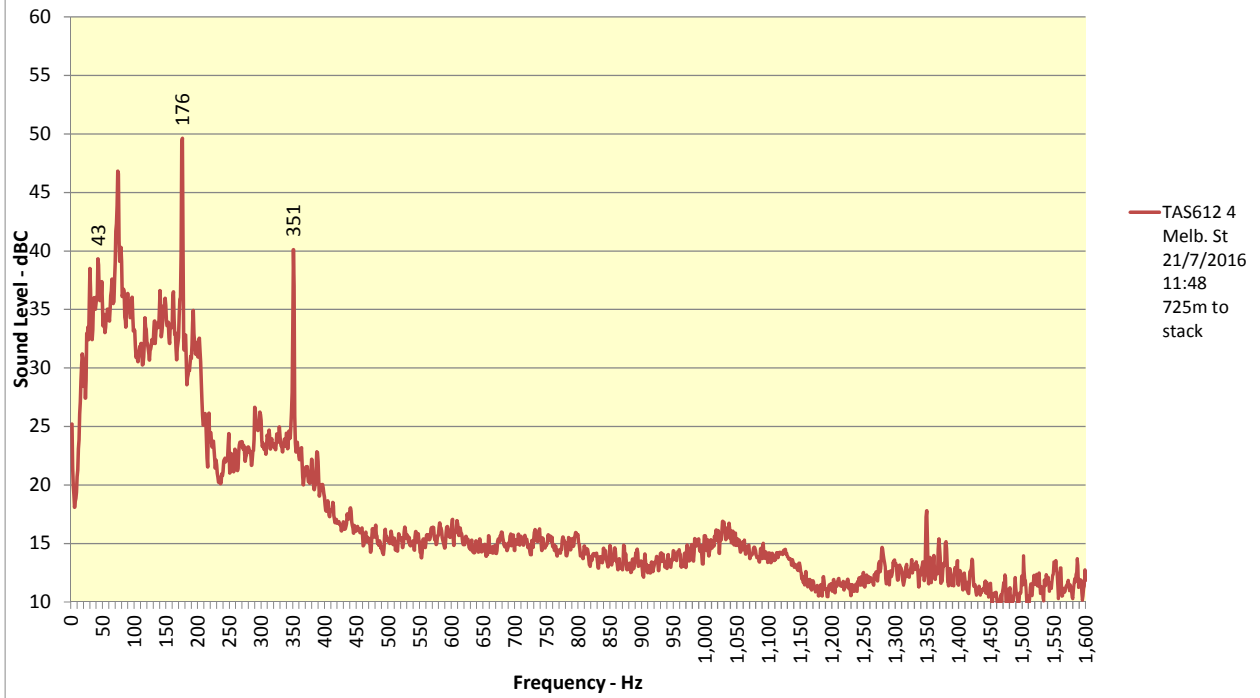


Figure 4.25: TAS612 4 Melb. St 21/7/2016 11:48 A-weighted 725m to stack

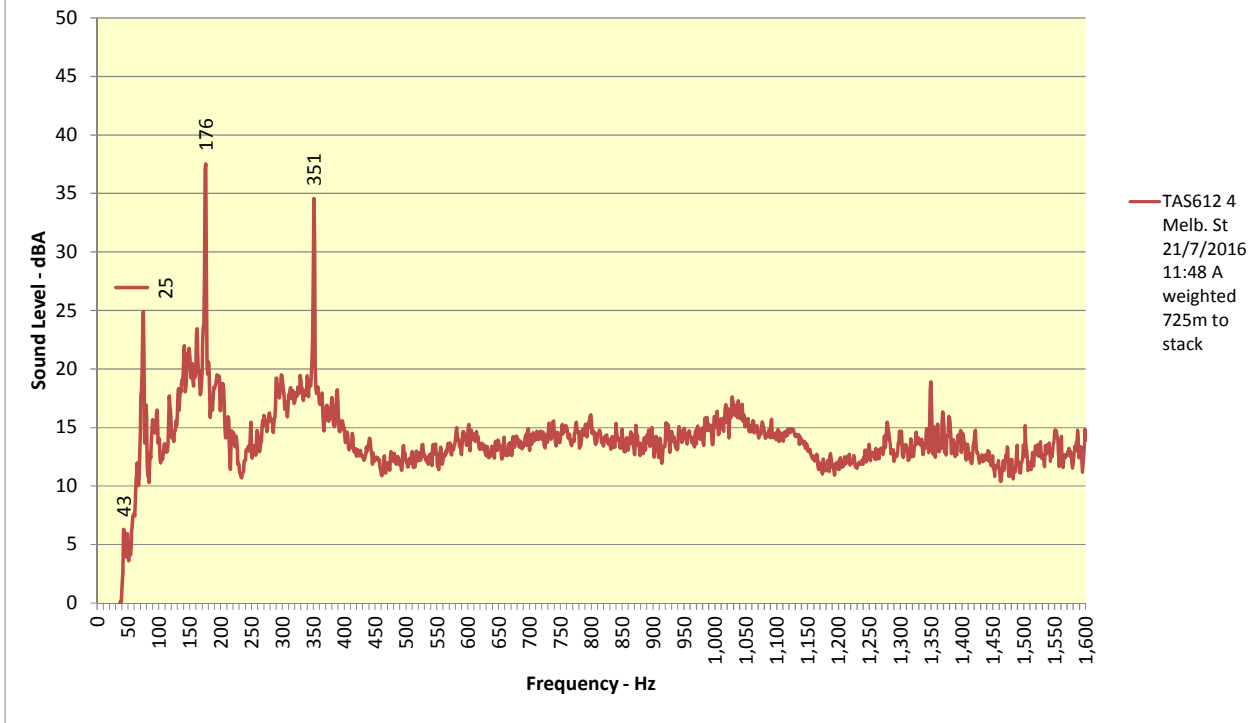


Figure 4.26: TAS 623 4 Melb St 10/8/16 19:08

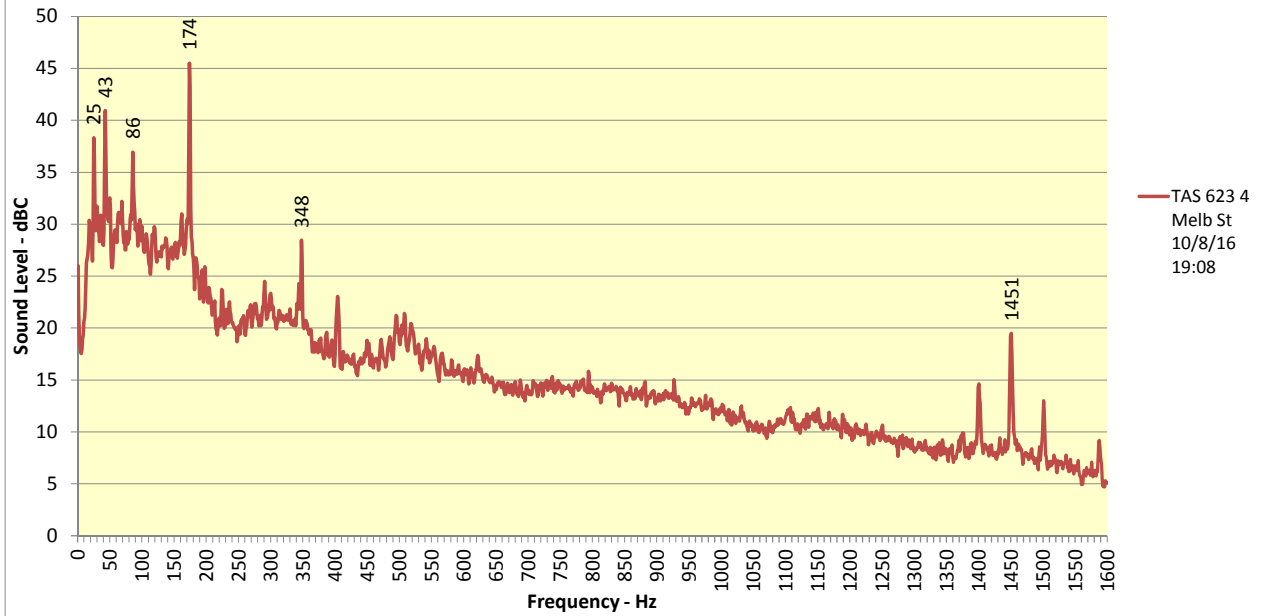


Figure 4.27: TAS 623 4 Melb St 10/8/16 19:08 A-weighted

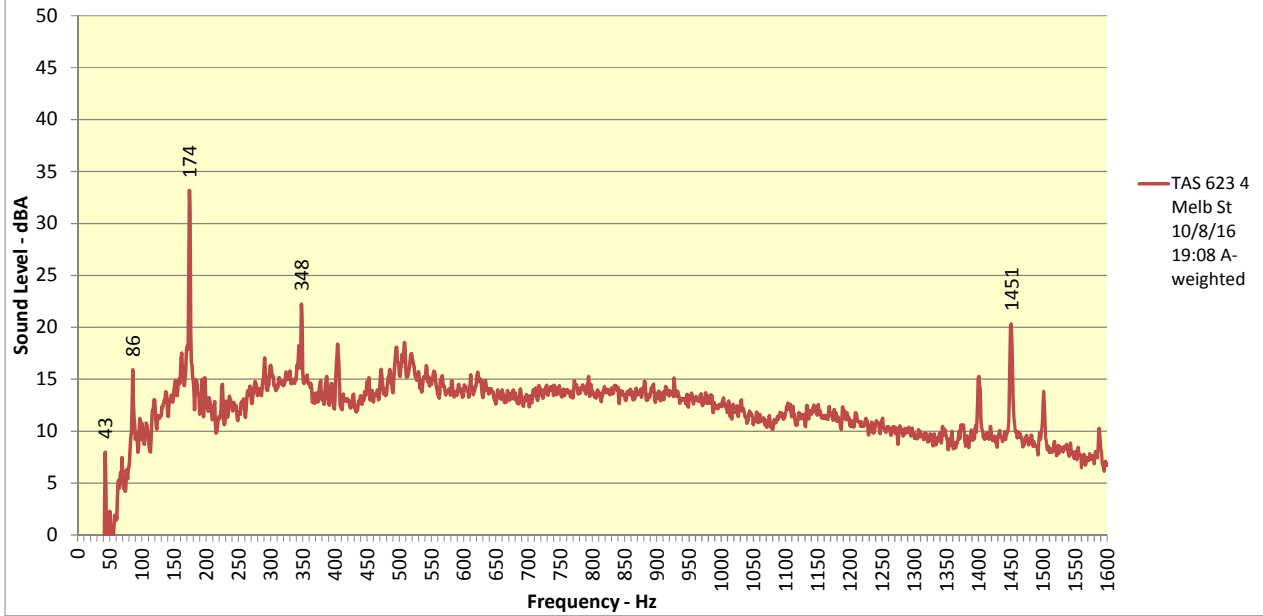


Figure 4.28: TAS 614 Adelaide St Near Taylor Ave 21/7/16 12:45

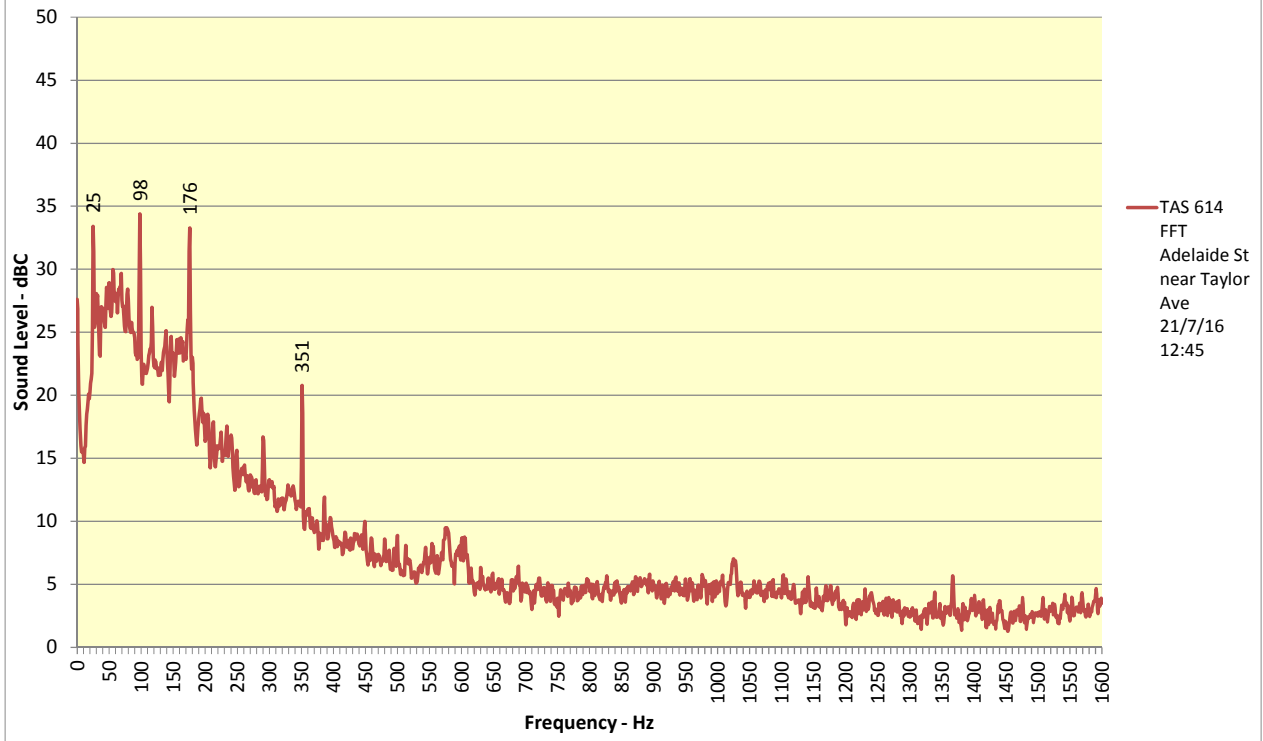


Figure 4.29: TAS 614 Adelaide St near Taylor Ave 21/7/16 12:05 A-weighted

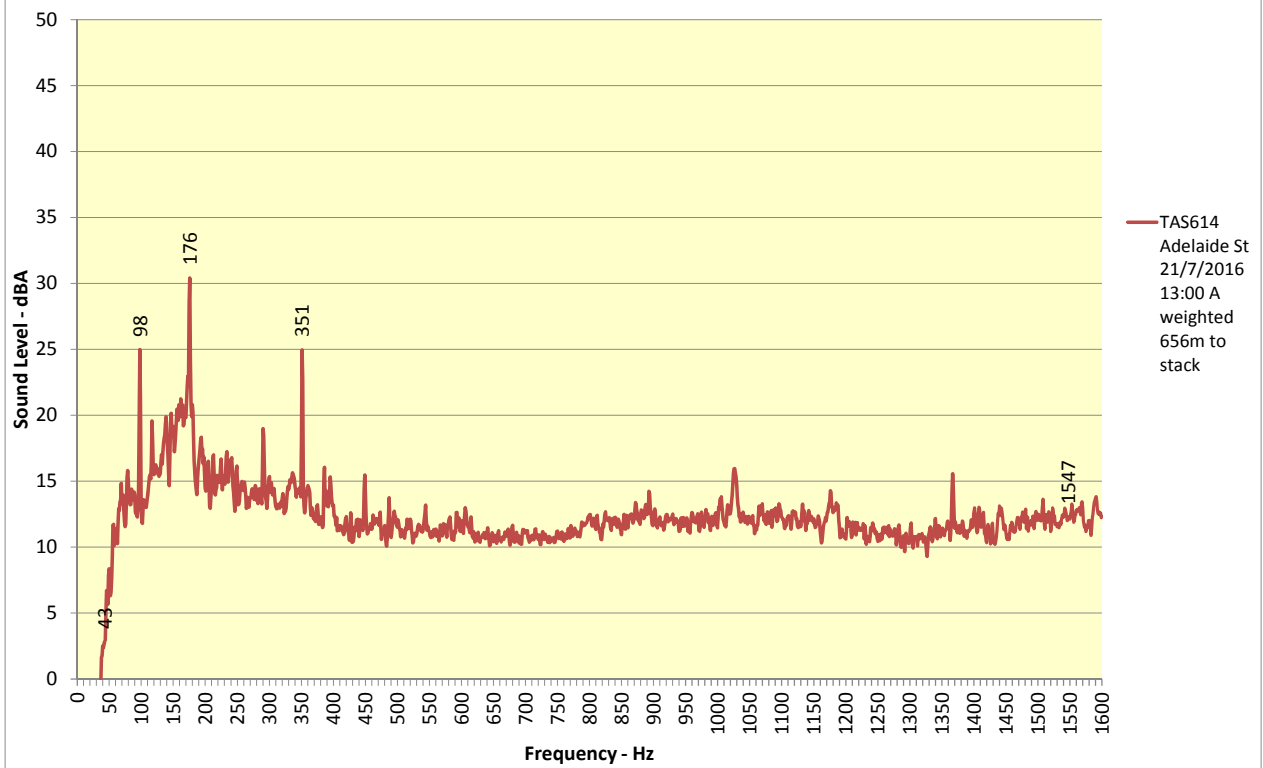


Figure 4.30: TAS 625FFT Adelaide St near Taylor Ave 10/8/16 19:08

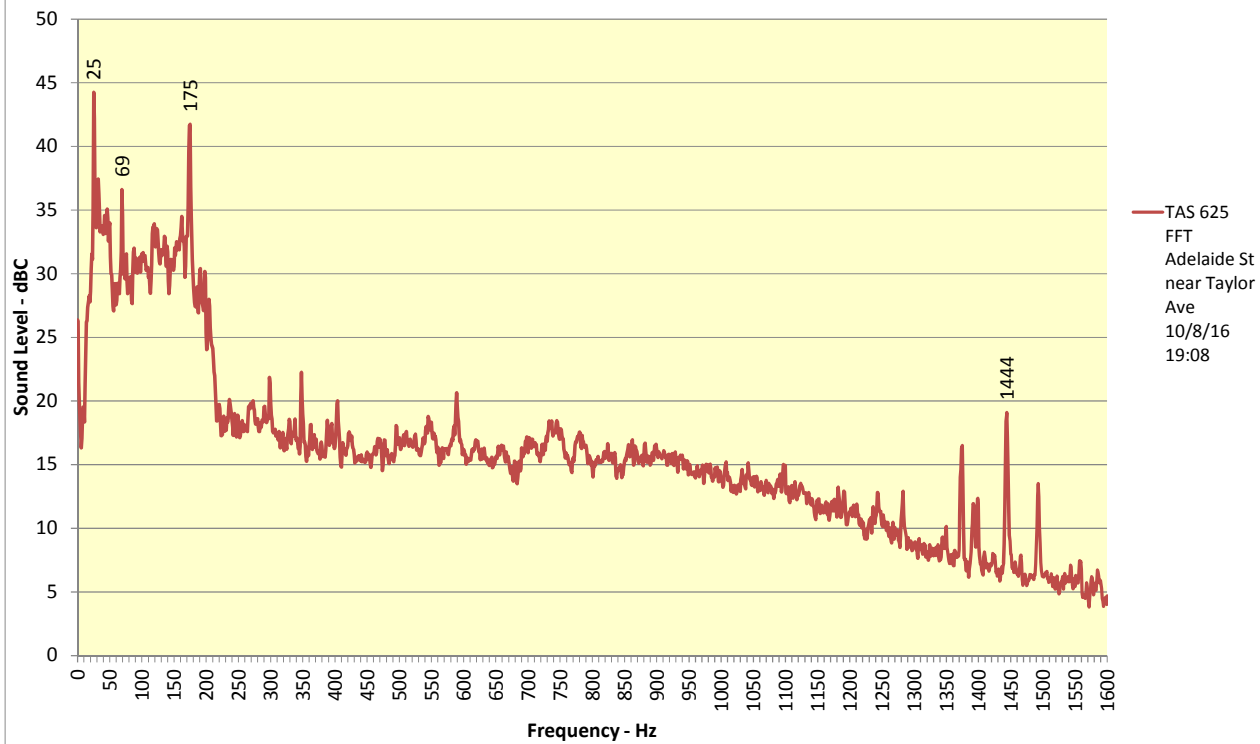


Figure 4.31: TAS 625FFT Adelaide St near Taylor Ave 10/8/16 19:08 A-weighted

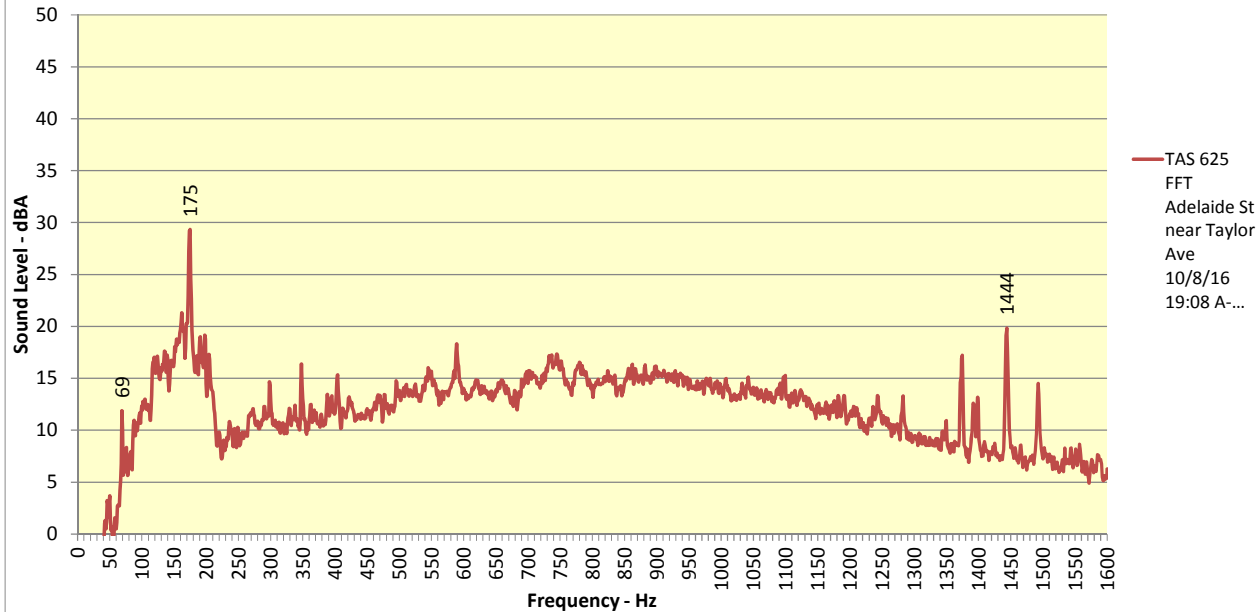


Figure 4.32: TAS 613 12 Brisb St 21/7/16 12:05

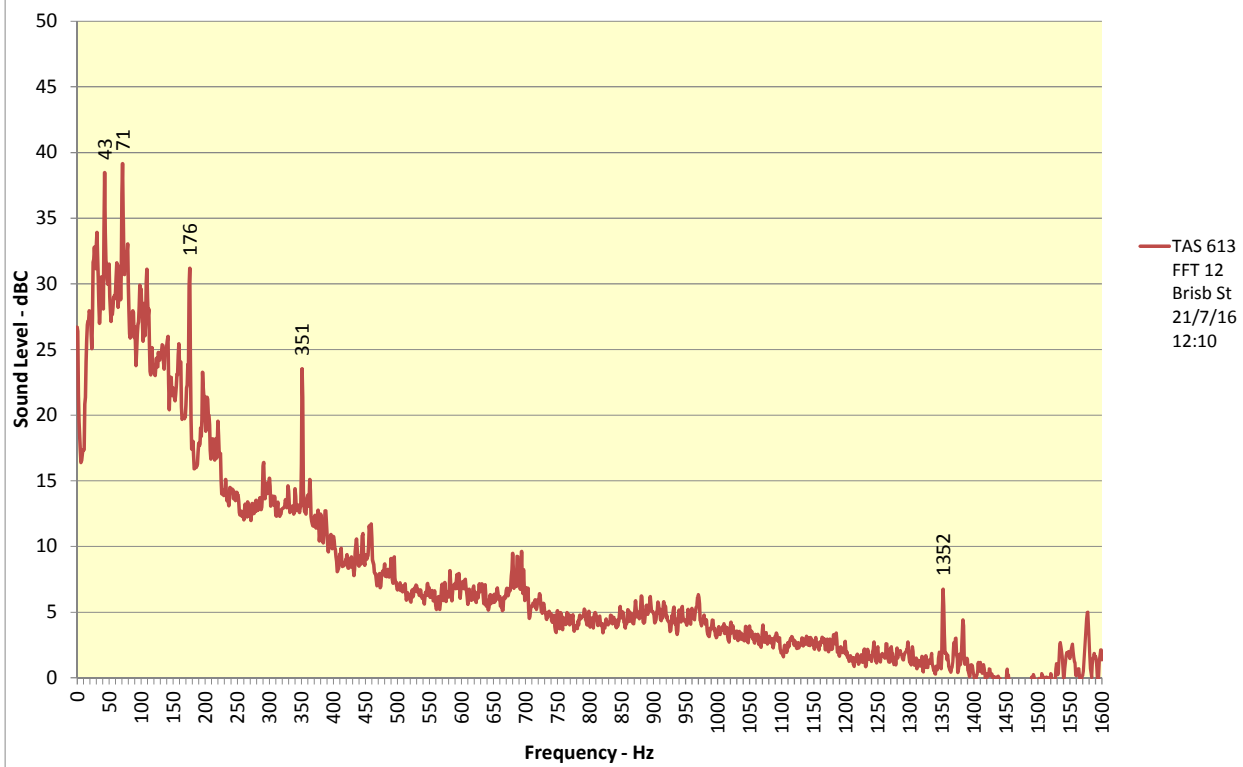


Figure 4.33: TAS 613 12 Brisb St 21/7/16 12:05 A-weighted

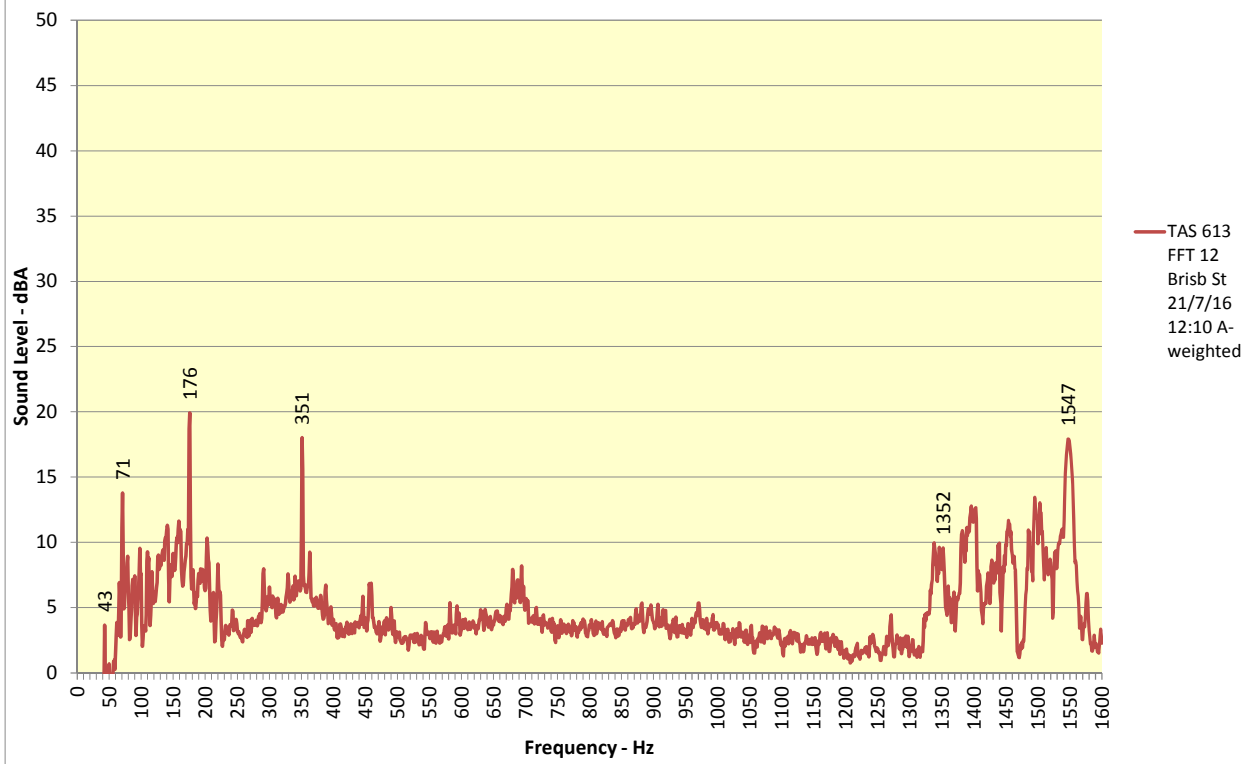


Figure 4.34: TAS 624 12 Brisb St 10/8/16 18:55

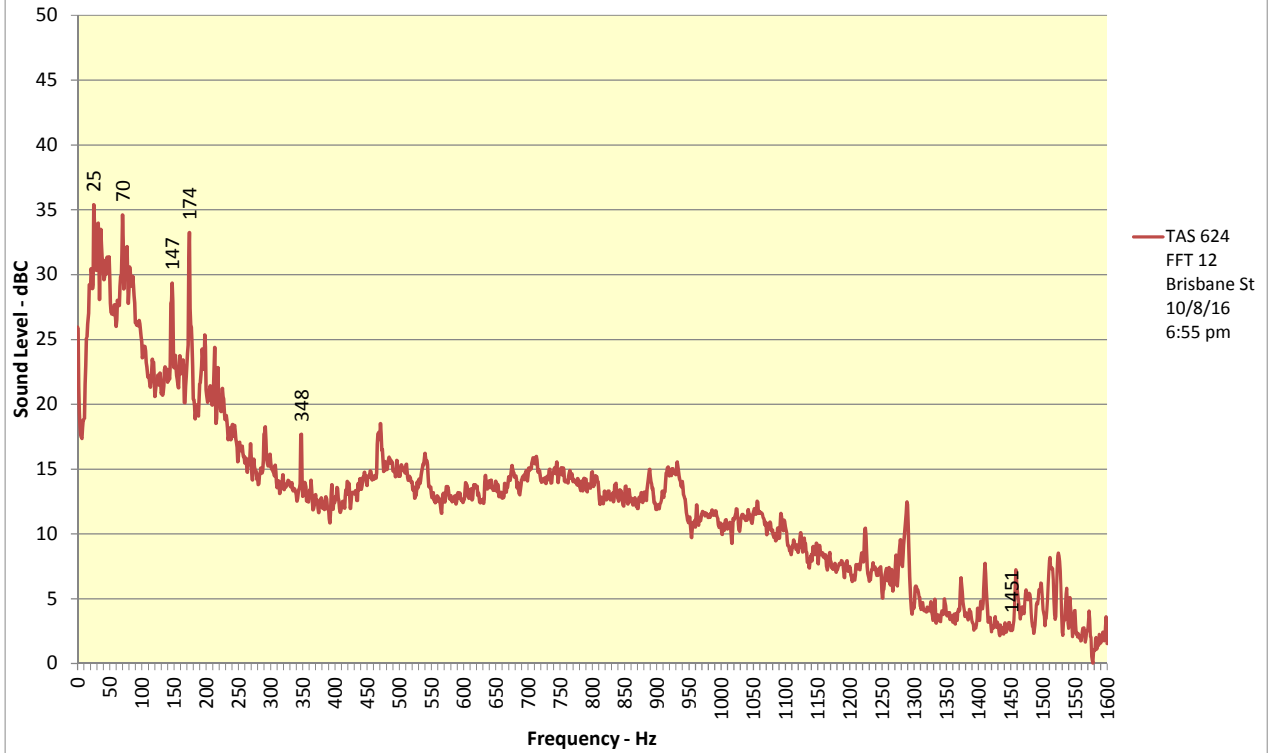


Figure 4.35: TAS 624 12 Brisb St 10/8/16 18:55 A-weighted

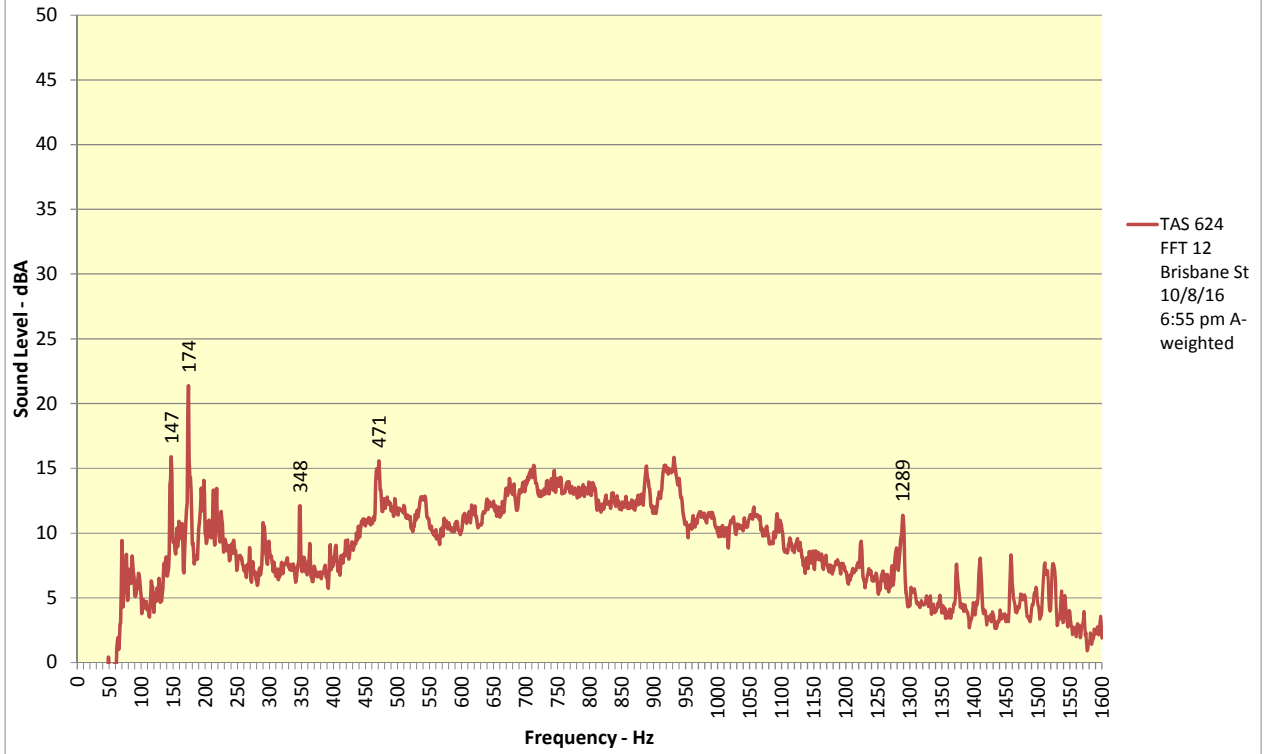


Figure 4.36: TAS 610 FFT Northern Boundary 21/7/2016 10:55 560m to stack

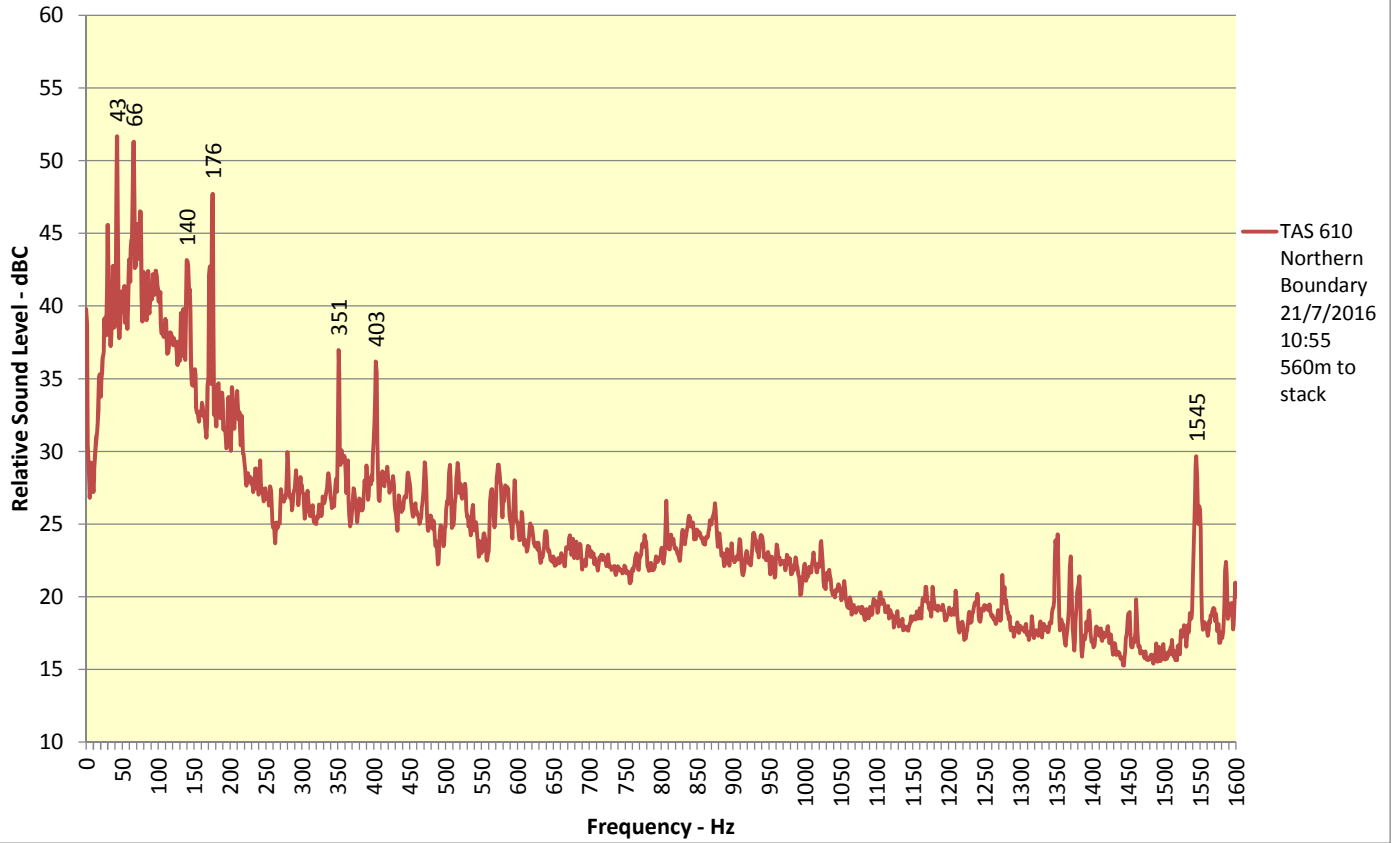


Figure 4.37: TAS 610 FFT Northern Boundary 21/7/16 10:55 A-weighted

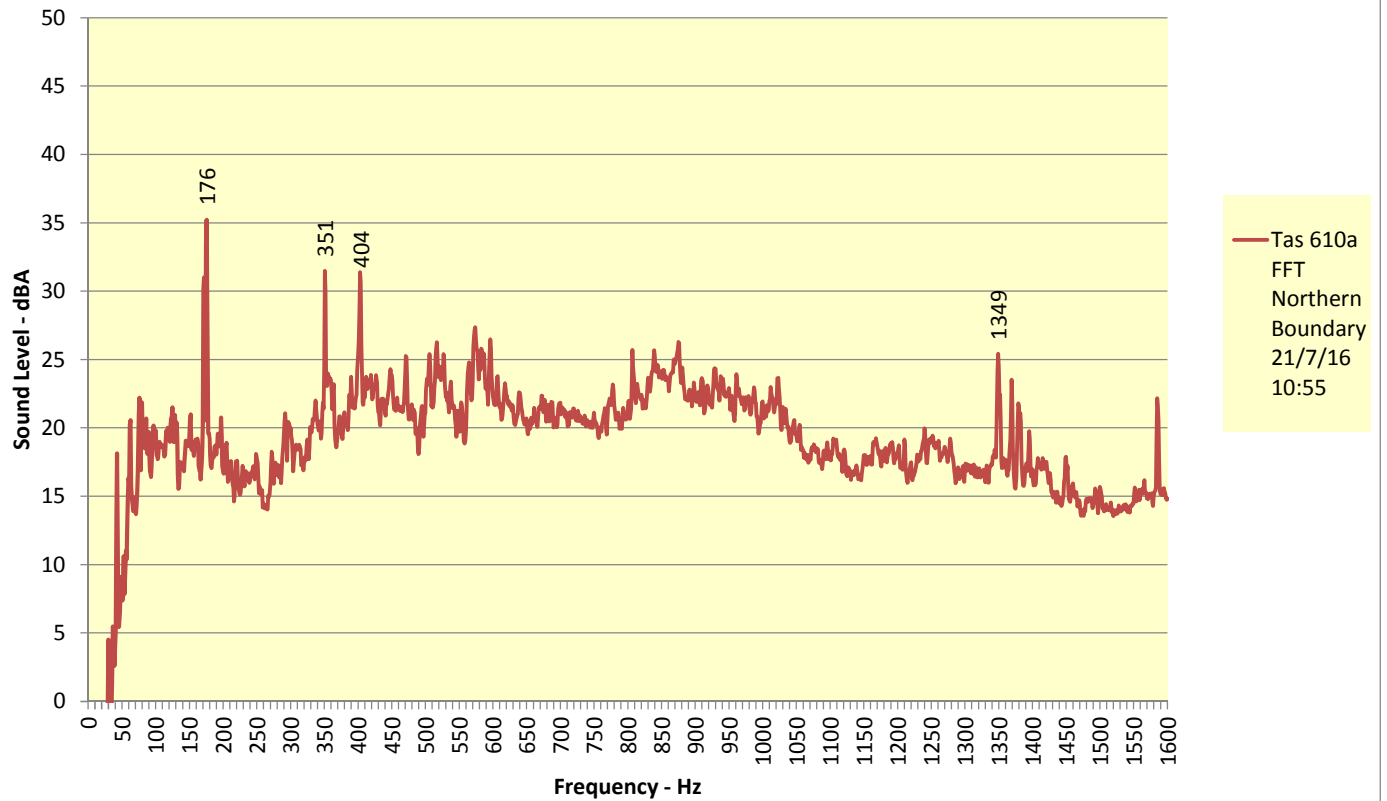


Figure 4.38: TAS 621 FFT Northern Boundary 10/8/16 10:10

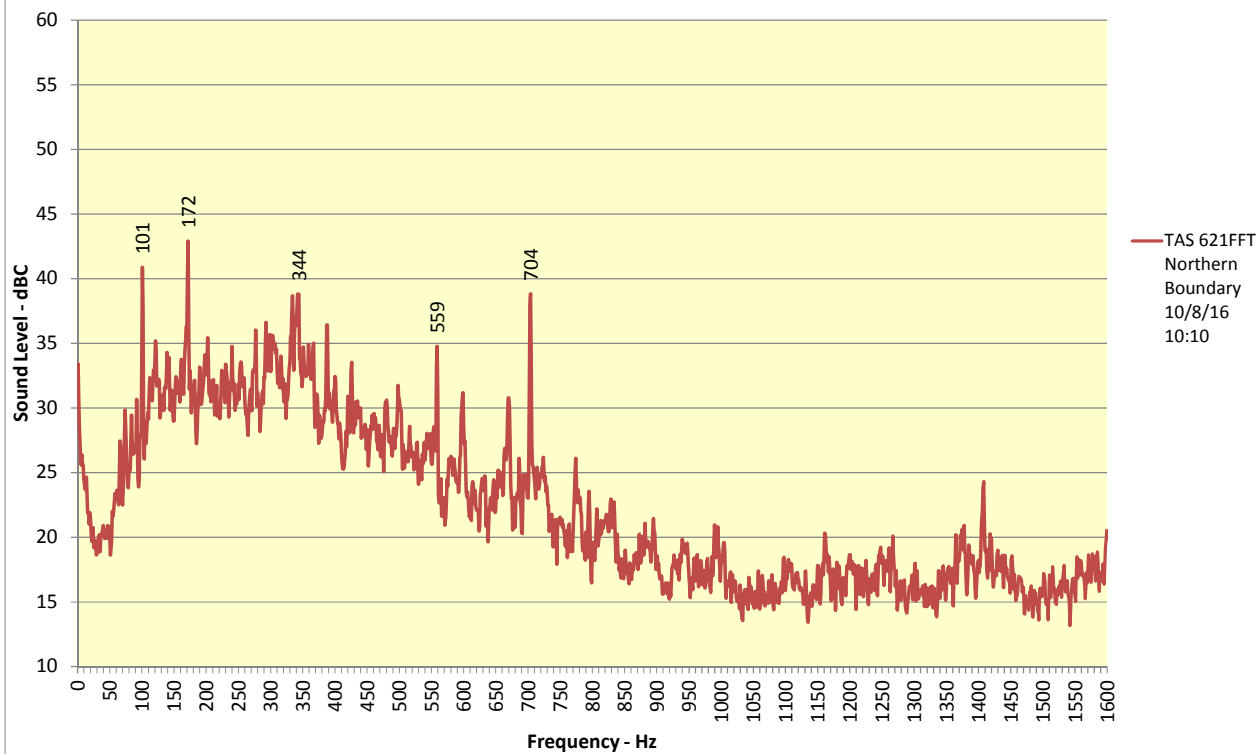


Figure 4.39: TAS 621 FFT Northern Boundary 10/8/16 10:10 A-weighted

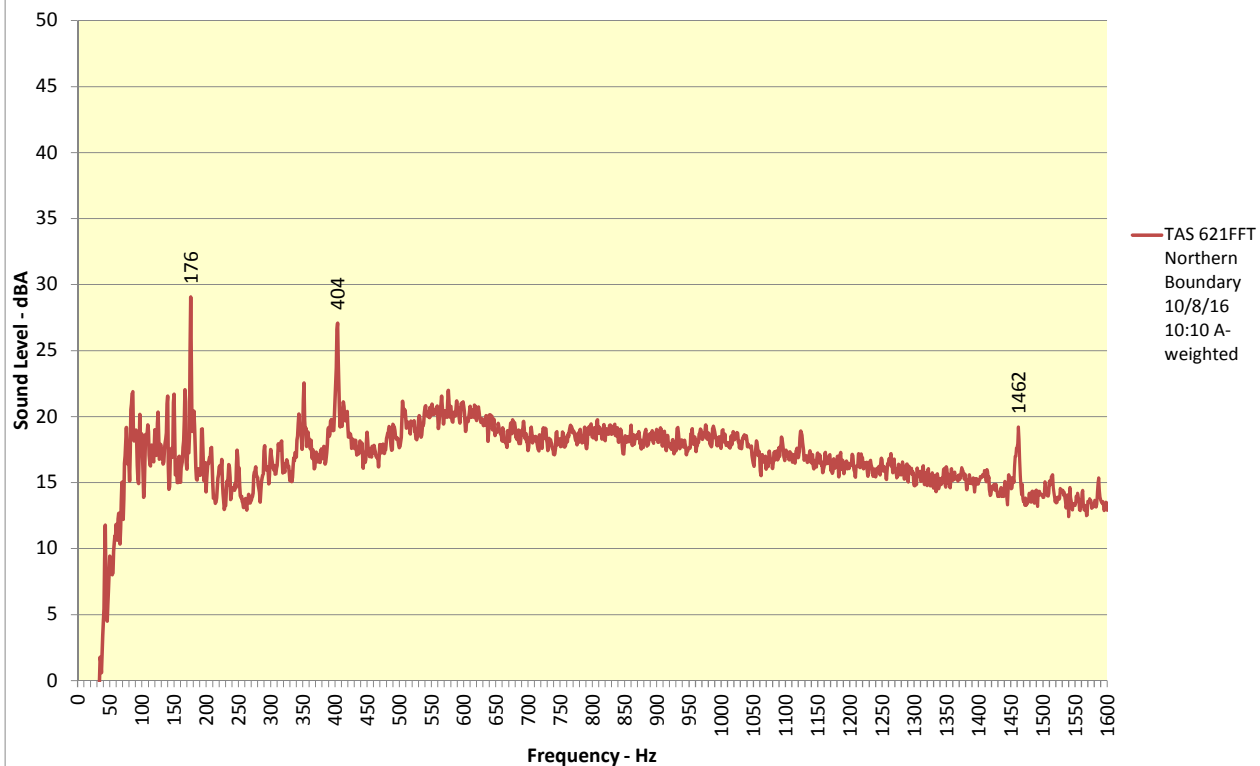


Figure 4.40: TAS FFT611 Stores Yard Close 21/7/2016 11:07 425m to stack

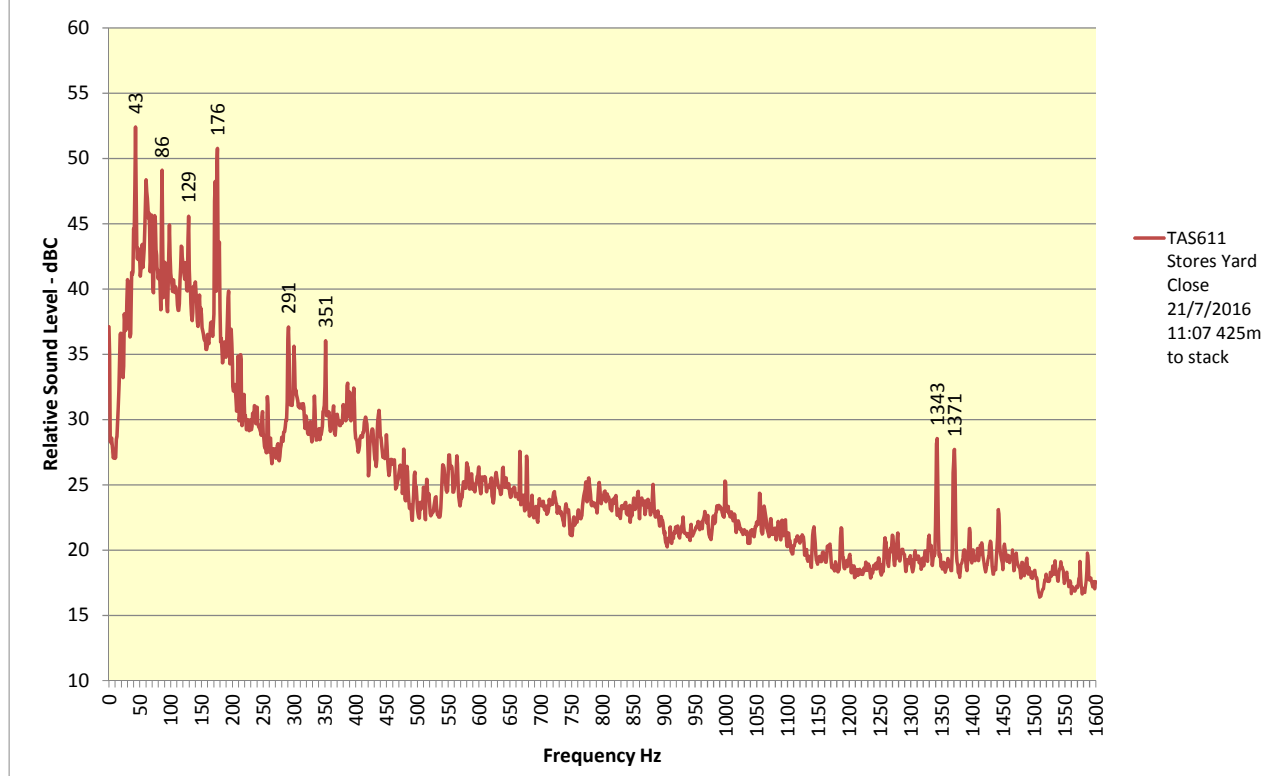


Figure 4.41: TAS611 Stores Yard Close 21/7/2016 11:07 425m to stack A-weighted

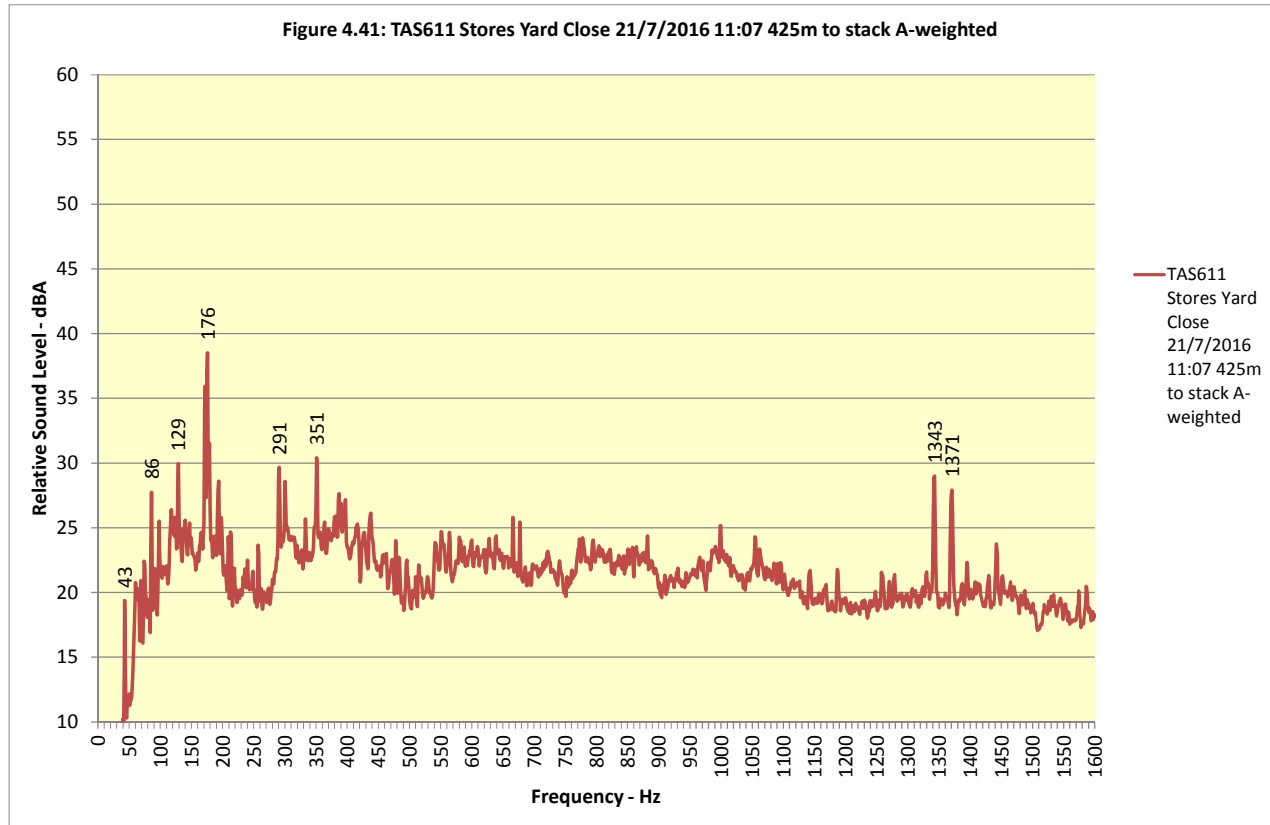


Figure 4.42: TAS 620 FFT Store Yard Close 10/8/16 9:17

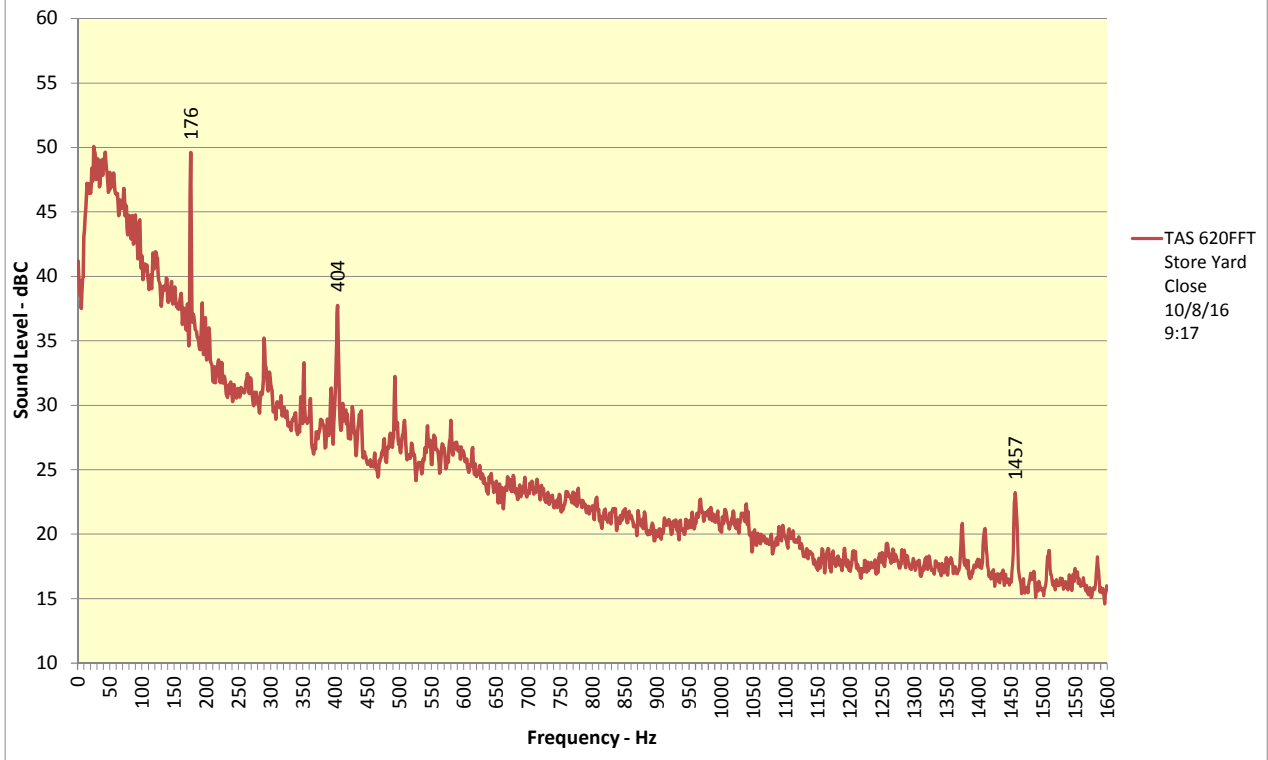


Figure 4.43: TAS 620 FFT Store Yard Close 10/8/16 9:17 A-weighted

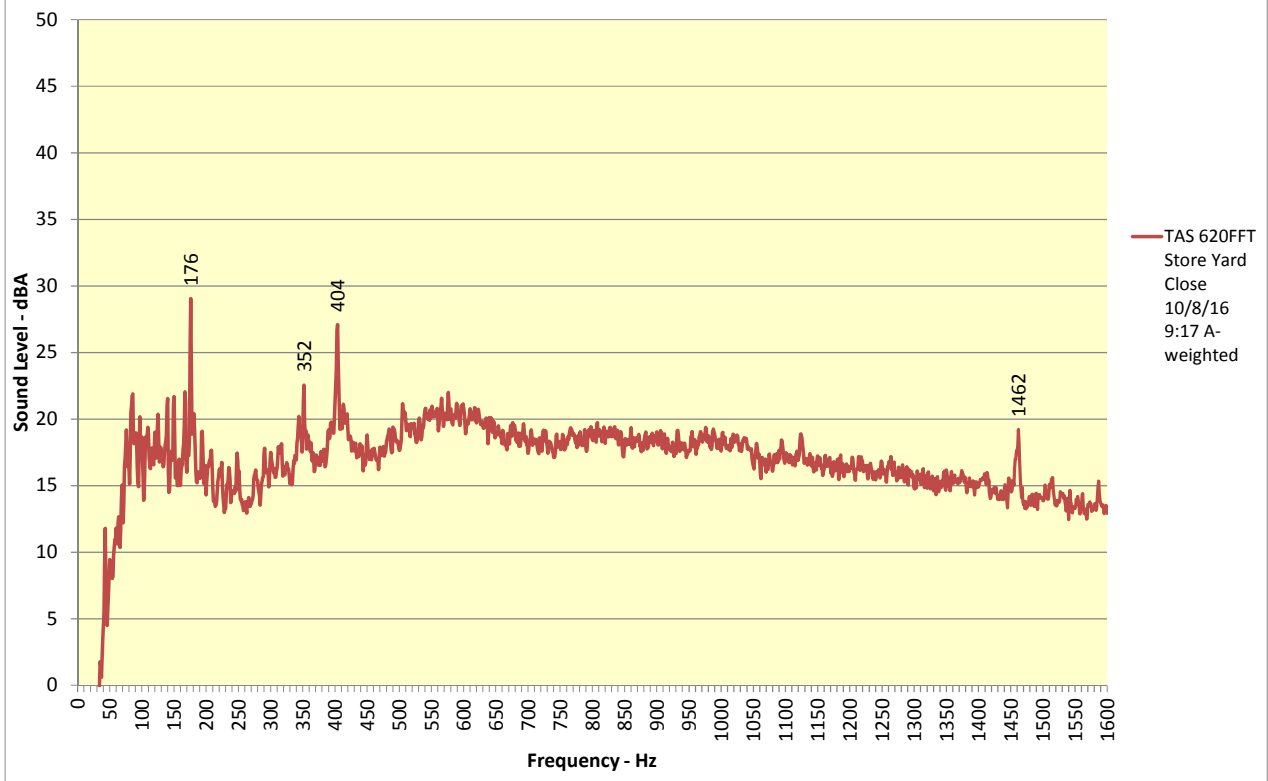


Figure 4.44: Boral Cement Berrima annual Environmental Noise Review 2016 - $L_{A01.1-min}$, $L_{A90.15-min}$ and difference values at Store Yard Close location for Night-times 21 July to 10 August 2016

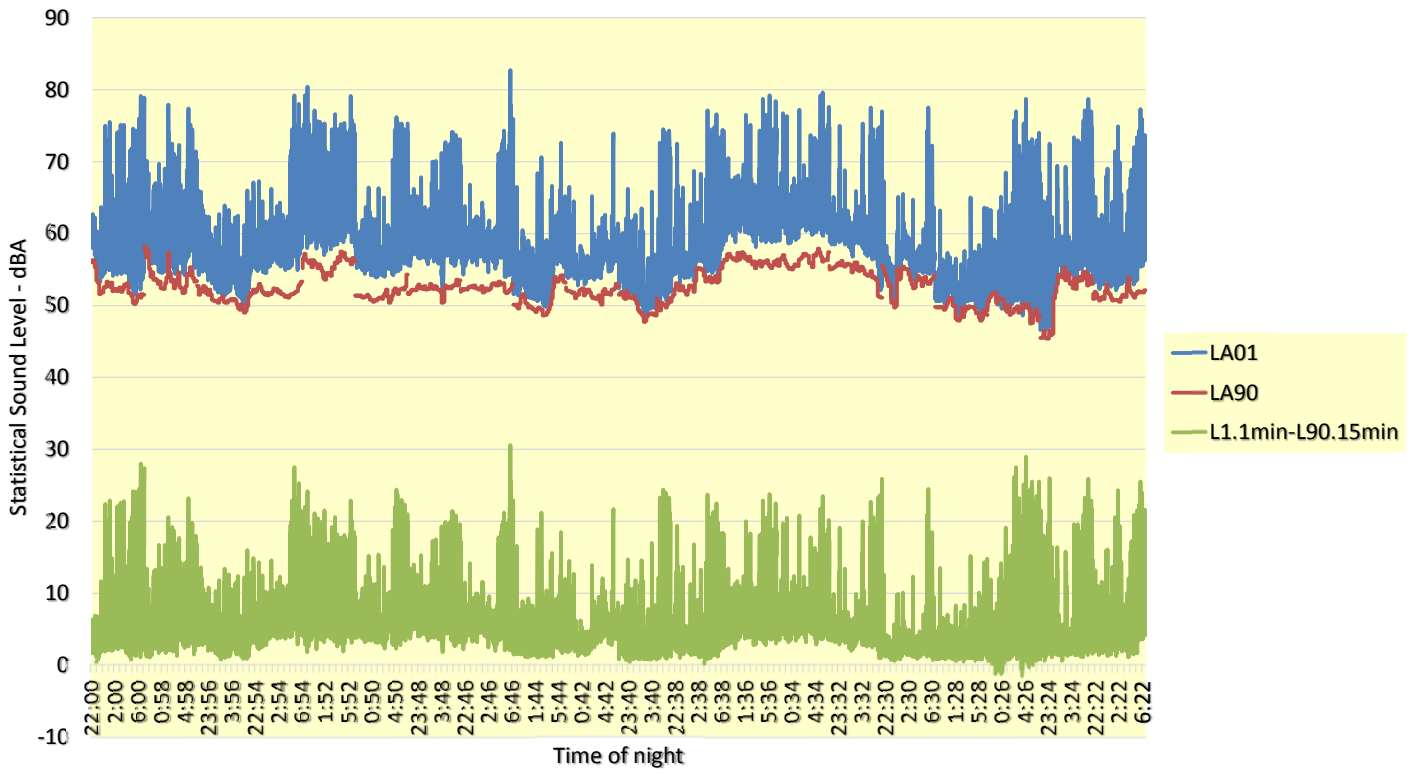


Figure 4.45: Boral Cement Berrima annual Environmental Noise Review 2016 - $L_{A01.1-min}$ and $L_{A90.15-min}$ values at Store Yard Close location for Night-times 21 July to 10 August 2016

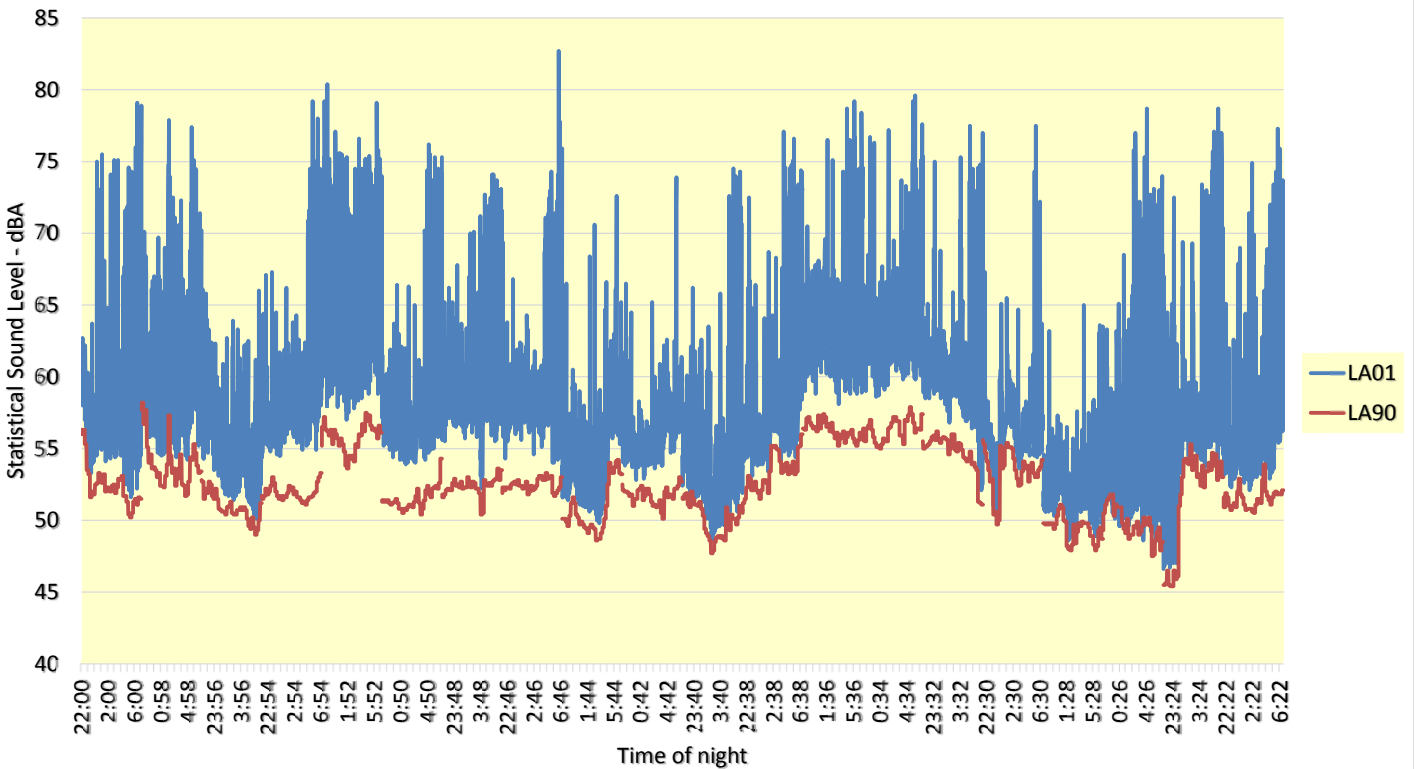


Figure 4.46: Boral Cement Berrima annual Environmental Noise Review 2016 - $L_{A01.1\text{-min}}$ - $L_{A90.15\text{-min}}$ values at Store Yard Close location for Night-times 21 July to 10 August 2016

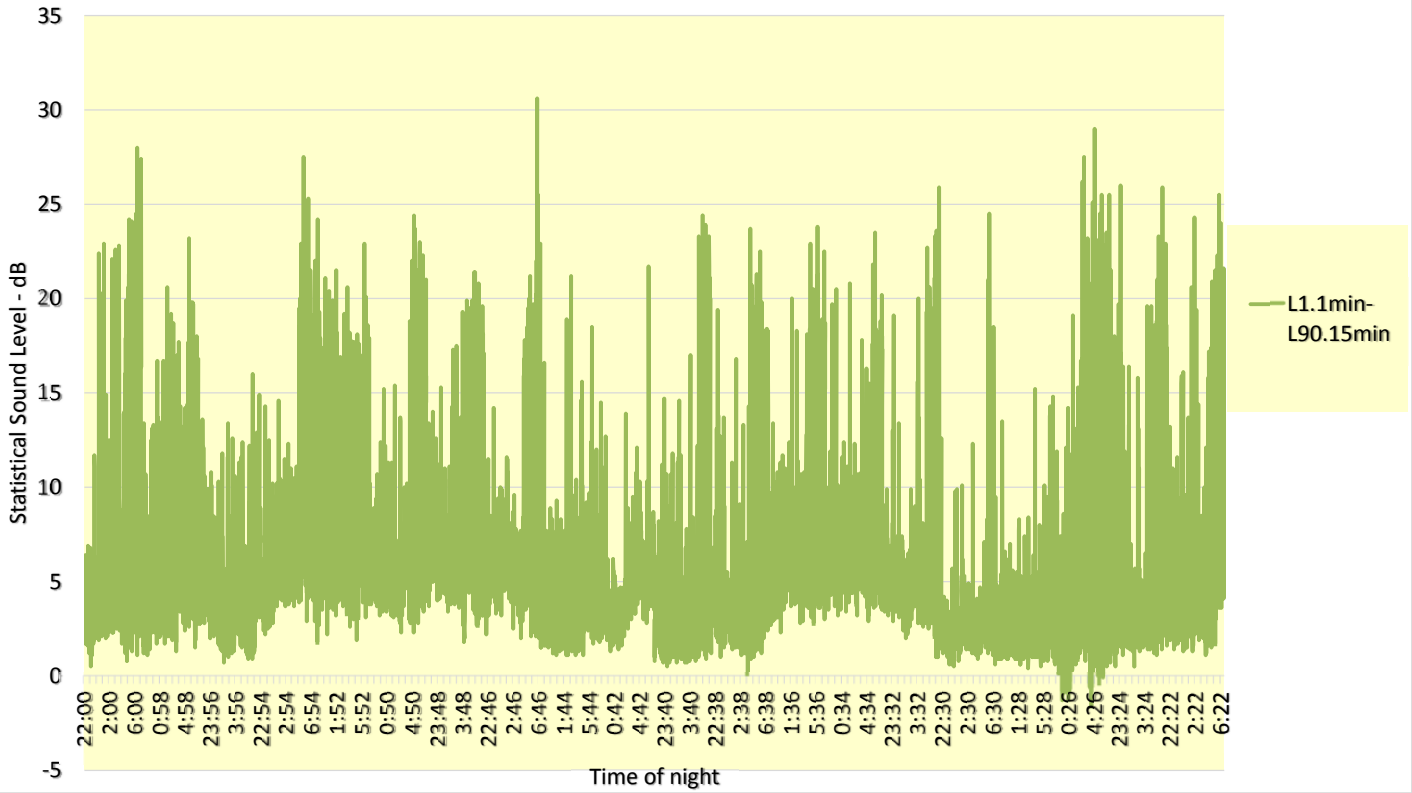


Figure 4.47: Boral Cement Berrima Annual Environmental Noise Assessment 2016 - Comparison of $L_{A01.15-min}$ at Store Yard Close and Northern Boundary Locations

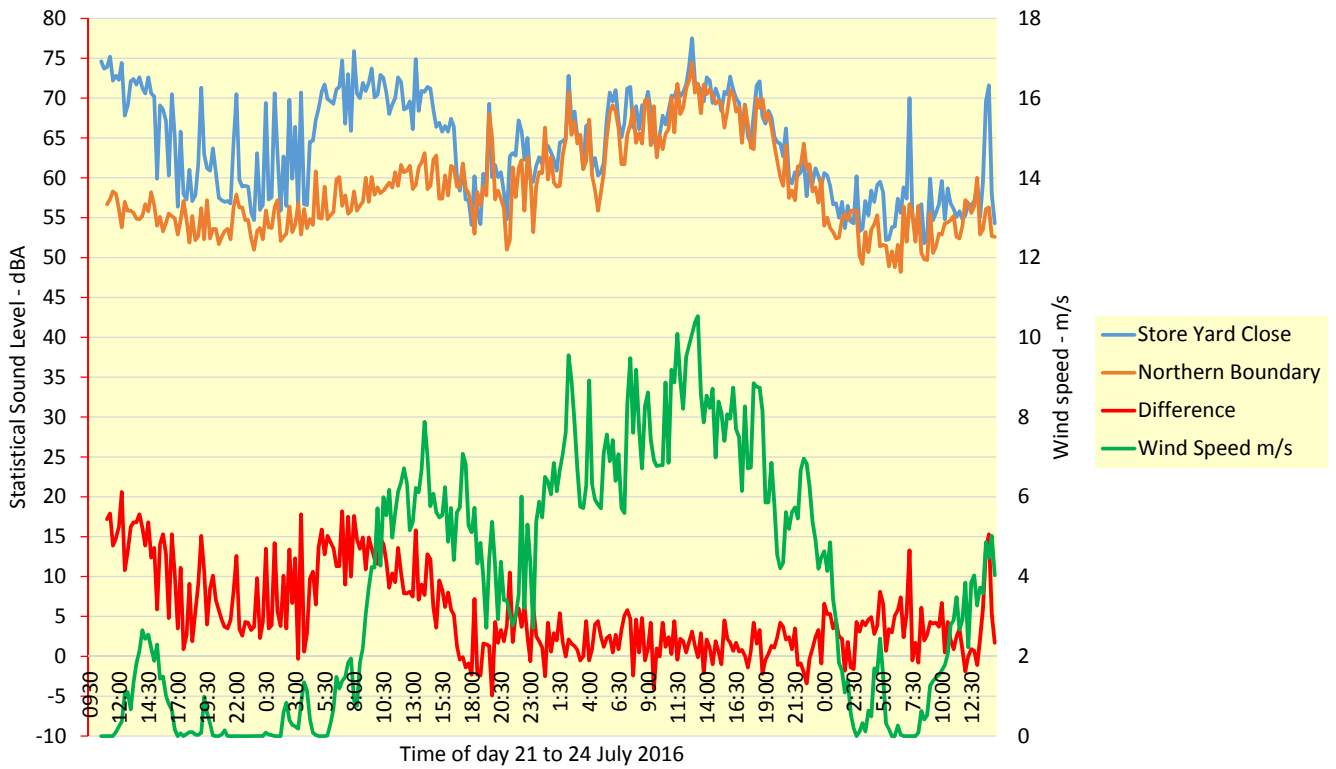
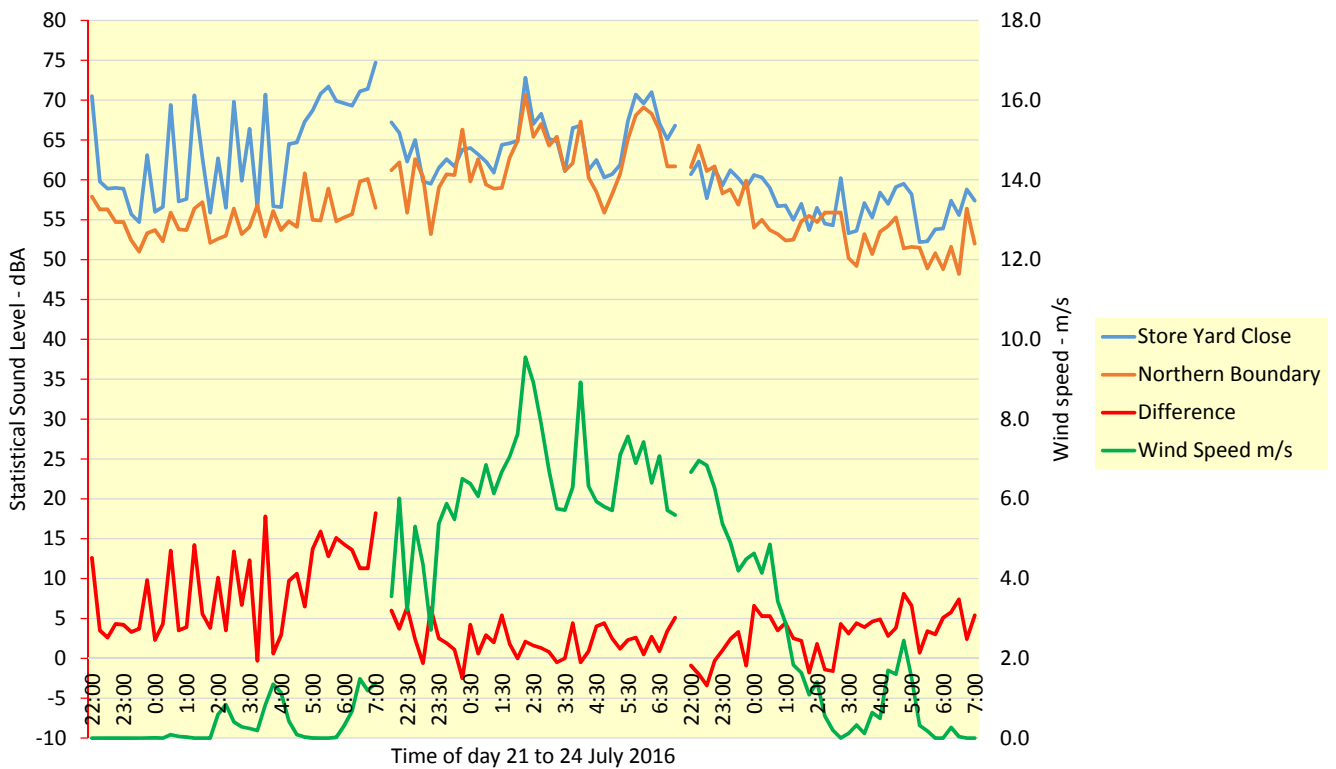


Figure 4.48: Boral Cement Berrima Annual Environmental Noise Assessment 2016 - Comparison of $L_{A01.15-min}$ at Store Yard Close and Northern Boundary Locations - Night periods only



5. Summary and Conclusions

Sound levels at the Boral Cement Berrima Cement Plant have been monitored on regular occasions since 2002. The annual monitoring undertaken has occurred around noise sources at the plant and at residential receivers in the adjoining community. Monitoring has been undertaken to assess environmental noise sources and the noise received at the residential locations.

Licence conditions for noise are in place for the Kiln 6 Upgrade plant items and the No.7 Cement Mill. These licence conditions require contribution sound levels from these items in the residential areas to be less than noted values in the Licence conditions.

Assessment of compliance of these licenced plant items has been undertaken following commissioning of each plant and the reports of compliance accepted by the DECC at the time of the assessment. Subsequent annual monitoring of noise emissions from those plant items, including this survey in 2016, has indicated that emission sound levels of these plant items have not changed significantly. Although some plant locations or items may have increased sound levels, the effect of their contribution at residential receiver locations is calculated to not be significant or in exceedance of objectives and audibly assessed to be minor. This indicates that both plant components remain in compliance with their licence conditions and have done so since commissioning.

Consideration of a review of sources with increased sound levels is recommended:

- the inlet silencer condition on grate cooler fans in the courtyard; and,
- Radicon cooler fans on most levels of the cooler.
- RM7 Roof magnetite impact plate cover and bucket elevator acoustic cladding
- FA252 discharge grill cleaning
- FA210 inlet silencer
- Raw meal silo baghouse DC30 discharge
- DC70 FA03 discharge tone at 63 Hz

It is the assessment of this study that the plant is in compliance with its licence conditions for noise.

Environmental sound levels in the community exposed to noise from the plant have been monitored and assessed, as in past reviews. Sound levels at all locations are in a similar range to those measured in the past and do not indicate any significant change or increase has occurred over the time of monitoring since 2002. Changes in sound levels between Kiln operating and non-operating periods during this survey indicated that plant operation caused very little change in sound levels at most residential receiver locations and could not be identified as significant.

Wind direction was again found to have a significant effect on receiver locations north of the plant with southerly winds. Increase of 5 to 10 dB occurred when southerly winds were predominant compared to westerly winds.

High winds during the monitoring period were a source of higher sound levels monitored during this survey, as occurred in 2015.

Road traffic noise remains the major source of noise intrusion at the residential receiver locations. This includes both Taylor Avenue traffic and Hume Freeway traffic (at night-time) when westerly winds occur.

Appendices

Appendix A: Unattended Environmental sound level results for 4 Melbourne Street

Appendix B: Unattended Environmental sound level results for 72 Taylor Avenue near the corner of Adelaide Street

Appendix C: Unattended Environmental sound level results for 12 Brisbane Street

Appendix D: Unattended Environmental sound level results for the Northern Boundary

Appendix E: Unattended Environmental sound level results for the Store Yard Close location

Appendix F: Unattended Environmental sound level results for the Lake Breed location

Appendix G: Attended receiver environmental sound level results and spectra

Appendix H: Comparison of site sound levels with Kiln 6 not operating on 9 June and operating in July and August 2016

Appendix A: Unattended Environmental sound level results for 4 Melbourne Street

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Appendix H: Comparison of sound levels with Kiln 6 not operating on 9 June and operating in July and August 2016

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Appendix B

Annual emission testing NPI report



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Report Number R003079

**Annual Emission Testing NPI Report
Boral Cement Ltd, Berrima**

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 Address: Taylor Avenue
 NEW BERRIMA NSW 2577
 Testing Laboratory: Ektimo (ETC) ABN 74 474 273 172

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Accredited for compliance with ISO/IEC 17025. NATA is a signatory to the ILAC mutual recognition arrangement for the mutual recognition of the equivalence of testing, calibration and inspection reports

Table of Contents

1	Executive Summary	4
2	Results Summary	5
3	Results	6
3.1	EPA 2 – No.6 Kiln Stack	6
3.2	EPA 4 – No.6 Cement Mill Stack Duct 1	12
3.3	EPA 4 – No.6 Cement Mill Stack Duct 2	13
3.4	EPA 5 – No.6 Kiln Cooler Stack	14
3.4	EPA 10 – No.7 Cement Mill Stack	15
4	Plant Operating Conditions	16
5	Test Methods.....	16
6	Quality Assurance/ Quality Control Information	17
7	Definitions	18

1 EXECUTIVE SUMMARY

Ektimo was engaged by Boral Cement Ltd (Berrima) to perform air emission monitoring as requested.

Monitoring was performed as follows:

Location	Test Date	Test Parameters*
EPA 2 – No.6 Kiln Stack	2 August 2016	Speciated volatile organic compounds (VOC), nitrogen oxides, carbon monoxide, carbon dioxide, oxygen, dioxins and furans (PCDD & PCDF), polycyclic aromatic hydrocarbons (PAH's)
	3 August 2016	Solid particles, fine particulates (PM10) by particle size analysis (PSA), fine particulates (PM2.5) by particle size analysis (PSA), coarse particulates, total fluoride, hydrogen chloride, chlorine, sulfur dioxide, sulfur trioxide
	4 August 2016	Metals (type 1 & 2) including copper, zinc and thallium, hexavalent chromium
EPA 4 – No.6 Cement Mill Duct 1	19 July 2016	Solid particles
EPA 4 – No.6 Cement Mill Duct 2	19 July 2016	Solid particles
EPA 5 – No. 6 Kiln Cooler Stack	5 August 2016	Solid particles
EPA 10 – No.7 Cement Mill Stack	19 July 2016	Solid particles

* Flow rate, velocity, temperature and moisture were determined unless otherwise stated

The sampling methodologies chosen by Ektimo are those recommended by the NSW Office of Environment and Heritage (as specified in the *Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales, January 2007*).

All results are reported on a dry basis at STP. Unless otherwise indicated, the methods cited in this report have been performed without deviation.

Plant operating conditions have been noted in the report.

2 RESULTS SUMMARY

EPA	Parameter	Units	Detected values	Detected values	Detected values	Detected values	Detected values	Detected values
			19-07-16	02-08-16	03-08-16	04-08-16	05-08-16	(corrected to 10% O ₂)
EPA 2 - Kiln Stack No. 6	Mercury	mg/m ³					0.016	0.014
	Cadmium	mg/m ³					< 0.0003	< 0.0003
	Hazardous substances (Type 1 + 2)	mg/m ³					≤ 0.054	≤ 0.049
	Copper	mg/m ³					0.0032	0.0029
	Thallium	mg/m ³					< 0.001	< 0.001
	Zinc	mg/m ³					0.0063	0.0057
	Solid particles	mg/m ³			22			21
	Coarse particulates	mg/m ³			9.9			9.5
	PM10 (by PSA)	mg/m ³			12			12
	PM2.5 (by PSA)	mg/m ³			5.1			4.9
	Nitrogen oxides	mg/m ³		860				830
	Carbon dioxide	%		19.6				-
	Oxygen	%		9.5				-
	Carbon monoxide	mg/m ³		560				540
	Total fluoride	mg/m ³				< 0.03		< 0.03
	Chlorine	mg/m ³				< 0.01		< 0.01
	Hydrogen chloride	mg/m ³				0.24		0.23
	Sulfur trioxide	mg/m ³				0.41		0.39
	Sulfur dioxide	mg/m ³				0.21		0.2
	Hexavalent chromium	mg/m ³					≤ 0.0022	≤ 0.002
Total VOC (as n-propane)	mg/m ³			1.6			1.5	
Dioxins & furans (I-TEQ middle bound)	ng/m ³			0.00043			0.00041	
PAHs (BaP-TEQ middle bound)	ng/m ³			3.3			3.1	
EPA 4 - Cement Mill Stack No.6 Duct 1	Solid particles	mg/m ³	2.2					-
EPA 4 - Cement Mill Stack No.6 Duct 2	Solid particles	mg/m ³	4					-
EPA 5 - Kiln Cooler Stack No. 6	Solid particles	mg/m ³					2.3	-
EPA 10 - Cement Mill Stack No. 6	Solid particles	mg/m ³	≤ 2.7					-

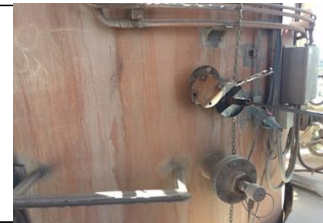
3 RESULTS

3.1 EPA 2 – No.6 Kiln Stack

Date	2-08-2016	Client	Boral Cement Ltd (Berrima)	State	NSW
Report	R003079	Stack ID	EPA 2: No.6 Kiln Stack		
Licence No.	1698	Location	New Berrima		
Ektimo Staff	Aaron Davis / Steven Weekes				
Process Conditions	Please refer to client records.				

Sampling Plane Details

Sampling plane dimensions	3000 mm
Sampling plane area	7.07 m ²
Sampling port size, number	4" Flange (x2)
Access & height of ports	Elevator 30 m
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit 8 D
Upstream disturbance	Junction 8 D
No. traverses & points sampled	2 24
Compliance of sample plane to AS4323.1	Ideal



Stack Parameters

Moisture content, %v/v	11
Gas molecular weight, g/g mole	30.1 (wet) 31.6 (dry)
Gas density at STP, kg/m ³	1.34 (wet) 1.41 (dry)
% Oxygen correction & Factor	10 % 0.96

Gas Flow Parameters

Measurement time (hhmm)	910
Temperature, °C	120
Velocity at sampling plane, m/s	30
Volumetric flow rate, discharge, m ³ /s	210
Volumetric flow rate (wet STP), m ³ /s	140
Volumetric flow rate (dry STP), m ³ /s	130
Mass flow rate (wet basis), kg/hour	690000

Isokinetic Sampling Parameters

	Test 1	Test 2
Sampling time, min	360	360
Isokinetic rate, %	95	99
Velocity difference, %	8	8

Dioxins & Furans	Sampling time	Average			Test 1 915-1520			Test 2 915-1520		
		Corrected to 10%		Mass Rate ng/min	Corrected to 10%		Mass Rate ng/min	Corrected to 10%		Mass Rate ng/min
		Concentration ng/m ³	O ₂ ng/m ³		Concentration ng/m ³	O ₂ ng/m ³		Concentration ng/m ³	O ₂ ng/m ³	
2,3,7,8-TCDF		0.000087	0.000083	0.66	0.000093	0.00009	0.71	0.00008	0.000077	0.61
2,3,7,8-TCDD		<0.0002	<0.0002	<1	<0.0002	<0.0002	<1	<0.0002	<0.0002	<1
1,2,3,7,8-PeCDF		0.000016	0.000015	0.12	0.000018	0.000017	0.13	0.000014	0.000014	0.11
2,3,4,7,8-PeCDF		0.00014	0.00013	1	0.00014	0.00014	1.1	0.00013	0.00013	1
1,2,3,7,8-PeCDD		<0.00009	<0.00008	<0.7	<0.00009	<0.00008	<0.7	<0.00008	<0.00008	<0.6
1,2,3,4,7,8-HxCDF		≤0.000014	≤0.000013	≤0.11	<0.00002	<0.00002	<0.1	0.000012	0.000012	0.092
1,2,3,6,7,8-HxCDF		0.000011	0.000011	0.086	0.000011	0.000011	0.085	0.000011	0.000011	0.087
2,3,4,6,7,8-HxCDF		<0.000009	<0.000008	<0.7	<0.000009	<0.000008	<0.7	<0.000008	<0.000008	<0.6
1,2,3,7,8,9-HxCDF		<0.000009	<0.000009	<0.7	<0.00001	<0.00001	<0.8	<0.000008	<0.000008	<0.6
1,2,3,4,7,8-HxCDD		<0.00002	<0.00001	<0.1	<0.00001	<0.00001	<0.1	<0.00002	<0.00002	<0.1
1,2,3,6,7,8-HxCDD		<0.00002	<0.00001	<0.1	<0.00001	<0.00001	<0.1	<0.00002	<0.00002	<0.1
1,2,3,7,8,9-HxCDD		<0.00001	<0.00001	<0.09	<0.00001	<0.00001	<0.1	<0.000008	<0.000008	<0.6
1,2,3,4,6,7,8-HpCDF		<0.000001	<0.000001	<0.008	<0.000009	<0.000008	<0.007	<0.000001	<0.000001	<0.01
1,2,3,4,7,8,9-HpCDF		<0.0000009	<0.0000008	<0.007	<0.0000007	<0.0000007	<0.005	<0.000001	<0.000001	<0.008
1,2,3,4,6,7,8-HpCDD		<0.000003	<0.000003	<0.3	<0.000004	<0.000003	<0.3	<0.000003	<0.000003	<0.3
OCDF		<0.0000002	<0.0000002	<0.001	<0.0000002	<0.0000002	<0.001	<0.0000002	<0.0000002	<0.001
OCDD		≤0.0000049	≤0.0000047	≤0.038	0.0000065	0.0000063	0.05	<0.000003	<0.000003	<0.03
Total TCDF isomers		0.021	0.02	160	0.026	0.025	200	0.016	0.015	120
Total TCDD isomers		≤0.0024	≤0.0023	≤19	0.0032	0.003	24	<0.002	<0.002	<10
Total PeCDF isomers		0.0015	0.0015	12	0.0021	0.002	16	0.00092	0.00088	7
Total PeCDD isomers		<0.001	<0.001	<8	<0.001	<0.001	<8	<0.001	<0.001	<8
Total HxCDF isomers		0.00027	0.00026	2.1	0.00026	0.00025	2	0.00028	0.00027	2.2
Total HxCDD isomers		<0.0009	<0.0008	<7	<0.0009	<0.0008	<7	<0.0008	<0.0008	<6
Total HpCDF isomers		<0.0003	<0.0003	<3	<0.0004	<0.0003	<3	<0.0003	<0.0003	<3
Total HpCDD isomers		<0.0008	<0.0007	<6	<0.0009	<0.0008	<7	<0.0007	<0.0006	<5
Total PCDD + PCDFs		0.028	0.026	210	0.038	0.037	290	0.017	0.016	130
I-TEQ										
Lower Bound		0.00026	0.00025	2	0.00027	0.00026	2.1	0.00025	0.00024	1.9
Middle Bound		0.00043	0.00041	3.3	0.00044	0.00042	3.4	0.00041	0.00039	3.1
Upper Bound		0.00059	0.00057	4.5	0.00062	0.00059	4.7	0.00057	0.00055	4.4

Date	2-08-2016	Client	Boral Cement Ltd (Berrima)	State	NSW
Report	R003079	Stack ID	EPA 2: No.6 Kiln Stack		
Licence No.	1698	Location	New Berrima		
Ektimo Staff	Aaron Davis / Steven Weekes				
Process Conditions	Please refer to client records.				

PAH's	Sampling time	Average			Test 1 915-1520			Test 2 915-1520		
		Corrected to 10%			Corrected to 10%			Corrected to 10%		
		Concentration ng/m ³	O ₂ ng/m ³	Mass Rate ng/min	Concentration ng/m ³	O ₂ ng/m ³	Mass Rate ng/min	Concentration ng/m ³	O ₂ ng/m ³	Mass Rate ng/min
Naphthalene		86000	83000	660000000	140000	140000	1100000000	30000	29000	230000000
2-Methylnaphthalene		35000	33000	260000000	46000	44000	350000000	23000	22000	180000000
Acenaphthylene		2900	2800	220000000	3300	3200	260000000	2500	2400	190000000
Acenaphthene		62	60	480000	62	59	470000	63	61	490000
Fluorene		200	190	1500000	160	150	1200000	230	220	1800000
Phenanthrene		2600	2500	200000000	2600	2500	200000000	2500	2400	190000000
Anthracene		34	33	260000	39	37	300000	30	29	230000
Fluoranthene		37	36	280000	51	49	390000	23	22	180000
Pyrene		18	17	140000	19	19	150000	17	16	130000
Benz(a)anthracene		<3	<3	<30000	<4	<3	<30000	<3	<3	<30000
Chrysene		18	17	130000	5.1	4.9	39000	30	29	230000
Benzo(b)fluoranthene		<3	<3	<30000	<4	<3	<30000	<3	<3	<30000
Benzo(k)fluoranthene		<3	<3	<30000	<4	<3	<30000	<3	<3	<30000
Benzo(e)pyrene		≤6.5	≤6.3	≤50000	<4	<3	<30000	9.5	9.1	73000
Benzo(a)pyrene		<3	<3	<30000	<4	<3	<30000	<3	<3	<30000
Perylene		<3	<3	<30000	<4	<3	<30000	<3	<3	<30000
Indeno(1,2,3-cd)pyrene		<3	<3	<30000	<4	<3	<30000	<3	<3	<30000
Dibenz(ah)anthracene		<3	<3	<30000	<4	<3	<30000	<3	<3	<30000
Benzo(ghi)perylene		<3	<3	<30000	<4	<3	<30000	<3	<3	<30000
Total 16 PAH's		92000	88000	710000000	150000	140000	1100000000	35000	34000	270000000
Total 19 PAH's		130000	120000	970000000	190000	190000	1500000000	59000	56000	450000000
BaP-TEQ										
Lower Bound		0.18	0.17	1300	0.051	0.049	390	0.3	0.29	2300
Middle Bound		3.3	3.1	25000	3.2	3.1	25000	3.3	3.2	25000
Upper Bound		6.3	6.1	49000	6.4	6.1	49000	6.3	6	48000

Gases	Sampling time	Average 1104-1203			Minimum 1104-1203			Maximum 1104-1203		
		Corrected to 10%			Corrected to 10%			Corrected to 10%		
		Concentration mg/m ³	O ₂ mg/m ³	Mass Rate g/s	Concentration mg/m ³	O ₂ mg/m ³	Mass Rate g/s	Concentration mg/m ³	O ₂ mg/m ³	Mass Rate g/s
Nitrogen oxides (as NO ₂)		860	830	110	740	710	95	900	870	120
Carbon monoxide		560	540	71	380	370	49	640	610	81
Carbon dioxide		19.6			19.2			20.1		
Oxygen		9.5			9.4			9.7		

Total VOCs (as n-Propane)	Sampling time	Average			Test 1 1100-1200			Test 2 1130-1230		
		Corrected to 10%			Corrected to 10%			Corrected to 10%		
		Concentration mg/m ³	O ₂ mg/m ³	Mass Rate g/s	Concentration mg/m ³	O ₂ mg/m ³	Mass Rate g/s	Concentration mg/m ³	O ₂ mg/m ³	Mass Rate g/s
Total		1.6	1.5	0.2	1.6	1.5	0.2	1.6	1.5	0.2

VOC's Speciated	Sampling time	Average			Test 1 1100-1200			Test 2 1130-1230		
		Corrected to 10%			Corrected to 10%			Corrected to 10%		
		Concentration mg/m ³	O ₂ mg/m ³	Mass Rate g/s	Concentration mg/m ³	O ₂ mg/m ³	Mass Rate g/s	Concentration mg/m ³	O ₂ mg/m ³	Mass Rate g/s
Detection limit ⁽¹⁾		<0.2	<0.2	<0.02	<0.2	<0.2	<0.02	<0.2	<0.2	<0.02
Benzene		2.1	2	0.26	2	1.9	0.25	2.1	2.1	0.27
Toluene		0.83	0.79	0.11	0.94	0.9	0.12	0.71	0.69	0.091

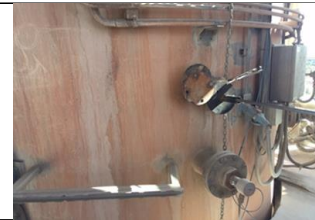
(1) Unless otherwise reported, the following target compounds were found to be below detection:

Ethanol, Isopropanol, Isobutanol, Butanol, 1-Methoxy-2-propanol, Cyclohexanol, 2-Butoxyethanol, Pentane, Hexane, Heptane, Octane, Nonane, Decane, Undecane, Dodecane, Tridecane, Tetradecane, Cyclohexane, 2-Methylhexane, 2,3-Dimethylpentane, 3-Methylhexane, Isooctane, Methylcyclohexane, alpha-Pinene, beta-Pinene, d-Limonene, 3-Carene, 3-Carene, Acetone, Methyl ethyl ketone, Ethyl acetate, Isopropyl acetate, Propyl acetate, MIBK, 2-Hexanone, Butyl acetate, 1-Methoxy-2-propyl acetate, Cyclohexanone, Cyclohexanone, Cellosolve acetate, 2-Butoxyethyl acetate, Ethylglycol acetate, Diacetone alcohol, Iso-phorone, Benzene, Toluene, Ethylbenzene, m-p-Xylene, Styrene, o-Xylene, Isopropylbenzene, Propylbenzene, 1,3,5-Trimethylbenzene, alpha-Methylstyrene, alpha-Methylstyrene, tert-Butylbenzene, 1,2,4-Trimethylbenzene, 1,2,3-Trimethylbenzene, m-Diethylbenzene, o-Diethylbenzene, p-Diethylbenzene, Dichloromethane, Chloroform, 1,1,1-Trichloroethane, 1,2-Dichloroethane, Carbon tetrachloride, 1,1-Dichloroethene, cis-1,2-Dichloroethene, trans-1,2-Dichloroethene, Trichloroethene, Tetrachloroethene, Tetrachloroethene, 1,1,2-Trichloroethane, 1,1,2,2-Tetrachloroethane, Chlorobenzene, Fluorobenzene

Date	3-08-2016	Client	Boral Cement Ltd (Berrima)	State	NSW
Report	R003079	Stack ID	EPA 2: No.6 Kiln Stack		
Licence No.	1698	Location	New Berrima		
Ektimo Staff	Aaron Davis / Steven Weekes				
Process Conditions	Please refer to client records.				

Sampling Plane Details

Sampling plane dimensions	3000 mm
Sampling plane area	7.07 m ²
Sampling port size, number	4" Flange (x2)
Access & height of ports	Elevator 30 m
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit 8 D
Upstream disturbance	Junction 8 D
No. traverses & points sampled	2 24
Compliance of sample plane to AS4323.1	Ideal



Stack Parameters

Moisture content, %v/v	11
Gas molecular weight, g/g mole	30.2 (wet) 31.6 (dry)
Gas density at STP, kg/m ³	1.35 (wet) 1.41 (dry)
% Oxygen correction & Factor	10 % 0.96

Gas Flow Parameters

Measurement time (hhmm)	845
Temperature, °C	115
Velocity at sampling plane, m/s	29
Volumetric flow rate, discharge, m ³ /s	210
Volumetric flow rate (wet STP), m ³ /s	140
Volumetric flow rate (dry STP), m ³ /s	130
Mass flow rate (wet basis), kg/hour	690000

Isokinetic Sampling Parameters

	Test 1	Test 2
Sampling time, min	120	120
Isokinetic rate, %	100	100
Velocity difference, %	7	7

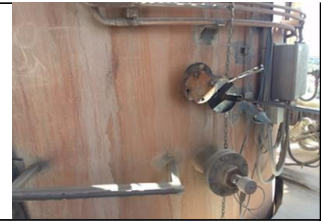
Isokinetic Results

	Sampling time	Average			Test 1 850-1055			Test 2 850-1055		
		Concentration mg/m ³	Corrected to 10%		Concentration mg/m ³	Corrected to 10%		Concentration mg/m ³	Corrected to 10%	
			O ₂ mg/m ³	Mass Rate g/s		O ₂ mg/m ³	Mass Rate g/s		O ₂ mg/m ³	Mass Rate g/s
Solid particles		22	21	2.8	23	22	3	21	20	2.7
PM10	(PSA)	12	12	1.6	13	12	1.6	12	12	1.6
PM2.5	(PSA)	5.1	4.9	0.65	4.9	4.7	0.63	5.3	5.1	0.67
Coarse particulates		9.9	9.5	1.3	11	10	1.4	9	8.6	1.1
Sulfur dioxide		0.21	0.2	0.026	0.35	0.33	0.044	0.066	0.063	0.0084
Sulfur trioxide		0.41	0.39	0.052	0.1	0.099	0.013	0.72	0.68	0.091

Date	3-08-2016	Client	Boral Cement Ltd (Berrima)	State	NSW
Report	R003079	Stack ID	EPA 2: No.6 Kiln Stack		
Licence No.	1698	Location	New Berrima		
Ektimo Staff	Aaron Davis / Steven Weekes				
Process Conditions	Please refer to client records.				

Sampling Plane Details

Sampling plane dimensions	3000 mm
Sampling plane area	7.07 m ²
Sampling port size, number	4" Flange (x2)
Access & height of ports	Elevator 30 m
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit 8 D
Upstream disturbance	Junction 8 D
No. traverses & points sampled	2 24
Compliance of sample plane to AS4323.1	Ideal

**Stack Parameters**

Moisture content, %v/v	11	
Gas molecular weight, g/g mole	30.2 (wet)	31.6 (dry)
Gas density at STP, kg/m ³	1.35 (wet)	1.41 (dry)
% Oxygen correction & Factor	10 %	0.96

Gas Flow Parameters

Measurement time (hhmm)	1125
Temperature, °C	115
Velocity at sampling plane, m/s	30
Volumetric flow rate, discharge, m ³ /s	210
Volumetric flow rate (wet STP), m ³ /s	140
Volumetric flow rate (dry STP), m ³ /s	130
Mass flow rate (wet basis), kg/hour	700000

Isokinetic Sampling Parameters

	Test 1	Test 2
Sampling time, min	120	120
Isokinetic rate, %	99	99
Velocity difference, %	-5	-5

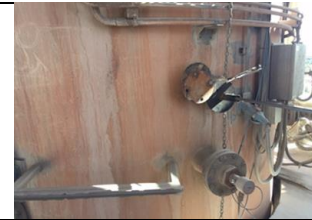
Isokinetic Results

Sampling time	Average			Test 1 1130-1335			Test 2 1130-1335		
	Concentration mg/m ³	Corrected to 10%		Concentration mg/m ³	Corrected to 10%		Concentration mg/m ³	Corrected to 10%	
		O ₂ mg/m ³	Mass Rate g/s		O ₂ mg/m ³	Mass Rate g/s		O ₂ mg/m ³	Mass Rate g/s
Chloride (as HCl)	0.24	0.23	0.031	0.18	0.17	0.023	0.3	0.29	0.039
Chlorine	<0.01	<0.01	<0.001	<0.01	<0.01	<0.002	<0.01	<0.01	<0.001
Total fluoride (as HF)	<0.03	<0.03	<0.003	<0.02	<0.02	<0.003	<0.03	<0.03	<0.004

Date	4-08-2016	Client	Boral Cement Ltd (Berrima)	State	NSW
Report	R003079	Stack ID	EPA 2: No.6 Kiln Stack		
Licence No.	1698	Location	New Berrima		
Ektimo Staff	Aaron Davis / Steven Weekes				
Process Conditions	Please refer to client records.				

Sampling Plane Details

Sampling plane dimensions	3000 mm
Sampling plane area	7.07 m ²
Sampling port size, number	4" Flange (x2)
Access & height of ports	Elevator 30 m
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit 8 D
Upstream disturbance	Junction 8 D
No. traverses & points sampled	2 24
Compliance of sample plane to AS4323.1	Ideal



Stack Parameters

Moisture content, %v/v	11
Gas molecular weight, g/g mole	30.2 (wet) 31.8 (dry)
Gas density at STP, kg/m ³	1.35 (wet) 1.42 (dry)
% Oxygen correction & Factor	10 % 0.90

Gas Flow Parameters

Measurement time (hhmm)	845
Temperature, °C	111
Velocity at sampling plane, m/s	26
Volumetric flow rate, discharge, m ³ /s	190
Volumetric flow rate (wet STP), m ³ /s	130
Volumetric flow rate (dry STP), m ³ /s	110
Mass flow rate (wet basis), kg/hour	620000

Isokinetic Sampling Parameters

	Test 1	Test 2
Sampling time, min	120	120
Isokinetic rate, %	101	101
Velocity difference, %	-2	-2

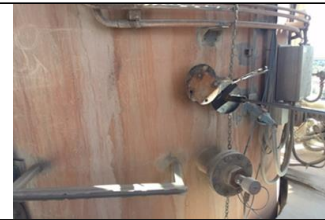
Isokinetic Results

Sampling time	Average			Test 1 900-1105			Test 2 900-1105		
	Concentration mg/m ³	Corrected to 10%		Concentration mg/m ³	Corrected to 10%		Concentration mg/m ³	Corrected to 10%	
		O ₂ mg/m ³	Mass Rate g/s		O ₂ mg/m ³	Mass Rate g/s		O ₂ mg/m ³	Mass Rate g/s
Antimony	<0.003	<0.003	<0.0003	<0.003	<0.003	<0.0003	<0.003	<0.003	<0.0003
Arsenic	<0.001	<0.001	<0.0001	<0.001	<0.001	<0.0001	<0.001	<0.001	<0.0001
Cadmium	<0.0003	<0.0003	<0.00003	<0.0003	<0.0003	<0.00003	<0.0003	<0.0003	<0.00003
Lead	<0.0007	<0.0007	<0.00008	<0.0007	<0.0007	<0.00008	<0.0007	<0.0007	<0.00008
Mercury	0.016	0.014	0.0018	0.016	0.015	0.0019	0.015	0.013	0.0017
Beryllium	<0.0006	<0.0006	<0.00007	<0.0006	<0.0006	<0.00007	<0.0006	<0.0006	<0.00007
Chromium	0.0014	0.0013	0.00016	0.0022	0.002	0.00026	0.00053	0.00048	0.00006
Cobalt	<0.0005	<0.0004	<0.00005	<0.0005	<0.0004	<0.00005	<0.0005	<0.0004	<0.00005
Manganese	0.022	0.02	0.0025	0.022	0.02	0.0025	0.022	0.02	0.0025
Nickel	0.0027	0.0024	0.00031	0.0024	0.0022	0.00027	0.003	0.0027	0.00034
Selenium	<0.003	<0.003	<0.0003	<0.003	<0.003	<0.0003	<0.003	<0.003	<0.0003
Tin	<0.001	<0.001	<0.0001	<0.001	<0.001	<0.0001	<0.001	<0.001	<0.0001
Vanadium	0.0016	0.0014	0.00018	0.0016	0.0014	0.00018	0.0016	0.0014	0.00018
Copper	0.0032	0.0029	0.00037	0.0051	0.0047	0.00059	0.0013	0.0012	0.00015
Thallium	<0.001	<0.001	<0.0001	<0.001	<0.001	<0.0001	<0.001	<0.001	<0.0001
Zinc	0.0063	0.0057	0.00072	0.0069	0.0063	0.00079	0.0056	0.0051	0.00064
Hazardous Substances									
Upper Bound									
Total Type 1 Substances	≤0.021	≤0.019	≤0.0024	≤0.022	≤0.02	≤0.0025	≤0.02	≤0.018	≤0.0022
Total Type 2 Substances	≤0.033	≤0.03	≤0.0038	≤0.034	≤0.031	≤0.0039	≤0.033	≤0.029	≤0.0037
Total Type 1 & 2 Substances	≤0.054	≤0.049	≤0.0061	≤0.055	≤0.05	≤0.0063	≤0.052	≤0.047	≤0.006

Date	4-08-2016	Client	Boral Cement Ltd (Berrima)	State	NSW
Report	R003079	Stack ID	EPA 2: No.6 Kiln Stack		
Licence No.	1698	Location	New Berrima		
Ektimo Staff	Aaron Davis / Steven Weekes				
Process Conditions	Please refer to client records.				

Sampling Plane Details

Sampling plane dimensions	3000 mm
Sampling plane area	7.07 m ²
Sampling port size, number	4" Flange (x2)
Access & height of ports	Elevator 30 m
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit 8 D
Upstream disturbance	Junction 8 D
No. traverses & points sampled	2 24
Compliance of sample plane to AS4323.1	Ideal



Stack Parameters

Moisture content, %v/v	12
Gas molecular weight, g/g mole	30.2 (wet) 31.8 (dry)
Gas density at STP, kg/m ³	1.35 (wet) 1.42 (dry)
% Oxygen correction & Factor	10 % 0.90

Gas Flow Parameters

Measurement time (hhmm)	1100
Temperature, °C	111
Velocity at sampling plane, m/s	27
Volumetric flow rate, discharge, m ³ /s	190
Volumetric flow rate (wet STP), m ³ /s	130
Volumetric flow rate (dry STP), m ³ /s	120
Mass flow rate (wet basis), kg/hour	630000

Isokinetic Sampling Parameters

	Test 1	Test 2
Sampling time, min	120	120
Isokinetic rate, %	101	101
Velocity difference, %	4	4

Isokinetic Results

Sampling time	Average			Test 1 1130-1335			Test 2 1130-1335		
	Concentration mg/m ³	Corrected to 10%		Concentration mg/m ³	Corrected to 10%		Concentration mg/m ³	Corrected to 10%	
		O2 mg/m ³	Mass Rate g/s		O2 mg/m ³	Mass Rate g/s		O2 mg/m ³	Mass Rate g/s
Hexavalent chromium	≤0.0022	≤0.002	≤0.00026	<0.002	<0.002	<0.0002	0.0026	0.0023	0.0003

3.2 EPA 4 – No.6 Cement Mill Stack Duct 1

Date	19-07-2016	Client	Boral Cement Ltd (Berrima)	
Report	R003079	Stack ID	EPA 4: No.6 Cement Mill Stack Duct 1	
Licence No.	1698	Location	New Berrima	State NSW
Ektimo Staff	Aaron Davis / Steven Weekes			
Process Conditions	Please refer to client records.			

Sampling Plane Details

Sampling plane dimensions	1160 x 1160 mm
Sampling plane area	1.35 m ²
Sampling port size, number	3" BSP (x3)
Access & height of ports	Stairs 20 m
Duct orientation & shape	Horizontal Rectangular
Downstream disturbance	Bend 0.5 D
Upstream disturbance	Bend 0.5 D
No. traverses & points sampled	3 15
Compliance of sample plane to AS4323.1	Non-compliant



Comments

Non-compliant sampling plane; the testing precision will be reduced
 The discharge is assumed to be composed of dry air and moisture

The sampling plane is deemed to be non-ideal or non-compliant due to the following reasons:

The downstream disturbance is <1D from the sampling plane
 The upstream disturbance is <2D from the sampling plane

Stack Parameters

Moisture content, %v/v	2.2	
Gas molecular weight, g/g mole	28.7 (wet)	29.0 (dry)
Gas density at STP, kg/m ³	1.28 (wet)	1.29 (dry)

Gas Flow Parameters

Measurement time (hhmm)	855
Temperature, °C	76
Velocity at sampling plane, m/s	17
Volumetric flow rate, discharge, m ³ /s	22
Volumetric flow rate (wet STP), m ³ /s	16
Volumetric flow rate (dry STP), m ³ /s	16
Mass flow rate (wet basis), kg/hour	75000

Isokinetic Sampling Parameters

	Test 1	Test 2
Sampling time, min	75	75
Isokinetic rate, %	100	101
Velocity difference, %	<1	<1

Isokinetic Results	Average		Test 1 850-1010		Test 2 850-1010	
	Concentration mg/m ³	Mass Rate g/s	Concentration mg/m ³	Mass Rate g/s	Concentration mg/m ³	Mass Rate g/s
Solid Particles	2.2	0.035	1.9	0.03	2.6	0.041

3.3 EPA 4 – No.6 Cement Mill Stack Duct 2

Date	19-07-2016	Client	Boral Cement Ltd (Berrima)
Report	R003079	Stack ID	EPA 4: No.6 Cement Mill Stack Duct 2
Licence No.	1698	Location	New Berrima
Ektimo Staff	Aaron Davis / Steven Weekes		
Process Conditions	Please refer to client records.		
		State	NSW

Sampling Plane Details

Sampling plane dimensions	700 x 1160 mm
Sampling plane area	0.812 m ²
Sampling port size, number	3" BSP (x3)
Access & height of ports	Stairs 20 m
Duct orientation & shape	Horizontal Rectangular
Downstream disturbance	Bend 0.5 D
Upstream disturbance	Bend 0.5 D
No. traverses & points sampled	3 15
Compliance of sample plane to AS4323.1	Non-compliant



Comments

Non-compliant sampling plane; the testing precision will be reduced
The discharge is assumed to be composed of dry air and moisture

The sampling plane is deemed to be non-ideal or non-compliant due to the following reasons:

The downstream disturbance is <1D from the sampling plane
The upstream disturbance is <2D from the sampling plane

Stack Parameters

Moisture content, %v/v	2.4	
Gas molecular weight, g/g mole	28.7 (wet)	29.0 (dry)
Gas density at STP, kg/m ³	1.28 (wet)	1.29 (dry)

Gas Flow Parameters

Measurement time (hhmm)	1015
Temperature, °C	82
Velocity at sampling plane, m/s	18
Volumetric flow rate, discharge, m ³ /s	14
Volumetric flow rate (wet STP), m ³ /s	10
Volumetric flow rate (dry STP), m ³ /s	9.8
Mass flow rate (wet basis), kg/hour	46000

Isokinetic Sampling Parameters

	Test 1	Test 2
Sampling time, min	75	75
Isokinetic rate, %	98	99
Velocity difference, %	2	2

Isokinetic Results	Average		Test 1 1015-1135		Test 2 1015-1135	
	Concentration mg/m ³	Mass Rate g/s	Concentration mg/m ³	Mass Rate g/s	Concentration mg/m ³	Mass Rate g/s
Solid Particles	4	0.039	2.3	0.022	5.8	0.057

3.4 EPA 5 – No.6 Kiln Cooler Stack

Date	5-08-2016	Client	Boral Cement Ltd (Berrima)	
Report	R003079	Stack ID	EPA 5: No.6 Kiln Cooler Stack	
Licence No.	1698	Location	New Berrima	State NSW
Ektimo Staff	Ryan Collins, Steven Weekes			
Process Conditions	Please refer to client records.			

Sampling Plane Details

Sampling plane dimensions	2400 mm
Sampling plane area	4.52 m ²
Sampling port size, number	4" Flange (x2)
Access & height of ports	Stairs 25 m
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit 5 D
Upstream disturbance	Junction 6 D
No. traverses & points sampled	2 16
Compliance of sample plane to AS4323.1	Satisfactory

Stack Parameters

Moisture content, %v/v	1.5	
Gas molecular weight, g/g mole	28.8 (wet)	29.0 (dry)
Gas density at STP, kg/m ³	1.29 (wet)	1.29 (dry)

Gas Flow Parameters

Measurement time (hhmm)	0950
Temperature, °C	91
Velocity at sampling plane, m/s	14
Volumetric flow rate, discharge, m ³ /s	61
Volumetric flow rate (wet STP), m ³ /s	43
Volumetric flow rate (dry STP), m ³ /s	42
Mass flow rate (wet basis), kg/hour	200000

Isokinetic Sampling Parameters

	Test 1	Test 2
Sampling time, min	80	80
Isokinetic rate, %	97	102
Velocity difference, %	5	5

Isokinetic Results	Sampling time	Average		Test 1 1000-1120		Test 2 1000-1120	
		Concentration mg/m ³	Mass Rate g/s	Concentration mg/m ³	Mass Rate g/s	Concentration mg/m ³	Mass Rate g/s
Solid Particles		2.3	0.096	2	0.085	2.6	0.11

3.4 EPA 10 – No.7 Cement Mill Stack

Date	19-07-2016	Client	Boral Cement Ltd (Berrima)
Report	R003079	Stack ID	EPA 10: No.7 Cement Mill Stack
Licence No.	1698	Location	New Berrima
Ektimo Staff	Aaron Davis / Steven Weekes		
Process Conditions	Please refer to client records.		
		State	NSW

Sampling Plane Details

Sampling plane dimensions	1520 x 1800 mm
Sampling plane area	2.74 m ²
Sampling port size, number	3" BSP (x5)
Access & height of ports	Stairs
Duct orientation & shape	Inclined Rectangular
Downstream disturbance	Bend 0.5 D
Upstream disturbance	Bend 2 D
No. traverses & points sampled	5 20
Compliance of sample plane to AS4323.1	Non-compliant



Comments

Non-compliant sampling plane; the testing precision will be reduced
The discharge is assumed to be composed of dry air and moisture

The sampling plane is deemed to be non-ideal or non-compliant due to the following reasons:

The downstream disturbance is <1D from the sampling plane
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters

Moisture content, %v/v	2.9	
Gas molecular weight, g/g mole	28.7 (wet)	29.0 (dry)
Gas density at STP, kg/m ³	1.28 (wet)	1.29 (dry)

Gas Flow Parameters

Measurement time (hhmm)	1155
Temperature, °C	92
Velocity at sampling plane, m/s	6.8
Volumetric flow rate, discharge, m ³ /s	19
Volumetric flow rate (wet STP), m ³ /s	14
Volumetric flow rate (dry STP), m ³ /s	13
Mass flow rate (wet basis), kg/hour	63000

	Test 1	Test 2
Sampling time, min	100	100
Isokinetic rate, %	106	101
Velocity difference, %	1	1

Isokinetic Results	Average		Test 1 1200-1345		Test 2 1200-1345	
	Concentration mg/m ³	Mass Rate g/s	Concentration mg/m ³	Mass Rate g/s	Concentration mg/m ³	Mass Rate g/s
Solid Particles	≤2.7	≤0.036	3.9	0.052	<2	<0.02

4 PLANT OPERATING CONDITIONS

Unless otherwise stated, the plant operating conditions were normal at the time of testing. See Boral Cement Ltd (Berrima)'s records for complete process conditions.

5 TEST METHODS

All sampling and analysis was performed by Ektimo unless otherwise specified. Specific details of the methods are available upon request.

Parameter	Test Method	Method Detection Limit	Uncertainty*	NATA Accredited	
				Sampling	Analysis
Velocity	NSW TM-2	2ms ⁻²	7%	✓	NA
Moisture content	NSW TM-22	0.4%	19%	✓	✓
PM2.5µm by Particle size analysis	NSW TM-15 + PSA	1.7 mg/m ³	9%	✓	x ⁴
Polycyclic aromatic hydrocarbons (PAH's)	NSW OM-6	Analyte specific	21%	✓	✓ ³
Sulfur trioxide	NSW TM-3	0.01mg/m ³	16%	✓	✓
Sulfur dioxide	NSW TM-3	0.4mg/m ³	not specified	✓	✓
Hexavalent chromium	NSW OM-4	5mg/m ³	16%	x	✓ ¹
Molecular weight	NSW TM-23	-	not specified	✓	✓
Sample plane criteria	NSW TM-1	NA	-	✓	NA
Temperature	NSW TM-2	0°C	2%	✓	NA
Flow rate	NSW TM-2	Location specific	8%	✓	NA
Chlorine	NSW TM-7	0.01mg/m ³	14%	✓	✓
Hydrogen chloride	NSW TM-8	0.01mg/m ³	14%	✓	✓
Total fluoride	NSW TM-9	0.01mg/m ³	17%	✓	✓ ⁵
Nitrogen oxides (NO _x)	NSW TM-11	4mg/m ³	12%	✓	✓
Type 1 substances (Sb, As, Cd, Pb, Hg)	NSW TM-12	Analyte specific	15%	✓	✓ ¹
Type 2 substances (Be, Cr, Co, Mn, Ni, Se, Sn, V)	NSW TM-13	Analyte specific	15%	✓	✓ ¹
Total (gaseous and particulate) metals and metallic compounds (Cu, Zn, Tl)	NSW TM-12, NSW TM-13, NSW TM-14	Analyte specific	15%	✓	✓ ¹
Solid particles	NSW TM-15	0.001g/m ³	5%	✓	✓
Dioxins and furans (PCDD's and PCDF's)	NSW TM-18	Analyte specific	16%	✓	✓ ²
Carbon dioxide	NSW TM-24	0.1%	13%	✓	✓
Oxygen	NSW TM-25	0.1%	13%	✓	✓
Carbon monoxide	NSW TM-32	0.0025g/m ³	12%	✓	✓
Speciated volatile organic compounds (VOC's)	NSW TM-34	0.33mg/m ³	19%	✓	✓
PM10 by Particle size analysis	NSW TM-15 + PSA	0.0017g/m ³	6%	✓	x ⁴
Coarse particulates	NSW OM-9	0.001g/m ³	not specified	✓	✓

* Uncertainty values cited in this table are calculated at the 95% confidence level (coverage factor = 2)

1. Analysis performed by Envirolab, NATA accreditation number 2901. Results were reported to Ektimo on 16 August 2016 in report number 151498.
2. Analysis performed by Australian Government National Measurement Institute, NATA accreditation number 198. Results were reported to Ektimo on 30 August 2016 in report number DAU16_182.
3. Analysis performed by Australian Government National Measurement Institute, NATA accreditation number 198. Results were reported to Ektimo on 2 September 2016 in report number ORG16_053.
4. Analysis performed by HRL Technology using a Malvern Instruments Mastersizer laser particle size analyser. NATA Accreditation does not cover the performance of this service.
5. Analysis (solid fluoride only) performed by Australian Laboratory Services Pty Ltd, NATA accreditation number 825. Results were reported to Ektimo on 19 August 2016 in report number EN1602936.

6 QUALITY ASSURANCE/ QUALITY CONTROL INFORMATION

Ektimo (EML) and Ektimo (ETC) are accredited by the National Association of Testing Authorities (NATA) for the sampling and analysis of air pollutants from industrial sources. Unless otherwise stated test methods used are accredited with the National Association of Testing Authorities. For full details, search for Ektimo at NATA's website www.nata.com.au.

Ektimo (EML) and Ektimo (ETC) are accredited by NATA (National Association of Testing Authorities) to ISO/IEC 17025. – General Requirements for the Competence of Testing and Calibration Laboratories. ISO/IEC 17025 requires that a laboratory have adequate equipment to perform the testing, as well as laboratory personnel with the competence to perform the testing. This quality assurance system is administered and maintained by the Compliance Manager.

NATA is a member of APLAC (Asia Pacific Laboratory Accreditation Co-operation) and of ILAC (International Laboratory Accreditation Co-operation). Through the mutual recognition arrangements with both of these organisations, NATA accreditation is recognised world –wide.

A formal Quality Control program is in place at Ektimo to monitor analyses performed in the laboratory and sampling conducted in the field. The program is designed to check where appropriate; the sampling reproducibility, analytical method, accuracy, precision and the performance of the analyst. The Laboratory Manager is responsible for the administration and maintenance of this program.

7 DEFINITIONS

The following symbols and abbreviations may be used in this test report:

STP	Standard temperature and pressure. Gas volumes and concentrations are expressed on a dry basis at 0°C, at discharge oxygen concentration and an absolute pressure of 101.325 kPa, unless otherwise specified.
Disturbance	A flow obstruction or instability in the direction of the flow which may impede accurate flow determination. This includes centrifugal fans, axial fans, partially closed or closed dampers, louvres, bends, connections, junctions, direction changes or changes in pipe diameter.
VOC	Any chemical compound based on carbon with a vapour pressure of at least 0.010 kPa at 25°C or having a corresponding volatility under the particular conditions of use. These compounds may contain oxygen, nitrogen and other elements, but specifically excluded are carbon monoxide, carbon dioxide, carbonic acid, metallic carbides and carbonate salts.
TOC	The sum of all compounds of carbon which contain at least one carbon to carbon bond, plus methane and its derivatives.
OU	The number of odour units per unit of volume. The numerical value of the odour concentration is equal to the number of dilutions to arrive at the odour threshold (50% panel response).
PM _{2.5}	Atmospheric suspended particulate matter having an equivalent aerodynamic diameter of less than approximately 2.5 microns (µm).
PM ₁₀	Atmospheric suspended particulate matter having an equivalent aerodynamic diameter of less than approximately 10 microns (µm).
BSP	British standard pipe
NT	Not tested or results not required
NA	Not applicable
D ₅₀	'Cut size' of a cyclone defined as the particle diameter at which the cyclone achieves a 50% collection efficiency ie. half of the particles are retained by the cyclone and half are not and pass through it to the next stage. The D ₅₀ method simplifies the capture efficiency distribution by assuming that a given cyclone stage captures all of the particles with a diameter equal to or greater than the D ₅₀ of that cyclone and less than the D ₅₀ of the preceding cyclone.
D	Duct diameter or equivalent duct diameter for rectangular ducts
<	Less than
>	Greater than
≥	Greater than or equal to
~	Approximately
CEM	Continuous Emission Monitoring
CEMS	Continuous Emission Monitoring System
DER	WA Department of Environment & Regulation
DECC	Department of Environment & Climate Change (NSW)
EPA	Environment Protection Authority
FTIR	Fourier Transform Infra Red
NATA	National Association of Testing Authorities
RATA	Relative Accuracy Test Audit
AS	Australian Standard
USEPA	United States Environmental Protection Agency
Vic EPA	Victorian Environment Protection Authority
ISC	Intersociety committee, Methods of Air Sampling and Analysis
ISO	International Organisation for Standardisation
APHA	American public health association, Standard Methods for the Examination of Water and Waste Water
CARB	Californian Air Resources Board
TM	Test Method
OM	Other approved method
CTM	Conditional test method
VDI	Verein Deutscher Ingenieure (Association of German Engineers)
NIOSH	National Institute of Occupational Safety and Health
XRD	X-ray Diffractometry

Appendix C

Annual emission testing compliance report



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Report Number R003079-1

**Annual Emission Testing Compliance Report
Boral Cement Ltd, Berrima**

Document Information

Client Name: Boral Cement Ltd, Berrima
 Report Number: R003079-1
 Date of Issue: 4 October 2016
 Attention: Gabriel Paicu
 Address: Taylor Avenue
 NEW BERRIMA NSW 2577
 Testing Laboratory: Ektimo (ETC) ABN 74 474 273 172

Report Status

Format	Document Number	Report Date	Prepared By	Reviewed By (1)	Reviewed By (2)
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Amendment Record

Document Number	Initiator	Report Date	Section	Reason
Nil	-	-	-	-

Report Authorisation



Aaron Davis
Operations Manager

NATA Accredited Laboratory
No. 14601

Steven Cooper
Client Manager

Accredited for compliance with ISO/IEC 17025. NATA is a signatory to the ILAC mutual recognition arrangement for the mutual recognition of the equivalence of testing, calibration and inspection reports

Table of Contents

1	Executive Summary	4
2	Results Summary	4
3	Results	5
3.1	EPA 2 – No.6 Kiln Stack	5
3.2	EPA 4 – No. 6 Cement Mill Stack Duct 1	8
3.3	EPA 4 – No.6 Cement Mill Stack Duct 2	9
3.4	EPA 5 - No.6 Kiln Cooler Stack	10
3.5	EPA 10 - No. 7 Cement Mill Stack	11
4	Plant Operating Conditions	12
5	Test Methods.....	12
6	Quality Assurance/ Quality Control Information	13
7	Definitions	14

1 EXECUTIVE SUMMARY

Ektimo was engaged by Boral Cement Ltd (Berrima) to perform air emission monitoring as required as part of their NSW Government Environment Protection Licence (number 1698).

Monitoring was performed as follows:

Location	Test Date	Test Parameters*
EPA 2 – No. 6 Kiln Stack	2 August 2016	Nitrogen oxides, carbon dioxide, oxygen
	3 August 2016	Solid particles, PM10 by particle size analysis (PSA), coarse particulates
	4 August 2016	Hazardous substances - metals (type 1 & 2 substances)
EPA 4 – No.6 Cement Mill Stack Duct 1	19 July 2016	Solid particles
EPA 4 – No.6 Cement Mill Stack Duct 2	19 July 2016	Solid particles
EPA 5 – No. 6 Kiln Cooler Stack	5 August 2016	Solid particles
EPA 10 – No.7 Cement Mill Stack	19 July 2016	Solid particles

* Flow rate, velocity, temperature and moisture were determined unless otherwise stated

The sampling methodologies chosen by Ektimo are those recommended by the NSW Office of Environment and Heritage (as specified in the *Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales, January 2007*).

All results are reported on a dry basis at STP. Unless otherwise indicated, the methods cited in this report have been performed without deviation.

Plant operating conditions have been noted in the report.

2 RESULTS SUMMARY

The following licence comparison table shows that all analytes highlighted in green are below the licence limit set by the NSW EPA as per licence 1698 (last amended on 14/07/2015).

EPA	Parameter	Units	Licence limit	Detected values	Detected values	Detected values	Detected values	Detected values	Detected values
				19/07/2016	2/08/2016	3/08/2016	4/08/2016	5/08/2016	(corrected to 10% O ₂)
EPA 2 - Kiln Stack No. 6	Mercury	mg/m ³	0.1				0.016		0.014
	Hazardous substances	mg/m ³	1.0				≤0.054		≤0.049
	Solid particles	mg/m ³	95			22			21
	Nitrogen oxides	mg/m ³	1000		860				830
	Cadmium	mg/m ³	0.1				<0.0003		<0.0003
EPA 4 - Cement Mill Stack No.6 Duct 1	Solid particles	mg/m ³	100	2.2					
EPA 4 - Cement Mill Stack No.6 Duct 2	Solid particles	mg/m ³	100	4					
EPA 5 - Kiln Cooler Stack No. 6	Solid particles	mg/m ³	100					2.3	
EPA 10 - Cement Mill Stack No.7	Solid particles	mg/m ³	20	≤2.7					

3 RESULTS

3.1 EPA 2 – No.6 Kiln Stack

Date	2/08/2016	Client	Boral Cement Ltd (Berrima)		
Report	R003079	Stack ID	EPA 2: No.6 Kiln Stack		
Licence No.	1698	Location	New Berrima	State	NSW
Ektimo Staff	Aaron Davis / Steven Weekes				
Process Conditions	Please refer to client records.				

Sampling Plane Details

Sampling plane dimensions	3000 mm
Sampling plane area	7.07 m ²
Sampling port size, number	4" Flange (x2)
Access & height of ports	Elevator 30 m
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit 8 D
Upstream disturbance	Junction 8 D
No. traverses & points sampled	2 24
Compliance of sample plane to AS4323.1	Ideal



Stack Parameters

Moisture content, %v/v	11	
Gas molecular weight, g/g mole	30.1 (wet)	31.6 (dry)
Gas density at STP, kg/m ³	1.34 (wet)	1.41 (dry)
% Oxygen correction & Factor	10 %	0.96

Gas Flow Parameters

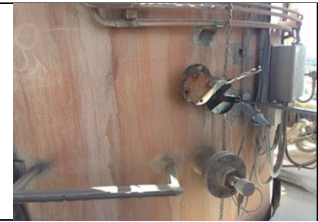
Measurement time (hhmm)	910
Temperature, °C	120
Velocity at sampling plane, m/s	30
Volumetric flow rate, discharge, m ³ /s	210
Volumetric flow rate (wet STP), m ³ /s	140
Volumetric flow rate (dry STP), m ³ /s	130
Mass flow rate (wet basis), kg/hour	690000

Gases	Sampling time	Average 1104-1203			Minimum 1104-1203			Maximum 1104-1203		
		Corrected to 10% O ₂			Corrected to 10% O ₂			Corrected to 10% O ₂		
		Concentration mg/m ³	Concentration mg/m ³	Mass Rate g/s	Concentration mg/m ³	Concentration mg/m ³	Mass Rate g/s	Concentration mg/m ³	Concentration mg/m ³	Mass Rate g/s
Nitrogen oxides (as NO ₂)		860	830	110	740	710	95	900	870	120
Carbon dioxide		Concentration %			Concentration %			Concentration %		
Oxygen		19.6			19.2			20.1		
		9.5			9.4			9.7		

Date	3/08/2016	Client	Boral Cement Ltd (Berrima)	State	NSW
Report	R003079	Stack ID	EPA 2: No.6 Kiln Stack		
Licence No.	1698	Location	New Berrima		
Ektimo Staff	Aaron Davis / Steven Weekes				
Process Conditions	Please refer to client records.				

Sampling Plane Details

Sampling plane dimensions	3000 mm
Sampling plane area	7.07 m ²
Sampling port size, number	4" Flange (x2)
Access & height of ports	Elevator 30 m
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit 8 D
Upstream disturbance	Junction 8 D
No. traverses & points sampled	2 24
Compliance of sample plane to AS4323.1	Ideal



Stack Parameters

Moisture content, %v/v	11
Gas molecular weight, g/g mole	30.2 (wet) 31.6 (dry)
Gas density at STP, kg/m ³	1.35 (wet) 1.41 (dry)
% Oxygen correction & Factor	10 % 0.96

Gas Flow Parameters

Measurement time (hhmm)	845
Temperature, °C	115
Velocity at sampling plane, m/s	29
Volumetric flow rate, discharge, m ³ /s	210
Volumetric flow rate (wet STP), m ³ /s	140
Volumetric flow rate (dry STP), m ³ /s	130
Mass flow rate (wet basis), kg/hour	690000

Isokinetic Sampling Parameters

	Test 1	Test 2
Sampling time, min	120	120
Isokinetic rate, %	100	100
Velocity difference, %	7	7

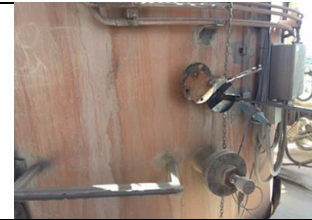
Isokinetic Results

Sampling time	Average			Test 1 850-1055			Test 2 850-1055		
	Concentration mg/m ³	Corrected to 10%		Concentration mg/m ³	Corrected to 10%		Concentration mg/m ³	Corrected to 10%	
		O2 mg/m ³	Mass Rate g/s		O2 mg/m ³	Mass Rate g/s		O2 mg/m ³	Mass Rate g/s
Solid particles	22	21	2.8	23	22	3	21	20	2.7
PM10 (PSA)	12	12	1.6	13	12	1.6	12	12	1.6
Coarse particulates	9.9	9.5	1.3	11	10	1.4	9	8.6	1.1

Date	4/08/2016	Client	Boral Cement Ltd (Berrima)	State	NSW
Report	R003079	Stack ID	EPA 2: No.6 Kiln Stack		
Licence No.	1698	Location	New Berrima		
Ektimo Staff	Aaron Davis / Steven Weekes				
Process Conditions	Please refer to client records.				

Sampling Plane Details

Sampling plane dimensions	3000 mm
Sampling plane area	7.07 m ²
Sampling port size, number	4" Flange (x2)
Access & height of ports	Elevator 30 m
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit 8 D
Upstream disturbance	Junction 8 D
No. traverses & points sampled	2 24
Compliance of sample plane to AS4323.1	Ideal



Stack Parameters

Moisture content, %v/v	11
Gas molecular weight, g/g mole	30.2 (wet) 31.8 (dry)
Gas density at STP, kg/m ³	1.35 (wet) 1.42 (dry)
% Oxygen correction & Factor	10 % 0.90

Gas Flow Parameters

Measurement time (hhmm)	845
Temperature, °C	111
Velocity at sampling plane, m/s	26
Volumetric flow rate, discharge, m ³ /s	190
Volumetric flow rate (wet STP), m ³ /s	130
Volumetric flow rate (dry STP), m ³ /s	110
Mass flow rate (wet basis), kg/hour	620000

Isokinetic Sampling Parameters

	Test 1	Test 2
Sampling time, min	120	120
Isokinetic rate, %	101	101
Velocity difference, %	-2	-2

Isokinetic Results

Sampling time	Average			Test 1 900-1105			Test 2 900-1105		
	Concentration mg/m ³	Corrected to 10%		Concentration mg/m ³	Corrected to 10%		Concentration mg/m ³	Corrected to 10%	
		O ₂ mg/m ³	Mass Rate g/s		O ₂ mg/m ³	Mass Rate g/s		O ₂ mg/m ³	Mass Rate g/s
Antimony	<0.003	<0.003	<0.0003	<0.003	<0.003	<0.0003	<0.003	<0.003	<0.0003
Arsenic	<0.001	<0.001	<0.0001	<0.001	<0.001	<0.0001	<0.001	<0.001	<0.0001
Cadmium	<0.0003	<0.0003	<0.00003	<0.0003	<0.0003	<0.00003	<0.0003	<0.0003	<0.00003
Lead	<0.0007	<0.0007	<0.00008	<0.0007	<0.0007	<0.00008	<0.0007	<0.0007	<0.00008
Mercury	0.016	0.014	0.0018	0.016	0.015	0.0019	0.015	0.013	0.0017
Beryllium	<0.0006	<0.0006	<0.00007	<0.0006	<0.0006	<0.00007	<0.0006	<0.0006	<0.00007
Chromium	0.0014	0.0013	0.00016	0.0022	0.002	0.00026	0.00053	0.00048	0.00006
Cobalt	<0.0005	<0.0004	<0.00005	<0.0005	<0.0004	<0.00005	<0.0005	<0.0004	<0.00005
Manganese	0.022	0.02	0.0025	0.022	0.02	0.0025	0.022	0.02	0.0025
Nickel	0.0027	0.0024	0.00031	0.0024	0.0022	0.00027	0.003	0.0027	0.00034
Selenium	<0.003	<0.003	<0.0003	<0.003	<0.003	<0.0003	<0.003	<0.003	<0.0003
Tin	<0.001	<0.001	<0.0001	<0.001	<0.001	<0.0001	<0.001	<0.001	<0.0001
Vanadium	0.0016	0.0014	0.00018	0.0016	0.0014	0.00018	0.0016	0.0014	0.00018
Copper	0.0032	0.0029	0.00037	0.0051	0.0047	0.00059	0.0013	0.0012	0.00015
Thallium	<0.001	<0.001	<0.0001	<0.001	<0.001	<0.0001	<0.001	<0.001	<0.0001
Zinc	0.0063	0.0057	0.00072	0.0069	0.0063	0.00079	0.0056	0.0051	0.00064
Hazardous Substances									
Upper Bound									
Total Type 1 Substances	≤0.021	≤0.019	≤0.0024	≤0.022	≤0.02	≤0.0025	≤0.02	≤0.018	≤0.0022
Total Type 2 Substances	≤0.033	≤0.03	≤0.0038	≤0.034	≤0.031	≤0.0039	≤0.033	≤0.029	≤0.0037
Total Type 1 & 2 Substances	≤0.054	≤0.049	≤0.0061	≤0.055	≤0.05	≤0.0063	≤0.052	≤0.047	≤0.006

3.2 EPA 4 – No. 6 Cement Mill Stack Duct 1

Date	19/07/2016	Client	Boral Cement Ltd (Berrima)
Report	R003079	Stack ID	EPA 4: No.6 Cement Mill Stack Duct 1
Licence No.	1698	Location	New Berrima
Ektimo Staff	Aaron Davis / Steven Weekes		State NSW
Process Conditions	Please refer to client records.		

Sampling Plane Details

Sampling plane dimensions	1160 x 1160 mm
Sampling plane area	1.35 m ²
Sampling port size, number	3" BSP (x3)
Access & height of ports	Stairs 20 m
Duct orientation & shape	Horizontal Rectangular
Downstream disturbance	Bend 0.5 D
Upstream disturbance	Bend 0.5 D
No. traverses & points sampled	3 15
Compliance of sample plane to AS4323.1	Non-compliant



Comments

Non-compliant sampling plane; the testing precision will be reduced
The discharge is assumed to be composed of dry air and moisture

The sampling plane is deemed to be non-ideal or non-compliant due to the following reasons:

The downstream disturbance is <1D from the sampling plane
The upstream disturbance is <2D from the sampling plane

Stack Parameters

Moisture content, %v/v	2.2	
Gas molecular weight, g/g mole	28.7 (wet)	29.0 (dry)
Gas density at STP, kg/m ³	1.28 (wet)	1.29 (dry)

Gas Flow Parameters

Measurement time (hhmm)	855
Temperature, °C	76
Velocity at sampling plane, m/s	17
Volumetric flow rate, discharge, m ³ /s	22
Volumetric flow rate (wet STP), m ³ /s	16
Volumetric flow rate (dry STP), m ³ /s	16
Mass flow rate (wet basis), kg/hour	75000

Isokinetic Sampling Parameters

	Test 1	Test 2
Sampling time, min	75	75
Isokinetic rate, %	100	101
Velocity difference, %	<1	<1

Isokinetic Results	Average		Test 1		Test 2	
	Concentration mg/m ³	Mass Rate g/s	Concentration mg/m ³	Mass Rate g/s	Concentration mg/m ³	Mass Rate g/s
Sampling time			850-1010		850-1010	
Solid Particles	2.2	0.035	1.9	0.03	2.6	0.041

3.3 EPA 4 – No.6 Cement Mill Stack Duct 2

Date	19/07/2016	Client	Boral Cement Ltd (Berrima)
Report	R003079	Stack ID	EPA 4: No.6 Cement Mill Stack Duct 2
Licence No.	1698	Location	New Berrima
Ektimo Staff	Aaron Davis / Steven Weekes		State NSW
Process Conditions	Please refer to client records.		

Sampling Plane Details

Sampling plane dimensions	700 x 1160 mm
Sampling plane area	0.812 m ²
Sampling port size, number	3" BSP (x3)
Access & height of ports	Stairs 20 m
Duct orientation & shape	Horizontal Rectangular
Downstream disturbance	Bend 0.5 D
Upstream disturbance	Bend 0.5 D
No. traverses & points sampled	3 15
Compliance of sample plane to AS4323.1	Non-compliant



Comments

Non-compliant sampling plane; the testing precision will be reduced
The discharge is assumed to be composed of dry air and moisture

The sampling plane is deemed to be non-ideal or non-compliant due to the following reasons:

The downstream disturbance is <1D from the sampling plane
The upstream disturbance is <2D from the sampling plane

Stack Parameters

Moisture content, %v/v	2.4	
Gas molecular weight, g/g mole	28.7 (wet)	29.0 (dry)
Gas density at STP, kg/m ³	1.28 (wet)	1.29 (dry)

Gas Flow Parameters

Measurement time (hhmm)	1015
Temperature, °C	82
Velocity at sampling plane, m/s	18
Volumetric flow rate, discharge, m ³ /s	14
Volumetric flow rate (wet STP), m ³ /s	10
Volumetric flow rate (dry STP), m ³ /s	9.8
Mass flow rate (wet basis), kg/hour	46000

Isokinetic Sampling Parameters

	Test 1	Test 2
Sampling time, min	75	75
Isokinetic rate, %	98	99
Velocity difference, %	2	2

Isokinetic Results	Average		Test 1		Test 2	
	Concentration mg/m ³	Mass Rate g/s	Concentration mg/m ³	Mass Rate g/s	Concentration mg/m ³	Mass Rate g/s
Sampling time			1015-1135		1015-1135	
Solid Particles	4	0.039	2.3	0.022	5.8	0.057

3.4 EPA 5 - No.6 Kiln Cooler Stack

Date	5/08/2016	Client	Boral Cement Ltd (Berrima)
Report	R003079	Stack ID	EPA 5: No.6 Kiln Cooler Stack
Licence No.	1698	Location	New Berrima
Ektimo Staff	Ryan Collins, Steven Weekes	State	NSW
Process Conditions	Please refer to client records.		

Sampling Plane Details

Sampling plane dimensions	2400 mm
Sampling plane area	4.52 m ²
Sampling port size, number	4" Flange (x2)
Access & height of ports	Stairs 25 m
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit 5 D
Upstream disturbance	Junction 6 D
No. traverses & points sampled	2 16
Compliance of sample plane to AS4323.1	Satisfactory

Stack Parameters

Moisture content, %v/v	1.5
Gas molecular weight, g/g mole	28.8 (wet) 29.0 (dry)
Gas density at STP, kg/m ³	1.29 (wet) 1.29 (dry)

Gas Flow Parameters

Measurement time (hhmm)	0950
Temperature, °C	91
Velocity at sampling plane, m/s	14
Volumetric flow rate, discharge, m ³ /s	61
Volumetric flow rate (wet STP), m ³ /s	43
Volumetric flow rate (dry STP), m ³ /s	42
Mass flow rate (wet basis), kg/hour	200000

Isokinetic Sampling Parameters

	Test 1	Test 2
Sampling time, min	80	80
Isokinetic rate, %	97	102
Velocity difference, %	5	5

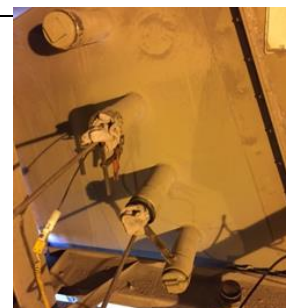
Isokinetic Results	Sampling time	Average		Test 1 1000-1120		Test 2 1000-1120	
		Concentration mg/m ³	Mass Rate g/s	Concentration mg/m ³	Mass Rate g/s	Concentration mg/m ³	Mass Rate g/s
Solid Particles		2.3	0.096	2	0.085	2.6	0.11

3.5 EPA 10 - No. 7 Cement Mill Stack

Date	19/07/2016	Client	Boral Cement Ltd (Berrima)
Report	R003079	Stack ID	EPA 10: No.7 Cement Mill Stack
Licence No.	1698	Location	New Berrima
Ektimo Staff	Aaron Davis / Steven Weekes		State NSW
Process Conditions	Please refer to client records.		

Sampling Plane Details

Sampling plane dimensions	1520 x 1800 mm
Sampling plane area	2.74 m ²
Sampling port size, number	3" BSP (x5)
Access & height of ports	Stairs
Duct orientation & shape	Inclined Rectangular
Downstream disturbance	Bend 0.5 D
Upstream disturbance	Bend 2 D
No. traverses & points sampled	5 20
Compliance of sample plane to AS4323.1	Non-compliant



Comments

Non-compliant sampling plane; the testing precision will be reduced
The discharge is assumed to be composed of dry air and moisture

The sampling plane is deemed to be non-ideal or non-compliant due to the following reasons:

The downstream disturbance is <1D from the sampling plane
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters

Moisture content, %v/v	2.9
Gas molecular weight, g/g mole	28.7 (wet) 29.0 (dry)
Gas density at STP, kg/m ³	1.28 (wet) 1.29 (dry)

Gas Flow Parameters

Measurement time (hhmm)	1155
Temperature, °C	92
Velocity at sampling plane, m/s	6.8
Volumetric flow rate, discharge, m ³ /s	19
Volumetric flow rate (wet STP), m ³ /s	14
Volumetric flow rate (dry STP), m ³ /s	13
Mass flow rate (wet basis), kg/hour	63000

Isokinetic Sampling Parameters

	Test 1	Test 2
Sampling time, min	100	100
Isokinetic rate, %	106	101
Velocity difference, %	1	1

Isokinetic Results	Average		Test 1		Test 2	
	Sampling time		1200-1345		1200-1345	
	Concentration mg/m ³	Mass Rate g/s	Concentration mg/m ³	Mass Rate g/s	Concentration mg/m ³	Mass Rate g/s
Solid Particles	≤2.7	≤0.036	3.9	0.052	<2	<0.02

4 PLANT OPERATING CONDITIONS

Unless otherwise stated, the plant operating conditions were normal at the time of testing. See Boral Cement Ltd (Berrima)'s records for complete process conditions.

5 TEST METHODS

All sampling and analysis was performed by Ektimo unless otherwise specified. Specific details of the methods are available upon request.

Parameter	Test Method	Method Detection Limit	Uncertainty*	NATA Accredited	
				Sampling	Analysis
Velocity	NSW TM-2	2ms ⁻²	7%	✓	NA
Moisture content	NSW TM-22	0.4%	19%	✓	✓
Molecular weight	NSW TM-23	-	not specified	✓	✓
Sample plane criteria	NSW TM-1	NA	-	✓	NA
Temperature	NSW TM-2	0°C	2%	✓	NA
Flow rate	NSW TM-2	Location specific	8%	✓	NA
Nitrogen oxides (NO _x)	NSW TM-11	4mg/m ³	12%	✓	✓
Type 1 substances (Sb, As, Cd, Pb, Hg)	NSW TM-12	Analyte specific	15%	✓	✓ ¹
Type 2 substances (Be, Cr, Co, Mn, Ni, Se, Sn, V)	NSW TM-13	Analyte specific	15%	✓	✓ ¹
Total (gaseous and particulate) metals and metallic compounds (Cu, Zn, Tl)	NSW TM-12, NSW TM-13, NSW TM-14	Analyte specific	15%	✓	✓ ¹
Solid particles	NSW TM-15	0.001g/m ³	5%	✓	✓
Carbon dioxide	NSW TM-24	0.1%	13%	✓	✓
Oxygen	NSW TM-25	0.1%	13%	✓	✓
PM10 by Particle size analysis	NSW TM-15 + PSA	0.0017g/m ³	6%	✓	x ²
Coarse particulates	NSW OM-9	0.001g/m ³	not specified	✓	✓

1. Analysis performed by Envirolab, NATA accreditation number 2901. Results were reported to Ektimo on 16 August 2016 in report number 151498.
2. Analysis performed by HRL Technology using a Malvern Instruments Mastersizer laser particle size analyser. NATA Accreditation does not cover the performance of this service.

6 QUALITY ASSURANCE/ QUALITY CONTROL INFORMATION

Ektimo (EML) and Ektimo (ETC) are accredited by the National Association of Testing Authorities (NATA) for the sampling and analysis of air pollutants from industrial sources. Unless otherwise stated test methods used are accredited with the National Association of Testing Authorities. For full details, search for Ektimo at NATA's website www.nata.com.au.

Ektimo (EML) and Ektimo (ETC) are accredited by NATA (National Association of Testing Authorities) to ISO/IEC 17025. – General Requirements for the Competence of Testing and Calibration Laboratories. ISO/IEC 17025 requires that a laboratory have adequate equipment to perform the testing, as well as laboratory personnel with the competence to perform the testing. This quality assurance system is administered and maintained by the Compliance Manager.

NATA is a member of APLAC (Asia Pacific Laboratory Accreditation Co-operation) and of ILAC (International Laboratory Accreditation Co-operation). Through the mutual recognition arrangements with both of these organisations, NATA accreditation is recognised world –wide.

A formal Quality Control program is in place at Ektimo to monitor analyses performed in the laboratory and sampling conducted in the field. The program is designed to check where appropriate; the sampling reproducibility, analytical method, accuracy, precision and the performance of the analyst. The Laboratory Manager is responsible for the administration and maintenance of this program.

7 DEFINITIONS

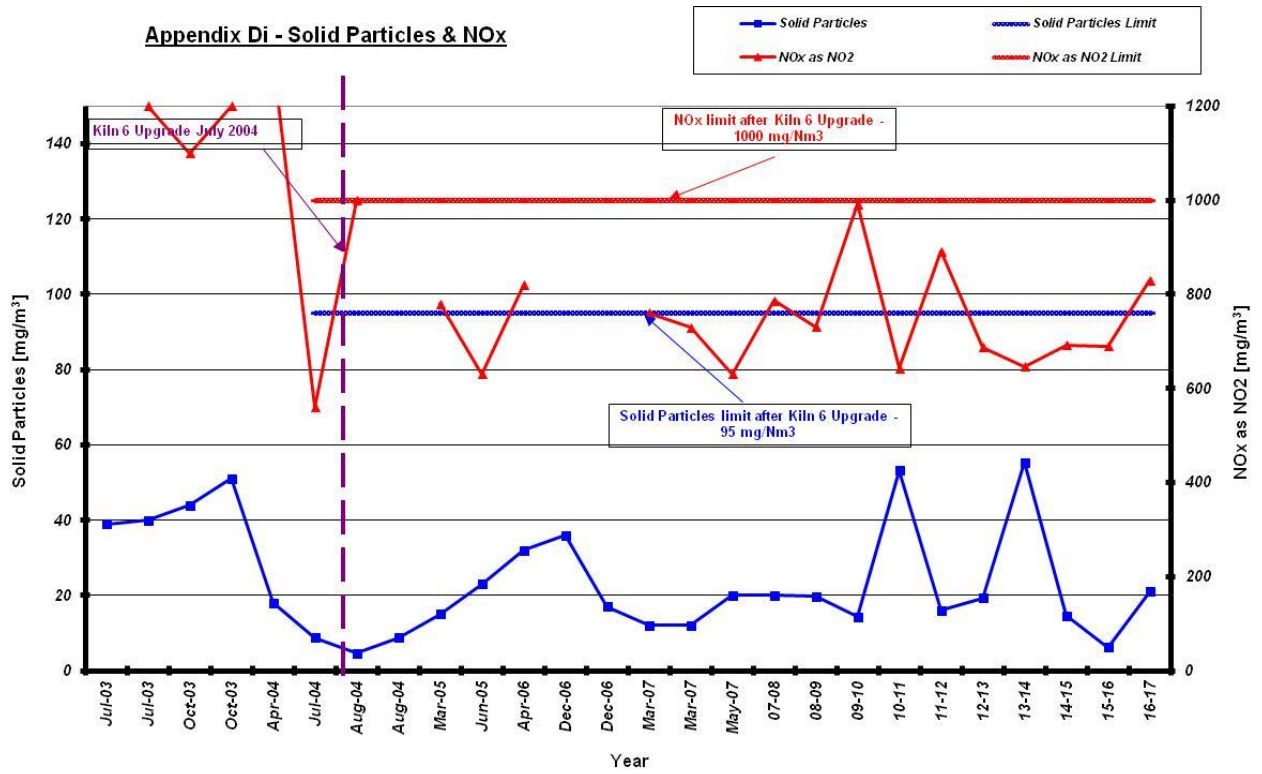
The following symbols and abbreviations may be used in this test report:

STP	Standard temperature and pressure. Gas volumes and concentrations are expressed on a dry basis at 0°C, at discharge oxygen concentration and an absolute pressure of 101.325 kPa, unless otherwise specified.
Disturbance	A flow obstruction or instability in the direction of the flow which may impede accurate flow determination. This includes centrifugal fans, axial fans, partially closed or closed dampers, louvres, bends, connections, junctions, direction changes or changes in pipe diameter.
VOC	Any chemical compound based on carbon with a vapour pressure of at least 0.010 kPa at 25°C or having a corresponding volatility under the particular conditions of use. These compounds may contain oxygen, nitrogen and other elements, but specifically excluded are carbon monoxide, carbon dioxide, carbonic acid, metallic carbides and carbonate salts.
TOC	The sum of all compounds of carbon which contain at least one carbon to carbon bond, plus methane and its derivatives.
OU	The number of odour units per unit of volume. The numerical value of the odour concentration is equal to the number of dilutions to arrive at the odour threshold (50% panel response).
PM _{2.5}	Atmospheric suspended particulate matter having an equivalent aerodynamic diameter of less than approximately 2.5 microns (µm).
PM ₁₀	Atmospheric suspended particulate matter having an equivalent aerodynamic diameter of less than approximately 10 microns (µm).
BSP	British standard pipe
NT	Not tested or results not required
NA	Not applicable
D ₅₀	'Cut size' of a cyclone defined as the particle diameter at which the cyclone achieves a 50% collection efficiency ie. half of the particles are retained by the cyclone and half are not and pass through it to the next stage. The D ₅₀ method simplifies the capture efficiency distribution by assuming that a given cyclone stage captures all of the particles with a diameter equal to or greater than the D ₅₀ of that cyclone and less than the D ₅₀ of the preceding cyclone.
D	Duct diameter or equivalent duct diameter for rectangular ducts
<	Less than
>	Greater than
≥	Greater than or equal to
~	Approximately
CEM	Continuous Emission Monitoring
CEMS	Continuous Emission Monitoring System
DER	WA Department of Environment & Regulation
DECC	Department of Environment & Climate Change (NSW)
EPA	Environment Protection Authority
FTIR	Fourier Transform Infra Red
NATA	National Association of Testing Authorities
RATA	Relative Accuracy Test Audit
AS	Australian Standard
USEPA	United States Environmental Protection Agency
Vic EPA	Victorian Environment Protection Authority
ISC	Intersociety committee, Methods of Air Sampling and Analysis
ISO	International Organisation for Standardisation
APHA	American public health association, Standard Methods for the Examination of Water and Waste Water
CARB	Californian Air Resources Board
TM	Test Method
OM	Other approved method
CTM	Conditional test method
VDI	Verein Deutscher Ingenieure (Association of German Engineers)
NIOSH	National Institute of Occupational Safety and Health
XRD	X-ray Diffractometry

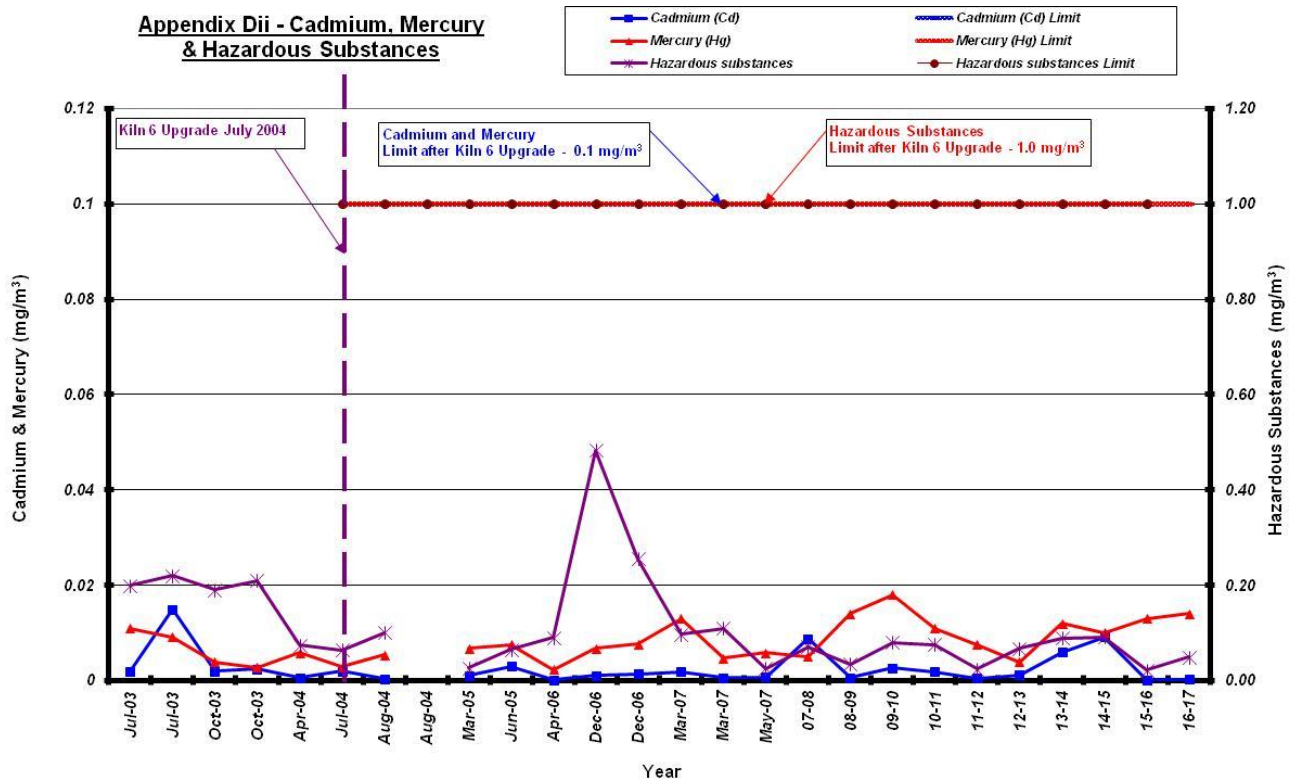
Appendix D

Air quality graph

Appendix Di - Solid Particles & NOx



Appendix Dii - Cadmium, Mercury & Hazardous Substances



Appendix E

Complaints register



Incident List Report - Berrima Cement Works 1/5/2016 - 30/4/2017

Incident No	Incident Date	Person Type	Risk Ratio	Reported By	Incident Type	Incident Description
16-29343	08/07/2016	Public	Low	Ford, Craig Andrew	Environment	Resident reported clinker dust on both of their cars this morning
16-29355	09/07/2016	Public	Low	Ford, Craig Andrew	Environment	Resident reported dust on her car on Saturday morning as well as the previous day
16-29363	16/07/2016	Public	Low	Ford, Craig Andrew	Environment	Fine dust on Cars from previous night
16-29371	20/07/2016	Public	Low	Ford, Craig Andrew	Environment	Fine dust on her car which was sticking to windscreen
16-32236	03/08/2016	Public	Low	Ford, Craig Andrew	Hazard, Environment	Text me to notify of a dust fall out on her cars, called around next morning to inspect and product appeared to be Cement dust.
16-32247	05/08/2016	Public	Low	Ford, Craig Andrew	Hazard, Environment	Dust reported on cars in the village
16-40749	17/09/2016	Public	Low	Ford, Craig Andrew	Environment	Dust on Car
16-43554	09/10/2016	Public	Low	Ford, Craig Andrew	Environment	Resident from New Berrima txt to inform she had dust on her car. Branko and I inspected and she had dust but not clinker dust on her car. Over the weekend the winds were mostly not in her direction but there was a period where material from our stockpiled area may have dusted her car
16-54003	30/11/2016	Public	Low	Ford, Craig Andrew	Environment	Chunky dust on car
17-5968	11/02/2017	Public	Medium	Bizjak, James Anthony	Environment	Complaint from member of public from Berrima, driving from Moss Vale to Berrima noticed dust coming from plant, (Description of DC204 area). "lots of dust and a bad smell whilst driving" Mode change and 7 raw mill start took place at similar time
17-9147	19/02/2017	Public	Medium	Ford, Craig Andrew	Environment	Resident informed me via text that she had dust on her car in the morning. Asked control room to check for obvious issues. There was clinker being moved from outside into the a Frame and mole overnight due to kiln slow down and 6 Cement mill water injection not operating effectively. The loading of clinker dust from external sources is known to cause fugitive dust. It does not often lead to dust going out of site but given the wind direction it is the most likely cause of contamination on this instance
17-9129	26/02/2017	Public	Low	Ford, Craig Andrew	Environment	Resident text myself to report that she had found dust on her car on Monday morning the 27/02/17. The dust had landed on their vehicle sometime late Sunday into Monday. A look at kiln conditions shows no emission levels that were too high in the last 24 hours, there were some spikes on DC200 which can be an issues but they only started today. The Off white run was during this time and perhaps this combined with some doors open on Gantry levels as well as main doors to A Frame may have contributed to dust getting to village. The wind direction in the last 24hrs has been primarily from the South to south East which is the direction from Kiln discharge end to village.
17-12097	07/03/2017	Public	Low	Ford, Craig Andrew	Environment	Resident text to let me know that their had been more dust on their cars from the previous day or two.
17-16453	07/03/2017	Public	Low	Ford, Craig Andrew	Environment	Had inspected her car in the morning and it had clinker or cement dust on the car. I inspected the car and there was evidence of dust on the car
17-17797	07/03/2017	Public	Low	Ford, Craig Andrew	Environment	Had inspected her car in the morning and it had clinker or cement dust on the car. I inspected the car and there was evidence of dust on the car
17-21345	16/04/2017	Public	Low	Paicu, Nicusor Gabriel	Environment	Resident sent SMS to Craig Ford regarding dust on the car. Gabriel Paicu tried to contact the resident during the day but no answer. resident call back on 18/4/17. She complained that she washed the car on 16/4/17 around 8 am and left the car on the driveway for about 45 minutes. She noticed dust on the car 45 mins after the car was washed.

