VISY PULP AND PAPER PTY LTD

AIR QUALITY ASSESSMENT TO SUPPORT A REQUEST FOR MODIFICATION OF A PROJECT APPROVAL

436 Gadara Road, Tumut, New South Wales

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Figure 1 Revised Phasing of Mill Components Affecting Stack Emissions

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Appendix A Additional Air Dispersion Modelling and Assessment *(Holmes Air Sciences, 19 June 2007)*

1. INTRODUCTION

Visy Pulp and Paper Pty Ltd (Visy) is seeking a modification to the Project Approval issued in May 2007 for the Visy Tumut plant expansion. The modification is required as a result of a change in the proposed phased installation of the new lime kiln, recovery boiler and natural gas boiler, and the associated process gas flow configuration of this phased installation. The Environmental Assessment (EA) report for the project submitted to the Department of Planning in January 2007 made it clear that the exact phasing of specific components of the mill expansion may change subject to changes in production requirements. The requested modification reflects that required flexibility in installation phasing. In light of the revised configuration, Visy has re-assessed the emissions profile to determine the potential impact on air quality of the mill expansion, compared with the assessment of these aspects contained in the EA. This present report, which presents the re-assessment of emissions, should be read in conjunction with the EA.

The scope of the revised assessment of emissions to air from the expanded mill comprised:

- Update of estimates of emissions to atmosphere during Phase 1a, Phase 1b and Phase 2 of the mill expansion;
- Assessment of compliance with the standards of concentration stated in the Protection of the Environment Operations (Clean Air) Regulation 2002 (amended 2005) (POEO (Clean Air) Regulation); and
- Assessment of compliance with the regulatory impact assessment criteria (ground level concentrations) stated in the *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (DEC 2005) through air dispersion modelling.

In summary, the data in this report indicate that, when installed, all of the new air emission sources at the expanded Visy mill will meet the NSW impact assessment criteria for air emissions at ground level. Compliance will be achieved throughout all three phases of the expansion.

Due to the reconfiguration of the gas flows as a result of the changes in the phased installation of components, the TRS emission limit for Stack 2 as set out in the Project Approval will need to be changed. Based on the supplier's operational maxima ,an increase from 2 mg/Nm3 to 3.6 mg/Nm3 is required for Stack 2, as currently applies to the existing mill operation, and which still maintains the individual contributing sources to this stack below the Group 6 limits.

2. SOURCES OF AIR EMISSIONS

The only existing discharge point at the site is the main stack (Stack 1) which currently serves the existing recovery boiler, lime kiln and power boiler. Under the revised proposal, during all phases of the mill expansion Stack 1 will serve the new lime kiln as well as the existing recovery boiler, lime kiln and power boiler. During Phase 1a of the mill expansion, Stack 2 will serve the new recovery boiler only. In Phase 1b of the mill expansion, Stack 2 will serve the new recovery boiler and natural gas boiler. In Phase 2 of the mill expansion, Stack 2 will serve the new recovery boiler and multi fuel boiler. The third stack, Stack 3, installed during Phase 2 will serve the new gas turbine, and is unchanged from the EA.

The proposed sources of emissions on the site (compared with the sources presented in the EA) are summarised in Table 1 and diagrammatically presented in Figure 1.

Table 1 Summary of Sources of Emissions to Atmosphere

Discharge Point	**Emission Sources**	
	EA Proposal	**New Proposal**
	Phase 1	***Phase 1a***
Stack 1	Existing Recovery Boiler Existing Lime Kiln Existing Power Boiler	Existing Recovery Boiler Existing Lime Kiln Existing Power Boiler New Lime Kiln
Stack 2	New Recovery Boiler New Lime Kiln New Natural Gas Boiler	New Recovery Boiler
	Phase 1	***Phase 1b***
Stack 1	Existing Recovery Boiler Existing Lime Kiln Existing Power Boiler	Existing Recovery Boiler Existing Lime Kiln Existing Power Boiler New Lime Kiln
Stack 2	New Recovery Boiler New Lime Kiln New Natural Gas Boiler	New Recovery Boiler New Natural Gas Boiler
	Phase 2	***Phase 2***
Stack 1	Existing Recovery Boiler Existing Lime Kiln Existing Power Boiler	Existing Recovery Boiler Existing Lime Kiln Existing Power Boiler New Lime Kiln

Discharge Point	Emission Sources	
	EA Proposal	**New Proposal**
Stack 2	New Recovery Boiler	New Recovery Boiler
	New Lime Kiln	New Multi Fuel Boiler
	New Multi Fuel Boiler	
Stack 3	New Gas Turbine	New Gas Turbine

2.1 Existing Recovery Boiler, Lime Kiln and Power Boiler

The stack parameters and emission concentrations for the existing recovery boiler, lime kiln and power boiler have been updated from the values presented in the EA. In addition, the data have been provided as individual duct data where these were available.

The volumetric flow rate, and the concentrations of CO and NO_x have been updated based on data collected by the Continuous Emissions Monitoring System (CEMS) for the individual recovery boiler, lime kiln and power boiler ducts. The concentrations of HCl, SO_2 and TRS (and therefore H_2S) have been updated based on data collected by the CEMS for the existing main stack. As in the EA, CEMS data from July 2005 to June 2006 have been used. However, the CEMS data were recently re-analysed by Visy personnel and refined to ensure all outliers such as measurements taken during start-up, shut-down or other non-steady state operation and/or monitoring equipment faults were excluded, and that the data were fully representative of steady-state operations. These changes have resulted in a small decrease in the flow rate from the existing lime kiln, a small increase in the flow rate from the existing power boiler, a slight decrease in the concentrations of SO_2 and HCl from the main stack, and a substantial increase in the TRS concentration from the main stack (from 1.59 mg/Nm^3 to 2.47 mg/Nm^3). This re-analysis has provided more representative “worst case” emission data for the ducts and stack under steady state operating conditions.

The concentrations of all other species are unchanged from the values presented in the EA. As well, the concentrations of the other less significant chemical species presented in Table 36 of the EA and based on past monitoring data are also considered to be essentially unchanged. The stack parameters and emission concentrations for the existing recovery boiler, lime kiln and power boiler are shown in Table 2.

Table 2 Emissions to Atmosphere – Existing Recovery Boiler, Lime Kiln and Power Boiler (Phases 1a, 1b and 2)

Parameter	**Averaging Period**	**Recovery Boiler** (at 8% O_2)	**Lime Kiln** (at 10% O_2)	**Power Boiler** (at 8% O_2)	**Recovery Boiler, Lime Kiln and Power Boiler Combined**
Volumetric Flow (Nm^3/s)	1 hour	40.6	8.62	36.7	-
CO (mg/Nm^3)	1 hour	308	236	297	-
Cl (mg/Nm^3)	1 hour	-	-	-	2.20
NO_x (mg/Nm^3)	1 hour	130	400	200	-
HCl (mg/Nm^3)	1 hour	-	-	-	48.1
SO_2 (mg/Nm^3)	1 hour	-	-	-	232.6
TSP (mg/Nm^3)	As per TM-15	26.0	22.8	10.6	-
Sulfuric Acid Mist as SO_3 (mg/Nm^3)	As per TM-3	-	-	-	9.20
Dioxins as TCDD equivalent (ng/Nm^3)	As per TM-18	-	-	-	0.0260
HF (mg/Nm^3)	As per TM-10	-	-	-	0.260
TRS as H_2S (mg/Nm^3)	1 hour	-	-	-	2.47
H_2S (mg/Nm^3)	1 hour	-	-	-	2.47
VOCs (mg/Nm^3)	1 hour	37.1	28.9	0	-
Methanol (mg/Nm^3)	24 hours	2.56	0	0	-
Type 1 and Type 2 Substances (mg/Nm^3)	As per TM-12, TM-13 and TM-14	-	-	-	0.297
Sb (mg/Nm^3)		-	-	-	0.00204
As (mg/Nm^3)		-	-	-	0.0200
Be (mg/Nm^3)		-	-	-	0.0000190
Cd (mg/Nm^3)		-	-	-	0.00320
Cr (mg/Nm^3)		-	-	-	0.0166
Co (mg/Nm^3)		-	-	-	0.00271
Cu (mg/Nm^3)		-	-	-	0.190
Pb (mg/Nm^3)		-	-	-	0.0523
Mn (mg/Nm^3)		-	-	-	0.133
Hg (mg/Nm^3)		-	-	-	0.00420
Ni (mg/Nm^3)		-	-	-	0.0171

Parameter	Averaging Period	Recovery Boiler (at 8% O_2)	Lime Kiln (at 10% O_2)	Power Boiler (at 8% O_2)	Recovery Boiler, Lime Kiln and Power Boiler Combined
Se (mg/Nm^3)		-	-	-	0.00665
Sn (mg/Nm^3)		-	-	-	0.0347
V (mg/Nm^3)		-	-	-	0.00413

Note: Where concentrations are provided for the recovery boiler, lime kiln and power boiler in the table, this data is based on available source data. The combined concentrations are for species where no individual data are available and the data for the existing main stack has been used. In these cases, the relative proportions of emissions between the individual streams are unknown and hence no individual concentrations are shown in the table.

2.2 New Recovery Boiler and Lime Kiln

The stack parameters and emission concentrations for the new recovery boiler and lime kiln have been updated from the values presented in the EA. The values in the EA were based on emissions data for the existing main stack and an assumption of the relative contributions from the recovery boiler and the lime kiln. The assumption that was adopted for the EA was extremely conservative as it did not consider any contribution from the existing power boiler. Further, it did not take into account the expected lower emissions from the new recovery boiler and lime kiln as a result of advances in technology. The revised emissions data presented below are based on the equipment supplier specifications and operational maxima emission levels for the new recovery boiler and lime kiln.

The volumetric flow rate for the new recovery boiler has been updated based on two flow scenarios. The recovery boiler has a maximum operating capacity of 900 tds/day with a discharge volumetric flow rate of 52.9 Nm^3/s. However during normal steady state operation, the new recovery boiler will be operated at a capacity of 750 tds/day with a discharge volumetric flow rate of 44.1 Nm^3/s. The supplier's operational maxima emission concentrations will remain the same under bother operating conditions, but the mass emission rates and exit velocity from Stack 2 will be higher when the recovery boiler is operating at the higher capacity. Thus both flow scenarios have been included in the modelling for each Phase of operation.

The volumetric flow rate for the new lime kiln has been updated based on the revised value for the existing lime kiln, as presented in Table 2.

The concentrations of CO, NO_x, SO_2, TSP and TRS have been updated based on the supplier's operational maxima for the new recovery boiler and lime kiln under steady state operating conditions. The new recovery boiler is rated to discharge CO at a concentration of less than 125 mg/m^3, NO_x at a concentration of less than 205 mg/m^3, SO_2 at a concentration of less than 88 mg/m^3, TSP at a concentration of less than 50 mg/m^3, and TRS at a concentration of less than 3 mg/m^3. The new lime kiln is rated to discharge NO_x at a concentration of less than 290 mg/m^3, SO_2 at a concentration of less than 34 mg/m^3, TSP at a concentration of less than 28 mg/m^3, and TRS at a concentration of less than 4.0 mg/m^3.

The concentrations of VOCs and methanol are unchanged from the values presented in the EA. The maximum concentration of H_2S emitted to atmosphere will not exceed the concentration of TRS being emitted, as H2S is a component of TRS.

As for the EA, individual duct data were not available to determine concentrations of Cl, HCl, sulfuric acid mist, dioxins, HF and trace metals from the new recovery boiler and lime kiln. Therefore, the expected concentrations of these species were determined using the monitoring data for the existing main stack, and assuming that only the existing recovery boiler and lime kiln are the sources of these emissions (i.e. there is no contribution to emissions of these species from the existing power boiler). For HCl only, this assumption was refined to the existing recovery boiler and lime kiln being the source of 60% of HCl emissions from the main stack, rather than 100% as in the EA. This assumption still provides a level of conservatism as the existing power boiler is the main contributor to HCl emissions due to the chlorine content of the fuels used (i.e. bark and paper residues).

However, for the changes in the project phases proposed, knowledge of the individual emissions from each duct is required so that the overall emissions from each stack can be determined. For emission parameters that have not been specified by the supplier, the assumption has been made that the concentrations at each of the recovery boiler and lime kiln ducts are equivalent to the combined concentrations discussed above. The relative contribution of each duct to the combined emissions concentrations is not known, and therefore a split between the two ducts for these parameters cannot be provided. The approach taken for these parameters is therefore highly conservative.

The stack parameters and emission concentrations for the new recovery boiler and lime kiln are shown in Table 3.

Table 3 Emissions to Atmosphere – New Recovery Boiler and Lime Kiln (Phases 1a, 1b and 2)

Parameter	**Averaging Period**	**Recovery Boiler** (at 8% O_2)	**Lime Kiln** (at 8% O_2)
Volumetric Flow (Nm^3/s)	1 hour	44.1 (750 tds/day) 52.9 (900 tds/day)	8.62
CO (mg/Nm^3)	1 hour	125	236
Cl (mg/Nm^3)	1 hour	3.67	3.67
NO_x (mg/Nm^3)	1 hour	205	290
HCl (mg/Nm^3)	1 hour	48.1	48.1
SO_2 (mg/Nm^3)	1 hour	88.0	34.0
TSP (mg/Nm^3)	As per TM-15	50.0	28.0
Sulfuric Acid Mist as SO_3 (mg/Nm^3)	As per TM-3	15.3	15.3
Dioxins as TCDD equivalent (ng/Nm^3)	As per TM-18	0.0433	0.0433
HF (mg/Nm^3)	As per TM-10	0.433	0.433
TRS as H_2S (mg/Nm^3)	1 hour	3.00	4.00
H_2S (mg/Nm^3)	1 hour	3.00	4.00
VOCs (mg/Nm^3)	1 hour	37.1	28.9
Methanol (mg/Nm^3)	24 hours	2.56	0
Type 1 and Type 2 Substances (mg/Nm^3)	As per TM-12, TM-13 and TM-14	0.495	0.495
Sb (mg/Nm^3)		0.00341	0.00341
As (mg/Nm^3)		0.0333	0.0333
Be (mg/Nm^3)		0.0000317	0.0000317
Cd (mg/Nm^3)		0.00534	0.00534
Cr (mg/Nm^3)		0.0277	0.0277
Co (mg/Nm^3)		0.00451	0.00451
Cu (mg/Nm^3)		0.317	0.317
Pb (mg/Nm^3)		0.0871	0.0871
Mn (mg/Nm^3)		0.222	0.222
Hg (mg/Nm^3)		0.00700	0.00700
Ni (mg/Nm^3)		0.0285	0.0285
Se (mg/Nm^3)		0.0111	0.0111
Sn (mg/Nm^3)		0.0578	0.0578
V (mg/Nm^3)		0.00689	0.00689

2.3 Natural Gas Boiler

The mass flow rates of species emitted from the natural gas boiler are unchanged from the values presented in the EA. However, the concentrations of species emitted from the boiler have been recalculated using the updated volumetric gas flow rate, which was assumed to be equivalent to that of the existing power boiler for the calculations. The updated duct parameters and emission concentrations for the natural gas boiler are shown in Table 4.

Table 4 Emissions to Atmosphere – Natural Gas Boiler (Phase 1b)

Parameter	**Averaging Period**	**Natural Gas Boiler** (at 8% O_2)
Volumetric Flow (Nm^3/s)	1 hour	36.7
CO (mg/Nm^3)	1 hour	50.5
NO_x (mg/Nm^3)	1 hour	84.2
SO_2 (mg/Nm^3)	1 hour	0.314
TSP (mg/Nm^3)	As per TM-15	4.57
VOCs (mg/Nm^3)	1 hour	3.31
Type 1 and Type 2 Substances (mg/Nm^3)	As per TM-12, TM-13 and TM-14	0.00366
As (mg/Nm^3)		0.000120
Be (mg/Nm^3)		0.00000714
Cd (mg/Nm^3)		0.000676
Cr (mg/Nm^3)		0.000827
Co (mg/Nm^3)		0.0000488
Cu (mg/Nm^3)		0.000526
Pb (mg/Nm^3)		0.000301
Mn (mg/Nm^3)		0.000229
Hg (mg/Nm^3)		0.000158
Ni (mg/Nm^3)		0.00128
Se (mg/Nm^3)		0.0000143

2.4 Multi Fuel Boiler

The concentrations of species emitted from the new multi fuel boiler are unchanged from the values presented in the EA. However, the volumetric flow rate has been updated as it is assumed to be equivalent to that of the existing power boiler.

2.5 Gas Turbine

The stack parameters and emissions concentrations for the new gas turbine are unchanged from the values presented in the EA.

3. EMISSIONS DISCHARGED TO ATMOSPHERE

The expected emissions from Stacks 1, 2 and 3 in each Phase of the project, have been updated based on the required changes to the ducting of emissions due to the installation phasing changes, outlined in Table 1, and the data presented in Section 2. The updated emissions data are presented in the following sections.

3.1 Stack 1 Combined Emissions

The emissions that will be discharged from Stack 1 during Phases 1a, 1b and 2 of the mill expansion will result from the operation of the existing recovery boiler, lime kiln and power boiler, and the new lime kiln. The combined stack emissions were determined using the test method TM-38 as specified in Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales (DEC 2005b). This method has been used in all calculations of combined stack emissions in this assessment.

The predicted volumetric flow rate has been calculated by adding the maximum flow rate from Stack 1 to the predicted maximum flow rate from the new lime kiln at 8% O2. This newly calculated flow meets the current 100 percentile limit of 100 Nm^3/s specified in the Protection of the Environment Operations (POEO) Licence issued by the NSW DECC for the site, but is greater than the 90 percentile Licence limit of 90.5 Nm^3/s. The predicted 90 percentile flow rate in Stack 1 based on the new configuration is 90 Nm^3/s.

The average concentration of smoke (opacity) emitted from Stack 1 during steady-state operations is expected to be similar to the average capacity result from the existing main stack, as determined from the continuous monitoring performed over the period 2004-2006. The maximum emission from Stack 1 will not exceed the Group 6 limits in the POEO (Clean Air) Regulation.

The updated stack parameters and emission concentrations for Stack 1 (Phases 1a, 1b and 2) are shown in Table 5.

Table 5 Emissions to Atmosphere – Stack 1 – Phases 1a, 1b and 2

Parameter	**Averaging Period**	**Stack 1 Emissions (Phases 1a, 1b and 2)** (at 8% O_2)
Volumetric Flow (Nm^3/s)	1 hour	94.5
CO (mg/Nm^3)	1 hour	289
Cl (mg/Nm^3)	1 hour	2.33
NO_x (mg/Nm^3)	1 hour	196
HCl (mg/Nm^3)	1 hour	48.1
SO_2 (mg/Nm^3)	1 hour	214
TSP (mg/Nm^3)	As per TM-15	19.9
Sulfuric Acid Mist as SO_3 (mg/Nm^3)	As per TM-3	9.8
Dioxins as TCDD equivalent (ng/Nm^3)	As per TM-18	0.0276
HF (mg/Nm^3)	As per TM-10	0.276
TRS as H_2S (mg/Nm^3)	1 hour	2.66
H_2S (mg/Nm^3)	1 hour	2.66
VOCs (mg/Nm^3)	1 hour	21.2
Methanol (mg/Nm^3)	24 hours	1.10
Type 1 and Type 2 Substances (mg/Nm^3)	As per TM-12, TM-13 and TM-14	0.315
Sb (mg/Nm^3)		0.00217
As (mg/Nm^3)		0.0212
Be (mg/Nm^3)		0.0000202
Cd (mg/Nm^3)		0.00339
Cr (mg/Nm^3)		0.0176
Co (mg/Nm^3)		0.00287
Cu (mg/Nm^3)		0.202
Pb (mg/Nm^3)		0.0554
Mn (mg/Nm^3)		0.141
Hg (mg/Nm^3)		0.00446
Ni (mg/Nm^3)		0.0181
Se (mg/Nm^3)		0.00706
Sn (mg/Nm^3)		0.0368
V (mg/Nm^3)		0.00438
Smoke (Opacity)	6 minutes	7.8% opacity

Note: TM = Test Method stated in the *Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales* (DEC 2005b).

3.2 Stack 2 Combined Emissions

The emissions that will be discharged from Stack 2 during Phase 1a of the mill expansion will be from the operation of the new recovery boiler only. During Phase 1b, emissions from the new recovery boiler and natural gas boiler will be discharged from Stack 2. In Phase 2, emissions from the new recovery boiler and multi fuel boiler will be discharged from Stack 2.

The combined stack emissions were determined using the test method TM-38 as specified in Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales (DEC 2005b).

The average concentration of smoke (opacity) emitted from Stack 2 during steady-state operations is expected to be similar to the average opacity result from the existing main stack, as determined from the continuous monitoring performed over the period 2004-2006. The maximum emission from Stack 1 will not exceed the Group 6 limits in the POEO (Clean Air) Regulation.

The updated stack parameters and emission concentrations for Stack 2 (Phases 1a) are shown in Table 6.

Table 6 Emissions to Atmosphere – Stack 2 – Phase 1a

Parameter	**Averaging Period**	**Stack 2 Emissions (Phase 1a)** (at 8% O_2)
Volumetric Flow (Nm^3/s)	1 hour	44.1 (750 tds/day) 52.9 (900 tds/day)
CO (mg/Nm^3)	1 hour	125
Cl (mg/Nm^3)	1 hour	3.67
NO_x (mg/Nm^3)	1 hour	205
HCl (mg/Nm^3)	1 hour	48.1
SO_2 (mg/Nm^3)	1 hour	88.0
TSP (mg/Nm^3)	As per TM-15	50.0
Sulfuric Acid Mist as SO_3 (mg/Nm^3)	As per TM-3	15.3
Dioxins as TCDD equivalent (ng/Nm^3)	As per TM-18	0.0433
HF (mg/Nm^3)	As per TM-10	0.433
TRS as H_2S (mg/Nm^3)	1 hour	3.00

Parameter	Averaging Period	Stack 2 Emissions (Phase 1a) (at 8% O_2)
H_2S (mg/Nm^3)	1 hour	3.00
VOCs (mg/Nm^3)	1 hour	37.1
Methanol (mg/Nm^3)	24 hours	2.56
Type 1 and Type 2 Substances (mg/Nm^3)	As per TM-12, TM-13 and TM-14	0.495
Sb (mg/Nm^3)		0.00341
As (mg/Nm^3)		0.0333
Be (mg/Nm^3)		0.0000317
Cd (mg/Nm^3)		0.00534
Cr (mg/Nm^3)		0.0277
Co (mg/Nm^3)		0.00451
Cu (mg/Nm^3)		0.317
Pb (mg/Nm^3)		0.0871
Mn (mg/Nm^3)		0.222
Hg (mg/Nm^3)		0.00700
Ni (mg/Nm^3)		0.0285
Se (mg/Nm^3)		0.0111
Sn (mg/Nm^3)		0.0578
V (mg/Nm^3)		0.00689
Smoke (Opacity)	6 minutes	7.8% opacity (average), 20% opacity (maximum)

Note: TM = Test Method stated in the *Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales* (DEC 2005b)

The updated stack parameters and emission concentrations for Stack 2 (Phase 1b) are shown in Table 7.

Table 7 Emissions to Atmosphere – Stack 2 – Phase 1b

Parameter	Averaging Period	Stack 2 Emissions (Phase 1b) (at 8% O_2)	
		(750 tds/day)	(900 tds/day)
Volumetric Flow (Nm^3/s)	1 hour	80.8	89.6
CO (mg/Nm^3)	1 hour	91.2	94.5
Cl (mg/Nm^3)	1 hour	2.00	2.17
NO_x (mg/Nm^3)	1 hour	150	156
HCl (mg/Nm^3)	1 hour	26.3	28.4

Parameter	Averaging Period	Stack 2 Emissions (Phase 1b) (at 8% O_2)	
		(750 tds/day)	(900 tds/day)
SO_2 (mg/Nm^3)	1 hour	48.2	52.1
TSP (mg/Nm^3)	As per TM-15	29.4	31.4
Sulfuric Acid Mist as SO_3 (mg/Nm^3)	As per TM-3	8.38	9.06
Dioxins as TCDD equivalent (ng/Nm^3)	As per TM-18	0.0237	0.0256
HF (mg/Nm^3)	As per TM-10	0.237	0.256
TRS as H_2S (mg/Nm^3)	1 hour	1.64	1.77
H_2S (mg/Nm^3)	1 hour	1.64	1.77
VOCs (mg/Nm^3)	1 hour	21.8	23.3
Methanol (mg/Nm^3)	24 hours	1.40	1.51
Type 1 and Type 2 Substances (mg/Nm^3)	As per TM-12, TM-13 and TM-14	0.272	0.294
Sb (mg/Nm^3)		0.00186	0.00201
As (mg/Nm^3)		0.0182	0.0197
Be (mg/Nm^3)		0.0000205	0.0000216
Cd (mg/Nm^3)		0.00322	0.00343
Cr (mg/Nm^3)		0.0155	0.0167
Co (mg/Nm^3)		0.00249	0.00269
Cu (mg/Nm^3)		0.173	0.187
Pb (mg/Nm^3)		0.0477	0.0516
Mn (mg/Nm^3)		0.121	0.131
Hg (mg/Nm^3)		0.00390	0.00420
Ni (mg/Nm^3)		0.0162	0.0174
Se (mg/Nm^3)		0.00606	0.00656
Sn (mg/Nm^3)		0.0316	0.0342
V (mg/Nm^3)		0.00376	0.00407
Smoke (Opacity)	6 minutes	7.8% opacity (average), 20% opacity (maximum)	7.8% opacity (average), 20% opacity (maximum)

Note: TM = Test Method stated in the Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales (DEC 2005b)

The updated stack parameters and emission concentrations for Stack 2 (Phases 2) are shown in Table 8.

Table 8 Emissions to Atmosphere – Stack 2 – Phase 2

Parameter	**Averaging Period**	**Stack 2 Emissions (Phase 2)** (at 8% O_2)	
		(750 tds/day)	(900 tds/day)
Volumetric Flow (Nm^3/s)	1 hour	80.8	89.6
CO (mg/Nm^3)	1 hour	120.5	120.9
Cl (mg/Nm^3)	1 hour	65.6	59.5
NO_x (mg/Nm^3)	1 hour	244	240
HCl (mg/Nm^3)	1 hour	67.1	65.2
SO_2 (mg/Nm^3)	1 hour	115.5	112.8
TSP (mg/Nm^3)	As per TM-15	39.1	40.2
Sulfuric Acid Mist as SO_3 (mg/Nm^3)	As per TM-3	17.5	17.3
Dioxins as TCDD equivalent (ng/Nm^3)	As per TM-18	0.0691	0.0665
HF (mg/Nm^3)	As per TM-10	1.417	1.320
TRS as H_2S (mg/Nm^3)	1 hour	1.64	1.77
H_2S (mg/Nm^3)	1 hour	1.64	1.77
VOCs (mg/Nm^3)	1 hour	20.3	21.9
Methanol (mg/Nm^3)	24 hours	1.40	1.51
Type 1 and Type 2 Substances (mg/Nm^3)	As per TM-12, TM-13 and TM-14	0.561	0.554
Sb (mg/Nm^3)		0.00682	0.00648
As (mg/Nm^3)		0.0418	0.0409
Be (mg/Nm^3)		0.000981	0.000888
Cd (mg/Nm^3)		0.0120	0.0113
Cr (mg/Nm^3)		0.0517	0.0493
Co (mg/Nm^3)		0.00478	0.00476
Cu (mg/Nm^3)		0.237	0.245
Pb (mg/Nm^3)		0.122	0.119
Mn (mg/Nm^3)		0.192	0.195
Hg (mg/Nm^3)		0.0311	0.0287
Ni (mg/Nm^3)		0.0239	0.0243
Se (mg/Nm^3)		0.00708	0.00748
Sn (mg/Nm^3)		0.0565	0.0567
V (mg/Nm^3)		0.00919	0.00896
Smoke (Opacity)	6 minutes	7.8% opacity (average), 20% opacity (maximum)	7.8% opacity (average), 20% opacity (maximum)

Note: TM = Test Method stated in the Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales (DEC 2005b)

3.3 Stack 3 Emissions

The expected emissions that will be discharged from Stack 3 during all phases of the mill expansion are unchanged from the values presented in the EA.

4. COMPARISION WITH REGULATORY LIMITS

The updated emissions from the new recovery boiler and lime kiln are compared in Table 9 and Table 10 respectively to the Group 6 limits specified in the POEO (Clean Air) Regulation. The emissions from the gas boiler, updated as a result of the refined flow rate, are compared in Table 11. There has been no change to the multi fuel boiler or gas turbine emission concentrations, and hence these continue to comply with the Group 6 limits as outlined in the EA.

The updated data show that the new recovery boiler, new lime kiln and the gas boiler comply with the Group 6 limits.

Table 9 Comparison to Regulatory Limits – New Recovery Boiler

Parameter	**Averaging Period**	**Expected Emissions** (at 8% O_2)	**POEO (Clean Air) Group 6 Limit** (as gazetted)
Cl (mg/Nm^3)	1 hour	3.67	200
NO_x (mg/Nm^3)	1 hour	205	300
HCl (mg/Nm^3)	1 hour	48.1	100
SO_2 (mg/Nm^3)	1 hour	88.0	-
TSP (mg/Nm^3)	As per TM-15	50.0	50
Sulfuric Acid Mist as SO_3 (mg/Nm^3)	As per TM-3	15.3	100
Dioxins as TCDD equivalent (ng/Nm^3)	As per TM-18	0.0433	0.1
HF (mg/Nm^3)	As per TM-10	0.433	50
TRS as H_2S (mg/Nm^3)	1 hour	3.00	4
H_2S (mg/Nm^3)	1 hour	3.00	5
VOCs (mg/Nm^3)	1 hour	37.1	40
Methanol (kg/t of black liquor solids fired)	24 hours	0.0120	0.0120
Type 1 and Type 2 Substances (mg/Nm^3)	As per TM-12, TM-13 and TM-14	0.495	1
Sb (mg/Nm^3)		0.00341	-
As (mg/Nm^3)		0.0333	-
Be (mg/Nm^3)		0.0000317	-
Cd (mg/Nm^3)		0.00534	0.2
Cr (mg/Nm^3)		0.0277	-
Co (mg/Nm^3)		0.00451	-
Cu (mg/Nm^3)		0.317	-

Parameter	Averaging Period	Expected Emissions (at 8% O_2)	POEO (Clean Air) Group 6 Limit (as gazetted)
Pb (mg/Nm^3)		0.0871	-
Mn (mg/Nm^3)		0.222	-
Hg (mg/Nm^3)		0.00700	0.2
Ni (mg/Nm^3)		0.0285	-
Se (mg/Nm^3)		0.0111	-
Sn (mg/Nm^3)		0.0578	-
V (mg/Nm^3)		0.00689	-

Table 10 Comparison to Regulatory Limits – New Lime Kiln

Parameter	Averaging Period	Expected Emissions (at 8% O_2)	POEO (Clean Air) Group 6 Limit (as gazetted)
Cl (mg/Nm^3)	1 hour	3.67	200
NO_x (mg/Nm^3)	1 hour	290	400
HCl (mg/Nm^3)	1 hour	48.1	100
SO_2 (mg/Nm^3)	1 hour	34.0	-
TSP (mg/Nm^3)	As per TM-15	28.0	50
Sulfuric Acid Mist as SO_3 (mg/Nm^3)	As per TM-3	15.3	100
Dioxins as TCDD equivalent (ng/Nm^3)	As per TM-18	0.0433	0.1
HF (mg/Nm^3)	As per TM-10	0.433	50
TRS as H_2S (mg/Nm^3)	1 hour	4.00	4
H_2S (mg/Nm^3)	1 hour	4.00	5
VOCs (mg/Nm^3)	1 hour	28.9	40
Methanol (kg/t of black liquor solids fired)	24 hours	0	0.0120
Type 1 and Type 2 Substances (mg/Nm^3)	As per TM-12, TM-13 and TM-14	0.495	1
Sb (mg/Nm^3)		0.00341	-
As (mg/Nm^3)		0.0333	-
Be (mg/Nm^3)		0.0000317	-
Cd (mg/Nm^3)		0.00534	0.2
Cr (mg/Nm^3)		0.0277	-
Co (mg/Nm^3)		0.00451	-
Cu (mg/Nm^3)		0.317	-

Parameter	Averaging Period	Expected Emissions (at 8% O_2)	POEO (Clean Air) Group 6 Limit (as gazetted)
Pb (mg/Nm^3)		0.0871	-
Mn (mg/Nm^3)		0.222	-
Hg (mg/Nm^3)		0.00700	0.2
Ni (mg/Nm^3)		0.0285	-
Se (mg/Nm^3)		0.0111	-
Sn (mg/Nm^3)		0.0578	-
V (mg/Nm^3)		0.00689	-

Table 11 Comparison to Regulatory Limits – Natural Gas Boiler

Parameter	Averaging Period	Expected Emissions (at 8% O_2)	POEO (Clean Air) Group 6 Limit (as gazetted)
NO_x (mg/Nm^3)	1 hour	84.2	300
SO_2 (mg/Nm^3)	1 hour	0.314	-
TSP (mg/Nm^3)	As per TM-15	4.57	50
VOCs (mg/Nm^3)	1 hour	3.31	40
Type 1 & 2 Substances (mg/Nm^3)	As per TM-12, TM-13 and TM-14	0.00366	1
As (mg/Nm^3)		0.000120	-
Be (mg/Nm^3)		0.00000714	-
Cd (mg/Nm^3)		0.000676	0.2
Cr (mg/Nm^3)		0.000827	-
Co (mg/Nm^3)		0.0000488	-
Cu (mg/Nm^3)		0.000526	-
Pb (mg/Nm^3)		0.000301	-
Mn (mg/Nm^3)		0.000229	-
Hg (mg/Nm^3)		0.000158	0.2
Ni (mg/Nm^3)		0.00128	-
Se (mg/Nm^3)		0.0000142	-

5. AIR QUALITY IMPACT ASSESSMENT – DISPERSION MODELLING

The air quality impact assessment presented in the EA has been revised by Holmes Air Science. This has included re-modelling of the dispersion of the emissions to air discharged from the stacks (Appendix A). The modelling approach was the same as for the EA, using the CALPUFF model, and has been undertaken in accordance with the Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales (DEC 2005c).

5.1 Impact Assessment Criteria

The aim of the revised air quality impact assessment was to determine whether air emissions would comply with the impact assessment criteria, as defined by DECC in Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales (DEC 2005c). The impact assessment criteria for species modelled by Holmes Air Sciences are provided in Table 12 below.

Table 12 Air Quality Impact Assessment Criteria

Substance	Averaging Period	Percentile	Impact Assessment Criteria (µg/m^3)
CO	1-h maximum	100	30,000
Cl	1-h maximum	99.9	50
NO_x	1-h maximum	100	-
	Annual	100	62
NO_2	1-h maximum	100	246
HCl	1-h maximum	99.9	140
SO_2	1-h maximum	100	570
	24-h maximum	100	228
	Annual	100	60
TSP as PM_{10}	24-h maximum	100	50
	Annual	100	30
Sulfuric Acid Mist as SO_3	1-h maximum	99.9	18
Dioxins as TCDD equivalent	1-h maximum	99.9	0.000002
HF	24-h maximum	100	1.5
TRS as H_2S	Nose response time	99	1.38 (>2,000 people) 4.83 (2 people)
VOCs	-	-	-
Methanol	1-h maximum	99.9	3,000

Substance	Averaging Period	Percentile	Impact Assessment Criteria (µg/m^3)
Type 1 and Type 2 Substances	-	-	-
Sb	1-h maximum	99.9	9
As	1-h maximum	99.9	0.09
Be	1-h maximum	99.9	0.004
Cd	1-h maximum	99.9	0.018
Cr	1-h maximum	99.9	0.09
Co	-	-	-
Cu	1-h maximum	99.9	18
Pb	Annual	100	0.5
Mn	1-h maximum	99.9	18
Hg	1-h maximum	99.9	0.18
Ni	1-h maximum	99.9	0.18
Se	-	-	-
Sn	-	-	-
V	-	-	-

5.2 Mill Expansion – Phase 1a

The dispersion model results for actual air emissions during Phase 1a of the mill expansion are provided in Table 13, which shows the maximum predicted ground level concentrations compared with their respective impact assessment criteria for the appropriate averaging time and percentile.

Table 13 Maximum Ground Level Concentrations - Mill Expansion Phase 1a

Substance	Averaging Period	Percentile	Ground Level Concentration (µg/m^3)		Impact Assessment Criteria (µg/m^3)
			(750 tds/day)	(900 tds/day)	
CO	1-h maximum	100	184	193	30,000
Cl	1-h maximum	99.9	1.36	1.48	50
NO_x	1-h maximum	100	197	193	-
	Annual	100	2.45	2.48	62
NO_2	1-h maximum	100	39.3	38.5	246
HCl	1-h maximum	99.9	21.7	24.3	140
SO_2	1-h maximum	100	136	142	570
	24-h maximum	100	20.5	21.0	228

Substance	Averaging Period	Percentile	Ground Level Concentration (µg/m^3)		Impact Assessment Criteria (µg/m^3)
			(750 tds/day)	(900 tds/day)	
	Annual	100	1.91	1.92	60
TSP as PM_{10}	24-h maximum	100	4.35	4.56	50
	Annual	100	0.414	0.423	30
Sulfuric Acid Mist as SO_3	1-h maximum	99.9	5.67	6.16	18
Dioxins as TCDD equivalent	1-h maximum	99.9	0.0000000162	0.0000000176	0.000002
HF	24-h maximum	100	0.0446	0.0472	1.5
TRS as H_2S	Nose response time	99	0.76 (maximum at a single residence) 3.71 (maximum in model domain)	0.80 (maximum at a single residence) 3.82 (maximum in model domain)	1.38 (>2,000 people) 4.83 (2 people)
VOCs	-	-	-	-	-
Methanol	1-h maximum	99.9	0.879	0.910	3,000
Type 1 and Type 2 Substances					
Sb	1-h maximum	99.9	0.00126	0.00137	9
As	1-h maximum	99.9	0.0123	0.0134	0.09
Be	1-h maximum	99.9	0.0000117	0.0000128	0.004
Cd	1-h maximum	99.9	0.00197	0.00214	0.018
Cr	1-h maximum	99.9	0.0103	0.0112	0.09
Cu	1-h maximum	99.9	0.117	0.128	18
Pb	Annual	100	0.000856	0.000873	0.5
Mn	1-h maximum	99.9	0.0819	0.0890	18
Hg	1-h maximum	99.9	0.00260	0.00283	0.18
Ni	1-h maximum	99.9	0.0106	0.0115	0.18

When compared against the impact assessment criteria, the maximum predicted ground level concentrations for all species discharged during Phase 1a of the mill expansion comply with the impact assessment criteria.

5.3 Mill Expansion – Phase 1b

The dispersion model results for actual air emissions during Phase 1b of the mill expansion are provided in Table 14, which shows the maximum predicted ground level concentrations compared with their respective impact assessment criteria for the appropriate averaging time and percentile.

Table 14 Maximum Ground Level Concentrations - Mill Expansion Phase 1b

Substance	**Averaging Period**	**Percentile**	**Ground Level Concentration (µg/m^3)**		**Impact Assessment Criteria (µg/m^3)**
			(750 tds/day)	(900 tds/day)	
CO	1-h maximum	100	202	195	30,000
Cl	1-h maximum	99.9	1.10	1.16	50
NO_x	1-h maximum	100	164	166	-
	Annual	100	2.15	2.19	62
NO_2	1-h maximum	100	32.8	33.3	246
HCl	1-h maximum	99.9	18.9	19.8	140
SO_2	1-h maximum	100	144	140	570
	24-h maximum	100	19.1	19.6	228
	Annual	100	1.69	1.71	60
TSP as PM_{10}	24-h maximum	100	3.61	3.84	50
	Annual	100	0.299	0.311	30
Sulfuric Acid Mist as SO_3	1-h maximum	99.9	4.60	4.85	18
Dioxins as TCDD equivalent	1-h maximum	99.9	0.0000000122	0.0000000149	0.000002
HF	24-h maximum	100	0.0381	0.0402	1.5
TRS as H_2S	Nose response time	99	0.64 (maximum at a single residence) 3.07 (maximum in model domain)	0.67 (maximum at a single residence) 3.19 (maximum in model domain)	1.38 (>2,000 people) 4.83 (2 people)
VOCs	-	-	-	-	-
Methanol	1-h maximum	99.9	0.632	0.668	3,000
Type 1 and Type 2 Substances					

Substance	Averaging Period	Percentile	Ground Level Concentration (µg/m^3)		Impact Assessment Criteria (µg/m^3)
			(750 tds/day)	(900 tds/day)	
Sb	1-h maximum	99.9	0.00102	0.00108	9
As	1-h maximum	99.9	0.00998	0.0105	0.09
Be	1-h maximum	99.9	0.0000103	0.0000108	0.004
Cd	1-h maximum	99.9	0.00167	0.00175	0.018
Cr	1-h maximum	99.9	0.00840	0.00886	0.09
Cu	1-h maximum	99.9	0.0952	0.100	18
Pb	Annual	100	0.000638	0.000661	0.5
Mn	1-h maximum	99.9	0.0664	0.0699	18
Hg	1-h maximum	99.9	0.00213	0.00224	0.18
Ni	1-h maximum	99.9	0.00870	0.00917	0.18

When compared against the impact assessment criteria, the maximum predicted ground level concentrations for all species discharged during Phase 1a of the mill expansion comply with the impact assessment criteria.

5.4 Mill Expansion – Phase 2

The dispersion model results for actual air emissions during Phase 2 of the mill expansion are provided in Table 15, which shows the maximum predicted ground level concentrations compared with their respective impact assessment criteria for the appropriate averaging time and percentile.

Table 15 Maximum Ground Level Concentrations - Mill Expansion Phase 2

Substance	Averaging Period	Percentile	Ground Level Concentration (µg/m^3)		Impact Assessment Criteria (µg/m^3)
			(750 tds/day)	(900 tds/day)	
CO	1-h maximum	100	211	202	30,000
Cl	1-h maximum	99.9	17.1	15.6	50
NO_x	1-h maximum	100	221	233	-
	Annual	100	3.48	3.52	62
NO_2	1-h maximum	100	44.3	46.5	246
HCl	1-h maximum	99.9	29.1	29.1	140
SO_2	1-h maximum	100	164	156	570
	24-h maximum	100	24.2	24.2	228
	Annual	100	2.08	2.06	60

Substance	Averaging Period	Percentile	Ground Level Concentration (µg/m^3)		Impact Assessment Criteria (µg/m^3)
			(750 tds/day)	(900 tds/day)	
TSP as PM_{10}	24-h maximum	100	4.79	4.97	50
	Annual	100	0.398	0.404	30
Sulfuric Acid Mist as SO_3	1-h maximum	99.9	6.87	6.75	18
Dioxins as TCDD equivalent	1-h maximum	99.9	0.0000000245	0.0000000246	0.000002
HF	24-h maximum	100	0.125	0.121	1.5
TRS as H_2S	Nose response time	99	0.64 (maximum at a single residence) 3.07 (maximum in model domain)	0.67 (maximum at a single residence) 3.19 (maximum in model domain)	1.38 (>2,000 people) 4.83 (2 people)
VOCs	-	-	-	-	-
Methanol	1-h maximum	99.9	0.632	0.668	3,000
Type 1 and Type 2 Substances					
Sb	1-h maximum	99.9	0.00226	0.00217	9
As	1-h maximum	99.9	0.0159	0.0156	0.09
Be	1-h maximum	99.9	0.000254	0.000230	0.004
Cd	1-h maximum	99.9	0.00387	0.00369	0.018
Cr	1-h maximum	99.9	0.0175	0.0168	0.09
Cu	1-h maximum	99.9	0.111	0.115	18
Pb	Annual	100	0.00107	0.00105	0.5
Mn	1-h maximum	99.9	0.0841	0.0854	18
Hg	1-h maximum	99.9	0.00903	0.00832	0.18
Ni	1-h maximum	99.9	0.0106	0.0109	0.18

When compared against the impact assessment criteria, the maximum predicted ground level concentrations for all species discharged during Phase 2 of the mill expansion are in compliance with the impact assessment criteria.

6. ODOROUS EMISSIONS

The potential sources of odorous emissions at the Tumut mill, following the expansion, are unchanged from those outlined in the EA report. Emissions from stack sources are not the most significant contributors to overall odorous emissions at the site.

The recovery boiler and lime kiln are the most significant sources of the odorous emissions from Stack 1 and 2. The gas and multi fuel boilers are not expected to contribute to the odorous emissions. The changes to the Phases of the mill expansion are not expected to materially impact the results of the dispersion modelling of the odorous emissions from the mill that were presented in the EA. This is due to:

- The overall concentrations of emissions from the stack sources are not expected to vary in a significant manner from those presented in the EA. The TRS concentration specified by the supplier for the operating capacities of 900 tds/day and 750 tds/day are the same, and whilst only a combined TRS concentration from the recovery boiler and lime kiln was able to be specified in the EA, these data and the new supplier data are expected to be consistent.
- The overall odorous emissions will remain unchanged in new Phased approach. Further, Stack 1 and 2 are located only approximately 50 m apart at the site and the plumes from these stacks are expected to interact resulting in the same odour profile as outlined in the EA.
- The discharge velocity from Stacks 1 and 2 in Phases 1 and 2 in the EA was 15.4 m/s. In the new Phase 1b, the velocity from Stack 1 will be 17 m/s and from Stack 2, when this stack is only serving the recovery boiler, will be 11.1 m/s at 750 tds/day and 13.3 m/s at 900 tds/day. Therefore the variation in discharge velocities is not significant. As well, the exhaust discharge temperature for the stacks will be as specified in the EA; there is no drop in temperature when the recovery boiler only is discharging from Stack 2 and hence no loss of buoyancy.
- The results of the modelling presented in Section 5 show that emissions of TRS for all three proposed Phases of the expansion will comply with the impact assessment criteria.

Therefore remodelling of the odorous emissions is not necessary and the changes to the Phases of the expansion are not expected to result in any odour impacts beyond those predicted in the EA.

7. CONCLUSIONS

The data in this report indicate that, when installed, all of the new air emission sources at the expanded Visy mill will meet the NSW impact assessment criteria for air emissions at ground level. Compliance will be achieved throughout all three phases of the expansion.