Conclusion and Recommendations for Future Work

7.1 *Conclusions*

An emission inventory for an industrial area covering a land area of 700 hectares had been prepared and a system for calculations had been described. Though the Clean Air 2000 identified the need this is the first such attempt carried out in Sri Lanka involving area sources and a defined land area.

• The summary of Total emission calculated for the Sapugaskanda area, based on modified emission factors is tabulated below.

Emissions (Metric tons / Year)			
SO_2	CO_2	NOx	SPM
13,331	1,070,608	17,166	323

• The following emission factors have been determined from basic calculations. The factors are

$$EF_{SO2} = 2 \times C_{S\ fual} \times \alpha_S \times \rho \times 10^{-2} \times (1 - \eta.\beta)$$

$$EF_{CO2} = \frac{44}{12} \times C_{C\ fuel} \times \alpha_c \times \rho \times 10^{-2}$$

$$EF_{NOx} = (n_{N2} \times \alpha_{NOx} + n_{Fuel}) \times M$$

$$EF_{TSP} = (n_C \times \alpha_{SPM} \times M + P_{Ash})$$

It is to be noted that the proposed standards for source emissions in Sri Lanka follows the use of factors based on power output and this needs to be given serious consideration for accuracy and relevance.

• Emission factors have been calculated based on power input data and is different from the normal method followed. This method is strongly recommended in preparation of emission inventories for small-scale thermal power plants. This will avoid the discrepancies in estimation of emissions.

• The predicted air pollution levels are quite high where as the monitored ambient vales gives small values for the same parameter. To avoid such discrepancy, it is recommended by reviewing our study that the monitoring locations should be selected according to the model out put predicted by using the local meteorology conditions at the site.

• Every air quality dispersion model requires validation to produce acceptable predictions. This involves lot of tricky field measurements as well as modifications. In this study, the attention was not paid to validate our dispersion model due to lack of time and resources.

It is observed that the ambient SO_2 level has exceeded its standard at some location in Sapugaskanda area. At the moment, other traditional gaseous pollutant has less tendency to exceeds their ambient standard levels since those values are quite high and the ambient levels of corresponding pollutant is less. Therefore, it is recommended to use fuels, which has less sulphur content in order to maintain ambient SO_2 levels around Sapugaskanda without installing remedial measures. This could be easily achieved by modifying or upgrading the refinery to produce clean fuel or requesting the power plant owners to use clean fuel. However, it is practicable in enforcing that the refinery change their processes to give clean fuel otherwise

enforcing several institutes to use clean fuel or asking to take any other remedial measures might be difficult.

7.1 Recommendations for Future Work

• Development of complete emission inventory at a national level is crucial for the sustainable development of the country. The best way of doing this task is use the same methodology followed in this study to develop emission inventories for every Industrial Zones in the country. Then the preparation of a National Emission Inventory would be a matter of combining individual unites.

• Atmospheric emission load is a dynamic aspect everywhere in the world. Therefore, regular updating of emission database is essential for better air pollution management systems. This has to be carried out as an organised activity involving monitoring institutions in both air pollution effects as well as meteorology.

• It is important to address the shortcomings identified earlier in future modeling efforts. Careful attention should be paid on the model output in forecasting the future trends in air pollution at the Sapugaskanda area. Establishment of monitoring stations in a proper manner is quite important in supporting predictive modeling.

• Air emission inventories can provide useful data for climate change studies. The coordination and knowledge transfer among the relevant organisation is therefore vital.

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APPENDIX 01

27 September 1998 – Sunday Times

Give US Fresh air

By K.M Weeraratne

Accusing the Environment Minister of doing precious little to combat air pollution in Colombo and the suburbs, a top environmental lawyer has petitioned the Supreme Court, stating that the people's right to breathe fresh air has been violated.

The petitioner, Lalanath de Silva, has cited Environment Minister Nandimithra Ekanayake and the Attorney General as respondents in the fundamental rights case, accusing them of violating the fundamental right of the people to breathe air of reasonable quality. Mr. de Silya states that chapters 3 and 4 of the Constitution recognise the right to life as a fundamental right and that the Supreme Court has ample power to grant redress under Article 126 for violation of this fundamental right.

He also says the right to life also includes a right to an environment adequate for such life and further includes a right to breathe air of reasonable quality that support such life.

Mr. De Silva says the minister has an obligation in law to ensure, through the appropriate exercise of his powers under the law, that the quality of air in Colombo is maintained at levels that are adequate for him and other members of the public to lead a healthy life.

He states that he had written to the minister, asking him to exercise his ministerial powers to enact air emission standards but the minister had not even extended the courtesy of an acknowledgement to his letter.

'The minister has failed to enact the air pollution standards thereby allowing the air quality in the city of Colombo to continue to deteriorate due to increasing vehicular emissions and has thereby through administrative and executive inaction Violated the fundamental right to health and life," Mr. de Silva alleges.

He is seeking leave to proceed with this case relating to the violation of right to life and a declaration by court that the minister has by his failure to enact regulations fixing all and/or any one of the following standards, violated the petitioners fundamental right to life — (i) mobile air emissions standards, (ii) fuel standards and (iii) specifications standards for import of vehicles.

APPENDIX 02

Traffic count data at Sapugaskanda area

Bus/Lorry

Road :Gonawala (Route No. 230)

Date	Time(hrs)					Total
	6:00-10:00	10:00-14:00	14:00-18:00	18:00-22:00	22:00-24:00	
Saturday-19-Jun-99	-	-	22	28	6	
Sunday-20-Jun-99	52	52	50	15	-	
Monday-21-Jun-99	44	47	45	34	3	
Tuesday-22-Jun-99	43	40	51	37	-	
Wednesday-23-Jun-99	68	52	59	41	-	
Thursday-24-Jun-99	44	52	51	37	-	
Friday-25-Jun-99	66	61	52	44	3	
Saturday-26-Jun-99	50	61	62	29	1	
Sunday-27-Jun-99	27	52	41	18	11	
Monday-28-Jun-99	28	4	-	-	-	
Average	47	47	48	31	5	178

Road :Bollegala (Route No. 228)

Monday-28-Jun-99	-	170	-	453	-	
Tuesday-29-Jun-99	516	471	560	293	-	
Wednesday-30-Jun-99	539	715	710	442	-	
Thursday-01-Jul-99	564	702	686	345	-	
Friday-02-Jul-99	554	704	645	403	-	
Saturday-03-Jul-99	537	598	592	295	-	
Sunday-04-Jul-99	256	403	335	234	-	
Average	494	538	588	352	-	1972

Van / Jeep

Road :Gonawala (Route No. 230)

Date	Time					Total
	6:00-10:00	10:00-14:00	14:00-18:00	18:00-22:00	22:00-24:00	
Saturday-19-Jun-99	-	-	32	92	19	
Sunday-20-Jun-99	92	87	99	44		
Monday-21-Jun-99	112	80	87	112	11	
Tuesday-22-Jun-99	112	91	100	124	-	
Wednesday-23-Jun-99	124	96	111	107	-	
Thursday-24-Jun-99	111	106	96	122	-	
Friday-25-Jun-99	119	104	124	124	13	
Saturday-26-Jun-99	99	86	100	96	3	
Sunday-27-Jun-99	61	72	90	93	6	
Monday-28-Jun-99	49	45	-	-	-	
Average	98	85	93	102	10	388

Road :Bollegala (Route No. 228)

Monday-28-Jun-99	-	242	785	-	-	
Tuesday-29-Jun-99	390	375	408	472	-	
Wednesday-30-Jun-99	403	323	427	489	-	
Thursday-01-Jul-99	414	390	453	371	-	
Friday-02-Jul-99	363	351	392	388	-	
Saturday-03-Jul-99	380	477	465	330	-	
Sunday-04-Jul-99	237	299	316	408	-	
Average	365	351	464	410	-	1589

Car

Road :Gonawala (Route No. 230)

Date	Time					Total
	6:00-10:00	10:00-14:00	14:00-18:00	18:00-22:00	22:00-24:00	
Saturday-19-Jun-99	-	-	13	36	7	
Sunday-20-Jun-99	18	41	48	17	-	
Monday-21-Jun-99	24	17	8	30	4	
Tuesday-22-Jun-99	19	22	18	40	-	
Wednesday-23-Jun-99	24	16	33	31	-	
Thursday-24-Jun-99	19	20	14	33	-	
Friday-25-Jun-99	28	29	11	27	1	
Saturday-26-Jun-99	26	31	29	30	1	
Sunday-27-Jun-99	23	24	16	27	2	
Monday-28-Jun-99	16	4	-	-	-	
Average	22	23	21	30	3	99

Road :Bollegala (Route No. 228)

Monday-28-Jun-99	-	86	-	245	-	
Tuesday-29-Jun-99	100	68	94	92	-	
Wednesday-30-Jun-99	94	78	103	135	-	
Thursday-01-Jul-99	108	58	79	115	-	
Friday-02-Jul-99	90	62	90	142	-	
Saturday-03-Jul-99	73	92	96	109	-	
Sunday-04-Jul-99	58	105	110	154	-	
Average	87	78	95	142	-	403

Motor Cycles

Road :Gonawala (Route No. 230)

Date	Time					Total
	6:00-10:00	10:00-14:00	14:00-18:00	18:00-22:00	22:00-24:00	
Saturday-19-Jun-99	-	-	52	193	18	
Sunday-20-Jun-99	149	139	146	103	-	
Monday-21-Jun-99	145	78	61	190	29	
Tuesday-22-Jun-99	132	149	122	214	-	
Wednesday-23-Jun-99	154	113	151	168	-	
Thursday-24-Jun-99	144	107	111	203	-	
Friday-25-Jun-99	144	91	120	177	14	
Saturday-26-Jun-99	138	124	140	181	8	
Sunday-27-Jun-99	147	157	144	143	10	
Monday-28-Jun-99	88	30	-	-	-	
Average	138	110	116	175	16	554

Road: Bollegala (Route No. 228)

Monday-28-Jun-99	-	271	-	630	-	
Tuesday-29-Jun-99	382	231	306	496	-	
Wednesday-30-Jun-99	380	263	309	386	-	
Thursday-01-Jul-99	296	203	299	407	-	
Friday-02-Jul-99	337	272	241	325	-	
Saturday-03-Jul-99	365	297	274	335	-	
Sunday-04-Jul-99	280	445	398	344	-	
Average	340	283	305	418	-	1345

Three Wheelers

Road :Gonawala (Route No. 230)

Date	Time					Total
	6:00-10:00	10:00-14:00	14:00-18:00	18:00-22:00	22:00-24:00	
Saturday-19-Jun-99	-	-	30	100	13	
Sunday-20-Jun-99	41	77	67	40		
Monday-21-Jun-99	56	47	35	79	7	
Tuesday-22-Jun-99	33	61	51	88	-	
Wednesday-23-Jun-99	30	48	49	76	-	
Thursday-24-Jun-99	39	58	30	102	-	
Friday-25-Jun-99	48	51	58	85	5	
Saturday-26-Jun-99	57	87	69	92	-	
Sunday-27-Jun-99	30	54	69	87	5	
Monday-28-Jun-99	41	15	-	-	-	
Average	42	55	51	83	8	239

Road: Bollegala (Route No. 228)

Monday-28-Jun-99	-	168	-	486	-	
Tuesday-29-Jun-99	183	117	155	245	-	
Wednesday-30-Jun-99	126	184	138	245	-	
Thursday-01-Jul-99	126	172	146	179	-	
Friday-02-Jul-99	136	162	135	172	-	
Saturday-03-Jul-99	147	150	164	195	-	
Sunday-04-Jul-99	105	215	188	239	-	
Average	137	167	154	252	-	710

Others

Road :Gonawala (Route No. 230)

Date	Time					Total
	6:00-10:00	10:00-14:00	14:00-18:00	18:00-22:00	22:00-24:00	
Saturday-19-Jun-99	-	-	4	4	-	
Sunday-20-Jun-99	7	7	3	-	-	
Monday-21-Jun-99	2	9	8	8	1	
Tuesday-22-Jun-99	5	7	2	8	-	
Wednesday-23-Jun-99	3	2	14	2	-	
Thursday-24-Jun-99	5	7	9	1	-	
Friday-25-Jun-99	2	7	-	4	-	
Saturday-26-Jun-99	4	6	6	3	-	
Sunday-27-Jun-99	1	1	-	6	-	
Monday-28-Jun-99	3	5	-	-	-	
Average	4	6	7	5	1	21

Road: Bollegala (Route No. 228)

Monday-28-Jun-99	-	11	-	39	-	
Tuesday-29-Jun-99	18	43	52	16	-	
Wednesday-30-Jun-99	23	25	49	52	10	
Thursday-01-Jul-99	21	81	69	11	-	
Friday-02-Jul-99	38	71	48	3	-	
Saturday-03-Jul-99	6	77	55	37	-	
Sunday-04-Jul-99	26	42	20	6	-	
Average	22	50	49	23	10	154

Computation of Vehicle – Kilometer

Crossings	Distance (km)	Bus/Lorry		Van/Jeep	
		Number	Vehicle-km	Number	Vehicle-km
Gonawala (R. No. 230)	10	178	1780	388	3880
Bollegala (R. No. 228)	10	1972	19720	1589	15890

Crossings	Distance (km)	Cars		Motor Cycles	
		Number	Vehicle-km	Number	Vehicle-km
Gonawala (R. No. 230)	10	99	990	554	5540
Bollegala (R. No. 228)	10	403	4030	1345	13450

Crossings	Distance (km)	Three wheelers		Other	
		Number	Vehicle-km	Number	Vehicle-km
Gonawala (R. No. 230)	10	239	2390	21	210
Bollegala (R. No. 228)	10	710	7100	154	1540

APPENDIX 03

ASIA POWER (PVT) LTD
80, Nawam Mawatha, Colombo 2, Sri Lanka

Tel No : 941 332514-5
Fax No : 94 74 712857
e-mail : kda@eureka.lk

To: NBRO Fax No: 01 502611

Attention: Mr Jasinghe / MrPriyantha Samarakkody

From: Kosala Abeysiriwardena Our Ref:AppIINBRO/240300

Subject: Emission Data Date: 24 March 2000

Total No **of Pages** 01

If any missing or illegible pages please phone us immediately

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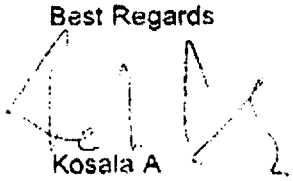
Dear Mr Jasinghe

Please find below the best figures that I could find. Some of the other figures do not seem realistic. Hope this will be of some use to you.

Emission Data- Asia Power

% Sulphur	SO2(mg/M3)	NOX(mg/M3)	% O2
2.80	835	1732	13.3
2.88	880	1667	13.7
2.66	614	1478	12.3
2.43	684	1557	12.7
3.06	940	1890	14.2

Best Regards



Kosala A

Calculation of Nitrogen present in the mixed air

Consider the empirical formula of Hydrocarbon compound ($C_xH_yS_zO_p$).

The stoichiometric Oxygen requirement for complete combustion of 1 mole of $C_xH_yS_zO_p$ is given by

$$n_{stoichiometric\,Oxygen} = x + \frac{y}{4} + z - p$$

But the dry air contains only 21 % of Oxygen. Therefore, the dry airflow to the burner is given by

$$n_{dry} = n_{stoic}\left(\frac{1+E}{0.21}\right)$$

where;
n_{dry} – Mole of dry air
E – excess air supplied

$$n_{Total} = n_{Dry}(1+H)$$

where,

H – relative humidity express as (mole H_2O/mole dry air)

Canceling the like terms we find

$$n_{Totalout} = x + \frac{y}{2} + n_{Stoic}\left\{\left(\frac{1+E}{0.21}\right)(1+H) - 1\right\}$$

where
n_{Total} – Total mole of dry air to be introduced

Total Nitrogen present in the mixed air can be found by solving the following equation.

$$n_{N2} = n_{Dry} \times 0.79$$

Where 0.79 accounts for the Nitrogen present in the dry air and n_{N2} is the mole of Nitrogen present in the mixed air per mole of $C_xH_yS_zO_p$.

APPENDIX 04

DANAK

Test Report

No. 198/399

Assignor.	BWSC A/S	1998.07.03
	Gydevang *35*	506-8-8073
	DK-3450 Allerod	kuk/mnklinf
	Denmark	Page 1 of 8
		9 appendices

Summary:

In 2 stacks from 8 diesel engines at Sapugaskanda BOO Diesel Power Station, Sri Lanka, DTI Environment has carded out measurements of the particulate emission and tested the grey level of the smoke fume according to Ringelmann scale.

The measurements were performed according to VDI 2066/EPA Method 17 and BS 2742 at *75%* and 100% MCR by measuring engineer P. Jessen on June 10-19, 1998.

The main results calculated as a arithmetic mean value of 2 measurements appear from the following table:

Engine No.	Particulate emission 75%MCR mg/Nm^3, 15% 02	100%MCR mg/Nm^3, 15% 0,
	21+4	23+4
2	21+4	22+4
3	21+4	21+4
4	19+4	17+4
5	21+4	24+4
6	18+4	18+4
7	21+4	19+4
8	18+4	21+4

The test of the grey level of the smoke fume showed at both 75 % and 100% MCR at any time < 1 (Ringelmann scale). The Ringelmann test is not included in Accreditation No. 198.

Division: DTI Environment

Signature:

Kent Uhre Knudsen
M.Sc. (Chemistry)

Mogens Kriegbaum
B.Sc. (Civil Eng.)

Testing conditions: Written consent form The Danish Technological Institute must be obtained before publication of excerpts from this Test Report. The test results only apply for the specific subject and in the period stated.

Dansk Teknologisk Institut

Arhus Teknologiparken
DK-8000 Arhus C

Telefon 89 438943

Gregersensvej
Postboks 141
DK-2630 Taastrup
Telefon 43504350

APPENDIX 05

Sample of Meteorological data collected at Sapugaskanda Area

Location Sapugaskanda
Parameter Wind Speed
Unit m/s

	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	Minimum	Maximum	Average
10-Aug-98	3.0	3.1	2.6	2.3	2.3	2.4	2.3	1.3	1.8	2.3	2.6	2.5	2.0	3.6	3.0	3.3	2.9	3.2	2.5	1.7	1.5	1.2	1.5	1.8	1.2	3.6	2.4
11-Aug-98	1.9	1.6	1.9	2.6	1.7	2.0	1.6	2.0	1.8	2.4	2.6	2.2	2.7	2.0	2.9	2.7	2.3	2.5	2.5	2.7	1.8	0.9	1.5	1.7	0.9	2.9	2.1
12-Aug-98	1.6	2.4	1.4	0.9	1.7	2.5	2.5	2.0	2.1	1.8	2.3	2.3	2.2	2.1	2.4	2.2	2.3	1.7	1.3	2.3	2.4	2.5	1.9	2.5	0.9	2.5	2.0
13-Aug-98	1.0	0.7	0.8	1.0	0.7	1.0	0.6	1.2	0.7	2.1	1.9	2.4	5.3	3.1	3.0	4.6	3.3	2.7	2.0	2.6	1.2	1.4	1.1	1.6	0.6	5.3	1.9
14-Aug-98	1.3	1.1	1.0	1.4	1.3	1.5	1.1	1.5	2.1	2.9	2.8	3.0	2.6	3.0	4.2	3.6	3.3	3.2	2.1	1.4	2.1	2.4	2.0	2.0	1.0	4.2	2.2
15-Aug-98	1.8	2.0	2.1	1.7	1.5	1.0	0.2	1.1	1.6	2.4	2.4	3.3	3.9	4.2	4.7	4.7	4.1	4.1	2.2	1.4	1.4	1.2	1.3	0.9	0.2	4.7	2.3
16-Aug-98	1.2	1.3	1.3	0.7	1.3	1.2	1.5	1.4	1.9	2.3	3.8	4.4	4.2	4.1	4.0	4.1	3.0	1.6	1.0	1.4	1.7	1.3	0.8	0.9	0.7	4.4	2.1
17-Aug-98	0.4	0.6	0.5	0.8	0.9	0.5	0.5	0.5	0.4	1.2	1.2	1.8	3.0	3.0	2.9	3.6	3.3	3.2	2.8	2.2	2.0	2.0	2.0	1.7	0.4	3.6	1.7
Minimum	0.4	0.6	0.5	0.7	0.7	0.5	0.2	0.5	0.4	1.2	1.2	1.8	2.0	2.0	2.4	2.2	2.3	1.6	1.0	1.4	1.2	0.9	0.8	0.9			
Maximum	3.0	3.1	2.6	2.6	2.3	2.5	2.5	2.0	2.1	2.9	3.8	4.4	5.3	4.2	4.7	4.7	4.1	4.1	2.8	2.7	2.4	2.5	2.0	2.5			
Average	1.5	1.6	1.5	1.4	1.4	1.5	1.3	1.4	1.6	2.2	2.5	2.7	3.2	3.1	3.4	3.6	3.1	2.8	2.1	2.0	1.8	1.6	1.5	1.6			

Parameter Wind Direction
Unit Degrees

	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	Minimum	Maximum	Average
10-Aug-98	244.2	240.5	243.0	243.6	243.5	242.1	243.2	253.1	250.8	248.9	261.5	250.8	264.6	241.4	245.8	248.7	247.5	240.3	208.0	210.9	234.0	180.2	168.7	195.6	168.7	264.6	235.5
11-Aug-98	219.1	187.7	207.1	240.5	250.8	245.8	244.0	239.7	252.8	248.9	245.6	259.1	255.8	263.5	248.3	249.5	247.8	243.0	241.8	242.6	233.2	214.1	236.5	231.6	187.7	263.5	239.5
12-Aug-98	226.7	240.0	246.8	247.3	248.0	241.3	242.5	244.8	243.9	251.7	245.3	260.1	269.7	284.9	277.3	269.6	262.9	276.2	244.8	242.1	243.5	243.2	243.1	239.9	226.7	284.9	251.5
13-Aug-98	213.2	194.2	142.9	127.2	126.9	149.5	86.0	135.3	187.3	246.6	246.6	253.3	238.9	250.5	247.1	238.9	243.1	239.1	237.4	241.8	219.2	160.5	141.5	152.1	86.0	253.3	196.6
14-Aug-98	166.3	153.8	142.4	159.5	141.0	150.3	156.6	165.3	185.3	212.4	226.4	204.7	201.0	204.6	210.8	217.9	234.6	205.4	211.5	194.3	199.8	225.6	217.9	192.0	141.0	234.6	190.8
15-Aug-98	187.0	191.5	193.9	184.3	168.9	151.7	183.3	118.1	135.4	234.4	231.5	215.5	229.4	223.9	232.0	218.6	210.1	203.2	184.2	176.6	124.0	144.7	135.4	144.7	118.1	234.4	184.3
16-Aug-98	169.3	159.0	147.6	152.9	137.9	139.8	135.8	153.4	158.9	201.6	209.5	217.4	229.3	240.6	241.2	239.4	243.1	219.7	184.0	163.7	169.6	155.0	132.0	144.2	132.0	243.1	181.0
17-Aug-98	112.5	130.0	110.6	112.4	95.4	119.0	107.3	122.1	138.2	255.4	263.4	261.6	242.0	245.5	243.0	233.4	223.9	214.6	204.2	203.6	199.5	190.6	183.1	217.4	95.4	263.4	184.5
Minimum	112.5	130.0	110.6	112.4	95.4	119.0	86.0	118.1	135.4	201.6	209.5	204.7	201.0	204.6	210.8	217.9	210.1	203.2	184.0	163.7	124.0	144.7	132.0	144.2			
Maximum	244.2	240.5	246.8	247.3	250.8	245.8	244.0	253.1	252.8	255.4	263.4	261.6	269.7	284.9	277.3	269.6	262.9	276.2	244.8	242.6	243.5	243.2	243.1	239.9			
Average	192.3	187.1	179.3	183.5	176.5	179.9	174.8	179.0	194.1	237.5	241.2	240.3	241.3	244.4	243.2	239.5	239.1	230.2	214.5	209.5	202.8	189.2	182.3	189.7			

Location Sapugaskanda
Parameter Ambient Temperature
Unit Degrees Celcius

	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	Minimum	Maximum	Average
10-Aug-98	27.0	27.0	26.9	26.8	26.8	26.7	26.6	26.8	27.2	27.6	27.9	28.1	28.5	28.6	28.7	28.4	28.2	27.8	27.2	27.0	27.1	26.7	26.4	26.8	26.4	28.7	27.4
11-Aug-98	26.9	26.6	26.5	26.9	26.8	26.8	26.4	26.5	27.3	27.8	28.3	28.8	28.9	28.8	28.7	28.6	28.4	28.0	27.7	27.2	27.2	27.0	26.9	26.6	26.4	28.9	27.5
12-Aug-98	26.4	26.8	26.3	26.3	26.4	26.5	26.4	26.5	27.2	27.7	28.0	28.7	28.7	29.1	29.2	29.0	28.5	28.1	27.6	27.3	27.1	27.1	27.1	27.0	26.3	29.2	27.5
13-Aug-98	26.3	26.0	25.5	25.5	25.4	25.5	25.4	25.7	26.3	27.4	28.0	29.0	29.5	29.7	29.3	28.1	27.9	27.6	27.4	27.1	27.0	26.5	26.2	26.0	25.4	29.7	27.0
14-Aug-98	25.8	25.6	25.4	25.4	25.4	25.3	25.0	25.5	26.9	28.1	28.9	29.5	30.3	30.8	29.9	28.6	28.7	27.7	27.5	27.1	27.0	27.2	27.1	26.9	25.0	30.8	27.3
15-Aug-98	26.8	26.5	26.4	26.2	26.2	26.1	25.9	26.0	26.7	27.9	28.8	29.5	30.1	30.0	30.0	28.8	27.6	27.4	27.0	26.4	26.0	25.9	25.6	25.5	25.5	30.1	27.2
16-Aug-98	25.4	25.4	25.4	25.2	25.2	25.1	24.9	25.0	25.9	27.0	28.4	29.2	29.8	29.7	29.9	29.5	28.7	26.8	26.2	25.9	25.6	25.4	25.3	24.9	24.9	29.9	26.7
17-Aug-98	24.9	24.6	24.6	24.2	24.3	24.2	24.2	24.5	26.4	28.0	28.3	29.2	29.1	29.2	29.6	29.2	27.9	27.8	27.3	27.0	26.9	26.7	26.6	26.7	24.2	29.6	26.7
Minimum	24.9	24.6	24.6	24.2	24.3	24.2	24.2	24.5	25.9	27.0	27.9	28.1	28.5	28.6	28.7	28.1	27.6	26.8	26.2	25.9	25.6	25.4	25.3	24.9			
Maximum	27.0	27.0	26.9	26.9	26.8	26.8	26.6	26.8	27.3	28.1	28.9	29.5	30.3	30.8	30.0	29.5	28.7	28.1	27.7	27.3	27.2	27.2	27.1	27.0			
Average	26.2	26.1	25.9	25.8	25.8	25.8	25.6	25.8	26.7	27.7	28.3	29.0	29.3	29.5	29.4	28.8	28.3	27.6	27.2	26.9	26.7	26.6	26.4	26.3			

Parameter Vertical Wind Speed
Unit m/s

	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	Minimum	Maximum	Average
10-Aug-98	0.110	0.076	0.068	0.064	0.074	0.053	0.096	0.164	0.140	0.114	0.154	0.143	0.334	0.038	0.055	0.147	0.062	0.065	0.082	0.048	0.071	0.017	0.010	0.066	0.010	0.334	0.094
11-Aug-98	0.028	0.041	0.071	0.052	0.007	0.057	0.009	0.070	0.123	0.186	0.082	0.100	0.238	0.281	0.092	0.157	0.211	0.017	0.086	0.097	0.049	0.003	0.007	0.045	0.003	0.281	0.088
12-Aug-98	0.013	0.079	0.004	0.006	0.006	0.111	0.114	0.055	0.068	0.151	0.075	0.295	0.393	0.355	0.314	0.340	0.302	0.339	0.966	0.075	0.122	0.105	0.092	0.075	0.004	0.966	0.186
13-Aug-98	0.008	0.021	0.024	0.023	0.027	0.024	0.061	0.023	0.024	0.025	0.070	0.156	0.199	0.119	0.206	0.185	0.046	0.055	0.066	0.088	0.051	0.006	0.014	0.029	0.006	0.206	0.065
14-Aug-98	0.021	0.009	0.019	0.002	0.018	0.026	0.014	0.011	0.016	0.101	0.079	0.118	0.037	0.076	0.171	0.146	0.064	0.001	0.053	0.013	0.081	0.019	0.037	0.058	0.001	0.171	0.050
15-Aug-98	0.043	0.042	0.039	0.002	0.007	0.017	0.057	0.014	0.012	0.059	0.072	0.056	0.013	0.008	0.000	0.153	0.142	0.149	0.048	0.005	0.027	0.018	0.016	0.019	0.000	0.153	0.042
16-Aug-98	0.023	0.018	0.038	0.034	0.010	0.024	0.023	0.010	0.015	0.065	0.159	0.136	0.042	0.059	0.023	0.133	0.049	0.000	0.009	0.027	0.028	0.002	0.005	0.004	0.000	0.159	0.039
17-Aug-98	0.007	0.014	0.002	0.007	0.009	0.007	0.012	0.017	0.041	0.154	0.220	0.269	0.029	0.053	0.186	0.001	0.081	0.140	0.122	0.091	0.098	0.050	0.049	0.017	0.001	0.269	0.070
Minimum	0.007	0.009	0.002	0.002	0.006	0.007	0.009	0.010	0.012	0.025	0.070	0.056	0.013	0.008	0.000	0.001	0.046	0.000	0.009	0.005	0.027	0.002	0.005	0.004			
Maximum	0.110	0.079	0.071	0.064	0.074	0.111	0.114	0.164	0.140	0.186	0.220	0.295	0.393	0.355	0.314	0.340	0.302	0.339	0.966	0.097	0.122	0.105	0.092	0.075			
Average	0.032	0.037	0.033	0.024	0.020	0.040	0.048	0.046	0.055	0.107	0.114	0.159	0.161	0.124	0.131	0.158	0.120	0.096	0.179	0.056	0.066	0.028	0.028	0.039			

Parameter : Rain Fall

Unit : mm

	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	Minimum	Maximum	Total
10-Aug-98	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-Aug-98	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.8	0.0	0.0	1.8	1.8
12-Aug-98	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.5
13-Aug-98	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14-Aug-98	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-Aug-98	0.0	0.0	0.0	0.0	0.0	0.0	1.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	1.3	0.3	0.0	0.0	0.0	0.0	1.8	3.6
16-Aug-98	0.0	0.0	0.0	1.8	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.4	0.0	0.0	0.3	0.0	0.0	0.0	0.0	8.4	10.9
17-Aug-98	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Minimum	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
Maximum	0.0	0.0	0.0	1.8	0.5	0.0	1.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.4	0.3	1.3	0.3	0.0	1.8	0.0			
Total	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0			

Parameter : Solar Radiation

Unit : W/m²

	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	Minimum	Maximum	Average
10-Aug-98	0.2	0.2	0.2	0.2	0.2	0.2	3.7	46.1	150.2	254.2	312.6	366.2	472.3	464.6	456.9	301.8	188.8	81.2	12.9	0.2	0.2	0.2	0.2	0.2	0.2	472.3	129.8
11-Aug-98	0.2	0.2	0.2	0.2	0.2	0.2	6.1	83.9	180.3	267.9	475.7	487.5	584.2	516.4	446.7	316.8	209.8	116.5	24.5	0.1	0.2	0.2	0.2	0.3	0.1	584.2	154.9
12-Aug-98	0.3	0.2	0.2	0.2	0.2	0.2	4.1	84.9	173.0	310.2	496.6	583.3	527.0	690.6	695.1	374.8	216.3	109.5	0.2	0.2	0.2	0.2	0.2	0.2	0.2	695.1	177.8
13-Aug-98	0.2	0.2	0.2	0.2	0.2	0.2	3.9	38.3	86.9	137.3	219.4	745.0	983.6	916.1	539.1	195.4	153.8	43.0	6.5	0.1	0.2	0.2	0.2	0.2	0.1	983.6	169.6
14-Aug-98	0.2	0.2	0.2	0.2	0.2	0.2	7.9	130.3	180.7	544.4	568.2	836.0	748.1	672.1	365.9	190.9	214.5	29.5	11.7	0.2	0.2	0.3	0.2	0.2	0.2	836.0	187.6
15-Aug-98	0.2	0.2	0.2	0.2	0.2	0.2	6.6	80.1	299.1	407.2	533.4	636.9	750.0	720.5	659.3	174.5	31.6	10.4	0.9	0.2	0.2	0.2	0.2	0.2	0.2	750.0	179.7
16-Aug-98	0.2	0.2	0.2	0.2	0.2	0.2	6.2	62.1	244.3	287.5	658.1	823.6	930.3	823.1	873.5	366.2	217.8	18.6	13.4	0.1	0.2	0.2	0.2	0.2	0.1	930.3	222.0
17-Aug-98	0.2	0.2	0.2	0.2	0.2	0.2	9.1	101.7	306.0	413.9	487.8	604.5	658.6	670.4	693.5	297.1	218.5	104.5	3.9	0.1	0.2	0.2	0.2	0.2	0.1	693.5	190.5
Minimum	0.2	0.2	0.2	0.2	0.2	0.2	3.7	38.3	86.9	137.3	219.4	366.2	472.3	464.6	365.9	174.5	31.6	10.4	0.2	0.1	0.2	0.2	0.2	0.2			
Maximum	0.3	0.2	0.2	0.2	0.2	0.2	9.1	130.3	306.0	544.4	658.1	836.0	983.6	916.1	873.5	374.8	218.5	116.5	24.5	0.2	0.2	0.3	0.2	0.3			
Average	0.2	0.2	0.2	0.2	0.2	0.2	5.9	78.4	202.6	327.8	469.0	635.4	706.8	684.2	591.3	277.2	181.4	64.1	9.3	0.1	0.2	0.2	0.2	0.2			

APPENDIX 06

DET NORSKE VERITAS

DNV Petroleum Services
DNV Technology Centre, 10 Science Park Drive, Singapore 118224
Tel: +65-779-8418 Fax: +65-779-3030 TLX: 39439/38597 DNVPS

REF: 7329243A001 WED 21 APR 99 07:27 GMT

Att Mr. Kosala

Date : 21/04/1999
Subject : 3993955 <<ADDR:FAX_0019474810442>><<ID:2563>>

TO: B & W SCANDINAVIAN CONTRACTORS A/S
ATTN: KNUD HVIDTFELD RASMUSSEN

Det Norske Veritas Petroleum Services - Fuel Quality Report dated : 21-APR-99
Re: ASIA POWER SAPUGASKANDA

Sample No.		3993955
Sample type		(HFO)
Sent from		COLOMBO
Date sent		17-APR-99
Arrived at lab		20-APR-99
Supplier		CEYLON PC
Seal Data		DNVPS
		0906899
		INTACT
Sampling Point		TANK LOWER HALF

Tested Results	Units	3993955
Density @ 15C	kg/m3	967.5
Viscosity @ 50C	mm2/s	317
Water	%v/v	LT 0.1
Micro Carbon Residue	%m/m	9.5
Sulphur	%m/m	2.43
Total Sediment Potent	%m/m	LT 0.01
Ash	%m/m	0.02
Vanadium	mg/kg	94
Sodium	mg/kg	8
Aluminium	mg/kg	LT 1
Silicon	mg/kg	LT 1
Iron	mg/kg	8
Nickel	mg/kg	31
Calcium	mg/kg	2
Magnesium	mg/kg	LT 1
Lead	mg/kg	LT 1
Zinc	mg/kg	LT 1
Flash Point	Deg.C	GT 70

Calculated values

Nett Specific Energy	MJ/Kg	40.42 (ISMA-100 1982)
CCAI (Ignition Quality)		830
Aluminium + Silicon	mg/Kg	LT 2

Note. LT = Less Than. GT = Greater Than.

Test results above shows a normal quality fuel.

[illegible] Document [illegible]

21/04 '99 13:30 TX/RX NO. 8553 P01

04-21-99 13:23 RECEIVED FROM:0094 074 810442 P.01

APPENDIX 07

National Air Quality Standards in Sri Lanka

Table 01: National Ambient Air Quality Standards in Sri Lanka

Pollutant	Averaging Time	Maximum Permissible Level	
		in $\mu g/m^3$	in ppm
Carbon Monoxide	8 hr.	10000	9.0
	1 hr.	30000	26.0
Nitrogen Dioxide	8 hr.	150	0.08
	1 hr.	250	0.13
Sulpher Dioxide	8 hr.	120	0.05
	1 hr.	200	0.08
Ozone	1 hr.	200	0.10
Suspended Particulate Matter	8 hr.	350	-
	1 hr.	500	-

APPENDIX 08

PASQUILL STABILITY CATEGORIES

(Knots)	Daytime (excluding dawn and dusk) from 1 hr after sunrise till 1 hr before sunset				Dawn and Dusk	Night - Time		
	Incoming solar radiation (W/m^2)					Total cloud amount (Octas)		
	Strong >600	Moderate 300-600	Slight < 300	Overcast N=8 Octas		8	4-7	0-3
< 3	A	A-B	B	C	D	D	F	F or G
4-5	A-B	B	C	C	D	D	E	F
6-9	B	B-C	C	C	D	D	D	E
10-12	C	C-D	D	D	D	D	D	D
> 12	C	D	D	D	D	D	D	D

Notes:

1. Category G occurs with total cloud amount 0 or 1 octa and wind speed 0 or 1 knot.
2. Dawn is the period within 1 hour after sunrise
3. Dusk is the period within 1 hour before sunset

Source: UK Meteorological Office

APPENDIX 09

Questioner for Emission data Collection

Section One

1.

Name of the company	

2.

Activity	Power Generation	Petroleum Production	Other
	Continue	Go to section 2	Go to section 3

3.

Plant Capacity (specify the capacity)	50-500 MW	<50 MW	Other	remarks

4.

Type of fuel used	Diesel	Residual fuel	Other (please specify)

5.

Composition of the Fuel used	%C	%H	%S	%N

6.

How many engines are running	Under normal operation	Under maximum load	Under minimum level

7.

What is the average power production per day(Mw/day)	

8.

Operating temperature of the engine (Degrees centigrade)	

9.

How many stack are there all together	

10.

How many stack are in one cluster	

11.

What is the diameter of individual stack(meter)	

12.

What is the height of the stack(m)	

13.

What is the flue gas emission rate?	rate		unit	

14.

What is the flue gas temperature (degrees Celsius)	

15.

Have you installed emission control system(please check appropriate box)	No	Yes

16.

Have you installed stack monitoring system	Yes		No	
	Continue		Stop	

17.

What are the parameters you are monitoring	SO2	NO	NO2	NOx	CO2	CO	% O2	PM-10	SPM	Other

18.

What is the unit of measurement(please specify)	

19.

What is the monthly average of effluent gas concentration of pollutants								Remarks
Month	NOx	NO	SO_2	CO	CO_2	$\%O_2$	PM-10	

20.

Are you connected to central waste treatment plant or any other waste handling system not operated by you?	No		Yes	
	continue		Stop	

21.

What is the type of waste treatment	Chemical	Biological	remarks
	Continue	Go to Q. No. 24	

22.

What is the chemical process used	Activated carbon	Chemical precipitation
	Go to Q. No. 25	Go to Q. No. 25

23.

What is the technique used			
Activated sludge	Extended Aeration	Rotating biological contactors (rbc)	Other(specify)

24.

What is the effluent flow rate(specify the unit)	

25.

What is the sludge production (specify the unit)	

26.

What is your sludge treatment method (check the appropriate box)			remarks
Burning		Other (specify the method)	
Open	Incineration		
Stop	Continue	Stop	

27.

What is the technique used	

28.

What is the rate of sludge incineration (indicate the unit)		Stop

Section 2

1.

What is your quantity of fresh feed crude oil	quantity	Unit

2.

What is your refinery process(check the appropriate box)		Remarks
Separation process	Atmospheric distillation	
	Vacuum distillation	
	Light ends recovery	
Petroleum conversion process	Cracking(thermal & catalytic)	
	Viscosity braking	
	Coking	
	Catalytic reforming	
	Isomerisation	
	Alkylation	
	Polymerization	
Petroleum treating processes	Hydrodesulfurization	
	Hydrotreating	
	Chemical sweetening	
	Acid gas removal	
	Deasphalting	
Blending	Motor gasoline	
	Light fuel oil	
	Heavy fuel oil	

3.

What kind of storage tanks do you have				remarks
Tank type	capacity	Feed rate(indicate the unit)		
Fixed roof tanks				
External floating roof				
Internal floating roof				
Pressure tank				
Other				

4.

How many flaring stacks are there in your refinery	

5.

What is a technique used in flaring	

6.

What is the quantities of gases flared at each flare (specify the unit)	

7.

What is the average composition of flare gas			Remarks:
H/C molar ratio	Molecular weight	Sulphur content	

8.

What is the diameter of the stack	

9.

What is the emission rate of flue gas	

10.

Have you taken a control measure to clean the emission gas(check the appropriate box)	Yes	No	Remarks
	Continue	Go to question no 12	

11.

What is a control technique	

12.

Are you connected to central waste treatment plant or any other waste handling system not operated by you?	No	Yes
	Please go to Question No: 20 0f Section 01	Stop

Section 3

1.

Is your main activity wastewater treatment? (check the appropriate box)	No	Yes
	continue	Please go to Question No: 20 of section 01

2.

What is your main activity	

3.

Where do you get electricity for your day today activity

Generator	National grid	From both sources	Other sources(please specify)
Continue	Go to question no 06	continue	

4.

What is the capacity of generator? (specify the unit)	

5.

Type of fuel used	

6.

Quantity of fuel used per day	

7.

Average operating hours(specify unit)	

8.

Are you connected to central waste treatment plant or any other waste handling system not operated by you?	No	Yes
	Please go to Question No: 20 0f Section 01	Stop

APPENDIX 10

Refinery Tank List

Tank No.	Type	Contents	Working Capacity (m^3)
01	Floating Roof	Crude oil	39914
02	Floating Roof	Do	38940
03	Floating Roof	Do	40139
04	Floating Roof	Do	40120
05	Floating Roof	Slops	2585
06	Fixed Roof	Naphtha	4056
07	Fixed Roof	Diesel	4059
08	Fixed Roof	Naphtha	748
09	Fixed Roof	Naphtha	746
10	Floating roof	Petrol	730
11	Floating roof	Petrol	711
12	Floating roof	Naphtha	541
13	Floating roof	Naphtha	541
16	Fixed roof	Gas oil	1508
Tank No.	Type	Contents	Working Capacity (M^3)
17	Fixed roof	ATF	1504
Tank No.	Type	Contents	Working Capacity (m^3)
18	Fixed roof	Fuel oil	3553
19	Fixed roof	Fuel oil	3554
20	Fixed roof	Kerosene	554
21	Fixed roof	Gas oil	555
22	Fixed roof	Gas oil	249
23	Floating roof	Petrol	400
24	Floating roof	Petrol	400
25	Floating roof	Petrol	700
26	Floating roof	Petrol	700
27	Floating roof	Chemical naphtha	5779

28	Floating roof	Chemical naphtha	5779
29	Fixed roof	Kerosene	2119
30	Fixed roof	Kerosene	2139
31	Fixed roof	Diesel	1620
32	Fixed roof	Diesel	1620
33	Fixed roof	Diesel	784
34	Fixed roof	Diesel	794
Tank No.	Type	Contents	Working Capacity (m^3)
35	Fixed roof	Diesel	795
36	Fixed roof	Fuel oil	3538
37	Fixed roof	Fuel oil	3542
38	Fixed roof	Fuel oil	1165
39	Fixed roof	Fuel oil	1165
40	Fixed roof	Bitumen	1521
41	Fixed roof	Bitumen	1521
42	Fixed roof	Bitumen	752
43	Fixed roof	Bitumen	752
44	Fixed roof	Diesel	782
45	Fixed roof	Kerosene	782
46	Fixed roof	Slops	210
47	Fixed roof	Slops	210
48	Fixed roof	Fuel oil	210
49	Fixed roof	Fuel oil	210
50	Floating roof	S.B.P.	231
51	Fixed roof	Kerosene	920
Tank No.	Type	Contents	Working Capacity (m^3)
52	Floating roof	Naphtha	6985
53	Floating roof	Naphtha	6985

54	Fixed roo	Fuel oil	3726
55	Fixed roo	Fuel oil	3726
58	Floating ro	Slops	2548
59	Floating ro	Crude oil	44919
60	Fixed roo	Bitumen	20
61	Fixed roo	Bitumen	20
62	Fixed roo	Bitumen	20
63	Fixed roo	ATF	1548

Slops is the mixture o l off grade products.

APPENDIX 11

Text file output of model run

Ausplume version 4.02

Sapugaskanda Cobined Stack Emission

Concentration or deposition	Concentration
Emission rate units	grams/second
Concentration units	microgram/m3
Units conversion factor	1.00E+06
Background concentration	0.00E+00
Terrain effects	None
Smooth stability class changes?	No
Other stability class adjustments ("urban modes")	None
Ignore building wake effects?	No
Decay coefficient (unless defined in met. file)	0.000
Anemometer height	10 m
Roughness height at the wind vane site	0.300 m
Averaging time for sigma-theta values	60 min.

DISPERSION CURVES

Horizontal dispersion curves for sources	<100m high Sigma-theta
Vertical dispersion curves for sources	<100m high Pasquill-Gifford
Horizontal dispersion curves for sources	>100m high Briggs Rural
Vertical dispersion curves for sources	>100m high Briggs Rural
Enhance horizontal plume spreads for buoyancy?	Yes
Enhance vertical plume spreads for buoyancy?	Yes
Adjust horizontal P-G formulae for roughness height?	Yes
Adjust vertical P-G formulae for roughness height?	Yes
Roughness height	0.800m
Adjustment for wind directional shear	None

PLUME RISE OPTIONS

Gradual plume rise?	Yes
Stack-tip downwash included?	Yes
Building downwash algorithm:	Schulman-Scire
Entrainment coeff. for neutral & stable lapse rates	0.60,0.60
Partial penetration of elevated inversions?	No
Disregard temp. gradients in the hourly met. file?	No

and in the absence of boundary-layer potential temperature gradients given by the hourly met. file, a value from the following table (in K/m) is used:

Wind Speed Category	Stability Class Category					
1	A	B	C	D	E	F
2	0.000	0.000	0.000	0.000	0.020	0.035
3	0.000	0.000	0.000	0.000	0.020	0.035
4	0.000	0.000	0.000	0.000	0.020	0.035
5	0.000	0.000	0.000	0.000	0.020	0.035
6	0.000	0.000	0.000	0.000	0.020	0.035

WIND SPEED CATEGORIES
Category boundaries (in m/s) are: 1.54, 3.09, 5.14, 8.23, 10.80

WIND PROFILE EXPONENTS
"Irwin Urban" values (unless defined in met. file)

AVERAGING TIMES
1 hour

Sapugaskanda Cobined Stack Emission

SOURCE GROUPS

Group No. Members

---

1 APPL1
2 APPL2
3 KDV3
4 Sapu
5 APPL1 APPL2
6 APPL1 APPL2 KDV3 Sapu
7 APPL1 APPL2 KDV3 Sapu Ref1 Ref2 Ref3 Ref4 Ref5 Ref6 Ref7 Ref8 Ref9 Ref10 Ref11

Sapugaskanda Cobined Stack Emission

SOURCE CHARACTERISTICS

Stack Source: APPL1

X(m)	Y(m)	Ground Elev	Stack Height	Diam.	Temp	Speed
0	0	0m	50m	0.95m	240C	30.0m/s

No building wake effects.
(Constant) emission rate = 9.00E+01 grams/second
No gravitational settling or scavenging.

Stack Source: APPL2

X(m)	Y(m)	Ground Elev	Stack Height	Diam.	Temp	Speed
0	0	0m	50m	0.95m	240C	30.0m/s

No building wake effects.
(Constant) emission rate = 9.00E+01 grams/second
No gravitational settling or scavenging.

Stack Source: KDV3

X(m)	Y(m)	Ground Elev	Stack Height	Diam.	Temp	Speed
250	0	0m	40m	1.00m	200C	29.0m/s

No building wake effects.
(Constant) emission rate = 1.60E+01 grams/second
No gravitational settling or scavenging.

Stack Source: Sapu

X(m)	Y(m)	Ground Elev	Stack Height	Diam.	Temp	Speed
1500	150	0m	60m	5.50m	280C	30.9m/s

No building wake effects.
(Constant) emission rate = 6.58E+02 grams/second
No gravitational settling or scavenging.

Stack Source: Ref1

X(m)	Y(m)	Ground Elev	Stack Height	Diam.	Temp	Speed
1100	100	0m	53m	1.00m	200C	25.0m/s

No building wake effects.
(Constant) emission rate = 1.80E+01 grams/second
No gravitational settling or scavenging.

Stack Source: Ref2

X(m)	Y(m)	Ground Elev	Stack Height	Diam.	Temp	Speed
1100	100	0m	27m	1.00m	200C	25.0m/s

No building wake effects.
(Constant) emission rate = 3.00E+00 grams/second
No gravitational settling or scavenging.

Stack Source: Ref3

X(m)	Y(m)	Ground Elev	Stack Height	Diam.	Temp	Speed
1100	100	0m	24m	1.00m	200C	25.0m/s

No building wake effects.
(Constant) emission rate = 1.00E+00 grams/second
No gravitational settling or scavenging.

Stack Source: Ref4

X(m)	Y(m)	Ground Elev	Stack Height	Diam.	Temp	Speed
1100	100	0m	60m	1.00m	200C	25.0m/s

No building wake effects.
(Constant) emission rate = 4.00E+00 grams/second
No gravitational settling or scavenging.

Stack Source: Ref5

X(m)	Y(m)	Ground Elev	Stack Height	Diam.	Temp	Speed
1100	100	0m	27m	1.00m	200C	25.0m/s

No building wake effects.
(Constant) emission rate = 5.00E+00 grams/second
No gravitational settling or scavenging.

Stack Source: Ref6

X(m)	Y(m)	Ground Elev	Stack Height	Diam.	Temp	Speed
1100	100	0m	27m	1.00m	200C	25.0m/s

No building wake effects.
(Constant) emission rate = 5.00E+00 grams/second
No gravitational settling or scavenging.

Stack Source: Ref7

X(m)	Y(m)	Ground Elev	Stack Height	Diam.	Temp	Speed
1100	100	0m	34m	1.00m	200C	25.0m/s

No building wake effects.
(Constant) emission rate = 2.00E+00 grams/second
No gravitational settling or scavenging.

Stack Source: Ref8

X(m)	Y(m)	Ground Elev	Stack Height	Diam.	Temp	Speed
1100	100	0m	16m	1.00m	200C	25.0m/s

No building wake effects.
(Constant) emission rate = 3.00E-01 grams/second
No gravitational settling or scavenging.

Stack Source: Ref9

X(m)	Y(m)	Ground Elev	Stack Height	Diam.	Temp	Speed
1100	100	0m	24m	1.00m	200C	25.0m/s

No building wake effects.
(Constant) emission rate = 4.00E+00 grams/second
No gravitational settling or scavenging.

Stack Source: Ref10

X(m)	Y(m)	Ground Elev	Stack Height	Diam.	Temp	Speed
1100	100	0m	60m	1.00m	200C	25.0m/s

No building wake effects.
(Constant) emission rate = 7.00E+00 grams/second
No gravitational settling or scavenging.

Stack Source: Ref11

X(m)	Y(m)	Ground Elev	Stack Height	Diam.	Temp	Speed
1100	100	0m	60m	1.00m	200C	25.0m/s

No building wake effects.
(Constant) emission rate = 7.00E+00 grams/second
No gravitational settling or scavenging.

Sapugaskanda Cobined Stack Emission

RECEPTOR LOCATIONS

The Cartesian receptor grid has the following x-values (or eastings):
0.m 500.m 1000.m 1500.m 2000.m 2500.m 3000.m
3500.m 4000.m 4500.m 5000.m 5500.m 6000.m 6500.m
7000.m 7500.m 8000.m 8500.m 9000.m 9500.m
