Air Quality Baseline Condition Report

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1 Baseline Information

1.1 Climate and Meteorological Conditions

Roşia Montană area has a continental temperate climate. Higher areas are characterized by a mountain microclimate with cold winters lasting 4 to 6 months, and with heavy snowfall. Spring and autumn are cold and humid, with significant rainfall. Summer is short, with gradual transitions between seasons.

Climatic data – air temperature, relative humidity, nebulosity, precipitation and wind – have been recorded between 1988 and 2005 by the Roşia Montană Meteorological Station, located on the top of Rotundu Hill, in the north-eastern corner of the Project site near the upper end of the Roşia Valley. No solar radiation measurements are available from Roşia Montană Meteorological Station. The station is managed by the National Administration of Meteorology, and belongs to the Romanian national meteorological network. Data presented in this paper have been provided by the National Administration of Meteorology. Sunshine daily duration data have been recorded between 2002 and 2005 by RMGC meteorological station.

1.2 Air Temperature

The average multiannual air temperature is 5.5 ^{o}C (Table 1-1). The highest values of the average multiannual maximum temperatures were recorded in July and August (19.8 ^{o}C and 20.1 ^{o}C, respectively), whereas the lowest values were recorded in December and January (0.3 ^{o}C and - 0.6 ^{o}C, respectively). Average annual values of the average maximum temperatures exceeding 10 ^{o}C were recorded in 1990, 2000, 2002 and 2003 (Table 1-2).

The lowest multiannual values of the average minimum temperatures were recorded in December-February (between -5.7 ^{o}C and -5.3 ^{o}C), whereas the highest values were recorded in July and August (12.1 ^{o}C and 12.5 ^{o}C, respectively). The average annual values of the average minimum temperatures were positive, between 2.1 and 4.0 ^{o}C (Table 1-3).

The absolute maximum temperature recorded during the analysed period ranged between 11.4 ^{o}C (07.01.2001) and 29.8 ^{o}C (22.08.2000) (Table 1-4). The absolute minimum temperature in the analysed period was between – 21.9 ^{o}C (13.02.2004) and 4.6 ^{o}C (29.08.1998) (Table 1-5).

1.3 Relative Air Humidity

The average relative air humidity is 76.2 % for the entire period, with most humid intervals in January (81.1 %) and February (80.7 %) (Table 1-6). Relative air humidity exceeds 70% for the entire analysed period, both as a monthly multiannual average value and as an annual average (excepting for 1992 and 2000). Such values classify the area into the high air humidity category.

1.4 Nebulosity (Cloud Coverage)

Multiannual values of monthly average nebulosity indicates the November - May period as the interval with the highest degree of cloud coverage (6.0 – 6.5 tenths of sky). The average multiannual nebulosity recorded during the analysed period was of 5.8 tenths of sky. The lowest value (4.5 tenths of sky) of the multiannual monthly average value was recorded in August (Table 1-7).

1.5 Precipitation and Snow Layer

The lowest amounts of multiannual monthly average precipitation were recorded in November (44.5 mm) and during January and March (34.8 – 43.0 mm). The highest quantities were recorded between June and September (83.1 – 109.5 mm). Annual amounts of precipitation ranged between 600.0 and 995.6 mm, with a multiannual average of 795.0 mm (Table 1-8).

Snow covers entirely the ground from December to February/March, and with some rare exceptions, from November to April, especially during cold years (Table1-9). The period of most abundant snowfall is January-March. The average monthly thickness of snow layer ranged between 1 and 74 cm.

1.6 Wind

Wind characteristic parameters are measured at a height of 10 m above the ground. The following parameters are used in this paper to characterize wind: the average multiannual wind frequency of 8 directions (%) and monthly average speed of wind per direction (m/s).

For the analyzed period, the multiannual average frequencies of wind directions indicate SW as the main direction (frequency 30.3 %), followed by NE (frequency 13.5 %) and W (frequency 8.4 %). The dominant wind direction (SW) has the highest frequencies of occurrence (31.5 – 38.4 %) between September and March, including transitional seasons and winter. The second dominant wind direction (NE) has the highest frequencies of occurrence during the warm season (Table 1-10)

The multiannual average frequency of wind calm was 17.7 %, with the highest values (over 20 %) recorded during January, June and August.

During the analyzed period, average wind speed per direction, show values between 2.0 and 4.1 m/s. The highest values are recorded along the dominant wind direction (SW), as well as along W direction (Table 1-11).

1.7 Sunshine Duration

The lowest values of monthly average sunshine durations were recorded in November – January period (28.37 – 58.23 hours/month). The highest values were recorded between May and August (197.13 – 233.34 hours/month). Annual total sunshine duration ranged between 1447.33 and 1830.85 hours, with a multiannual average of 1596.07 hours (Table 1-12). Such values classify the area into the low sunshine duration category.

Table 1-1. Monthly average temperature (°C)

Year	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	A.A.[2]
1988	-0.4	-2.5	-2.1	3.4	9.9	11.7	16.9	16	10.6	6.2	-4.4	-4	5.1
1989	-3.4	-1.8	2.3	7.8	8.7	10.8	14.7	14.7	10.3	6.6	-0.5	-2.7	5.6
1990	-2.6	0.7	4	4.8	9.9	12.1	14.6	15.7	7.9	8.2	2.5	-3	6.2
1991	-4.2	-5.7	3.1	3.6	5.8	13.2	15.8	13.7	11.3	4.7	2.3	-6.5	4.8
1992	-3.7	-4.4	-0.5	5.3	9.4	12.9	15.2	19.9	10.5	5.4	0.6	-3.1	5.6
1993	-3.9	-5.7	-2	3.8	11.3	12.8	14	15.7	9.7	9.2	-0.6	-1.3	5.3
1994	-1	-2.2	1.5	5.8	9.7	13.2	16.8	15.8	15.1	5.5	1.5	-2.6	6.6
1995	-5.8	0	-0.3	3.6	9	12.9	17.4	14.3	9.1	8.9	-1.7	-2.2	5.4
1996	-3.5	-5.1	-4.5	5.1	11.9	14.4	13.6	14.4	6.3	6.2	3.9	-2.4	5.0
1997	-1.9	-3.2	-1.8	0	10.4	13.4	13.1	13.7	9.5	2.9	2.6	-2	4.7
1998	-2.4	-0.5	-4.1	5.9	8.8	13.7	14.8	15.5	9.5	6.9	-1.7	-4.8	5.1
1999	-0.9	-5.8	0.1	5.5	9.4	14.8	16.7	15.1	12.9	6.0	0.7	-3.0	6.0
2000	-7.7	-3.2	-1.6	8.0	12.0	15.1	14.6	17.4	10.7	9.7	7.0	0.9	6.9
2001	-1.6	-2.6	3.1	5.4	11.1	11.4	15.6	17.0	9.6	9.2	-1.4	-7.8	5.8
2002	-3.5	0.9	2.7	4.9	12.7	14.7	17.1	14.9	10.1	5.7	4.6	-3.6	6.8
2003	-4.4	-7.2	-0.8	3.4	15.2	16.3	15.3	17.8	11.0	3.4	4.0	-1.3	6.1
2004	-6.9	-4.1	-0.2	6.4	8.5	13.2	15.6	15.0	10.4	8.5	1.8	-1.5	5.6
2005	-4.6	-5.9	-2.9	5.5	11.0	12.6	15.2	14.4	12.3	6.9	1.2	-3.3	5.2
M.A.[1]	-3.5	-3.2	-0.2	4.9	10.3	13.3	15.4	15.6	10.4	6.7	1.2	-3.0	5.5

1 Multiannual monthly average value
2 Annual average value

Table 1-2. Average values of maximum temperatures (°C)

Year	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	A.A.[2]
1988	2	0.4	0.8	7.6	14.5	15.9	21.1	20.8	14.6	10.3	-1.4	-1.8	8.7
1989	0.1	1.5	6	12.6	13	15.2	18.9	19.1	14.1	10.5	2.9	0.4	9.5
1990	-0.6	4.5	9	9	14.5	16.6	19.1	20.5	12	12.8	5.7	-0.6	10.2
1991	-1.3	-1.9	7.5	8.1	10	17.5	19.8	17.8	15.7	8.3	5.7	-3.4	8.7
1992	-0.5	-1.4	3.7	9.8	14.3	16.8	19.7	24.7	15.3	9.6	3.3	-0.2	9.6
1993	-0.9	-2.1	1.2	7.7	15.7	17.2	19.2	20.4	13.8	13.7	2.7	1.3	9.2
1994	1.5	0.5	5.5	10.2	13.9	17.4	21	20.2	19.8	9.7	4.4	-0.2	10.3
1995	-3.4	3.5	3.9	7.9	13.2	17.2	21.7	18.8	13.1	12.9	1.1	0.8	9.2
1996	-0.7	-2	-0.7	9.3	16.3	18.5	18.1	18.7	9.1	9.7	7	0.3	8.6
1997	1.1	0	2.7	3.9	14.8	17.6	17	17.8	13.8	6.7	5.8	0.3	8.5
1998	0.2	3.5	0.4	10.5	13.0	17.8	19.1	19.9	13.2	10.7	1.2	-1.7	9.0
1999	2.4	-3.0	3.9	9.5	14.2	19.5	21.0	19.7	17.6	9.8	4.4	-0.6	9.9
2000	-4.7	0.0	2.0	12.8	16.8	20.1	19.7	22.5	14.9	14.5	10.6	3.8	11.1
2001	1.5	0.5	7.4	10.4	15.9	15.8	19.8	21.5	13.0	12.9	1.5	-5.3	9.6
2002	-0.6	4.2	7.3	9.8	17.3	19.4	22.0	18.7	13.6	9.4	7.3	-0.8	10.6
2003	-0.9	-2.7	3.7	8.4	20.2	21.2	20.1	22.7	15.8	6.7	7.5	2.1	10.4
2004	-3.6	-0.8	4.1	11.3	13.4	17.8	20.1	19.8	14.7	12.5	5.0	1.3	9.6
2005	-1.8	-2.6	1.1	10.4	16.0	17.6	19.8	18.5	16.3	10.9	4.8	-0.4	9.2
M.A.[1]	-0.6	0.1	3.9	9.4	14.8	17.7	19.8	20.1	14.5	10.6	4.4	-0.3	9.7

1 Multiannual monthly average value
2 Annual average value

Table 1-3. Average values of minimum temperatures (°C)

Year	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	A.A.[2]
1988	-2.2	-4.6	-4.1	0.4	6.8	8.7	13.3	12.5	8.1	3.5	-6.7	-5.9	2.5
1989	-6.4	-4.3	-0.1	5	5.9	8.3	11.7	12	8.1	4.2	-3.1	-5	3.0
1990	-4.9	-1.5	1	2	6.7	9	11.1	12.6	5.3	5.3	0.5	-4.9	3.5
1991	-6.2	-8.2	0.5	0.9	3.4	10.1	12.7	10.9	8.5	2.5	-0.1	-8.9	2.2
1992	-5.9	-6.9	-3.3	2.3	6	10.1	12	16	7.4	2.5	-1.6	-5.4	2.8
1993	-6.3	-8.6	-4.2	1.1	8.2	9.5	10.4	12.6	7.1	6.4	-2.9	-3.7	2.5
1994	-2.9	-4.3	-1.2	2.8	6.8	10.1	13.5	12.4	12.1	2.8	-0.6	-5	3.9
1995	-7.9	-2.7	-3.2	0.7	6	9.7	13.9	11.4	6.7	6.1	-3.9	-4.5	2.7
1996	-5.7	-7.4	-6.9	1.9	8.7	11	10.1	11.7	4.6	3.9	1.5	-4.7	2.4
1997	-4.3	-5.6	-4.4	-2.7	7.2	10.2	10.5	11	6.8	0.6	0.3	-3.9	2.1
1998	-4.2	-3.2	-6.8	2.9	5.9	10.6	11.8	12.1	7.4	4.6	-3.7	-7.4	2.5
1999	-3.0	-8.2	-2.4	2.9	6.2	11.6	13.7	12.1	9.9	3.7	-2.0	-5.2	3.3
2000	-10.1	-5.5	-4.4	4.9	8.5	11.2	11.1	14.0	7.8	6.8	4.6	-1.1	4.0
2001	-4.0	-4.8	0.0	2.2	7.7	8.4	12.7	13.9	7.1	6.8	-4.0	-10.1	3.0
2002	-6.2	-1.9	-0.7	1.9	9.4	11.2	13.6	12.2	7.8	3.0	2.3	-6.0	3.9
2003	-6.9	-9.8	-4.0	0.3	11.2	12.4	11.9	14.2	8.1	0.9	1.9	-4.0	3.0
2004	-9.1	-6.7	-3	3.4	5.3	9.8	12.1	12.0	7.6	5.7	-0.6	-3.9	2.7
2005	-6.7	-8.2	-6.0	2.4	7.5	9.0	12.1	11.8	10.0	4.3	-1.4	-5.5	2.4
M.A.[1]	-5.7	-5.7	-3.0	2.0	7.1	10.1	12.1	12.5	7.8	4.1	-1.1	-5.3	3.1

1 Multiannual monthly average value
2 Annual average value

Table 1-4. Absolute maximum temperatures (°C)

Year	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	A.A.[2]
1988	7.2	7.9	7.9	14.7	19.6	20.5	28.0	27.0	22.0	19.4	4.5	6.2	28.0
1989	5.4	8.8	15.3	20.2	21.3	19	25.8	25.5	20.1	15.6	13	11.7	25.8
1990	9.8	13	17.5	16.3	20.8	24.2	25.8	25.3	23.8	19	14	5.7	25.8
1991	5.6	8	19.5	13.1	16.6	26.6	23.7	23.6	22.7	19.3	10.2	5	26.6
1992	7.5	7.8	14.3	19.5	19.7	22.4	24.5	27.6	23.8	20.1	16	8.2	27.6
1993	10.7	9.4	13	16.9	20.3	24.8	26.8	25.5	22.8	20.6	11.7	7.2	26.8
1994	8.9	9.9	12	17.9	23.2	27.0	24.6	27.3	26	17.6	14.2	4.4	27.3
1995	5.5	8.4	15.5	18.6	21.7	23.0	25.3	22.7	21.6	22.0	9.2	7.5	25.3
1996	8.3	3.4	9	18.8	24.3	25	24.8	25.4	15.4	18	16	9	25.4
1997	8.6	9	11.2	13.9	23.3	25.3	23.7	21.4	21	17.4	16.3	7.2	25.3
1998	6.7	13.4	8.8	17.3	20.9	23.8	26.5	27.4	20.5	19.7	11.0	10.5	27.4
1999	9.5	7.1	12.2	16.9	21.3	24.0	25.8	26.2	21.5	20.3	15.3	6.3	26.2
2000	4.2	8.7	12.1	20.2	21.8	27.4	28.3	29.8	22.6	21.8	16.7	11.6	29.8
2001	11.4	11.7	17.9	18.3	21.6	24.0	25.7	27.8	18.2	20.8	12.6	0.3	27.8
2002	8.0	12.0	15.3	14.8	22.4	27.3	28.4	22.8	20.6	16.6	17.5	7.1	28.4
2003	3.8	7.3	12.5	19.7	24.6	25.7	25.6	26.5	23.7	16.8	16.3	10.6	26.5
2004	3.7	5.9	14.3	18.6	19.5	21.9	27.9	24.3	21.1	18.9	18.9	6.8	27.9
2005	7.9	3.8	12.9	18.2	25.3	22.6	27.8	26.2	20.3	16.6	11.6	9.0	27.8
M.A.[1]	11.4/ 07.01	13.4/ 23.98	17.9/ 25.01	20.2/ 18.00	25.3/ 29.05	27.4/ 14.00	28.4/ 11.00	29.8/ 22.00	23.7/ 22.03	21.8/ 15.00	18.9/ 02.04	11.6/ 03.00	29.8/ 22.08 .00

1 Monthly absolute maximum temperature from period 1988 - 2005
2 Absolute maximum temperature from the period 1988 - 2005

Table 1-5. Absolute minimum temperatures (°C)

Year	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	A.A.[2]
1988	-7	-14.8	-11.5	-6.9	2.6	4.6	7.6	5	2.3	-7	-11.7	-13.3	-4.2
1989	-11.2	-8.5	-4.8	-0.5	-3	4	5	4.6	4.6	-3.4	-14.9	-15	-3.6
1990	-12.6	-7.4	-10.6	-3.6	0	2.8	6.2	6	1.5	-5.8	-5.2	-11.6	-3.4
1991	-19.4	-18.8	-8.4	-3.7	-0.8	5.5	7.4	5.3	-1.2	-7.9	-7.3	-16	-5.4
1992	-12.5	-14	-9	-4.8	1	6.6	8.4	9.5	1.5	-5.4	-6.6	-13.5	-3.2
1993	-17	-14.3	-11.5	-6.7	5	3.4	3.5	4.4	2.2	-1.1	-11.2	-10.5	-4.5
1994	-9.6	-17.1	-7	-3	-1.4	3	8.2	6.2	5.6	-4	-10	-11.1	-3.4
1995	-13.1	-11	-11.1	-8.5	-1	5.3	10.4	3	-1.4	-1.6	-10.8	-13.1	-4.4
1996	-13.2	-12.5	-15	-9.1	4.2	3.9	3.8	7.6	0.9	-2.2	-7	-18.8	-4.8
1997	-12.5	-14	-11.1	-10.5	0	1.9	7.2	7.1	0.7	-9.5	-7.5	-15.4	-5.3
1998	-14.3	-16.9	-12.2	-1.8	0.3	3.7	3.5	4.6	2.4	-1.9	-11.9	-16.7	-16.9
1999	-14.0	-15.7	-10.0	-2.5	-2.2	5.0	9.6	7.0	5.0	-5.0	-9.2	-13.8	-15.7
2000	-18.2	-11.1	-11.8	-5.6	-0.4	2.2	4.5	5.4	1.7	-1.6	-1.5	-13.2	-18.2
2001	-12.1	-12.4	-5.2	-6.5	0.0	2.0	8.5	5.0	1.5	-2.4	-10.7	-16.2	-16.2
2002	-17.0	-8.5	-6.9	-8.0	4.8	2.5	9.5	9.0	1.6	-2.8	-7.3	-16.6	-17.0
2003	-15.3	-16.4	-16.1	-11.0	1.4	6.1	6.2	7.6	0.8	-8.4	-6.0	-11.4	-16.4
2004	-18.4	-21.9	-16.0	-1.2	-1.4	5.8	5.8	7.6	-0.7	-4.9	-11.1	-11.2	-21.9
2005	-14.7	-18.0	-19.7	-6.7	-1.0	1.2	7.5	4.9	4.9	-3.0	-10.7	-12.1	-19.7
M.A.[1]	-18.4/ 23.04	-21.9/ 13.04	-19.7/ 01.05	-11.0/ 07.03	-2.2/ 7.99	1.2/ 10.05	3.5/ 9.98	4.6/ 29.98	-0.7/ 10.04	-8.4/ 26.03	-11.9/ 20.98	-16.7/ 11.98	-21.9/ 13.02. 04

1 Monthly absolute minimum temperature from period 1988 – 2005
2 Absolute minimum temperature from the period 1988 - 2005

Table 1-6. Relative air humidity (%)

Year	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	A.A.[2]
1988	82	84	88	79	74	78	71	65	79	68	81	93	78.5
1989	76	84	74	73	75	83	70	80	84	76	78	81	77.8
1990	75	69	64	74	66	72	68	65	79	66	84	85	72.3
1991	84	78	71	72	84	76	79	79	75	82	77	83	78.3
1992	74	81	68	68	60	77	67	52	65	83	84	7	65.5
1993	75	77	86	78	69	75	78	75	78	74	77	88	77.5
1994	83	81	78	73	72	71	66	68	66	78	76	85	74.8
1995	89	79	78	76	79	81	70	76	84	74	87	86	79.9
1996	80	83	79	67	79	72	75	77	92	81	77	86	79.0
1997	76	80	75	81	71	76	84	79	75	77	77	86	78.1
1998	78	72	79	74	77	78	78	69	84	80	87	77	77.8
1999	76	95	75	77	74	76	74	76	74	77	71	84	77.4
2000	82	81	79	63	57	54	61	50	70	50	56	73	64.7
2001	77	86	78	73	70	81	82	74	87	83	87	86	80.3
2002	83	76	66	74	69	74	75	78	81	83	77	78	76.2
2003	91	77	71	69	62	66	78	58	72	88	78	75	73.8
2004	92	88	80	72	76	76	74	79	81	78	85	82	80.3
2005	87	81	78	71	77	75	81	87	81	78	79	88	80.3
M.A.[1]	81.1	80.7	75.9	73.0	71.7	74.5	73.9	71.5	78.2	76.4	78.8	79.1	76.2

1 Multiannual monthly average value
2 Annual average value

Table 1-7. Total nebulosity (tenths)

Year	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	A.A.[2]
1988	7.0	7.5	7.7	6.9	6.0	5.8	3.6	3.6	5.8	4.4	6.1	7.8	6.0
1989	4.1	6.0	6.1	7.8	6.5	7.5	4.8	5.8	6.4	4.9	6.0	5.6	6.0
1990	5.4	4.5	4.5	6.6	5.3	5.5	4.4	3.9	6.0	3.6	7.2	7.0	5.3
1991	5.3	6.1	6.2	6.1	8.3	5.2	5.4	5.1	4.4	5.5	6.1	5.4	5.8
1992	5.4	5.9	4.9	6.5	5.2	6.1	4.7	2.7	3.3	7.1	7.5	4.6	5.3
1993	4.6	4.4	6.9	6.1	6.5	5.1	4.8	4.1	5.4	5	5.5	7.8	5.5
1994	6.6	7.2	6.1	6.8	6.4	5.1	4.9	4.3	3.9	5.5	6.0	6.6	5.8
1995	7.4	5.9	7.1	6.0	6.8	6.1	3.5	5.8	6.3	3.7	7.2	7.1	6.1
1996	6.7	7.3	6.6	5.8	6.2	5.1	4.7	5.4	8.6	6.0	6.1	7.0	6.3
1997	6.1	5.4	5.0	7.3	5.6	5.1	6.4	5.5	4.7	5.6	5.7	8.1	5.9
1998	5.4	4.6	5.8	7.3	6.8	5.8	5.3	3.6	6.7	6.6	7.0	4.5	5.8
1999	5.5	8.6	5.8	6.6	6.0	6.0	5.5	5.0	4.9	6.2	5.7	6.7	6.0
2000	6.4	5.9	6.7	6.2	4.2	3.2	5.1	3.1	5.4	3.5	3.9	6.2	5.0
2001	5.8	6.4	7.3	6.0	5.1	6.5	5.7	3.8	7.5	4.2	7.4	6.9	6.1
2002	5.8	6.2	4.7	6.4	5.2	4.9	5.9	5.4	6.6	6.6	7.0	6.8	6.0
2003	7.9	4.8	5.3	5.9	4.3	4.0	6.0	3.0	5.2	7.2	5.2	5.0	5.3
2004	7.2	7.1	6.9	6.2	6.6	5.6	5.7	4.6	5.7	5.1	7.2	5.5	6.1
2005	6.8	6.5	6.1	6.2	6.1	4.8	5.8	6.7	5.5	4	5.4	7.6	6.0
M.A.[1]	6.1	6.1	6.1	6.5	6.0	5.4	5.1	4.5	5.7	5.3	6.2	6.5	5.8

1 Multiannual monthly average value
2 Annual average value

Table 1-8. Precipitation (mm)

Year	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	T.A.[2]
1988	49.8	39.3	120.7	66.8	79.4	89	99.8	38.5	75.2	40.7	14.1	86.6	800
1989	7	39.5	20.8	81.9	33.9	109.1	54.5	203.5	74	31.6	43	25.8	725
1990	12.5	41.3	13.5	60	75.7	85.4	62.7	65.6	64.2	68.3	41.5	53	644
1991	12.6	23.4	18.1	41.9	136.6	86.3	159	76.8	69.1	98.4	44.9	17.1	784
1992	25	12.8	7.3	47	49.9	89.3	72.3	52.5	53.4	134	44.1	12.2	600
1993	20.5	17.9	62.8	78.3	51.6	59	84.7	36	72	20.7	63.9	107.4	675
1994	37.9	15.8	36.4	81	55	114.1	103.7	78.4	92.5	73.2	26.4	34	748
1995	62.1	39	35.3	58	86	180.3	24.3	91.4	87.6	3	73.4	143	883
1996	54.6	29.7	24.1	16.7	109.9	97.5	71.1	113.4	143.2	53.1	38.5	63	815
1997	25.6	43.2	24.3	96	84.1	112.5	156.5	76.8	68.8	71.6	29.3	55.5	844
1998	28.2	6.1	40.2	58.8	106.0	157.1	102.3	122.2	133.7	108.6	49.2	16.7	929.1
1999	17.7	112.3	28.8	105.0	150.2	132.1	66.9	63.8	44.6	26.3	41.0	146.1	934.8
2000	37.9	22.8	66.4	56.8	74.4	29.8	101.4	35.2	71.7	2.6	23.2	61.9	584.1
2001	38.3	49.9	103.9	67.7	61.1	132.6	159.5	68.2	137.7	25.1	60.6	37.9	942.5
2002	11.4	22.1	27.7	35.7	63.1	43.8	174.3	177.9	112.9	56.0	47.5	32.9	805.3
2003	68.8	20.2	13.7	30.9	49.6	28.8	147.0	28.4	53.9	142.8	29.6	27.2	640.9
2004	69.9	55.5	52.8	119.7	68	100.2	151.7	82.8	68.8	51.1	92.5	47.0	960.0
2005	46.5	52.3	76.9	124.2	80.1	79.5	178.7	130.7	71.6	21.5	38.5	95.1	995.6
M.A.[1]	34.8	35.7	43.0	68.1	78.6	95.9	109.5	85.7	83.1	57.1	44.5	59.0	795.0

1 Multiannual monthly average value
2 Total annual quantity

Table 1-9. Thickness of snow layer (cm)

Year	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
1988	11	11	1								3	15
1989	16	6									1	2
1990	2	4										9
1991	2	7	1							1		6
1992	15	17									1	1
1993	3	5	2								7	8
1994	7	12									1	4
1995	24	5	1								6	6
1996	12	35	9								1	3
1997	13	15	3									1
1998	9	7	10								6	14
1999	7	51	28								4	30
2000	74	53	40									1
2001	1	10	4								6	32
2002	32	7		1							2	3
2003	30	53	30	1						1		5
2004	26	45	29	2							7	6
2005	14	44	68	8							2	35
M.A.[1]	16.6	21.5	12.6	0.7	0.0	0.0	0.0	0.0	0.0	0.1	2.6	10.1

1 Multiannual monthly average value

Table 1-10. Multiannual average frequency of wind direction (%) (1988 – 2005)

Year	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	M.D.[1]
N	2.7	2.6	5.7	4.0	4.2	4.8	5.4	4.2	4.6	1.4	2.0	3.3	3.8
NE	13.5	8.1	9.8	16.2	17.4	11.4	15.8	15.3	16.9	11.0	9.8	15.3	13.5
E	3.4	2.2	4.8	11.5	8.1	3.8	6.9	7.3	4.7	4.6	5.9	5.9	5.8
SE	2.1	2.1	2.9	7.5	6.6	4.6	6.9	6.1	5.8	3.7	6.5	3.2	4.8
S	6.6	7.8	7.5	8.6	4.5	5.5	6.2	6.1	8.4	10.6	13.3	10.1	7.9
SW	31.5	38.4	33.5	26.0	23.7	27.2	25.8	22.7	31.6	35.6	34.7	32.9	30.3
W	9.0	12.9	11.0	6.5	7.7	10.0	8.6	7.8	6.8	8.6	6.1	6.5	8.4
NW	2.1	4.4	6.2	4.7	4.1	5.0	4.0	3.8	2.1	3.4	2.0	1.8	3.6
Calm	24.7	15.2	11.6	11.8	19.9	22.8	16.3	22.7	15.8	16.9	16.8	17.8	17.7

1 Mean values per direction

Table 1-11. Multiannual average speed of wind (m/s)

Year	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	A.D.[1]
N	1.8	1.9	2.3	2.0	2.1	2.2	1.7	1.7	2.2	1.6	1.4	2.1	2.0
NE	3.3	3.3	3.0	3.2	2.6	2.3	2.5	2.3	3.1	2.8	2.9	3.3	2.9
E	2.7	2.5	3.0	4.1	3.1	2.9	2.9	2.7	3.2	3.0	3.1	2.8	3.1
SE	2.2	3.6	2.8	3.6	3.0	2.4	2.4	2.4	2.4	2.6	3.1	3.2	2.8
S	3.2	3.3	3.1	3.5	2.8	2.6	2.7	2.5	3.0	3.0	3.4	3.7	3.1
SW	4.5	4.5	5.0	4.3	3.7	3.6	3.6	3.6	3.6	4.1	4.4	4.6	4.1
W	4.0	4.1	4.1	3.5	3.0	3.1	3.0	2.6	2.9	3.6	3.1	3.5	3.4
NW	2.2	2.4	2.8	2.3	2.0	2.3	2.0	2.0	1.5	2.4	2.0	2.3	2.4
1 Average values per direction													

Table 1-12. Monthly sunshine duration (hours)

Year	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	A.A.[2]
2002	56.18	73.23	159.03	130.78	221.50	221.40	224.93	169.60	97.07	86.40	62.60	42.80	1545.53
2003	28.30	119.30	167.50	172.23	269.10	273.60	193.37	284.40	128.40	72.68	90.20	31.77	1830.85
2004	66.23	77.87	125.10	148.47	174.28	238.45	190.77	232.93	136.63	110.78	38.18	20.85	1560.55
2005	53.55	65.72	131.63	120.07	202.35	199.92	179.47	177.52	128.97	128.15	41.95	18.05	1447.33
M.A.[1]	51.07	84.03	145.82	142.89	216.81	233.34	197.13	216.11	122.77	99.50	58.23	28.37	1596.07
1 Multiannual monthly average value 2 Annual duration													

1.8 Considerations Regarding the Transport and Diffusion Conditions For Air Pollutants

The Project site has a complex topography, which sets a number of specific constraints or conditions on the airborne transport and diffusion of potential pollutants. The Project area has a mountainous relief, with elevations of 1000 m or more above sea level, transected by valleys oriented in various directions, and locally reaching 200-300 m in depth. This orographic complexity is reflected in the dynamics and thermal regime of the atmospheric boundary layer, with direct consequences on horizontal currents and turbulence. Although higher altitudes are exposed to general atmospheric circulation and to a more pronounced turbulence, the valley floor areas display a different transport and diffusion regime, which is specific to this particular relief, due both to dynamic (e.g., increased wind speed) and thermodynamic causes (e.g., the vertical currents which may occur due to hillside temperature gradients). Atmospheric circulation and thermodynamic conditions in narrow valley floors, such as those in the Project area, have the following typical characteristics:

- the prevalent wind direction is local, and corresponds to the geographic orientation of the particular valley;
- the wind direction regime at ground level and in the layer between the valley floor and surrounding hilltops is characterized by a mountain-valley breeze phenomenon which generates a daily upstream-downstream oscillation of air masses;
- air circulation is characterized by low velocity and by relatively high frequencies of atmospheric calm;
- the thermal layering of air between the valley floors up to 100 m above the surrounding hilltops is dominated by thermal stability, including thermal inversions during nights and cold seasons.

These features result in conditions that will, in general, limit the airborne transport and diffusion of pollutants emitted by sources at elevations below the surrounding hilltops, and will lead to a greater likelihood of pollutant concentrations at ground level, when compared to more open and better-ventilated areas. Pollutant oscillation phenomena occurring in these areas will make these conditions even more pronounced. As a consequence, pollutants from sources located in higher elevations will be dispersed by substantially larger air volumes than those emitted by valley sources, leading to a minimization in overall air quality impacts in surrounding areas. The level of impact and the size of the affected area of course depend on emission rates as well as the physical characteristics of the sources.

As previously noted, the main sources of Project-related atmospheric pollutants will be the dusts associated with open pit excavation and hauling activities during dry seasons. These dusts will be associated with low-height emission sources (except potentially for some initial blasting operations). Sources will typically be located in more open areas, with generally higher atmospheric turbulence than is typically experienced in valley areas. During the initial years of the operational phase, these sources will tend be located at higher altitudes, in open areas exposed to general atmospheric circulation. Although these areas will be better ventilated than valley floors, due to the extremely reduced effective heights of emission sources (as pollutants will not have dynamically or thermally induced accessional speed), the pollutants will tend to be transported by corresponding air currents, following the relief along the average horizontal direction of flow. As mining progresses below the open pit crests, potential impacts on air quality will be reduced because increasingly lower volumes of airborne pollutants will reach these crests. Potential dust emissions from the Tailings Management Facility in the Corna Valley will constitute a special case, as transport and dispersion conditions will be more typical of valley areas. As a consequence, mitigation measures will require maintaining a wetted surface to minimize the potential for the generation of windborne dust from the tailings beach during dry seasons.

These general observations have been substantiated by the quantitative results of mathematical modelling of concentration fields, as discussed in Section 4.2.3.1. As noted therein, applied models are based on boundary layer parameters that are in turn based on local meteorological data.

2 Current Situation of Air Quality

2.1 Identification of Sationary and Mobile Pollution Sources Currently in the Area

Numerous air pollution sources are currently related to human settlements, gold-silver ore mining and processing by C.N.C.A.F. MINVEST S.A. Deva – Roşiamin branch, vehicle traffic and agricultural activities on homesteads located both inside and outside the residential areas.

The existent air pollution sources are located within the industrial site (Roşia Montană project site) as well as outside, close to the industrial site limits. The existent sources located inside the industrial site influence the air quality both on the site area and in the areas located outside. On the other hand, the sources located outside the site influence the air quality locally but also in the areas located within the project area.

The existent sources inside the industrial area (Roşia Montană project site) are represented by:

- Activities related to the gold and silver extraction as open pits (Cetate and Cârnic pits) within the C.N.C.A.F. MINVEST S.A. Deva, - Roşiamin Branch, stockpiling of sterile rock (Valea Verde and Hop stockpile), and surface transport (by train wagons) to the secondary crushers at Aprăbuş.
- Specific emission sources from the localities Ţarina, Balmoşeşti, Corna, Bunta, Gura Cornei (approximately 50 %, northern area);
- Specific agricultural activities from inside and outside of the localities Ţarina, Balmoşeşti, Corna, Bunta, Gura Cornei (approximately 50 %, northern area);
- The traffic on the existent infrastructure.

The existent sources outside the industrial area are:

- Activities related to the ore preparation within the C.N.C.A.F. MINVEST S.A. Deva, - Roşiamin Branch at different locations: secondary crushing at Aprăbuş, ore transport by conveyer at the processing plant, crushing and floating at Gura Roşiei processing plant, processed ore storing at two tailing ponds (Săliştei Valley and Gura Roşiei).
- Specific emission sources from the localities Roşia Montană, Gura Roşiei, Coasta Henţii, Iacobeşti, Ignaţeşti, Vârtop, Gârda Bărbuleşti, Petreni, Bisericani, Heleşti, Floreşti, Dogăreşti, Bucium Sat, Abrud, Gura Cornei (approximately 50 %, south-west area);
- Specific agricultural activities from inside and outside of the localities Roşia Montană, Gura Roşiei, Coasta Henţii, Iacobeşti, Ignăţeşti, Vârtop, Gârda Bărbuleşti, Petreni, Bisericani, Heleşti, Floreşti, Dogăreşti, Bucium Sat, Abrud, Gura Cornei (approximately 50 %, south-west area);
- The traffic on the existent infrastructure (national road DN 74 and DN 74A).

A. The sources of air pollution which are specific to all localities (inside and outside the localities) are:

- burning of solid fuel (wood, vegetal waste) for domestic heating and cooking, in the most of the localities;
- burning of liquefied gas for cooking (especially in Abrud and in Roşia Montană), and incidentally, for heating of commercial spaces;
- animal farming in individual households;
- arable land cultures;
- private vegetable gardens;
- orchards and vines;

- small industry plants;
- other activities: bread manufacture in specialized facilities, domestic alcohol manufacture, etc;
- local and transit road traffic.

Residential heating is based on domestic systems (stoves) using almost exclusively wood and vegetal waste. The pollutants specific to the above sources are:

- stationary burning sources: nitrogen oxides (NO, NO_2, N_2O), carbon oxides (CO, CO_2), sulphur oxides (SO_2, SO_3), particulates, volatile and condensable organic compounds (VOC) (including polycyclic aromatic hydrocarbons – PAH, which are potentially carcinogenic substances);
- animal farming: methane (CH_4) generated by enteric fermentation and by decomposition of manure, ammonia (NH_3) generated by decomposition of manure;
- seasonal and perennial land cultures: non-methane volatile organic compounds (nmVOC), nitrous oxide, naturally occurring particulates (mineral and vegetal particulates), ammonia (NH_3) from chemical fertilizers, chemical compounds generated by the use of pesticides, pollutants generated by agricultural equipment (NO_x, N_2O, CH_4, nmVOC, CO, CO_2, SO_2, particulates with Cd, Cu, Cr, Ni, Se, Zn, PAH);
- stationary sources represented by internal-combustion engines (pumps, generators, etc.): NO, NO_2, N_2O, CO, CO_2, SO_2, heavy metal particulates, volatile and condensable organic compounds (including PAH and other potentially carcinogenic compounds);
- road traffic: specific pollutants including NO, NO_2, N_2O, CO, CO_2, SO_2, CH_4, nmVOC and particulates loaded with heavy metals (Pb, Cd, Cu, Cr, Ni, Se, Zn);
- industrial plants, bakeries, other activities: pollutants related to fuel burning, particulates, non-methane organic compounds.

The pollutants released into the atmosphere both inside and outside localities include greenhouse gases such as: CO_2, N_2O, CH_4 – generated by stationary and mobile burning sources and by agricultural activities.

The multitude of low magnitude stationary sources located inside localities, form an aggregate of low-height area sources (the average height of buildings: approx. 4-5 m in villages, and 6-7 m in Abrud). The main stationary sources in residential areas are ducted (with chimneys for evacuation of burnt gases).

The road traffic inside localities is also constituted by low-height (approx. 2 m) area sources (the vehicle roads within the street network).

Vehicle traffic outside localities generates linear sources, one for each vehicle road.

B. Pollutant sources specific to the current Roşiamin activities.

Atmospheric pollutant sources related to the existing mining operation are represented by the following activities:

- open pit ore mining and primary "*in situ*" crushing; at present the open pits Cârnic and Cetate are active;
- secondary crushing of ore at Aprăbuş;
- conveying of ore to the processing plant;
- concentration of ore by simple flotation in order to extract metallic gold and silver.

Current average excavation rate is 1000 tones of ore per day; average processing rate is 850 tones of ore per day. Waste rock is excavated at a rate of 250 tones per day and is stockpiled near Cetate open pit.

Activities related to the processing plant are limited to concentration of ores. The concentrate is transported to other plants in the country for smelting and for producing metal ingots.

The pollutant which is characteristic to mining, ore/rock hauling and crushing activities, is represented by rock dust which may contain several potentially toxic and dangerous metals, such as: As, Pb, Cr, Ni. Dust sources are represented by: rock drilling for loading with explosive charges, blasting, handling of ore and waste rock, ore crushing.

Some pollutants emitted in the open pit area are related to exhaust gases from haul vehicle traffic between excavation point and primary crusher, and from other types of equipment. During blasting significant quantities of NO_x, CO and SO_2 are released into the atmosphere.

Ore transport from open pit to secondary crusher is partially done by an underground conveyor and partially, at grass. At grass, haulage is done along a narrow gauge rail, in dump cars pulled by electric or Diesel engines. Thus, the emissions of dust or pollutants from Diesel engines are generally low.

Pollutants related to the processing plant are represented by ore dust from the conveyor system and by a series of chemical reagents used for flotation. Crushing of ore is carried out in a wet system.

Another polluting source within the process plant is the thermal plant used for heating the plant during winter. The thermal plant works on distilled oil fuel ("CLU" with maximum sulphur content of 2%), at a consumption rate of 120 l/h.

Burned gas from the heating plant is evacuated through a 20 m height and 0.5 m diameter stack.

Beside these sources there are two waste rock dumps in the area (Valea Verde, double-benched, with a surface of 5.32 ha, and Hop, single-benched, with a surface of 4.3 ha), and two tailing ponds (Săliştei Valley and Gura Roşiei). The dry surfaces of these ponds represent free emission sources of dust generated by wind erosion. At wind speed of over 3 m/s, the quantities of dust carried by wind may be particularly high.

Sources related to Roşiamin activities are free, open and fugitive emissions (unducted), with the exception of the thermal station (which is a ducted source) within the processing plant site.

Roşiamin does not use any system for control dust or other pollutant emissions.

Because the mine is heavily subsidized by the government and the current operation is losing money, it is not possible for the existing operation to construct and maintain any system for controlling dust or other pollutant emissions.

The main anthropogenic sources of air pollution which define the initial levels of air pollution at the commencement of Project activities and which will continue to affect the air quality during the life of the Project, are represented the burning of wood and other fuels in residential, commercial or institutional heating systems. Another specific category of significant sources are those related to animal farming. These sources will relate to the following localities from the nearer or farther neighbourhood of the future industrial areas: Roşia Montană, Vâtop, Gârda Bărbuleşti, Ignăteşti, Iacobeşti, Gura Roşiei, Coasta Henţii, Abrud, Gura Cornei (the south-west area including approximately 50 % of the households), Bucium Sat, Dogăreşti, Heleşti, Floreşti, Bisericani, Petreni.

The number of inhabitants in these localities, at Project start-up, is directly related to the number of air pollution sources. According to the estimations, the population of Abrud is expected to increase as a consequence of household relocation and of socio-economic development. Thus, a population increase of up to 7,400 inhabitants is estimated during the first stage of the Project (5-10 years) and subsequently expected to grow to 7,500 inhabitants.

Partial resettlement of current residents of the villages of Gura Cornei is anticipated, as well as total resettlement from Ţarina, Balmoşeşti, Corna and Bunta. Resettlement areas are located in Piatra Albă, Abrud, and Alba Iulia.

For the scope of this study, the main air pollution sources have been considered: burning of solid fuel (wood and vegetal waste) for residential, commercial and institutional heating in the above-mentioned localities, burning of liquefied gas for cooking in Abrud and Roşia Montană especially, burning of solid fuel (wood and vegetal waste) for homestead cooking in the rural localities, animal farming and local vehicle traffic. The pollutants which are released from these sources and which will be similar to those released by Project activities are the following: NO, NO_2, N_2O, CO, CO_2, SO_2, CH_4, nmVOC, heavy metal particulates (Pb, Cd, Cu, Cr, Ni, Se, Zn, etc), PAH.

By taking into account the above elements, the emission inventories for the mathematical modelling of initial pollution levels will point to a situation of maximal atmospheric pollution (at least in what concerns the emissions for burning sources). This is due to the fact that no modifications of fuel characteristics – such as by introduction of gas distribution networks, extended use of liquefied gas – have been taken into consideration.

The inventory of pollutant emissions was determined by means of:

- EEA/EMEP/CORINAIR methodology (Last version - 1996);
- US EPA/AP-42 (Air CHIEF, Version 11.0, 2004) methodology;
- COPERT III Program for pollutants generated by mobile sources.

The only sources for which usable specific data where directly available for the calculation of emissions where those related to the road traffic intensity outside localities, to the sources inside Roşia Montană and those related to the Roşiamin activities. The data related to the road traffic intensity where obtained from measurements (counting of vehicles as per their category) carried out in year 2001 as a part of the Project baseline conditions study. The measurements were done in six points located on NR 74, NR 74A and CR 742. In the present study, updated measurement data were used (initial values multiplied by 10 % accounting for the average traffic increase rate).

The necessary data for calculation of pollutant emissions in Roşia Montană have been collected based on questionnaires drafted for this purpose, directly from people living and/or carrying out economic activities in this locality. The questionnaires were designed to collect data from each house, household, non-residential building and business, including: types and quantities of fuel used for heating and cooking, physical characteristics of emissions (number of chimney stacks, height of stacks/buildings), types and number of heating systems, types and number of vehicles used and related fuel types and consumption, types and number of mobile equipment (including agricultural equipment) and related fuel consumption rates, type of economic activity and production rate, production-related fuel types and consumption, as well as physical characteristics of emissions, agricultural land surfaces, types of crops, number and species of animals and poultry.

Due to the fact that no data were available for other emission sources, substitute data from the Resettlement and Relocation Action Plan and from the Statistical Yearbook of Romania (2001 – the last published issue) were used. The results concerning the emission inventories for stationary and mobile sources from inside and outside Project area are given in the tables below.

2.2 Emission Inventories for Sources From Inside Project Area

a. Roşiamin Activities

Table 2-1. Mass flow rates of particulate matter released into the atmosphere during ore extraction works [1]

No.	Type of work/operation	Mass flow rates vs. particulate matter dimensions (kg/h)			
		d ≤ 30 μm	d ≤ 15 μm	d ≤ 10 μm	d ≤ 2.5 μm
1.	Drilling	0.300	ND	0.069	ND
2.	Blasting	32.4 kg/blast	ND	16.9 kg/blast	ND
3.	Crushing of oversized blocks	2.460	ND	1.279	ND
4.	Stockpiling	0.292	0.050	0.037	0.031
5.	Loading in haul vehicles	0.294	ND	0.140	ND
6.	Haulage inside open pit	1.257	0.785	0.566	0.149
7.	Unloading + primary crushing	0.754	ND[3]	0.359	ND
8.	Wind erosion	13.584	ND	6.469	ND
	TOTAL[2]	18.941	-	8.919	-

1 - hourly emission
2 excepting blast-related emissions
3 no emission factors

Table 2-2. Mass flow rates of pollutants released into the atmosphere by blasting[1]

NO_x	CO	SO_2
42	179	5.25

1 rock dust excluded; instant emissions (kg/blasting)

Table 2-3. Mass flow rates of pollutants released into the atmosphere by equipment and vehicles during ore extraction works [1]

Source	Mass flow rates (g/hour)												
	NO_x	CH_4	VOC	CO	N_2O	SO_2	PM	Cd [10^{-3}]	Cu [10^{-3}]	Cr [10^{-3}]	Ni [10^{-3}]	Se [10^{-3}]	Zn [10^{-3}]	Pb 10^{-3}]
Vehicles	1920.65	11.25	367.04	1538.32	5.4	449.8	193.41	0.45	76.47	2.25	3.15	0.45	44.98	0.00
Equipments	3288.31	11.46	477.08	1064.66	87.6	673.84	386.11	0.67	114.55	3.37	4.72	0.67	67.38	223.71
Total	5208.96	22.7	844.11	2602.98	93.00	1123.64	579.52	1.12	191.02	5.62	7.87	1.12	112.36	223.71

1 - hourly emissions
2 - particulate matter contained in the exhaust gases (diameters are smaller than 2.5 μm)

Table 2-4. Mass flow rates of metals (contained in particulate matter) released into the atmosphere during ore extraction works [1]

Type of particulate matter	Mass flow rates (kg/h)											
	As	Ba	Sb	Cu	Pb	Sn	Mn	Cr	Ni	Zn	Co	V
TSP[2]	0.003	0.023	0.0005	0.0011	0.005	0.0001	0.038	0.0004	0.0003	0.006	0.0002	0.002
PM_{10}[3]	0.002	0.011	0.0002	0.0005	0.0022	0.00005	0.018	0.0002	0.0001	0.003	0.001	0.001

1 - hourly emissions
2 - particulate matter with Φ < 30 μm
3 - particulate matter with Φ < 10 μm

Table 2-5. Mass flow rates of pollutants released into the atmosphere from the waste rock dumps[1]

Source	Mass flow rates (kg/h)	
	TSP[2]	PM_{10}[3]
Valea Verde Waste rock dump	0.688	0.328
Hop Waste rock dump	0.626	0.298

1- fugitive emissions; hourly emissions
2 - particulate matter with Φ < 30 μm
3 - particulate matter with Φ < 10 μm

b. Localities and road traffic

Table 2-6. Emissions of atmospheric pollutants – stationary sources related to burning and animal farming

Locality	Mass flow (t/an)										
	PM10	CO	NOx	N2O	SO2	CH4 heating	TNMOC	CH4 animal	PAH	NH3	CH4 total
Țarina	9.180	69.240	0.840	0.000	0.120	9.000	15.900	4.241	0.219	2.206	13.241
Balmoşeşti	2.203	16.618	0.202	0.000	0.029	2.160	3.816	1.023	0.053	0.533	3.183
Corna	11.94	90.08	1.09	0.00	0.16	11.71	20.69	8.83	0.29	4.59	20.54
Bunta	1.33	10.01	0.12	0.00	0.02	1.30	2.30	0.98	0.03	0.51	2.28
Gura Cornei	1.377	10.386	0.126	0.000	0.018	1.350	2.385	1.010	0.033	0.529	2.360

Table 2-7. Emissions of atmospheric pollutants – mobile sources inside localities (surface sources)

Locality	Mass flow (t/an)														
	PM	CO	NOx	N2O	SO2	TNMOC	CH4	VOCtot	Pb (10^{-3})	Cd (10^{-3})	Cu (10^{-3})	Cr (10^{-3})	Ni (10^{-3})	Se (10^{-3})	Zn (10^{-3})
Țarina	0.001	0.365	0.055	0.000	0.003	0.086	0.003	0.089	0.000	0.000	0.003	0.000	0.000	0.000	0.002
Balmoşeşti	0.001	0.234	0.038	0.000	0.002	0.055	0.002	0.057	0.000	0.000	0.002	0.000	0.000	0.000	5E-04
Corna	0.002	0.825	0.124	0.000	0.007	0.195	0.000	0.000	0.000	4.3E-05	0.007	0.0002	0.0005	4.52E-05	0.004523
Bunta	0.0003	0.0917	0.0138	0.0000	0.0008	0.0216	0.000	0.000	0.000	4.77E-06	0.000754	2.51E-05	5.03E-05	5.03E-06	0.0005
Gura Cornei	0.001	0.084	0.020	0.000	0.001	0.020	0.000	0.000	0.000	5.2E-06	9E-04	7E-05	1E-04	5E-06	5E-04

Table 2-8. Emissions of atmospheric pollutants – linear sources (road traffic outside localities)

Source	Mass flow (g/h)													
	NO_x	CH_4	VOC	CO	N_2O	SO_2	Part.	Cd [10^{-3}]	Cu [10^{-3}]	Cr [10^{-3}]	Ni [10^{-3}]	Se [10^{-3}]	Zn [10^{-3}]	Pb 10^{-3}]
DJ 742	575.88	5.40	176.35	1030.54	1.62	52.73	31.35	0.16	27.05	0.80	1.11	0.16	15.91	0.69

2.3 Emission Inventories for Sources from Outside Project Area

a. Roşiamin Activities

Table 2-9. Mass flow rates of pollutants released into the atmosphere in the secondary crusher area [1] (Aprăbuş)

Source	Mass flow rates (kg/h)	
	TSP[2]	PM_{10}[3]
Unloading + crushing of ore	3.675	1.75
1 fugitive emissions; hourly emissions 2 particulate matter with Φ < 30 µm 3 particulate matter with Φ < 10 µm		

Table 2-10. Mass flow rates of pollutants released into the atmosphere in the processing plant area[1] – unducted sources

Source	Mass flow rates (kg/h)	
	TSP[2]	PM_{10}[3]
Unloading + crushing of ore	0.021	0.01
1 fugitive emissions; hourly emissions 2 particulate matter with Φ < 30 µm 3 particulate matter with Φ < 10 µm		

Table 2-11. Mass flow rates of pollutants released into the atmosphere in the processing plant area1 – thermal plant – ducted source

Pollutant	Mass flow rate (g/h)	Gas flow rate (Nm^3/h)	Concentration in emissions (mg/ Nm^3)	Alert threshold (mg/Nm^3)	Intervention threshold (mg/Nm^3)
NOx	288.0	1440	200	315	450
CO	216.0	1440	150	119	170
SOx[2]	4147.2	1440	2880	1190	1700
Total particulate matter	100.8	1440	70	35	50
Organic particulate matter	0.048	1440	-	-	-
N_2O	1.584	1440	-	-	-
CH_4	0.749	1440	-	-	-
TOC[3]	3.6	1440	-	-	-
Formaldehyde	0.878	1440	-	-	-
Benzene	0.003	1440	-	-	-
PAH	0.017	1440	-	-	-
Benz(a)anthracene	0.00006	1440	-	-	-
As	0.019	1440	-	-	-
Cd	0.006	1440	-	-	-
Cr	0.016	1440	-	-	-
Ni	1.217	1440	-	-	-
1 - ducted sources: the thermal power plant; hourly emissions 2 - for a 2% sulphur content in fuel 3 - total organic compounds Alert threshold = 70% of the limit concentration as provided for by M.O. 462/1993 (with respect of M.O. 756/1997) Intervention threshold = concentration limit of emissions as provided for by M.O. 462/1993 (with respect of M.O. 756/1997)					

Table 2-12. Average mass flow rates of particulate matter released into the atmosphere from tailing ponds areas [1]

Source	Mass flow rates (kg/h)	
	TSP[2]	PM_{10}[3]
Săliştei Valley	1.20	0.57
Gura Roşiei	0.85	0.43
1 fugitive emissions; hourly emissions 2 particulate matter with Φ < 30 μm 3 particulate matter with Φ < 10 μm		

At wind speed above 3m/s, it is possible for total particulate matter emissions from the dry surfaces of the two tailing facilities to reach 38 kg/h in the case of Săliştei Valley, and 35 kg/h in the case of Gura Roşiei.

b. Localities and road traffic

Table 2-13. Emissions of atmospheric pollutants – stationary sources related to burning and animal farming

Locality	Mass flow (t/an)										
	PM10	CO	NOx	N2O	SO2	CH4 heating	TNMOC	CH4 animal	PAH	NH3	CH4 total
Vârtop	10.526	79.395	0.963	0.000	0.138	10.320	18.232	4.847	0.251	2.518	15.167
Gârda Barbuleşti	5.753	43.390	0.526	0.000	0.075	5.640	9.964	2.670	0.137	1.389	8.310
Ignăţeşti	5.508	41.544	0.504	0.000	0.072	5.400	9.540	2.552	0.131	1.330	7.952
Iacobeşti	2.938	22.157	0.269	0.000	0.038	2.880	5.088	1.343	0.070	0.700	4.223
Gura Roşiei	8.323	62.778	0.762	0.000	0.109	8.160	14.416	3.873	0.199	2.011	12.033
Coasta Henţii	7.589	57.238	0.694	0.000	0.099	7.440	13.144	3.539	0.181	1.839	10.979
Roşia Montană	24.152	182.237	2.254	0.002	0.316	23.678	41.832	2.419	0.576	1.480	26.097
Abrud	399.195	3013.876	38.477	0.088	5.219	391.340	691.386	38.609	9.522	24.521	429.948
Gura Cornei	2.203	16.618	0.202	0.000	0.029	2.160	3.816	1.010	0.053	0.529	3.170
Bucium Sat	9.670	72.933	0.885	0.000	0.126	9.480	16.748	4.454	0.231	2.316	13.934
Dogăreşti	2.203	16.618	0.202	0.000	0.029	2.160	3.816	1.084	0.053	0.562	3.244
Heleşti	2.693	20.310	0.246	0.000	0.035	2.640	4.664	1.237	0.064	0.644	3.877
Floreşti	2.938	22.157	0.269	0.000	0.038	2.880	5.088	1.417	0.070	0.733	4.297
Bisericani	10.159	76.626	0.930	0.000	0.133	9.960	17.596	4.760	0.242	2.473	14.720
Petreni	2.815	21.234	0.258	0.000	0.037	2.760	4.876	1.326	0.067	0.688	4.086

Table 2-14. Emissions of atmospheric pollutants – mobile sources inside localities (surface sources)

Locality	Mass flow (t/an)														
	PM	CO	NOx	N2O	SO2	TNMOC	CH4	VOCtot	Pb (10^{-3})	Cd (10^{-3})	Cu (10^{-3})	Cr (10^{-3})	Ni (10^{-3})	Se (10^{-3})	Zn (10^{-3})
Virtop	0.001	0.365	0.055	0.000	0.003	0.086	0.003	0.089	0.000	0.000	0.003	0.000	0.000	0.000	0.0018
Girda Barbulesti	0.002	0.430	0.072	0.001	0.005	0.102	0.003	0.105	0.000	0.000	0.004	0.000	0.000	0.000	0.000667
Ignatesti	0.001	0.084	0.020	0.000	0.001	0.020	0.001	0.020	0.000	0.000	0.001	0.000	0.000	0.000	0.001
Iacobesti	0.001	0.215	0.036	0.000	0.002	0.051	0.002	0.052	0.000	0.000	0.002	0.000	0.000	0.000	0.001
Gura Rosiei	0.001	0.122	0.025	0.000	0.002	0.029	0.001	0.030	0.000	0.000	0.001	0.000	0.000	0.000	7E-04
Coasta Hentii	0.002	0.337	0.061	0.001	0.004	0.080	0.002	0.082	0.000	0.000	0.003	0.000	0.000	0.000	0.002
Roşia Montana	0.002	0.318	0.058	0.001	0.004	0.075	0.002	0.077	0.000	0.000	0.003	0.000	0.000	0.000	0.002
ABRUD	0.002	0.065	0.076	0.001	0.007	0.014	0.000	0.015	0.000	0.000	0.059	0.002	0.002	0.000	0.148
Gura Cornei	0.150	25.140	5.451	0.047	0.389	5.926	0.183	6.109	0.009	0.001	0.252	0.018	0.025	0.001	5E-04
Bucium Sat	0.001	0.084	0.020	0.000	0.001	0.020	0.001	0.020	0.000	0.000	0.001	0.000	0.000	0.000	0.002
Dogaresti	0.002	0.393	0.068	0.001	0.004	0.093	0.003	0.096	0.000	0.000	0.004	0.000	0.000	0.000	5E-04
Helesti	0.001	0.084	0.020	0.000	0.001	0.020	0.001	0.020	0.000	0.000	0.001	0.000	0.000	0.000	7E-04
Floresti	0.001	0.122	0.025	0.000	0.002	0.029	0.001	0.030	0.000	0.000	0.001	0.000	0.000	0.000	7E-04
Bisericani	0.001	0.122	0.025	0.000	0.002	0.029	0.001	0.030	0.000	0.000	0.001	0.000	0.000	0.000	0.002
Petreni	0.002	0.411	0.070	0.001	0.005	0.097	0.003	0.100	0.000	0.000	0.004	0.000	0.000	0.000	0.004

Table 2-15. Emissions of atmospheric pollutants – linear sources (road traffic outside localities)

Source	Mass flow (g/h)													
	NO_x	CH_4	VOC	CO	N_2O	SO_2	Part.	Cd [10^{-3}]	Cu [10^{-3}]	Cr [10^{-3}]	Ni [10^{-3}]	Se [10^{-3}]	Zn [10^{-3}]	Pb 10^{-3}]
DN 74 A	3923.90	41.59	1357.36	8127.04	11.03	353.29	208.16	1.09	185.40	5.45	7.63	1.09	109.06	6.28
DN 74	1480.22	11.28	368.06	2069.73	4.16	132.69	72.63	0.38	64.97	1.91	2.68	0.38	38.21	1.40

2.4 Ambient Air Quality - Evaluation of Background Air Quality in the Area for NO_2, SO_2, CO, Suspended Particulate Matter (PM_{10})

As already mentioned, the studied area includes two categories of atmospheric pollutant sources:

- Category 1 – sources within the Project area, represented by localities and Roşiamin activities which will cease before the start of the Project. Thus, the existing localities will be relocated, and the current mining operations will be replaced by activities related to the new Project.
- Category 2 – existing sources which will remain active throughout the life of the Project, represented by activities inside and outside localities surrounding the Project area, as well as by the road traffic on national, county and local road, outside Project area. Current Roşiamin activities from outside the Project area, namely the secondary crushing at Aprăbuş and the processing plant (with all related facilities) will be shut down with the implementation of the Project.

No certain information is available on whether the tailings dams in Săliştei Valley and Gura Roşiei will continue to exist as air pollution sources. Thus, prior to the beginning of activities within the Roşia Montană Project, a closure and rehabilitation plan must be developed for all current Roşiamin production areas. However, the implementation of this plan will depend on whether the Ministry of Economy and Commerce will provide the necessary funding. Therefore, the exact moment of rehabilitation of the two tailings dams and their elimination as polluting sources, it is currently not known.

During the period of initial implementation of the Project, after the dismantling of all existing sources from within the Project footprint, the air quality will be under the exclusive influence of the localities surrounding the industrial area, of the road traffic and of other potential sources from outside the Project area. In order to create the possibilities to assess the air quality in areas with sensitive receptors located outside the Project area, as a direct consequence of the Project related sources cumulated with the active external sources, the background pollution levels which will be characteristic during the life of the Project will need to be evaluated. The knowledge of the current pollution levels in the area under scrutiny has no relevance for the present study which is directed towards assessing the impact of the Project related activities. The mentioned lack of relevance resides in the fact the current location and intensity of sources will change significantly.

The results are given in Exhibits 4.2.1 – 4.2.8.

These maps indicate that (excluding emissions specifically associated with the current Roşiamin operation) all background pollutants are well below the limit values (LV). The data associated with the CO, PM_{10}, NO_2 and SO_2 pollutants are discussed further as follows:

- **CO Concentrations:** The highest values of maximum 8-hour mean concentration of CO (i.e., maximum daily 8-hour mean concentration selected from 8-hour running averages) ranges between 400 and 1200 µg/m^3; well below the LV of 10,000 µg/m^3. These maximum values are in the northwest area of Abrud. The maximum values occur in the cold seasons, apparently also due to CO emissions related to residential heating.
- **PM_{10} Concentrations:** For PM_{10}, the highest values of annual average concentration, the 24-hour average concentrations were also expected to be in the area northwest of Abrud. The maximum annual average PM_{10} concentration ranged between 1.5 and 4.5 µg/m^3; well below the LV of 20 µg/m^3. The maximum 24-hour concentration ranged between 2 and 11 µg/m^3; well below the LV of 50 µg/m^3.
- **NO_2 Concentrations:** For NO_2, the highest values for the 1-hour average concentration and the annual average concentration were also expected to be in the area northwest of Abrud. The 1-hour average NO_2 concentration ranged

between 20 and 80 μg/m^3; below the LV of 200 μg/m^3. In this area, the maximum annual average NO_2 concentration ranged between 1.5 and 5 μg/m^3; well below the LV of 40 μg/m^3.

- **SO_2 Concentrations:** For SO_2, the highest values for the 1-hour average concentration, the 24-hour average concentration, and the annual average concentration were also expected to be in the area northwest of Abrud. In this area, the 1-hour average SO_2 concentration ranged between 2 and 9 μg/m^3; below the LV of 350 μg/m^3. In this area, the 24-hour average SO_2 concentration ranged between 0.3 and 2.7 μg/m^3; below the LV of 125 μg/m^3. The maximum annual average SO_2 concentration ranged between 0.1 and 0.6 μg/m^3; well below the LV of 20 μg/m^3.