

Chapter S6 EMISSION SOURCES OTHER THAN POWER PLANTS

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6.1 Introduction

This Chapter reports results of the survey carried out in three Field Work stages and their analyses on the emissions of air pollutants such as SO₂, NO_x and PM from stationary and mobile sources other than power plants in three model areas.

6.2 Stationary Emission Sources

6.2.1 Preface

The previous JICA Project in 1994 listed in its report (#161) many petroleum and chemical industries as stationary sources. Within around 90 listings, the appendix S6-A1 is a list of the factories in the three model areas, selected from names of streets and municipalities. In addition to this list, the JICA Team tried to find stationary emission sources as described below.

6.2.2 San Nicolas Area

The JICA and Argentine Study Teams had gotten the list (shown in S6-A2) on the factories and their consumption amounts of natural gas (NG) from the Environmental Protection Department, San Nicolas Municipal Government. Both Teams visited and surveyed the several factories of the list, which used NG of more than 10,000 m³N/month. Also visited SIDERAR and ECOCEMENTO in the Municipality of Ramallo. ECOCEMENTO is in operation at the new industrial estate, COMIRSA in the model area of the Study.

Visiting Factories and Their Emission Sources

- ① ATANOR (An Agricultural Chemical Factory)
Sources: 2 NG-fired Boilers (8t steam /h and 20t steam /h)
- ② Fabrica de hielo Luchelli Cavalli (An Ice Manufacturing Factory)
Sources: A Gas Engine (12.5 m³N/h of NG Consumption)
- ③ ECOCEMENTO (A Cement Factory)
Sources: Cement Raw Material Drying Furnace (250~300m³N/h of NG Consumption)
- ④ HDF LANAS (A Silk Mill and A Dye Works)
Sources: A NG-fired Boiler (3t steam /h)
- ⑤ SIDERAR (A Steelworks) (See also S6-A5 of this Support Volume)
Sources: 2 Blast Furnaces, 2 Coke Ovens, 4 Boilers, 3 Converters, a Sintering Machine, etc.
(Emission data on some of these sources were not measured yet.)
- ⑥ FORTUNATO BONELLI Y CIA (A Rolling Mill)

Sources: A Metal Rolling Furnace (2200m³_N/h of NG Consumption)

⑦ Acindar Industria Argentina de Aceros (steel from direct reduction of sponges and scrap iron)

Sources: 3 bag filters (each exhaust 20,000m³_N/hr, emission below 250 mg/m³: hearing on 14 Dec. 2000) (See also S6-A5 of this Support Volume)

6.2.3 Lujan de Cuyo Area

Both Teams surveyed the surrounding area of the Central Termica Mendoza Power Plant and confirmed that the following factories were main stationary emission sources. Also the both Teams obtained related information from the Environmental Protection Department of Mendoza Province and the Environmental Research Institute of Mendoza University.

① YPF Petroleum Refinery

② YPF Liquefaction Factory

③ PETROQUIMICA CUYO (Petrochemical Factory)

④ STEIN FERROALEACIONES (SiCa Manufacturing Factory)

⑤ ACSA (Foundry)

⑥ GASSURU (Petro-coke Factory)

⑦ KNAUF (Gypsum Product Manufacturing Factory)

The measurement of SO₂ and NO_x in flue gas was reportedly carried out at PETROQUIMICA CUYO (③). However, data was not presented to the Study. Sources ② and ⑥ did not accept the Teams' visit.

Visiting Factories and Their Emission Sources

① YPF Petroleum Refinery (See also S2-A2 & S6-A5 of this Support Volume)

Sources: 3 Boilers (two 100t steam /h boilers and a 130t steam /h boiler)

2 Flare-stacks and oil heating furnaces, etc.

③ PETROQUIMICA CUYO

Sources: 4 NG-fired Boilers (two 2t steam /h boilers and two 8t steam /h boilers)

A Flare-stack

④ STEIN

Sources: Electric Furnaces (2 arc furnaces for ore fusion)

⑤ ACSA

Sources: Electric Furnaces (2 arc furnaces for iron and steel smelting)

A Metal Heat Treatment Furnace (70m³_N/h of NG consumption)

⑦ KNAUF (Started operation in April, 2001)

Sources: Gypsum Raw Material Drying Furnace (100m³N/h of NG consumption)

6.2.4 Buenos Aires Area

Although both Teams visited Center of Investigation and Development for Energy Conservation, National Institute for Industrial Technology (INTI) and Ministry of Social Development and Environment to obtain lists of stationary sources in the Buenos Aires model area, both Teams could not obtain any list.

The big factories have already moved to the suburbs and the use of fuel oil is prohibited in the Buenos Aires model area by law, except at power plants in winter. The Study Teams obtained a partial list on natural gas fired boilers in this area (shown in S6-A3). These are small boilers that belong to factories, hospitals and hotels. There are more than 60 hotels listed as 4- to 5- star grades in the Buenos Aires Official Guide (7/2001). Apparently these 60 are not included in the S6-A3 list. The survey on the representative boilers (a hotel and hospitals) was carried out in the Field Work stages, and the NO_x emissions from the rest was estimated by using the emission factor in Japan.

6.3 Data on Stationary Sources

S6-A4 shows the summary of the data obtained during the survey on the stationary sources other than power plants in three areas. S6-A5 compiles results of calculation to predict order of the magnitude of important pollutant emissions from large stationary sources in the model areas. The photographs on main sources and street scenes in San Nicolas and Lujan de Cuyo Areas are shown in the last appendix of this Chapter S6.

S6-A1 Petroleum and Chemical Industries in Model Areas (#161)

Buenos Aires Area

No.	Product	Capacity ton/year	Company	Location Street Name	BA	Start	Steam t/product	Electric kwh/t	Fuel MMBtu/t
11	Fumaric Acid	800	Atanor SA	Liavallol (BA)		1972			
77	Liquid Gas	300,000	Gas del Estado	Gral. Cerri (BA)		1981			
156	Methanol	50,000	Resnfor-Metanol	Pto. San Martin (BA)		1990			
159	Nylon Yarn	4,500	Sniafa SA	Hernandez (BA)		1959			
158	Polyacetate vinyl copolymer	4,000	Sipak SA	Capital		1966			
47	Polyols	25,344	(ex-Dow Quimica SA)	Puerto San Martine (BA)		1982			
46	SBR Latices	10,000	Indoquim SA	Puerto San Martine (BA)		1969	3	500	0
14	Ureic Glues	8,300	Atanor SA	Munro (BA)		1962	0.3	30	0
150	Vinyl Polyacetate & Copolymers	15,000	Quimica Hoechst	Liavallol (BA)		1965			

Note: Checked with Sr. Gomez of CNEA. No one of the above was able to be contacted.

San Nicolas and Lujan de Cuyo Areas

No.	Product	Capacity ton/year	Company	Location		Start	Steam t/product	Electric kwh/t	Fuel MMBtu/t
22	Weedkillers Atrazine	4,000	Atanor SA	San Nicolas		1987			
27	Creosoto, Phenol, Anthracene	30,000	Carboquimica Arg. SA	San Nicolas		1974			
28	Petroleum Asphalt	30,000	Carboquimica Arg. SA	San Nicolas		1974			
29	Naphthalene	5,000	Carboquimica Arg. SA	San Nicolas		1974	1.36	42	
160	Ammonium Sulfate		Somisa	San Nicolas		1959	0.15	20	
67	Tartaric Acid	3,500	Duperial	Palmira (Mendoza)	x	1940			
139	Polypropylene	40,000	Petroquimica Cuyo	Lujan de Cuyo		1988			
137	Polypropylene	40,000	Petroquimica Cuyo	Lujan de Cuyo		1988	1.2	590	0
91	Hydrochloric Acid	9,600	Khegart SA	Chacras de Coria(Mendoza)	x	1960		10	
5	Expandable Polyethylene	1,200	Aislantes de Cuyo SA	Godoy Cruz (Mendoza)	x	1973			
90	Caustic Soda	4,000	Khegart SA	Chacras de Coria(Mendoza)	x	1960			

Note: Outside of the model area

S6-A2 Monthly Natural Gas Consumption at Boilers in San Nicolas

Empresa	Consumo de Combustible Gas m3/month	Others
Hilados HDF	32,000	
Proarmet	30,000	Closed
Molino Harinero		1,500 kg/month (gas envasado)
Panaderia las Delicias	230	1,200 kg of wood/month
Bonelli	590,000	420,000 for No. 1 unit 190,000 for No. 2 unit
Norte (Panaderia)	2,000	
Boutque del Pan	2,000	
Venus Panaderia	1,000	
Somisa (Panaderia)	1,500	
Dalymir	300	
Panaderia Cielo	230	
Panaderia San Martin	970	
Panaderia Nuevo Estilo	340	
Panaderia el Paraiso	40	
Metalurgia Leval		O ₂ : 320 m ³ /month O ₂ : 400 m ³ /month CO ₂ : 360 kg/month
Auteyral Helados	400	
Vallorani Copetin	2,000	
Central Plastic	800	Gas oil 500 liter/month
Gosa Panaderia	1,340	
Tintoreria Rex	400	
Tomas Panaderia	670	
Vitantonio Panaderia	1,500	
Mondial Panaderia	1,500	
Fabria de Hielo Luchelli Cavalli	6,000	
Tia Panaderia	2,000	
Ninona	1,250	
Helados Maxim's	100	
Mateo Torres Carpinteria		Gas oil 60 liter/month
Galante Copetin	3,000	

Source:

Municipalidad de San Nicolas

Direccion de Recursos Naturales y Gestion Ambiental

S6-A3 Partial List of Boilers in Buenos Aires

	Location	Business	No. of Boilers	Steam Production kg/hr
1	Juan B. Justo 1119-51	Industria	1	2,600
2	Cerrito 1433-55	Hotel	2	3,200
3	Cerrito 1433-55	Hotel	1	1,950
4	San Martine 1225-75	Hotel	3	1,227
5	San Jose 1046	Fca. de Galletitas	2	1,600
6	Cerrito 370	Hotel	2	1,400
7	Reconquista 446	Oficinas	2	1,300
8	Virrey Cevallos 1473	Laboratorio	1	1,300
9	San Martin 137	Banco	2	1,080
10	San Martin 469	Oficinas	2	1,200
11	Av. Patricias Argentinas 351	Hospital	3	1,560
12	Defensa 113	Oficinas	1	1,800
13	Av. Patricias Argentinas 351	Hospital	3	3,360
14	San Juan 2258	Laboratorio	2	1,940
15	San Jose 1448	Laboratorio	1	1,080
16	D. Taborda 482	Curtiembre	1	1,200
17	Iguazu 953	Fca. Poliester	1	3,000
18	Iguazu 953	Fca. Poliester	1	10,000
19	Cachi 1202	Pr. Medicinales	2	2,500
20	A. Alcorta 3420	Coca Cola	1	6,000
21	A. Alcorta 3420	Coca Cola	1	8,000
22	D. Taborda 1620	Coca Cola	2	2,000
23	D. Taborda 1620	Coca Cola	1	7,000
24	S. Domingo 3972	Curtiembre	1	2,400
25	Grito de Ascencio 3270	R. Tambores	1	2,000
26	N. de la Vega 3697	Hospital Aeronautico	1	1,200
27	A. Alcorta 3676	Lavadero	1	1,400
28	California 3201	Fabrica Aceite	1	6,000
29	California 3201	Fabrica Aceite	1	10,000
30	O. Cruz 3348	Molino	1	5,000
31	Zepita 3157	Fabrica Tintas	1	2,000
32	Zepita 3164	Lab. Farmaceutico	1	4,000
33	Lujan 3138	Fabrica Envases	1	2,000
34	Uspallata 2172	Lavadero	1	4,000
35	Dr. Finochietto 2116-92	Fabrica Tejidos	1	5,000
36	Montesquiu 494	Estampado de Telas	1	5,000
37	Caseros 2046	Lavadero	1	1,400
38	Luna 472	Lavadero	1	3,000
39	Caseros 2519	Lavadero	1	3,000
40	Perdriel 74	Hospital Britanico	2	2,400
41	Luzuriaga 70	Hospital Britanico	1	1,200
42	Perdriel 1461	Bebidas Gaseosas	1	1,000
43	Rio Limay 1538-72	Fabrica Carton	1	2,000
44	Lujan 2507-97	Prod. Alimentacion	1	2,500
45	Vieytes 1729	Fabrica Chocolates	1	1,000
46	Barracas 388	Fabrica Cereales	1	4,000
47	Montes de Oca 169	Fabrica Galletitas	2	6,000
48	Montes de Oca 10-110	Htal de Ninos	1	1,000
49	Dr. Finochietto 425	Pepsi Cola	1	1,000
50	B. Perez Galdos 52-54	Lavanderia	2	4,000
51	Juan de Garay 164	Estab. Grafico	4	1,000
52	Juan de Garay 164	Estab. Grafico	1	2,000

Note: Buenos Aires Official Guide (7/2001) listed 14 five-star and 52 four-star hotels, and also 6 large shopping centers. Each may have boilers. The JICA Team stayed in the Gran Hotel Buenos Aires located at M. T. de Alvear 767. The hotel had two natural gas fired boilers.

S6-A4 Emissions from Visited Stationary Sources (except Power Plants)

Model Area Plant Name	San Nicolas ATANAR(Agrochemicals)(I)		San Nicolas ATANAR(II)		San Nicolas Fabrica de Hielo Luchelli Cavalli (Ice)		San Nicolas ECOCEMENTO	
	Unit		Unit		Unit		Unit	
1 Facility & Fuel								
① Facility Name	Boiler No.1		Boiler No.2		Gas Engine		Cement raw material drying furnace	
② Capacity	8 t steam/h*		20 t steam/h		-		-	
③ Daily Operation Time	20 hr/day		20 hr/day		16 hr/day		24 hr/day	
④ Annual Operation Days					360 days		300 days	
⑤ Fuel Type	Natural Gas		Natural Gas		Natural Gas		Natural Gas	
⑥ S% (if liquid fuel used)								
⑦ Fuel Consumption/h	no answer		no answer		12.5 m ³ /h (6000m ³ /mon)		250~300 m ³ /h	
2 Flue Gas & Stack	When generating 3t steam/hr		no answer				No intention to report data	
① Flue Gas Volume/h								
② Temperature	- °C						100	
③ Concentration SO ₂	0 ppm						0	
	NO _x 4.62 mg/m ³ N						4049.5 kg/y	
	Dust not measured						0	
	O ₂ 19.11 %						17 %	
④ Stack Height	15.5 m		15.5 m		5 m		20 m	
⑤ Stack Diameter	90 cm		90 cm		30 cm		100 cm	
3 Countermeasures	nothing				nothing		nothing	
Comment	Normally either one is in use. * Rated capacity							

Model Area Plant Name	San Nicolas Fortunato Bonelli y CIA		San Nicolas HDF LANAS(Filature & dye)	
	Unit		Unit	
1 Facility & Fuel				
① Facility Name	Metal Rolling Furnace		Boiler	
② Capacity			3 t steam/h	
③ Daily Operation Time	24 hours		11 hr/day, Sat:6hr/day, Sun:0hr/day.	
④ Annual Operation Days	335 days			
⑤ Fuel Type	Natural Gas		Natural Gas	
⑥ S% (if liquid fuel used)				
⑦ Fuel Consumption/h	2200 m ³ /h		27.3m ³ /h	
2 Flue Gas & Stack			98.12.1 monitored	
① Flue Gas Volume/h	28314 m ³ /h,dry=23958		1236 m ³ /h(dry)	
② Temperature	664.9 °C		180 °C	
③ Concentration SO ₂	0 mg/m ³ N		0 ppm	
	NO _x 93.43 mg/m ³ N		58 ppm	
	Dust 0		- No data	
	O ₂ 4.1 %		4.1 °C	
④ Stack Height	26.5 m		9 m	
⑤ Stack Diameter	1.4 m		60 cm	
3 Countermeasures			nothing	
Comment	Steel for building:130000t/y Employee:240, Area:13ha.		1)Two factories for filature and dying 2)The boiler in the dying factory near the air club	

Model Area Plant Name	Lujan de Cuyo Petroquimica Cuyo(I)		Lujan de Cuyo Petroquimica Cuyo(II)		Lujan de Cuyo Petroquimica Cuyo(III)		Lujan de Cuyo KNAUF(Gypsum boards)	
		Unit		Unit		Unit		Unit
1 Facility & Fuel								
① Facility Name	Flare Stack		Boiler No.1 & No.2	One in use	Boiler No.3 & NO.4	One in use	Cement raw material drying furnace	
② Capacity	-		2	t steam/h	8	t steam/h	-	
③ Daily Operation Time	24	hr/day	24	hours	24	hours	-	8 hours
④ Annual Operation Days	365	days	365	days	365	days	-	265 days
⑤ Fuel Type	Propane		Natural Gas		Natural Gas		Natural Gas	
⑥ S%(if liquid fuel used)	0	%						
⑦ Fuel Consumption/h	800	kg/h	-				100	m ³ /h
2 Flue Gas & Stack			Monitored		Monitored		No data	
① Flue Gas Volume/h								
② Temperature			157.3	°C	140	°C		
③ Concentration SO ₂	No data		0	ppm	0	ppm		
			66	ppm	60	ppm		
			6.1	%	3.1	%		
④ Stack Height	70	m(50m by view)	18	m	12	m	36~38	m
⑤ Stack Diameter	30	cm	40	cm	60	cm	100~120	cm
3 Countermeasures							Low NO _x burners A bagfilter installed for a hammermill	
Comment			Low NO _x burners		Low NO _x burners		In operation from April 2001	

Model Area Plant Name	Lujan de Cuyo Stein(I)		Lujan de Cuyo Stein(II)		Lujan de Cuyo ACSA(I a+b+c) 3 units		Lujan de Cuyo ACSA(II)	
		Unit		Unit		Unit		Unit
1 Facility & Fuel								
① Facility Name	Arc Furnace		Arc Furnace		Electric furnace		Metal heat treatment furnace	
② Capacity	850	t/month	400~450	t/month	2 or 4	t	-	
③ Daily Operation Time	24	hours	24	hours	24	hours	-	
④ Annual Operation Days	365	days	365	days	365	days	-	
⑤ Fuel Type		Electric		Electric power	250	000kW/month	Natural Gas	
⑥ S%(if liquid fuel used)								
⑦ Fuel Consumption/h							50000	m ³ /month
2 Flue Gas & Stack								
① Flue Gas Volume/h	13.2	m/sec						
② Temperature								
③ Concentration SO ₂	0	ppm						
								met the standards
④ Stack Height	40	m	26~29	m	20	m		
⑤ Stack Diameter	170	cm	80	cm	50	cm		
3 Countermeasures	vel=13.2m/s Take out melt each in 70 minutes		vel=7.1m/s		Two bagfilters with hoods			
Comment					Particulates fly when products withdrawn No PM emission to outside - a collector inside			

Model Area Plant Name	Lujan de Cuyo YPF (I)		Lujan de Cuyo YPF (II)		Lujan de Cuyo YPF (III)	
		Unit		Unit		Unit
1 Facility & Fuel						
① Facility Name	Boiler		Boiler		Boiler	
② Capacity	100	t/h	100	t/h	130	t/h
③ Daily Operation Time	24 hours		24 hours		24 hours	
④ Annual Operation Days	365 days		365 days		365 days	
⑤ Fuel Type	Mix of NG,FuelGas,HO		Mix of NG,FuelGas,HO		Mix of NG,FuelGas incl. S%	
⑥ S%(if liquid fuel used)	0.5% in Fuel Gas				0.1% in Fuel Gas	
⑦ Fuel Consumption/h	NG:3.492km ³ /h FG:1.268Mm ³ /h		NG:4.036km ³ /h FG:2.56Mm ³ /h		NG:2.613km ³ /h FG:8.068Mm ³ /h	
2 Flue Gas & Stack	HO:3600kg/h		HO:2153kg/h			
① Flue Gas Volume/h	100,510	m ³ /h wet*	97,850	m ³ /h wet*	170,810	m ³ /h wet*
② Temperature	220 °C		220 °C		200 °C	
③ Concentration	SO ₂	153 ppm	3	ppm	668	ppm
	NO _x	150 ppm	71	ppm	113	ppm
	Dust	0 ppm(cannot estimate)	0	ppm(cannot estimate)	0	ppm(cannot estimate)
	O ₂	4.2% (m=1.25)	4.2%	(m=1.25)	3.5%	(m=1.2)
④ Stack Height	32 m		32 m		55 m	
⑤ Stack Diameter	225 cm		225 cm		340 cm	
3 Countermeasures	71500x10 ³ kcal/h		71500x10 ³ kcal/h		137499x10 ³ kcal/h	
Comment	* dry=88690m ³ /h		*dry=83470m ³ /h		* dry=150300m ³ /h	

Model Area Plant Name	Buenos Aires Children's Hospital (I)		Buenos Aires Children's Hospital (II)		Buenos Aires Children's Hospital (III)	
		Unit		Unit		Unit
1 Facility & Fuel						
① Facility Name	Heating Boiler		Heating Boiler		Heating Boiler	
② Capacity	2,500,000	kcal/h/boiler	2,500,000	kcal/h/boiler	2,500,000	kcal/h/boiler
③ Daily Operation Time	24 hours		24 hours		24 hours	
④ Annual Operation Days	365 days		65 days		65 days	
⑤ Fuel Type	NG		NG		NG	
⑥ S%(if liquid fuel used)						
⑦ Fuel Consumption/h	271 m ³ /h		271 m ³ /h		271 m ³ /h	
2 Flue Gas & Stack						
① Flue Gas Volume/h	3379 m ³ /h,dry=2837		3379 m ³ /h,dry=2837		3379 m ³ /h,dry=2837	
② Temperature	150 °C		150 °C		150 °C	
③ Concentration	SO ₂	0	0		0	
	NO _x	511.8 g/h	511.8	g/h	511.8	g/h
	Dust	0	0		0	
	O ₂	3.5% (m=1.2)	3.5%	(m=1.2)	3.5%	(m=1.2)
④ Stack Height	25 m		25 m		25 m	
⑤ Stack Diameter	60 cm		60 cm		60 cm	
3 Countermeasures						
Comment	Normally one boiler in operation 3 boilers in operation for 60~70 days in winter				NO _x : 300days=511.8g/h 65days=1535.3g/h	

Model Area	Buenos Aires	Buenos Aires	Buenos Aires	Buenos Aires
Plant Name	Children's Hospital (IV)	Children's Hospital (V)	Children's Hospital (VI)	Children's Hospital (VII)
	Unit	Unit	Unit	Unit
1 Facility & Fuel				
① Facility Name	Hot Water Supply System Boiler	Hot Water Supply System Boiler	Anti-bacterial Boiler (Medium Pressure Vapor)	Anti-bacterial Boiler (Medium Pressure Vapor)
② Capacity	1,800,000 kcal/h/boiler	1,800,000 kcal/h/boiler	2,000,000 kcal/h/boiler	2,000,000 kcal/h/boiler
③ Daily Operation Time	24 hours	0 hours	24 hours	0 hours
④ Annual Operation Days	65 days	0 days	365 days	0 days
⑤ Fuel Type	NG	NG	NG	NG
⑥ S%(if liquid fuel used)				
⑦ Fuel Consumption/h	195 m3N/h	195 m3N/h	216.5 m3N/h	216.5 m3N/h
2 Flue Gas & Stack				
① Flue Gas Volume/h	2430 m3N/h,dry=2040	2430 m3N/h,dry=2040	2700 m3N/h,dry=2267	2700 m3N/h,dry=2267
② Temperature	150 °C	150 °C	150 °C	150 °C
③ Concentration SO2	0	0	0	0
	NOx 368.5 g/h	0 g/h	409.4 g/h	0 g/h
	Dust 0	0	0	0
	O2 3.5 %(m=1.2)	3.5 %(m=1.2)	3.5 %(m=1.2)	3.5 %(m=1.2)
④ Stack Height	25 m	25 m	25 m	25 m
⑤ Stack Diameter	60 cm	60 cm	60 cm	60 cm
3 Countermeasures				
Comment	one in operation one standby		one in operation one standby	

Model Area	Buenos Aires	Buenos Aires	Buenos Aires	Buenos Aires
Plant Name	German Hospital (I)	German Hospital (II)	Gran Hotel Buenos Aires (I)	Gran Hotel Buenos Aires (II)
	Unit	Unit	Unit	Unit
1 Facility & Fuel				
① Facility Name	Heating Boiler	Heating Boiler	Heating Boiler	Heating Boiler
② Capacity	6 ton/h	5.5 ton/h	340,000 kcal/h	340,000 kcal/h
③ Daily Operation Time	24 hours	24 hours	9 hours, heating 6-9,17-23	24 hours, hot water
④ Annual Operation Days	181 days	184 days	365 days	365 days
⑤ Fuel Type	NG	NG	NG	NG
⑥ S%(if liquid fuel used)	0	0		
⑦ Fuel Consumption/h	105 m3N/h(70~140)	105 m3N/h(70~140)	12.8 m3N/h	7.2 m3N/h
2 Flue Gas & Stack				
① Flue Gas Volume/h	1228.5 m3N/h,dry=1020	1279 m3N/h,dry=1071	159.616 m3N/h,dry=134.016	89.784 m3N/h,dry=75.744
② Temperature	199.3 °C	154.9 °C	150 °C	
③ Concentration SO2	0	0	0	
	NOx 200.5 g/h(133.7~267.3)	Average 200.5 g/h(133.7~267.3)	38.4 g/h(24.576+13.824)	←common stack
	Dust 0	0	0	
	O2 2.3 %(m=1.12)	3.1 %(m=1.17)	3.5 %(m=1.2)	
④ Stack Height	26 m	26 m	7 m	
⑤ Stack Diameter	100 cm	100 cm	60 cm square	
3 Countermeasures				
Comment	Wet=819~1638m3N/h Dry=680~1360m3N/h	Wet=853~1279m3N/h Dry=714~1428m3N/h		

S6-A5 Assumption of Emissions from Large Stationary Sources

S6A5-1 Siderar in the San Nicolas Model Area

1. Basic assumptions

- (1) Annual steel production of SIDERAR is 2.1 million tons.
- (2) Outputs of coke ovens, sintering furnaces, blast furnaces and steel production are based on the Table 3-3-10 of the previous JICA Study Report in 1994 (#161).
- (3) Output of converters was estimated based on a Japanese example of output ratios of blast furnaces and converters (Handbook on Japanese Steel Production in 2,000 (J)).
- (4) All cokes are produced in the factory.
- (5) 790 tons of coal are used to produce 535 tons of cokes (JCOAL Monthly No. 35 2001/05 (J)).
- (6) Use of PM emission factors of US. EPA (#78, uncontrolled).

2. PM emission factors (#78)

Process	Source	Ef	unit
Coke oven	charging	0.425	kg/ton-coal charged
	door leaks	0.255	
	pushing	0.235	
	quenching	0.500	
	stacks	0.290	
	total	1.705	
Sintering furnace	windbox	9.91	kg/ton-finished sinter
	discharge	3.40	
	total	13.31	
Blast furnace	monitor	0.30	kg/ton-hot metal
	tap hole, etc.	0.15	
	total	0.45	
Converter	top blown furnace	14.25	kg/ton-steel

3. PM emission

Process	Output (input)	Quantity	Ef	PM
		(1000 ton/year)	(kg/ton)	(ton/year)
Coke oven	Coal	1282	1.705	2186
Sintering	Finished	2759	13.31	36722
Blast furnace	Hot metal	1839	0.45	828
Converter	Steel	1615	14.25	23014
Total				62750

$$62750 \text{ ton/year} = 62750 \times 10^6 \text{ g/year} = 2000 \text{ g/sec at maximum}$$

Take overall removal efficiency to be 78%

$$\text{Escape } 62,750 \times 0.22 = 13,800 \text{ ton/year}$$

4. SO₂ emission

A) US-EPA (#78) EPA emission factor - Uncontrolled emissions

Sulfur in coal: 0.8% - 33% goes to COG – 40% of COG is burned during the underfiring operation, and remainder is used in other parts of the steel operation and SO₂ is discharged totally 3 kg/ 1000 kg of coal.

Steel production requires 0.55 unit of coke to 1.7 unit of iron bearing charge.

Yield of coke from coal: 60 to 80% (from Jap Information)

Coal requirements $2.1 \times 10^6 \times 1.7 \times 0.55 \times 1/0.7 = 2.805 \times 10^6$ ton/year

SO₂ emission $2.805 \times 10^6 \times 3/1000 = 8,415$ ton/year

In San Nicolas, sulfur in coal: 0.3 to 0.7% (#230). Take SO₂ emission = 4,000 ton/year

B) Japanese Example: Emission controlled with COG desulfurization

Sulfur emission 561 ton/year in flue gas = 1122 ton of SO₂/year

S in coal 0.5% ; Crude Steel production : 7,000,000 ton/year

In San Nicolas $1122 \times 2,100,000/7,000,000 = 336.6$ ton/year Take

S6A5-2 Acindar S.A. in (or vicinity of) San Nicolas Area

Suspended particulate emission 0.35 kg/ton of sponge iron – as given in #164

Iron Products 1,000,000 t/year (of that 70% is sponge iron)

$0.35 \times 700,000 = 245,000$ kg/year = 8 g/sec

Emissions from 3 bag filters $3 \times 20,000 \times 250*/1000 = 15000$ g/hr = 4.2 g/sec < 8 g/sec

*Note: 250 mg/Nm³ - the emission guideline for new facility in BA Province

S6A5-3 YPF Refinery in the Lujan de Cuyo Model Area

1. Conditions (#251)

Crude processed 19,000 m³/day

#201reported YPF Lujan crude 6,324,570m³/year

$6,324,570\text{m}^3/\text{year}/19000 = 333$ days check as stream days

Claus Unit introduced in 9/1999.

	S Production ton/Month	SO ₂ Emission ton/hr
1/2000	280	0.89
2	380	0.85
3	420	0.86
4	490	0.75
5	595	0.76
6	850	0.73
7	840	0.78
8	775	0.7
9	930	0.72
10	530	0.73
11	700	0.71
12	820	0.69

2. SO₂ emitted from the refinery

$$0.69 \times 24 \times 30 = 496.8 = 500 \text{ ton/month}$$

$$= 193 \text{ g/sec}$$

as S 250 ton/month

3. Sulfur in Product (#201)

	Unit	YPF Lujan de Cuyo	S in Products %*1)	S in Products ton/year
National Crude	m ³	6,324,570		
Other Feed	ton	219,694		
Total Feed		6,544,264		
Refinery Gas	1000m ³	238,396		
Liquefied Gas	ton	215,720		
Jet Fuel	m ³	0		
Gasoline, common	m ³	548,855	0.035	140.0
super	m ³	1,035,807	0.028	211.7
straight	m ³	476,780	0.035	121.8
JP (Jet Fuel?)	m ³	245,816		
Gas Oil	m ³	3,081,354	0.11	2,813.3
Residual Carbon	ton	531,621		
Other Product	ton	442,127		
Total except Gases		6,362,360		3,286.8

Note *1) YPF internet home-page

3287 tons/annual = 274 ton/month

$$\text{S in Crude } 820 + 250 + 274 = 1344 \text{ ton /month}$$

$$= 1344 \times 100 / (19000 \times 30) = 0.236\% \text{ in Crude}$$

4. 136 m Flare Stack Take Claus recovery 97%

$$\text{S to the air from Claus } 900 \times 0.03 = 27 \text{ ton/month}$$

$$= 54 \text{ ton SO}_2 \text{ /month around 10 \% of current SO}_2 \text{ emission}$$

6.4 Mobile Emission Source

6.4.1 Estimation of Mobile Emission Source

Pollutant loads from vehicles will be determined as mobile emission sources. The emissions from vehicles on major and minor roads could be calculated from traffic volume, road length, and emission factors if traffic volumes on each road are known.

$$\text{Running Distance} = \text{Traffic Volume} \times \text{Road Length}$$

(Vehicle Number • km/h) (Vehicle Number/h) (km)

$$\text{Pollutant Loads} = \text{Running Distance} \times \text{Emission Factors}$$

The above method can replicate source distribution on major roads more precisely than other methods.

Emission factors have to be set up for each vehicle type, existence of vehicular related regulations, fuel type, engine type, and vehicle weight. Also vehicle numbers of each category must be obtained. There are national vehicular regulations for new vehicles, NO_x regulation for light duty trucks from 1994, PM regulation from 1996, and for heavy duty trucks and buses from 1995.

The main flow of mobile emission calculation method used in the Study is shown in Figure 6.4.1. Total vehicle numbers in each target area were obtained. For distance traveled in a year (Table 6.4.1), and emission factor (Table 6.4.2), estimated values in #269 were used. The road distance traveled in #269 is obtained by surveying many car and taxi drivers, and from bus schedules, etc.

$$\text{Running Distance} = \text{Vehicle Number} \times \text{Road Distance Traveled}$$

(Vehicle number • km) (km/y/vehicle)

$$\text{Emission} = \text{Running Distance} \times \text{Emission Factor} \times \text{Unit Factor}$$

(ton) (Vehicle number • km) (g/km/vehicle) (ton/1,000,000g)

Figure 6.4.1 Flowchart of Mobile Emission Calculation

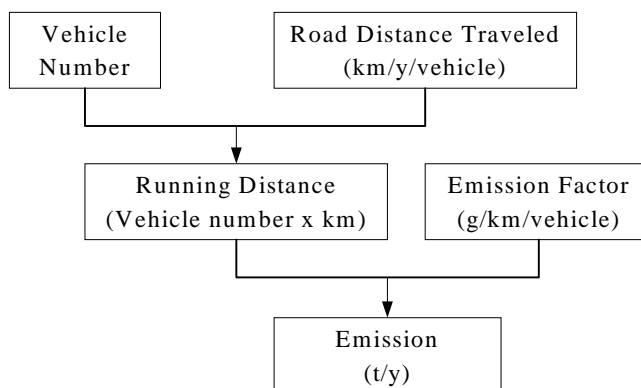


Table 6.4.1 Road Distance Traveled in a Year (#269)

Unit : km

		Gasoline	Diesel	CNG
Passenger car		12,000	15,000	15,000
Taxi		15,000	50,000	50,000
Truck	<2t	44,000	45,000	44,000
	~4t	7,000	20,000	0
	4t~	7,000	20,000	0
Bus (Omnibus)	2~4t	0	93,000	0
	4t~	0	13,000	0

Table 6.4.2 Emission Factors (#269)

NO _x (g/km Vehicle)	Gasoline		Diesel		CNG		
	Before 1997	After 1998	Before 1997	After 1998	Before 1997	After 1998	
Passenger car	1.27	0.28	0.75	0.75	1.89	0.18	
Taxi	1.27	0.28	0.75	0.75	1.89	0.18	
Truck	<2t	1.90	1.90	1.00	1.00	2.00	0.18
	~4t	5.20	5.20	16.60	16.60	---	---
	4t~	5.20	5.20	16.60	16.60	---	---
Bus (Omnibus)	2~4t	---	---	12.10	12.10	---	---
	4t~	---	---	24.20	24.20	---	---

SO ₂ (g/km Vehicle)	Gasoline		Diesel		CNG		
	Before 1997	After 1998	Before 1997	After 1998	Before 1997	After 1998	
Passenger car	0.090	0.090	0.400	0.400	0.002	0.002	
Taxi	0.090	0.090	0.400	0.400	0.002	0.002	
Truck	<2t	0.131	0.131	0.550	0.550	0.004	0.004
	~4t	0.131	0.131	0.550	0.550	---	---
	4t~	0.131	0.131	0.469	0.469	---	---
Bus (Omnibus)	2~4t	---	---	0.530	0.530	---	---
	4t~	---	---	0.530	0.530	---	---

PM (g/km Vehicle)	Gasoline		Diesel		CNG		
	Before 1997	After 1998	Before 1997	After 1998	Before 1997	After 1998	
Passenger car	0.10	0.10	0.60	0.60	0.06	0.06	
Taxi	0.10	0.10	0.60	0.60	0.06	0.06	
Truck	<2t	0.17	0.17	1.40	1.40	0.06	0.06
	~4t	0.14	0.14	2.30	2.30	---	---
	4t~	0.14	0.14	2.30	2.30	---	---
Bus (Omnibus)	2~4t	---	---	3.30	3.30	---	---
	4t~	---	---	3.10	3.10	---	---

6.4.2 Current data of Mobile Emission Source

In Buenos Aires, a project with its theme as global warming, “Co-controls Benefits Analysis Project for Argentina—Baseline and Mitigation Scenarios for the Buenos Aires Metropolitan Area”, has handled mobile emission source (#269). In this project, many surveys are done in Buenos Aires Metropolitan Area to grasp driving length, fuel economy, etc. Also, many samples are taken from actual testing to find vehicle emission factors, thus the data are reliable. Vehicle numbers in Federal Capital, and each province in Argentina can be found in ADEFA—Industria Automotriz Argentina (#188). This statistical data are updated every year.

In San Nicolas, 2 registration offices have responsibilities in the area, and the vehicle registration data were obtained.

In Mendoza and Lujan de Cuyo, vehicle numbers in Province of Mendoza is published in ADEFA in annual bases. For Mendoza, traffic density by its range, and traffic and emission by grid were obtained from a study by University of Mendoza, “Contaminacion del aire por fuentes fijas y moviles en el Gran Mendoza” (#184). These data were printed on a map, and the results covered NO_x and PM. Another study obtained was “Calculo de las Emisiones y del Consumo de Energia causados por los colectivos del Transporte Publico en el Gran Mendoza” (#264). The actual emission factors used in the project of University of Mendoza were not in either report obtained.

6.4.3 Calculation of Mobile Emission Source

1) Buenos Aires

For Buenos Aires, vehicle numbers in ADEFA (#188) were used to estimate emission in Federal Capital in year 2000. ADEFA publishes statistical data relating to registered vehicles each year, and covers Federal Capital, and each province in Argentina.

A Vehicle Numbers

First, the vehicle numbers are summarized into before 1997 and after 1998 (Table 6.4.3), and in vehicle types (passenger, taxi, truck [$<2t$, 2 to $4t$, $4t \leq$], and bus [2 to $4t$, $4t \leq$]) by using the ratio of vehicle numbers in the categories from #269 (Table 6.4.4). Categorized vehicle numbers are shown in Table 6.4.5. The categorization was necessary because running distance traveled, fuel economy, and emission factors are categorized in similar pattern.

Table 6.4.3 Vehicle Numbers (#188)

Manufactured year	Before 1997	After 1998	Total
Passenger car	936,382	203,324	1,139,706
Truck	172,353	37,424	209,777
Bus	12,235	2,657	14,892
Total	1,120,969	243,405	1,364,374

Table 6.4.4 Vehicles by their Type and Fuel Type in Federal Capital (#269)

		Gasoline	Diesel	CNG	Total
Passenger car		815,109	74,101	37,050	968,940
Taxi		3,756	24,754	14,170	
Truck	<2t	74,843	81,885	7,042	206,000
	~4t	5,912	36,318	0	
	4t~	0	0	0	
Bus (Omnibus)	2~4t	0	11,300	0	13,862
	4t~	0	2,562	0	

Ratio

Passenger car		0.84124	0.07648	0.03824	1.00
Taxi		0.00388	0.02555	0.01462	
Truck	<2t	0.36332	0.39750	0.03418	1.00
	~4t	0.02870	0.17630	0.00000	
	4t~	0.00000	0.00000	0.00000	
Bus (Omnibus)	2~4t	0.00000	0.81518	0.00000	1.00
	4t~	0.00000	0.18482	0.00000	

Table 6.4.5 Calculated Vehicles by its Type and Fuel Type in Federal Capital

		Gasoline		Diesel		CNG		Total	Grand Total
		Before 1997	After 1998	Before 1997	After 1998	Before 1997	After 1998		
Passenger car		787,720	171,044	71,611	15,549	35,805	7,775	1,089,504	1,139,706
Taxi		3,630	788	23,922	5,194	13,694	2,973	50,202	
Truck	<2t	62,618	13,597	68,510	14,876	5,892	1,279	166,773	209,777
	~4t	4,946	1,074	30,386	6,598	0	0	43,004	
	4t~	0	0	0	0	0	0	0	
Bus (Omnibus)	2~4t	0	0	9,974	2,166	0	0	12,139	14,892
	4t~	0	0	2,261	491	0	0	2,752	
Total		858,914	186,503	206,664	44,875	55,391	12,027	1,364,374	1,364,374

B Running Distance

The vehicle numbers calculated in categories, road distance traveled in a year (Table 6.4.1) are used to estimate running distance of vehicles in Federal Capital (Table 6.4.6).

Table 6.4.6 Calculated Running Distance (Federal Capital)

Unit : Vehicles x 10⁶km

	Gasoline		Diesel		CNG		Total
	Before 1997	After 1998	Before 1997	After 1998	Before 1997	After 1998	
Passenger car	9,453	2,053	1,074	233	537	117	13,466
Taxi	54	12	1,196	260	685	149	2,355
Truck	<2t	2,755	598	3,083	669	259	7,421
	~4t	35	8	608	132	0	782
	4t~	0	0	0	0	0	0
Bus (Omnibus)	2~4t	---	---	928	201	0	1,129
	4t~	---	---	29	6	0	36
Total	12,297	2,670	6,918	1,502	1,481	322	25,190

C Emission

Calculated emission is shown in Table 6.4.7. The NO_x emission estimated in #269 was 128,000 ton for BAMA for year 2000, and the vehicle numbers of Federal Capital was 43% of BAMA, and so roughly, 55,000 ton of NO_x is emitted in Federal Capital. In the calculation of this Study, NO_x emission from Federal Capital is 54,758 ton, nearly equal to estimation in #269. For PM, roughly 9,500 ton in #269 whereas estimation in the Study was 14,290 ton. In Argentina, statistical summary of fuel sales for vehicles does exist, but this Study followed the calculation method using annual road distance traveled per vehicle, according to #269.

Table 6.4.7 Summary of Emissions in Buenos Aires (Federal Capital)

Unit : t/y

NO _x Emission	Gasoline		Diesel		CNG		Total
	Before 1997	After 1998	Before 1997	After 1998	Before 1997	After 1998	
Passenger car	12,005	575	806	175	1,015	21	14,596
Taxi	69	3	897	195	1,294	27	2,485
Truck	<2t	5,235	1,137	3,083	669	518	10,653
	~4t	180	39	10,088	2,191	0	12,498
	4t~	0	0	0	0	0	0
Bus (Omnibus)	2~4t	---	---	11,223	2,437	0	13,660
	4t~	---	---	711	154	0	866
Total	17,489	1,754	26,809	5,821	2,828	58	54,758
Grand Total		19,243		32,630		2,886	

SO ₂ Emission	Gasoline		Diesel		CNG		Total
	Before 1997	After 1998	Before 1997	After 1998	Before 1997	After 1998	
Passenger car	851	185	430	93	1	0	1,560
Taxi	5	1	478	104	1	0	590
Truck	<2t	361	78	1,696	368	1	2,504
	~4t	5	1	334	73	0	412
	4t~	0	0	0	0	0	0
Bus (Omnibus)	2~4t	---	---	491	107	0	598
	4t~	---	---	16	3	0	19
Total	1,221	265	3,445	748	3	1	5,683
Grand Total		1,486		4,193		4	

PM Emission	Gasoline		Diesel		CNG		Total
	Before 1997	After 1998	Before 1997	After 1998	Before 1997	After 1998	
Passenger car	945	205	644	140	32	7	1,974
Taxi	5	1	718	156	41	9	930
Truck	<2t	468	102	4,316	937	16	5,842
	~4t	5	1	1,398	304	0	1,707
	4t~	0	0	0	0	0	0
Bus (Omnibus)	2~4t	---	---	3,061	665	0	3,726
	4t~	---	---	91	20	0	111
Total	1,424	309	10,228	2,221	89	19	14,290
Grand Total		1,733		12,449		108	

2) San Nicolas

For San Nicolas, vehicle registrations at the time of June 2001 were obtained from registration offices. Also, vehicle registration of Ramallo city were obtained. Ramallo is included in the target area.

A Vehicle Numbers

Only total vehicle numbers (44,500 vehicles) were found in the target area. To categorize the numbers into 3 vehicle types and manufactured year, the ratio in ADEFA (#188) was used because the vehicle number is studied every year (Table 6.4.8). Then, the 3 vehicle types are categorized into smaller categories and by fuel types by using the vehicle numbers estimated in #269 (Table 6.4.4). The details of vehicle numbers are shown in Table 6.4.10.

Table 6.4.8 Vehicle Numbers and Ratio in Province of Buenos Aires excluding Federal Capital (#188)

Manufactured year	All Fuels		Total
	Before 1997	After 1998	
Passenger car	25,401	7,354	32,754
Truck	9,054	2,621	11,676
Bus	54	16	70
Total	34,509	9,991	44,500

	Ratio		Total
	Before 1997	After 1998	
Passenger car	0.57	0.17	0.74
Truck	0.20	0.06	0.26
Bus	0.00	0.00	0.00
Total	0.78	0.22	1.00

Table 6.4.9 Estimated Vehicle Numbers in Three Categories in San Nicolas

Manufactured year	All Fuels		Total
	Before 1997	After 1998	
Passenger car	25,401	7,354	32,754
Truck	9,054	2,621	11,676
Bus	54	16	70
Total	34,509	9,991	44,500

Table 6.4.10 Estimated Vehicle Numbers in Detailed Categories and Fuel Type in San Nicolas

		Gasoline		Diesel		CNG		Total	Sub Total
		Before 1997	After 1998	Before 1997	After 1998	Before 1997	After 1998		
Passenger car		18,574	5,378	2,013	583	4,581	1,326	32,455	
Taxi		1	0	21	6	210	61	299	32,754
Truck	<2t	2,161	626	3,814	1,104	1,088	315	9,107	
	~4t	279	81	1,713	496	0	0	2,568	
	4t~	0	0	0	0	0	0	0	11,676
Bus	2~4t	0	0	42	12	0	0	54	
(Omnibus)	4t~	0	0	13	4	0	0	16	70
Total			27,100		9,820		7,580	44,500	44,500

B Running Distance

The vehicle numbers calculated in categories, road distance traveled in a year (Table 6.4.1) are used to estimate running distance of vehicles in San Nicolas (Table 6.4.11).

Table 6.4.11 Calculated Running Distance (San Nicolas)

Unit : Vehicles x 10⁶km

		Gasoline		Diesel		CNG		Total
		Before 1997	After 1998	Before 1997	After 1998	Before 1997	After 1998	
Passenger car		223	65	30	9	69	20	415
Taxi		0	0	1	0	10	3	15
Truck	<2t	95	28	172	50	48	14	406
	~4t	2	1	34	10	0	0	47
	4t~	0	0	0	0	0	0	0
Bus	2~4t	---	---	4	1	0	0	5
(Omnibus)	4t~	---	---	0	0	0	0	0
Total		320	93	241	70	127	37	887

C Emission

Calculated emission is shown in Table 6.4.12. There are 44500 vehicles in San Nicolas, which is 3.3% of Federal Capital (1,364,374 vehicles). The emissions also lies near 3% of Capital Federal, with NO_x 3.4%, SO₂ 3.7%, PM 3.6%.

Table 6.4.12 Summary of Emissions in San Nicolas

Unit : t/y

NO _x Emission	Gasoline		Diesel		CNG		Total	
	Before 1997	After 1998	Before 1997	After 1998	Before 1997	After 1998		
Passenger car	283	18	23	7	130	4	464	
Taxi	0	0	1	0	20	1	21	
Truck	<2t	181	52	172	50	96	2	552
	~4t	10	3	569	165	0	0	746
	4t~	0	0	0	0	0	0	0
Bus (Omnibus)	2~4t	---	---	47	14	0	0	60
	4t~	---	---	4	1	0	0	5
Total	474	73	815	236	245	7	1,850	
Grand Total	547		1,050		252			

SO ₂ Emission	Gasoline		Diesel		CNG		Total	
	Before 1997	After 1998	Before 1997	After 1998	Before 1997	After 1998		
Passenger car	20	6	12	3	0	0	42	
Taxi	0	0	0	0	0	0	1	
Truck	<2t	12	4	94	27	0	0	138
	~4t	0	0	19	5	0	0	25
	4t~	0	0	0	0	0	0	0
Bus (Omnibus)	2~4t	---	---	2	1	0	0	3
	4t~	---	---	0	0	0	0	0
Total	33	9	128	37	0	0	208	
Grand Total	42		165		0			

PM Emission	Gasoline		Diesel		CNG		Total	
	Before 1997	After 1998	Before 1997	After 1998	Before 1997	After 1998		
Passenger car	22	6	18	5	4	1	57	
Taxi	0	0	1	0	1	0	2	
Truck	<2t	16	5	240	70	3	1	334
	~4t	0	0	79	23	0	0	102
	4t~	0	0	0	0	0	0	0
Bus (Omnibus)	2~4t	---	---	13	4	0	0	16
	4t~	---	---	1	0	0	0	1
Total	39	11	351	102	8	2	513	
Grand Total	50		453		10			

3) Mendoza and Lujan de Cuyo

The total vehicle numbers in the model area were not obtained, but the number is published by ADEFA (#188) for Mendoza province for year 1999, and from annual increase, number for year 2000 was estimated. The vehicles in the project model area were calculated by population ratio in the model area verses Mendoza province, and then emission was estimated.

A Vehicle Numbers

Total vehicle numbers within Province of Mendoza was found as a statistical book of #188 (Table 6.4.13). From Provincial vehicle numbers, numbers within the model area (Table 6.4.14) was estimated by ratio of population in the model area and province. In 2001, population in the Province of Mendoza is 1,412,381 and Mendoza and Lujan de Cuyo are about 853,065 (Mendoza city 773,113 [#117] and Lujan de Cuyo 79,952 [#259]), which takes 60.4%. The estimated vehicle numbers in the model area are further categorized into

smaller categories and by fuel types by using the vehicle numbers estimated in #269 (Table 6.4.4). The details of vehicle numbers are shown in Table 6.4.15.

Table 6.4.13 Vehicle Number of Province of Mendoza (#188)

Manufactured year	All Fuels		Total
	Before 1997	After 1998	
Passenger car	212,171	46,070	258,242
Truck	94,347	20,486	114,834
Bus	1,668	362	2,031
Total	308,187	66,919	375,106

Table 6.4.14 Estimated Vehicle Number in Lujan de Cuyo (#188)

Manufactured year	All Fuels		Total
	Before 1997	After 1998	
Passenger car	128,149.56	27,826.08	155,976
Truck	56,984.97	12,373.57	69,359
Bus	1,007.74	218.82	1,227
Total	186,142	40,418	226,561

Table 6.4.15 Calculated Vehicles by its Type and Fuel Type in Mendoza and Lujan de Cuyo

	Gasoline		Diesel		CNG		Total	Sub Total	
	Before 1997	After 1998	Before 1997	After 1998	Before 1997	After 1998			
Passenger car	93,710	20,348	10,158	2,206	23,110	5,018	154,551		
Taxi	6	1	105	23	1,059	230	1,425	155,976	
Truck	<2t	13,601	2,953	24,003	5,212	6,845	1,486	54,101	
	~4t	1,755	381	10,781	2,341	0	0	15,258	
	4t~	0	0	0	0	0	0	0	69,359
Bus (Omnibus)	2~4t	0	0	774	168	0	0	0	
	4t~	0	0	234	51	0	0	1,227	1,227
Total		132,757		56,055		37,749	226,561	226,561	

B Running Distance

The vehicle numbers calculated in categories and road distance traveled in a year (Table 6.4.1) are used to estimate running distance of vehicles in Lujan de Cuyo (Table 6.4.16).

Table 6.4.16 Calculated Running Distance (Lujan De Cuyo)

	Gasoline		Diesel		CNG		
	Before 1997	After 1998	Before 1997	After 1998	Before 1997	After 1998	
Passenger car	112,453	24,418	13,714	2,978	32,931,987	7,150,770	
Taxi	9	2	474	103	5,031,980	1,092,632	
Truck	<2t	71,815	15,594	118,813	25,799	34,636,706	7,520,929
	~4t	4,607	1,000	75,464	16,386	0	0
	4t~	0	0	0	0	0	0
Bus (Omnibus)	2~4t	0	0	28,802	6,254	0	0
	4t~	0	0	1,093	237	0	0
Total	188,884	41,014	238,360	51,757	72,600,673	15,764,331	
Grand Total		229,898		290,117		88,365,004	

C Emission

Estimated emission from Mendoza and Lujan de Cuyo is shown in Table 6.4.17. In

“Calculo de las Emisiones y del Consumo de Energia causados por los colectivos del Transporte Publico en el Gran Mendoza” (#264), the target vehicle type was urban bus (2 to 4 tons) with consumption of Diesel and CNG, and the estimated emission was 1,228 ton/year of NO_x, 76 ton/year of SO₂, and 123 ton/year of PM. The target area of #264 was Gran Mendoza (Capital, Godey Cruz, Lujan de Cuyo, Maipu, Guaymallen, and Las Heras). The target year is not specified, but probably year 2000 because European emission factor of year 2000 is mentioned. According to JICA Study, the estimation was 1,060 ton/year, 46 ton/year, and 289 ton/year respectively for are of Mendoza capital and Lujan de Cuyo. NO_x emission was less than of #264, and SO₂ and PM were more than of #264, even the model area of JICA Study is smaller.

In “Contaminacion del Aire por Fuentes Fijas y moviles en el Gran Mendoza” (#184), the estimated emission from the surroundings of Mendoza was 3,100 ton/year of NO_x, and 480 ton/year of PM in the target year of 1999. Although JICA study has smaller model area, estimation of #184 was smaller.

Table 6.4.17 Summary of Emissions in Mendoza and Lujan de Cuyo

Unit : t/y

NO _x Emission	Gasoline		Diesel		CNG		Total	
	Before 1997	After 1998	Before 1997	After 1998	Before 1997	After 1998		
Passenger car	1,428	68	114	25	655	14	2,304	
Taxi	0	0	4	1	100	2	107	
Truck	<2t	1,137	247	1,080	235	602	12	3,313
	~4t	64	14	3,579	777	0	0	4,434
	4t~	0	0	0	0	0	0	0
Bus (Omnibus)	2~4t	---	---	871	189	0	0	1,060
	4t~	---	---	73	16	0	0	89
Total	2,629	329	5,722	1,243	1,358	27	11,308	
Grand Total		2,958		6,965		1,385		

SO ₂ Emission	Gasoline		Diesel		CNG		Total	
	Before 1997	After 1998	Before 1997	After 1998	Before 1997	After 1998		
Passenger car	101	22	61	13	1	0	198	
Taxi	0	0	2	0	0	0	3	
Truck	<2t	78	17	594	129	1	0	820
	~4t	2	0	119	26	0	0	146
	4t~	0	0	0	0	0	0	0
Bus (Omnibus)	2~4t	---	---	38	8	0	0	46
	4t~	---	---	2	0	0	0	2
Total	181	39	815	177	2	0	1,216	
Grand Total		221		993		2		

PM Emission	Gasoline		Diesel		CNG		Total	
	Before 1997	After 1998	Before 1997	After 1998	Before 1997	After 1998		
Passenger car	112	24	91	20	21	5	273	
Taxi	0	0	3	1	3	1	8	
Truck	<2t	102	22	1,512	328	18	4	1,986
	~4t	2	0	496	108	0	0	606
	4t~	0	0	0	0	0	0	0
Bus (Omnibus)	2~4t	---	---	238	52	0	0	289
	4t~	---	---	9	2	0	0	11
Total	216	47	2,350	510	42	9	3,174	
Grand Total		263		2,860		51		

4) Summary of Emissions

The summary of emission in 3 model areas are shown in Table 6.4.18. Buenos Aires with largest population has the most emission. Mendoza, the third largest city in Argentina, has the second largest emission of the model areas.

Table 6.4.18 Summary of Emissions in each model area

	ton/year		
	NO _x	SO ₂	PM
Buenos Aires	54,757.9	5,683.2	14,290.3
San Nicolas	1,849.6	207.6	512.5
Mendoza	11,308.2	1,215.5	3,173.9

6.4.4 Calculation of Emission into each Grid

Each emission of the model areas needs to derive in more detail. Road sections of the model areas were made as in Figure 6.4.2, Figure 6.4.1, and Figure 6.4.4, and the road section ratio of each grid (2km by 2km) compared to the total area were estimated. The total length in each model area is 2842km, 1409km, and 2715km for Federal Capital, San Nicolas, and Lujan de Cuyo and Mendoza, respectively.

Road Section Weight in each grid

$$= \text{Road length in each grid} \div \text{Total Road length in the model area}$$

Emission in each grid

$$= \text{Road Section Weight in each grid} \times \text{Total Emission in the model area}$$

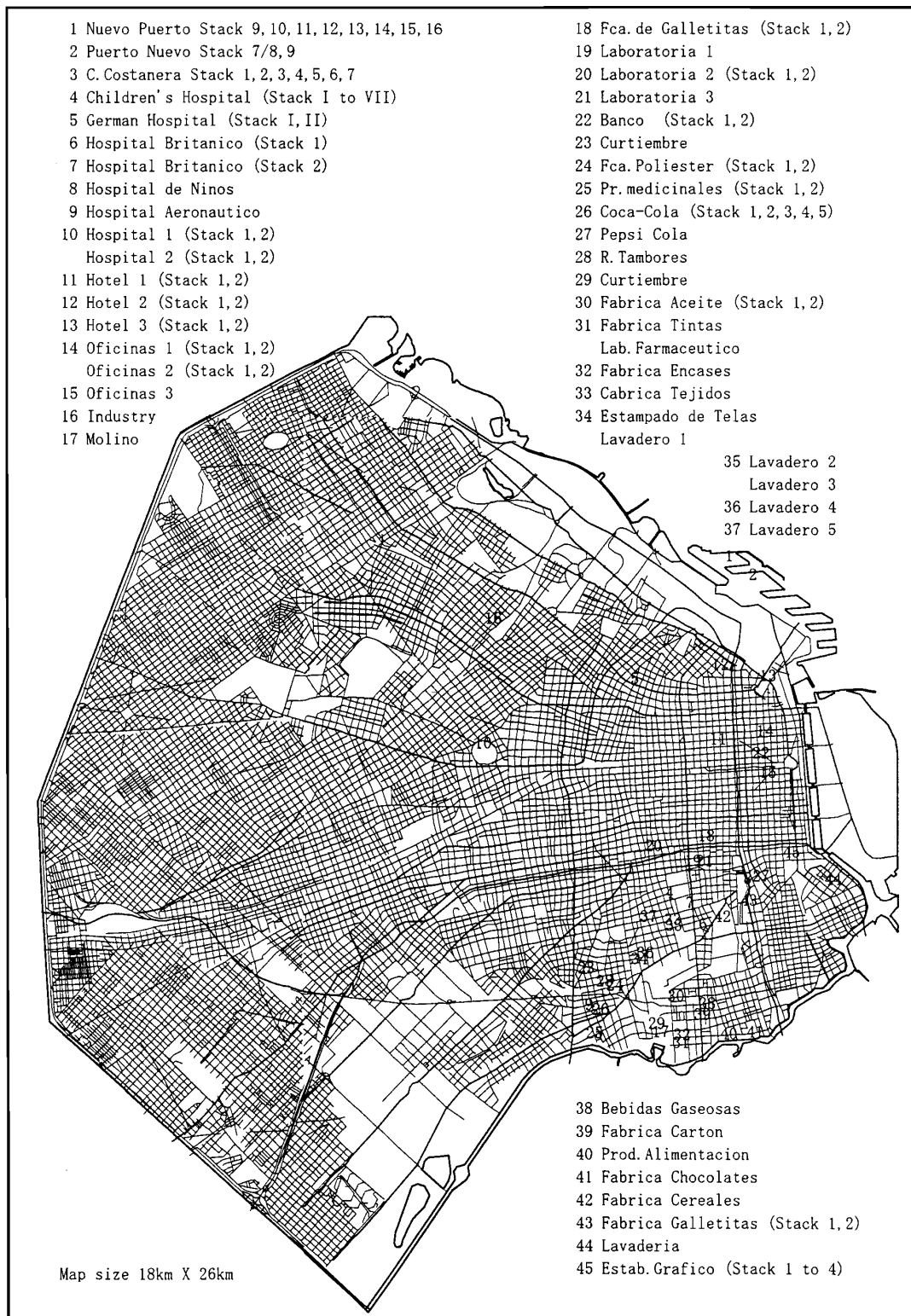


Figure 6.4.2 Road Links and Other Stationary Location (Buenos Aires)

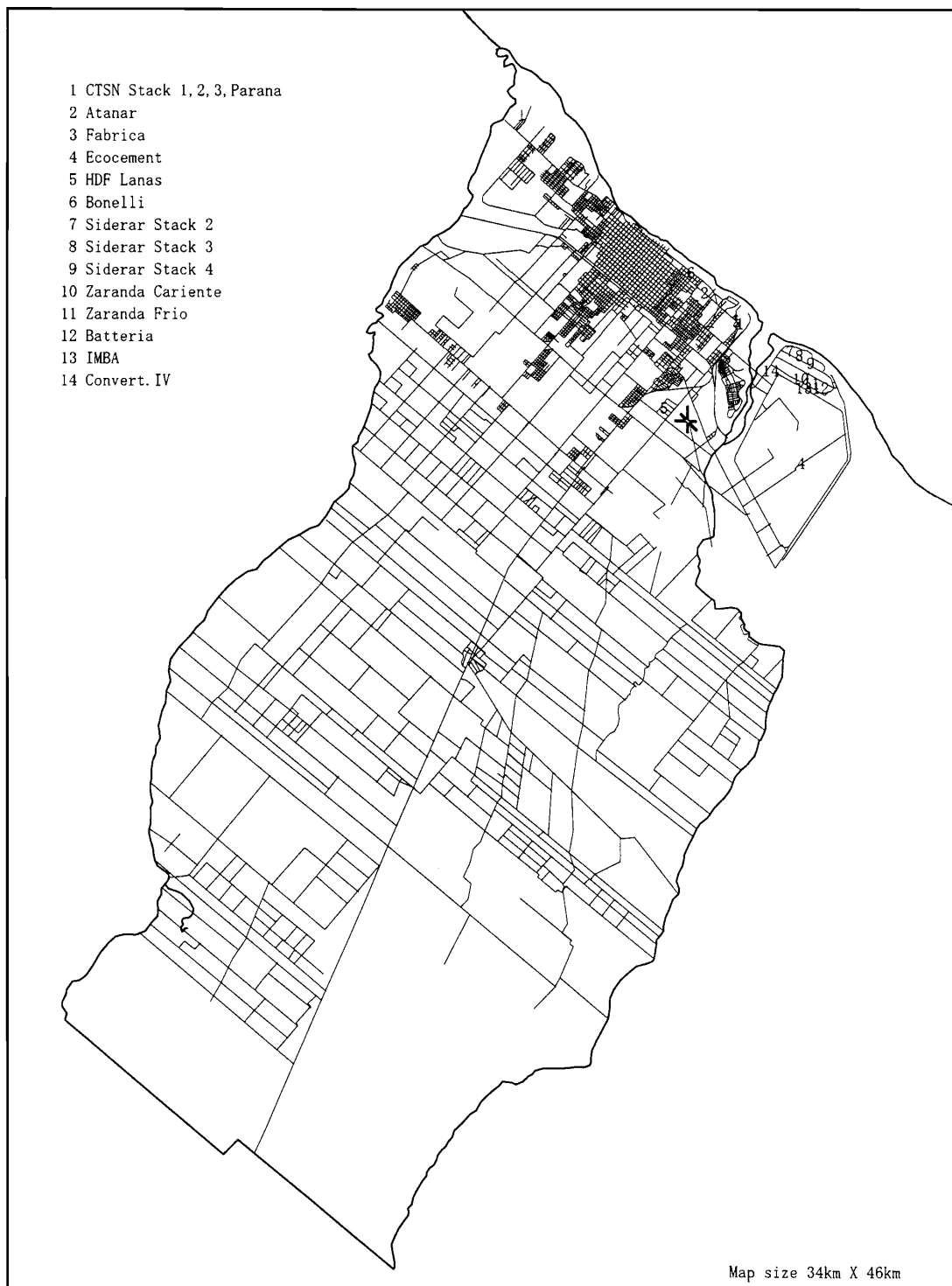


Figure 6.4.3 Road Links and Other Stationary Location (San Nicolas)



Figure 6.4.4 Road Links and Other Stationary Location (Mendoza and Lujan de Cuyo)

Photographs Some of Stationary Sources other than Power Plants

San Nicolas Area



A Distant View of Siderar S. A.

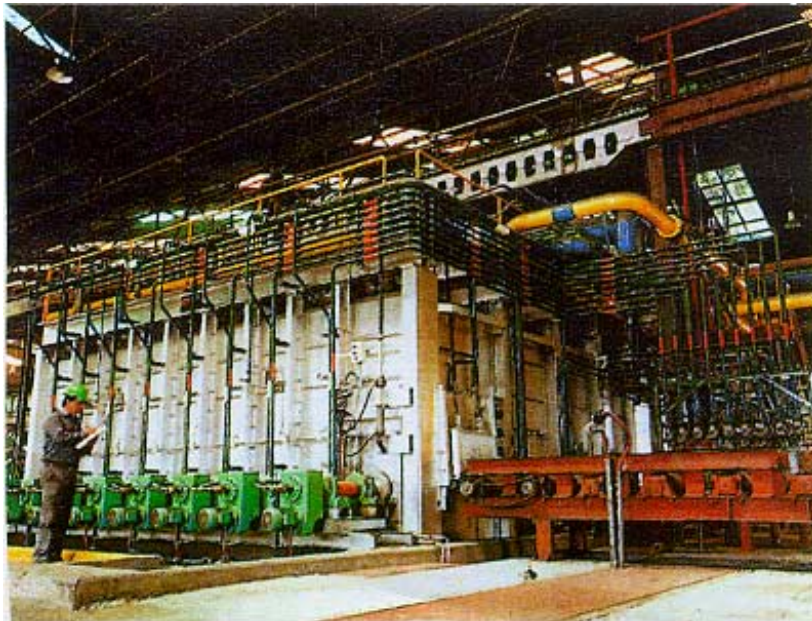
Crusher and Dryer at ECOCEMENTO S. A.



Lujan de Cuyo Area



A Distant View of YPF Refinery



Rolling Furnace at Bonelli S. A.

Lujan de Cuyo

Petroquímica Cuyo S. A.



Electric Arc Furnace
at Stein S. A.

