THE UNITED MEXICAN STATES

THE STUDY ON THE AIR POLLUTION CONTROL PLAN OF STATIONARY SOURCES IN THE METROPOLITAN AREA OF THE CITY OF MEXICO

FINAL REPORT
APPENDIX

SEPTEMBER 1991

JAPAN INTERNATIONAL COOPERATION AGENCY

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1. Results of Detailed On-site Questionnaire at 97 Establishments

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(1) Objectives

A total of 97 establishments were selected for the no-site questionnaire survey: 82 factories, 11 bathhouses, 2 hotels, one sports center, and one hospital. Breakdown of the 82 factories by types and scales is shown in Table 1.1.

Table 1.2 (1) and 1.2 (2) show the names of the 97 establishments with the date of visit for survey.

(2) Results

The results of the survey are presented in the following tables by each establishment in the order of the visit.

Table 1.1 Number of Establishments Surveyed by Types and Scales

Type of Industry	Number of Establishments by Scale			
	Large	Medium	Small	Total
Food	5	1	3	9
Drinks	1	-	-	1
Leather	-	1	-	1
Paper and its products	5	6	-	11
Chemical products	9	5	4	18
Petrochemical products	4	1	2	7
Petroleum refinery	1	-	-	1
Coal and petroleum products	1	-	1	2
Rubber and plastic products	2	2	1	5
Non-metallic mineral products	9	-	1	10
Basic metals	1	3	3	7
Metal products	2	3	-	5
Transportation equipment	1	-	-	1
Precision instruments	-	1	-	1
Other manufacture	1	-	-	1
Electric power	2	-	-	2
Factories Total	44	23	15	82
Public bathhouse		11		11
Sports center		1		1
Hotel		2		2
Hospital		1		1
Service and Commerical Total		15		15
Total				97

Table 1.2 (1) Names of Establishments for On-site Questionnaire (No.1)

Visit No.	Name of Establishment	Type of Industry	Date of Vist
1	FCA. DE JABON LA CORONA, S.A.	Chemical	June 12, 1990
2	POLAQUMIA, S.A. DE C.V.	Checmial	
3	PROCTOR & GAMBLE DE MEXICO, S.A. DE C.V.	Chemical	
4	BANOS RIO BLANCO	Bothhouse	
5	HARINAS Y GRASAS XALOSTOC, S.A.	Food	June 13, 1990
6	POLIESTERES BAYER, S.A.	Petrochemical	
7	CIBA GEIGY MEXICANA, S.A. DE C.V.	Chemical	
8	FIBRAS SINTETICAS, S.A. DE C.V.	Petrochemical	
9	BANOS COSTA DEL SOL	Bathhouse	
10	BANOS COACALCO	Bathhouse	
11	PLANTA DE ASFALTO D.D.F.	Coal/petroleum product	June 14, 1990
12	INDUSTRIAS DE HULE GALGO	Rubber/plastic	
13	VIDRIERA MEXICO, S.A.	Non-metallic mineral	
14	UNIROYAL, S.A. DE C.V.	Rubber/plastic	
15	CENTRO DEPORTIVO CHAPULTEPEC, A.C.	Sport center	
16	KIMEX, S.A. DE C.V.	Petrochemical	June 15, 1990
17	INDUSTRIAS RESISTOL, S.A.	Checmial	
18	NOVAQUIM, S.A.	Chemical	
19	ALCOMEX, S.A. DE C.V.	Metal product	
20	FUNDICION CHORNE	Basic metal	June 18, 1990
21	BANOS TACUBAYA	Bathhouse	
22	BANOS NAUCALPAN	Bathhouse	
23	NUEVA FABRICA NACIONAL DE VIDRIO	Non-metallic mineral	
24	PENNWALT, S.A. DE C.V.	Chemical	June 19, 1990
25	GENERAL PRODUCTOS CO., S.A. DE C.V.	Chemical	
26	IDEAL STANDARD, S.A.	Non-metallic mineral	
27	FCA. DE PAPEL SAN RAFAEL	Paper	June 20, 1990
28	FCA. DE PAPEL MEXICO	Paper	
29	HACO MEXICANA, S.A.	Chemical	
30	CIA. PAPELERA EL FENIX, S.A.	Paper	
31	VITRO FIBRAS, S.A.	Non-metallic mineral	June 21, 1990
32	PASTEURIZADORA LA LAGUNA	Food	
33	VIDRIO PLANO DE MEXICO, S.A.	Non-metallic mineral	
34	PAPELERA IRUNA, S.A.	Paper	June 22, 1990
35	METALURGICA ALMENA	Basic metal	
36	BANOS LA NARANJA	Bathhouse	
37	BANOS XOLALPA	Bathhouse	
38	BANOS GABIS	Bathhouse	
39	MEDIDORES AZTECA, S.A.	Basic metal	June 25, 1990
40	SALICILATOS DE MEXICO	Preciion instrument	
41	CEMENTOS ANAHUAC, S.A.	Non-metallic mineral	
42	PAPELERA ATLAS	Paper	
43	BANOS LUPITA	Bathhouse	
44	PORCELANITE, S.A.	Non-metallic mineral	June 26, 1990
45	PRODUCTOS SAN CRISTOBAL	Paper	
46	CIA. HULERA TORNEL	Rubber/plastic	
47	CERVECERIA MODELO, S.A. DE C.V.	Drinks	
48	BANOS TACUBA	Bathhouse	

Table 1.2 (2) Names of Establishments for On-site Questionnaire (No.2)

Visit No.	Name of Establishment	Type of Industry	Date of Vist
49	CARTONAJES ESTRELLA	Paper	June 27, 1990
50	FUNDIDORA Y LAMINADORA ANAHUAC	Basic metal	
51	ACEROS AHUEHUETES	Basic metal	
52	BANOS SANTIAGO	Bathhouse	
53	ACEROS CORSA	Metal product	June 28, 1990
54	DU PONT	Chemcial	
55	INDUSTRIAS NYLBO	Metal product	
56	FUNDICIONES FIERRO-MEX	Metal product	
57	REFINERIA 18 DE MARZO	Petroleum refinery	June 29, 1990
58	ANDERSON CLAYTON, S.A.	Food	
59	FUNDICIONES DE HIERRO Y ACERO	Metal product	
60	FUNDIDORA DE ACEROS TEPEYAC	Basic metal	
61	FORD MOTOR COMPANY	Transport equipment	July 2, 1990
62	QUIMICA LUCAVA, S.A.	Chemical	
63	INDUSTRIAS UNIDAS, S.A.	Non-metallic mineral	
64	3M DE MEXICO, S.A.	Other	
65	ANDERSON CLAYTON & COMPANY, S.A. DE C.V.	Food	July 3, 1990
66	ESMALTES Y COLORANTES, S.A.	Non-metallic mineral	
67	ACEITES Y JABONES, S.A.	Checmial	
68	VIDRIERA ORIENTAL, S.A. DE C.V.	Non-metallic mineral	
69	TERMOELECTRICA DEL VALLE DE MEXICO	Electric power	July 4, 1990
70	TERMOELECTRICA JORGE LUQUE	Electric power	
71	FUNDICION DE FIERRO Y METALES	Basic metal	
72	P.P.G. INDUSTRIAS DE MEXICO	Chemical	
73	ORGANIZACION QUIMICA MEXICANA	Food	July 5, 1990
74	PRODUCTOS NUTRICIONALES	Food	
75	POLIMEROS (POLIESPUMAS DE MEXICO)	Petrochemical	
76	EMPAQUES DE CARTON UNITED	Paper	
77	SILICATOS Y DERIVADOS, S.A.	Checmial	July 6, 1990
78	GANADEROS PRODUCTORES DE LECHE PURA	Food	
79	HOSIPTAL 20 DE NOVIEMBRE ISSSTE	Hospital	
80	HOTEL DEL ANGEL	Hotel	
81	MA. ISABEL SHERATON	Hotel	
82	SOSA TEXCOCO, S.A.	Chemical	July 9, 1990
83	AMERICAN TEXTILE, S.A. DE C.V.	Petrochemical	
84	MANUFACTURAS GARGO, S.A. DE C.V.	Paper	
85	INDUSTRIAL PAVIMENTADORA, S.A.	Coal/petroleum product	
86	HULE INDUSTRIAL, S.A.	Rubber/plastic	July 10, 1990
87	POLIRESINAS HUETTENES ALBERTOS, S.A.	Petrochemical	
88	AGA DE MEXICO, S.A. DE C.V.	Chemical	
89	TAMM Y CIA, S.A. DE C.V.	Petrochemical	
90	CIA. HULLRA ATLAS, S.A.	Rubber/plasitc	July 11, 1990
91	CORRUGADO Y FIBRA, S.A.	Paper	
92	SALES INDUSTRIALES DE MEXICO	Checmial	
93	TENERIA TEMOLA, S.A. DE C.V.	Leather	
94	SABRITAS, S.A. DE C.V.	Food	
95	LA HACIENDA, S.A. DE C.V.	Food	July 12, 1990
96	EMPAQUES Y CARTON CORRUGADO, S.A.	Paper	
97	DOW QUIMICA MEXICANA, S.A.	Checmial	

No. 1	Date of Visit	June 12, 1990

Name of Establishment	FABRICA DE JABON LA CORONA, S.A.		
Type of Industry (Product)	Chemical (soap, detergent, cooking oil)		
Scale of Factory	Large	Number of Employees	2,777
Annual Sales or Production	570,000,000,000 pesos/yr		
Kind of Fuel, Consumption and Price	Natural gas (211.3 pesos/m^3) 6,440,000 m^3/mon 1,360,770,000 pesos/mon		

Type of Combustion Facility	Capacity	Kind of Fuel	Fuel consumption	Age	Remarks
Water tube boiler	15 ton/hr	Natural gas	1,400 m^3/hr		3 units
Water tube boiler	15 ton/hr	Natural gas	1,130 m^3/hr		2 units
Water tube boiler	20 ton/hr	Natural gas	1,725 m^3/hr		
Water tube boiler	6 ton/hr	Natural gas	416 m^3/hr		
Water tube boiler	5 ton/hr	Natural gas	382 m^3/hr		
Heat medium boiler	3.5 ton/hr	Natural gas	112 m^3/hr		4 units
Heat medium boiler	35 ton/hr	Natural gas	45 m^3/hr		
Heat medium boiler	12 ton/hr	Natural gas	336 m^3/hr		
Heat medium boiler	5 ton/hr	Natural gas	45 m^3/hr		
Heat medium boiler	1.5 ton/hr	Natural gas	56 m^3/hr		
Dryer	10 ton/hr	Natural gas	350 m^3/hr		
Dryer	10 ton/hr	Natural gas	350 m^3/hr		2 units
Dryer	60 ton/hr	Natural gas	182 m^3/hr		

Outline of the Facility Surveyed — Heat Medium Boiler 3.5 ton/hr

Capacity of the facility	:	3.5 ton/hr
Fuel consumption	:	112 m^3/hr
Heat Medium and temperature	:	Oil, 260 - 280 °C
Fuel temperature	:	Normal
Combustion air temperature	:	Normal
Operating time	:	24 hr/day, 144 hr/week
Stack diameter and height	:	0.4 mϕ x 15 m
Remarks	:	Most of combustion facilities are aged ones.

Outline of Survey Result

Present pollution control measures	:	Cyclones attached to dryers. Natural gas used.
Future plan for pollution control	:	None
Present energy-saving measures	:	None

1. This is a large plant having many thermal units. These units are installed closely to each others. Therefore, there are little space secured for reconstruction or grading up. All thermal units use natural gas.

2. Exhaust gas analysis was made on a heat medium boiler of around 1 million kcal/hr among a total of 19 thermal units. The O_2 content was relatively high at 8.8% and the exhaust gas temperature also high at 330°C. Namely, the efficiency was around 76% and may be increased to 82% by means of combustion control (i.e., by setting the O_2 concentration to 3 - 4%). Since natural gas was burnt, no soot was generated.

No. 2	Date of Visit	June 12, 1990

Name of Establishment	POLAQUMIA, S.A. DE C.V.		
Type of Industry (Product)	Chemical (herbicide, insecticide, glycol ester)		
Scale of Factory	Medium	Number of Employees	245
Annual Sales or Production	42,750,000,000 pesos/yr		
Kind of Fuel, Consumption and Price	Natural gas (211.3 pesos/m^3) 172,000 m^3/mon 363,000,000 pesos/mon		

Type of Combustion Facility	Capacity	Kind of Fuel	Fuel consumption	Age	Remarks
Water tube boiler	5 ton/hr	Natural gas	272 m^3/hr	25	Alternate use
Water tube boiler	4 ton/hr	Natural gas	227 m^3/hr	25	
Heat medium boiler	Small capacity	Natural gas	47 m^3/hr	25	

Outline of the Facility Surveyed		Smoke tube boiler 5 ton/hr (steam)
Evaporatin rate	:	Rating: 5 ton/hr
	:	Normal: 3.3 ton/hr
	:	Steam pressure: 8.0 kg/cm^2g
Fuel consumption	:	Normal: 272 m^3/hr
Fuel pressure	:	340 mmAq
Combustion air temperature	:	Normal
Combustion exhaust gas composition	:	O_2 - 5%, CO_2 - 9.3%, CO - 0.15%, H_2O - 7.9% (as measured by the plant)
Stack	:	0.5 mϕ x 5.5 m
Operating hour	:	24 hr/day, 144 hr/week

Outline of Survey Result

Present pollution control measures	:	Natural gas used
Future plan for pollution control	:	None
Present energy-saving measures	:	None

1. This is a relatively small plant producing herbicide and odor of chlorine was detectd in the plant. Fuel used is entirely natural gas.
2. The fire tube boiler has been installed 25 years ago. The O_2 content was 5.2%, with Bacharach No. 5 in spite of natural gas burning. The exhaust gas temperature was relatively low at 197°C. Overall renewal of facilities or at least renewal of all burners is necessary. (Smoke was observed visually.)

No. 3	Date of Visit	June 12, 1990

Name of Establishment	PROCTOR & GAMBLE DE MEXICO, S.A. DE C.V.		
Type of Industry (Product)	Chemical (soap, detergent)		
Scale of Factory	Large (One of ten largest plants)	Number of Employees	500
Annual Sales or Production			
Kind of Fuel, Consumption and Price	Heavy oil (L) 696 kl/mon (175.57 pesos/l) 122,322,000 pesos/mon		

Type of Combustion Facility	Capacity	Kind of Fuel	Fuel consumption	Age	Remarks
Water tube boiler	22.7 ton/hr	Heavy oil (L)	1,125 l/hr	12	

Outline of the Facility Surveyed: Water tube boiler 22.7 ton/hr (steam)

Evaporation rate	:	Rating: 22.7 ton/hr
	:	Normal: 19 ton/hr
Fuel consumption	:	Rating: 1.125 l/hr
	:	Normal: 1,000 l/hr
Steam pressure	:	9.2 kg/cm^{2}g
Fuel pressure	:	2.12 kg/cm^{2}g
Temperature	:	115°C
Atomizing steam temperature	:	115°C
Combustion air temperature	:	Normal
Stack	:	1.2 mϕ x 15 m
Operating hour	:	24 hr/day, 157 hr/week

Outline of Survey Result

Present pollution control measures	:	Transfer from heavy oil (H) to heavy oil (L)
Future plan for pollution control	:	None
Present energy-saving measures	:	None

1. The recording peprs of instruments for boiler monitoring have gradations in percent scale. It is advisable to change to the actual measuring unit so that everyone concerning operation can understand easily. Besides, the instrument panel was small.
2. The Bacharach value was No. 4, which is not so bad a value. This is possibly due to satisfactory atomized steam pressure and oil pressure. It is necessary, however, to install an atomized steam pressure gauge and to clean the nozzle frequently.
3. The boiler outlet temperature of 242°C and the O_2 content of 4.3% are generally approprite.
4. Boiler operation is under satisfactory control, but better result will be achieved by paying more attention to maintenance.

No. 4	Date of Visit	June 12, 1990

Name of Establishment	BANOS RIO BLANCO		
Type of Industry (Product)	Bathhouse		
Scale of Factory	Small	Number of Employees	
Annual Sales or Production			
Kind of Fuel, Consumption and Price	Diesel		

Type of Combustion Facility	Capacity	Kind of Fuel	Fuel consumption	Age	Remarks
Smoke tube boiler		Diesel			Alternate use
Smoke tube boiler		Diesel			every another
					week

Outline of the Facility Surveyed — Smoke tube boiler (steam)

Fuel temperature : Normal
Combustion air temperature : Normal
Stack : 0.4 mφ x 16 m

Outline of Survey Result

Present pollution control measures	:	With simple dust remover on top of the stack
Future plan for pollution control	:	None
Present energy-saving measures	:	None

1. Primary air for boiler is natural draft and the opening is satisfactory.
2. Air was entering between the boiler body and stack. This needs to be repaired.
3. Diesel oil atomized by steam. The burner is desired to be renewed because its performance was not satisfactory.
4. The boiler body was damaged in many places and desired to be renewed.
5. Upon boiler renewal, it is advised to preheat air and supply water by utilizing exhaust gas.
6. The boiler surface temperature was 52 - 129°C. It is necessary for the time being to apply heat insulation on the high temperature section of 90°C or more.
7. As an unexperienced person was operating the boiler, periodical diagnosis by the authority is desired. It is also necessary to adjust air quantity and damper as required.
   Measured value: O_2 - 4.8%, exhaust gas temperature - 745°C, Bacharach - No. 9

No. 5	Date of Visit	June 13, 1990

Name of Establishment	HARINAS Y GRASAS XALOSTOC, S.A.		
Type of Industry (Product)	Food (feeds : processed bone, blood, and grease of animals)		
Scale of Factory	Small	Number of Employees	54
Annual Sales or Production			
Kind of Fuel, Consumption and Price	Heavy oil (L) 33.6 kl/mon (178 pesos/l) 5,980,800 pesos/mon		

Type of Combustion Facility	Capacity	Kind of Fuel	Fuel consumption	Age	Remarks
Water tube boiler	2.5 ton/hr	Heavy oil (L)	250 l/hr	25	
Water tube boiler	Spare				

Outline of the Facility Surveyed		Water tube boiler	2.5 ton/hr (steam)
Evaporation rate	:	Rating: 2.5 ton/hr	Normal: 2.0 ton/hr
Fuel consumption	:	Rating: 250 l/hr	Normal: 100 l/hr
Steam pressure	:	8.0 kg/cm^{2}g	
Fuel temperature	:	80°C	
Atomizing medium	:	Steam	
Combustion air temperature	:	Normal	
Stack	:	0.92 mφ x 12 m	
Operating hours	:	7 - 8 hr/day	

Outline of Survey Result

Present pollution control measures	:	Offensive odor producted in the process was treated as boiler combustion air
Future plan for pollution control	:	None
Present energy-saving measures	:	None

1. Instruments necessary for boiler operation were not complete; data recorder and steam flow meter were not provided.
2. The front door of the boiler was deformed and kept open. The measured result of exhaust gas includes O_2 content at 14%, temperature at 314°C, and Bacharach of No. 9. Air entry is considered large. The door should be repaired as early as possible in view of energy saving and pollution control. Since the exhaust gas temperature is expected to rise further after repair of the door, installation of the damper is recommended.
3. The flame state indicates excess in air and needs to be adjusted.
4. The heat insulation state of the furnace wall was satisfactory, with temperature being 61°C at ceiling.
5. Guidance was given on the method of calculating the vapor generation amount.

No. 6	Date of Visit	June 13, 1990

Name of Establishment	POLIESTERES BAYER, S.A.		
Type of Industry (Product)	Petrochemical (polyester fiber, agricultural chemicals)		
Scale of Factory	Small	Number of Employees	89
Annual Sales or Production			
Kind of Fuel, Consumption and Price	Diesel 8.5 kl/mon		

Type of Combustion Facility	Capacity	Kind of Fuel	Fuel consumption	Age	Remarks
Heat medium boiler	700,000 kcal/hr	Diesel	40 l/hr	15	

Outline of the Facility Surveyed: Heat medium boiler 700,000 kcal/hr

Heat quantity	:	Rating: 700,000 kcal/hr, Normal: 250,000 kcal/hr
Fuel consumption	:	Rating: 65.5 l/hr, Normal: 10 l/hr
Temperature of medium to be heated	:	257°C
Steam pressure	:	3.5 kg/cm^{2}g
Fuel temperature	:	Normal
Combustion air temperature	:	Normal
Stack	:	0.28 mϕ x 7 m
Operating hours	:	24 hr/day, 168 hr/week

Outline of Survey Result

Present pollution control measures	:	None
Future plan for pollution control	:	None
Present energy-saving measures	:	None

1. The heat medium (oil) is circulated in the boiler to raise its temperature of 240°C by 13°C.
2. Hydrocarbon produced from the production process is treated by control devices.

No. 7	Date of Visit	June 13, 1990

Name of Establishment	CIBA GEIGY MEXICANA, S.A. DE C.V.		
Type of Industry (Product)	Chemical (medicines, dyeing agent, insecticide)		
Scale of Factory	Large	Number of Employees	1,200
Annual Sales or Production			
Kind of Fuel, Consumption and Price	Diesel (513 pesos/l) 18,900 l/mon 9,700,000 pesos/mon		

Type of Combustion Facility	Capacity	Kind of Fuel	Fuel consumption	Age	Remarks
Once-through boiler	1.5 ton/hr	Diesel	92 l/hr		
Once-through boiler	1.5 ton/hr	Diesel	92 l/hr		1 - 2 units in operation
Once-through boiler	1.0 ton/hr	Diesel	80 l/hr		
Once-through boiler	0.5 ton/hr	Diesel	40 l/hr		

Outline of the Facility Surveyed		Once-through boiler 1.5 ton/hr (steam)
Evaporation rate	:	Rating: 1.5 ton/hr, Normal: 92 l/hr
Steam pressure	:	9.0 kg/cm^{2}g
Fuel consumption	:	Rating: 92 l/hr, Normal: 92 l/hr
Fuel pressure	:	15 kg/cm^{2}g
Temperature	:	Normal
Combustion air temperature	:	Normal
Combustion exhaust gas composition	:	O_2 - 13.6%, CO_2 - 10 to 12%, CO - 0.005% (as measured by the plant)
Exhaust gas temperature	:	300°C (as measured by the plant)
Stack	:	0.4mφ x 15m
Operating hours	:	16 hr/day, 96 hr/week

Outline of Survey Result		
Present pollution control measures	:	None
Future plan for pollution control	:	None
Present energy-saving measures	:	None

1. The factory is kept clean. No particular offensive odor was detected.

2. This is a vertical once-through boiler and the combustion air fan is also driven by a diesel engine. Vibration of the boiler is high. The exhaust gas O_2 content was 10.1%, with the exhaust gas temperature being at 250°C to indicate excess air combustion. The efficiency was relatively low at 79%. As the Bacharach value was No. 3, reducing the O_2 content slightly may achieve the efficiency of 80% or more.

No. 8	Date of Visit	June 13, 1990

Name of Establishment	FIBRAS SINTETICAS, S.A. DE C.V.				
Type of Industry (Product)	Petrochemical (polyester fiber, nylon)				
Scale of Factory	Large	Number of Employees		1,400	
Annual Sales or Production					
Kind of Fuel, Consumption and Price	Heavy oil (H) (175.6 pesos/l) 2,560,000 l/mon 449,536,000 pesos/mon				
Type of Combustion Facility	Capacity	Kind of Fuel	Fuel consumption	Age	Remarks
Water tube boiler	40 ton/hr	Heavy oil (H)	3,142 l/hr	21	Alternate use
Water tube boiler	40 ton/hr	Heavy oil (H)	3,142 l/hr	18	
Smoke tube boiler	13 ton/hr	Heavy oil (H)	416 l/hr		

Outline of the Facility Surveyed		Water tube boiler 40 ton/hr (steam)
Evaporation rate	:	Rating: 40 ton/hr, Normal: 30 ton/hr
Steam pressure	:	40 kg/cm^{2}g (425°C)
Fuel consumption	:	Rating: 4,100 l/hr, Normal: 3,142 l/hr
Fuel pressure	:	5.3 kg/cm^{2}g, Temperature: 120°C
Atomizing steam pressure	:	7.2 kg/cm^{2}g, Temperature: 120°C
Combustion air temperature	:	161°C
Combustion exhaust gas composition	:	O_2 - 3.75%, CO_2 - 13%, CO - 0.25% (as measured by the plant)
Combustion eshaust gas temperature	:	Recuperator outlet 204°C (as measured by the plant)
Stack	:	1.97mϕ x 14m
Operating hours	:	24 hr/day, 168 hr/week

Outline of Survey Result

Present pollution control measures	:	None
Future plan for pollution control	:	None
Present energy-saving measures	:	Recuperator installed

1. This is a tidy clean plant producing synthetic fibers of polyester and nylon.

2. The boiler was 18 years old, and the combustion control was satisfactory. The O_2 content was 2.8% and the Bacharach value was rather satisfactory at Nos. 4 to 5 in spite of heavy oil (H) burning.

3. The air preheater was also provided, with the final exhaust gas temperature as low as 238°C. The boiler efficiency was satisfactory at 86%.

No. 9	Date of Visit	June 13, 1990

Name of Establishment	BANOS COSTA DEL SOL		
Type of Industry (Product)	Bathhouse		
Scale of Factory	Small	Number of Employees	
Annual Sales or Production			
Kind of Fuel, Consumption and Price	Heavy oil (L) (175.6 pesos/l) 19,000 l/mon 3,340,000 pesos/mon		

Type of Combustion Facility	Capacity	Kind of Fuel	Fuel consumption	Age	Remarks
Smoke tube boiler	Unknown	Heavy oil (L)	107 l/hr	20	Alternate use
Smoke tube boiler	Unknown	Heavy oil (L)	107 l/hr	20	Alternate use

Outline of the Facility Surveyed — Water tube boiler (steam)

Evaporation rate	:	Rating: Unknown
	:	Normal: 1.2 ton/hr (estimate)
Steam pressure	:	7 kg/cm^{2}g
Fuel consumption	:	Normal: 107 l/hr
Combustion air pressure	:	Natural draft, Temperature: Normal
Stack	:	0.3 mϕ x 15 m
Operating hours	:	6 hr/day, 42 hr/week

Outline of Survey Result

Present pollution control measures	:	None
Future plan for pollution control	:	None
Present energy-saving measures	:	None

1. The boiler is installed in the third floor of the bathhouse. One boiler man is operating the burner manually.

2. The O_2 content was 7.4%, and the exhaust gas temperature 235°C, and the boiler efficicency satisfactory at 83%, except that the Bacharach value was high at No. 7. Almost no smoke from the stack was observed. The boiler, which is 20 years old, requires equipment renewal, or at least the burner should adopt forced drafting.

No. 10	Date of Visit	June 13, 1990

Name of Establishment	BANOS COACALCO		
Type of Industry (Product)	Bathhouse		
Scale of Factory	Small	Number of Employees	
Annual Sales or Production			
Kind of Fuel, Consumption and Price	Heavy oil (L), 4.5 kl/mon, (176 pesos/l) 792,000 pesos/mon		

Type of Combustion Facility	Capacity	Kind of Fuel	Fuel consumption	Age	Remarks
Water tube boiler		Heavy oil (L)	11 l/hr	20	

Outline of the Facility Surveyed — Water tube boiler (steam)

Fuel consumption	:	Normal: 11 l/hr
Steam presure	:	8.0 kg/cm^2, Fuel temperature: 80°C
Atomizing medium	:	Steam, Pressure: 4.0 kg/cm^2, Fuel temperature: 80°C
Combustion air temperature	:	Normal
Stack	:	0.3 mφ x 10 m
Operating hours	:	14 hr/day, 98 hr/week

Outline of Survey Result

Present pollution control measures	:	None
Future plan for pollution control	:	None
Present energy-saving measures	:	None

1. There is an opening on the upper part of burner, which admits entry of large quantity of air not related to combustion. As a result, the O_2 content was 11.9%. A guidance was given to close this opening.
2. The measured exhaust gas temperature was 460°C. It rose further by reducing the entry of air.
3. Since the Bacharach value was No. 9 or more, shortage of steam in atomizer and poor performance of burner may be responsible.
4. The boiler was of a water tube type and should be renewed because it is already 20 years after installaiton.

No. 11	Date of Visit	June 14, 1990

Name of Establishment	PLANTA DE ASFALTO D.D.F.		
Type of Industry (Product)	Coal and petroleum product (asphalt mix)		
Scale of Factory	Large	Number of Employees	
Annual Sales or Production			
Kind of Fuel, Consumption and Price	Diesel 21.76 kl/day		

Type of Combustion Facility	Capacity	Kind of Fuel	Fuel consumption	Age	Remarks
1 Rotary kiln	250 ton/hr	Diesel	1,360 l/hr		
2 Rotary kiln	250 ton/hr	Diesel	1,360 l/hr		
3 Rotary kiln			1,000 l/hr		

Outline of the Facility Surveyed		Rotary kiln for aggregate
Rating	:	250 ton/hr, Normal: 200 ton/hr
Fuel consumption	:	Rating: 1,360 l/hr
	:	Normal: 800 - 1,000 l/hr
Temperature of object to be heated	:	140°C
Fuel pressure	:	2.8 - 3.5 kg/cm^{2}g
Fuel temperature	:	Normal
Atomizing medium pressure	:	800 - 155 mmAq
Combustion air pressure	:	1.7 kg/cm^{2}g
Combustion air temperature	:	Normal
Stack	:	1.7 m x 0.8 m x 9.8 m

Outline of Survey Result

Present pollution control measures	:	Fuel change, dust collection with bag filter/scrubber
Future plan for pollution control	:	None
Present energy-saving measures	:	None

1. Problems of plant location
   This plant is in a hollow place of several ten thousand square meter, which is the remain of mining of igneous rocks, a raw material for asphalt concrete. The stack height is only 9.8m for this low place. The location is a basic mistake in view of dispersion of air pollutants and environmental protection.

2. Outline of the process
   93% of sand, crushed igneous rocks, and cement are dried (direct drying with 900°C flame and combustion exhaust gas) in a rotary kiln. 7% of asphalt No. 6 is mixed to make product.

3. Combustion conditions
   The burner was of a low-pressure atomization type. The O_2 content of stack sample was said to be 12.5% and this value needs to be reevaluated because it appears to be affected by air intrusion. (Not necessarily air excess in combustion)

4. Present state of air pollution control
   Dust collection is made with bag filter for one kiln and with scrubber for another. Judging from visually observed dust emission from the stack, the efficiency was not satisfactory.

No. 12	Date of Visit	June 14, 1990

Name of Establishment	INDUSTRIAS DE HULE GALGO		
Type of Industry (Product)	Rubber and plastic product (tire tube)		
Scale of Factory	Medium	Number of Employees	145
Annual Sales or Production	Under test operation (operation started in February 1990)		
Kind of Fuel, Consumption and Price	Heavy oil (L) 16.0 kl/mon		

Type of Combustion Facility	Capacity	Kind of Fuel	Fuel consumption	Age	Remarks
Smoke tube boiler	2.55 ton/hr	Heavy oil (L)	28.4 l/hr	0	

Outline of the Facility Surveyed — Smoke tube boiler — 2.55 ton/hr (steam)

Evaporation rate	:	Rating: 2.55 ton/hr, Present: 25%
Fuel consumption	:	Normal: 28.4 l/hr
Steam pressure	:	16 kg/cm^{2}g, Fuel pressure: 3kg/cm^{2}g
Temperature	:	Normal
Atomizing steam pressure	:	0.6 - 1.1 kg/cm^{2}g
Combustion air temperature	:	Normal
Combustion exhaust gas composition	:	O_2 - 2.9%, CO_2 - 13.4% (as measured by the plant)
Temperature	:	170°C (as measured by the plant)
Operating hours	:	24 hr/day, 120 hr/week

Outline of Survey Result

Present pollution control measures	:	None
Future plan for pollution control	:	*None*
Present energy-saving measures	:	None

1. This is a Mexican-made boiler, three months since installation, and the control system is satisfactory and compact as a whole.
2. This is currently in test operation at 25% of the rating.
3. The burner performance during ignition was poor because of low-load operation, and the Bacharach value was No. 9 or more. This value was improved to No. 3 during normal operation.
4. The atomizer uses air, but its pressure was low. Changeover to steam is recommended.
5. We were asked about additives to heavy oil and answered that they were not necessary for low-load operation.
6. The work environment was poor because of fine dusts generated in the molding process. We proposed directing such dust to the outside via collection duct and cleaning with bag filter.

No. 13	Date of Visit	June 14, 1990

Name of Establishment	VIDRIERA MEXICO, S.A.		
Type of Industry (Product)	Non-metallic mineral product (glass bottle)		
Scale of Factory	Large	Number of Employees	1,650
Annual Sales or Production	Glass bottle 2,400,000,000 bottles/year		
Kind of Fuel, Consumption and Price	Natural gas (211.4 pesos/m^3) 3,692,000 m^3/mon 780,120,000 pesos/mon		

Type of Combustion Facility	Capacity	Kind of Fuel	Fuel consumption	Age	Remarks
Glass melting furnace tank oven	8.6 ton/hr	Natural gas	1,282 m^3/hr		Cullet 75%
Glass melting furnace tank oven	8.6 ton/hr	Natural gas	1,282 m^3/hr		Cullet 75%
Glass melting furnace tank oven	8.6 ton/hr	Natural gas	1,282 m^3/hr		Cullet 75%
Glass melting furnace tank oven	8.6 ton/hr	Natural gas	1,282 m^3/hr		Cullet 75%
Glass melting furnace tank oven	8.6 ton/hr	Natural gas	1,282 m^3/hr		Not used

Outline of the Facility Surveyed	Glass melting furnace tank oven (Glass)
Capacity of facility	: 8.6 ton/hr (glass)
Unit consumption	: 1,260,000 kcal/ton (glass)
Fuel consumption	: 1,282 /hr
Fuel pressure	: 0.4 kg/cm2g
Combustion air pressure	: Several mmAq, Temperature: 1,200°C
Combustion exhaust gas composition	: O_2 - 10.8%, CO_2 - 5.2%, CO - 0% (as measured by the plant)
Combustion exhaust gas temperature	: Regenerator inlet - 1,350°C, Outlet - 240°C (as measured by the plant)
Operating hours	: 24 hr/day, 168 hr/week
Regenerator	: 30 - minute changeover (manual)

Outline of Survey Result

Present pollution control measures	:	Natural gas used
Future plan for pollution control	:	None
Present energy-saving measures	:	Regenerator installed

1. The plant is a member of the VITRO group.

2. As the measuring instrument brought from Japan became faulty, the Teledyne instrument was used for measurement. Because of too small amount of air (O_2: 0.5%), CO emission was as high as 890 - 940 ppm. The unit fuel consumption was relatively low at 1.26 million Kcal/ton glass, which may be attributed to the use of cullet in a high percentage of 75%. The CO content may decrease by increasing the O_2 content to 1 - 2%, and this furnace may not present any problem.

No. 14	Date of Visit	June 14, 1990

Name of Establishment	UNIROYAL, S.A. DE C.V.		
Type of Industry (Product)	Rubber and plastic product (tire)		
Scale of Factory	Large	Number of Employees	530
Annual Sales or Production			
Kind of Fuel, Consumption and Price	Heavy oil (L) (175.6 pesos/l) 308,600 l/mon 54,190,000 pesos/mon		

Type of Combustion Facility	Capacity	Kind of Fuel	Fuel consumption	Age	Remarks
Water tube boiler	10 ton/hr	Heavy oil (L)	500 l/hr	18	
Water tube boiler	6.4 ton/hr	Heavy oil (L)		18	Not used
Hot water boiler	0.5 ton/hr	Diesel			For shower

Outline of the Facility Surveyed: Water tube boiler 10 ton/hr (steam)

Evaporation rate	:	Rating: 10 ton/hr, Normal: 6 ton/hr
Steam pressure	:	21 kg/cm^{2}g
Fuel consumption	:	Rating: 803 l/hr Normal: 600 l/hr
Fuel pressure	:	3 kg/cm^{2}g, Temperature: 104°C
Atomizing steam pressure	:	4.3 kg/cm^{2}g, Temperature: 120°C
Combustion air temperature	:	Normal
Combustion exhaust gas composition	:	O_2 - 3.4%, CO_2 - 12.4% (as measured by the plant)
Combustion exhaust gas temperature	:	320°C (as measured by the plant)
Stack	:	1.68 mϕ x 37.8 m
Operating hours	:	24 hr/day, 144 hr/week

Outline of Survey Result

Present pollution control measures	:	None
Future plan for pollution control	:	None
Present energy-saving measures	:	None

1. Tires are produced and steam used for heating during molding.

2. The O_2 content was 10.1% and the exhaust gas temperature was as high as 289 - 304°C, with the boiler efficiency as poor as 76%. Besides, the Bacharach value was No. 9 or more indicating soot generation. Smoke emission from the stack was visually observed.

3. The steam pressure at the burner inlet was 4.3 kg/cm^{2}g and the oil pressure was 3.0 kg/ cm^{2}g, with ΔP=1.3 kg/cm^{2}g. Atomization was also considered appropriate. It is therefore necessary to carry out fundamental burner checks (air intake method, etc.).

No. 15	Date of Visit	June 14, 1990

Name of Establishment	CENTRO DEPORTIVO CHAPULTEPEC, A.C.		
Type of Industry (Product)	Public Sports Center		
Scale of Factory	Medium	Number of Employees	
Annual Sales or Production			
Kind of Fuel, Consumption and Price	Heavy oil (H) 117.0 kl/mon		

Type of Combustion Facility	Capacity	Kind of Fuel	Fuel consumption	Age	Remarks
Water tube boiler	9.0 ton/hr	Heavy oil (H)	307 l/hr	8	13 hr/day
Water tube boiler	5.0 ton/hr	Heavy oil (H)	185 l/hr	27	3 hr/day

Outline of the Facility Surveyed: Water tube boiler 9.0 ton/hr (steam)

Evaporation rate	:	Rating: 9.0 ton/hr
Fuel consumption	:	Rating: 307 l/hr, Normal: 185 l/hr
Steam pressure	:	11.2 kg/cm^{2}g, Temperature: 186°C
Fuel pressure	:	4 kg/cm^{2}g, Temperature: 100°C
Atomizing steam pressure	:	4 - 6 kg/cm^{2}g
Combustion air temperature	:	Normal
Stack	:	0.8 mϕ x 32 m
Operating hours	:	13 hr/day, 91 hr/week

Outline of Survey Result

Present pollution control measures	:	None
Future plan for pollution control	:	None
Present energy-saving measures	:	None

1. The boiler efficiency was 78% and operation conditions were satisfactory.
2. The measured O_2 concentration was 7.7%, with relatively large excess air. It is necessary to check for air entry through boiler wall.
3. The measured Bacharach value was No. 3 and for satisfactory combustion of heavy oil (H). Atomizer was satisfactory.
4. It is advisable to change the graduations of recording paper for the boiler operation meter from the percent scale to the measured value.

No. 16	Date of Visit	June 15, 1990

Name of Establishment	KIMEX, S.A. DE C.V.		
Type of Industry (Product)	Petrochemical (nylon, polyester fiber)		
Scale of Factory	Large	Number of Employees	2,280
Annual Sales or Production			
Kind of Fuel, Consumption and Price	N. gas 2,160,000m^3/mon (235.65 pesos/m^3) 511,164,000 pesos/mon H. oil (L) 1,499.7 kl/mon (185.85 pesos/l) 278,719,245 pesos/mon		

Type of Combustion Facility	Capacity	Kind of Fuel	Fuel consumption	Age	Remarks
Water tube boiler	14 ton/hr	Natural gas	500 m^3/hr	29	
Water tube boiler	14 ton/hr	Natural gas	Not operating	29	
Water tube boiler	28 ton/hr	Heavy oil (L)	2,083 l/hr	29	Superheater
Water tube boiler	41 ton/hr	Natural gas	2,500 m^3/hr	16	Superheater

Outline of the Facility Surveyed		Water tube boiler 28 ton/hr (steam)
Evaporation rate	:	Rating: 28 ton/hr, Normal: 16 ton/hr
Fuel consumption	:	Normal: 2.083 l/hr
Steam pressure	:	38 kg/cm^{2}g, Temperature: 450°C
Fuel pressure	:	12 g/cm^{2}g, Temperature: 95°C
Atomizing steam pressure	:	14 kg/cm^{2}g
Combustion air temperature	:	240°C
Stack	:	1.5 mϕ x 30 m
Operating hours	:	24 hr/day, 168 hr/week

Outline of Survey Result

Present pollution control measures	:	Change fuel to natural gas
Future plan for pollution control	:	None
Present energy-saving measures	:	With Ljungstrom type recuperator

1. The result of measurement of combustion exhaust gas showed the O_2 content of 4% and 330°C at the recuperator inlet and 4.8% and 230°C at its outlet. The Bacharach value was No. 3 and the combustion state was very good.

2. It is advisable to change the graduations of recording paper from the percent scale to the actual value to indicate the state of boiler operation.

3. Since the life of the Jungstrom type recuperator is short at two to three years, desirable structure of recuperators and their materials such as Sicrmal and S-ten steel were explained.

4. Dwelling houses are quite near to the plant and efforts are being made for pollution control. Exhaust gas measurement was made periodically, and slightly excess-air combustion was made to prevent black smoke.

5. Boiler control was also satisfactory.

No. 17	Date of Visit	June 15, 1990

Name of Establishment	INDUSTRIAS RESISTOL, S.A.		
Type of Industry (Product)	Chemical (ABS resin, latex, soda phosphate)		
Scale of Factory	Large	Number of Employees	430
Annual Sales or Production			
Kind of Fuel, Consumption and Price	N. gas 86,400 m^3/mon (211.3 pesos/m^3) 18,256,320 pesos/mon		

Type of Combustion Facility	Capacity	Kind of Fuel	Fuel consumption	Age	Remarks
Water tube boiler	11.8 ton/hr	Natural gas	200 m^3/hr	25	
Water tube boiler	12.5 ton/hr	Natural gas	Not operating	8	

Outline of the Facility Surveyed — Water tube boiler — 11.8 ton/hr (steam)

Evaporatin rate	:	Rating: 11.8 ton/hr
Fuel consumption	:	Normal: 200 m^3/hr
Steam pressure	:	12 kg/cm^2g, Steam temperature: 180°C
Fuel pressure	:	1.265 mmAq
Combustion air temperature	:	Normal
Stack	:	1.1 mϕ x 8.0 m
Combustion exhaust gas composition	:	O_2 - 8.6%, CO_2 - 8.6% (as measured by the plant)
Temperature	:	210°C (as measured by the plant)
Operating hours	:	24 hr/day, 168 hr/week

Outline of Survey Result

Present pollution control measures	:	Fuel changed to natural gas
Future plan for pollution control	:	None
Present energy-saving measures	:	None

1. The boiler was in continuous operation, but may enter intermittent operation depending on the steam pressure. The actual operating hours were therefore 7.2 hr/day.

2. The result of exhaust gas measurement showed the O_2 content at 2%, temperature at 180°C, and Bacarach at 0. The combustion state was satisfactory.

3. Installation of a low NOx burner was advised in order to meet the emission standard of NOx.

4. One meter was used to indicate both the steam generation amount and fuel consumption (critical for boiler operation). It is recommended to separate indication of these elements.

No. 18	Date of Visit	June 15, 1990

Name of Establishment	NOVAQUIM, S.A.		
Type of Industry (Product)	Chemical (oxidation inhibitor, stabilizer)		
Scale of Factory	Small	Number of Employees	67
Annual Sales or Production	27,000,000,000 pesos/yr		
Kind of Fuel, Consumption and Price	Heavy oil (L) (175.6 pesos/l) 95,761 l/mon 16,820,000 pesos/mon		

Type of Combustion Facility	Capacity	Kind of Fuel	Fuel consumption	Age	Remarks
Smoke tube boiler	4.7 ton/hr	Heavy oil (L)	168 l/hr	3	Alternate use
Smoke tube boiler	4.7 ton/hr	Heavy oil (L)	168 l/hr	3	

Outline of the Facility Surveyed — Smoke tube boiler — 4.7 ton/hr (steam)

Evaporation rate	:	Rating: 4.7 ton/hr
Steam pressure	:	15 kg/cm2g
Fuel consumption	:	Normal: 168 l/hr
Fuel pressure	:	2.8 kg/cm^{2}g, Temperature: 100 - 110°C
Atomizing air pressure	:	1.4 kg/cm^{2}g, Temperature: Normal
Combustion air temperature	:	Normal
Combustion exhaust gas composition	:	O_2 - 2%, CO_2 - 11.5%, (as measured by the plant)
Combustion exhaust gas temperature	:	195°C (as measured by the plant)
Stack	:	0.4 mφ x 10 m
Operating hours	:	19 hr/day, 133 hr/week

Outline of Survey Result

Present pollution control measures	:	None
Future plan for pollution control	:	None
Present energy-saving measures	:	None

1. This is a company member of the CYDSA group, and the plant is located near a newly-built residential area.

2. The O_2 content varied from 1.6 to 4.8% and the Bacharach value from No. 5 to No. 8. This is caused by faulty adjustment of the air quantity for the fuel amount which fluctuates with fluctuation of boiler load. This adjustment should be made. The exhaust gas temperature was low at 195°C, with the boiler efficiency at 87%.

No. 19	Date of Visit	June 15, 1990

Name of Establishment	ALCOMEX, S.A. DE C.V.		
Type of Industry (Product)	Metal product (Al sash, Al racket, tube)		
Scale of Factory	Large	Number of Employees	400
Annual Sales or Production	33,319,000,000 pesos/yr		
Kind of Fuel, Consumption and Price	Natural gas (211.3 pesos/m^3) 247,265 m^3/mon 52,250,000 pesos/mon		

Type of Combustion Facility	Capacity	Kind of Fuel	Fuel consumption	Age	Remarks
Melting furnace	20 ton/hr	Natural gas	227 m^3/hr		Batch type
Melting furnace	1.75 ton/hr	Natural gas	20 m^3/hr		Batch type
Melting furnace	1.75 ton/hr	Natural gas	20 m^3/hr		Batch type
Melting furnace	1.75 ton/hr	Natural gas	20 m^3/hr		Batch type
Melting furnace	1.75 ton/hr	Natural gas	20 m^3/hr		Batch type
Heat treating furnace		Natural gas	36 m^3/hr		
Heat treating furnace		Natural gas	36 m^3/hr		
Heat treating furnace		Natural gas	36 m^3/hr		
Heat treating furnace		Natural gas	36 m^3/hr		
Heat treating furnace		Natural gas	36 m^3/hr		

Outline of the Facility Surveyed	Melting furnace	20 ton/hr (Aluminum)
Capacity	:	80 ton/4 hr (1 batch)
Fuel consumption	:	227 m^3/hr
Fuel pressure	:	600 mmAq
Combustion air pressure	:	300 mmAq, Temperature: Normal
Stack	:	0.6 mϕ x 15 m
Operating hours	:	16 hr/day (4 batches/day), 96 h/week (24 batches/week)

Outline of Survey Result

Present pollution control measures	:	Natural gas used
Future plan for pollution control	:	None
Present energy-saving measures	:	None

1. The working environment was relatively good.

2. Measurement was made at the end of batch operation, with the low combustion load. The result was generally satisfactory with the O_2 content at 4.6 - 6.8%. The exhaust gas temperature was 205°C, which is very low considering the high temperature within the furnace at 800°C. It indicates that the heat equivalent to the exhaust gas of 500 - 600 °C may be escaping. Installation of a recuperator is recommended.

No. 20	Date of Visit	June 18, 1990

Name of Establishment	FUNDICION CHORNE		
Type of Industry (Product)	Basic metals (cast iron)		
Scale of Factory	Small	Number of Employees	19
Annual Sales or Production	437,000,000 pesos/yr		
Kind of Fuel, Consumption and Price	*Coke 2,000 kg/mon (US$670/ton) US$1,340/mon*		

Type of Combustion Facility	Capacity	Kind of Fuel	Fuel consumption	Age	Remarks
Cupola	1.5 ton/hr	Coke	500 kg/day	10	

Outline of the Facility Surveyed — Cupola

Raw materials : Iron: 100 kg, lime: 3kg, coke: 15 kg/charge
Temperature of object to be heated : 1,400°C
Stack : 0.6 mϕ x 6.5 m
Operating hours : 6 hr/day, 12 hr/week

Outline of Survey Result

Present pollution control measures : Change to US-made coke, installation of simple dust remover
Future plan for pollution control : Relocation of the plant is scheduled in two months
Present energy-saving measures : None

1. Operation: Two time per day, two hours per time
2. Combustion of the coke: C - 89.9%, Ash - 9.5%, S - 0.52% (US-made)
3. This facility will be relocated out of the metropolitan area in two months, and it is planned to use a rotary type melting furnace.

No. 21	Date of Visit	June 18, 1990

Name of Establishment	BANOS TACUBAYA		
Type of Industry (Product)	Bathhouse		
Scale of Factory	Small	Number of Employees	
Annual Sales or Production			
Kind of Fuel, Consumption and Price	Heavy oil (L) 51.0 kl/mon (175.0 pesos/l) 8,925,000 pesos/mon		

Type of Combustion Facility	Capacity	Kind of Fuel	Fuel consumption	Age	Remarks
Smoke tube boiler	1.27 ton/hr	Heavy oil (L)	170 l/hr	21	Alternate use
Smoke tube boiler	1.27 ton/hr	Heavy oil (L)	170 l/hr	20	at every other week

Outline of the Facility Surveyed	Smoke tube boiler	1.27 ton/hr (steam)
Evaporation rate	:	Rating: 1.27 ton/hr
Fuel consumption	:	Normal: 170 l/hr, Normal: 120 l/hr
Steam pressure	:	6 kg/cm^{2}g
Fuel pressure	:	Tare (head tank), Temperature: 60°C
Atomizing steam pressure	:	6 kg/cm^{2}g
Combustion air temperature	:	Normal
Combustion exhaust gas composition	:	O_2 - 13.8%, CO_2 - 5.6% (as measured by the plant)
Temperature	:	255°C (as measured by the plant)
Operating hours	:	12 hr/day, 84 hr/week

Outline of Survey Result

Present pollution control measures	:	Simple dust remover
Future plan for pollution control	:	None
Present energy-saving measures	:	None

1. Combustion air is supplied by natural draft, and the air is in excess with the O_2 content at 13.4%. Primary air needs to be adjusted.
2. The Bacharach number was No. 9 because of poor atomization of fuel. Atomization should be changed from current gravity feed method to the use of pump and forced drafting.
3. The burner performance is poor. A series of combustion devices need to be replaced.
4. The manager is eager to improve the combustion facilities.

No. 22	Date of Visit	18, Jun, 1990

Name of Establishment	BANOS NAUCALPAN		
Type of Industry (Product)	Bathhouse		
Scale of Factory	Small	Number of Employees	7
Annual Sales or Production	720,000,000 pesos/yr		
Kind of Fuel, Consumption and Price	Heavy oil (L) (175.6 pesos/l) 33,600 l/mon 590,000 pesos/mon		

Type of Combustion Facility	Capacity	Kind of Fuel	Fuel consumption	Age	Remarks
Smoke tube boiler	0.6 ton/hr	Heavy oil (L)	80 l/hr	20	Alternate use
Smoke tube boiler	0.6 ton/hr	Heavy oil (L)	80 l/hr	20	

Outline of the Facility Surveyed — Smoke tube boiler — 0.6 ton/hr (steam)

Evalporation rate	:	Rating: 0.6 ton/hr, Normal: 0.6 ton/hr
Steam pressure	:	6 kg/cm^{2}g
Fuel consumption	:	Rating: 80 l/hr, Normal: 80 l/hr
Fuel pressure	:	Unknown, Temperature: 52°C
Combustion air pressure	:	Natural draft, Temperature: Normal
Stack	:	0.4 mφ x 15 m
Operating hours	:	14 hr/day, 98 hr/week

Outline of Survey Result

Present pollution control measures	:	None
Future plan for pollution control	:	None
Present energy-saving measures	:	None

1. The boiler is installed in the second floor of the bathouse and a boiler operator is manually operating the boiler.

2. The O_2 content was 7% and the Bacharach value high at No. 9. The combustion state was relatively satisfactory. Certain problems may be invitable considering that the 20-year old boiler is operated by natural draft. The exhaust gas temperature was high at 325°C and the O_2 content high. Because of these factors, the efficiency was low at 78%.
   It is recommended to change to a forced draft burner. (Bricks laid in the lower half of the flue may be partially responsible for high exhaust gas temperature.)

No. 23	Date of Visit	Jun.18, 1990

Name of Establishment	NUEVA FABRICA NACIONAL DE VIDRIO				
Type of Industry (Product)	Non-metallic mineral product (glass bottle)				
Scale of Factory	Large		Number of Employees	2,100	
Annual Sales or Production	(Capital: 500,000,000 pesos)				
Kind of Fuel, Consumption and Price	Natural gas (211.3 pesos/m^3) 5,415,000 m^3/mon 1,144,000,000 pesos/mon				
Type of Combustion Facility	Capacity	Kind of Fuel	Fuel consumption	Age	Remarks
Glass melting furnace tank oven	16.7 ton/hr	Natural gas	2,160 m^3/hr	4	Cullet 55%
Glass melting furnace tank oven	8.3 ton/hr	Natural gas	1,500 m^3/hr	5	Cullet 55%
Glass melting furnace tank oven	8.3 ton/hr	Natural gas	800 m^3/hr	0	Cullet 55%
Decorating furnace (12 units)		Natural gas	Total		
Annealing furnace (17 units)		Natural gas	2,980 m^3/hr		

Outline of the Facility Surveyed		Glass melting furnace tank oven (Glass)
Capacity of the facility	:	16.7 ton/hr (glass)
Unit consumption	:	1,302,000 kcal/ton (glass)
Fuel consumption	:	2,160 m^3/hr
Glass melting temperature	:	1,500°C
Fuel pressure	:	300 mmAq
Combustion air pressure	:	Several mmAq
Combustion air temperature	:	1,350 °C
Combustion exhaust gas composition	:	O_2 - 6.95% CO_2- 8.90% (as measured by the plant)
Combustion exhaust gas temperature	:	Regenerator inlet - 1,440 °C Outlet - 466 °C (as measured by the plant)
Stack	:	3.6 mϕ x 88 m
Operating hours	:	24 hr/day, 168 hr/week
Regenerator	:	15-minute changeover (automatic) Burner: 24 pcs Air port: 12pcs

Outline of Survey Result

Present pollution control measures	:	Stress on fine dust prevention measures, natural gas used
Future plan for pollution control	:	None
Present energy-saving measures	:	Regenerator installed

1. This is a leading glass maker. Efforts are made to prevent dust generation.

2. The O_2 content was 2.2% and controlled to a reasonable level. In spite of natural gas burning, smoke emission (thin purple) was observed from the stack. The Bacharach value was No.3 - 4, which is due to faulty construction of the burner which should be changed. Heat insulation of the furnace was generally satisfactory and the unit fuel consumption was rather low at 1.3 million kcal/ton (with cullet at 55%).

No. 24	Date of Visit	Jun. 19, 1990

Name of Establishment	PENNWALT, S.A. DE C.V.		
Type of Industry (Product)	Chemical (NaOH, Cl_2, NaClO)		
Scale of Factory	Large	Number of Employees	330
Annual Sales or Production	80,000,000,000 pesos/yr		
Kind of Fuel, Consumption and Price	Natural gas (211.3 pesos/m^3) 285,000 m^3/mon 60,200,000 pesos/mon		

Type of Combustion Facility	Capacity	Kind of Fuel	Fuel consumption	Age	Remarks
Water tube boiler	7.7 ton/hr	Natural gas	363 m^3/hr	4	
Water tube boiler	7.7 ton/hr	Natural gas	363 m^3/hr	12	
Smoke tube boiler	3.8 ton/hr	Natural gas		20	Spare
Smoke tube boiler	3.8 ton/hr	Natural gas		20	Spare

Outline of the Facility Surveyed	Water tube boilelr	7.7 ton/hr (steam)

Evaporation rate	:	Rating: 7.7 ton/hr Normal: 3.9 ton/hr
Steam pressure:	:	11 kg/cm^2g
Fuel consumption	:	Rating: 714 m^3/hr Normal: 363 m^3/hr
Fuel pressure	:	*60 mmAq*
Combustion air pressure	:	Unknown Temperature: Normal
Combustion exhaust gas composition	:	O_2 - 4% CO_2 -4.2% CO - 0% (as measured by the plant)
Combustion exhaust gas temperature	:	225°C (as measured by the plant)
Stack	:	*0.5 mϕ x 8 m*
Operating hours	:	24 hr/day, 168 hr/week

Outline of Survey Result

Present pollution control measures	:	Natural gas used
Future plan for pollution control	:	None
Present energy-saving measures	:	None

1. This is a chemical company producing NaOH and Cl_2 from salt and odor of chlorine was felt from time to time. Gas pipings were heavily corroded.

2. The O_2 content was 2.4% when the combustion amount was large, and 7% when it was small. Combustion control was generally satisfactory.
   The exhaust gas temperature was 250 °C, with the boiler efficiency high at 86%.
   There was no particular problem in terms of combustion.

No. 25	Date of Visit	Jun.19, 1990

Name of Establishment	GENERAL PRODUCTOS CO., S.A. DE C.V.			
Type of Industry (Product)	Chemical ($Na_2S_2O_4$, ZnO, SO_2 solution)			
Scale of Factory	Large	Number of Employees	320	
Annual Sales or Production	30,000,000,000 pesos/yr			
Kind of Fuel, Consumption and Price	Natural gas (211.3 pesos/m^3) 1,137,600 m^3/mon 240,400,000 pesos/mon			

Type of Combustion Facility	Capacity	Kind of Fuel	Fuel consumption	Age	Remarks
Smoke tube boiler	7.8 ton/hr	Natural gas	686 m^3/hr	4	Three of four units in operation
Smoke tube boiler	7.8 ton/hr	Natural gas	686 m^3/hr	4	
Smoke tube boiler	4.7 ton/hr	Natural gas	208 m^3/hr	4	
Smoke tube boiler	3.1 ton/hr	Natural gas	208 m^3/hr	3	

Outline of the Facility Surveyed: smoke tube boiler 7.8 ton/hr (steam)

Evaporation rate	:	Normal: 7.8 ton/hr
Steam pressure:	:	8 kg/cm^2g
Fuel consumption	:	Normal: 686 m^3/hr
Fuel pressure	:	250 mmAq
Combustion air temperature	:	Normal
Combustion exhaust gas composition	:	O_2 - 4.3% CO_2 - 8.4% CO - 17 ppm (as measured by the plant)
Combustion exhaust gas temperature	:	204°C (as measured by the plant)
Stack	:	0.6 mϕ x 7.3 m
Operating hours	:	24 hr/day, 168 hr/week

Outline of Survey Result

Present pollution control measures	:	Natural gas used
Future plan for pollution control	:	None
Present energy-saving measures	:	None

1. The work environment was poor with ammonium and sulfur odor detected.
2. The O_2 content was 1.7% and Bacharach value No.1, thus combustion control was extremely good. The flue gas measurement is carried out once a week using the Teledyne gas analyzer.
3. The exhaust gas temperature was also satisfactory at 209°C, with the boiler efficiency at 88%.

No. 26	Date of Visit	Jun. 19, 1990

Name of Establishment	IDEAL STANDARD, S.A.				
Type of Industry (Product)	Non-metallic mineral product (sanitary porcelain)				
Scale of Factory	Large	Number of Employees	600		
Annual Sales or Production	860,000 pieces/yr				
Kind of Fuel, Consumption and Price	Natural gas 712,300 m^3/day (207.36 pesos/m^3) 4,431,075,840 pesos/mon				

Type of Combustion Facility	Capacity	Kind of Fuel	Fuel consumption	Age	Remarks
1. Tunnel kiln	403,200 kcal/hr	Natural gas	245 m^3/hr	6	
2. Tunnel kiln	403,200 kcal/hr	Natural gas	245 m^3/hr	6	
3. Tunnel kiln	296,000 kcal/hr	Natural gas	180 m^3/hr	34	
4. Tunnel kiln	296,000 kcal/hr	Natural gas	180 m^3/hr	34	
5. Downdraft kiln	453,600 kcal/hr	Natural gas	500 m^3/hr	3	
Infrared burner	30,200-60,600 kcal/hr				800 units

Outline of the Facility Surveyed: Tunnel kiln for sanitation fixture

Heat quantity	:	403,200 kcal/hr
Fuel consumption	:	Rating : 245 m^3/hr Normal 200 m^3/hr
Tempeerature of an object to be heated	:	1,225°C
Fuel pressure	:	50 mmAq
Combustion air temperature	:	Normal
Combustion exhaust gas composition	:	O_2 - 2.09%, CO_2 - 10.59% (as measured by the plant)
Exhaust gas temperature	:	275°C (as measured by the plant)
Operating hours		24 hr/day, 168 hr/week

Outline of Survey Result

Present pollution control measures	:	Fuel changed to natural gas
Future plan for pollution control	:	None
Present energy-saving measures	:	None

1. There was no door at inlet and outlet of the tunnel kiln for kiln car and large quantity of air was entering. Consequently, the exhaust gas of stack on the side of the preheating zone contained O_2 at 12.9% and the temperature was 275°C. As the exhaust gas temperature is expected to rise by installing the door to the kiln, the use of air preheater becomes possible.

2. Kiln measuring instruments and automatic control equipment were well controlled except for part of equipment.

3. Under the present economic situation, this plant is refraining from investment for pollution control.

No.27	Date of Visit	Jun. 20, 1990

Name of Establishment	FCA. DE PAPEL SAN RAFAEL		
Type of Industry (Product)	Paper and its product (paper)		
Scale of Factory	Large	Number of Employees	1,023
Annual Sales or Production	50,000 ton/yr		
Kind of Fuel, Consumption and Price	Black liquor 5,590 kl/mon Heavy oil (H) 6,846 kl/mon		

Type of Combusion Facility	Capacity	Kind of Fuel	Fuel consumption	Age	Remarks
1. Black liquor boiler	12.5 ton/hr	Black liquor	3,280 l/hr	-	
2. Black liquor boiler	20.5 ton/hr	Black liquor Heavy oil (H)	4,480 l/hr 416 l/hr	15	Superheater
3. Water tube boiler	34.0 ton/hr	Heavy oil (H)	2,017 l/hr	-	
4. Water tube boiler	60.0 ton/hr	Heavy oil (H)	3,600 l/hr	-	
5. Water tube boiler	60.0 ton/hr	Heavy oil (H)	3,500 l/hr	15	Superheater

Outline of the Facility

1. Black liquor boiler	:	20.5 ton/hr (steam)	
Evaporation rate	:	Rating: 20.5 ton/hr	Normal: 18 ton/hr
Fuel consumption	:	Normal: Black liquor 4,480 l/hr	Heavy oil (H) 416 l/hr
Steam pressure	:	30 kg/cm^2	Temperature : 235 °C
Fuel pressure	:	Black liquor 3.0 kg/cm^{2}g	Heavy oil 2.0 kg/cm ^{2}g
Temperature	:	Black liquor 110°C	Heavy oil 105°C
Combustion air temperature	:	120°C	
Combustion exhaust gas composition	:	O_2 - 3.0% CO_2 - 14% (as measured by the plant)	
Exhaust gas temperature	:	140°C (as measured by the plant)	
Stack	:	2.7 mϕ x 51.5 m	
Operating time	:	24 hr/day, 168 hr/week	
2. Water tube boiler	:	60 ton/hr (steam), with recuperator	
Evaporation rate	:	Rating: 60 ton/hr Normal: 45 ton/hr	
Fuel consumption	:	Normal: Heavy oil (H) 3,500 l/hr	
Steam pressure	:	30kg/cm^{2}g	
Steam temperature	:	235°C	
Fuel pressure and temperature	:	3,000 mmAq, 105°C	Atomizing steam pressure: 5.0 kg/cm^2
Combustion air temperature	:	130°C	
Exhaust gas composition	:	O_2 - 3.2%, CO_2 - 14% (as measured by the plant)	
Exhaust gas temperature	:	Recuperator inlet : 300°C,	Outlet: 130°C (as measured by the plant)
Stack	:	2 mϕ x 15.2m	
Operating time	:	24 hr/day, 168 hr/week	

Outline of Survey Result

Present pollution control measures	:	Electrtic precipitator, bag filter
Future plan for pollution control	:	None
Present energy-saving measures	:	Economizer, recuperator

Black liquor boiler

1. Composition of the black liquor: Water: 40%, C: 38.3%, H_2: 3.7%, S: 3.5%, and 3,408kcal/kg
2. Black liquor is sprayed and burnt in the boiler by means of a splash type burner and NaOH is recovered by sumelt. Heavy oil (H) is auxiliarily used at 5%.
3. Electric precipitator is used, with white smoke generated due to water content in black liquor. Smoke changes black when the precipitator is stopped.
4. The O_2 content in exhaust gas was 10.5% and the temperature 165°C at the economizer outlet.
5. Instruments of boilers are well serviced.

Water tube boiler

1. Measurement result of exhaust gas was as follows:
   Recuperator inlet - Temperature 360°C, O_2 - 5.5%
   Recuperator outlet - Temperature 150°C, O_2 - 9 - 11%, Bacharach No.3

O_2 content was increasing at the recuperator outlet

No.28	Date of Visit	Jun. 20, 1990

Name of Establishment	FCA. DE PAPEL MEXICO		
Type of Industry (Product)	Paper and its product (recycled paper)		
Scale of Factory	Large (One of ten largest plants)	Number of Employees	286
Annual Sales or Production			
Kind of Fuel, Consumption and Price	Heavy oil (L) 1,800 kl/mon (174.45 pesos/l) 314,000,000 pesos/mon		

Type of combustion Facility	Capacity	Kind of Fuel	Fuel consumption	Age	Remarks
1. Water tube boiler	20.8 ton/hr	Heavy oil (L)	1,250 l/hr	18	Superheater
2. Water tube boiler	20.8 ton/hr	Heavy oil (L)	1,250 l/hr	18	Superheater
(with recuperator)					

Outline of the Facility — Water tube boiler 20.8 ton/hr (steam)

Evaporation rate	:	Rating: 20.8 ton/hr Normal : 12.5 ton/hr
Fuel consumption	:	Rating: 1,560 l/hr Normal : 1,250 l/hr
Steam pressure	:	39 kg/cm^{2}g Temperature : 450°C
Fuel pressure	:	3 kg/cm^{2}g Temperature : 110°C
Atomizing pressure	:	7 kg/cm^{2}g Combustion air temperature : 160°C
Combustion exhaust gas temperature	:	350°C at recuperator inlet 250°C at outlet (as measured by the plant)
Stack	:	3.6mφ x 36m
Operating time	:	24 hr/day, 168 hr/week

Outline of Survey Result

Present pollution control measures	:	None
Future plan for pollution control	:	None
Present energy-saving measures	:	Jungstrom type recuperator

1. The boiler was not operating because of expansion work on the day of the visit.

2. For this boiler, instruments were faulty and automatic control not satisfactory. Combustion control is made manually by looking into the level gauge and vapor pressure gauge. Danger of the present status and urgency of improving faulty points were advised to the plant.

No. 29	Date of Visit	Jun. 20, 1990

Name of Establishment	HACO MEXICANA, S.A.			
Type of Industry (Product)	Chemical (Fe_2O_3, $FeSO_4$, i.e.. paint materials)			
Scale of Factory	Medium	Number of Employees	142	
Annual Sales or Production	4,560,000,000 pesos/yr			
Kind of Fuel, Consumption and Price	Heavy oil (L) (192.65 pesos/l) 25,500 l/mon 46,810,000 pesos/mon			

Type of Combustion Facility	Capacity	Kind of Fuel	Fuel consumption	Age	Remarks
Smoke tube boiler	3.8 ton/hr	Heavy oil (L)	266 l/hr	6	
Roasting furnace	Unknown	Diesel	83 l/hr	15	2 day/week
Drying furnace	Unknown	Heavy oil (L)		50	
Drying furnace	Unknown	Heavy oil (L)	Drying furnace total	50	
Drying furnace	Unknown	Heavy oil (L)	88 l/hr	50	
Drying furnace	Unknown	Heavy oil (L)		50	

Outline of the Facility Surveyed		Smoke tube boiler	3.8 ton/hr (steam)
Evaporation rate	:	Rating : 3.8 ton/hr	Normal : 2.9 ton/hr
Steam pressure	:	5 kg/cm_2g	
Fuel consumption	:	Rating : 340 l/hr	Normal : 266 l/hr
Fuel pressure	:	9 kg/hr	Temperature : 120°C
Atomizing steam pressure	:	4.2 kg/cm^2g	Temperature : 120°C
Combustion air temperature	:	Normal	
Stack	:	0.6 mϕ x 15 m	
Operating time	:	24 hr/day, 168 hr/week	
		One boiler will be added in the near future for alternate use.	

Outline of Survey Result		
Present pollution control measures	:	None
Future plan for pollution control	:	None
Present energy-saving measures	:	None

1. This is an old plant. Inside of the plant is totally yellow.

2. The O_2 content was 10.2% and the Bacharach value No. 8, with combustion control unsatisfactory. Carbon deposit was also observed in the boiler. The exhaust gas temperature was relatively satisfactory at 251°C. As only one boiler was used for 24-hour operation, it had to be operated continuously without maintenance. As another boiler will be added in one month, operation control is said to be planned.

No. 30	Date of Visit	Jun. 20, 1990

Name of Establishment	CIA. PAPELERA EL FENIX, S.A.		
Type of Industry (Product)	Paper and its product (high-grade paper, carton paper)		
Scale of Factory	medium	Number of Employees	232
Annual Sales or Production	(Capital : 748,492,400 pesos)		
Kind of Fuel, Consumption and Price	Heavy oil (L) (192.65 pesos/l) 745,700 l/mon 143,660,000 pesos/mon		

Type of Combustion Facility	Capacity	Kind of Fuel	Fuel consumption	Age	Remarks
Water tube boiler	16 ton/hr	Heavy oil (L)	750 l/hr	29	turbine
Water tube boiler	14 ton/hr	Heavy oil (L)	600 l/hr	24	turbine

Outline of the Facility Surveyed		Water tube boiler 16 ton/hr (steam)
Evaporation rate	:	Rating : 16 ton/hr Normal : 9.5 ton/hr
Steam pressure	:	18 kg/cm^{2}g
Fuel consumption	:	Normal : 750 l/hr Burner : 3 pcs
Fuel pressure	:	2.5 - 3.5 kg/cm^{2}g Temperature : 100-110°C
Atomizing steam pressure	:	3.5 - 4.5 kg/cm^2
Combustion air temperature	:	80°C
Combustion exhaust gas composition	:	0.2 - 5.0%, CO_2 - 13.0%, CO - 0.0 ppm (as measured by the plant)
Combustion exhaust gas temperature	:	Recuperator outlet : 204°C (as measured by the plant)
Stack	:	2.2 $m\phi$ x 36 m
Operating time	:	24 hr/day, 144 hr/week

Outline of Survey Result		
Present pollution control measures	:	None
Future plan for pollution control	:	None
Present energy-saving measures	:	Recuperator installed

1. Corrugated fiber board and high-grade paper are produced from used paper and cellulose. Boilers are used for power generation, with remaining steam used for paper drying.

2. The boiler load was minimum because of trouble in turbine on the day of measurement. As a consequence, the exhaust gas O_2 content was 12% and the Bacharach value No. 5.

3. No improvement was observed though air pressure was lowered during operation. Unburnt fuel particles were scattering in the boiler with poor atomization. As the air preheater was provided, the exhaust gas temperature was normal at 252°C. As the boiler is outdated, its renewal is advisable.

No. 31	Date of Visit	Jun. 21, 1990

Name of Establishment	VITRO FIBRAS, S. A.				
Type of Industry (Product)	Non-metallic mineral product (glass wool, glass fiber)				
Scale of Factory	Large	Number of Employees	671		
Annual Sales or Production	79,554,800,000 pesos/yr 950 ton/yr				
Kind of Fuel, Consumption and Price	Natural gas 1,448,000 m^3/mon (211.19 pesos/m^3) 305,803,120 pesos/mon				

Type of Combustion Facility	Capacity	Kind of Fuel	Fuel consumption	Age	Remarks
1. Melting furnace	1.3 ton/hr	Natural gas	535.6 m^3/hr	4	Glass wool
2. Melting furnace	0.9 ton/hr	Natural gas	495.2 m^3/hr	5	Glass fiber
3. Melting furnace	0.7 ton/hr	Natural gas	569.1 m^3/hr	6	Glass fiber
4. Water tube boiler	3.1 ton/hr	Natural gas	2,300 m^3/hr	10	Alternate use by every six months
5. Water tube boiler	3.1 ton/hr	Natural gas	2,300 m^3/hr	5	Alternate use by every six months

Outline of the Facility Surveyed		Melting furnace 0.9 ton/hr (glass)
Rating	:	0.9 ton/hr (glass)
Fuel consumption	:	Rating : 916 m^3/hr Normal : 450 m^3/hr
Temperature of object to be heated	:	1,350°C
Fuel pressure	:	40 mmAq
Combustion air temperature	:	730°C With recuperator
Combustion exhaust gas composition	:	O_2 - 1.5% CO - 0.05%
Temperature	:	1,250°C at recuperator inlet 900°C at outlet (as measured by the plant)
Stack	:	1.68 mφ x 21 m
Operating time	:	24 hr/day, 168 hr/week

Outline of Survey Result

Present pollution control measures	:	Change of fuel to natural gas
Future plan for pollution control	:	None
Present energy-saving measures	:	Recuperator

1. The melting furnace is renewed as a whole every five years because of high operating emperature at 1,500°C.
2. Instruments and automatic control system necessary for operation of the furnace are complete.
3. There are two stacks for the furnace. The stack on the melting room side discharges 3/4 of total exhaust gas, with temperature at 1,250°C while that on the extractor side dischargesz 1/4 with the temperature at 1,000°C. A part of waste heat is recovered for drying of units. Further utilization of waste heat is necessary. For example, waste heat may be used for a boiler.
4. This furnace has a gap in a part of the wall. Air-tightening is necessary.

No. 32	Date of Visit	Jun. 21, 1990

Name of Establishment	PASTEURIZADORA LA LAGUNA		
Type of Industry (Product)	Food (dairy products, milk, yogurt)		
Scale of Factory	Large	Number of Employees	500
Annual Sales or Production	Orange : 240,000 l/yr, Milk : 120,000,000 l/yr		
Kind of Fuel, Consumption and Price	Heavy oil (L) (175.6 pesos/l) 32,000 l/mon 5,619,200 pesos/mon		

Type of Combustion Facility	Capacity	Kind of Fuel	Fuel consumption	Age	Remarks
Smoke tube boiler	2.6 ton/hr	Heavy oil (L)	42 l/hr	13	Alternate use
Smoke tube boiler	2.6 ton/hr	Heavy oil (L)	42 l/hr	13	Alternate use

Outline of the Facility Surveyed		Smoke tube boiler 2.6 ton/hr (steam)
Evaporation rate	:	Rating : 2.6 ton/hr Normal : 0.52 ton/hr
Steam pressure	:	8 kg/cm^{2}g
Fuel consumption	:	Rating : 230 l/hr Normal : 42 l/hr
Fuel pressure	:	0.85 kg/cm^{2}g Temperature : Normal
Atomizing steam pressure	:	1.0 kg/cm^{2}g Temperature : Normal
Combustion air temperature	:	Normal
Combustion exhaust gas temperature	:	175°C (as measured by the plant)
Stack	:	0.5 mϕ x 18 m
Operating time	:	24 hr/day, 168 hr/week

Outline of Survey Result		
Present pollution control measures	:	None
Future plan for pollution control	:	None
Present energy-saving measures	:	None

1. Boiler steam is used as heat source for sterilization of milk.

2. The O_2 content was suitable at 4.8%, without smoke emission from the stack. The high Bacharach value of No. 9 may be possibly due to too low atomizing steam pressure. The exhaust gas temperature was very low at 165°C. The boiler efficiency was satisfactory at 88%. The combustion state was satisfactory except that the flame was offset to right.

No. 33	Date of Visit	Jun. 21, 1990

Name of Establishment	VIDRIO PLANO DE MEXICO, S.A.		
Type of Industry (Product)	Non-metallic mineral products (plate glass, glass for automobile)		
Scale of Factory	Large	Number of Employees	1,480
Annual Sales or Production	210,000,000,000 pesosyr		
Kind of Fuel, Consumption and Price	Natural gas (211.3 pesos/m^3) 5,380,630 m^3/mon 1,232,010,000 pesos/mon		

Type of Combustion Facility	Capacity	Kind of Fuel	Fuel consumption	Age	Remarks
Glass melting furnace tank oven	3.3 ton/hr Cullet 30%	Natural gas	2,050 m^3/hr	22	6,210,000 kcal/ton
Glass melting furnace tank oven	15.8 ton/hr Cullet 30%	Natural gas	3,618 m^3/hr	20	2,290,000 kcal/ton

Outline of the Facility Surveyed		Glass melting furnace 15.8 ton/hr (Glass)
Capacity of facility	:	15.8 ton/hr (Glass)
Unit consumption	:	2,290,000 kcal/ton (Glass)
Fuel consumption	:	3,618 m^3/hr Glass melting temperature : 1,450°C
Fuel pressure	:	245 - 2,450 mmAq
Combustion air pressure	:	a few mmAq
Combustion exhaust gas composition	:	O_2 - 9.39%, CO_2 - 11.17%, H_2O - 7.35% (as measured by the plant)
Combustion exhaust gas temperature	:	Regenerator inlet : 1,560°C, Outlet : 521°C (as measured by the plant)
Stack	:	3.9 mφ x 81 m
Operating time	:	24 hr/day, 168 hr/week
Regenerator	:	20-minute changeover (automatic) Cullet : 30%

Outline of Survey Result

Present pollution control measures	:	Fuel changed to natural gas
Future plan for pollution control	:	None
Present energy-saving measures	:	Regenerator installed

The O_2 content was 7% because of unsatisfactory sampling position. Although control is made to prevent leak in the furnace up to the regenerator, air leak is permitted after this regenerator (about 2.9% in the regenerator). The flame was satisfactory and no smoke generated. The fuel consumption per unit product was 2.29 million kcal/ton, with cullet of around 30%.

No. 34	Date of Visit	Jun. 22, 1990

Name of Establishment	PAPELERA IRUÑA, S. A.		
Type of Industry (Product)	Paper and its product (recycled paper)		
Scale of Factory	Medium	Number of Employees	250
Annual Sales or Production	72,000 ton/yr		
Kind of Fuel, Consumption and Price	Heavy oil (L) 913.8 kl/mon (255 pesos/l) 233,019,000 pesos/mon		

Type of Combustion Facility	Capacity	Kind of Fuel	Fuel consumption	Age	Remarks
1. Water tube boiler	9.4 ton/hr	Heavy oil (L)	902 l/hr	30	
2. Smoke tube boiler	7.8 ton/hr	Heavy oil (L)		17	Not operating
3. Smoke tube boiler	7.8 ton/hr	Heavy oil (L)	283 l/hr	15	
4. Smoke tube boiler	7.8 ton/hr	Heavy oil (L)	283 l/hr	12	
5. Smoke tube boiler	7.8 ton/hr	Heavy oil (L)	283 l/hr	10	

Outline of the Facility Surveyed: Smoke tube boiler 7.8 ton/hr (steam)

Evaporation rate	:	Rating : 7.8 ton/hr Normal : 6.4 ton/hr
Fuel consumption	:	Rating : 566 l/hr Normal : 283 l/hr
Steam pressure	:	8 kg/cm^{2}g Temperature : 170°C
Fuel pressure	:	3.5 kg/cm^{2}g Temperature : 110°C
Atomizing pressure	:	1.75 kg/cm^{2}g
Combustion air temperature	:	Normal
Combustion exhaust gas composition	:	O_2 - 5.5%, CO_2 - 13.0% (as measured by the plant)
Temperature	:	200°C (as measured by the plant)
Stack	:	0.61 mϕ x 7 m
Operating time	:	24 hr/day, 168 hr/week

Outline of Survey Result

Present pollution control measures	:	Exhaust gas measured while making effort to improve combustion.
Future plan for pollution control	:	None
Present energy-saving measures	:	None

1. This boiler is compact and the control of steam pressure - air/fuel ratio is made. Atomazed air is manual adjusted, and well serviced as a whole.

2. Analysis of exhaust gas is entrusted to a professional firm, but the result contained some theoretical errors.

3. The O_2 content was 9.5%, temperature 211°C, and the Bacharach value of No. 5. It was advised that the O_2 content be reduced to 4% and the atomization ratio be increased while checking the flame state.

No. 35	Date of Visit	Jun. 22, 1990

Name of Establishment	METALURGICA ALMENA		
Type of Industry (Product)	Basic metals (copper, brass, bronze castings)		
Scale of Factory	Medium	Number of Employees	170
Annual Sales or Production	17,616,145,000 pesos/yr		
Kind of Fuel, Consumption and Price	Natural gas 21,156,000 m^3/mon (211.19 pesos/m^3) 4,467,935,640 pesos/mon Kerosin 6,000 kl/mon (630.00 pesos/l) 3,780,000,000 pesos/mon Electricity 10,640 kwh/mon (171.19 pesos/kwh) 1,773,528 pesos/mon		

Type of Combustion Facility	Capacity	Kind of Fuel	Fuel consumption	Age	Remarks
1. Crucible furnace	600 kg/charge	Natural gas	48,300m^3/hr	35	
2. Electric furnace	600 kg/charge	Electricity	11 kw/hr	11	
3. Electric furnace	600 kg/charge	Electricity	11 kw/hr	11	
4. Electric furnace	600 kg/charge	Electricity	11 kw/hr	11	
5. Electric furnace	600 kg/charge	Electricity	11 kw/hr	11	

Outline of the Facility Surveyed	Crucible furnace	600 kg/charge (brass etc.)
Rating	: 600 kg/charge	Normal : 360 kg/charge
Fuel consumption	: Normal : 48,300 m^3/hr	
Temperature of object to be heated	: 912 - 1,100°C	
Combustion air temperature	: 500°C with recuperator	
Stack	: 0.41 mϕ x 10 m	
Operating time	: 12 hr/day, 60 hr/week, 2 - 3 charge/day	

Outline of Survey Result

Present pollution control measures	:	Fuel changed to natural gas
Future plan for pollution control	:	None
Present energy-saving measures	:	Radiation type recuperator

1. Air is entering from the wide gap between the crucible furnace and hood. As a result, the exhaust gas temperature was measured to be low at 840°C. Repair of hood is necessary to enhance the efficiency of the recuperator. Measures against dust must also be taken.

2. There is no engineer with expertise on the combustion facilities in this plant. No detailed explanation was given concerning the facilities.

No. 36	Date of Visit	Jun. 22, 1990

Name of Establishment	BANOS LA NARANJA		
Type of Industry (Product)	Bathhouse		
Scale of Factory	Small	Number of Employees	4
Annual Sales or Production	73,000,000 pesos/yr		
Kind of Fuel, Consumption and Price	Diesel (478.26 pesos/l) 3,300 l/mon 1,580,000 pesos/mon		

Type of Combustion Facility	Capacity	Kind of Fuel	Fuel consumption	Age	Remarks
Smoke tube boiler	0.8 ton/hr	Diesel	55 l/hr	15	Alternate use
Smoke tube boiler	0.8 ton/hr	Diesel	55 l/hr	25	
Hot water boiler	Unknown	Diesel		25	used as required
Hot water boiler	Unknown	Diesel		25	used as required
Hot water boiler	Unknown	Diesel		25	used as required
Hot water boiler	Unknown	Diesel		25	used as required

Outline of the Facility Surveyed: Smoke tube boiler 0.8 ton/hr (steam)

Evaporation rate	:	Rating : 0.8 ton/hr Normal : 0.6 ton/hr
Steam pressure	:	6 kg/cm^{2}g
Fuel consumption	:	Rating : 70 l/hr Normal : 55 l/hr
Fuel pressure	:	7 kg/cm^{2}g Temperature : Normal
Combustion air temperature	:	Normal
Stack	:	0.3 mϕ x 15 m
Operating time	:	2 hr/day, 14 hr/week

Outline of Survey Result

Present pollution control measures	:	Due attention paid on prevention of smoke generation
Future plan for pollution control	:	None
Present energy-saving measures	:	None

1. Considerable attention is paid on smoke generation. Diesel oil is used, though quite exceptional for the bathhouse.

2. The O_2 content was 7.3% and the Bacharach value No. 0. Combustion was satisfactory and control superior, except that the O_2 content was slightly high. The exhaust gas temperature was in an average at 203°C and the boiler efficiency was satisfactory at 85%.

No. 37	Date of Visit	Jun. 22, 1990

Name of Establishment	BANOS XOLALPA		
Type of Industry (Product)	Bathhouse		
Scale of Factory	Small	Number of Employees	3
Annual Sales or Production			
Kind of Fuel, Consumption and Price	Heavy oil (L) (163.48 pesos/l) 11,700 l/mon 1,910,000 pesos/mon		

Type of Combustion Facility	Capacity	Kind of Fuel	Fuel consumption	Age	Remarks
Smoke tube boiler	1.0 ton/hr	Heavy oil (L)	130 l/hr	4 4	Steam and hot water
Smoke tube boiler	0.8 ton/hr	Heavy oil (L)	130 l/hr	4 4	Spare

Outline of the Facility Surveyed — Smoke tube boiler — 1.0 ton/hr (steam)

Evaporation rate	:	Rating : 1.0 ton/hr Normal : 1.0 ton/hr
Steam pressure	:	5 kg/cm^{2}g
Fuel consumption	:	Rating : 130 l/hr Normal : 130 l/hr
Fuel pressure	:	Unknown Temperature : 40°C
Atomizing steam pressure and temperature	:	Unknown
Combustion air pressure	:	Natural draft Temperature : normal
Stack	:	0.4 mϕ x 15 m
Operating time	:	3 hr/day, 21 hr/week

Outline of Survey Result

Present pollution control measures	:	None
Future plan for pollution control	:	None
Present energy-saving measures	:	None

1. The boiler is more than 40 years old and manually operated by the intuition of the operator.
2. Control was extremely poor with the O_2 content at 13.3% and the Bacharach value at No. 8, and smoke generation was observed. The exhaust gas temperature was in an average at 205°C, but the boiler efficiency was 77% because of large amount of exhaust gas.
3. Renewal of equipment is recommended.

No. 38	Date of Visit	Jun. 22, 1990

Name of Establishment	BANOS GABIS		
Type of Industry (Product)	Bathhouse		
Scale of Factory	Small	Number of Employees	8
Annual Sales or Production	91,250,000 pesos/yr		
Kind of Fuel, Consumption and Price	Heavy oil (L) (175.65 pesos/l) 10,800 l/mon 1,900,000 pesos/mon		

Type of Combustion Facility	Capacity	Kind of Fuel	Fuel consumption	Age	Remarks
Smoke tube boiler	0.4 ton/hr	Heavy oil (L)	51 l/hr	31	
Smoke tube boiler	0.6 ton/hr	Heavy oil (L)	51 l/hr	31	Not operating

Outline of the Facility Surveyed — Smoke tube boiler 0.4 ton/hr (steam)

Evaporation rate	:	Rating : 0.4 ton/hr Normal : 0.4 ton/hr
Steam pressure	:	4 kg/cm^{2}g
Fuel consumption	:	Rating : 51 l/hr Normal : 51 l/hr
Fuel pressure	:	Unknown Temperature : normal
Atomizing steam pressure and temperature	:	Uunknown
Combustion air pressure	:	Natural draft Temperature : normal
Stack	:	0.4 mϕ x 15 m
Operating time		7 hr/day, 49 hr/week

Outline of Survey Result

Present pollution control measures	:	None
Future plan for pollution control	:	None
Present energy-saving measures	:	None

1. The boiler is 31 years old and manually operated by the intuition of boiler man.

2. Combustion control was extremely poor with the O_2 content at 15.3% and the Bacharach value at No. 8. The oil temperatuer was 25°C and not heated and atomization poor. Though the exhaust gas temperature was in an average of 230°C, the boiler efficiency was poor at 67%.

No. 39	Date of Visit	Jun. 25, 1990

Name of Establishment	MEDIDORES AZTECA, S.A.		
Type of Industry (Product)	Basic metal (brass castings)		
Scale of Factory	Medium	Number of Employees	120
Annual Sales or Production	9,000,000,000 pesos/yr		
Kind of Fuel, Consumption and Price	Electricity 31,200 kwh/mon (159.56 pesos/kwh) 4,978,272 pesos/mon		

Type of Combustion Facility	Capacity	Kind of Fuel	Fuel consumption	Age	Remarks
1. Electric furnace	69 kg/hr	Electricity	1.2 kwh/kg	5	

Outline of the Facility Surveyed — Electric furnace 69 kg/hr (brass)

Normal : 69 kg/hr
Power consumption : Normal 1.2 kwh/kg
Temperature of an object to be heated : 1,000°C
Operating time : 12 hr/day

Outline of Survey Result

Present pollution control measures : Transfer of diesel operating facility
Future plan for pollution control : None in particular
Present energy-saving measures : None in particular

1. This is a U type electric induction furnace, with raw material charged from one side and melting metal unloaded from the other.
2. As this furnace has the loading port left open, installation of a lid to the loading port was proposed to prevent heat loss.
3. As a pollution control measure, a diesel operating facility was abolished six month ago.

No. 40	Date of Visit	Jun. 25, 1990

Name of Establishment	SALICILATOS DE MEXICO		
Type of Industry (Product)	Precision instruments (medical supplies)		
Scale of Factory	Medium	Number of Employees	239
Annual Sales or Production	17,300,000,000 pesos/yr		
Kind of Fuel, Consumption and Price	Heavy oil (H) 233.92 kl/mon (180 pesos/l) 42,105,600 pesos/mon		

Type of Combustion Facility	Capacity	Kind of Fuel	Fuel consumption	Age	Remarks
Water tube boiler	7.6 ton/hr	Heavy oil (H)	311 l/hr	50	

Outline of the Facility Surveyed		Water tube boiler 7.6 ton/hr (steam)
Evaporation rate	:	*Rating : 7.6 ton/hr*
Fuel consumption	:	Normal : 311 l/hr
Steam pressure	:	11 kg/cm^{2}g Fuel temperature : 157°C
Atomizing steam pressure	:	11 kg/cm^{2}g
Combustion air temperature	:	Normal
Combustion exhaust gas composition	:	O_2 - 9.3%, CO_2 - 8.8%, CO - 7 ppm (as measured by the plant)
Temperature	:	320°C (as measured by the plant)
Stack		0.96 mφ x 22 m
Operating time		24 hr/day, 168 hr/week

Outline of Survey Result

Present pollution control measures	:	None
Future plan for pollution control	:	Plant relocation planned
Present energy-saving measures	:	None

1. This boiler has been operated for about 50 years.

2. Exhaust gas measurement result is shown below:

   Present: O_2 - 12.8%, Temperature - 355°C Bacharach No. 9 or more
   After adjustment of primary air : O_2 - 11.2%, Temperature - 340°C
   After adjustment of fuel : O_2 . 8.5%, Temperature - 339°C

   Combustion air is natural draft and air reduction is difficult.

3. Plant relocation is being planned.

No. 41	Date of Visit	Jun. 25, 1990

Name of Establishment	CEMENTOS ANAHUAC, S.A.				
Type of Industry (Product)	Non-metallic mineral product (Portland cement)				
Scale of Factory	Large		Number of Employees	755	
Annual Sales or Production	209,909,000,000 pesos/yr				
Kind of Fuel, Consumption and Price	Heavy oil (H) (152.17 pesos/l), Natural gas (211.3 pesos/m^3) Heavy oil (H) 14,580,000 l/mon, 1,690,000,000 pesos/mon				
Type of Combustion Facility	Capacity	Kind of Fuel	Fuel consumption	Age	Remarks
Rotary kiln	96 ton/hr	Heavy oil (H)	9,000 l/hr	19	
Rotary kiln	96 ton/hr	Heavy oil (H)	9,000 l/hr	18	
Rotary kiln	25 ton/hr	Heavy oil (H)	2,250 l/hr	20	
Drying furnace	180 ton/hr	Natural gas		15	
Drying furnace	180 ton/hr	Natural gas		15	
Drying furnace	45 ton/hr	Natural gas		20	
Heat medium boiler	1.3 ton/hr	Heavy oil (H)		15	
Heat medium boiler	1.3 ton/hr	Heavy oil (H)		15	
Hot water boiler	1.3 ton/hr	Heavy oil (H)		20	

Outline of the Facility Surveyed		Rotary kiln	96 ton/hr (cement)
Capacity of facility	:	Rating : 96 ton/hr	
Cement heating temperature	:		
Fuel consumption	:	Normal : 9,000 l/hr	
Unit consumption	:	870 - 890 kcal/kg (cement)	
Fuel pressure	:	35 kg/cm^2g	Temperature : 120°C
Combustion air pressure	:	600 - 800 mmAq	Temperature : 1,000 - 1,100°C
Combustion exhaust gas composition	:	O_2 - 8 - 9%, CO_2 - 18 - 20%	(as measured by the plant)
Fuel proportion between primary and secondary burners	:	90% : 10%	
Operating time	:	24 hr/day, 168 hr/week	

Outline of Survey Result		
Present pollution control measures	:	Electrostatic precipitator installed
Future plan for pollution control	:	None
Present energy-saving measures	:	None

1. This is the sole cement plant located in the metropolitan area of Mexico City. Though it is said that attention is paid on pollution control, dust collection is not effective.

2. As the measured result of SO_2 content in summer of 1989 was said to be relatively low, fuel was changed from heavy oil (L) to heavy oil (H) under consent of SEDUE. The heavy oil preheating temperature was 135 - 140°C. The unit fuel consumption was 8.7 million kcal/kg of clinker which is higher than that in Japan by 1.0 - 1.3 million kcal/kg.

3. The instrument installed in site indicated 5.5% for O_2 and 0.05% for CO at the rear of the kiln.

No. 42	Date of Visit	Jun. 25, 1990

Name of Establishment	PAPELERA ATLAS		
Type of Industry (Product)	Paper and its product (Recycled paper)		
Scale of Factory	Medium	Number of Employees	200
Annual Sales or Production	14,400,000,000 pesos/yr		
Kind of Fuel, Consumption and Price	Heavy oil (H) (163.48 pesos/l) 480,000 l/mon 78,470,000 pesos/mon		

Type of Combustion Facility	Capacity	Kind of Fuel	Fuel consumption	Age	Remarks
Water tube boiler	9.6 ton/hr	Heavy oil (H)	400 l/hr	19	
Smoke tube boiler	6.4 ton/hr	Heavy oil (H)	270 l/hr	6	
Smoke tube boiler	2.4 ton/hr	Heavy oil (H)		5	Spare

Outline of the Facility Surveyed		Water tube boiler	9.6 ton/hr (steam)
Evaporation rate	:	Rating: 9.6 ton/hr	Normal : 5.0 ton/hr
Steam pressure	:	5 - 6 kg/cm^2	
Fuel consumption	:	Normal : 400 l/hr	
Fuel pressure	:	4.7 kg/cm^{2}g Temperature : 108°C	
Atomizing steam pressure	:	4.8 kg/cm^{2}g	
Temperature	:	Saturated steam temperature	
Combustion air temperature	:	Normal	
Combustion exhaust gas temperature	:	275°C (as measured by the plant)	
Stack	:	1 mϕ x 10 m	
Operating time	:	24 hr/day, 168 hr/week	

Outline of Survey Result		
Present pollution control measures	:	None
Future plan for pollution control	:	None
Present energy-saving measures	:	None

1. This plant produces corrugated fiber board paper from used paper and cellulose and uses the boiler for drying. The stack is provided with a sampling port.

2. The exhaust gas O_2 content was relatively satisfactory at 3.9 - 4.0%. But the Bacharach value was high at No. 9 because of the use of heavy oil (H). The exhaust gas temperature was 268°C and the boiler efficiency 84%

No. 43	Date of Visit	Jun. 25, 1990

Name of Establishment	BANOS LUPITA		
Type of Industry (Product)	Bathhouse		
Scale of Factory	Small	Number of Employees	5
Annual Sales or Production	200,750,000 pesos/yr		
Kind of Fuel, Consumption and Price	Heavy oil (L) (175.65 pesos/l) 15,000 l/mon 3,320,000 pesos/mon		

Type of Combustion Facility	Capacity	Kind of Fuel	Fuel consumption	Age	Remarks
Smoke tube boiler	0.6 ton/hr	Heavy oil (L)	83 l/hr	25	Alternate use
Smoke tube boiler	0.5 ton/hr	Heavy oil (L)	83 l/hr	25	

Outline of the Facility Surveyed — Smoke tube boiler — 0.6 ton/hr (steam)

Evaporation rate	:	Rating : 0.6 ton/hr Steam pressure : 6 kg/cm^{2}g
Fuel consumption	:	Normal : 83 l/hr
Fuel pressure	:	Unknown Temperature : 55°C
Atomizing steam pressure and temperature	:	Unknown
Combustion air pressure	:	Natural draft Temperature : normal
Stack	:	0.25 mϕ x 15 m
Operating time	:	6 hr/day, 42 hr/week

Outline of Survey Result

Present pollution control measures	:	None
Future plan for pollution control	:	None
Present energy-saving measures	:	None

1. Two units of natural draft boiler (25 years old) are operated alternately.
2. The exhaust gas O_2 content was 10.3%, indicating excess air intake. The Bacharach value was No. 9, with thin smoke observed from the stack. The exhaust gas temperature was 233°C and the boiler efficiency 80%.
3. The facility is old as a whole and equipment renewal is advisable.

No. 44	Date of Visit	Jun. 26, 1990

Name of Establishment	PORCELANITE, S.A.				
Type of Industry (Product)	Non-metallic mineral product (tile for building)				
Scale of Factory	Large		Number of Employees	360	
Annual Sales or Production	1,200,000 m^3/yr (area of tile)				
Kind of Fuel, Consumption and Price	Natural gas 811,577 m^3/mon (211 pesos/m^3) 171,242,747 pesos/mon				
Type of Combustion Facility	Capacity	Kind of Fuel	Fuel consumption	Age	Remarks
1. Tunnel kiln	108,000 *	Natural gas	100 m^3/hr	9	length 62 m
2. Tunnel kiln	108,000 *	Natural gas	100 m^3/hr	15	length 62 m
3. Tunnel kiln	108,000 *	Natural gas	100 m^3/hr	15	length 62 m
4. Tunnel kiln #	875,000 *	Natural gas	145.7 m^3/hr	0	length 67 m
# : hearth roller type		* : kcal/hr			
There are three more kilns of 30, 60 and 80 m in addition to above					

Outline of the Facility Surveyed	tunnel kiln for tile		108,000 kcal/hr
Heat quantity	: 108,000 kcal/hr	Kiln length : 62 m	
Fuel consumption	: Normal : 100 m^3/hr		
Temperature of object to be heated	: 1,105°C		
Product residence time in kiln	: 56 hr		
Combustion air temperature	: Normal		
Stack	: 1.0 mϕ x 2.5 m		
Operating time	: 24 hr/day, 168 hr/week		

Outline of Survey Result		
Present pollution control measures	:	Fuel changed to natural gas
Future plan for pollution control	:	None
Present energy-saving measures	:	Part of exhaust gas used for drying

1. Waste heat should be utilized for preheating of combustion air.

2. The equipment as a whole is well serviced and the operation state satisfactory. Equipment investment is also active, with the hearth roller type tunnel kiln was introduced from Italy.

No. 45	Date of Visit	Jun. 26, 1990

Name of Establishment	PRODUCTOS SAN CRISTOBAL		
Type of Industry (Product)	Paper and its product (tissues, toilet paper, etc.)		
Scale of Factory	Large	Number of Employees	2,100
Annual Sales or Production	126,000 ton/yr		
Kind of Fuel, Consumption and Price	Natural gas 3,600,000 m^3/mon (211.3 pesos/m^3) 760,680,000 pesos/mon		

Type of Combustion Facility	Capacity	Kind of Fuel	Fuel consumption	Age	Remarks
1. Water tube boiler	18 ton/hr	Natural gas	Not operating	36	Recuperator
2. Water tube boiler	35 ton/hr	Natural gas	1,681 m^3/hr	33	Recuperator
3. Water tube boiler	45 ton/hr	Natural gas	2,162 m^3/hr	8	Recuperator
4. Dryer		Natural gas	363 m^3/hr		
5. Dryer		Natural gas	250 m^3/hr		
6. Dryer		Natural gas	242 m^3/hr		
7. Dryer		Natural gas	467 m^3/hr		
8. Dryer		Natural gas	854 m^3/hr		

Outline of the Facility Surveyed		Water tube boiler 45 ton/hr (steam)
Evaporation rate	:	Rating : 45 ton/hr Normal : 32 - 38 ton/hr
Fuel consumption	:	Normal : 2,162 m^3/hr
Steam pressure	:	13 kg/cm^2g Temperature : 190°C
Fuel pressure	:	5 kg/cm^2g
Combustion exhaust gas composition	:	O_2 - 5.6%, CO_2 - 8.6%, CO - 0.002% (as measured by the plant)
Recuperator temperature	:	Inlet: 303°C, Outlet : 178°C (as measured by the plant)
Stack	:	1.2 mϕ x 15 m
Operating time	:	24 hr/day, 168 hr/week

Outline of Survey Result		
Present pollution control measures	:	Fuel changed to natural gas, low NO_X burner
Future plan for pollution control	:	None
Present energy-saving measures	:	

1. The O_2 content of exhaust gas is slightly high at 5.9% and should be reduced to about 2% by adjusting the air ratio.
2. It is recommended to change the scale of instruments indicating the operation state from percent to actual value.
3. As there is no preheating air thermometer, we instructed the place of installation.

No. 46	Date of Visit	Jun. 26, 1990

Name of Establishment	CIA, HULERA TORNEL		
Type of Industry (Product)	Rubber and plastic product (tire, tube)		
Scale of Factory	Large	Number of Employees	475
Annual Sales or Production	Capital: 54,967,000,000 pesos		
Kind of Fuel, Consumption and Price	Diesel (478.026 pesos/l) 182,000 l/mon 87,000,000 pesos/mon		

Type of Combustion Facility	Capacity	Kind of Fuel	Fuel consumption	Age	Remarks
Smoke tube boiler	2.6 ton/hr	Diesel	180 l/hr	9	
Smoke tube boiler	1.6 ton/hr	Diesel	112 l/hr	10	
Smoke tube boiler	1.3 ton/hr	Diesel		19	Not operating
Smoke tube boiler	0.8 ton/hr	Diesel		22	Not operating
Heat medium boiler	5,040 kcal/hr	Diesel			Intermittent operation

Outline of the Facility Surveyed — Smoke tube boiler 2.6 ton/hr (steam)

Evaporation rate	:	Rating : 2.6 ton/hr Normal : 2.1 ton/hr
Steam temperature	:	160°C
Fuel consumption	:	Rating : 221 l/hr Normal : 180 l/hr
Fuel pressure	:	1.8 kg/cm^{2}g Temperature : normal
Atomizing air pressure	:	0.7 kg/cm^{2}g Temperature : normal
Combustion air temperature	:	Normal
Combustion exhaust gas temperature	:	200°C (as measured by the plant)
Stack	:	0.41 mφ x 9.6 m
Operating time	:	24 hr/day, 144 hr/week

Outline of Survey Result

Present pollution control measures	:	None
Future plan for pollution control	:	None
Present energy-saving measures	:	None

1. Boiler steam is used for heating during molding of rubber tire. Odor producing ingradients of rubber is evaporated and the plant is filled with odor.

2. The exhaust gas O_2 content was 6.5% and air was in excess for the use of diesel oil. The Bacharach value was Nos. 1 - 2, without soot generation. The exhaust gas temperature was low at 175°C, with the boiler efficiency satisfactory at 87%.

No. 47	Date of Visit	Jun. 26, 1990

Name of Establishment	CERVECERIA MODELO, S.A. DE C.V.		
Type of Industry (Product)	Drinks (beer)		
Scale of Factory	Large	Number of Employees	6,500
Annual Sales or Production	Capital : 111,817,563,000 pesos		
Kind of Fuel, Consumption and Price	Heavy oil (H) (175.6 pesos/l), 4,700,000 l/mon Natural gas (211.3 pesos/m^3) 4,500,000 m^3/mon		

Type of Combustion Facility	Capacity	Kind of Fuel	Fuel consumption	Age	Remarks
Water tube boiler	100 ton/hr	Heavy oil (H)	3,333 l/hr	30	Two of three
Water tube boiler	63 ton/hr	Mixed burning of heavy	6,250 m^3/hr	16	units in
Water tube boiler	27 ton/hr	oil (H) and natural gas		36	operation
Water tube boiler	82 ton/hr				Not operating

Outline of the Facility Surveyed: Water tube boiler for power generation 100 ton/hr (steam)

Evaporation rate	:	Rating : 100 ton/hr	Normal : 70 ton/hr
Steam pressure	:	30 kg/cm^2g	
Fuel consumption	:	Rating : 10,000 m^3/hr	Normal : 6,000 m^3/hr
Fuel pressure	:	0.8 kg/cm^2g	
Combustion air	:	Pressure: 340 mmAq	Temperature : 180°C
Stack	:	4.1 mϕ x 75 m	
Operating time	:	24 hr/day, 168 hr/week	

* Only natural gas was burnt on the day of the visit.
* The steam used for power generation is supplied to production processes.
* A new boiler is under construction.

Outline of Survey Result

Present pollution control measures	:	None
Future plan for pollution control	:	None
Present energy-saving measures	:	Recuperator installed

1. This is the largest company specialized in beer production in Mexico. The boiler is used for independent power generation, with remaining steam used for brewery. Mixture of heavy oil and natural gas is usually burnt. But, at the time of the measurement of exhaust gas, only natural gas was burnt.

2. The exhaust gas O_2 content was 2.5% and air-fuel ratio satisfactory. The burner combustion state was good.

3. The Bacharach value was Nos. 2 to 3, slightly high for gas burning. The exhaust gas temperature was 320°C at the inelt of the air preheater and the temperature at the outlet is estimated at 140°C.

No. 48	Date of Visit	Jun. 26, 1990

Name of Establishment	BANOS TACUBA		
Type of Industry (Product)	Bathhouse		
Scale of Factory	Small	Number of Employees	10
Annual Sales or Production	5,400,000,000 pesos/yr		
Kind of Fuel, Consumption and Price	Heavy oil (L) (175.65 pesos/l) 18,000 l/mon 3,160,000 pesos/mon		

Type of Combustion Facility	Capacity	Kind of Fuel	Fuel consumption	Age	Remarks
Smoke tube boiler	0.6 ton/hr	Heavy oil (L)	43 l/hr	30	Selected depending on the situation
Smoke tube boiler	0.3 ton/hr	Heavy oil (L)	27 l/hr	30	

Outline of the Facility Surveyed — Smoke tube boiler — 0.6 ton/hr (steam)

Evaporation rate	:	Rating : 0.6 ton/hr Normal : 0.5 ton/hr
Steam pressure	:	3 kg/cm^{2}g
Fuel consumption	:	Rating : 54 l/hr Normal : 43 l/hr
Fuel temperature	:	Unknown
Atomizing steam pressure and temperature	:	Unknown
Combustion air pressure	:	Natural draft Temperature : Normal
Stack	:	0.3 mϕ x 18 m
Operating time	:	14 hr/day, 98 hr/week

Outline of Survey Result

Present pollution control measures	:	None
Future plan for pollution control	:	None
Present energy-saving measures	:	None

1. The boiler is 30 years old.
2. The exhaust gas O_2 content was 7.0 - 9.5%, indicating excess air combustion. The Bacharach value was No. 9 with considerable soot generation.
3. The exhaust gas temperature was relatively low at 214°C and the boiler efficiency 84%.

No. 49	Date of Visit	Jun. 27, 1990

Name of Establishment	CARTONAJES ESTRELLA		
Type of Industry (Product)	Paper and its product (carton)		
Scale of Factory	Large	Number of Employees	1,050
Annual Sales or Production	20,000,000,000 pesos/yr 99,000 ton/yr		
Kind of Fuel, Consumption and Price	Natural gas 3,500,000 m^3/mon (211 pesos/m^3) 738,500,000 pesos/mon		

Type of Combustion Facility	Capacity	Kind of Fuel	Fuel consumption	Age	Remarks
1. Water tube boiler	35 ton/hr	Natural gas	Not operating	17	Superheater
2. Water tube boiler	60 ton/hr	Natural gas	Not operating	12	Superheater
3. Water tube boiler	112 ton/hr	Natural gas	8,500 m^3/hr	9	Superheater

Outline of the Facility Surveyed — Water tube boiler — 112 ton/hr (steam)

Evaporation rate	:	Rating : 112 ton/hr Normal : 60 ton/hr
Fuel consumption	:	Rating : 8,500 m^3/hr Normal : 4,300 m^3/hr
Steam pressure	:	42 kg/cm^2 Temperature : 450°C
Fuel pressure	:	1.0kg/cm^2
Combustion air temperature	:	Normal
Stack	:	1.3 mφ x 24.5 m
Operating time	:	24 hr/day, 168 hr/week

Outline of Survey Result

Present pollution control measures	:	Fuel changed to natural gas
Future plan for pollution control	:	None
Present energy-saving measures	:	

1. The exhaust gas at the boiler outlet showed the O_2 content of 2.4% and temperature of 249°C, indicating satisfactory combustion state. Note that the operation was at 50% of the rating.
2. It is recommended to change the scale of instruments indicating the operation state from percent to actual value.
3. Efficiency may be higher when a 60 ton/hr boiler is operated at rating than when a 112 ton/hr boiler is operated at 50% of the rating.
4. The plant was kept tidy and in good order and engineers seemed eager to improve the combustion state.

No. 50	Date of Visit	Jun.27, 1990

Name of Establishment	FUNDIDORA Y LAMINADORA ANAHUAC				
Type of Industry (Product)	Basic metals (angle steel, channel steel)				
Scale of Factory	Medium	Number of Employees		110	
Annual Sales or Production	19,230 ton/yr				
Kind of Fuel, Consumption and Price	Natural gas 174,668 m^3/mon (211.3 pesos/m^3) 3,690,703 pesos/mon				
Type of Combustion Facility	Capacity	Kind of Fuel	Fuel consumption	Age	Remarks
Heating furnace	10 ton/hr	Natural gas	539 m^3/hr	30	

Outline of the Facility Surveyed		Heating furnace 10 ton/hr (billet)
Rating	:	10 ton/hr Normal : 8 ton/hr
Fuel consumption	:	Normal : 539 m^3/hr
Temperature of object to be heated	:	1,100°C
Fuel pressure	:	4 kg/cm^2
Combustion air temperature	:	Normal
Stack	:	0.5 m x 2.55 m x 3.5 m
Operating time	:	13 hr/day, 76 hr/week

Outline of Survey Result

Present pollution control measures	:	Fuel changed to natural gas
Future plan for pollution control	:	Energy saving through furnace improvement
Present energy-saving measures	:	None

1. Billets of 127 x 127 x 2,400 mm are heated to 1,050 to 1,100°C. The fuel consumption per unit product is around 43,000 kcal/ton and the heating rate in hearth 439 kg/m^2h.

2. As the natural gas is used, the combustion state is satisfactory. But the furnace outlet temperature is as high as 750°C, and installation of a recuperator is recommended.

3. There is a plan in future to save energy through furnace reconstruction, to improve environment in line with energy saving, and automation of current manual rolling process.

No. 51	Date of Visit	Jun. 27, 1990

Name of Establishment	ACEROS AHUEHUETES		
Type of Industry (Product)	Basic metals (steel bar)		
Scale of Factory	Small	Number of Employees	50
Annual Sales or Production	12,000,000,000 pesos/yr		
Kind of Fuel, Consumption and Price	Heavy oil (H) (175.65 pesos/l) 150,000 l/mon 33,150,000 pesos/mon		

Type of Combustion Facility	Capacity	Kind of Fuel	Fuel consumption	Age	Remarks
Heating furnace	6 ton/hr	Heavy oil (H)	400 l/hr	8	
Smoke tube boiler		Heavy oil (H)			For shower

Outline of the Facility Surveyed — Heating furnace — 6 ton/hr (iron)

Capacity of facility	:	Rating : 6 ton/hr Normal : 5 ton/hr
Heating temperature	:	1,100°C
Fuel consumption	:	Rating : 480 l/hr Normal : 400 l/hr No. of burners : 1 pc
Combustion air pressure	:	Natural draft Temperature : Normal
Combustion exhaust gas temperature	:	749°C (as measured by the plant)
Stack	:	1.5 mϕ x 25 m
Operating time	:	15 hr/day, 90 hr/week

* Smoke tube boiler is also used for preheating of heavy oil and steam atomizing of the fuel in addition for shower.

Outline of Survey Result

Present pollution control measures	:	None
Future plan for pollution control	:	None
Present energy-saving measures	:	None

1. This plant purchases angle steel and produces bar steel through reheating and rolling. Loading and unloading of steel are made manually. Facilities are outdated.

2. The exhaust gas O_2 content was 11.8%, indicating excess air combustion. This may be due to air leakage from the steel loading port. Soot measurement with a smoke tester (BC) was impossible because of excessively high exhaust gas temperature. The exhaust gas is discharged at high temperature of 749°C and the furnace efficiency was 34%. The fuel consumption was high at 640,000 kcal/ton.

3. It is advisable to renew the furnace with a recuperator.

No. 52	Date of Visit	Jun. 27, 1990

Name of Establishment	BANOS SANTIAGO		
Type of Industry (Product)	Bathhouse		
Scale of Factory	Small	Number of Employees	6
Annual Sales or Production			
Kind of Fuel, Consumption and Price	Heavy oil (L) (175.65 pesos/l) 21,400 l/mon 4,740,000 pesos/mon		

Type of Combustion Facility	Capacity	Kind of Fuel	Fuel consumption	Age	Remarks
Smoke tube boiler	1.3 ton/hr	Heavy oil (L)	71 l/hr	22	Alternate use
Smoke tube boiler	1.3 ton/hr	Heavy oil (L)	71 l/hr	22	

Outline of the Facility Surveyed		Smoke tube boiler	1.3 ton/hr (steam)
Evaporation rate	:	Rating : 1.3 ton/hr	Normal : 0.9 ton/hr
Steam pressure	:	6 kg/cm^{2}g	
Fuel consumption	:	Rating : 110 l/hr	Normal : 71 l/hr
Fuel pressure	:	Unknown	Temperature : 45 - 50°C
Combustion air pressure	:	Natural draft	Temperature : normal
Stack	:	0.3 mφ x 12 m	
Operating time	:	10 hr/day, 70 hr/week	

Outline of Survey Result		
Present pollution control measures	:	None
Future plan for pollution control	:	None
Present energy-saving measures	:	None

1. Two 22-year old boilers are installed on the second floor of the bathhouse and used alternately.

2. The exhaust gas O_2 content was 10.4%, indicating excess air combustion. The Bacharach value was also high at No. 9, with considerable soot generation. The exhaust gas temperature was relatively high at 289°C, and the boiler efficiency was not satisfactory at 76%. Because the boilers are very old, their renewal is recommended.

No. 53	Date of Visit	Jun. 28, 1990

Name of Establishment	ACEROS CORSA		
Type of Industry (Product)	Metal product (steel for sash)		
Scale of Factory	Medium	Number of Employees	250
Annual Sales or Production	60,000,000,000 pesos/yr		
Kind of Fuel, Consumption and Price	Natural gas (211.3 pesos/m^3) 381,238 m^3/mon 80,560,000 pesos/mon		

Type of Combustion Facility	Capacity	Kind of Fuel	Fuel consumption	Age	Remarks
Heating furnace	12 ton/hr	Natural gas	610 m^3/hr	22	
Electric furnace	30 ton/hr			4	Batch type

Outline of the Facility Surveyed — Heating furnace — 12 ton/hr (iron)

Capacity of facility	:	Rating : 12 ton/hr Normal : 11 ton/hr
Heating temperature	:	1,300°C
Fuel consumption	:	Rating : 640 m^3/hr Normal : 610 m^3/hr
Combustion air temperature	:	Normal Burner : 4 pcs
Stack	:	0.4 mϕ x 15 m
Operating time	:	24 hr/day, 144 hr/week

* There are sometimes complaints by inhabitants on dust emitted by the plant.

Outline of Survey Result

Present pollution control measures	:	Bag filter installed on the electric furnace
Future plan for pollution control	:	Discussion made on the improvement plan with SEDUE
Present energy-saving measures	:	None

1. This is a leading company in the industry, which melts scraps in the electric furnace to produce angle steels, then reheat them to produce bar steels and iron bars.

2. The exhaust gas O_2 content was 3.4% and the operation made with adequate air ratio. Brown dust was sampled during measurement with a smoke tester (BC), but no soot emission observed. The exhaust gas is released at high temperature of 1,040°C, without heat exchange, and the furnace efficiency was 50% and the unit consumption 430,000 kcal/ton. The unit consumption may decrease considerably by adding the air preheater.

No. 54	Date of Visit	Jun. 28, 1990

Name of Establishment	DU PONT		
Type of Industry (Product)	Chemical (freon 11, 12, 22 and electronics parts)		
Scale of Factory	Medium	Number of Employees	238
Annual Sales or Production	15,424,000,000 pesos/yr		
Kind of Fuel, Consumption and Price	Natural gas (159.06 pesos/m^3) 113,686 m^3/mon 18,080,000 pesos/mon		

Type of Combustion Facility	Capacity	Kind of Fuel	Fuel consumption	Age	Remarks
Smoke tube boiler	4.6 ton/hr	Natural gas	360 m^3/hr	10	Alternate use
Smoke tube boiler	4.6 ton/hr	Natural gas	360 m^3/hr	8	

Outline of the Facility Surveyed: Smoke tube boiler 4.6 ton/hr (steam)

Evaporation rate	:	Rating : 4.6 ton/hr Vapor pressure : 10 kg/cm^2g
Steam pressure	:	10 kg/cm^2g
Fuel consumption	:	Normal : 360 m^3/hr
Fuel pressure	:	1.4 kg/cm^2g Temperature : normal
Combustion air temperature	:	normal
Stack	:	0.3 mφ x 5 m
Operating time	:	18 hr/day, 76 hr/week

Outline of Survey Result

Present pollution control measures	:	The plant is a closed system, and there is almost no leak of halogen.
Future plan for pollution control	:	None
Present energy-saving measures	:	None

1. Boiler steam is used as heat source of freon distillation.
2. The exhaust gas O_2 content was 4.3%, indicating a slight excess of air, but there was no soot emission. Though CO concentration was 114 ppm, there was no particular problem.
3. The exhaust gas temperature was considerably low at 165°C and the boiler efficiency satisfactory at 89%.

No. 55	Date of Visit	Jun. 28, 1990

Name of Establishment	INDUSTRIAS NYLBO, S.A. DE C.V.		
Type of Industry (Product)	Metal product (bar steel, angle steel)		
Scale of Factory	Medium	Number of Employees	185
Annual Sales or Production	25,000,000,000 pesos/yr	36,000 ton/yr	
Kind of Fuel, Consumption and Price	Natural gas 589,452 m^3	(211.3 pesos/m^3)	124,551,207 pesos/mon

Type of Combustion Facility	Capacity	Kind of Fuel	Fuel consumption	Age	Remarks
1. Heating furnace	10 ton/hr	Natural gas	634 m^3/hr	45	
2. Heating furnace	8 ton/hr	Natural gas	634 m^3/hr	45	
3. Electric furnace	25 ton/charge	Electricity	7,500 kwh/charge		

Outline of the Facility Surveyed		Heating furnace 10 ton/hr (billet)
Rating	:	Rating : 10 ton/hr Normal : 6 ton/hr
Fuel consumption	:	Normal : 634 m^3/hr
Temperature of object to be heated	:	1,200°C
Combustion air temperature	:	Normal
Stack	:	0.6 m x 0.6 m x 2.0 m
Operating time	:	15.5 hr/day, 93 hr/week

Outline of Survey Result		
Present pollution control measures	:	Fuel changed to natural gas
Future plan for pollution control	:	Improvement of fuel consumption per unit product
Present energy-saving measures	:	None

1. Billets of 75 x 75 x 2,000 mm are heated to 1,100 - 1,170°C. Natuiral gas consumption per unit product is planned to be improved from present 80 m^3/ton to 40 m^3/ton.

2. The furnace is the inclined type, with opening at billet extraction port and furnace wall, thereby causing drop of the inside temperature. Automation of discharge (currently executed manually) is recommended while repairing openings and increasing the size of billet. As the exhaust gas temperature is high (740°C), the use of recuperator should be considered.

3. Since this plant has a Japanese-made continuous casting equipment, continuous operation from casting to rolling is possible.

No. 56	Date of Visit	Jun. 28, 1990

Name of Establishment	FUNDICIONES FIERRO-MEX		
Type of Industry (Product)	Metal product (bar steel, angle steel)		
Scale of Factory	Medium	Number of Employees	185
Annual Sales or Production	29,000,000,000 pesos/yr		
Kind of Fuel, Consumption and Price	Heavy oil (L) 250 kl/mon (176.3 pesos/l) 44,150,000 pesos/mon		

Type of Combustion Facility	Capacity	Kind of Fuel	Fuel consumption	Age	Remarks
1. Heating furnace	6 ton/hr	Heavy oil (L)	360 l/hr	4 4	
2. Heating furnace	4.5 ton/hr	Heavy oil (L)	320 l/hr	4 4	

Outline of the Facility Surveyed: Heating furnace 6 ton/hr (billet)

Normal	:	6 ton/hr
Fuel consumption	:	Rating : 400 l/hr Normal : 350 l/hr
Temperature of object to be heated	:	900°C
Fuel temperature	:	100°C
Combustion air temperature	:	Normal
Stack	:	1.9 mϕ x 28 m
Operating time	:	24 hr/day, 135 hr/week

Outline of Survey Result

Present pollution control measures	:	None in particular
Future plan for pollution control	:	None in particular
Present energy-saving measures	:	Heating of heavy oil with exhaust gas

1. This furnace is operated manually including charge and discharge of billets. The billet size is 10 x 10 x 700 mm and the heating time is 1.5 hr.

2. The exhaust gas temperature is high at 1,280°C and the use of regenerator recommended.

No. 57-1	Date of Visit	Jun. 29, 1990

Name of Establishment	REFINERIA 18 DE MARZO		
Type of Industry (Product)	Petroleum refinery		
Scale of Factory	Large	Number of Employees	5,429
Annual Sales or Production			
Kind of Fuel, Consumption and Price	Heavy oil Natural gas		

Type of Combustion Facility	Capacity	Kind of Fuel	Fuel consumption	Age	Remarks
Water tube boiler	56 ton/hr	Heavy oil Natural gas	450-353 l/hr 1,880-2,700 m^3/hr		4 units
Water tube boiler	120 ton/hr	Heavy oil Natural gas	783 l/hr 6,000 m^3/hr		
Packaged boiler	55 ton/hr	Heavy oil Natural gas	273 l/hr 2,090 m^3/hr		
CO boiler	124 ton/hr	Heavy oil Natural gas	1,055 l/hr 4,530 m^3/hr		

Outline of the Facility Surveyed: Water tube boiler 56 ton/hr (steam)

Evaporation rate	:	Rating : 56 ton/hr Normal : 34 - 50 ton/hr
Fuel consumption	:	Rating : natural gas : 5,060 m^3/hr or heavy oil : 4,542 l/hr Normal : natural gas : 2,300 m^3/hr and heavy oil : 300 l/hr
Fuel consumption (natural gas)	:	Rating : 5,060 m^3/hr Normal : 4,050 m^3/hr
Steam pressure	:	42 kg/cm^2g (380°C)
Fuel pressure	:	1.0 kg/cm^2g Temperature : normal
Combustion air pressure	:	100 mmAq Temperature : 200°C
Stack	:	2 mφ x 23 m
Operating time	:	24 hr/day, 168 hr/week

Outline of Survey Result

Present pollution control measures	:	Natural gas used for heating furnace
Future plan for pollution control	:	Change to low-NO_X burner. Continuous exhaust gas measurement and combustion control.
Present energy-saving measures	:	Recuperator installed

1. There are 17 heating furnaces and 7 boilers, with boilers used for independent power generation.

2. Boilers are 40 to 50 years oild. Air intrusion occurs when the internal pressure is controlled to -5 to 10 mmAq, which is indicated by the O_2 content at 7.6% measured by the O_2 gauge in the site. No smoke generation is observed from the stack. In view of considerable oldness, renewal of equipment and substantial maintenance are necessary.

No. 57-2	Date of Visit	Jun.29, 1990

Name of Establishment	REFINERIA 18 DE MARZO		
Type of Industry (Product)	Petroleum refinery		
Scale of Factory	Large	Number of Employees	
Annual Sales or Production			
Kind of Fuel, Consumption and Price	Natural gas		

Type of Combustion Facility	Capacity	Kind of Fuel	Fuel consumption	Age	Remarks
Heating furnace	117 ton/hr	Natural gas	4,270 m^3/hr	50	AA-F1,2
Heating furnace	59 ton/hr	Natural gas	2,140 m^3/hr	50	AA-F3
Heating furnace	45 ton/hr	Natural gas	1,600 m^3/hr	50	AR-H7,8,9
Heating furnace	4.3 tonhr	Natural gas	140 m^3/hr	50	AF- H1,2
Heating furnace	12 ton/hr	Natural gas	400 m^3/hr	50	RV-H1,2
Heating furnace	14 ton/hr	Natural gas	470 m^3/hr	50	AW-H1
Heating furnace	49 ton/hr	Natural gas	810 m^3/hr	50	RE-H9
Heating furnace	29 ton/hr	Natural gas	270 m^3/hr	50	RE-H10
Heating furnace	31 ton/hr	Natural gas	810 m^3/hr	50	AR-H1
Heating furnace	19ton/hr	Natural gas	780 m^3/hr	50	AU-H1
Heating furnace	50 ton/hr	Natural gas	4,050 m^3/hr	50	AI-H1
Heating furnace	10ton/hr	Natural gas	250 m^3/hr	50	AQ-H1

Outline of the Facility Surveyed

The fuel consumption of the plant as a whole is large. Diagnostic survey is necessary on boilers and heating furnaces of the plant.

Outline of Survey Result

Present pollution control measures	:
Future plan for pollution control	:
Present energy-saving measures	:

No. 58	Date of Visit	Jun. 29, 1990

Name of Establishment	ANDERSON CLAYTON, S.A.		
Type of Industry (Product)	Food (dressing, peanut butter, jelly, cake mix)		
Scale of Factory	Large	Number of Employees	450
Annual Sales or Production	Capital : 585,000,000 pesos		
Kind of Fuel, Consumption and Price	L.P.G. (180.36 pesos/l), 4,000 l/mon 721,440 pesos/mon Diesel (408.67 pesos/l), 11,000 l/mon 4,495,370 pesos/mon		

Type of Combustion Facility	Capacity	Kind of Fuel	Fuel consumption	Age	Remarks
Water tube boiler	0.9 ton/hr	Diesel	27 l/hr	10	Alternate use
Water tube boiler	0.4 ton/hr	Diesel	27 l/hr	9	
Drying oven	400 kg/hr	L.P.G.	7 l/hr	10	
Drying oven	450 kg/hr	L.P.G.	8 l/hr	10	

Outline of the Facility Surveyed — Water tube boiler 0.9 ton/hr (steam)

Evaporation rate	:	Rating : 0.9 ton/hr Normal : 0.4 ton/hr
Steam pressure	:	7 kg/cm^{2}g
Fuel consumption	:	Rating : 80 l/hr Normal : 27 l/hr
Fuel pressure	:	7 kg/cm^{2}g Temperature : normal
Combustion air temperature	:	Normal
Exhaust gas temperature	:	201°C (as measured by the plant)
Stack	:	0.3 mϕ x 8 m
Operating time		12 hr/day, 63 hr/week

Outline of Survey Result

Present pollution control measures	:	Use of diesel oil and L.P.G.
Future plan for pollution control	:	None
Present energy-saving measures	:	None

1. This water tube boiler is rare for small size. The exhaust gas O_2 content was 8.0 - 8.7%, indicating excess air combustion. The Bacharach value was No. 0 - 1, without soot generation. The exhaust gas temperature was high at 370°C and the boiler efficiency was low at 74%. It is recommended to reduce the exhaust gas O_2 content to 3 - 4%. Then, the efficiency may rise to around 80%.

No. 59	Date of Visit	Jun. 29, 1990

Name of Establishment	FUNDICIONES DE HIERRO Y ACERO		
Type of Industry (Product)	Metal product (wheel, truck for railroad)		
Scale of Factory	Large	Number of Employees	304
Annual Sales or Production	9,520 ton/yr		
Kind of Fuel, Consumption and Price	Natural gas		

Type of Combustion Facility	Capacity	Kind of Fuel	Fuel consumption	Age	Remarks
1. Electric furnace	15 ton/charge	Electricity	859 kwh/charge	17	
2. Electric furnace	4 ton/charge	Electricity	800 kwh/charge	42	
3. Electric furnace	4 ton/charge	Electricity	800 kwh/charge	42	
4. Annealing furnace	4.4 ton/hr	Natural gas	420 m^3/hr	15	
5. Heating furnace					Not operating
6. Cupola					Not operating

Outline of the Facility Surveyed — Annealing furnace — 4.4 ton/hr (wheel)

Rating	:	4.4 ton/hr — Normal : 3.3 ton/hr
Fuel consumption	:	Rating : 525 m^3/hr — Normal : 420 m^3/hr
Temperature of an object to be heated	:	920°C
Fuel pressure	:	*52.7 mmAq*
Combustion air temperature	:	Normal
Stack	:	0.68 mφ x 16 m
Operating time	:	24 hr/day, 144 hr/week, 6 mon/yr

Outline of Survey Result

Present pollution control measures	:	*Fuel changed to natural gas, use of bag filter*
Future plan for pollution control	:	None
Present energy-saving measures	:	None

1. This is a rotary annealing furnace which performs continuous annealing of railroad wheels.
2. Cupola and melting furnace are not operating.

No. 60	Date of Visit	July 29, 1990

Name of Establishment	FUNDIDORA DE ACEROS TEPEYAC.			
Type of Industry (Product)	Basic Metals (Cast iron)			
Scale of Factory	Large	Number of Employees		815
Annual Sales or Production	4,800 ton/yr			
Kind of Fuel, Consumption and Price	Natural gas	86,560 m^3/mon	(211.304 pesos/m^3)	18,290,474 pesos/mon
	Electricity	1,506,000 kwh/mon	(165.50 pesos/kwh)	249,243,000 pesos/mon

Type of Combustion Facility	Capacity	Kind of Fuel	Fuel consumption	Age	Remarks
1 Electric furnace	2.5 ton/charge	Electricty	500 kw/h	25	
2 Electric futnace	6.0 ton/charge	Electricty	500 kw/h	30	
3 Electric futnace	3.5 ton/charge	Electricty	500 kw/h	35	
4 Electric futnace	6.0 ton/charge	Electricty	500 kw/h	20	
5 Electric futnace	2.5 ton/charge	Electricty	500 kw/h	15	
6 Electric futnace	6.5 ton/charge	Electricty	500 kw/h	8	
7 Annealing furnace	40 ton/charge	Natural gas	459.7m^3/hr		
8 Annealing furnace	20 ton/charge	Natural gas	554.5m^3/hr		
9 Annealing furnace	4 ton/charge	Natural gas	173.5m^3/hr		
There are 16 units of annealing furnace in addition to above.					

Outline of the Facility Surveyed — Annealing furnace — 40 ton/charge

Capacity : Normal : 40 ton/charge
Fuel consumption : 459.7 m^3/hr
Temperature of object to be heated : 1,200°C
Combustion air temperature : Normal
Operating time : 20 hr/day

Outline of Survey Result

Present pollution control measures	:	Fuel changed to natural gas, use of bag filter
Future plan for pollution control	:	None
Present energy-saving measures	:	None

1. There are six small electric furnaces (2.5 - 6.5 ton/charge) and 19 annealing furnaces (4 - 40 ton/charge) in this plant.
2. Due to secular change, the annealing furnace has gaps. These must be repaired and utilization of high-temperature exhaust gas should be pushed forward.
3. For NOx problem, the low NOx burner may be an economical solution.

No. 61	Date of Visit	July 2, 1990

Name of Establishment	FORD MOTOR COMPANY				
Type of Industry (Product)	Transportation equipment (Vehicle engine, car body assembly)				
Scale of Factory	Large		Number of Employees		4,175
Annual Sales or Production	65,000 units/yr				
Kind of Fuel, Consumption and Price	Natural gas 292,000 m^3/mon				
Type of Combustion Facility	Capacity	Kind of Fuel	Fuel consumption	Age	Remarks
1 Drying furnace	0.6 - 3.2 ton/hr	Natural gas	50 - 60 m^3/hr	10	3 units
2 Hot water boiler	1 - 3.5 ton/hr	Natural gas	16 - 88 m^3/hr	26	13 units
3. Air heater		Natural gas	80 m^3/hr	10	1 unit
4 Electric furnace	8 ton/hr	Electricty	600 kw/hr	26	4 units
5 Annealing furnace		Natural gas		26	1 unit

Outline of the Facility Surveyed		Drying furnace	1.5 ton/hr (mold)
Normal	:	1.5 ton/hr (mold)	
Fuel consumption	:	Normal: 60 m^3/hr	
Temperature of object to be heated	:	260°C	
Combustion air temperature	:	Normal	
Combustion exhaust gas composition	:	O_2 - 14%, CO_2 - 0.4%, CO - 0.0013% (as measured by the plant)	
Temperature	:	130°C (as measured by the plant)	
Operating time	:	16 hr/day, 80 hr/week	

Outline of Survey Result

Present pollution control measures	:	Transfer to natural gas
Future plan for pollution control	:	None in particular
Present energy-saving measures	:	None in particular

1. The foundry is well maintained.
2. About 66 kl of organic solvent is discharged annually into atomsphere during painting of the car body.
3. For the NOx problem, the low NOx burner may be an economical solution.
4. It is said that the bag filter with 99.5% efficiency is installed to collect dust generated during production of castings.

No. 62	Date of Visit	July 2, 1990

Name of Establishment	QUIMICA LUCAVA, S.A.				
Type of Industry (Product)	Chemical (Agricultural chemicals, plasticizer, culture agent)				
Scale of Factory	Medium		Number of Employees		137
Annual Sales or Production	18,500,000,000 pesos/yr				
Kind of Fuel, Consumption and Price	Heavy oil (L) 56.4 kl/mon (192.65 pesos/l) 108,654,600 pesos/mon Diesel 6.7 kl/mon (495.29 pesos/l) 3,318,443 pesos/mon				
Type of Combustion Facility	Capacity	Kind of Fuel	Fuel consumption	Age	Remarks
1. Smoke tube boiler	2.6 ton/hr	Heavy oil (L)	84 l/hr	17	
2. Heat medium boiler	100,000 kcal/hr	Diesel	10 l/hr	17	

Outline of the Facility Surveyed		Smoke tube boiler	3.1 ton/hr (steam)
Evaporation rate	:	Rating : 3.1 ton/hr	
Fuel consumption	:	Normal: 84 l/hr	
Steam pressure	:	10.5 kg/cm^{2}g	Temperature: 190°C
Fuel pressure	:	2.8 kg/cm^{2}g	Temperature: 110°C
Atomizing pressure	:	2.8 kg/cm^{2}g	
Combustion air temperature	:	Normal	
Stack	:	0.6 mϕ x 6 m	
Operating time		24 hr/day , 168 hr/weel	

Outline of Survey Result

Present pollution control measures	:	None
Future plan for pollution control	:	None
Present energy-saving measures	:	None

1. The exhaust gas O_2 content at boiler outlet was 8.4 - 11.2%, the temperature 250°C, and Bacharach value No.9. As operation is made with excess air combustion, it is advisable to adjust the air-fuel ratio.

2. The boiler has no fuel gauge, and its installation is recommended.

3. The heat medium boiler suffers extremely poor atomization and a half of jetted diesel oil falls on the floor of the furnace. It is necessary to increase the atomizing air and to decresase the primary air of natural draft.

No. 63	Date of Visit	July 2, 1990

Name of Establishment	INDUSTRIAS UNIDAS, S.A.				
Type of Industry (Product)	Non-metallic mineral product (ceramics, wireless telephone, electric parts)				
Scale of Factory	Large	Number of Employees		1,600	
Annual Sales or Production	Capital: 398,403,200,000 pesos				
Kind of Fuel, Consumption and Price	Natural gas (211.3 pesos/m^3) 380,000 m^3/mon 80,300,000 pesos/mon				
Type of combustion Facility	Capacity	Kind of Fuel	Fuel consumption	Age	Remarks
Electric furnace	0.25 ton/h	-		39	Melting
Electric furnace	0.25 ton/hr	-		25	Hardining
Hardening kiln	0.50 ton/hr	Natural gas		25	Pipe
Tunnel kiln	0.33 ton/hr	Natural gas	132 m^3/hr	35	Ceramic
Tunnel kiln	0.33 ton/hr	Natural gas	132 m^3/hr	40	Ceramic
Tunnel kiln	0.17 ton/hr	Natural gas	70 m^3/hr	45	Ceramic

Outline of the Facility Surveyed		Hardening tunnel kiln	0.33 ton/hr (ceramic)
Capacity of facility	:	0.33 ton/hr	
Heating temperature	:	1,270°C	
Fuel consumption	:	132 m^3/hr	
Combustion air temperature	:	Normal	
Combustion exhaust gas composition	:	O_2 - 10%, CO_2 - 11% (as measured by the plant)	
Exhaust gas temperature	:	200 - 300°C (as measured by the plant)	
Operating time	:	24 hr/day, 144 hr/week	

* There are other combustion facilities in addition to above, but a sufficient information was not provided by the plant.

Outline of Survey Result

Present pollution control measures	:	Natural gas used
Future plan for pollution control	:	None
Present energy-saving measures	:	None

This company produces insulator for power transmission lines and wireless telephone sets and belongs to the IUSA group. The plant within the Mexico City area is moving to the industrial complex (outside the survey area). The existing insulator baking furnace (tunnel kiln) remains in this plant in the Mexico City area, but we were refused to visit and to measure exhaust gas.