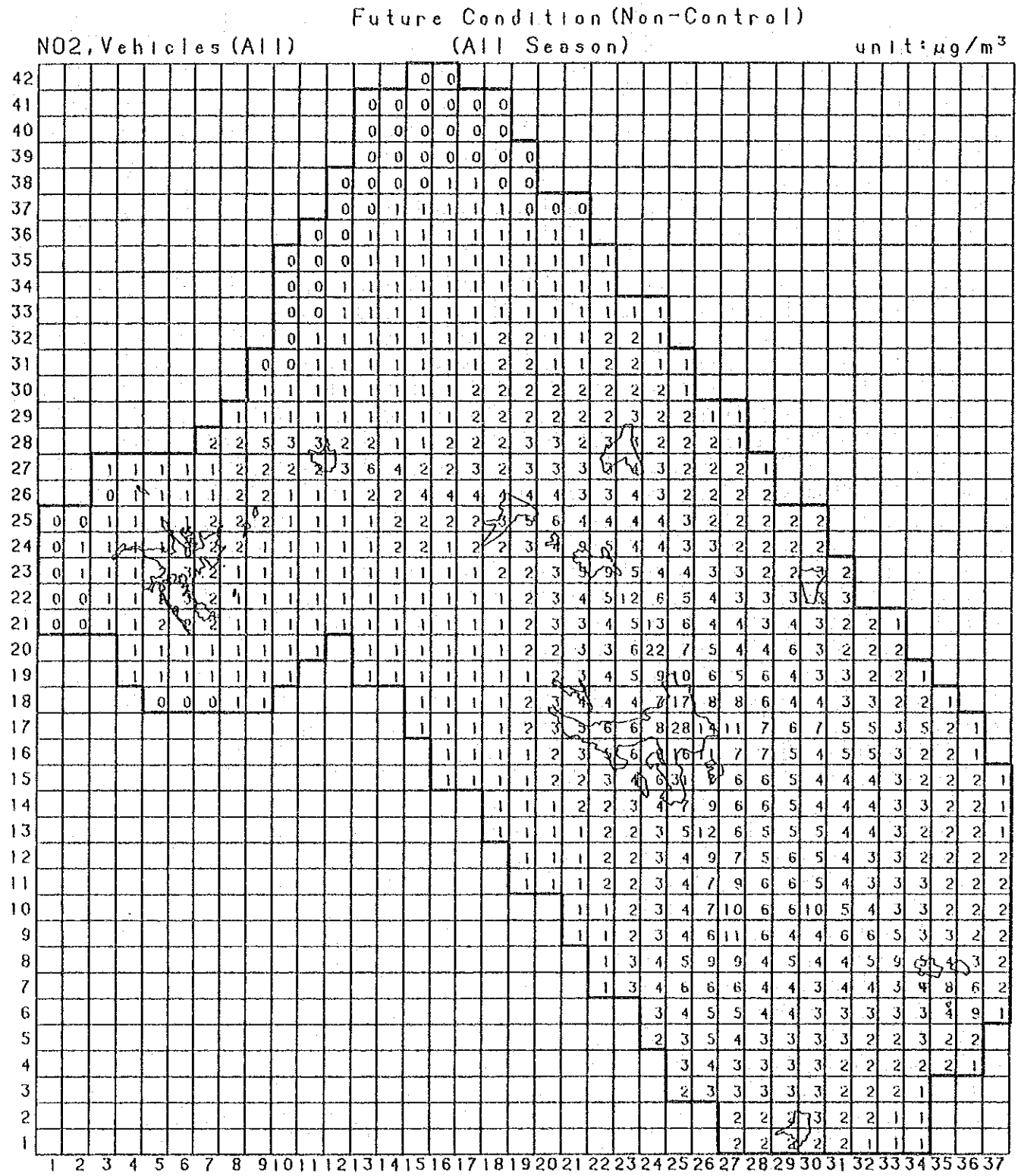

Figure D8.4.36 Annual Average Concentration for NO2 in 2005 (Case F-0,Motor Vehicles)

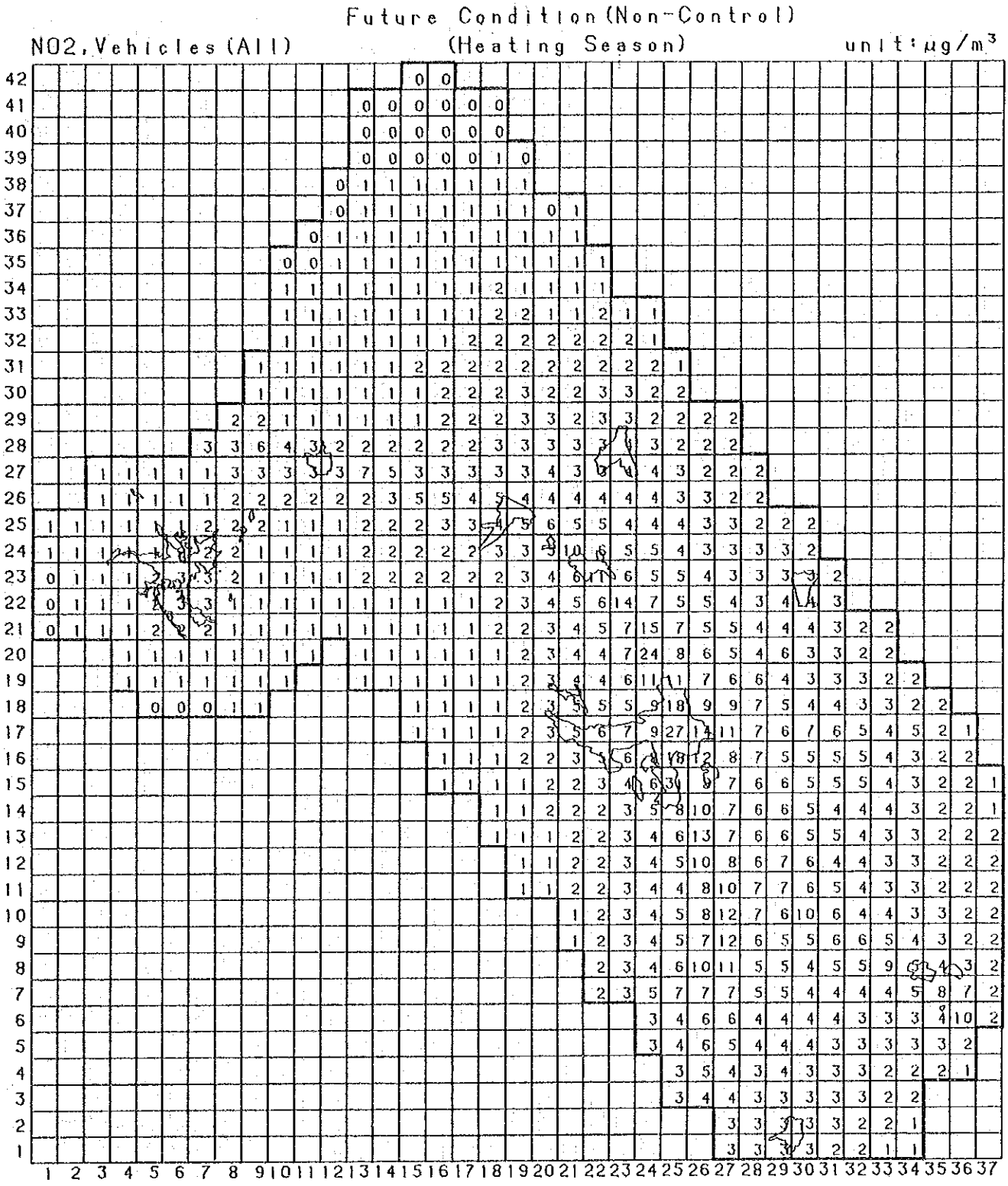

Figure D8.4.37 Average Concentration for NO2 in Heating Season (2005,Case F-0,Motor Vehicles)

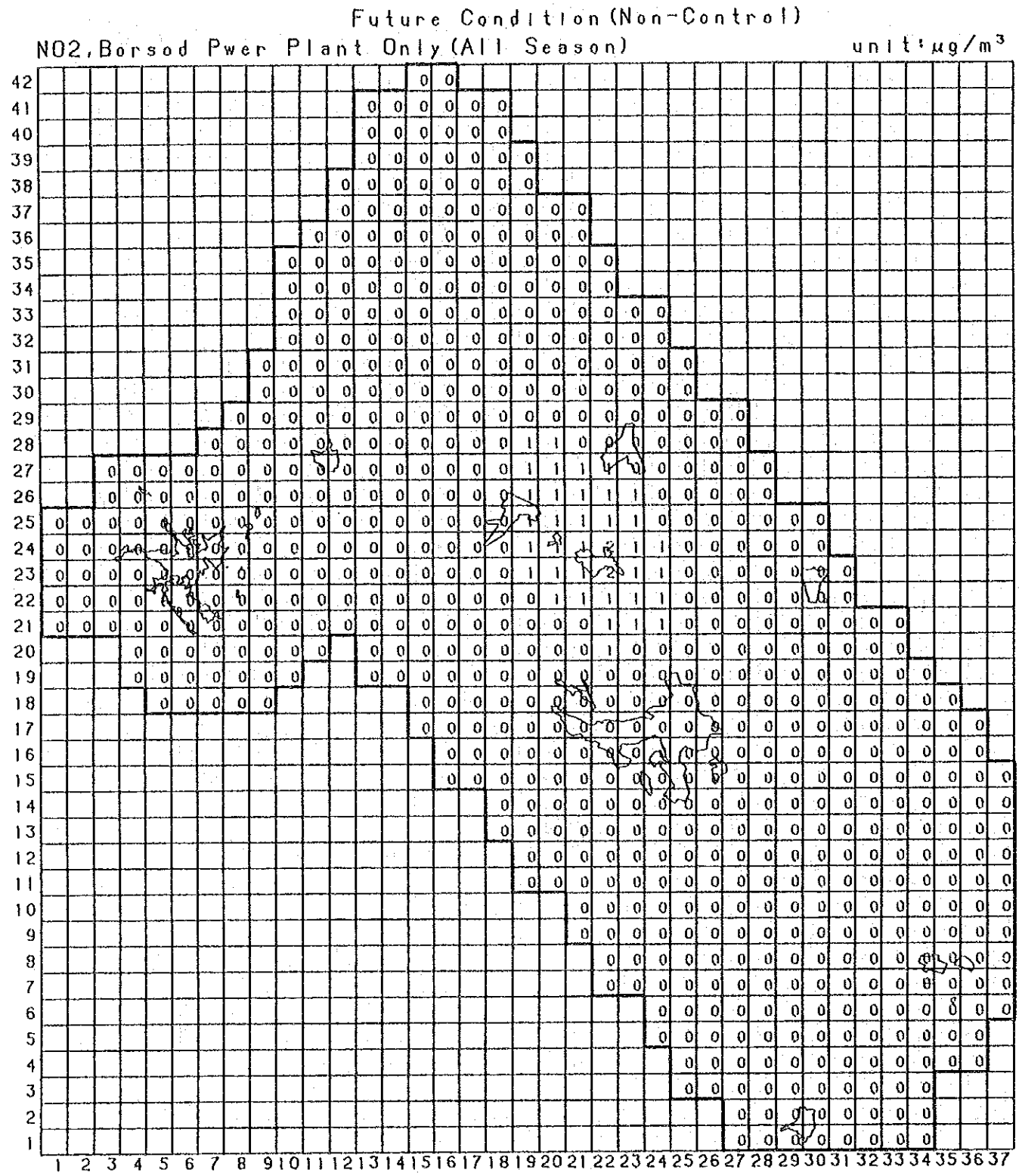

Figure D8.4.38 Annual Average Concentration for NO2 in 2005 (Case F-0,Borsod P.S.)

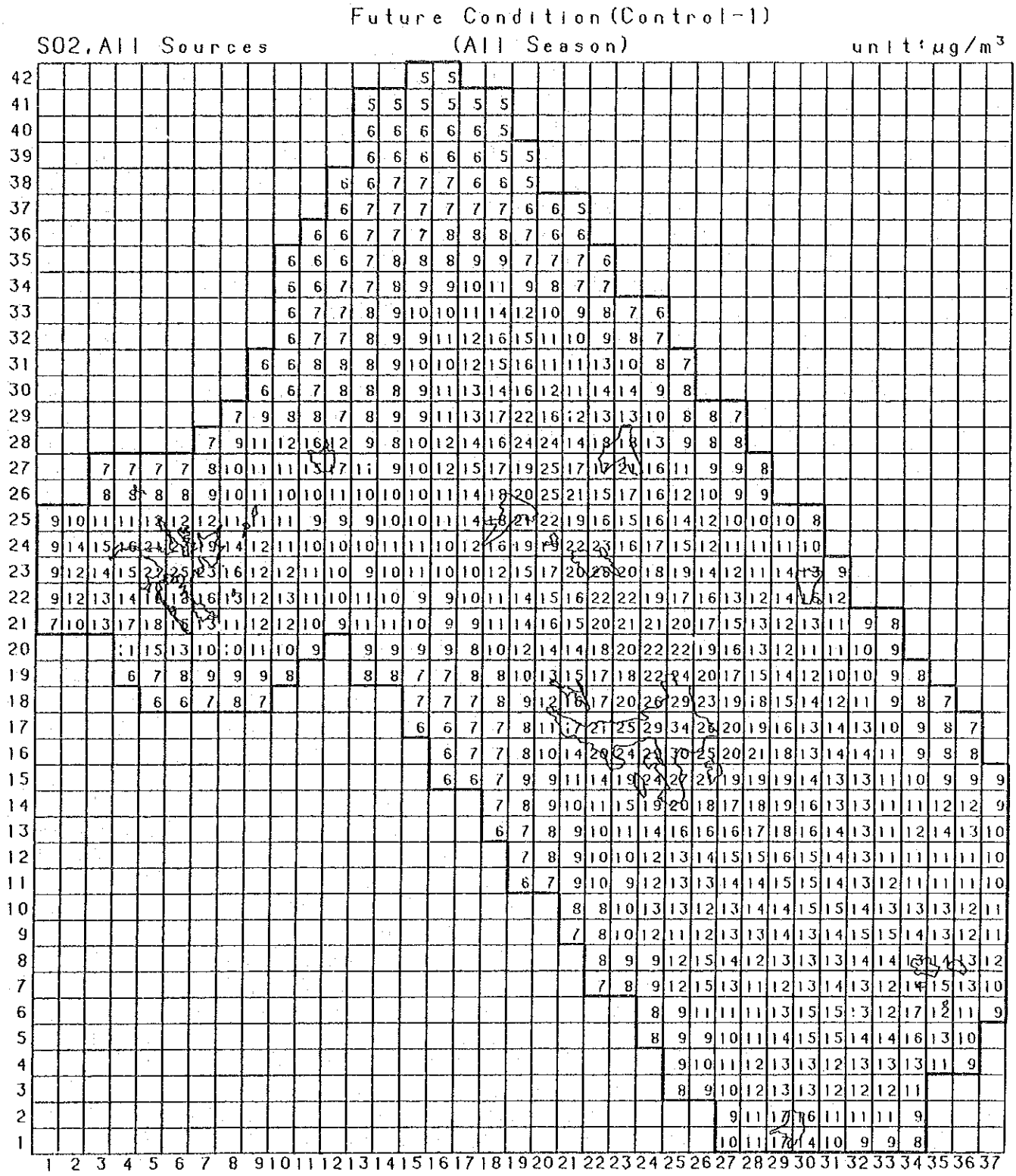

Figure D8.4.39 Annual Average Concentration for SO2 in 2005 (Case F-1, All Sources)

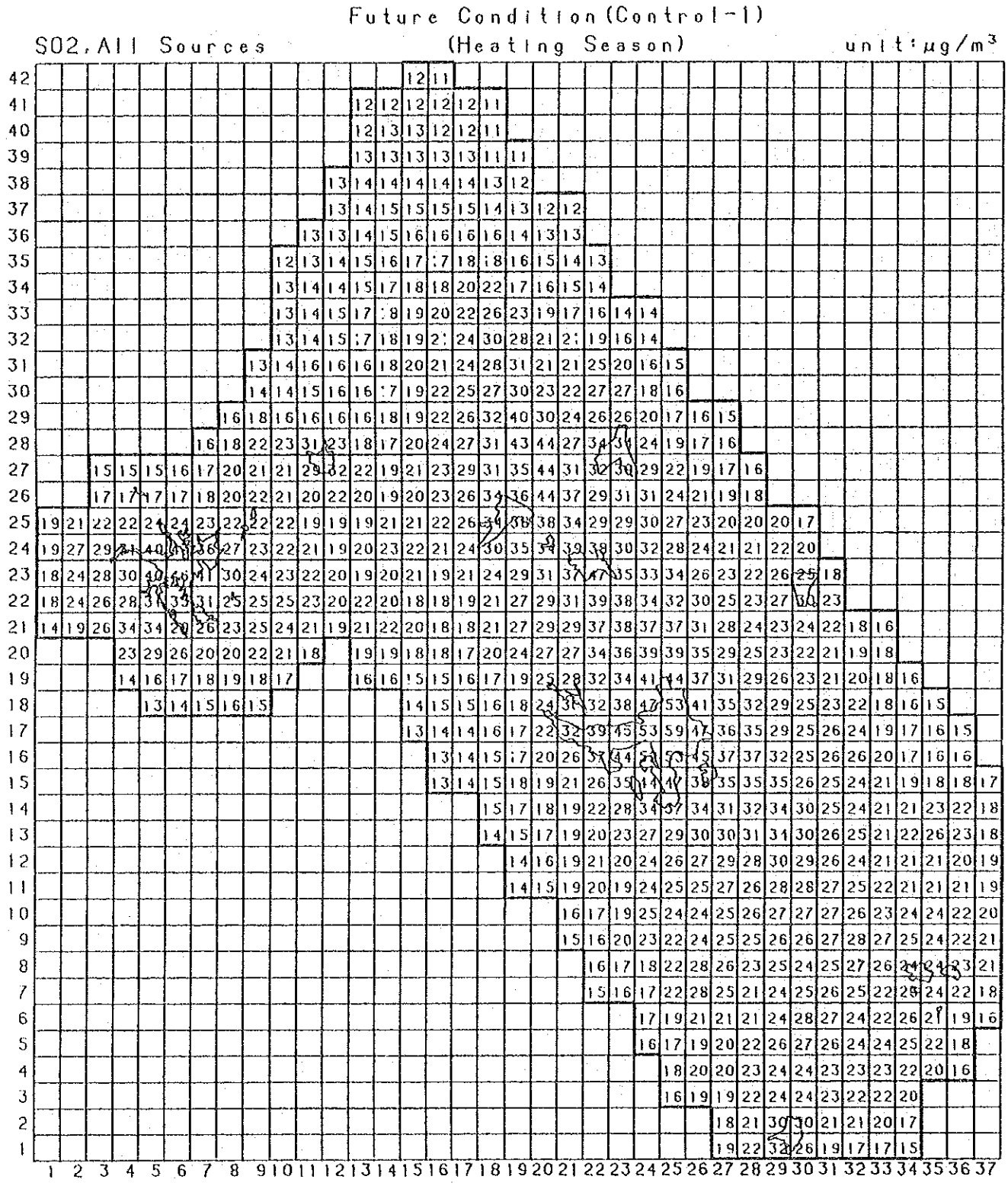

Figure D8.4.40 Average Concentration for SO2 in Heating Season (2005,Case F-1,All Sources)

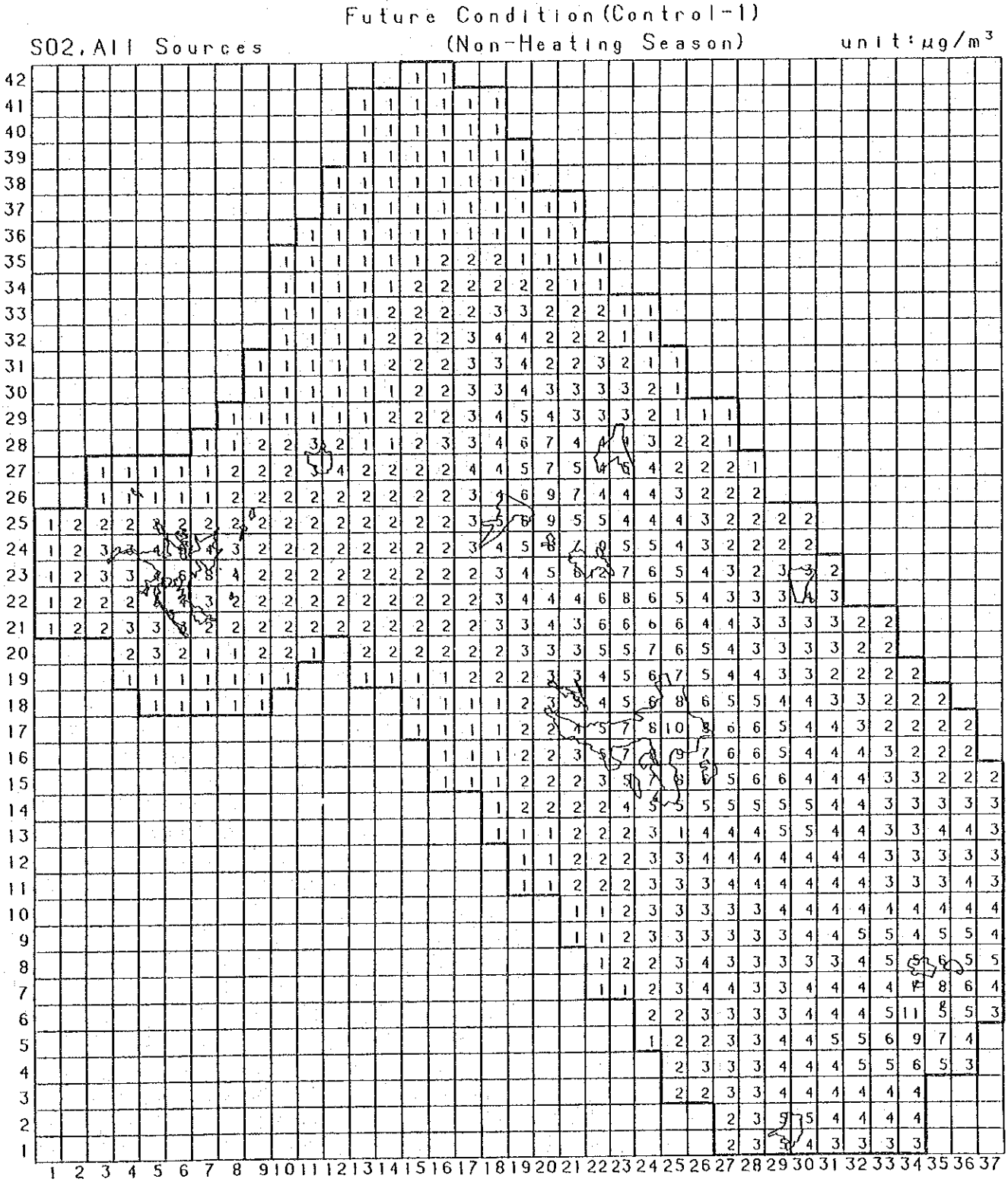

Figure D8.4.41 Average Concentration for SO2 in Non-heating Season (2005,Case F-1,All Sources)

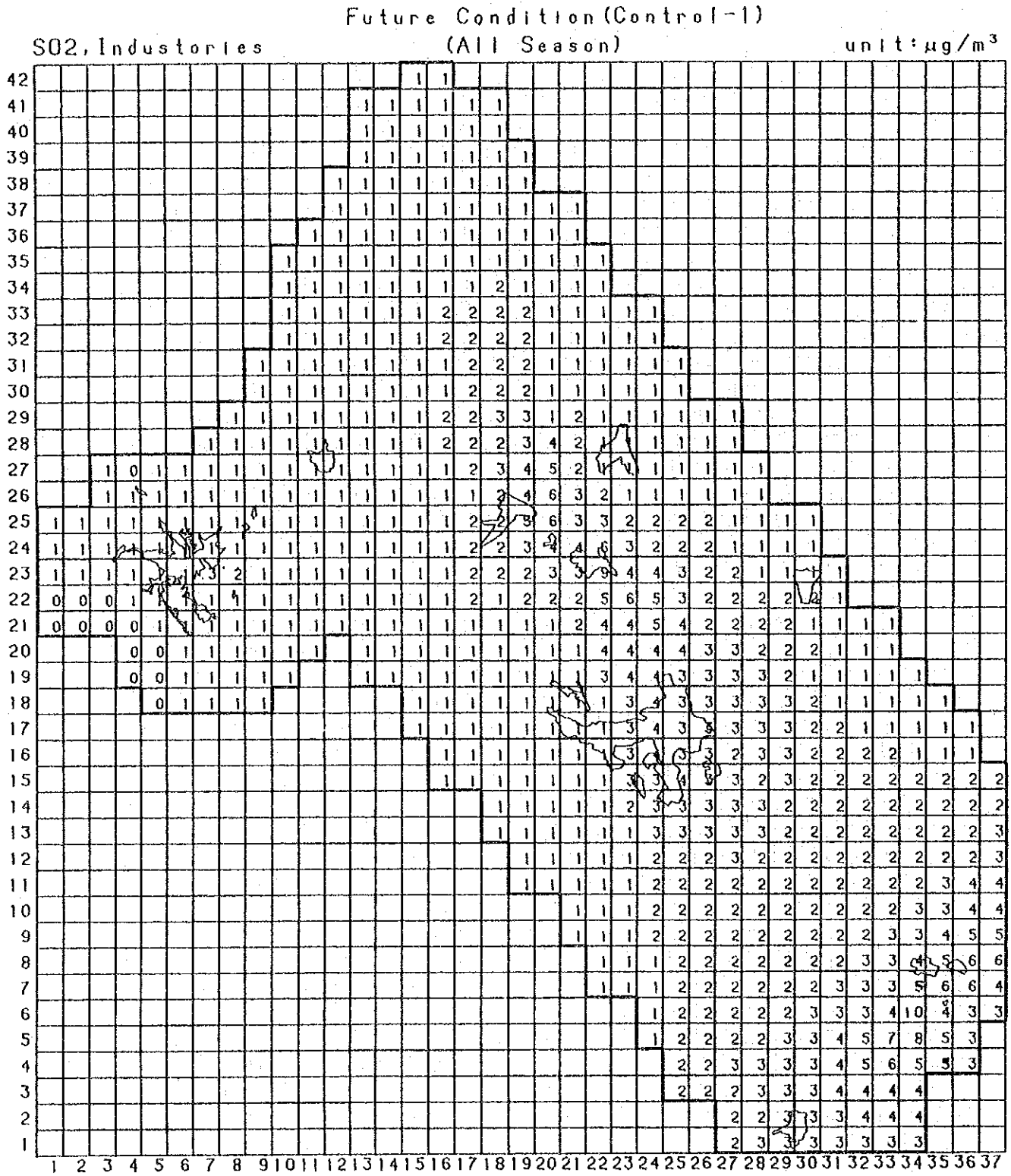

Figure D8.4.42 Annual Average Concentration for SO2 in 2005 (Case F-1,Industries)

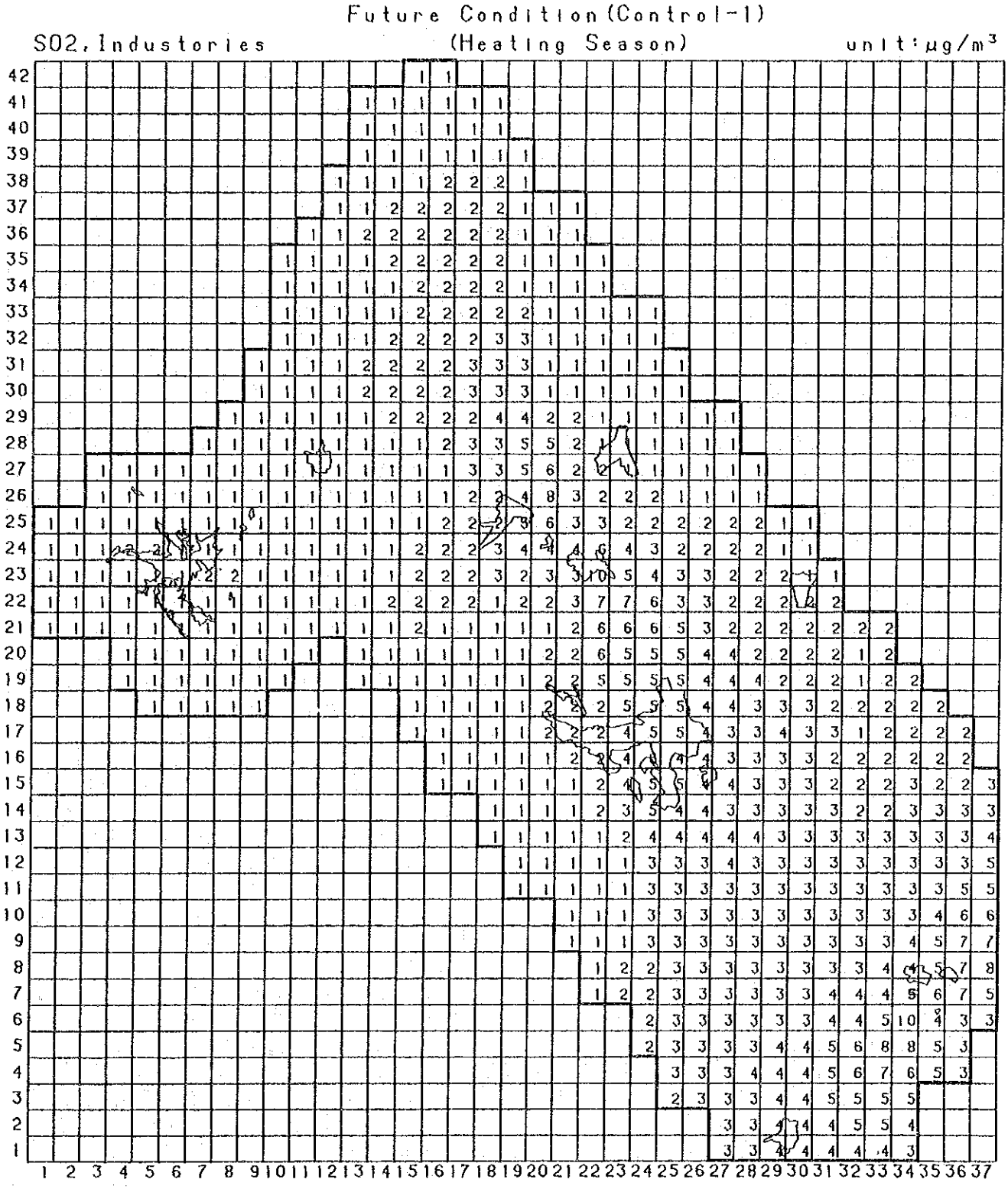

Figure D8.4.43 Average Concentration for SO2 in Heating Season (2005,Case F-1,Industries)

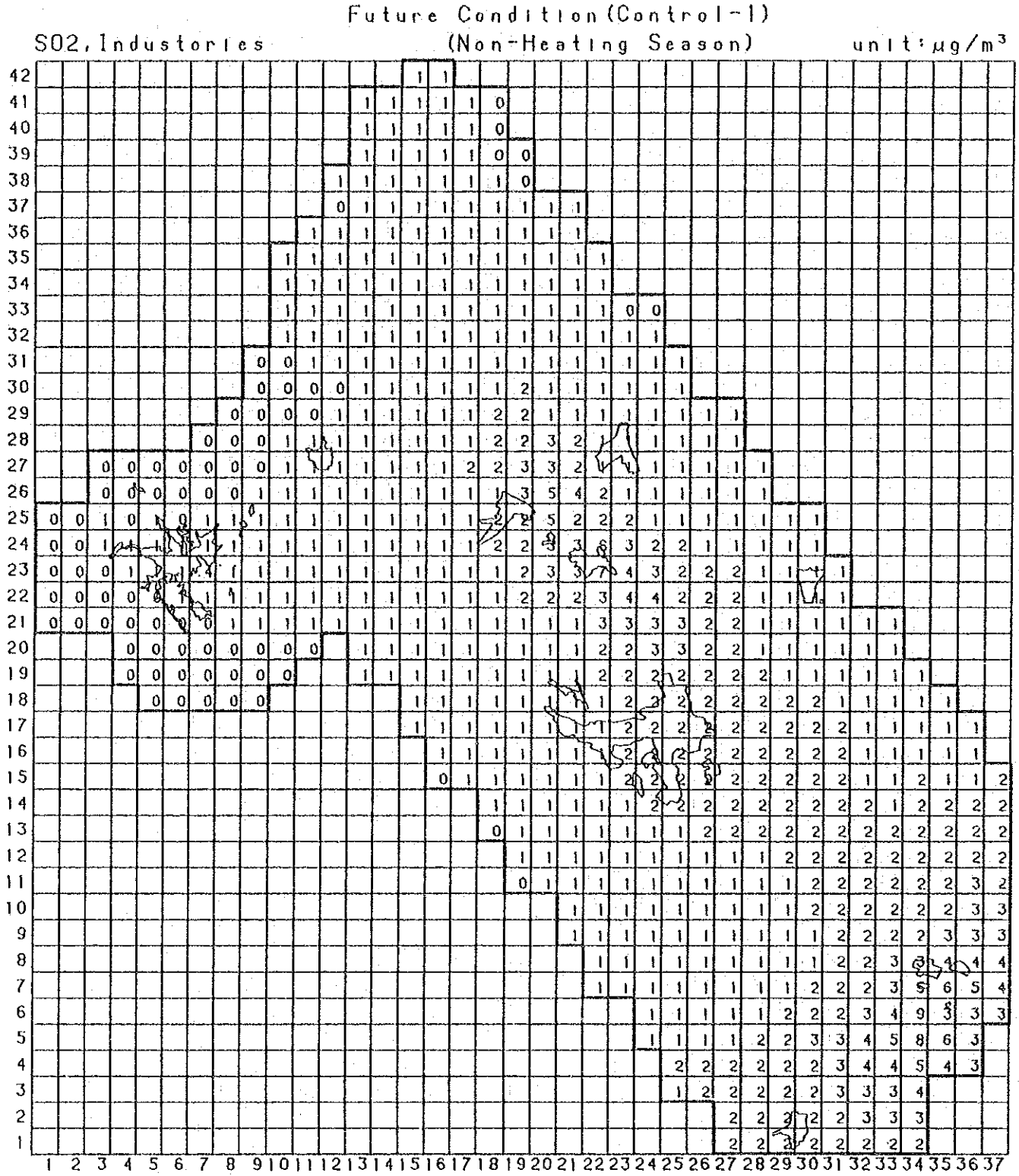

Figure D8.4.44 Average Concentration for SO2 in Non-heating Season (2005,Case F-1,Industries)

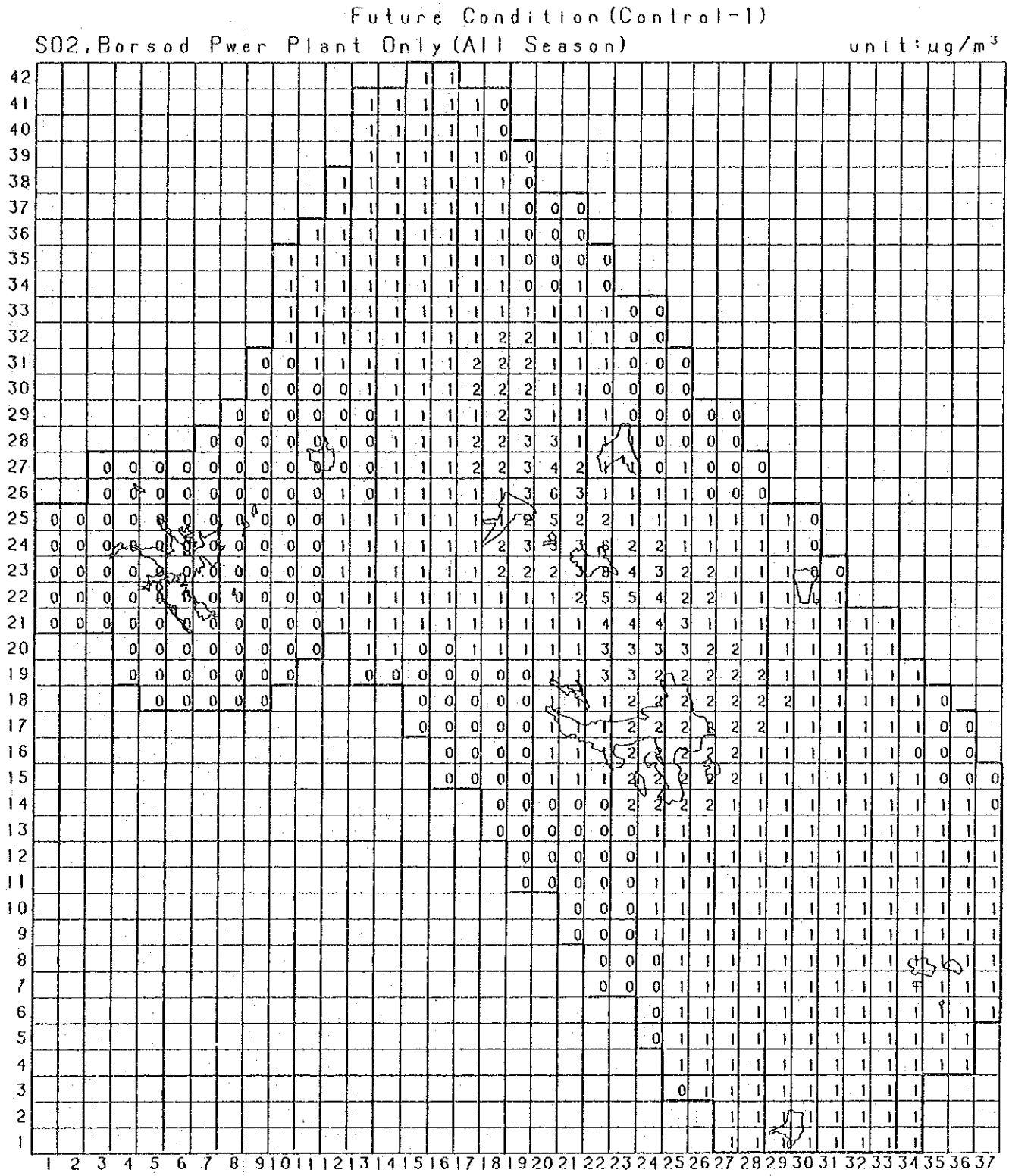

Figure D8.4.45 Annual Average Concentration for SO2 in 2005 (Case F-1,Borsod P.S.)

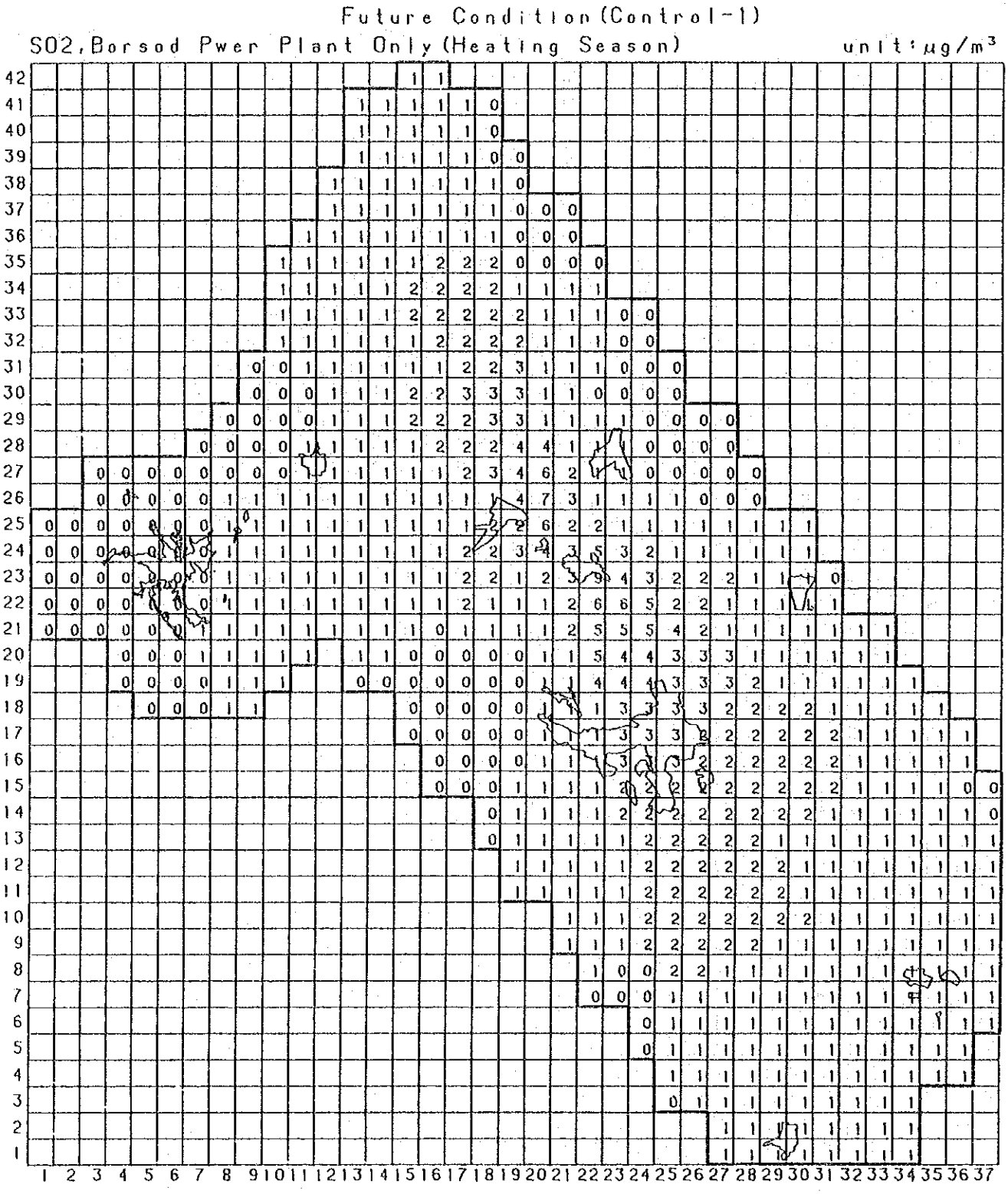

Figure D8.4.46 Average Concentration for SO2 in Heating Season (2005,Case F-1,Borsod P.S.)

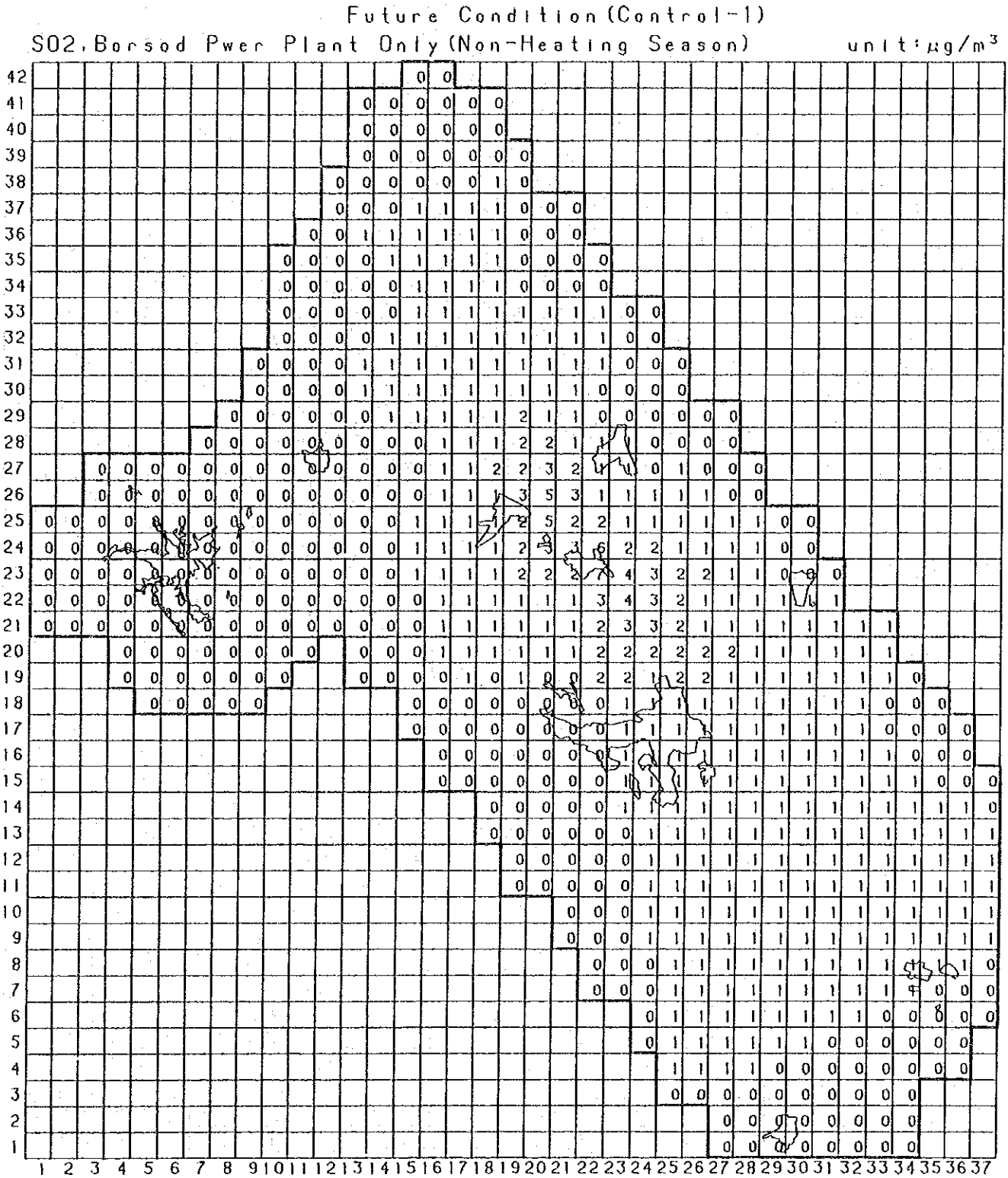

Figure D8.4.47 Average Concentration for SO2 in Non-heating Season (2005,Case F-1,Borsod P.S.)

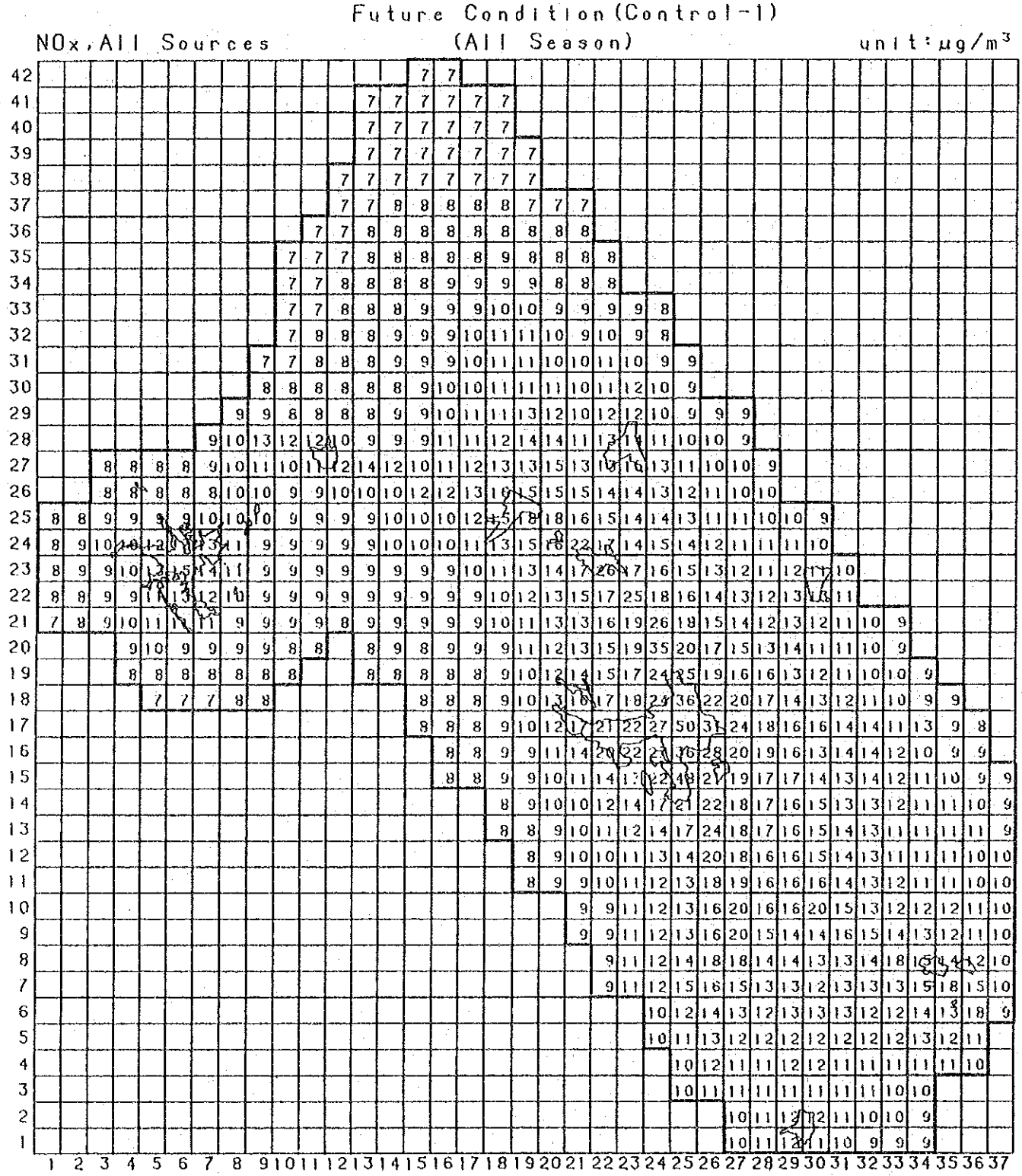

Figure D8.4.48 Annual Average Concentration for NOx in 2005 (Case F-1,All Sources)

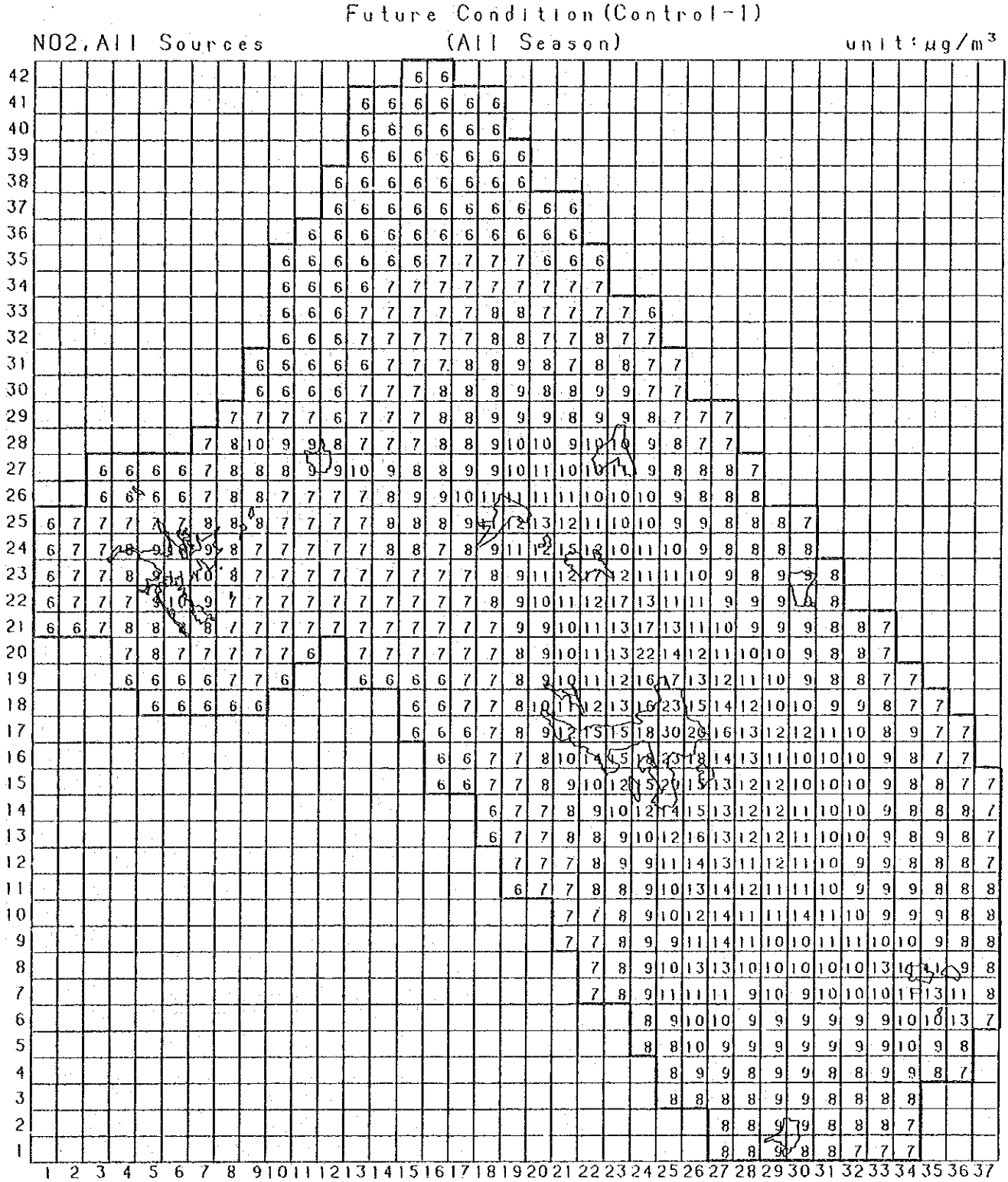

Figure D8.4.49 Annual Average Concentration for NO2 in 2005 (Case F-1,All Sources)

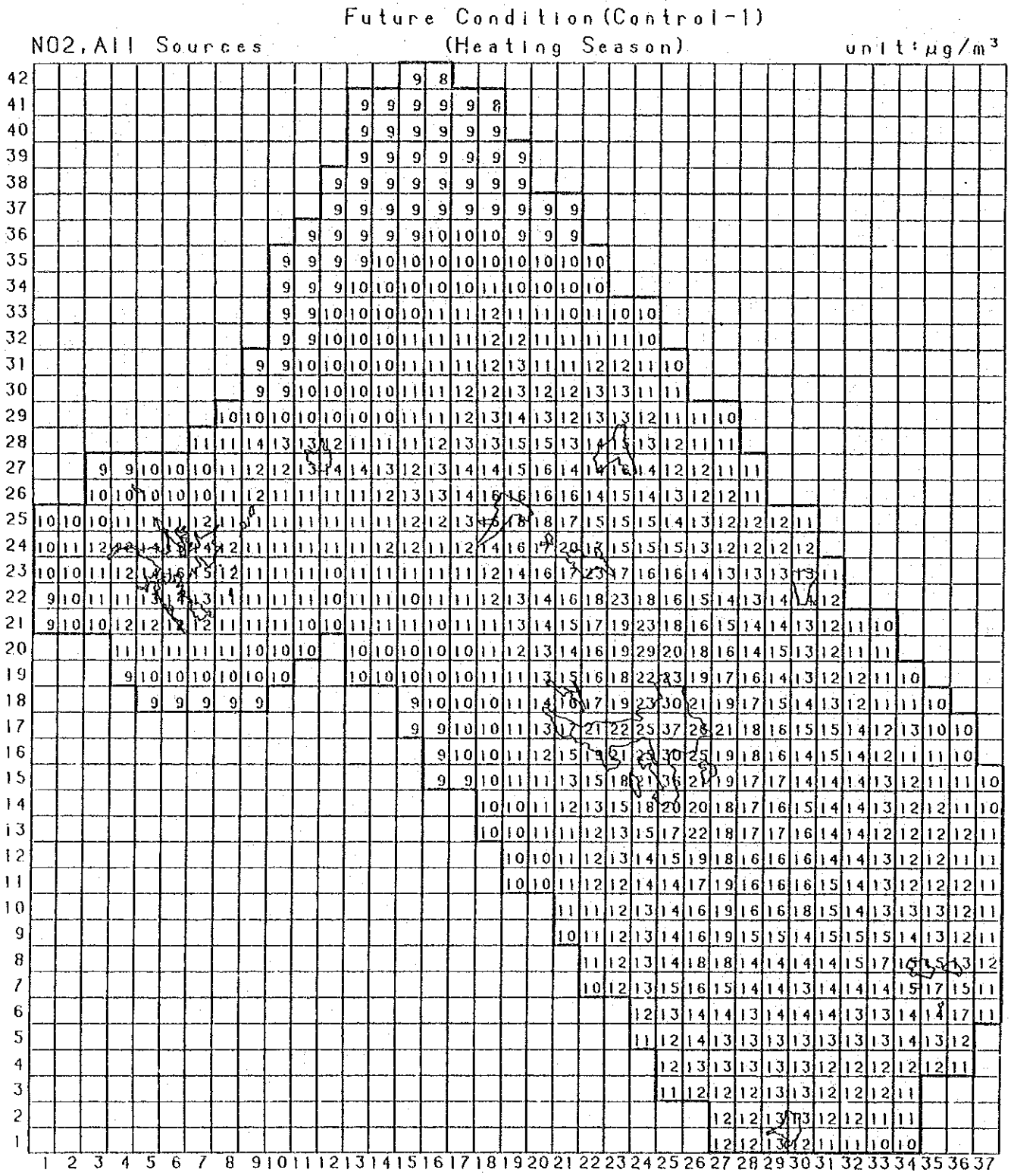

Figure D8.4.50 Average Concentration for NO2 in Heating Season (2005,Case F-1,All Sources)

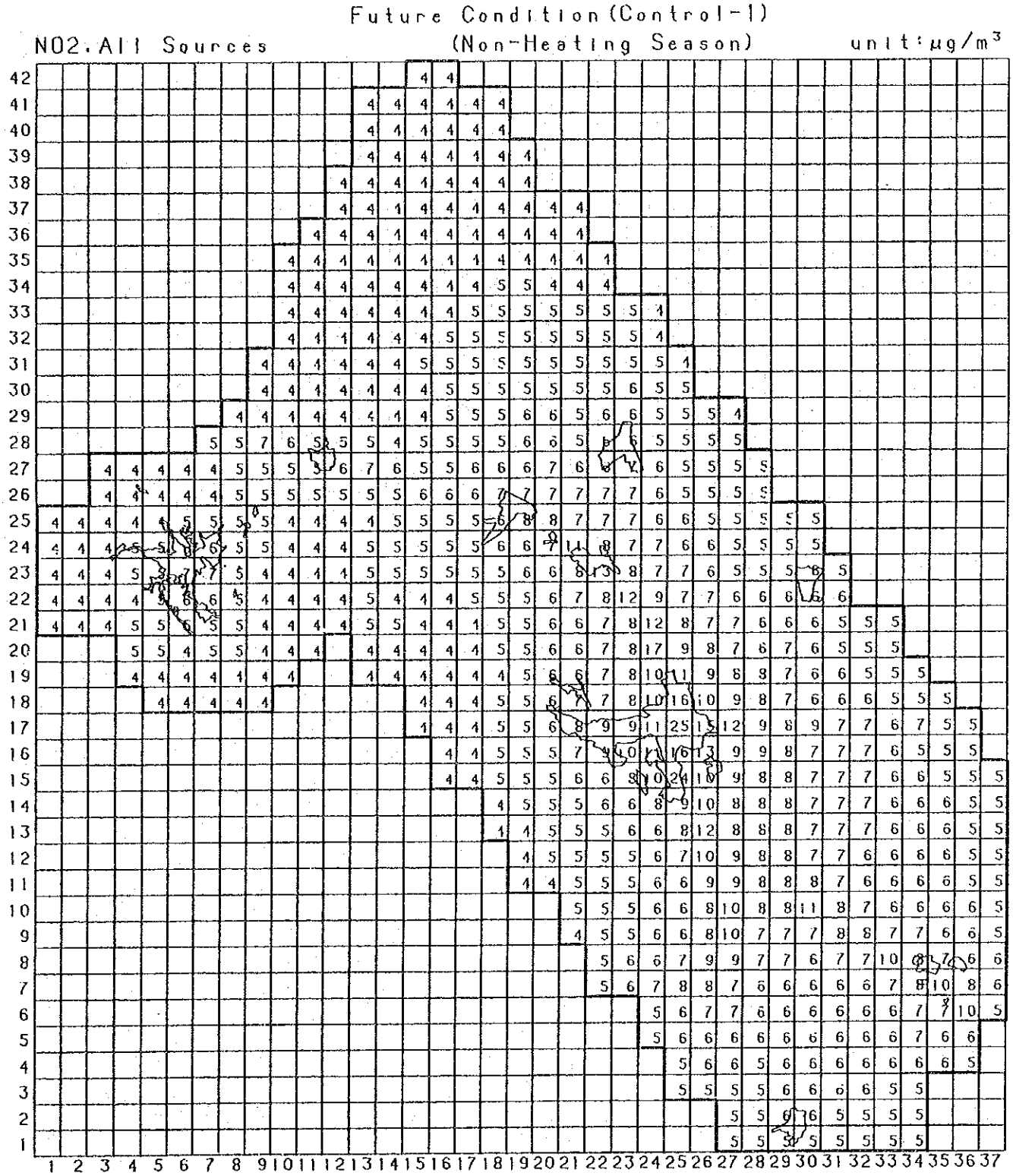

Figure D8.4.51 Average Concentration for NO2 in Non-heating Season (2005,Case F-1,All Sources)

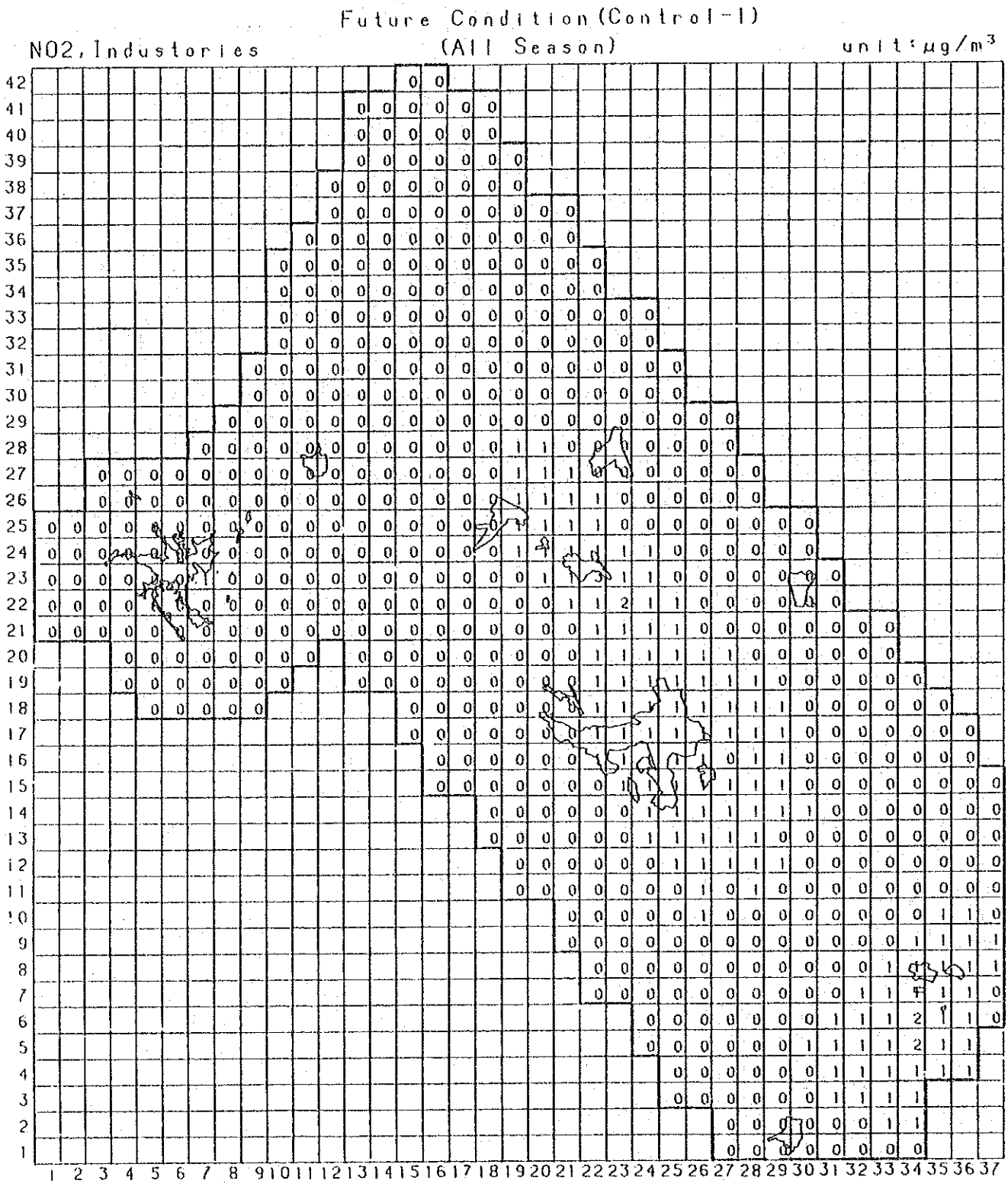

Figure D8.4.52 Annual Average Concentration for NO2 in 2005 (Case F-1,Industries)

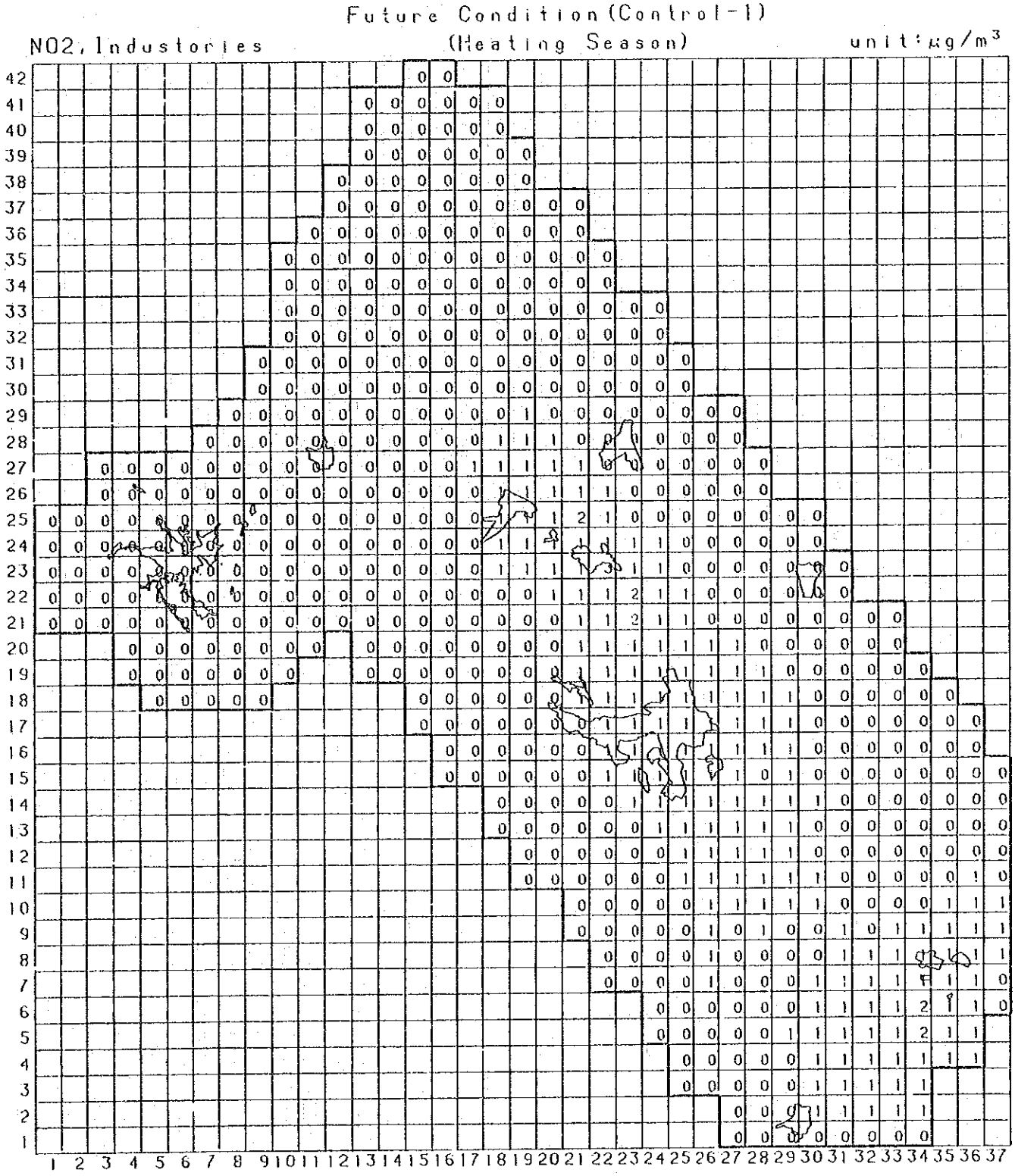

Figure D8.4.53 Average Concentration for NO2 in Heating Season (2005,Case F-1,Industries)

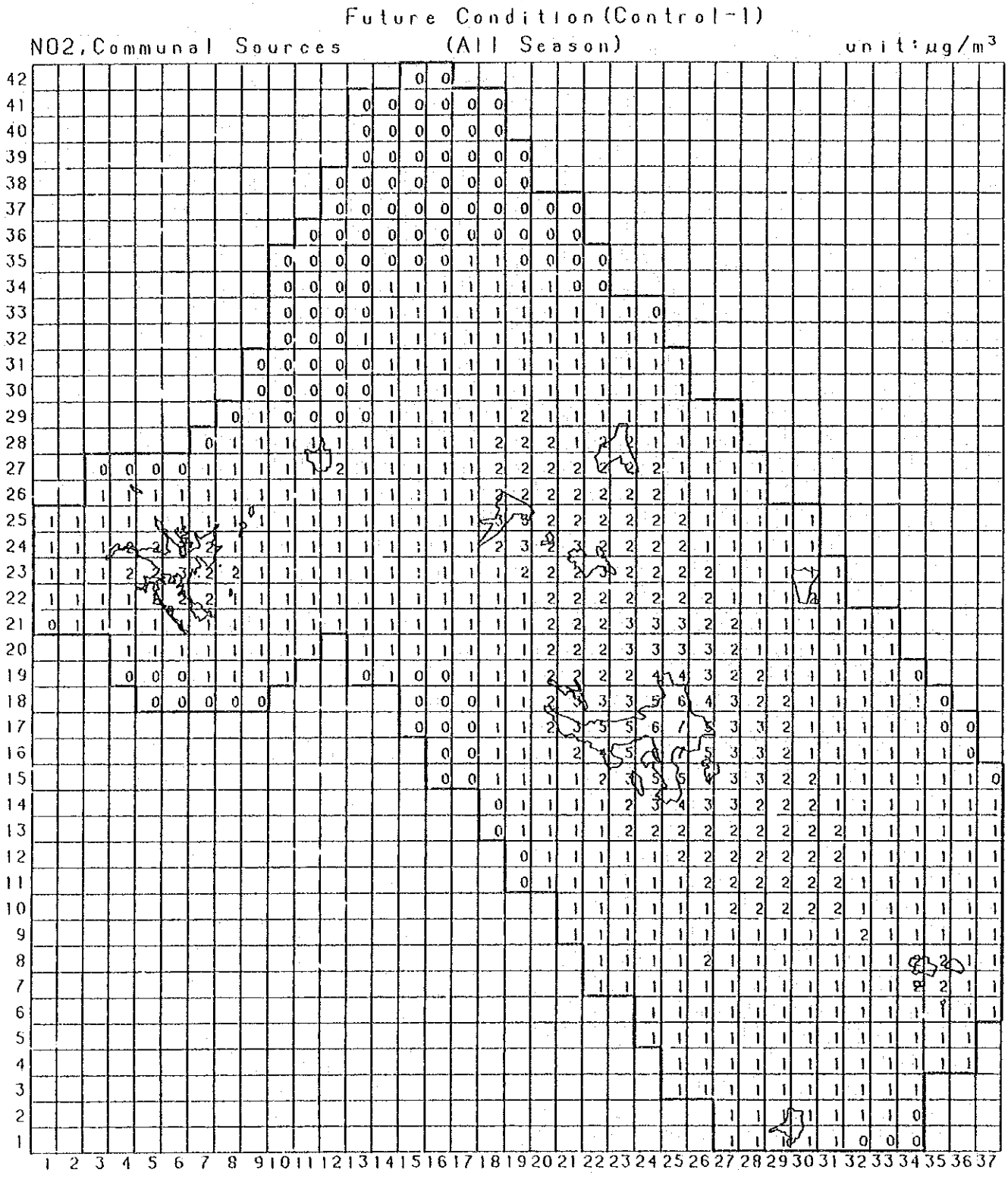

Figure D8.4.54 Annual Average Concentration for NO2 in 2005 (Case F-1,Communal Sources)

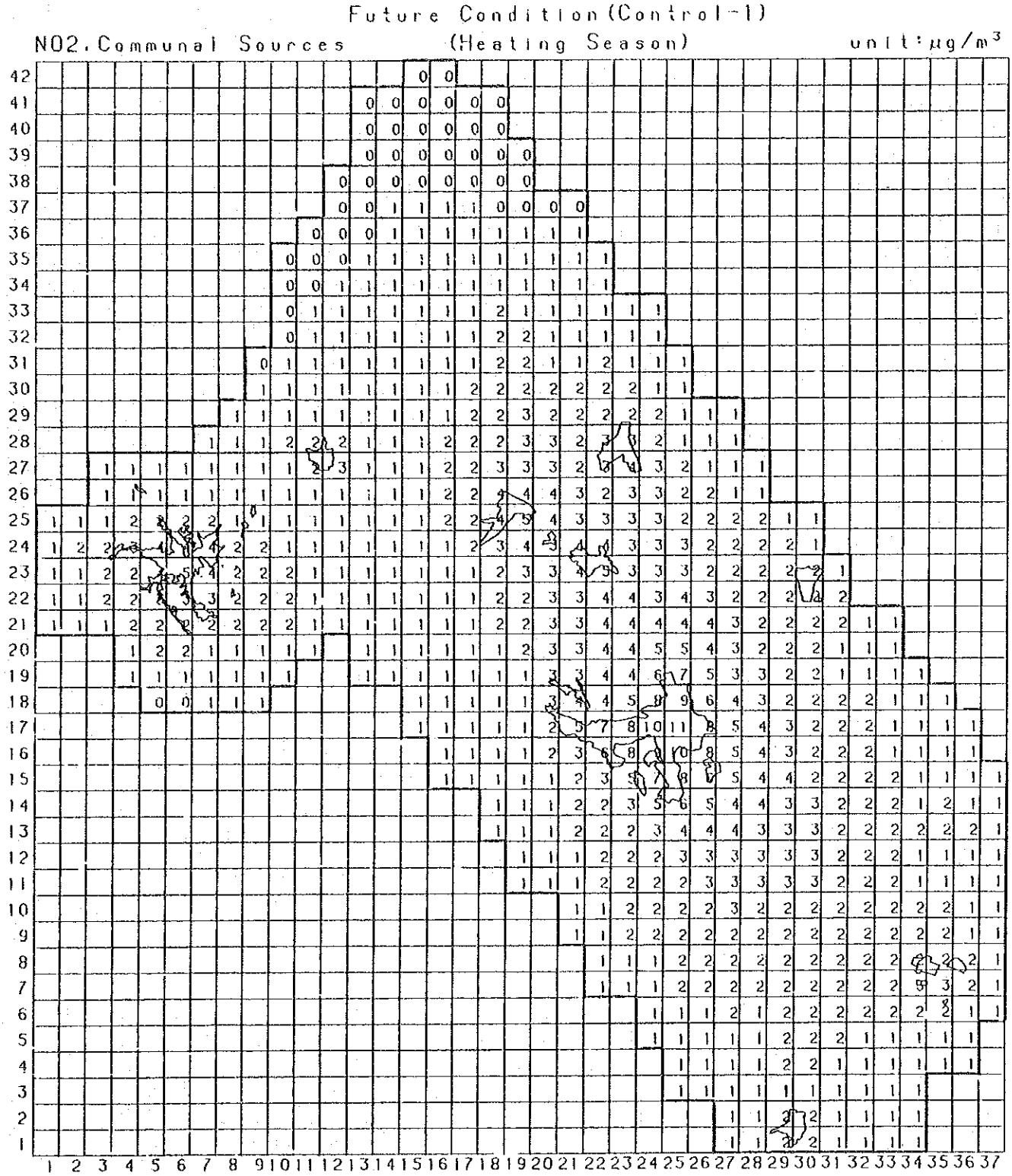

Figure D8.4.55 Average Concentration for NO2 in Heating Season (2005,Case F-1,Communal Sources)

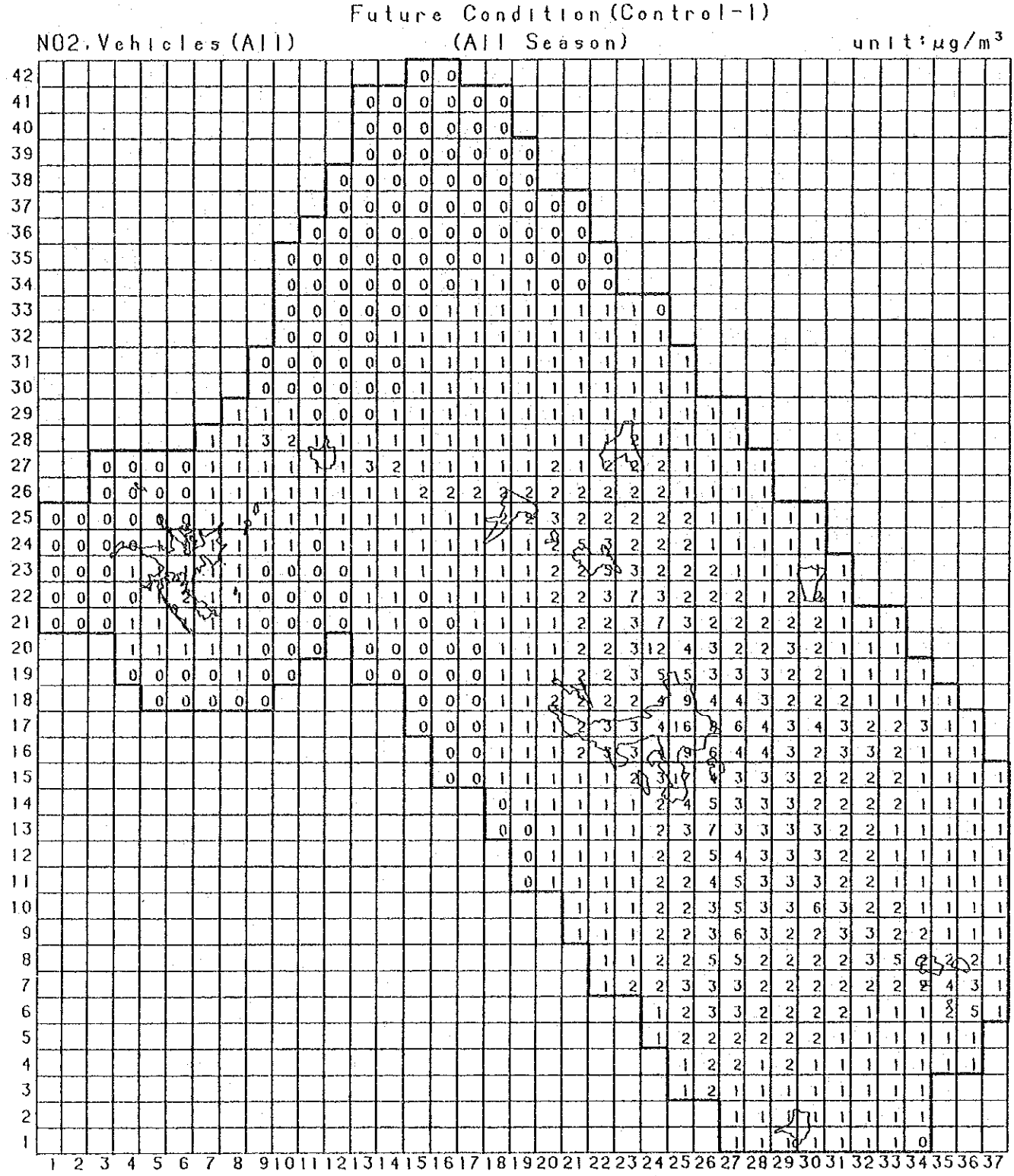

Figure D8.4.56 Annual Average Concentration for NO2 in 2005 (Case F-1,Motor Vehicles)

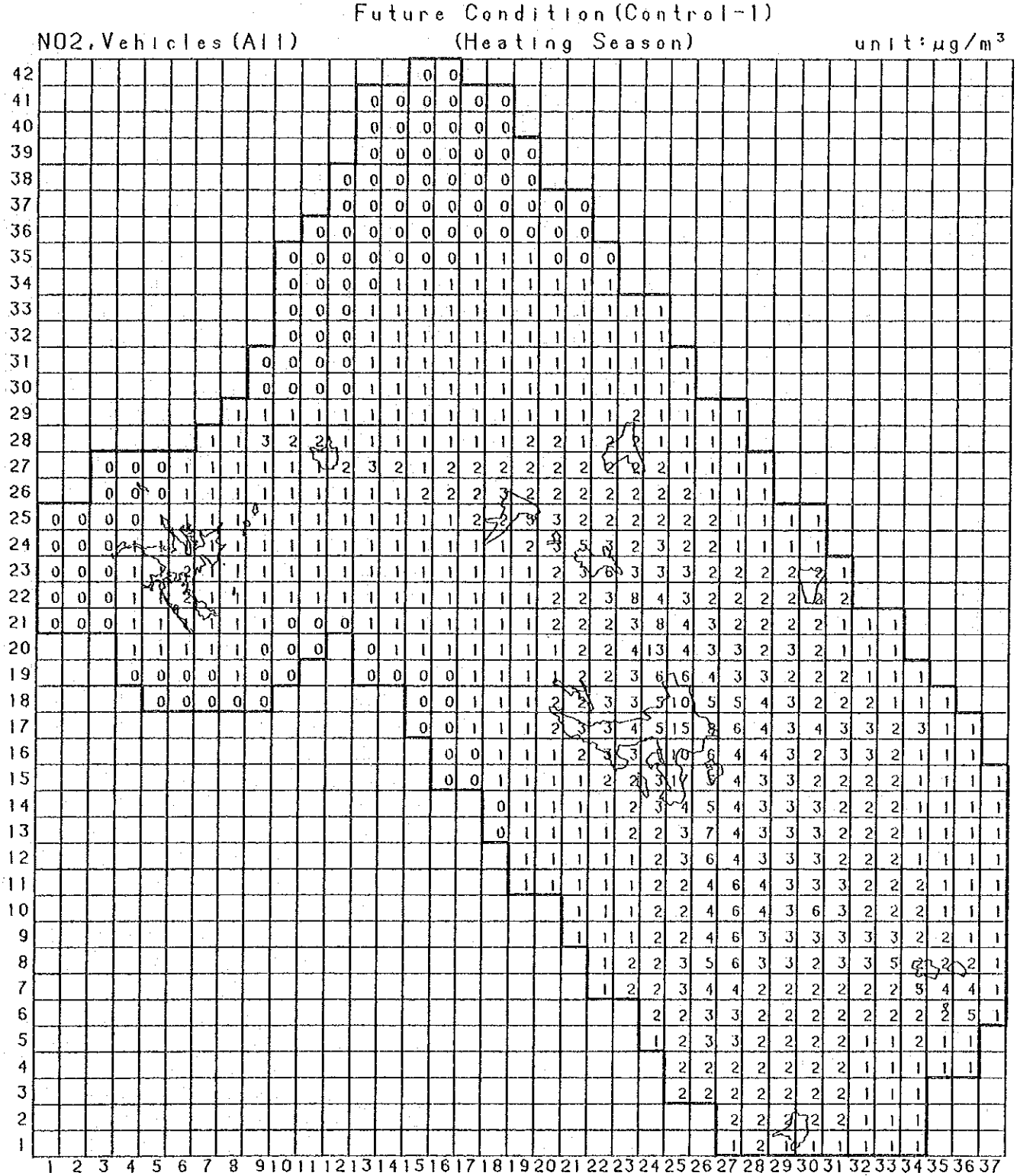

Figure D8.4.57 Average Concentration for NO2 in Heating Season (2005,Case F-1,Motor Vehicles)

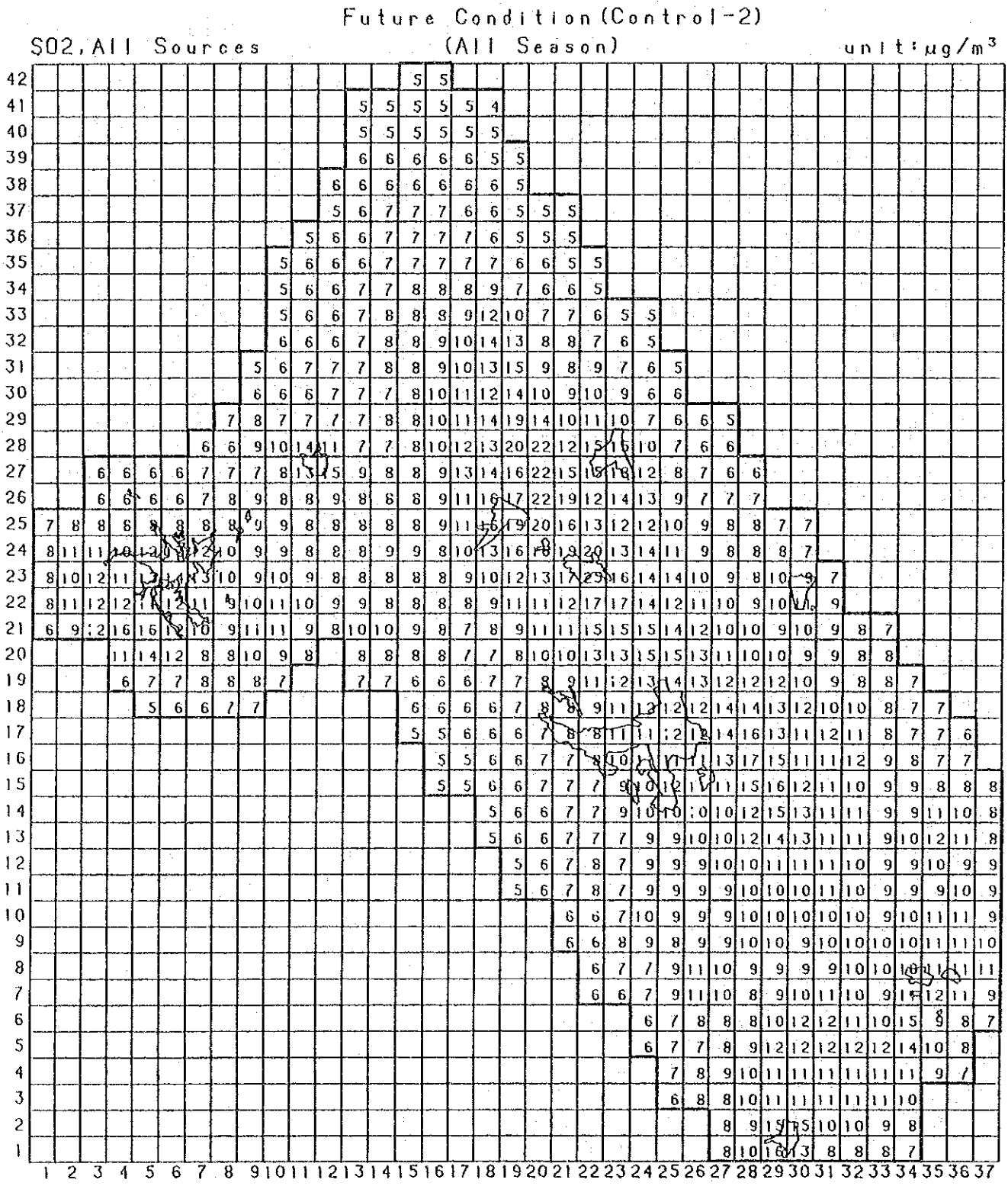

Figure D8.4.58 Annual Average Concentration for SO2 in 2005(Case F-2,All Sources)

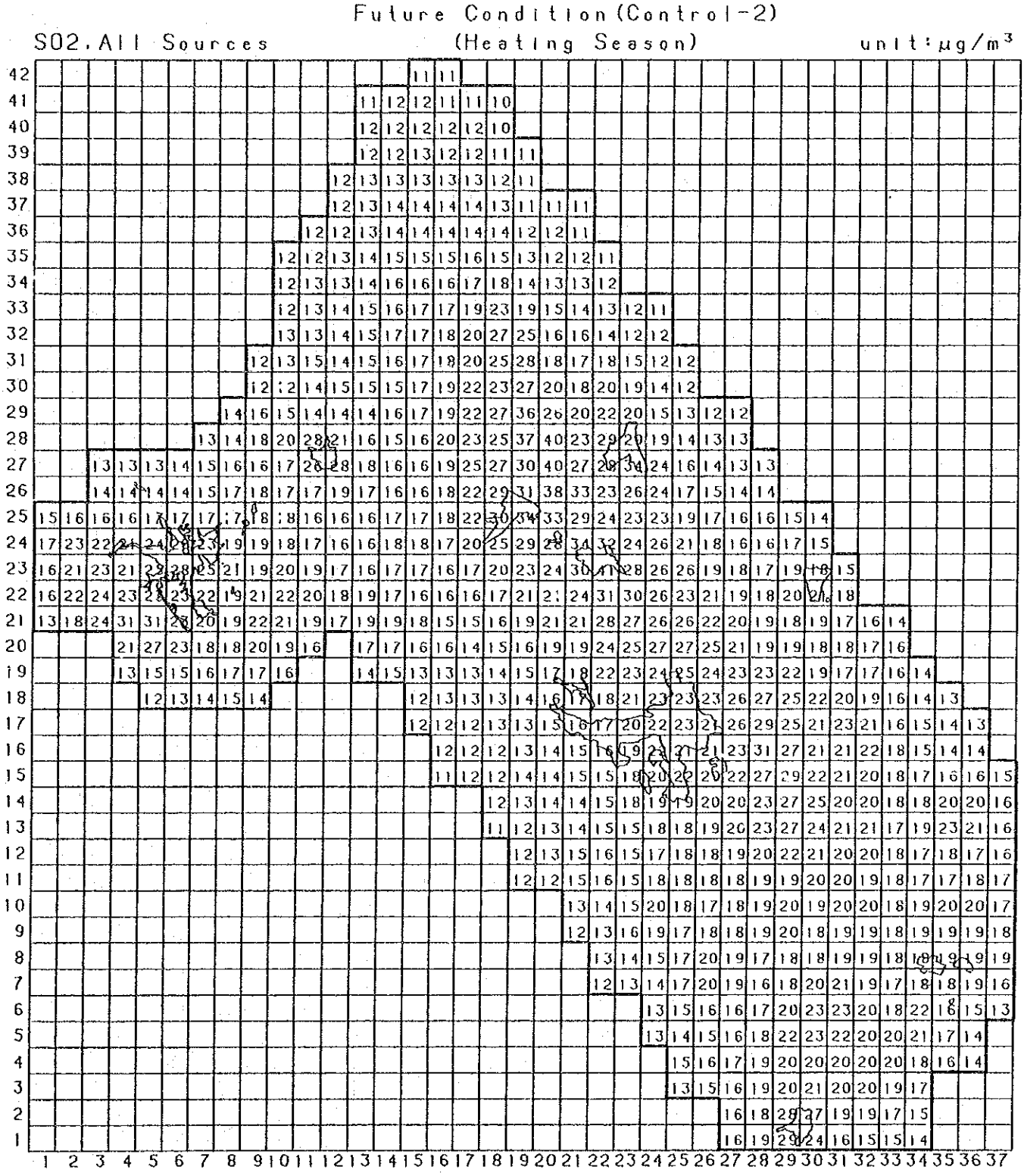

Figure D8.4.59 Average Concentration for SO2 in Heating Season (2005,Case F-2,All Sources)

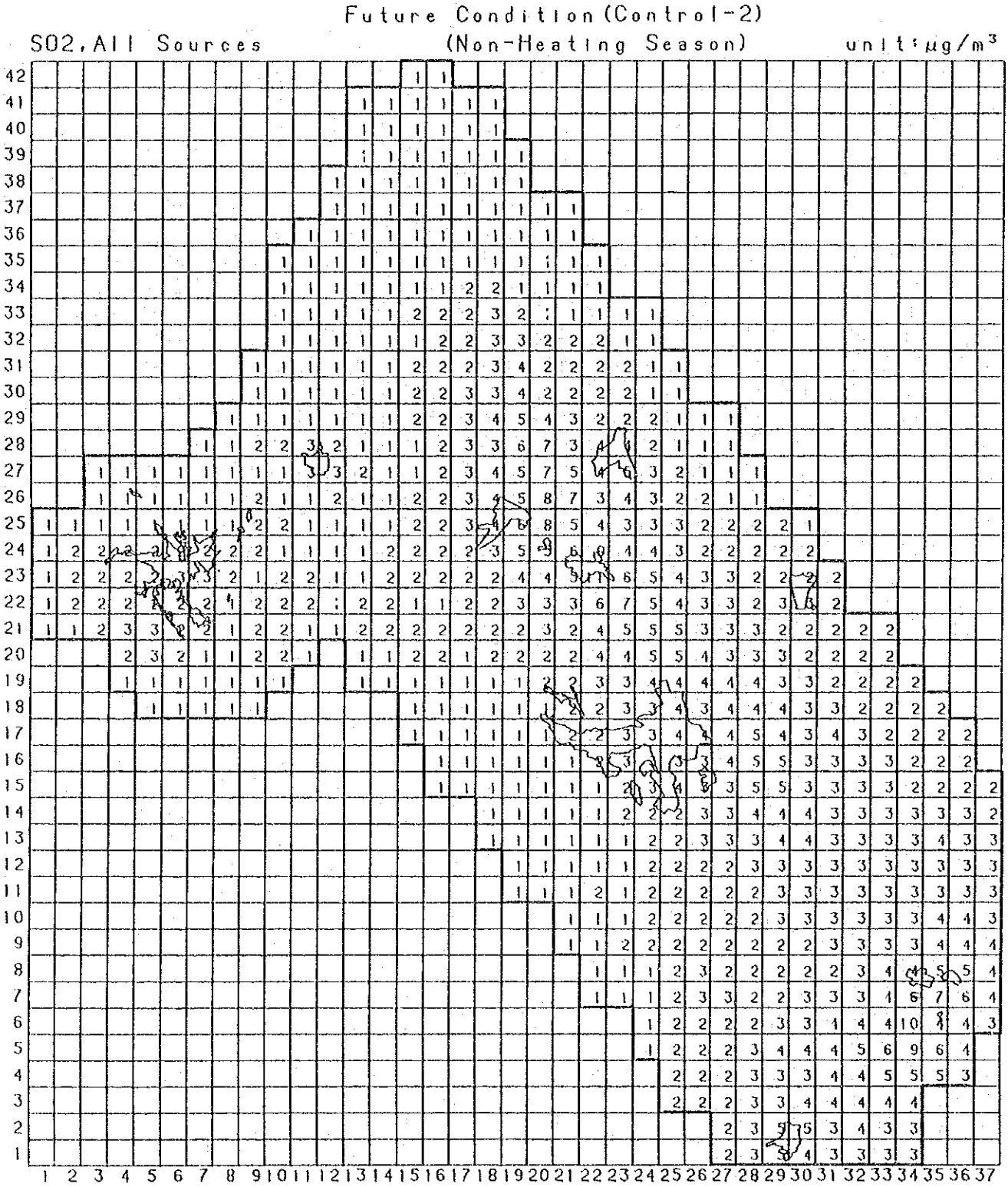

Figure D8.4.60 Average Concentration for SO2 in Non-heating Season (2005,Case F-2,All Sources)

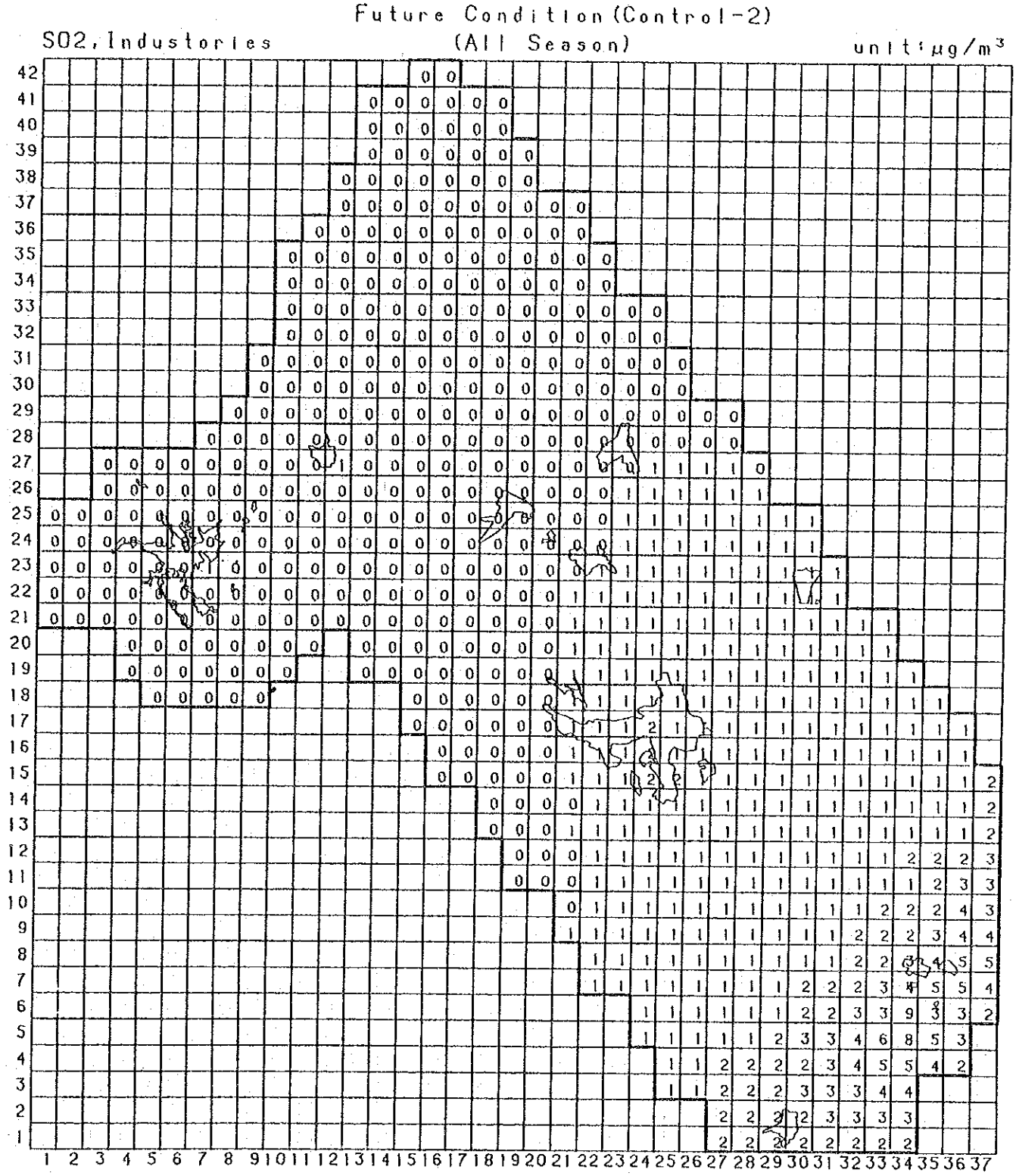

Figure D8.4.61 Annual Average Concentration for SO2 in 2005 (Case F-2,Industries)

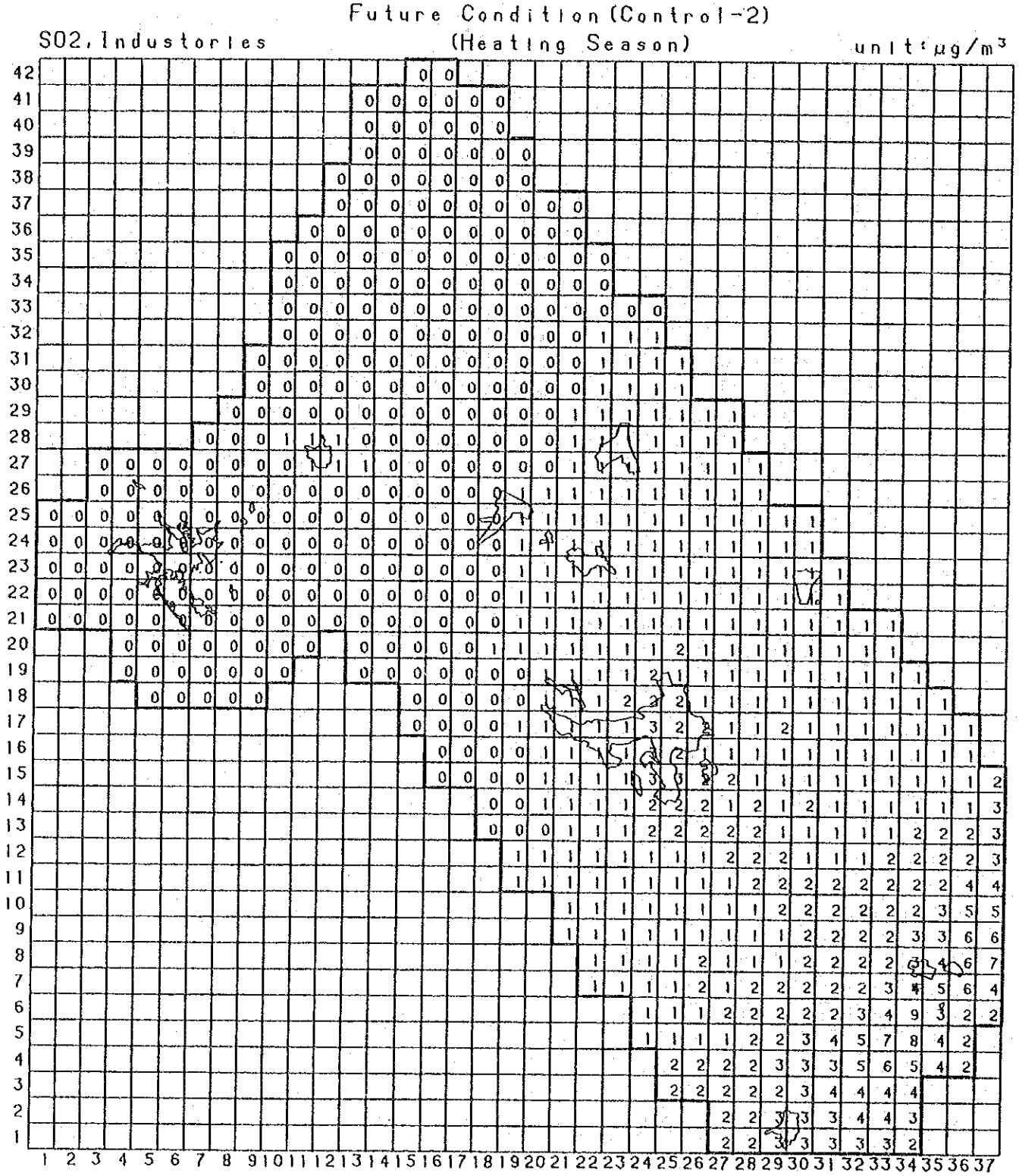

Figure D8.4.62 Average Concentration for SO2 in Heating Season (2005,Case F-2,Industries)

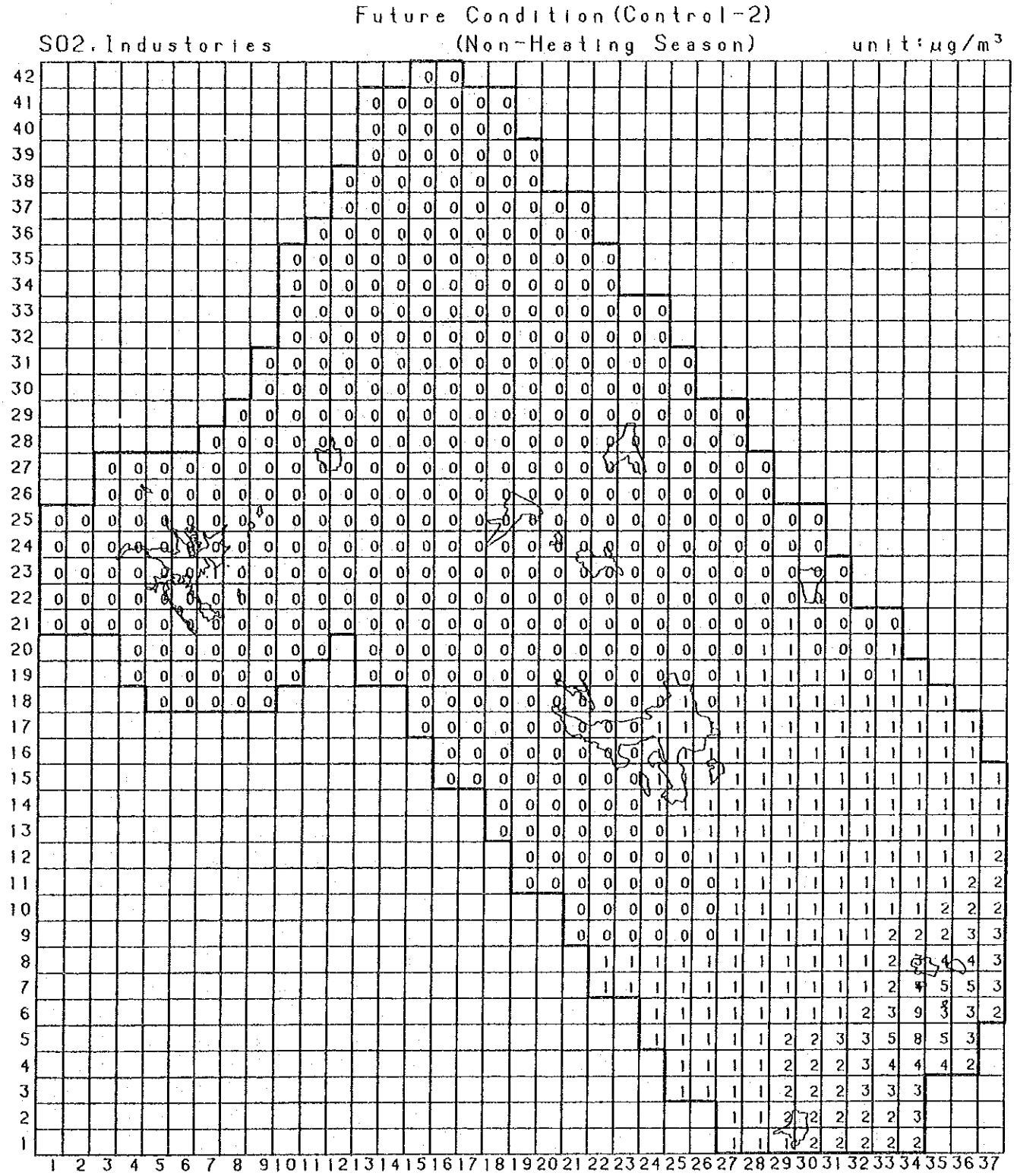

Figure D8.4.63 Average Concentration for NO2 in Non-heating Season (2005,Case F-2,Industries)

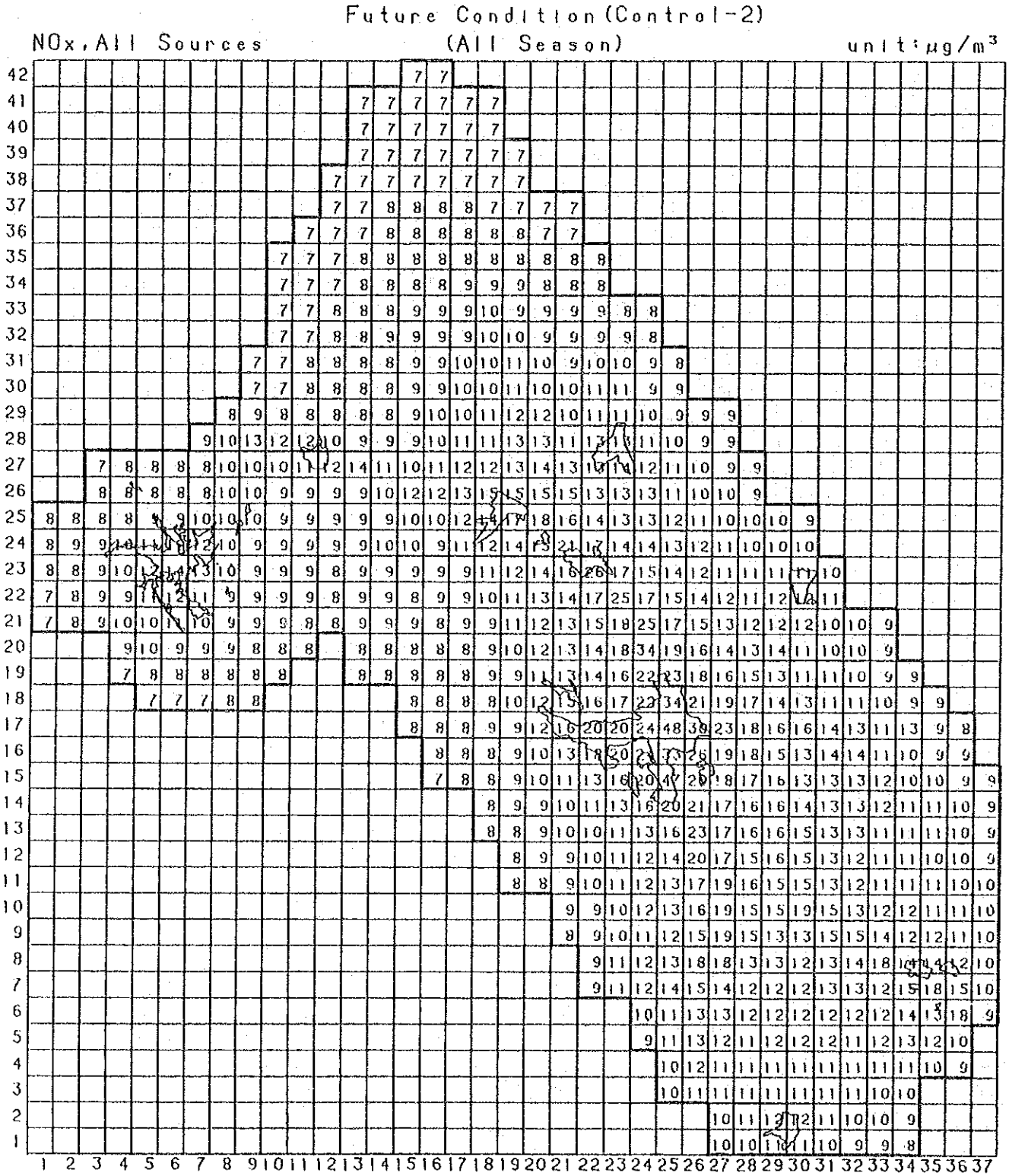

Figure D8.4.64 Annual Average Concentration for NOx in 2005 (Case F-2,All Sources)

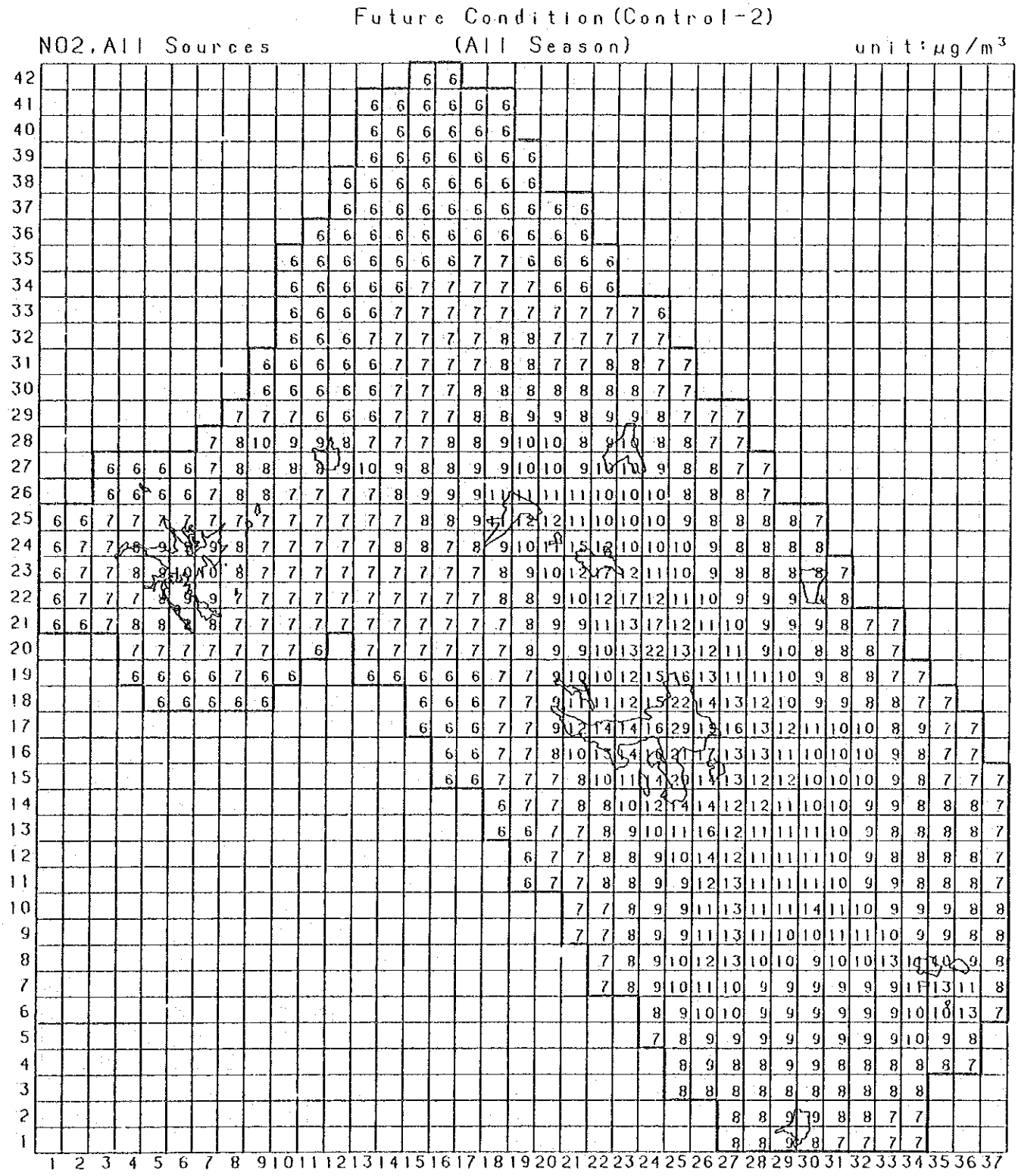

Figure D8.4.65 Annual Average Concentration for NO2 in 2005 (Case F-2,All Sources)

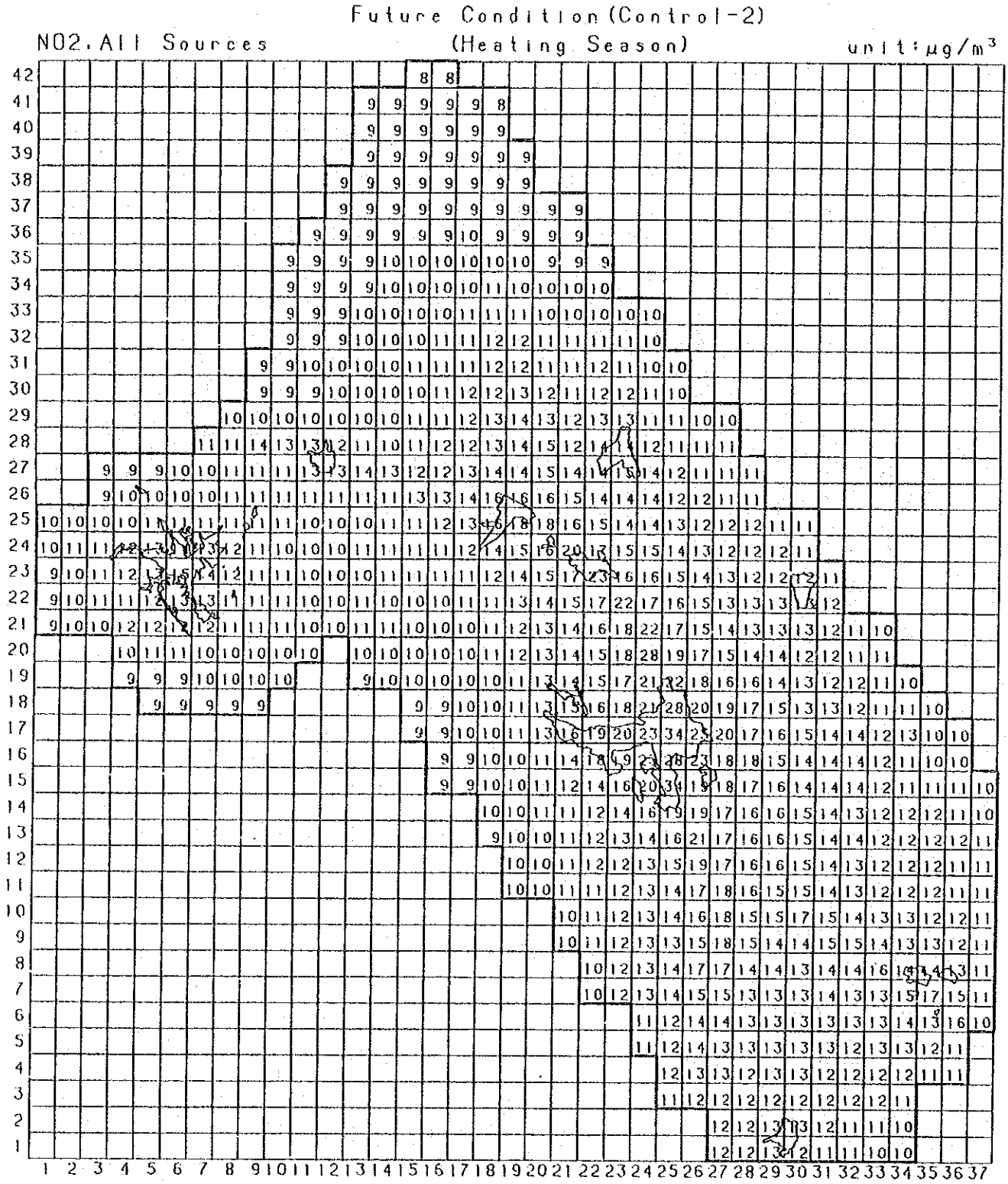

Figure D8.4.66 Average Concentration for NO2 in Heating Season (2005,Case F-2,All Sources)

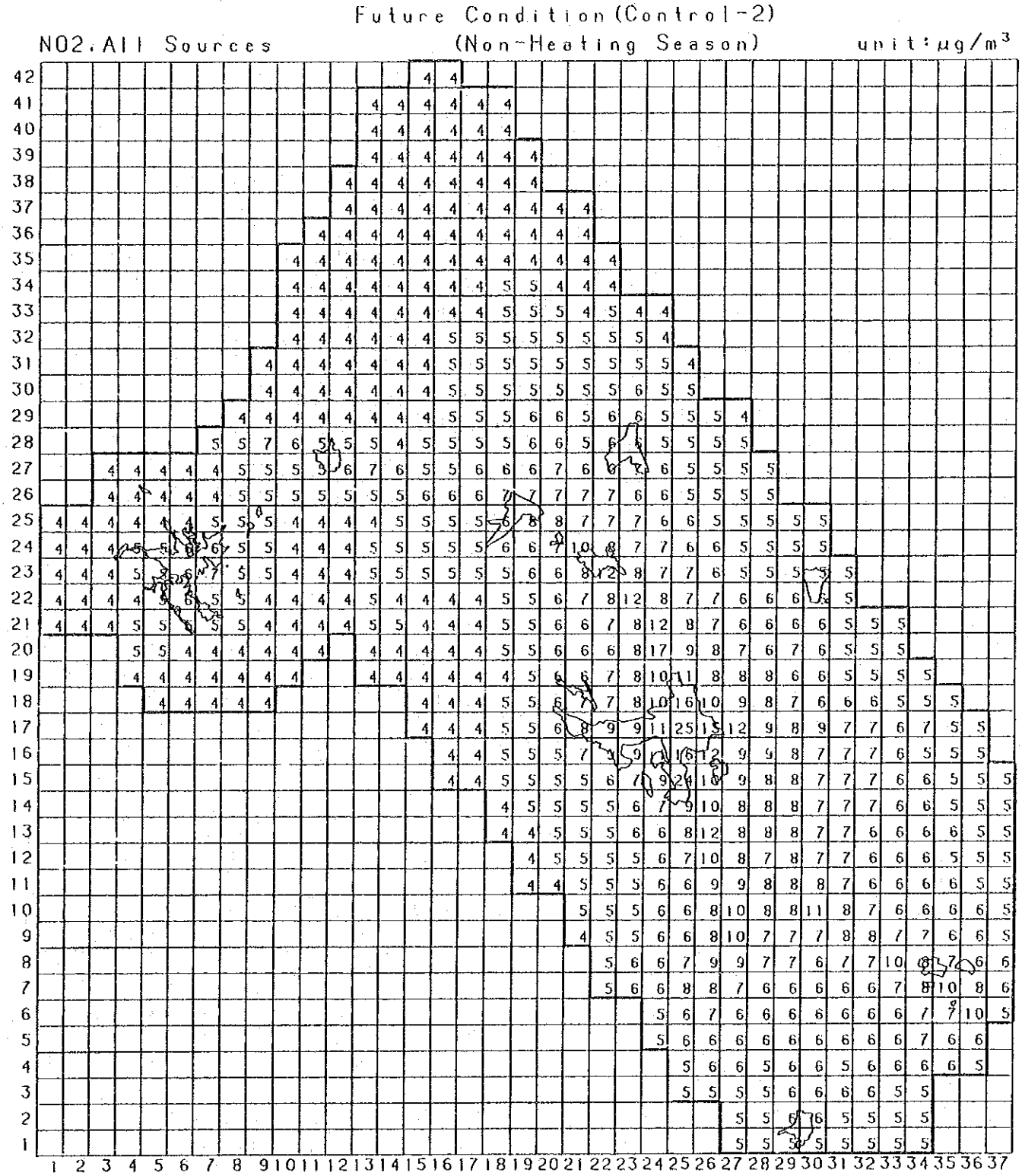

Figure D8.4.67 Average Concentration for NO2 in Non-heating Season (2005,Case F-2,All Sources)

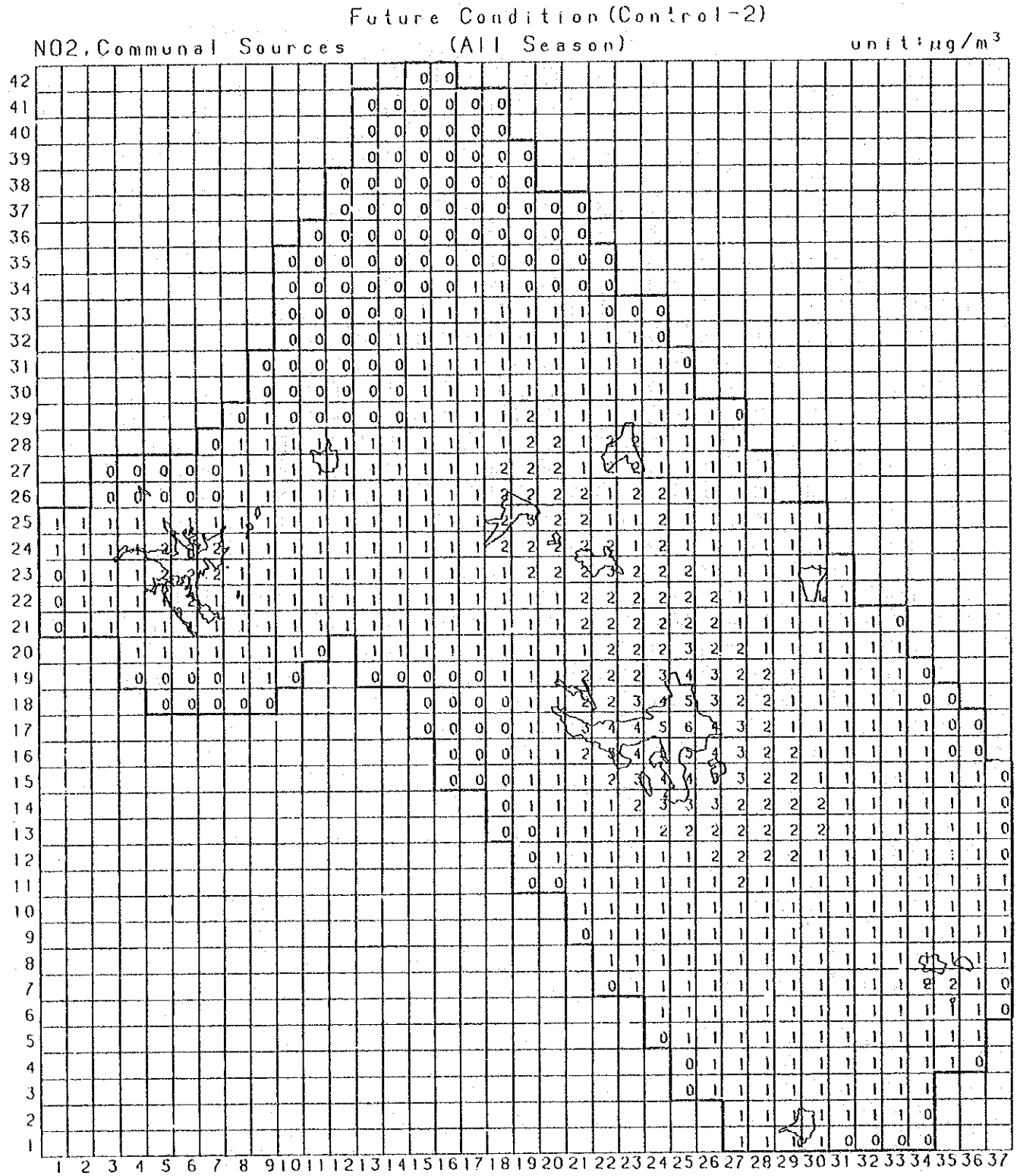

Figure D8.4.68 Annual Average Concentration for NO2 in 2005 (Case F-2,Communal Sources)

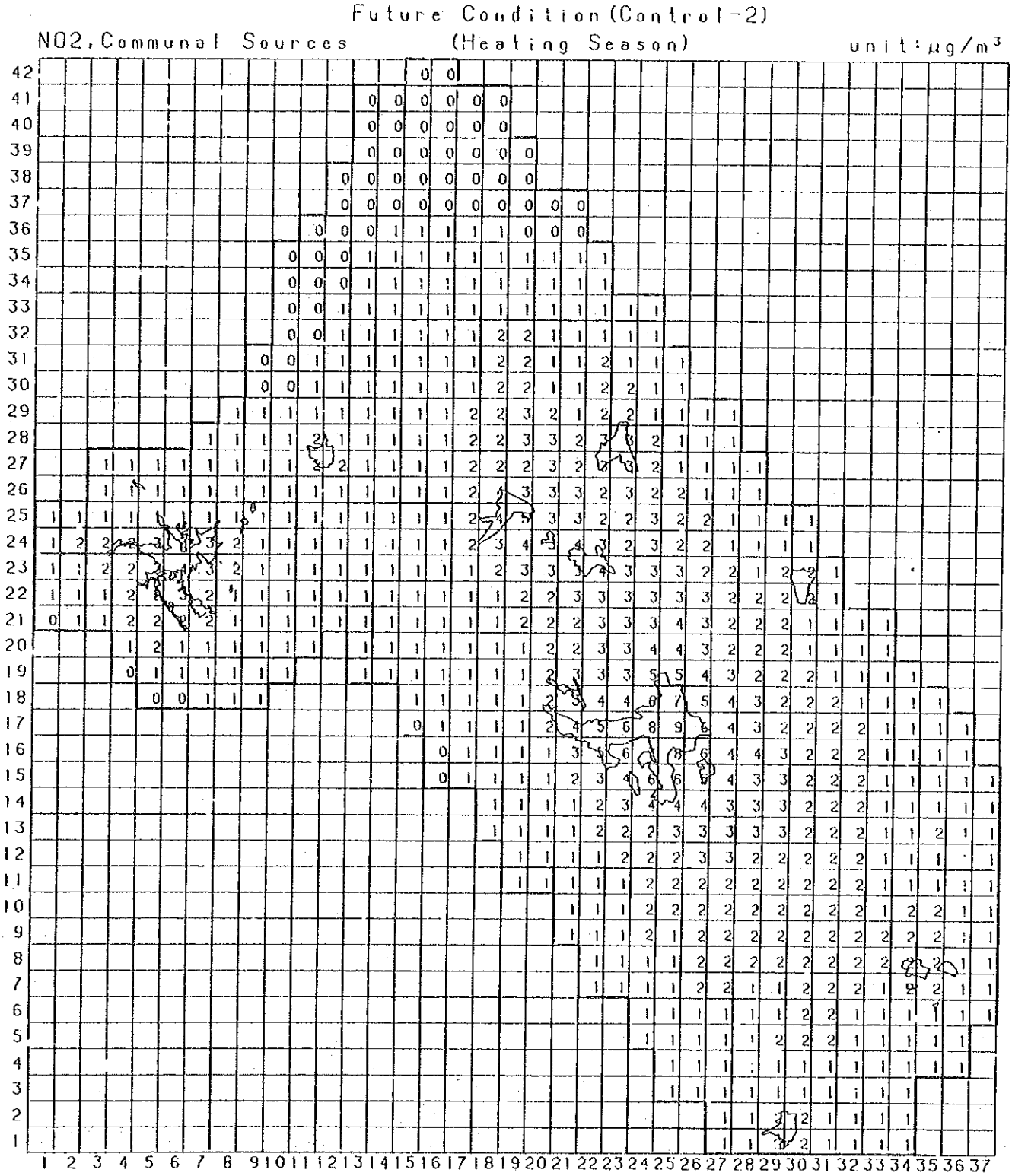

Figure D8.4.69 Average Concentration for NO2 in Heating Season (2005,Case F-2,Communal Sources)

DATA FOR CHAPTER 9

Table D9.1.1 Cost Estimation for CFBC in Borsod Power Station

Cost estimation for Circulation Fluidized Bed Combustion method(CFBC)
(150MW power generation, boiler 460t/h)

Design condition				
	Coal	Ryuko	Sulfur	2.20%
	Total carbon	27.52%	Nitrogen	0.62%
	Ash	34.68%	Hydrogen	2.32%
	Moisture	24.80%	Oxygen	8.30%
	Volatile matter	22.56%		
	Net calorific value(MJ/kg)	8.50		
	Facility scale	Boiler 460t/h		
	Coal consumption(t/h)	160		
	SO2 emission(kg/h)	6,336		
	Exhaust gas(Nm3/h)	721,000		
	Flue gas temperature(℃)	150		
	Desulfurization method : CFBC			
	CaCO3 purity(%)	95%		
	Ca/S	2.6		
	Desulfurization rate(%)	90%		

Cost		Price(Ft)	Consumption(/h)
	CaCO3(t)	1,204	30.10
	Electric power (KWH)	3.96	16,000
	Water (m3)	27.61	5.00
	Wages (/month)	50,000	
	Number of labor	2	
	Annual hours of operation	6,920	
Investment in plant and equipment			
	Cost of equipment(Ft)	5,740,000,000	
	Offsite(Ft)	9,000,000,000	
		14,740,000,000	
Annual operating cost			
	CaCO3(Ft)	250,783,568	
	Electric power(Ft)	438,451,200	
	Water(Ft)	955,306	
	Labor(Ft)	1,200,000	
	Maintenance(Ft)	221,100,000	
	Interest(Ft)	737,000,000	
	Depreciation (10%)	1,326,600,000	
		2,976,090,074	
	Annual interest rate (%)	5%	
Evaluation	Annual SO2 removal(t)	39,461	
	SO2 treatment cost(Ft/t)	75,419	

Note) Cooling water for turbine are excluded.

Table D9.1.2 Establishment Costs for CFBC in Borsod Power Station

Unit: Million HUF

	Items	Construc-tion	Domestic product	Import	Cus-toms	Installa-tion	Invest-ment (others)	Invest-ment (total)	Others	Gross Invest-ment
01	Design						600.00	600.00		600.00
02	Moves	58.00	16.00					74.00		74.00
03	Site preparation	9.00						9.00		9.00
04	Road construction	12.00						12.00		12.00
05	Rail way	45.00	12.50			22.00		79.60		79.60
06	Fence	6.0						6.0		6.0
08	Dismantling	23.00	11.00					34.80		34.80
91	Main building	930.00						930.00		930.00
92	Chimney	202.00						202.00		202.00
93	Boiler 1 combustion eq.	45.00		3006.60	300.60	590.00	131.41	4073.60		4073.60
94	Steam turbine	75.00	940.00					1015.00		1015.00
95	Block trans.	67.00	195.50			4.50		267.00		267.00
96	Supply house		87.00	518.60	57.60	157.00	27.00	847.20		847.20
97	Main bldg. crane		80.00					80.00		80.00
98	Main bldg. electric eq.		281.50	273.51		85.64		640.65		640.65
99	Control unit		112.44	394.82	27.64	130.00	10.02	674.92	101.54	776.46
10	Fuel transport	249.00	631.20	58.00	9.10	117.90	3.00	1068.20		1068.20
11	Slag arrange	29.00	75.00	28.00	3.00	37.00	1.40	173.40	45.00	218.40
12	Water supply system	84.00	183.69	54.91	6.04	55.10	3.00	386.74		386.74
13	Pre-water treatment	103.00	172.70	47.00	5.17	68.00	1.80	397.67		397.67
14	Out door trans-housing	11.50	21.00			2.50		35.00		35.00
15	Plant recon-struction	18.00	24.00					42.00		42.00
16	Office	4.00						4.00		4.00
18	Security (labor, asset)	1.00	3.00	3.00	0.40	1.50	0.15	9.05		9.05
19	Pollution control eq. (water, air)	17.00	29.00					46.00		46.00
20	Lights	14.00						14.00		14.00
21	Hydrant	8.50	28.00	3.00	0.40	5.00	0.15	45.05		45.05
22	Process wiring	34.40						34.40		34.40
23	Waste pipe	39.20						39.20		39.20
25	Test room		5.50					5.50		5.50
26	Test run						280.00	280.00		280.00
29	Traffic, transport		12.00					12.00		12.00
30	Communi-cation, fire alarm	23.00	109.50	17.50	2.10	26.50		178.60		178.60
32	Working system	31.00	110.00			11.00		152.00		152.00
33	Other costs	30.00						30.00		30.00
34	Fixed assets		75.00	110.00	11.00			196.00		196.00
35	promoting investment									
36	Reserve						1000.00	1000.00		1000.00
	Total 01-36	2169.50	3215.53	4514.94	423.05	1313.64	2057.92	13694.58	146.54	13841.12
	Electricity, gas, etc.			500.00	50.00					
	6.5% of the total									899.69
	Gross Total									14740.79

Note: 1USD = 100.19 HUF as of December 15, 1993.

Table D9.1.3 Investment Schedule for CFBC in Borsod Power Station

Unit : Million HUF

Year	Construction	Domestic Product	Import	Customs Tariff (Import)	Installation	Investment (Others)	Investment (Total)	Others	Gross Total Investment
1994						850.00	850.00		850.00
1995	1821.50	227.00			68.00	70.00	2186.50		2186.50
1996	318.00	2000.00	4014.00	343.05	745.64	1000.00	8420.69		8420.69
1997	30.00	988.53	500.94	80.00	500.00	1037.59	3137.06	146.54	3283.60
Total	2169.50	3215.53	4514.94	423.05	1313.64	2957.59	14594.25	146.54	14740.79

Note: 1USD = 100.19 HUF as of December 15, 1993.

Table D9.1.4 Cost Estimation for HFBC in Borsod Power Station

Cost estimation for Hybrid Fluidized Bed Combustion method(HFBC)
(Boiler 100t/h×4)

Design condition				
	Coal	Ryuko	Sulfur	2.20%
	Total carbon	27.52%	Nitrogen	0.62%
	Ash	34.68%	Hydrogen	2.32%
	Moisture	24.80%	Oxygen	8.30%
	Volatile matter	22.56%		
	Net calorific value(MJ/kg)	8.5		
	Facility scale	Boiler(100t/h×4)		
	Coal consumption(t/h)	96	(60% load)	
	SO2 emission(kg/h)	3,802		
	Exhaust gas(Nm3/h)	432,000		
	Flue gas temperature(℃)	150		
	Desulfurization method : HFBC			
	CaCO3 purity(%)	95%		
	Ca/S	2.6		
	Desulfurization rate(%)	43%		

Cost		Price(Ft)	Consumption(/h)
	CaCO3(t)	1,204	18.06
	Electric power (KWH)	3.96	3,000
	Water (m3)	27.61	5
	Wages (/month)	50,000	
	Number of labor	2	
	Annual hours of operation	2,210	

Investment in plant and equipment			
	Cost of retrofitting(Ft)	1,330,000,000	
	Elecric precipitator(Ft)	0	(Using existing equipment)
	Offsite(Ft)	0	(Using existing offsite)
		1,330,000,000	

Annual operating cost		
	CaCO3(Ft)	48,054,770
	Electric power(Ft)	26,254,800
	Water(Ft)	305,091
	Labor(Ft)	1,200,000
	Maintenance(Ft)	19,950,000
	Interest(Ft)	66,500,000
	Depreciation (10%)	119,700,000
		281,964,661
	Annual interest rate (%)	5%

Evaluation	Annual SO2 removal(t)	3,613
	SO2 treatment cost(Ft/t)	78,042

Note) Turbine are excluded.

Table D9.1.5 Cost Estimation of Control Measures Planned by Enterprises

Plant	Case 1	Plant	Case 1
03/0 ESZAKMAGYARO- RSZAGI TEGRA ES CSEREPIPARI VALLALATA PUTNOKI TEGRAGYAR	Change of Fuel Quality Uncountable due to shortage of low sulfur coal for bricks.	15/2 DIOSGYORI ACEL ES VASONT KFT	Installation of Valuum/Dust Collectors For Two 17.5t Electric are Furnaces One 2.5t Electric are Furnaces (USD): 610,400 (HUF): 61,160,000
15/1 HAMOR RESZVENY- TARSASAG	Furnace Improvement and Fuel Change 8 furnaces to be improved by Rath type furnace (HUF) : 160,000,000	23/1 TISZAI VEGYI KOMBINAT	Using Ammonia Additive For NOx reduction by using Ammonia additive method (HUF) : 31,000,000

Table D9.1.6 Cost Estimation of Suction Dust Control System Installation in DAV

The cost for three suction system:

(a)	Dust collector:	USD 191,500
(b)	Fan:	35,000
(c)	Duct:	35,500
(d)	Bell-shaped suction (heat-proof steel):	3,000
(e)	Bell-shaped structure:	7,100
(f)	Mechanism to move bell-shaped suction	
	Caterpillar structure: 3 machines total:	12,200
(g)	Stack	
	Diameter : 1.5 m, height : 35 m:	55,000
(h)	Steel structures	
	Dust filter, steps, ladder, handrail:	10,500
(i)	Six containers:	7,700
(j)	Noise shield:	10,900
(k)	Foundations	
	Filter, fan, stack:	36,700
(l)	Installation (40%):	154,000
(m)	Practical design	44,700
	(Geological features, site investigation, static strength, civil engineering, steel structure, machine, electricity, control)	
Total:		USD 610,400
		HUF 61.16 million

Note: 1USD = 100.19 HUF as of December 15, 1993.
Freight charges are not included.

Table D9.1.7 Cost Estimation of Additional Measures for Factories

Plant	Case 1	Plant	Case 1
02/1 OZD KOHASZATI UZEMEM	Fuel Change For fuel change (HUF): 44,064,000	15/2 DIOSGYORI ACEL ES VASONT KFT	Retrofitting and Recuperator I/A, I-II car type kilns (heating furnace) (HUF): 60,000,000 Introducing recuperator for energy saving about 10%. Cost of equipment(HUF) : 1,650,000 Excluded cost for the following Incidental works: ・Retrofitting flue duct ・Air duct construction ・Keeping warm air system ・Air control values ・Control measures for high temperature above 200℃
03/0 ESZAKMAGYARO- RSZAGI TEGRA ES CSEREPIPARI VALLALATA PUTNOKI TEGRAGYAR	Change of Fuel Quality Uncountable due to shortage of low sulfur coal for bricks.		
04/1 BORSODCHEM	Two-Stage Combustion Cost of equipment for two-stage combustion burner(60kg/h)(HUF): 1,650,000	17/1 HEJOCSABA DEMENT-ES MESZIPARI RT.	Using Low NOX Burner Low NOx burner cost of equipment (HUF) : 32,076,000 sp. Cement electric static kilns precipitators maintenance for all of factories.
09/2 SAGROCHEM KFT.	Two-Stage Combustion Cost of equipment for two-stage combustion burner(60kg/h)(HUF): 2,200,000