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NATIONAL REPORTING ON ATMOSPHERE/AIR POLLUTION

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1. Decision-making: Strategies, policies, programmes and plans, legislation, policy instruments and the regulatory framework; involvement of Major Groups

Air pollution control has been high on the environmental agenda since 1980s. After Finland's accession to the European Union in 1995, air pollution control has continued to evolve alongside the increasingly stringent Community legislation on the subject.

Thanks to well-planned measures to combat pollution from industrial plants, power stations and motor vehicles, harmful emissions and acidification have both declined considerably in Finland over the last 20 years. However, natural habitats in sensitive areas are still burdened by more acidifying deposition than they can naturally cope with, so the emissions that cause these problems need still to be cut further. Neither has urban air quality in Finland improved as rapidly as expected, even though traffic emissions have been curbed. Fine particles remain a serious problem, and emissions from industries, power stations, and smaller combustion plants causing fine particle concentrations should all be reduced further. The streets must also be cleaned more effectively from sand after winter season.

In general terms the air quality in Finland is good for most of the time at most places. However, during periods when certain atmospheric conditions prevail – particularly atmospheric inversions in the winter and spring – concentrations of pollutants in the air in Finnish cities may compare to or even exceed those observed in cities of similar size elsewhere in Europe. During such episodes concentrations of nitrogen oxides and particulate matter can be exceptionally high. In an air pollution episode these compounds are mainly produced by local traffic, but long range transport of fine particulate matter ($PM_{2,5}$) from, for example, wild land fires or controlled burning of the grassland in spring may also increase concentrations in Finland during eastern or south-easterly winds.

Environmental Protection Act

The Environmental Protection Act of March 2000 (86/2000) is applied to all activities that cause or may cause environmental damage. The principles of the Environmental Protection Act are:

- the prevention or the restriction of damages to a minimum caution and precaution principle,
- the application of the best available technology (BAT),
- the best practice from the perspective of the environment (BEP), and
- the polluter pays –principle.

The European Union directive on Integrated Pollution Prevention and Control (IPPC) is implemented through the Environmental Protection Act, which calls for integrating the control of emissions caused by industry.

An integrated system for environmental permits

The integration of the environmental permits system was one of the most important aims of the recent revision of the Environmental Protection Act. With the integration of the environmental legislation, pollution can be prevented efficiently since the environment is considered as a whole.

Applications for the environmental permits are made to one single authority, and all the environmental impacts of the activity will be assessed during the consideration of the permit. Technological solutions that save energy at the lowest possible cost need to be applied to reduce emissions.

The Act defines more explicitly and in a more integrated manner the requirements of environmental permits and the prerequisites for granting them.

Responsibility for environmental permits

Environmental permits are needed in Finland for all activities that may lead to pollution of air and water or contamination of soil. Permits may be granted to individuals or companies. Advice on permit application procedures is available from Finland's 13 regional environment centres, the three environmental permit authorities, local environmental authorities or the Finnish Environment Institute (SYKE).

Exceptional planning permission may also be required for certain types of building and changes in land use. Permits are also compulsory for the sale and use of certain chemicals, and for waste transportation and shipments, although in some cases a simple notification to the authorities will suffice. Off-road motor traffic and the use of motor boats are also subject to limitations designed to protect sensitive areas.

Official decisions on all permit applications are made public. Citizens have greater opportunity to influence the decision-making since the right to appeal has been extended. In addition to the parties involved (applicants for a permit and the party suffering inconveniences), associations and foundations that promote the protection of the environment, health and nature or improve the living environment have the right to appeal.

Government decrees on air pollution control

Under the Environmental Protection Act the Government may issue necessary decrees for the purpose of preventing and reducing environmental pollution.

The Government may stipulate by decree for example:

- on the quality, monitoring and observation of the environment;
- on emissions into the environment, restrictions of emissions and enforcement of emissions limits; and
- on emissions from machinery and equipment and on prohibiting or restricting their use or placement on the market.

In addition, if emissions resulting from the use of a fuel or a substance which may cause harmful effect to the atmosphere may be justifiably be deemed to cause harm to health or the environment the Government may stipulate by decree on the limiting or prohibiting the manufacture, import, placing on the market, export, transfer or use of a substance, preparation or product and on the composition and marking of a substance, preparation or product.

The Government decrees on the reduction of emission from transport are issued under the Vehicle Act. In this field the decrees follow the requirements of the EU legislation.

The Government decrees have proved to be significant in enforcing both national air pollution control targets and the EU legislation.

The tasks of Finland’s various environmental authorities

The Ministry of the Environment defines environmental policies, sets administrative controls and makes strategic plans at national level. The Ministry also sets targets for environmental protection, drafts and develops environmental legislation, and oversees international co-operation.

The Finnish Environment Institute (SYKE) produces and compiles environmental data, and develops new ways to protect water, the air and the soil, to improve waste management, and to improve the management of wastes and the supervision of chemicals. The institute also provides experts to participate in the drafting of environmental legislation.

Finland's 13 *regional environmental centres* implement environmental protection measures and ensure that environmental legislation is observed in their respective areas. They also process environmental permits for medium-sized industrial plants and waste processing facilities, and restoration permits for contaminated sites.

The Environmental Permit Authorities deal with permits for larger industrial plants, and permits issued under the Water Act.

Municipalities promote and supervise environmental protection on a local scale. They are also responsible for environmental assessments, like air quality monitoring. Local authorities also issue environmental permits needed by smaller plants and facilities.

The Finnish Meteorological Institute (FMI) Laboratory provides expertise in issues concerning air quality, quality control of measurements and measuring methods as well as atmospheric chemistry. It functions as the National Air Quality Reference Laboratory, and is responsible for verification of the comparability of municipal air quality measurements, arrangement of national comparison measurements, training, data collection from local networks and data transmission between the local, national and international level.

1.1 Assessing ambient air quality and the levels of air pollution

Air Quality Objectives

Finnish air quality objectives are basically twofold – there are binding limit values and non-binding national guide values. The mandatory air quality limit values correspond to those of the European Framework Directive (96/62/EC) and the three Daughter Directives (1999/30/EY, 2000/69/EY and 2002/3/EC).

The provisions of these directives have been transposed into the national legislation by the Environmental Protection Law (86/2000), the Government Degree on Air Quality (711/2001) and the Government Degree on Ozone (783/2003).

Limit values are legally binding maximum values which have to be attained by the given attainment date. If limit values are exceeded or if there is a risk of exceedance local authorities have to prepare plans or programmes to ensure that the limit values are met within the specific time limit. Limit values for the protection of human health, ecosystems and vegetation are presented in tables 1 and 2.

Guide values set non-binding longer term targets for air quality. They are to be taken into account in various kind of planning activities like land use planning, traffic management and environmental permitting. Air quality guide values are presented in table 3.

Table 1. Limit values for the protection of human health

Compound	**Averaging time for the limit value**	**Limit value (293 K, 101,3 kPa)**	**Allowed exceedances/ reference year**	**Attainment date**
Sulphur dioxide (SO_2)	1 hour	350 µg/m^3	24	1.1.2005
	24 hours	125 µg/m^3	3	1.1.2005
Nitrogen dioxide (NO_2)	1 hour	200 µg/m^3	18	1.1.2010
	1 year	40 µg/m^3	-	1.1.2010

Particulate matter (PM_{10})	24 hours	50 µg/m^3 [1)]	35	1.1.2005
	1 year	40 µg/m^3 [1)]	-	1.1.2005
Lead	1 year	0,5 µg/m^3	-	15.8.2001
Carbon monoxide (CO)	8 hours [2)]	10 mg/m^3	-	1.1.2005
Benzene (C_6H_6)	1 year	5 µg/m^3	-	1.1.2010

[1)] Concentrations are expressed in ambient conditions
[2)] Highest running eight hour average.

Table 2. Limit values for the protection of ecosystems and vegetation

Compound	**Averaging time for the limit value**	**Limit value (293 K, 101,3 kPa)**	**Allowed exceedances/ reference year**	**Attainment date**
Sulphur dioxide (SO_2)	1 year and 1.10. – 31.3.	20 µg/m^3	-	15.8.2001
Nitrogen oxides (NO_x)	1 year	30 µg/m^3	-	15.8.2001

Table 3. National air quality guide values

Compound	**Guide value (20 ºC, 1 atm)**	**Statistical definition**
Carbon monoxide (CO)	20 mg/m^3	hourly mean
	8 mg/m^3	running 8 hour average
Nitrogen dioxide (NO_2)	150 µg/m^3	99. percentile of the hourly averages per month
	70 µg/m^3	2. highest daily average of each month
Sulphur dioxide (SO_2)	250 µg/m^3	99. percentile of the hourly averages per month
	80 µg/m^3	2. highest daily average of each month
Total suspended particulates (TSP)	120 µg/m^3	98. percentile of the daily averages per year
	50 µg/m^3	annual average
Thoracic particulates (PM10)	70 µg/m^3	2. highest daily average of each month
Total reduced sulphur (odorous sulphur compounds) (TSR)	10 µg/m^3	2. highest daily average of each month

In addition to binding limit values and non-binding guide values there are target values and long-term objectives for ozone. These targets are based on Directive 2002/3/EC relating to tropospheric ozone. Target values are to be met as far as possible by the year 2010. For long term objectives there is no specific attainment date, but year 2020 is used as a benchmark. Air quality objectives for tropospheric ozone are presented in table 4.

Finally, there are warning thresholds for sulphur dioxide (500 µg/m^3/three consecutive hours), nitrogen dioxide (400 µg/m^3/three consecutive hours) and ozone (240 µg/m^3/hour) and a separate information threshold for ozone (180 µg/m^3/hour). All thresholds values are based on relevant European Air Quality Directives.

Table 4. Target values and long-term objectives for ozone

Type of target	**Measured parameter**	**Concentration or AOT value (293 K, 101,3 kPa)**	**Allowed exceedances**
Target value for the protection of human health to be met by 2010	maximum daily 8 hour average	120 µg/m^3	25 days per calendar year averaged over 3 years
Target value for the protection of vegetation to be met by 2010	AOT40 [1)]	18 000 µg/m^3 h	5 year average
Long-term objective for the protection of human health	maximum daily 8 hour average	120 µg/m^3	-
Long-term objective for the protection of vegetation	AOT40 [1)]	6 000 µg/m^3 h	-

[1)]AOT40 calculated from 1 hour values from May to July measured between 8.00 - 20.00 CET

Background air quality monitoring

Finnish Meteorological Institute (FMI) is responsible for the national background air quality monitoring. The network consists of some twenty measurement stations in different parts of the country. Most of the measurements are part of the international monitoring and research programmes like EMEP (Co-operative programme for monitoring and evaluation of the long-range transmission of air pollutants in Europe), IM (Integrated Monitoring), GAW (Global Atmosphere Watch), AMAP (Arctic Monitoring and Assessment Programme) and HELCOM (Helsinki Commission monitoring programme).

The background air quality monitoring started in the beginning of the 1970's. The longest time series include sulphur dioxide and major ions in precipitation. Today measurements include a variety of sulphur and nitrogen compounds, ozone, volatile organic compounds and heavy metals. The monitoring results are published annually in the *Air Quality Measurements* yearbook. Further information can be found at http://www.fmi.fi.

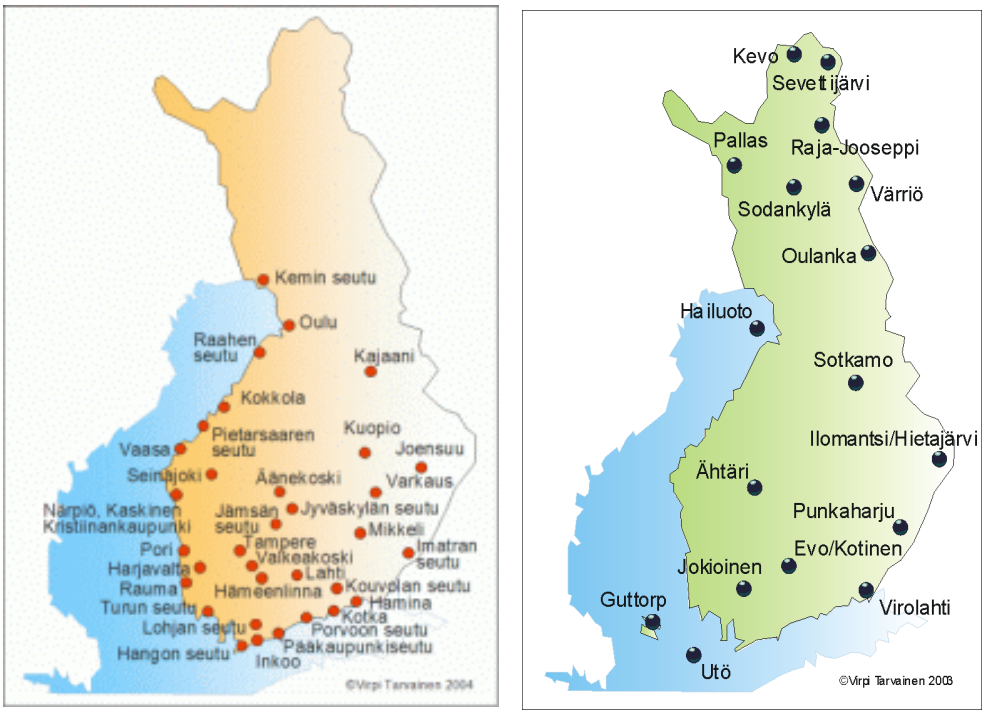
Urban air quality monitoring

Urban air quality is monitored at some 35 monitoring networks. The total number of stations is about 120 – majority of which are multi pollutant stations. The network in the Helsinki Metropolitan Area consists of seven fixed and three mobile stations, and is the most extensive network in Finland. About 50 % of the whole population lives in municipalities where there is at least one measuring station. For example, all municipalities above 45 000 inhabitants monitor PM_{10}, but there are also municipalities below 10 000 inhabitants where PM_{10} measurements are performed either to assess the overall air pollution caused by traffic or the contribution of a particular point source.

Most commonly measured pollutants – with some 55 – 65 measurement stations each – are sulphur dioxide, nitrogen oxides and thoracic particles (PM_{10}). Total suspended particulates, ozone, carbon monoxide and odorous substances (TRS = Total Reduced Sulphur) are

measured less frequently with some 20- 30 stations. Fine particulates ($PM_{2,5}$) have been measured only for a reasonably short period of time – since late 1990's – but the number of measuring stations is slowly increasing. Today, fine particulates are measured at six stations which are run by municipalities.

Thoracic particles (PM_{10}) represent airborne particles with an aerodynamic diameter of 10 micrometers or less which pass through the upper respiratory organs and enter the human thoracic airways. Fine particles ($PM_{2,5}$) are particles with an aerodynamic diameter of 2,5 micrometers or less which can pass deep into the respiratory track and deposit in the lung alveoli.



Urban monitoring networks and rural background monitoring stations in Finland (Source: Finnish Meteorological Institute)

The gradual improvement of air quality can be seen, for example, in the air quality trends of the Helsinki Metropolitan Area, which is the largest urban agglomeration in Finland with approximately one million inhabitants. Similar kind of development has taken place elsewhere. At the same time, however, the number of inhabitants exposed to air pollutants has increased since more and more people move into the cities and their surrounding areas, which in turn, leads to urban sprawl and increased traffic volumes.

The downward trend starting from the 1970's and 1980's is most apparent for sulphur dioxide (SO_2) and carbon monoxide (CO) for which about half of the trends are statistically significantly decreasing. Nitrogen monoxide (NO) concentrations have fallen along with emission reductions in traffic and other sources, but the concentrations of nitrogen dioxide (NO_2) have decreased only slightly which is presumably due to the complex atmospheric reactions of the nitrogen species and high NO_2/NO ratio from new diesel vehicles sites. Decreasing trends calculated from annual statistics have thus been found only at some 18 % of the measurement.

As for particles, the total suspended particles show a clear downward trend starting from the late 1970's. Unfortunately, for thoracic particles (PM_{10}) the trend is not as clear and undisputable. However, at some locations the maximum concentrations are coming down and also the average concentrations are slowly decreasing. Decreasing trends calculated from

annual statistics have been measured at some 13 % of the stations. Fine particles ($PM_{2,5}$) are measured at eight locations. Most of the stations have operated only for a limited period of time so that trend analyses are not available yet. Measured annual average concentrations at urban stations in Helsinki are around 10 micrograms/m^3. Equal results obtained from background stations at Utö (near the south cost of Finland) and Virolahti (close to the south-eastern Russian border) demonstrate the transboundary nature of fine particulate matter. For ozone, half of the studied time series show a statistically significant increasing trend.

In a recent study *The Preliminary Assessment under the EC Air Quality Directives in Finland - SO_2, NO_2, NO_x, PM_{10} and lead (Finnish Meteorological Institute, 2001)* measured and modelled concentrations were compared with the limit values and assessment thresholds set out in the European Air Quality Directive 1999/30/EC. The available data covered years 1994 – 1998 with special emphasis on particulate matter. The spatial annual mean of PM_{10} concentrations for selected urban areas were evaluated with a semi empirical model, which utilizes the measured PM_{10} and NO_x concentrations and the modelled NO_x concentrations. According to the measured and modelled data the PM_{10} concentrations are highest in the city centres and near the busiest roads of the largest cities, but high concentrations are possible also in reasonably small towns and conurbations.

Similar kind of studies *The Preliminary Assessment under the EC Air Quality Directives in Finland - Carbon monoxide and benzene (Finnish Meteorological Institute, 2002)* and *The Preliminary Assessment under the EC Air Quality Directives in Finland - Ozone (Finnish Meteorological Institute, 2003)* have been commissioned by the Ministry of the Environment and they cover pollutants of the second and third air quality daughter directives. Preliminary assessment reports and a more recent report *Air Quality in Finland (Finnish Meteorological Institute, 2003)* with graphs and an English summary can be downloaded at http://www.fmi.fi. Further information on the Helsinki Metropolitan Area can be found at http://www.ytv.fi/english/air/index.html.

Since the year 2000 and transposition of the Directive 1999/30/EC the limit values for sulphur dioxide, particulate matter and carbon monoxide to be attained by 2005 have not been exceeded at fixed monitoring sites used for compliance checking. Also the nitrogen dioxide concentrations have stayed below the 2010 limit values. However, annual nitrogen dioxide values and daily PM_{10} concentrations are sometimes quite close to the limit values and, thus, exceedances are possible at hot spot areas near busy traffic lanes and in canyon streets with poor dispersion conditions. In 2003 the daily limit value for PM_{10} was exceeded at one mobile measuring station in Helsinki leading to a process of preparing and implementing an air pollution abatement plan (See Chapter 1.3 on plans to deal with severe air pollution incidents).

National guide values are usually more difficult to meet than limit values due to different statistical definitions. Exceedances of the guide values are fairly common and sometimes quite widespread indicating a need for further air pollution abatement measures. According to the report *Air Quality in Finland (Finnish Meteorological Institute, 2003)* the daily guide value for thoracic particles (PM_{10}) was exceeded at 40 % of the stations in year 2000, while those for total suspended particles (TSP) and total reduced sulphur (TRS) were exceeded at 56 % and 18 % of the stations respectively. The guide values for sulphur dioxide and nitrogen dioxide were exceeded at two stations which represents only 1 – 2 % of the stations. The guideline values for carbon monoxide were not exceeded in 2000.

1.2 Control of air pollution (e.g. for stationary, mobile, area and other pollution sources)

Emission trends

In Finland, the sources of nitrogen oxides (NO_x) and sulphur dioxide (SO_2) are mainly in energy production. Nitrogen oxides are generated also in the transport sector and ammonia (NH_3) emissions in agriculture.

Finland reports air pollutant emission data annually to the Secretary of the UNECE Convention on Long-Range Transboundary Air Pollution and to the EU Commission. The emission inventory methodology is based on national and default methods being consistent with the EMEP/Corinair Atmospheric Emission Inventory Guidebook.

Emissions of acidifying compounds and particles in 1990-2003

	Emissions of acidifying compounds and particles (1 000 tonnes)							
	SO_x (as SO_2)	NO_x (as NO_2)	NH_3	NMVOC	CO	PM_{tot}	PM_{10}	$PM_{2,5}$
1990	260	286	38	227	622	Particulate matter emissions have been estimated since 2000		
1991	194	271	-	213	595			
1992	141	266	-	207	567			
1993	123	265	-	197	541			
1994	114	263	-	194	532			
1995	96	238	35,2	186	522			
1996	105	246	-	180	543			
1997	99	235	38	175	559			
1998	90	227	-	171	537			
1999	87	220	35,2	166	631*			
2000	73,5	210	33,1	159,9	608*	73,6	48,2	37,7
2001	85,2	222	33,2	157,1	605*	80,1	56,6	39,6
2002	82,4	208	33,3	151,1	600,4*	81,2	54,8	38,7
2003	98,8	219	33,2	145,2	563,9*	81,7	54,9	38,3

* Emission increase originates from emissions of off-road machinery (macinery used in construction, agriculture and other applications). These emissions have been calculated since year 1999. Emission data from years 1990-1998 will be updated during year 2005.

Heavy metal emissions in 1990-2003
Finland reports emissions of the following eight heavy metals: arsenic, cadmium, chrome, copper, lead, mercury, nickel and zinc. Emissions of vanadium are also calculated, but emissions of selenium are not estimated in time series. The main sources of heavy metal emissions in Finland are production of non-ferrous metals and waste incineration.

	Heavy metal emissions (tonnes)								
	Lead (Pb)	Cadmium (Cd)	Mercury (Hg)	Arsenic (As)	Chrome (Cr)	Copper (Cu)	Nickel (Ni)	Zinc (Zn)	Vanadium (V)
1990	326,1	6,3	1,1	33,2	31,6	94,4	67,0	570,5	-
1991	247,7	3,4	0,9	22,1	41,4	90,7	45,1	381,4	-
1992	174,7	2,9	0,8	16,0	31,2	65,5	37,1	283,7	-
1993	99,7	2,9	0,6	14,3	20,5	54,1	25,9	259,6	-
1994	60,1	2,4	0,7	9,3	19,6	48,9	33,6	315,6	-
1995	56,6	1,7	0,7	3,5	21,7	26,7	33,8	321,7	-
1996	35,0	1,5	0,8	7,2	21,2	54,5	25,0	191,3	-
1997	18,5	1,1	0,6	12,3	20,5	72,3	27,8	70,2	-
1998	20,3	1,3	0,5	12,4	18,2	27,4	20,8	71,2	-
1999*	-	-	-	-	-	-	-	-	-
2000	37,5	1,4	0,6	4,6	28,0	18,7	33,3	70,7	59,6
2001	37,5	1,6	0,7	5,2	26,1	19,3	33,0	69,1	65,9
2002**	39,6	1,3	0,7	3,7	37,6	28,1	35,9	87,8	63,4

2003	33,5	1,2	0,8	3,2	27,4	21,5	33,8	62,8	68,4

* Emission data from year 1999 is missing. This emission data will be added with time series (1990-1998) updating.
** Emission data will be rechecked with time series updating.

Emissions of persistent organic compounds in 1990-2003
Finland reports emissions of polyaromatic hydrocarbons (PAHs) as the sum of benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene and indeno(1,2,3-cd)pyrene (PAH-4). The emissions of dioxins and furans (PCDD/F) are also included in the reporting. In Finland, the sources of these compounds are mainly in incomplete combustion. The use of POP compounds is restricted or forbidden.

	Emissions of persistent organic compounds (POP)	
	g I-TEQ	**kg**
	Dioxins and furans	Polyaromatic hydrocarbons (PAH)
1990	30	15 800
1991	33,3	15 300
1992	31,2	15 500
1993	31,9	15 700
1994	32,7	15 600
1995	33,8	16 900
1996	31,7	15 800
1997	32,0	16 100
1998	32,1	16 300
1999	32,2	15 900
2000	30,7	15 200
2001	30,6	16 300
2002	32,2	16 900
2003*	32,3	16 700

* PCB (0,204 kg) and HCB (0,460 kg) emissions were calculated separately at 2003.

The Air Pollution Control Programme 2010

In September 2002, the Finnish Government approved a national programme setting maximum annual limits for emissions of sulphur dioxide, nitrogen oxides, ammonia and volatile organic compounds to be complied with from 2010 onwards. The programme contains measures to reduce emissions from energy production, transport, agriculture and industry, and also sets out ways to curb emissions from machinery, leisure boats and the small-scale combustion of wood.

The Air Pollution Control Programme 2010 has been specifically designed to transpose the European Union National Emission Ceilings Directive. The implementation of this directive throughout Europe should reduce the emissions and subsequent atmospheric deposition of pollutants that cause eutrophication and acidification in Finland, while also curbing long-range ozone and particle pollution, and thus improving air quality.

Achieving these targets must involve co-ordinated international action in addition to measures taken in Finland, since a considerable proportion of the air pollution that causes problems in Finland actually originates from other European countries.

Targets

The National Emission Ceilings Directive obliges EU member countries to cut emissions of sulphur dioxide (SO2), nitrogen oxides (NOx), ammonia (NH3), and volatile organic

compounds (VOCs) with the exception of methane (CH4), to certain limits, which must not be exceeded after 2010. These substances can be transported for long distances in the atmosphere, and they may result in acidification, the formation of ozone near ground level, eutrophication or the formation of secondary aerosol particles. Where these forms of pollution are concerned, the locations of emission sources and geographical connections with the affected sensitive areas or human populations are highly significant – in contrast with the global nature of the impacts of greenhouse gas emissions.

Planned emission cuts

The Air Pollution Control Programme 2010 is largely based on existing and previously planned measures, and other EU legislation soon due to come into effect. The programme contains measures to reduce emissions from energy production, traffic, agriculture and industry, and also sets out ways to curb emissions from machinery, leisure boats and the small-scale combustion of wood.

Estimates of the emissions of sulphur dioxide, nitrogen oxides, ammonia and VOCs in Finland in 2010, and information about the measures planned to curb them were all compiled during summer 2002 by a working group set up by the Ministry of the Environment, also containing representatives from the Ministry of Finance, the Ministry of Agriculture and Forestry, the Ministry of Transport and Communications, and the Ministry of Trade and Industry. The working group also assessed information on models and scenarios prepared by experts from the Finnish Environment Institute (SYKE) and the Technical Research Centre of Finland (VTT). The first annual report on the emissions covered by the directive was submitted to the European Commission in December 2002, together with the Air Pollution Control Programme 2010.

Monitoring the implementation of the programme

The Ministry of the Environment and other stakeholders are closely monitoring the implementation of the Air Pollution Control Programme 2010. Monitoring is particularly important concerning the possible impacts of Kyoto mechanisms and EU emissions trading, the implementation of the Large Combustion Plants Directive, and the renewal of Finland's motor vehicle fleet. If necessary, a revised programme may be prepared by 1 October 2006 under the supervision of the Ministry of the Environment.

1.3 Plans to deal with severe air pollution incidents

Legislative background

According to the Finnish Environmental Protection Act local authorities (municipalities) are responsible for arranging the necessary air quality monitoring taking into account local circumstances. Furthermore, there are specific provisions in the law stating that local authorities have to exercise their power to prevent limit value exceedances and to take necessary action if limit values have been exceeded. Such action may include emission reductions and suspension of traffic.

Government Decree on Air Quality (711/2001) oblige municipalities to prepare and implement plans and programmes for attaining the limit values within the given time, or to establish a specific scheme concerning re-suspension of particulate matter and winter sanding. Also the Act on the Maintenance and Sanitation of Streets and Certain Public Areas (669/1978) sets obligations for local authorities and property owners to remove grit and sand effectively from the streets and sidewalks and to reduce re-suspension of road dust.

Air Quality Episodes

The meteorological factors play conclusive role in air pollution episodes. In adverse weather conditions even average traffic volumes are enough to prolong the episode. According to the study high nitrogen dioxide concentrations during an episode would not be significantly lower even if traffic restrictions were introduced. Instead, long-term measures for air pollution control are called for. The most effective measures are the technical improvements of vehicles and fuels, as well as better urban planning and traffic management. The action plans for air pollution episodes support this long-term air protection work.

The Finnish Technical Research Centre (VTT) has studied the role of meteorological factors in air pollution episodes and the possibilities to control the duration and severity of such episodes (*Kari Mäkelä et al. 1997: Air pollution episodes).* The duration and frequency of episodes have occasional variation. Serious episode situations occur approximately every two to five years but less pronounced periods of poor air quality are observed every year. Episodes are associated with stagnant anticyclones, light winds and surface inversions. In Finland air pollutions episodes have been of relatively short duration – from two to five days at the maximum.

However, the symptoms of those suffering from respiratory or heart deceases can be aggravated and even healthy subjects can experience symptoms during the episodes. It is therefore necessary to prepare plans of action for areas where air quality objectives are at risk to be exceeded. Some major cities in Finland have already prepared such plans. An effective system for public information is essential in cases where air pollution episodes are likely to occur. Especially those with health risk need to be notified about the situation. Public awareness is important in order to facilitate voluntary action to lower the emissions and to reduce exposure to the pollutants. The purpose is to encourage transition from private cars to public transport, car sharing, cycling and walking – though keeping in mind that the most vulnerable subgroups may have to reduce exposure by staying inside.

Winter sand problem

Use of road sand (grit material) and studded winter tyres is typical for Finland. As a consequence of these traffic safety measures we have high PM concentrations especially in the spring time. The contribution of re-suspension of road sand is difficult to estimate exactly, but it is the major source of suspended particulates (particularly the coarse fraction). A recent study has indicated, that road sand acts like a sand paper – thus called "the sand paper effect" – and increases asphalt wear considerably. The re-suspension includes road sand, asphalt, material from tires, studs, brakes etc. The share of each component is still under study. It can be estimated, that roughly 1/3 of the particle mass comes from tail pipe and stack emissions and 2/3 from re-suspension. The share of re-suspended particles is highest in the spring.

Local authorities have taken various measures to alleviate the road sand problem and to reduce concentration of particulate matter, particularly since the introduction of new, binding air quality limit values for PM_{10}. For example, the amount of gritting material (material used for winter sanding of streets) has been reduced, the quality of sanding material has been improved by washing and sieving, and new road maintenance equipment and better procedures (better planning and timing) have been introduced, which has led to improvements in average TSP levels and maximum concentrations. Annual variation in the meteorology, however, can have significant effect (e.g. through the amount of road sand needed during the winter period and possibilities to remove the road sand effectively in the spring) on the maximum PM concentrations and the number of days with elevated PM levels. The City of Helsinki has prepared a scheme *Helsinki City Abatement Plan to Reduce the Harmful Effects of Road Sand (Helsinki: 2003)* concerning PM_{10} limit value exceedances observed in 2003 and required by the Government Degree on Air Quality.

Ozone

Tropospheric ozone is still, to a large extent, a transboundary problem. Highest hourly concentrations are usually measured at background stations, and the urban areas act as ozone sinks. Thus, the concentrations also in the Helsinki Metropolitan Area are lower than those at the Finnish background monitoring stations. The population information threshold (180 $\mu g/m^3/h$) was exceeded twice in 1996 and three times in 2004. The warning threshold (240 $\mu g/m^3/h$ has not been exceeded in Finland. However, the long-term ozone averages have been increasing in the 1990's both at traffic stations and urban background stations.

Finnish Meteorological Institute maintains monitoring and warning system for tropospheric ozone concentrations. The hourly values of ozone measured at the selected measuring stations are shown in real time on internet from April to September.

1.4 Programmes designed to reduce indoor air pollution

In Finland, due to our cold and northern location, people spend much of their lives time indoors. We therefore have to design buildings that shelter us against the adverse conditions, yet, at the same time, have good quality indoor air. The building itself, its design, construction, use and maintenance, will cause serious problems with indoor air. The need to build tight houses for energy conservation is not always easy to combine with the need for healthy indoor air quality.

Good indoor air quality (IAQ) is recognised as an important question of national health and national economy in Finland. In our cold climate, however, good IAQ must be combined with good energy economy.

Official requirements

Construction activities in Finland are regulated under the Land Use and Building Act. The Ministry of the Environment issues the Building Code, which consists of binding regulations and guidelines. Act and Building Code incorporate the requirements of European Union (EU) construction product directive.

The municipal building authorities, who give the building permit and who also control and guide the construction activities generally, supervise the building regulations locally.

Air quality in buildings is regulated in accordance with the Health Protection Act under the supervision of the Ministry of Social Affairs and Health. The ministry gives detailed guidelines for defining air quality requirements in practice, for example, in the form of allowed maximum concentrations of impurities in indoor air. These guidelines are mainly based on the need to protect health and they follow to large extent international recommendations, among others, WHO recommendations.

Local health authorities in the municipalities also supervise air quality reguirements. The local authorities can also take measurements of indoor air quality in homes and state buildings, such as schools and kindergartens. Additionally they can give guidelines for renovation and if necessary even prevent the use of buildings with poor air quality before renovations.

Finnish classification of indoor climate 2000

This classification is voluntary and not a part of the official Building Code. It has been prepared by researchers and other interested parties to aid building owners, architects, other designers, builders and manufacturers of materials and building components in achieving good indoor air quality. Besides the Ministry of the Environment, all main branch organisations in the building sector support and recommend the classification.

The classification has three main parts:

- The classification of indoor climate, categories S 1, S 2, S 3, gives target and design values for thermal conditions, odour intensity, noise levels, ventilation and indoor air pollutants.
- The guidelines for design and construction, including the classification of cleanliness in the construction, categories P 1, P 2, is composed of principles and procedures for the main stages of construction work.
- The classification of finishing materials, categories M 1, M 2, M 3, contains maximum allowed values for harmful emissions from finishing and other construction materials.

In all these classifications, better indoor air quality correspond to a lower category number, and the higher numbers correspond the minimum accepted requirements for the IAQ in accordance with the official building regulations.

Construction clients, building owners and designers can use the classification as a tool in setting target values for indoor climate and in achieving these goals during the construction process. Designers in various building projects have used especially the first part of the classification, dealing with the target values of indoor air quality, widely.

For more detailed information about the classification system see the website, www.rts.fi.

1.5 Policy measures taken to improve the quality of fuels – including lead in gasoline

Mandatory requirements and monitoring

Finnish mandatory fuel requirements for petrol and diesel oil correspond to the European Community legislation (Directive 98/70/EC of the European Parliament and of the Council of 13 October 1998 relating to the quality of petrol and diesel fuels amended by Directives 2000/71/EC and 2003/17/EC).

The directives have been transposed into national legislation by the Government Degree on the Quality of Petrol and Diesel Oil (1271/2000, 1265/2002, 767/2003).

Fuel quality monitoring is organized in co-operation with the Ministry of the Environment and the Finnish Customs Office. The Finnish Customs is in charge of the practical realization of the monitoring programme. Pump samples of petrol and diesel oil are taken according to the sampling plan, and the samples are analyzed at the Customs Laboratory. The results are reported to the Ministry and further to the European Commission. Reported data can be found at http://europa.eu.int/comm/environment/air/fuel_quality_monitoring.htm

Leaded petrol

Until 1980 the maximum lead content of petrol was 0,7 g/l, from which it has been lowered step by step as follows:

Effective as from	RON 95 Pb g/l	> RON 95 Pb g/l	Legal document
1.1.1985	0,15	0,4	157/1983
1.1.1986		0,15	157/1983
1.9.1989	0,013	0,15	1025/1988
1.1.2000	0,005	0,005	786/1999
1.1.2001			1271/2000

From 1 January 2000 the marketing of leaded petrol has been banned. Small quantities to the maximum of 0,5 % of total sales may be allowed to be marketed for vintage cars and restricted purposes (old vehicles of a characteristic nature and to be distributed through special interest groups). This, however, requires in advance allowance from the Ministry of the Environment.

Such allowances have not been requested. The derogation possibility is equal to Article 3 of the European Community Directive 98/70/EC.

Economic incentives were used to promote the use of unleaded petrol, and to discourage the use of leaded qualities. Tax differentiation of leaded and unleaded petrol was introduced in 1986. The amount of the differentiation was 0,45 FIM/litre (0,076 euros/litre). The phase-out period of leaded qualities was relatively short, and in 1994 practically all petrol sold in Finland was unleaded.

Reformulated petrol and City Diesel

Environmental differentiation of excise duty on reformulated motor petrol and low-sulphur diesel oil (50 ppm sulphur) was introduced in the beginning of 1993. The policy objective was to promote the use of oxygenated e.g. reformulated motor petrol and low-sulphur diesel oil through tax differentiation by levying a lower excise duty rate on improved fuel qualities. In about two years almost 100 % of all motor petrol sold in Finland was reformulated. Similar results were obtained in the market share of low-sulphur diesel oil. The quality criteria applied were:

Reformulated petrol	
oxygen content	at least 2 but not more that 2,7 %
benzene content	max. 1 v/v %
vapour pressure	
1.6.-31.8. (summer quality)	max 70 kPa
1.9.-31.5. (winter quality)	max 90 kPa
aromatic hydrocarbons	max 35 v/v %

Low-sulphur diesel oil	
sulphur content	max 0,005 w/w % = 50 ppm
aromatics	max 20 v/v %
setane index/number	at least 47

Full scale introduction of sulphur-free petrol and diesel as from 2005

Sulphur-free fuels have been available on the Finnish markets from year 2002 onwards and their share of the total sales has increased steadily. Fuel suppliers are obliged to provide sulphur-free fuels on the market, but there are no detailed legal provisions on how this should be done (for instance mandatory availability of sulphur-free fuels in certain type of stations near highways etc.). The Government policy has been to perform full scale shift from low-sulphur fuels to sulphur-free qualities as from 1.1.2005, since it is not economically feasible to have two parallel fuel distribution infrastructures for sulphur-free fuels and fuels with higher sulphur content. It was anticipated that with the help of economic incentives the shift to sulphur-free fuels would happen in practice more or less completely in 2004 - 2005. New tax provisions and criteria came into force on the 1st of September 2004. It seems that the shift to sulphur-free petrol and diesel oil has taken place as planned and no major set backs have emerged. New quality criteria for reduced tax levels are:

Reformulated sulphur-free petrol	
sulphur content	max 0,001 w/w % = 10 ppm
oxygen content	at least 2 but not more that 2,7 %
vapour pressure	

1.6 – 31.8	(summer quality)	max 70 kPa
1.9 – 31.5	(winter quality)	max 90 kPa

Sulphur-free diesel oil
sulphur content max 0,001 w/w % = 10 ppm

Biofuels in the transport sector

The use of biofuels in transport has been and still is negligible. Some pilot projects on bioethanol have been performed in 2003 – 2004. In our national report to the Commission pursuant to Directive 2003/30/EC the overall target for biofuels used in the transport sector in 2005 is 0,1 %. The target is set at such low level because we emphasize the role of the energy sector – heat and power production – as the primary utilizer of bioenergy. According to the report it is not possible to set a definite national target for 2010 at this point of time. However, it is estimated that the maximum share of transport biofuels – originating from domestic raw materials – could be around 2 % by 2010 if intensive government support like investment aid or tax relieves were used. The full Finnish report in English and Finnish can be downloaded at http://europa.eu.int/comm/energy/res/legislation/biofuels_members_states_en.htm.

Some interesting new developments and initiatives have taken place quite recently in development of biofuels. The Finnish oil company Neste Oil has developed a new biomass-to-liquid –type of fuel called NExBTL. The first full scale commercial unit (170 000 t/a) will start-up in 2007. NExBTL is a synthetic biofuel which can be produced from bio-oils like vegetable oil and animal fats. It is a flexible blending component compared with traditional biofuels – like ethanol and biodiesel – because it can be blended in with diesel fuel without technical limitations. Typical blends, in the range of 5 – 50 % will not compromise the limit values of the Directive 98/70/EC or requirements of the European Standard EN 590. Furthermore, there are no storage problems because NExBTL is stable and has excellent cold properties. It's free of aromatics and sulphur and compares well with GTL fuels in emission performance and FAME in CO2 performance. The production costs of NExBTL are higher than for regular or sulphur free diesel so that tax incentives are needed for commercial breakthrough.

1.6 Policies promoting cleaner transportation measures and technology

Finland (Ministry of Transport and Communications and its administrative sector) has had an environmental management programme for transport policy since 1994. The new programme *Environmental guidelines for transport sector till 2010,* which is third in order, covers years 2005-2010. The programme is available on web-site: www.mintc.fi/environment and a paper copy of the programme can be provided. The programme defines objectives and measures needed to reach these objectives in the following areas:

- reduction of transport-related greenhouse gas emissions;
- reduction of other exhaust emissions and improvement of air quality;
- reduction of noise emissions and reduction of number of people annoyed by traffic noise;
- reduction of other environmental and health problems caused by transport (pollution of waters and soil, biodiversity and waste problems); and
- development of transport system to become ecologically more sustainable.

The programme also shares responsibilities for measures that needs to be taken and establishes a follow-up mechanism with follow-up indicators.
As regards measures promoting cleaner transportation and technology, they are especially the following:

- active participation in EU and other international work (within UNECE, ICAO, IMO) to promote setting and adoption of more stringent emission standards, cleaner and more energy-saving vehicles and other measures;

- funding national research programmes and studies with the aim to produce data on clean technologies and alternative fuels. The main emphasis at the moment is given on increasing knowledge on transport-related small and fine particle pollutants and efficient measures for reducing them (especially so-called FINE-particle programme). Another priority in transport research is increasing knowledge on efficient measures for reducing emissions and energy consumption of heavy duty vehciles (so-called HD-Energy-programme);
- development of national and local/urban transport system:
- promotion and development of public transport system, cycling and walking,
- promotion of railway transport and short-sea shipping,
- promotion of Mobility Management,
- promotion of tele-working and other information technologies,
- integration of urban planning and transport planning,
- improvement of transport logistics (Finland has chosen “Improvement of Transport Logistics” as a main theme in transport sector for its EU-Presidency in fall 2006),
- voluntary energy saving programmes with transport companies and hauliers,
- promotion of eco-driving,
- development of economic measures and guidance,
- developing new service concepts, such as car sharing, Mobility Centres, Cycling Service Centres and possibly introduction of service cars providing different kind of combined services in scarcely populated areas (shopping, postal, pharmacy, library etc. services),
- sharing responsibilities between transport service providers and other industries (those who buy transport services) in order to improve energy saving and increase environmental performance; and
- development of CBA-calculations of transport investments (taking into account health and other social aspects such as comfort, accessibility, attractiveness of living environment and security should promote development of sustainable modes of transport); and
- participation in awareness raising and information campaigns, such as so-called Moving Finland –campaign, Mobility Week and Car Free Day.

1.7 Emission limits of vehicles and machinery

The use of vehicle emission standards has traditionally been the most efficient way of reducing exhaust emissions generated by traffic. A major step was the introduction of emission limits that required catalytic converters in early 1990s. After 1995 vehicle emission standards in Finland have been exactly the same as in EU legislation. Finland has supported the step by step approach to tighten the European emission limit values and is in favor of quick introduction of new EURO V and EURO VI regulations.

First regulations for non-road mobile machines were introduced in 1998 so that the technologies developed for heavy duty vehicles are applied for these diesel engines. Decisions on third and fourth generation limit values for this category of engines were taken to government degree in June 2005. At the same time, first emission standards for railway and inland waterway engines were given. Somewhat earlier, the scope of engine regulations was extended to cover spark ignition engines in small non-road machinery, 2- and 3-wheel vehicles and recreational boats.

Emission limit values as re set within EU-legislation or E-regulations of the UNECE. Broad international alignment is advantageous providing that standards are on a high level of ambition reflecting the use of best available technology.

1.8 Role played by air pollution in urban planning, especially related to transportation

In Finland, more than 400 local authorities independently plan land use on a local scale through local master plans, which define land use patterns, and local detailed plans, controlling construction. The municipal land use plans also cover streets and transportation planning.

On the regional level, regional land use plans are drawn up by Finland's 19 regional councils, which are made up of the representatives of local authorities. To integrate land use and transportation planning, National Road Administration has a significant role in the planning processes. Regional plans must be approved by the Ministry of the Environment.

Finland's Environmental Administration develops and controls land use planning and construction throughout the country. Finland's 13 regional environment centres additionally control municipal planning and construction within their respective regions. The Finnish Environment Institute (SYKE) conducts research and monitoring related to the built environment.

Land Use and Building Act (1999) aims to organise land use and construction to create the basis for high quality residential environments and to promote ecologically, economically, socially and culturally sustainable development. Among other things this includes good air quality.

Land use plans must be founded on sufficient studies and reports. When a plan is drawn up, the environmental impact of implementing the plan, including socio-economic, social, cultural and other impacts, must be assessed to the necessary extent. Such an assessment must cover the entire area where the plan may be expected to have material impact. (Land Use and Building Act, Section 9 *Impact assessment in connection with planning*)

When a land use plan's impact is investigated, the purpose of the plan, earlier investigations and other factors affecting the need for investigations must be taken into account. Investigation must provide the data necessary for assessing the significant direct and indirect impact of the plan's implementation on the following:
1) people's living conditions and environment;
2) soil and bedrock, water, air and climate;
3) plants and animals, biodiversity and natural resources;
4) regional and community structure, community and energy economy and traffic;
5) townscape, landscape, cultural heritage and the built environment.
(Land Use and Building Decree, Section 1 *Impact assessment in connection with planning*)

The land use and building legislation gives good guidance for land use and transportation planning. Anyway, some expressions, such as *"sufficient studies and reports"* or *"necessary extent",* are still open to interpretations. More detailed instructions about the air quality adjustments are needed and will be developed.

1.9 Economic instruments for air quality management in Finland

Environmentally related taxes accounted for 3.2 % of the Finnish GDP in 2004.

<u>Energy, including traffic fuels</u>

Energy taxes on traffic fuels (petrol and diesel oil) and other energy sources (light and heavy fuel oil, coal, peat, natural gas and electricity), and strategic stockpile fees, account for most of the environmentally related taxes.

In 1990, Finland introduced a carbon tax (or carbon dioxide tax) on fossil fuels. The tax was introduced in order to slow down the growth in energy consumption and to reduce harmful environmental impacts.

As of 1 September 2004, there has been a slight change in the motor petrol tax: stricter quality requirements for lower basic tax rate (i.e. 53.85 cents/litre; see below), and a tiny rise in the basic tax on other grades.

The most recent general rise in tax rates occurred in January 2003, by an average of 5.2 %. There were also some other changes that were initiated at the same time: tax expenditures were raised somewhat to favour electricity produced from renewable energy sources, the use of peat to fuel small power plants was exempted, cogeneration of heat and power was given an even more preferential tax treatment and some technical changes were made, too.

The general structure of energy taxation in Finland has remained unchanged since 1997. The environmental tax component (i.e. carbon surtax), based on the carbon content of fuels used for heating and transportation, is at present €18.05 per tonne of CO_2 (€66.2 per tonne of carbon).

Excise tax rates and strategic stockpile fees in Finland (February 2005):

Fuel	**Basic tax**	**Additional tax (*=carbon comp.)**	**Strategic stockpile fee**
Unleaded petrol, cents/litre			
- reformulated sulphur free	53.85	* 4.23	0.68
- other grades	56.50	* 4.23	0.68
Diesel oil, cents/litre			
- sulphur free	26.83	* 4.76	0.35
- other grades	29.48	* 4.76	0.35
Light fuel oil (heating), cents/litre	1.93	* 4.78	0.35
Heavy fuel oil (heating), cents/kg	-	* 5.68	0.28
Coal (heating), euros/tonne	-	*43.52	1.18
Peat (heating), euros/MWh	-	* 1.59	-
Natural gas (heating), cents/nm^3	-	* 1.82	0.084
Electricity, cents/kWh			
- rate I (households, services)	-	0.73	0.013
- rate II (mining, manufacturing)	-	0.44	0.013
Pine oil, cents/kg	5.68	-	-

Notes: Leaded petrol is no longer sold in Finland; "heating" = rate applied only if fuel used for heating - fuels for electricity production exempted; carbon components for peat and natural gas: reduced rate; additional strategic stockpile fee = precautionary stock fee; (for time series use: 1 euro = 5.94573 markka).

Energy tax on peat is to be repealed in 2005 by a Government bill.

Tax subsidies and tax refunds

A number of tax subsidies that have helped to improve the position of renewable energy sources have been incorporated into the Finnish tax system.

A lower electricity-tax class for industry and a partial refund of the energy taxes to energy-intensive industry are two additional measures aimed at ensuring the competitiveness of Finnish companies.

Subsidies related to energy taxation must be approved by the European Commission before they can be introduced at national level. The Commission has taken the view that subsidies and tax exemptions should be on a temporary basis and gradually reduced.

Other energy subsidies

In addition to the tax subsidies referred to above, the Government can also grant companies, corporations and municipalities R & D assistance for investment projects and surveys that further energy conservation, make energy production and use more efficient, promote the production and use of renewable energy, reduce the harmful environmental impacts of energy production and use, and help to secure and diversify the energy supply.

Motor vehicles

Finland has three different special taxes levied on motor vehicles: a car tax payable on the purchase of the car, an annual vehicle basic tax payable by the person owning or possessing the vehicle, and an annual vehicle additional tax levied on vehicles other than those that are petrol driven (‘diesel tax’).

The car tax is levied on private cars, vans and other cars weighing less than 1,875 kg, and motorcycles. The tax is payable before the vehicle is registered or taken into use in Finland. The tax on motorcycles depends on their displacement. The vehicle basic tax is levied annually on private cars and vans and special vehicles with a maximum weight of 3,500 kg.

The vehicle additional tax is levied annually on vehicles other than those that are petrol driven. Its purpose is to compensate for the fact that petrol has a higher excise tax than other fuels. The tax is determined on the basis of the vehicle weight. For lorries and similar heavy vehicles the tax also depends on the number of axles and the bogie structure.

Impacts of economic policy instruments

Energy taxes (incl. traffic fuels)

A retrospective assessment made by the Economic Council in 2000 showed that Finland’s CO2 emissions would have been 4 million tonnes i.e. 7% higher in 1998 had the energy taxes been kept at the 1990 level. It was estimated that 50 per cent of this reduction (2 million tonnes) resulted from changes in the end use of the energy i.e. from the reduced consumption of traffic fuels and restructuring by industry and the associated lowering in demand. The effect of both factors was put at about 1 million tonnes. The other 50 per cent of the reduction was estimated to have come from converting to fuels with less carbon dioxide in the production of electricity and heating.

The CO2 tax on fossil fuels has also had a positive impact on other air pollutants, as a "side benefit".

It has been estimated by means of a general equilibrium model that a doubling of the surtax on fuel tax would reduce carbon dioxide emissions by 4% by 2010 compared with the baseline scenario. If the surtax on the electricity tax were to be raised to a level corresponding to the fuel tax, emissions would fall by slightly more than 5%. The main negative effects at the industrial sector level would be seen in the form of a reduction in exports and production by energy-intensive sectors. The negative impacts could be alleviated to some extent by refunding the increased tax proceeds through reduced income taxes or social security payments.

It has also been estimated the price elasticities of certain goods on the basis of statistics on consumer behaviour by households 1966-1985. The price elasticity for energy reached in the

study was –0.36. In an earlier study the price elasticity for the energy consumed in dwelling was –0.17.

Taxation of vehicles

According to a study carried out by the EU Commission, the price elasticity in the demand for private vehicles is –0.1. In the long term, too, the price elasticity in relation to the number of kilometres driven is quite limited, between –0.1 and -0.4. All in all, the price elasticities in owning and using a car have been found to be quite small.

Changing the car tax from the present system, in which the tax depends on the car's value, or changing the annual vehicle tax into one where they are dependent on the car's emissions, would probably improve the environmental effectiveness of the tax instrument. Tax differentiation, to speed up the move towards cleaner vehicles and fuels, has been quite successful in Finland. Examples range from catalytic converters and unleaded petrol to more recent differentiation in different grades of diesel oil (sulphur free) and petrol (reformulated, sulphur free).

1.10 Nature and impacts of transpoundary air pollution

Transboundary nature of air pollution was first discovered as "acid rain". Acidification problems first became evident in the 1960s, when industrial emissions increased rapidly, and efficient methods for cleaning waste gases had not yet been developed. It took some time for action to be taken, although the threat of "acid rain" was clearly serious, with fish disappearing from some lakes, forests dying, and metal structures being rapidly corroded. Ultimately international agreements were signed to force industries to curb harmful emissions, and these measures have been particularly successful where sulfur emissions are concerned.

It was estimated that in 1960 the sulfur deposition exceeded the critical load in 10 % of Finnish forests and lakes. In 1980 already quarter of these ecosystems faced this risk. The exceedances of critical loads for sulfur have currently decreased to about 7 % of ecosystem area. Further reduction is difficult with domestic measures, since Finland still imports a relatively large fraction of its acidifying deposition, about 80 % for sulfur and nitrogen oxides and 67 % for ammonia. In Southern Finland the domestic share of deposition due to nitrogen compounds can be locally between 20-50 % and the domestic share of sulfur deposition near major sources bigger than 20 %.

Recently, the long range transport of fine particulates have been observed to be major source of particulate exposures in Finland. In rural areas more than 90 % of PM2,5 concentration is of transboundary origin. Even in Helsinki metropolitan area the impact of domestic sources to annual concentrations varies between 20-40 % depending on distances from major streets and other local sources.

1.11 Programmes designated to reduce ozone-depleting substances and promote alternatives under the Montreal Protocol

Finland has had restrictions on ozone depleting substances for a long time, since late 1980's. At present we have both national and EU legislation controlling the use and placing on the market of these substances. The Council of State Decision on Substances that Deplete the Ozone Layer was adopted in 1998 and it entered into force on the same year. It covers all substances which were controlled by the Montreal Protocol at that time (CFC's, halons, tetrachloromethane, 1,1,1-trichloroethane, methyl bromide, HBFC's and HCFC's). Most of these substances were banned with a few exemptions. It also gives orders on recovery and disposal of used substances.

Finland is covered by EU legislation and we are implementing the EC regulation on ozone depleting substances (2037/2000). To implement the regulation we have established minimum qualification requirements for personnel who serves equipment containing ozone depleting substances as refrigerant.

2. Capacity-building, Information, Research and Development

2.1 Availability of data concerning
a) the impacts of air pollution on human health and ecosystems

Data Collection and Informing the Public about Air Quality

Finland has a decentralized monitoring system where local authorities are responsible for the necessary air quality assessment taking into account the local circumstances. The Finnish Meteorological Institute runs monitoring stations in rural background areas.

Networks generate raw data and aggregated statistics. All data is collected by the Finnish Meteorological Institute to be stored in the National Air Quality Data Base (ILSE) and to be sent to the European Environment Agency and the European Commission. The information on air quality which has been sent to the European Commission can be found at http://cdr.eionet.eu.int/fi/eu/annualair/envqvzkyw.

All the data is public but, at the moment, not all networks are capable of publishing up-to-date data on internet. Some networks do, however, and they publish also hourly and daily values. A simple air quality index which has been designed to help to inform the public is also widely used. The index describes air quality in simple terms (good, satisfactory, acceptable, bad, very bad) and is determined by the worst measured parameter of the station or the network. Index results are presented on the internet pages of some 30 municipality and they can also be found at the FMI web site.

The Ministry of the Environment and the Finnish Meteorological Institute have launched a co-operative project in 2005 to establish a national air quality web site. The web site would include both historic time series with statistics and up-to-date air quality data from most urban networks and background stations. Useful information would also be given about monitoring sites, measuring methods and equipment, effects of different air pollutants and air quality legislation. The web service is expected to be operational by the end of year 2006.

Air quality monitoring

The Finnish Environment Institute and the Finnish Meteorological Institute have monitored deposition or air quality in background areas at about 45 stations. The measurements started at the beginning of the 1970s. Some of the stations belong to international networks: Arctic Monitoring and Assessment Programme (AMAP), Co-operative programme for monitoring and evaluation of the long-range transmission of air pollutants in Europe (EMEP), HELCOM network under the Helsinki Commission monitoring airborne pollution load to the Baltic Sea, Global Atmosphere Watch programme of the World Meteorological Organization (WMO/GAW), and Integrated Monitoring (IM) investigating the whole ecosystem in small catchments.

Major ions in bulk deposition are monitored at all stations, and nutrients (total nitrogen and total phosphorus) at 30 stations. Heavy metals in deposition are measured at 8 stations (mercury only at two stations), and at one station (Pallas in northern Finland) heavy metals including gaseous and particulate mercury are also measured in air. Deposition of mercury is monitored at two stations.

Persistent organic pollutants (POP) in air and in bulk deposition are measured at one station (Pallas) all year around. POP and mercury measurements are conducted by the Finnish

Meteorological Institute in co-operation with the Swedish Environmental Research Institute IVL. In summer POPs in bulk deposition are also measured by the Finnish Environment Institute at three stations.

Sulphur and nitrogen in gases and particles are measured at five stations and ozone at nine stations. In addition, sulphur dioxide is measured at some stations, and samples for measuring light hydrocarbons are collected at two stations. At the Pallas-Sodankylä GAW station a variety of different measurements are running, including greenhouse gases, black carbon, particle mass, UV radiation, column ozone, etc.

The concentrations and wintertime deposition of pollutants in snowpack are measured at about 50 stations monitoring groundwater quality.

Urban air quality is measured at about 50 municipalities. The variables most often measured are sulphur dioxide (S02), nitrogen dioxide (NO2), particles (PM10), total suspended particles (TSP), total reduced sulphur (TRS), carbon monoxide (CO) and ozone (O3). In some stations also bentzene and lead are monitored. For more details about air quality air quality objectives and assessment see Chapter 1.1.

Measurements of the stratosphere

Ozone layer

In Finland ozone column monitoring has been carried out at the Finnish Meteorological Institute – Arctic Research Centre (FMI-ARC), Sodankylä (latitude 67 N) since 1988 and at the Jokioinen meteorological observatory (latitude 60 N) since 1994 using Brewer spectrophotometers. At Sodankylä ozone soundings are also carried out regularly throughout the year, whereas in Jokioinen these measurements are conducted during winter and spring when chemical ozone depletion is expected.

At Sodankylä, wintertime ozone column has also been monitored with an SAOZ spectrophotometer in cooperation with CNRS, Paris since 1990. SAOZ is capable of making measurements through the winter up to latitudes of 67° N. Multi-year ozone measurements from both stations reveal largeinter-annual variations and significant ozone loss in several winters since the early 1990s. (http://fmiarc.fmi.fi/ozonecolumn.html).

Polar stratospheric clouds (PSC)

PSCs play an essential role in chemical chlorine activation and subsequent ozone depletion in the polar stratosphere (WMO, 1999). PSCs are observed in cold regions of the lower polar stratosphere and are generally divided into two types based on their optical parameters. PSCs of type II are large particles of primarily water ice, type 1 are typically smaller particles of mostly nitric acid trihydrate (HNO3 3 H2O - NAT, type Ia) or supercooled ternary solution droplets (HNO3/H2SO4/H2O STS, type Ib). At FMI-ARC, Sodankylä, these stratospheric cloud particles have been observed during stratospheric campaigns since 1991/1992 by lidar and since 1994 by aerosol backscatter probes. By these aerosol probe measurements, it has also been possible to monitor the stratospheric background aerosol concentration, which was perturbed for five years by the eruption of Mt Pinatubo in 1991. Sodankylä has participated in all major European statospheric ozone campaigns, including EASOE in 1991/1992, SESAME in 1994/1995 and THESEO in 1998-2000.

Ultraviolet radiation

Continuous monitoring of UV–radiation has been conducted by FMI-ARC, Sodankylä, since the year 1990. Measurements are made with a Brewer spectrophotometer. This continuously updated time-series is one of the longest calibrated UV-records in Northern Europe. In 1995

the measurements of skin erythemal UV index were started as a part of FMI's national monitoring network tasks. In addition to Sodankylä, measurements are also conducted at Utö, Helsinki, Jokioinen, Tikkakoski and Sotkamo sites. The Sodankylä UV-index, updated every five minutes, and an estimate of the safe exposure time for different skin types can be seen at http://fmiarc.fmi.fi/. In addition to this, monitoring has included measurements of photochemically active radiation (PAR), which is important for plant photosynthesis, and damaging UV-radiation, from the beginning of year 2002.

Finnish UV-International Research Centre (FUVIRC)

The studies of ecological impacts of UV-radiation at FUVIRC have been enhanced uv-exposure fields recently built at Sodankylä http://thule.oulu.fi/fuvirc/. Enhanced exposure exceeds the ambient uv-irradiance level by 46%, corresponding to 20% loss of stratospheric ozone. FUVIRC serves atmospheric chemistry, human health, and biological research initiatives by providing UV monitoring data, guidance (i.e. calibration of instruments, maintenance of field test sites), and research facilities (i.e. laboratories, instruments, equipment and accommodation for visiting researchers).

Forests

Forest condition monitoring under UN/ECE and EC programmes

The International Co-operative Programme on the Assessment and Monitoring of Air Pollution Effects on Forests (ICP Forests) was established in 1985 under the UN/ ECE Convention on Long Range Transboundary Air Pollution (CLRTAP). In 1986 the European Union adopted the Scheme on the Protection of Forests against Atmospheric Pollution, and with the Council Regulation (EEC) No. 3528/86 the legal basis for the co-financing of the assessments was provided. The monitoring activities therefore pursue the objectives of resolution S1 of the Strasbourg, the resolution H1 of the Helsinki and the resolution L2 of the Lisbon Ministerial Conference on the Protection of Forests in Europe. Since then the monitoring of forest condition and development has been carried out under these UN/ECE and EC programmes in 38 participating countries.

Under the programme large-scale extensive monitoring takes place on a network of 5 700 plots arranged on a systematic grid. This Level I network provides a good annual picture of widescale trends in crown condition throughout Europe. It also offers the possibility to investigate large scale relations between stress factors and forest condition. Finland has been participating since 1985 in this large-scale extensive monitoring of forest condition.

In order to gain a better understanding of the effects of air pollution and other stress factors on forests, a Pan-European Programme for Intensive and Continuous Monitoring of Forest Ecosystems (Level II) was implemented in 1995. Approximately 860 intensive monitoring plots have been established throughout the participating countries. At these plots, intensive investigations are carried out on site and stress factors as well as on the biological and chemical ecosystem condition. By the end of 1997, 31 intensive monitoring plots had been established in different parts of Finland.

The Finnish Forest Research Institute (METLA) is responsible for the forest condition monitoring under UN/ECE and EC programmes in Finland. Parkano Research Station is responsible for the task of the National Focal Centre.

Extensive monitoring of forest condition – Level I

The Finnish Forest Research Institute annually inventories tree condition, using internationally standardized methods, on a representative sample of tree stands. The inventory is carried out on about 450 permanent sample plots selected from the permanent National Forest Inventory

sample plots established in 1985. A number of different parameters are measured on the trees. In addition, soil samples have been collected from all the plots, as well as needle samples for elemental analysis from some plots.

Intensive and continuous monitoring of forest ecosystems – Level II

When Finland joined the European Union in 1995, some modifications were made to the national monitoring of forest condition (Level I) and, at the same time, the intensive monitoring of forest ecosystems (Level II) was also started.

By 1997, 31 intensive monitoring plots had been established in different parts of the country, 27 of the plots on mineral soil sites and 4 on peatlands. 17 of the plots have stands comprising Scots pine and 14 Norway spruce. All the plots, except the four Integrated Monitoring (IM) plots, are located in commercially exploited forest. The IM plots represent natural stands in catchment areas. Four of the 31 permanent observation plots in Finland have been established on peatlands. A number of the plots are located close to background, air quality monitoring stations primarily run by the Finnish Meteorological Institute.

Harmful substances

The use of chemicals

The use of chemicals in Finland is monitored jointly by Health and Environmental authorities. The Finnish Environmental Institute (SYKE) is responsible for the environmental aspects of monitoring of harmful substances. At present very limited data exists on concentrations of such substances in the Finnish environment. Diffuse and point source pollution are assessed mainly by modeling techniques. An advance approval procedure is used for pesticides, slimicides and wood preservative products in order to control the introduction of new harmful substances to the environment. SYKE is also responsible for the registration of information on properties and sales of the above-mentioned products.

Terrestrial environment

The Finnish Environment Institute (SYKE) collects data on concentrations and accumulation of harmful substances in the boreal forest food chains and their key species. Such species include red woodants (*Formica* sp.), common shrew (*Sorex araneus*), pine marten (*Martes martes* L.) and moose (*Alces alces* L.). Additionally, harmful substances are monitored in humus layer. Monitoring at the national bases are focused on reference areas located in the regions of Sipoo, Evo, Konnevesi and Pallas. The areas can be classified as high land (watershed) areas, which are known to be sensitive to acidification. Acidity of forest soil is known to affect the availability, mobility and enrichment of metals e.g. Cd, As, Cu, Zn, Mn and Pb. The main sources of pollution in the areas are airborne contaminants such as organochlorine pesticides (OCPs) and polychlorinated biphenyles (PCBs), which are monitored in the food chains. The areas of Evo and Pallas also serve as the international stations for monitoring of long-range transported pollutants and are therefore supplied with versatile research concerning environmental quality (ICP IM, ICP FOREST, AMAP). During the coming three-year period, the monitoring will be adjusted according to demands from the EU and the national interest, which require screening of several new priority chemicals in the Finnish natural environment.

Monitoring of heavy metal deposition by means of moss samples

The nationwide heavy metal deposition survey, conducted by the Finnish Forest Research Institute (METLA) using forest mosses, has highlighted the major emission sources, the areas affected by emissions, and the changes in deposition levels since 1985. The monitoring work is part of the Pan-European network co-ordinated by the UN/ECE ICP Vegetation Programme.

The next series of moss samples will be collected in 2005 from the permanent sample plot network of the Finnish National Forest Inventory. Samples were collected from the same plots during the 1985, 1990, 1995 and 2000 surveys. The laboratory of the Muhos Research Station, Metla, the Central Laboratory, Metla, and the Chemistry Department, University of Oulu, are responsible for carrying out the chemical analyses. The results for the Finnish network will be completed and reported during 2006. After analysis, the remaining samples will be stored at the Paljakka Environmental Sample Bank, Metla, for future research purposes, as has already been done with the samples collected since 1985.

Further information: http://www.metla.fi/metinfo/metsienterveys/raskasmetalli/raskasmetalli-esittely.htm and http://www.metla.fi/metinfo/index-en.htm

Integrated environmental monitoring

Integrated monitoring of ecosystems means physical, chemical and biological measurements over time of different ecosystem compartments simultaneously at the same location. The multi-disciplinary Integrated Monitoring Programme is part of the effects monitoring strategy under the Long-range Transboundary Air Pollution Convention of the United Nations Economic Commission for Europe (UN/ECE/ICP IM). At present 20 European countries and Canada are participating in the ICP IM programme. The international Programme Centre is located at the Finnish Environment Institute. The Programme Centre collects, stores, processes and analyses the data and is responsible for the cooperation with other related programmes.

The ICP IM Programme has been carried out in Finland since 1987 at four monitoring areas. It is one of the most intensive ecological cooperation programmes ever conducted in Finland. More than 20 chemical and biological sub-programmes have been implemented by designated institutes at the monitoring sites. Most of the sub-programmes have been carried out in all four actively monitored ICP IM sites. At present the programme is carried out in the Valkea-Kotinen and Hietajärvi areas. The Finnish ICP IM Programme is coordinated by an expert group consisting of experts from the participating institutes. Most Finnish research institutes and universities involved in environmental research have participated in the ICP IM Programme and several regional authorities have made considerable contributions.

b) the levels of pollution in different industries

Air emission inventories

The Finnish Environment Institute (SYKE) produces information on emissions for environmental planning and policy making, for research and for public use. Emission data are reported according to international conventions such as the UN Convention on Climate Change, the UNECE Convention on Long Range Transboundary Air Pollution and according to the EU Directives on atmospheric pollution as well to the regional conventions of HELCOM and OSPAR.

SYKE produces air emissions inventories, prepares reports and participates in national and international air pollution expert tasks. A special task for SYKE is to maintain national information on emission estimation methods and emission factors in cooperation with the expert institutes and industry.

The Air Emissions Data System uses the Compliance Monitoring Data system – VAHTI as a main input system. The VAHTI compliance data system functions as a tool for the 13 regional environment centres in their work on processing and monitoring permits. The data system contains information on the environmental permits of clients and on their wastes generated, discharges into water and emissions to air. In the year 2003 VAHTI contained air emission information on about 900 installations.

The Air Emissions Data System is part of the Environmental Information System based on the Environmental Protection Act and produces emission data of both air emissions and greenhouse gases at the level of individual processes and on local and national scales. The emission data is available both through the user interface of the environmental administration (HERTTA) and on the websites:
http://www.environment.fi/default.asp?node=13255&lan=en (air pollutants).

National greenhouse gas reporting system

Emission calculations are compiled by Finland's national greenhouse gas evaluation system, which was permanently established in 2004. The greenhouse gas evaluation system comprises Statistics Finland as the national greenhouse gas inventory unit and the other expert organisations participating in the compilation, that is, the Finnish Environment Institute (SYKE), the Finnish Forest Research Institute (Metla) and Agrifood Research Finland (MTT). Co-operation with the ministries responsible for the climate policy is a fixed part of the evaluation system. The national entity for the system, Statistics Finland, is responsible for the production of annual emission calculations and the related methodological reports and for their submission to the UN Framework Convention on Climate Change and to the EU.

The system utilises the data produced by energy and environmental statistics, the data sources for monitoring agriculture and forestry and other information collected in public administration, such as plant-specific emission reporting for environmental permits and future emissions trading.

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2.2 Capacity to carry out air dispersion modeling

The Finnish Meteorological Institute (FMI) analyses the concentrations of atmospheric pollutants with a suite of mathematical dispersion models. The FMI has investigated the basic processes of air physics and chemistry and developed dispersion models since the early 1970's. The atmospheric dispersion models of the FMI are based on current state-of-the-art expertise relating to turbulent diffusion, transformation and deposition processes.

The following local scale dispersion models are available: (1) an urban area multiple source dispersion model, (2) vehicular pollution line-source dispersion models, (3) dispersion models for hazardous materials, (4) dispersion model for odorous compounds and (5) statistical regression models for predicting the evolution in time of air quality. Dispersion models for larger scales are also available, including a regional scale model, a three-dimensional trajectory model and models for evaluating the dispersion and doses for accidental releases of radioactive materials. The system of dispersion models can be applied world-wide using meteorological data from the global observational network of the World Meteorological Organisation (WMO).

The FMI's Air Quality Research provides international consulting and training services in all its key areas of expertise and participates in international co-operation projects with environmental administrations, public and private firms, consulting companies, international organisations, etc.

The Finnish Meteorological Institute has performed thousands of dispersion studies of different kind of emissions (energy production, industrial sources, cars, trains, ships, aeroplanes, waste and waste water treatment, etc.) in Finland and in the foreign countries since the 1970’s

including wide range of dispersion modelling studies for odorous compounds. In 2003 we carried out about 50 commercial dispersion modelling projects in Finland.

The dispersion models are very suitable for air quality assessments of energy production and industry, as well as for plant planning. The models are also good tools for Environment Impact Assessments. With the dispersion models it is possible to compare the air quality effects of different processes, fuel or purification alternatives and to optimize the stack height. Model calculations include evaluation of the air quality effects of accidents, such as fires or the breakage of containers of hazardous materials. The model results can be used directly in the customer's environmental report.

2.3 Programmes designed to increase citizens' awareness about the impacts of indoor air pollution

The adverse health effects and costs of indoor air quality (IAQ) problems could be reduced significantly with proper use and maintenance of buildings and early detection and remediation of problems. Dissemination of information is the key to these savings. Therefore the Finnish ministries responsible for IAQ decided to launch an education and information campaign “Indoor Climate 2002”. The activities were coordinated by the Finnish Society of Indoor Air Quality and Climate. The representatives of all the target groups were invited to join the work. Over 60 expert and consumer organisations responded positive. These organisations took up indoor climate issues in their activities during the campaign year. They produced informative material, arranged events, gave advice and organised education.

The objectives of the Campaign were:

- To improve the consumers’ understanding of the health effects of indoor climate and their possibilities to improve it.
- To increase the knowledge and sense of responsibility of building owners and key management and maintenance personnel in solving indoor climate problems.
- To increase the level of know-how of construction professionals in indoor climate issues.
- To increase the knowledge of health care professionals in diagnosing symptoms and illnesses caused by poor indoor climate.
- To supply information and tools for guidance and control of indoor climate to municipal decision makers and authorities.

The following activities were carried out with the financial support of the Ministry of Social Affairs and Health, the Ministry of the Environment:

- Dissemination of information through mass media and professional journals
- Local indoor climate events
- Nationwide net of information stands
- Production of informative material
- Local networks of municipal experts
- Web service www.sisailma2002.net
- Production of educational material and organisation of professional education
- Participation in events and trade fairs
- Linking all interested organisations and their activities to the campaign
- Planning of future cooperation

The objective of dissemination of information through the mass media was to give the consumers and professionals in the building and real estate industry information about the importance of good IAQ and possibilities to improve it. The main messages of the campaign were:

- Indoor climate has an effect on everyone’s life, quality of life and health
- Indoor climate has a great effect on work productivity
- Good maintenance of real estate pays back

- Information on the effects, factors, improvement and remedies of indoor climate is available

The main results of the campaign were:

- Dissemination of information through mass media and professional journals increased the number of media hits on indoor climate by 38 %
- 15 local indoor climate events with 1900 participants
- Nationwide net of 160 information stands
- Production and distribution of informative material: 10 leaflets, 30 000 copies each
- Local networks of municipal experts in 83 (out of 450) communities
- Over 7000 answered telephone and internet enquiries
- Web service www.sisailma2002.net
- Production of educational material and organisation of professional education
- Participation in events and trade fairs
- Linking all interested organisations and their activities to the campaign

2.4 R & D programmes related to atmosphere/air pollution

The National Technology Agency in Finland (TEKES) / Technology programmes:

- FINE Particles – Technology, Environment and Health 2002-05. Emissions, measuring, buildings, indoor air, health, environmental impacts.
- Business Opportunities from Space Technology 2002-05. Incl.: remote sensing applications.
- Small Scale Production and use of Wood Fuel. 2002-06.
- Waste to REF and energy. 2002-05.
- Energy and Environmental Technology (SIHTI 2). 1996-00

The Academy of Finland / A research programme:

- Space Research Programme (ANATARES) 2001-04. Incl. remote sensing.

Finnish Meteorological Institute:

- R&D on air quality, middle and upper atmosphere, space research, climate change and polar research. R& D on modeling, air chemistry etc.

Finnish Environment Institute (SYKE):

- R&D on effects and risks caused by air pollution and climate change, Geographical Information Systems (GIS) and remote sensing etc.

National Public Health Institute (KTL):

- R&D on environmental health risk analysis incl. urban air quality etc.

VTT Technical Research Centre of Finland:

- One R&D area is Energy and environment including emission control and reduction technologies, emission assessments and systems analyses, measurement technologies etc.

Government Institute for economic research (VATT):

- One R&D areas is Environment and infrastructures including economically effective environmental protection, alternatives and effects of climate policy etc.

The National Technology Agency in Finland (TEKES) operates a technology programme "CLIMBUS Business Opportunities – Mitigation a Climate Change" for the years2004-2008. The budget exceeds 70 M€. The main areas are clean energy production and biofuels, business services and service concepts and energy efficiency technologies.

Ministry of the Environment co-ordinates the Environmental Cluster Programme. The fourth phase of the Programme will begin in 2006. The MoE finances the programme by 2 M€ a year and funding has also been undertaken by TEKES, the Academy of Finland and other ministries. One central issue in the programme has been promotion of good and healthy environment.

The Academy of Finland has a research programme "Russia in Flux" for the years 2003-2007. The budget is about 10 M€. One financed project is "Environmental effect of the Kola air pollution sources in the Kola area and in Finnish Lapland". The budget of this project is 0,4 M€.

2.5 Internet websites related to atmosphere and air pollution

Ministry of the Environment:
http://www.environment.fi/
http://www.ymparisto.fi/default.asp?node=6041&lan=en

Finnish Environment Institute (SYKE):
http://www.ymparisto.fi/default.asp?node=5297&lan=en

Finnish Meteorological Institute (FMI):
http://www.fmi.fi/en/index.html

Ministry of Transport and Communication:
http://www.mintc.fi/scripts/cgiip.exe/WService%253Dlvm/cm/pub/showdoc.p?DocId=1815

3. Cooperation

3.1 Efforts to establish or participate in regional, multilateral or bilateral agreements to address transboundary air pollution concerns

The UNECE Convention on Long-range Transboundary Air pollution has played a major role in protection of the Finnish environment for over 25 years. Finland has been active in further developing the convention instruments and ratified all its 8 protocols already before they have come internationally in force. In addition, Finland negotiated bilateral agreements with Estonia and Russian Federation on reductions of sulfur compounds during 1990s.

During the 1990s Finland was involved in supporting the process of political and economic transition in neighbouring areas. Co-operation developed in particular with those regions of Russia bordering on Finland and with Estonia, Latvia, Lithuania and Poland. A broad co-operation network in Finland and its partner countries are involved in neighbouring areas co-operation programme of the Ministry of the Environment. Private enterprises also play a key role in this programme in addition to government agencies and public authorities. Under new multilateral operating conditions Finland's limited resources are being used with maximum efficiency so as to encourage partner countries, the European Union and international financial institutions to invest in neighbourging areas. At present, work is going on in the following six project on air pollution control and renewable energy:

<u>Finnish JI/CDM Pilot Projects in Estonia</u>

Tamsalu and Kadrina District Heating Projects

The Tamsalu and Kadrina District Heating Projects were included in the project portfolio of the Finnish CDM/JI Pilot Programme in October and August 2000, respectively.

The projects concern the installations of new bark boilers to the district heating systems in Tamsalu and Kadrina. According to the Project Design Documents (PDDs), new boilers satisfy

approximately 80 % of the annual energy demand in the district heating systems. The bark to the new boilers comes from several sawmills in the regions.

The Programme's contribution to the Tamsalu Project was around € 360 000, i.e. approximately 37% of the total investment. The amount of emission reductions generated by the Tamsalu Project was estimated at 32 400 tCO_2 eq. during 2002-2012. The Programme's contribution to the Kadrina Project was € 230 500, i.e. 24% of the total investment. The amount of emission reductions generated by the Kadrina Project was estimated at 46 500 tCO_2 eq. during 2002-2012.

The Emission Reduction Purchase Agreements (ERPAs) of the Kadrina and Tamsalu Projects were signed in June 2004 in Tallinn between the companies and Ministry of the Environment, Finland. The initial and first periodic verifications of the Tamsalu and Kadrina District Heating Projects were carried out in the last quarter of 2004. According to the verification reports the Tamsalu and Kadrina Projects have generated 18 007 verified emission reductions (VERs) to Finland between 2002-2003 to be transferred to Finland as Kyoto units (ERUs/AAUs) as soon as it will become possible.

Paide Bioenergy Project

The Steering Committee of the Pilot Programme granted preliminary approval to the Paide Bioenergy Project in June 2002. The objective of the project is to introduce a new biomass boiler in the town of Paide, Estonia. The partners of the project are OÜ Pogi, i.e. the privately owned district heating company, Wärtsilä Finland Oy BioPower and various financial institutions.

Before the project, the district heating system of Paide was based on an oil-fired Peetri boiler house using approximately 7600 tonnes of shale oil annually. Heavy fuel oil has also been used (depending on price). The core of the project is the installation of a bio fuel boiler that supplies the district-heating network. During summer operation the plant would deliver heat for hot tap water production in local substations covering the whole demand. The unit is using wood-based waste but it is also capable of burning peat up to 30% of the total fuel consumption. The use of peat is, however, unlikely.

Before determination, the emission reductions of the Paide Project was estimated at 72 300 t CO_2 eq. in 2008-2012 and 135 000 t CO_2 eq. in 2003-2012 provided that no peat is used. The emission reductions during the total expected lifetime of 20 years is estimated at 294 000 t CO_2 eq. in 2003-2023. The project was successfully determined and the PDD of the project was finalised in accordance with the outcome of the determination in January 2003. KPMG Wideri Oy Ab acted as the determinator (validator). The construction of the district heating installation was finalised in September 2003 and the project started production in October 2003.

Furthermore, in October 2003, the Emission Reductions Purchase Agreement (ERPA) between the company and Ministry of the Environment, Finland and the Government level project agreement (PA) were signed and the plant was commissioned. The initial verification of the Paide Project was carried out in the last quarter of 2004.

Enhancing Air Quality Monitoring in St. Petersburg, 2004-2006

The project is part of the City Twinning Programme between Environment Committee of St Petersburg and Finnish cities. The project will enhance capacities of local policy makers, officials and experts in design, management and evaluation of air quality monitoring systems, including data management and distribution. The project includes two in –depth analyses of the present air quality monitoring and control in St Petersburg and in Finland. Through joint seminars and training, recommendations for future actions will be prepared. By the end of the

project a proposal for a joint development project with European partner cities and agencies will be developed.

Impact of the Project: Capacity building of local policy makers, officials and experts in the field of air pollution control.

Course in quality assurance for the emission measurement laboratory of the Republic of Karelia and comparison measurements in Finland, 4 June 2004 – 31 September 2005

A quality course will be organized during the project, which will focus on the European accreditation principles and how to estimate the measurement uncertainty in emission measurements (e.g. quality documents, method descriptions, calculation of measurement uncertainties in emission measurements) The comparison measurements will be organized in Finland in order to evaluate the level of emission measurement of the laboratory.

The aim of the project is to improve the skills and knowledge of the laboratory on quality issues in emission measurements. Two main goals of the project are 1) the competence and skills of the experts in emission measurement is increased; and 2) the level of emission measurements of the laboratory will be evaluated in comparison measurements.

Emission measurement activities in Estonia and Latvia, June 2004 – December 2005

The project will support the Estonian and Latvian emission measurement laboratories in implementing the new requirements by the European Union; new emission measurement techniques and new standards. Two training sessions will be arranged in both countries during the project.

The aim of the project is to update the know-how of emission measurement laboratories in Estonia and Latvia, so that they have the competence and skills to fulfil the requirements coming from new demands from European Union (like directive on incineration of waste and directive on the limitation of emissions of certain pollutants into the air from large combustion plants). Two main goals of the project are 1) the competence and skills of the Estonian and Latvian experts in emission measurement is increased; and 2) the knowledge of authorities how to implement the directives into national legislation is increased.

Environmental Effects of the Kola Air Pollution Sources in the Kola Area and in Finnish Lapland, 2004-2007

The mining and metallurgical industry at Kola peninsula, north-west Russia is the most important source of air pollution next to Norilsk in the Arctic. The gas- and particle-phase pollutants have a serious impact on the atmosphere and biosphere at Kola peninsula and Finnish Lapland, including acidification, ecotoxicological effects, and even human health effects.

The objective of this multi-disciplinary four years project is to make an integrated analysis of past and present atmospheric emissions from Kola area, their transport and dispersion patterns in the atmosphere, and their effects on climate and terrestrial and aquatic ecosystems in the Kola area, Russia and Finnish Lapland. Experimental methods as well as literature surveys and computer modelling will be used in this work. Research training is an essential part of the project.

The project provides a comprehensive picture of the past and present environmental status of the Kola peninsula and Finnish Lapland. The expected results consist of new experimental techniques, observational data series, improved computer models, extensive model runs and literature surveys.

The immediate users of the results are the international scientific community and environmental authorities in Finland, Russia and Norway. Later also national and local political decision-makers benefit from the results as well as the local inhabitants and business enterprises based on the environment.