



CITY OF HELSINKI

ENVIRONMENT CENTRE

Papers 1/2000

Operational Plan for the Prevention of Acute Street Dust Problems

(Translation of Paper 3/99)

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Helsinki 2000

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OPERATIONAL PLAN FOR THE PREVENTION OF ACUTE STREET DUST PROBLEMS

CONTENTS:

1. INTRODUCTION	2
2. DUST EPISODES IN HELSINKI	2
2.1. Development of suspended particle concentrations in Helsinki	2
2.2. Origins of the suspended dust	3
3. ACTIONS TAKEN TO REDUCE SUSPENDED PARTICLE CONCENTRATIONS	4
3.1. Energy production and traffic	4
3.2. Road maintenance	4
4. ACTIONS TO FURTHER REDUCE SUSPENDED PARTICLE CONCENTRATIONS	6
5. EMERGENCY ACTIONS TO REDUCE PROBLEMS CAUSED BY STREET DUST	7
5.1 Binding the dust with a saline solution	7
5.2. Information and implementation of measures when a dust episode occurs	8
6. MAINTENANCE OF THE PLAN	9
7. EXPLANATION OF TERMS AND ABBREVIATIONS	9

ATTACHMENT

PREPARATIONS FOR DUST EPISODES

1. Reporting, warning and action diagram
2. List of actions
3. Contact information for official offices and institutions

1. INTRODUCTION

Suspended particles in the air has for a long time been one of the most crucial problems for air protection in Helsinki. Dust episodes occur particularly in springtime when the air quality guideline values for suspended particle concentrations are repeatedly exceeded in the urban area. There is also the danger of the air quality limit values being exceeded on the busiest thoroughfares.

Under the Air Protection Act § 7a, a municipality is obliged to initiate the necessary procedures, for example by issuing orders for limiting traffic and emissions, in those situations where the limit values set by the Government for air quality are exceeded. In Helsinki the current limit values for suspended particle concentrations, and particularly the new limit values for PM₁₀ particles, may be exceeded. New limit values comes into effect in Finland in 2001.

On 27.1.1997 the Helsinki City Government approved a plan of action concerning serious air pollution situations causes by nitrogen emissions from traffic. The plan of action excluded air quality episodes caused by dust particles because the procedures for reducing concentrations of suspended particles are of a substantially different nature than those for nitrogen dioxide. The City Government required that a separate plan be drafted for reducing the problems caused by suspended particles.

With this plan Helsinki would comply with the obligations set for municipalities in the Air Protection Act 7§a, also in terms of exceeding the limit values for suspended particles. The plan, however, starts from the point that actions would already be initiated before the limit values for Total Suspended Particles (TSP) are found to be exceeded. The actions are determined according to the concentrations of inhalable particles i.e. PM₁₀, particles, because the data regarding these concentrations is available in real-time, and because the limit values for PM₁₀ particles will, in future, replace the TSP limit values.

This plan does not include the regulations under the Air Protection Act § 7a for real estate premises because the possible incidences of the limit values being exceeded due to the grit (sand and gravel) used in wintertime maintenance are excluded from the directive.

2. DUST EPISODES IN HELSINKI

2.1. Development of suspended particle concentrations in Helsinki

Suspended particle concentrations have been measured in Helsinki since 1978. The guideline values set for Total Suspended Particles (TSP) are exceeded quite regularly in Helsinki, particularly during the springtime. The limit value set for the average yearly value has not, however, been exceeded since 1980 but the daily values

measured have been at the same level as the limit values in the urban traffic environment (figure 1).

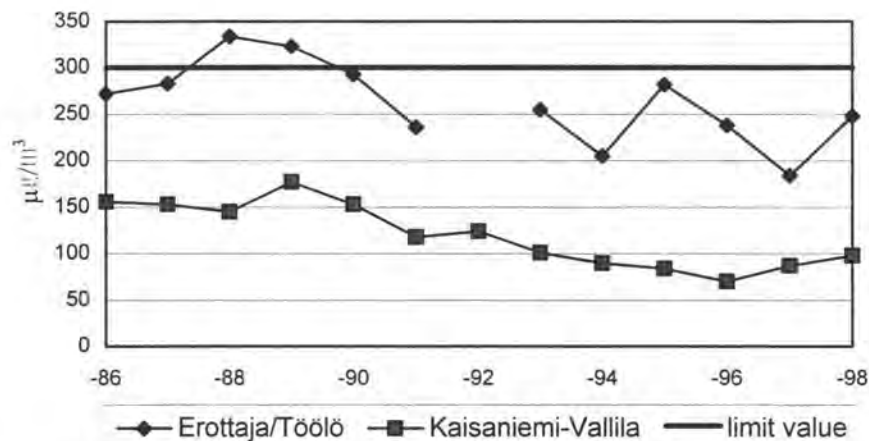


Figure 1. Total Suspended Particles (TSP) concentrations compared to limit values at the Helsinki measurement station 1986 - 1998 (Ref. YTV)

Suspended particle concentrations follow a seasonal pattern inasmuch as the TSP is lowest in the summer and reaches its maximum value in March/April. The variation in concentrations of inhalable particles follows the same trend (figure 2).

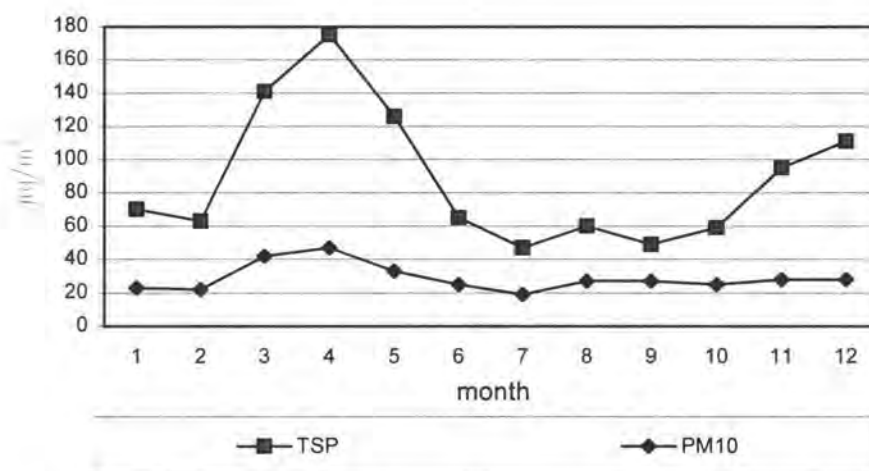


Figure 2. Monthly variations in average values for TSP and inhalable particles in Töölö 1994-1995 (Ref. YTV)

2.2. Origins of the suspended dust

The dust problems in springtime are regarded as mainly stemming from traffic constantly kicking up the dust accumulated on the road surfaces during winter. The dust originates from the gritting of the roads (using sand and gravel), the wearing of the road surfaces, as well as emissions from traffic, energy production and industry, but also partly from nature (e.g. pollen).

3. ACTIONS TAKEN TO REDUCE SUSPENDED PARTICLE CONCENTRATIONS

3.1. Energy production and traffic

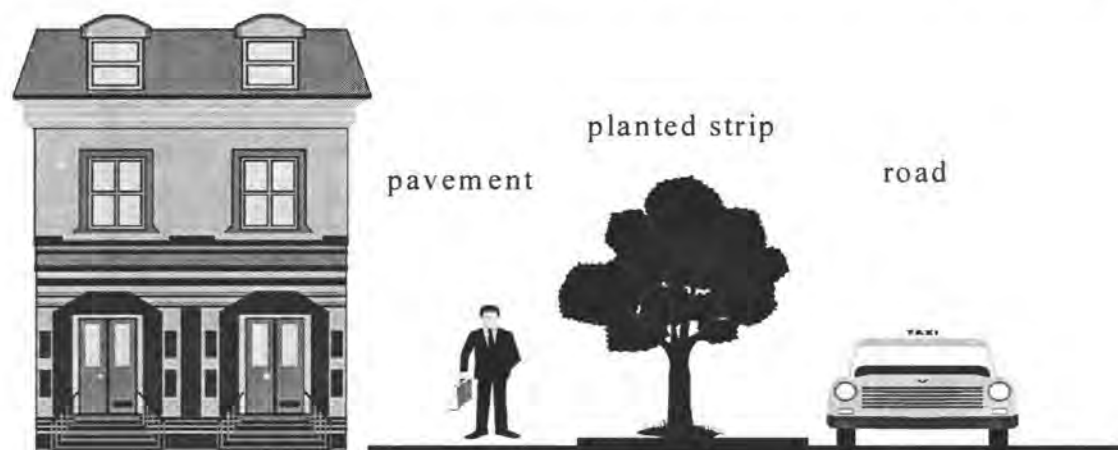
Helsinki air has been cleaned by directing operations towards traffic, energy production, and the removal of grit from the streets in spring. Particle emissions from energy production have decreased from the 1989 level, with about 75% due to the use of particle filters and approximately 30% due to the utilisation of catalytic converters and better quality fuel.

Despite these quite considerable reductions in direct particle emissions, the suspended particle concentrations themselves have not decreased in the same proportion. This is due to the large proportion of road dust in the suspended particle concentrations.

3.2. Road maintenance

Division of responsibility

The springtime cleaning of the roads in Helsinki is regarded as being part of winter maintenance, where the City is responsible for cleaning the roads as well as the planted strips between the roads and the buildings. The area of responsibility for building and estate managers includes the cleaning of pavements. In addition, Helsinki City Transport is responsible for cleaning the road areas reserved for trams.



cleaning	building	city	building
winter maintenance	building	city	
other maintenance	city		

Figure 3. Division of responsibility (Ref. Public Works Department)

Current work methods

Sand removal work commences by wetting down the road surface to prevent the dust from rising. After a winter with heavy snow, there may be compacted ice on the road, this is removed using a road grader. After wetting down, the coarser stone material and dirt is removed with a mechanical sweeper. The swept road is then cleaned using vacuum sweeping equipment. After vacuum sweeping the road is sprayed with high pressure water from a washing truck.

The cleaning work is carried out in such a way that the equipment mentioned above operates as a complete work group. In the urban areas the work proceeds from street to street and notice boards carry prior information and requests for people to remove vehicles. After the springtime sand removal work those areas under the responsibility of the Public Works Department are vacuum swept one to four times a month. The use of the vacuum sweeper is restricted to exclude the cobblestone surfaced area, as the sand used to bind the stones gets sucked up, which may loosen the stones.

Vehicles parked on the side of the road cause most problems for cleaning residential streets. Therefore removing the sand in the urban areas is only possible by giving prior notice of the forthcoming street cleaning via information boards. The preparatory procedures prior to the actual work are:

1. Two working days before commencement of the work, boards attached to concrete blocks requesting people to remove their vehicles are taken to the street (approximately 2 hours/street).
2. Removal supervisors visit and make a record of those cars which are parked by the side of the road (approximately one hour).
3. One day prior to the cleaning work, the traffic sign group visit and cover up the signs which regulate roadside parking. They also distribute building-specific information.
4. Cars still left at the side of the road are moved to the limit of visibility (15 minutes/car). A removal decision is made for each car moved and a removal record is kept. The car owners are invoiced for the removal (273 FIM/car, 1999).

After this the actual street cleaning commences, this takes around 0.5 – 2 hours /street. The city is divided into six districts and each district is responsible for the cleaning and winter maintenance of the streets in its area. The contact information for the people responsible is mentioned in the preparation attachment.

Dust reduction procedures carried out in street maintenance

Systematic work has been carried out since 1987 to reduce street dust. The principle means utilised have been through the different forms of information, upgrading and increasing the amount of street cleaning equipment, as well as collaboration with

building owners. The use of gritting material has been reduced and a switch has been made to the use of washed and screened grit (figure 4). Mechanical brushing has been replaced by wet vacuum sweeping. Endeavours are made to inform building owners about those streets due for sand removal and washing, to enable them to carry out their pavement cleaning at the same time in order to minimise the spread of dust. At the same time the building owners have been able to have the pavement sand removed at the City's expense.

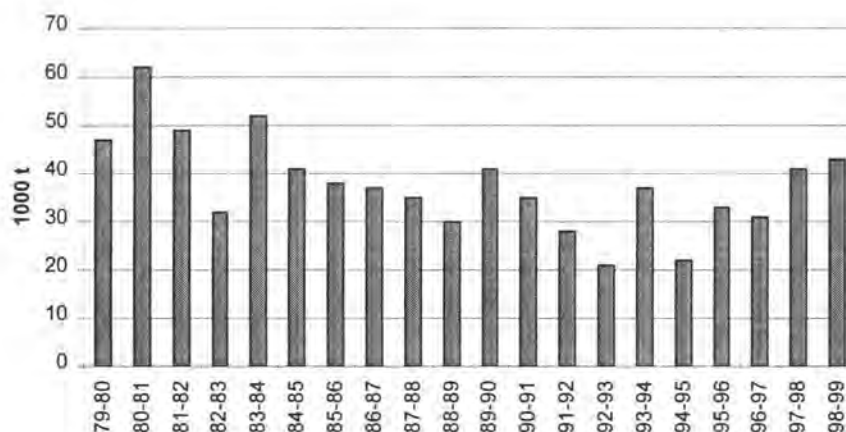


Figure 4. The use of grit and chippings to prevent slipperiness during the winter seasons 1980 – 1999 (Ref. Public Works Department)

Information has been increased in order to clarify the division of work between the City and the building owners, and in particular to reduce the number of vehicle removals from residential streets, in order to speed up the cleaning operation itself.

Thanks to the measures taken, the springtime dust peaks have been cut by a third, but the dust concentrations are still disturbingly large. One of the worst problems is that it has only been possible to start cleaning the streets after the night frosts have ended, because of the danger of the street cleaning water freezing.

4. ACTIONS TO FURTHER REDUCE SUSPENDED PARTICLE CONCENTRATIONS

In 1997 the Environment Centre prepared a report "The reduction of street dust in the capital" (published by the Environment Centre 3/97). This report contains the results achieved for improving the quality of air, particularly with regard to the dust problem. On the basis of this report a research plan aimed at eliminating the Helsinki dust problem was drawn up in collaboration with the Public Works Department. The research plan included a return to the self-cleaning street profile, the optimisation of work points and timing for sand removal, an assessment of the direct and indirect effects of dust control, and the utilisation of plants as dust binders.

In 1998 a project was instigated by the Public Works Department, which studied the dusting characteristics of materials for preventing slipperiness (in collaboration with

the Geological Survey of Finland, Helsinki University of Technology, Lohja Rudus Oy, the Finnish Institute of Occupational Health, Helsinki Environment Centre, the Environment Office of Helsinki Metropolitan Area Council, the Association of Finnish Local and Regional Authorities, the National Roads Administration, Espoo, Turku and Tampere).

In 1996, YTV (the Environment Office of Helsinki Metropolitan Area Council) and the Finnish Meteorological Institute commenced research into the size distribution, composition and origin of inhalable particles, as well as their effect on the health of the resident population. The first report of the project has been published and the experimental material collected in 1999 is still being analysed.

Under the heading of the optimisation of workpoints and work, in addition to district contract trials, an experiment was carried out in 1998 in Etu-Töölö in which responsibility for road maintenance was transferred in its entirety to the City. Based on the experience gained, the possibilities for extending the City's overall street maintenance responsibility to encompass the whole city are being investigated.

On the equipment side, methods are being developed whereby sand removal could also be carried out during dry, sub-zero conditions. In spring 1999 it was possible to try this method out in the central Helsinki area.

5. EMERGENCY ACTIONS TO REDUCE PROBLEMS CAUSED BY STREET DUST

The measures at the City's disposal when dust episodes occur are very limited. With the equipment and personnel resources currently available the sand removal operation itself can not really be speeded up. In the optimum situation it can now be carried out in four weeks unless there is a re-occurrence of wintry conditions or night frosts slow the work down unreasonably. Earlier the work took up to eight weeks.

In principle, extra equipment from the suburban areas would be available for cleaning the centre, but the parked vehicles in residential areas form a bottleneck, because increasing the number of vehicle removals to nearby areas is not possible due to a lack of space. Therefore the only fast acting measure remains the prevention of dusting by wetting down the street surfaces.

5.1 Binding the dust with a saline solution

A saline solution is generally used on gravel roads for binding the dust. The same method was tried out in spring 1998 in the Vallila district using a 5% saline solution (CaCl₂). The initial results were promising. The road surface remained wet for several days. The negative side to the use of a saline solution is its staining influence, but this problem can be minimised by using a sufficiently diluted solution.

For wetting down operations, the Public Works Department has ten large cleaning and watering vehicles at its disposal, with an average tank size of 7 m³. During one shift each vehicle can empty its water tank four times, in other words each vehicle uses approximately 28 m³ of water. This amount of water is sufficient for wetting down approximately 20 km of streets, so the entire fleet can do approximately 200 km. The area between the centre and Vallila has about 260 km of road, in other words 540 km of road side, so practically the entire area gets wetted down in two shifts.

The costs of the operation, in terms of water, are around 2,800 FIM (5 FIM / m³ x 280 m³ x 2 shifts). Helsinki Water does not charge a waste water fee for the water used. In addition, the 5% saline addition costs 11,200 FIM. Other costs for the wetting down vehicles are approximately 220 FIM / hour, so the entire fleets costs are about 35,200 FIM (10 x 220 FIM/hour x 16 hours).

The total costs for the operation are therefore approximately 50,000 FIM a time. If the operational strategy called for the wetting down to be carried out during night time, it would cause additional costs of 100 FIM/hour, or 16,000 FIM.

5.2. Information and implementation of measures when a dust episode occurs

YTV, the Environment Office of Helsinki Metropolitan Area Council, measures air quality, the City of Helsinki air protection authorities look after air protection in Helsinki and the Public Works Department is responsible for road maintenance. Operational procedures have been agreed between them for air pollution episodes and other situations of abnormal air quality.

Advance warning limit

YTV's internal monitoring and information readiness is increased when the air quality index exceeds 100. In terms of particle content (PM₁₀), this means a value for the day of 70 µg/m³. A report of the situation is sent to the city's Environment Centre. A report of an increase in the air quality index caused by dust is separately given to the Environment Centre, which acknowledges receipt of the information. The Environment Centre requests the roads department of the Public Works Department to prepare for wetting down the road surfaces. The reporting method only works on weekdays.

Limit for action

If the index value for air quality exceeds 150 (PM₁₀ particle concentration 105 µg/m³), and on the basis of weather forecasts no changes are expected, YTV sends an episode bulletin to the Environment Centre. A corresponding bulletin also goes to the media. The Environment Centre sends an operations request to the roads department of the Public Works Department for the commencement of the wetting down of the streets.

Measures are initiated on the basis of PM_{10} concentration, because the Total Suspended Particle measurement results are not available in real-time. It should be pointed out that the measures are initiated before any possible exceeding of the TSP limit values are observed.

The Public Works Department and the Environment Centre give information about the commencement of the wetting down of streets, and also encourage at the same time building managers to wet the pavements down, if there is no danger of them freezing.

6. MAINTENANCE OF THE PLAN

The Environment Centre updates the plan daily due to the ongoing personnel, positional, organisational, legislative and other similar changes. In order to make this possible, the parties concerned which are outside the Environment Centre supply the Centre with the amended information. The Environment Centre checks the information of other parties yearly, at the end of the year, when they are up-to-date in all respects as the possible commencement of episodic situations approaches in spring.

The advance warnings and operational limits in particular are checked in case the limit values for particle concentrations have been tightened. The new directive concerning limit values comes into effect in July 2001.

The Public Works Department examines its operational strategy yearly on the basis of experience and feedback. The operational strategy is updated with any possible changes.

7. EXPLANATION OF TERMS AND ABBREVIATIONS

Episode: Situation in which the concentrations of air impurities are clearly at a dangerously high level, generally over a period of several days.

Inhalable particles, PM_{10} : Particles with a diameter of less than 10 μm .

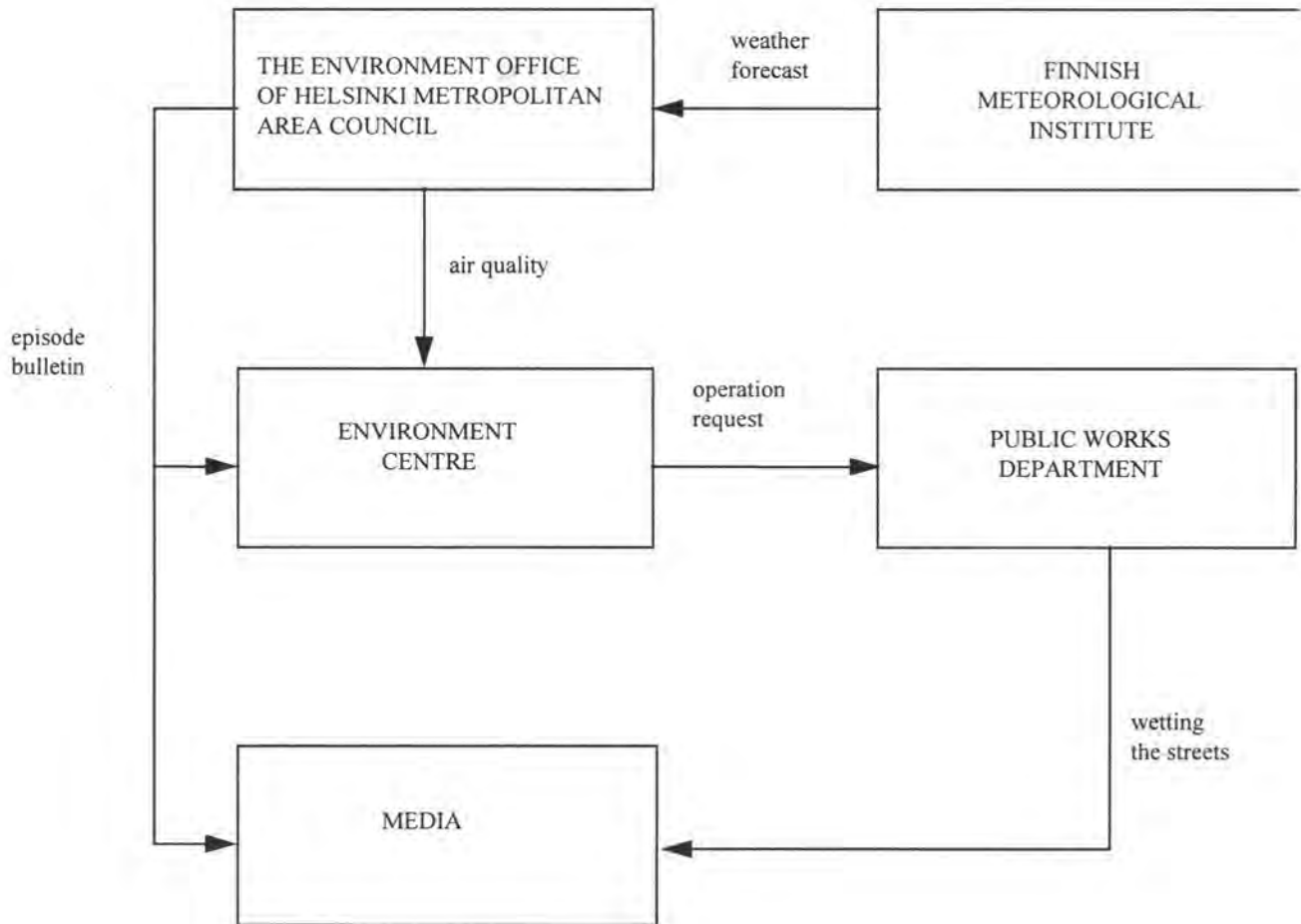
Total Suspended Particles, TSP: The mass of particles in a square kilometre of air.

Guideline values: Maximum objective values set by the Government for different impurities. The guideline values are based on the effect of air pollution on health and nature. The statistically defined value may allow a certain number of excesses over the limit in a month or in a year. The daily value for inhalable particles is given as 70 $\mu g/m^3$. Values exceeding this guideline value are examined monthly and one average daily value in one month may exceed 70 $\mu g/m^3$.

The daily concentration guideline value is $120 \mu\text{g}/\text{m}^3$. 98% of the measured daily values of the calendar year are compared with this numerical value, which means that 2% of the daily concentration values during the year may exceed $120 \mu\text{g}/\text{m}^3$.

Limit values: Government set values for the maximum amounts of different air impurities. The limit values are based on EU directives. The current Total Suspended Particle (TSP) limit value for the yearly concentration is $150 \mu\text{g}/\text{m}^3$. The limit value for the daily concentration is $300 \mu\text{g}/\text{m}^3$. 95% of the measured daily values of the year are compared with this numerical value, in other words 5% of the daily concentrations may exceed $300 \mu\text{g}/\text{m}^3$ during the year.

1. REPORTING, WARNING AND ACTION DIAGRAM:



2. LIST OF ACTIONS:

FINNISH METEOROLOGICAL INSTITUTE

Is responsible of weather forecasts.
Delivers the forecasts to YTV.

THE ENVIRONMENT OFFICE OF HELSINKI METROPOLITAN AREA COUNCIL (YTV)

Measures the concentration of particles.
Sends the air quality report and weather forecast to the Environment Centre.
Is responsible of air quality information.

ENVIRONMENT CENTRE

Starts the action to prevent the dust episodes.

PUBLIC WORKS DEPARTMENT

Takes care of wetting down of the streets and informs about it.

3. CONTACT INFORMATION FOR OFFICIAL OFFICES AND INSTITUTIONS:

OFFICE	TEL.	FAX.
FINNISH METEOROLOGICAL INSTITUTE		
Meteorologist on duty	0600-9-3801 (chargeable)	
ENVIRONMENT OFFICE OF HELSINKI METROPOLITAN AREA COUNCIL		
	*15611	
Director (Wallenius)	1561 258	1561 334
Air quality expert on duty	0400-304430	
CITY OF HELSINKI, ENVIRONMENT CENTRE		
	*73121	
Director General (Kansanen)	7312 2600	7312 2605
Head of Environmental Health (Pönkä)	7312 2710	7312 2700
Environmental Inspector (Juopperi)	7312 2679	7312 2675
Environmental Inspector on duty	7312 2760	7312 2745
CITY OF HELSINKI, PUBLIC WORKS DEPARTMENT		
	*1661	
Maintenance Engineer Timo Paavilainen	166 2614	166 2027
Western Street Unit		
City Centre District		
Chief Supervisor Matti Ahtiainen	166 2531	166 2560
Atomitie District		
Chief Supervisor Seppo Ilvonen	166 5320	166 5309
Northern Street Unit		
Vallila District		
Chief Supervisor Erkki Kukkonen	166 3200	712 713
Oulunkylä District		
Chief Supervisor Erkki Heiskanen	166 5511	166 5582
Tattarisuo District		
Chief Supervisor Raimo Grönqvist	166 3951	166 3960
Eastern Street Unit		
Chief Supervisor Jorma Manner	166 5824	1665842

HELSINGIN KAUPUNGIN YMPÄRISTÖKESKUKSEN MONISTEITA 1998

1. **Taurian puiston luontopolku Pietarin ympäristöviikolla 1997.** Matti Nieminen, Jarmo Laine
2. **Helsingin kaupungin valmiussuunnitelma koskien liikenteen tyyppipäästöistä aiheutuvia vakavia ilmansaastetilanteita.** Rauno Tolonen ja Olavi Lyly
3. **Kivihiihivoimalaitosten palamisjätteiden sijaintikartoitus Helsingin alueella.** Mika Ruotsalainen
4. **Maaperää likaavien riskikohteiden kartoitus. Laitosten osoitteita vuosilta 1946 - 1979.** Virpi Salo
5. **Kemiallisen pesulatoiminnan vaikutus maaperään Helsingin Kunnalliskodintiellä.** Esiselvitys. Reetta Pyrylä
6. **Purojen ja purovarsiens merkitys ekokäytävänä Helsingissä.** Jere Malinen
7. **Selvitys ympäristökeskuksen sisäisen viestinnän nykytilasta.** Marika Kallio
8. **Helsingin itäisen merialueen kalliorantojen uposkasvillisuus vuonna 1997 - Vertailu vuosiin 1984, 1988 ja 1993.** Sini-Pilvi Saarnio
9. **Uuniruokien, keittojen ja kastikkeiden suolapitoisuus - analysoidun ja laskennallisen pitoisuuden vertailua.** Virve Raussi ja Ingrid Aminoff

HELSINGIN KAUPUNGIN YMPÄRISTÖKESKUKSEN MONISTEITA 1999

1. **Helsingin kaupungin ympäristönsuojelun tavoite- ja toimenpideohjelma 1994 - 1998. Seurantareportti 1998.** Camilla v. Bonsdorff, Pirkko Pulkkinen, Rauno Tolonen, Mona Arnold, Hannu Arovaara, Eeva Pitkänen, Markku Viinikka, Ilkka Viitasalo, Seija Malinen, Kaisa Pajanen, Kari Silfverberg ja Sari Kettunen
2. **Helsingin seudun merialueen tarkkailu automaattisin ja perinteisin menetelmin vuonna 1998.** Katja Pellikka ja Hilka Viljamaa
3. **Toimintasuunnitelma akuuttien katupölyhaittojen torjumiseksi.** Rauno Tolonen, Timo Paavilainen ja Mona Arnold
4. **Vuoden 1999 tutkimusohjelma.** Irene Rissanen (toim.)
5. **Helsingin ja Espoon merialueiden velvoitetarkkailu vuonna 1998.** Lauri Pesonen (toim.)
6. **Grillaukseen käytettävien makkaroiden koostumus ja laatu.** Ingrid Aminoff, Antti Pönkä, Aimo Kuhmonen, Pirjo Tikkanen ja Seppo Ahonen
7. **Helsingin kaupungin ympäristökeskuksen julkaisuohjeet.** Irene Rissanen
8. **Opas ympäristötilinpäätöksestä hallintokunnille.** Janne Rönkkö
9. **Boreaaliset metsäluhdut ja puustoiset suot Mustavuoren - Porvarinlahden - Labbackan - Kasabergetin alueella. Lausunto.** Arto Kurtto ja Leena Helynranta
10. **Pakattujen mehujen A-, C- ja E-vitamiinipitoisuudet.** Timo Vartiala ja Pirjo Tikkanen

HELSINGIN KAUPUNGIN YMPÄRISTÖKESKUKSEN MONISTEITA 2000

1. **Operational Plan for the Prevention of Acute Street Dust Problems. (Translation of Paper 3/99).** Rauno Tolonen, Timo Paavilainen and Mona Arnold