

Air quality in South Karelia 2019



Table of contents

1. In general.....	2
2. Measured components.....	4
3. Air quality guidelines and limit values.....	5
4. Air quality in Imatra 2019	6
4.1 Odorous sulphur compounds in Imatra (TRS).....	6
4.2 Sulphur dioxide in Imatra (SO ₂)	7
4.3 Nitrogen dioxide in Imatra (NO ₂).....	7
4.4 Particles in Imatra (PM10 and PM2.5).....	8
4.5 Sulphur deposition in Imatra	9
5. Air quality in Lappeenranta 2019	10
5.1 Odor sulphur compounds in Lappeenranta (TRS).....	10
5.2 Sulphur dioxide in Lappeenranta (SO ₂)	11
5.3 Nitrogen dioxide in Lappeenranta (NO ₂).....	12
5.4 Particles in Lappeenranta (PM10 ja PM2,5).....	12
5.5 Sulphur deposition in Lappeenranta	14
6. Air quality in Svetogorsk in 2019.....	15
6.1 Odorous sulphur compounds in Svetogorsk (TRS).....	15
6.2 Nitrogen dioxide in Svetogorsk (NO ₂).....	15
7. Summary	16

1. In general

Imatra's, Lappeenranta's and Svetogorsk's measuring stations form an air quality **network in South Karelia**. 2019 the network had all together 15 measuring stations. Air quality was measured continuously in 11 stations. The continuous online data has enabled the real time information from the whole network.

The measuring stations are located close industrial plants, and close population and close traffic centers. The maintenance of the South Karelia air quality network has been carried out by Imatra region Environmental department together with the local industry and environmental authorities more than 20 years.

Air quality in South Karelia was mostly good in 2019. Air quality weakened most in springtime because of the springtime road dust period. Also the emissions from the local forest and metal industries weakened air quality time to time. Also long distance emissions affected the air quality.

The Finnish Meteorological Institute is maintaining the nationwide air quality network online at www.ilmatieteenlaitos.fi/ilmanlaatu. The air quality online data of 49 Finnish cities is updated hourly in internet.

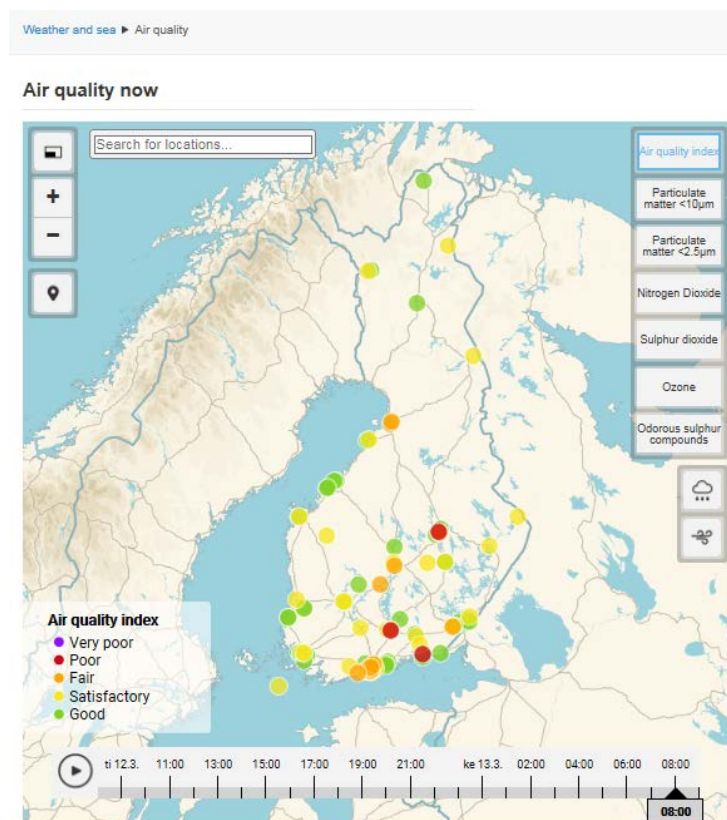


Figure 1: Finnish Meteorological Institute published air quality online data from 49 Finnish cities and from 99 air quality measuring stations in 2019

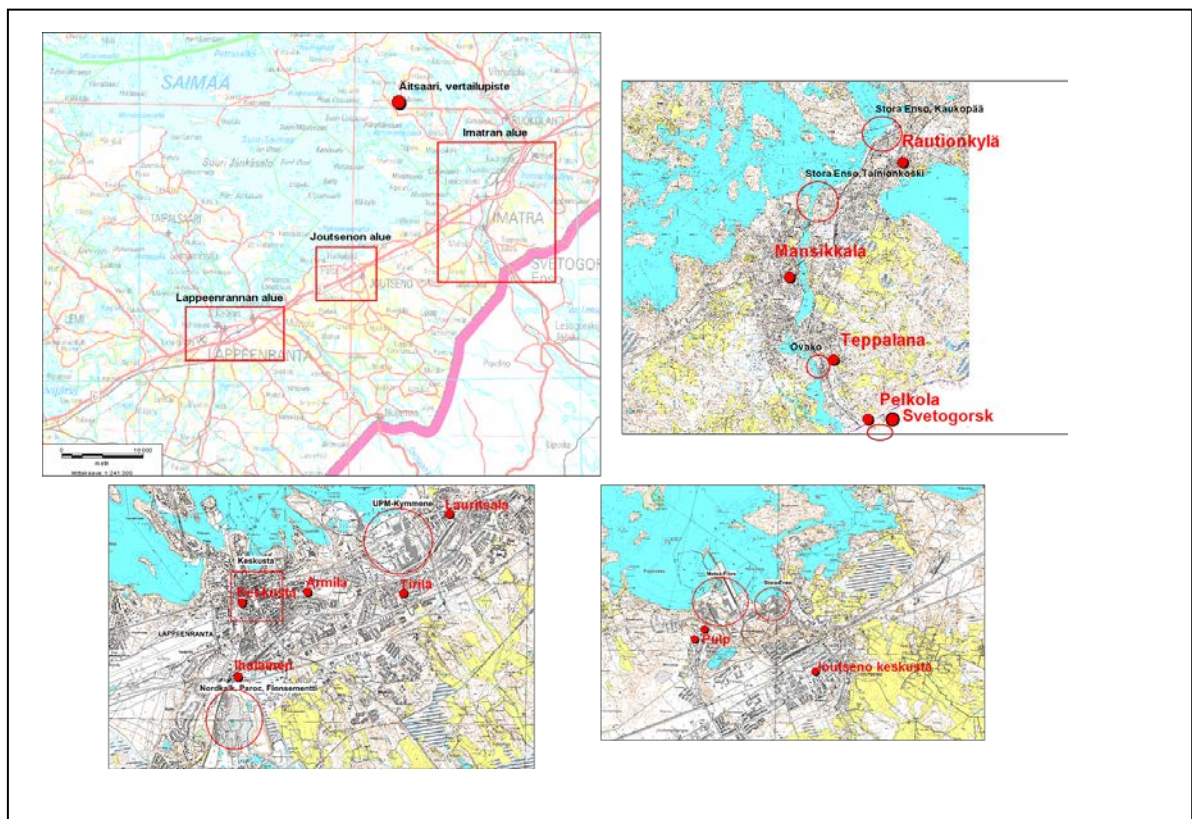


Figure 2: Air quality measuring stations of South Karelia in 2019. The red circles perform local industrial plants.

2. Measured components

Odorous sulphur compounds (TRS) are formed in the production processes in pulp industry. Even the low concentrations of TRS cause bad odor and discomfort in breathing air. Studies have shown that TRS concentrations have healthy effects like headaches and nausea.

Sulphur dioxide (SO₂) in South Karelia forms mostly in energy production and industry. The sulphur dioxide levels in our region are growing also due the long distance emissions. When sulfur dioxide dissolves in water, it forms sulfuric acid which causes acidification. The high level sulphur dioxide concentration irritates the upper respiratory tract, and it can cause respiratory infection and asthma attack.

Nitrogen dioxide (NO_x) forms in traffic and in heating systems. Nitrogen dioxide (NO₂) has healthy effects. It can cause respiratory irritation, asthma attacks and predispose to respiratory tract infection.

Particulate matter diameter < 10 µm (PM₁₀) and particulate matter diameter < 2.5 µm (PM_{2.5}) occurs in the air as a result of nature emissions, but is also emitted from the industry, transport, energy production and long distance emission.

Weather information, like wind direction, wind speed, temperature, humidity and pressure are measured at two weather stations located in Rautionkylä in Imatra and in Armila in Lappeenranta. According the weather data it is possible to deduce emission sources and transformation of pollutants.

3. Air quality guidelines and limit values

Finnish government has given in act 480/96 air quality guidelines and in setting 79/2017 air quality limit values. The guidelines and limit values aim to prevent health risks and reduce environmental pollution. World's Healthy Organization (WHO) has set a daily guideline 25 $\mu\text{g}/\text{m}^3$ for particulates diameter less than 2.5 μm (PM2.5).

Table 1: (Vnp 480/96) Finnish guidelines

Component	Interval	The maximum level, ($\mu\text{g}/\text{m}^3$)
Nitrogen dioxide (NO_2), $\text{NO}+\text{NO}_2$	- daily (2.highest value/month) - hourly (99 %-value/month) -yearly guideline, based on vegetation effects ($\text{NO}+\text{NO}_2$ in unit $\mu\text{g}(\text{NO}_2)/\text{m}^3$) (Vnp 38/2011)	70 150 30
Sulphur dioxide (SO_2)	- daily (2. highest/month) - hourly (99 %-value/month) - yearly guideline, based on vegetation effects (Vnp 38/2011)	80 250 20
Total suspended particles (TSP)	- yearly - daily (98 %-value/year)	50 120
Particulate matter < 10 μm (PM10)	- daily (2. highest/month)	70
Odorous sulphur compounds (TRS)	- daily (2. highest/month) *) in unit $\mu\text{g}(\text{S})/\text{m}^3$	10 (*)

Table 2: (79/2017) Finnish limit values to prevent healthy effects

Component	Interval	Maximum level ($\mu\text{g}/\text{m}^3$)	Number of allowed exceedings (number)
Nitrogen dioxide (NO_2)	hourly yearly	200 40	18
Sulphur dioxide (SO_2)	hourly daily	350 125	24 3
Particulate matter < 10 μm (PM10)	daily yearly	50 40	35
Particulate matter < 2.5 μm (PM2.5)	yearly	25	

4. Air quality in Imatra 2019

In 2019 air quality in Imatra was mostly good according to the index. Poor or very poor air quality wasn't measured in Mansikkala nor Pelkola nor Rautionkylä stations at all in 2019. Air quality was weakening most in springtime during the road dust period, and also due the emissions (like odorous sulphur compounds, sulphur dioxide and particulate matter) from the local forest and metal industries. In the border zone in Pelkola the emissions of Svetogorsk's industry affected the air quality. The changes in border traffic affected the emissions of nitrogen oxides in Pelkola as well. Also long distance emissions affected the air quality in Imatra.

4.1 Odorous sulphur compounds in Imatra (TRS)

The highest TRS concentrations in Imatra were measured in Rautionkylä and in Pelkola stations. In 2019 the Finnish guideline wasn't exceeded. Odor hours (hourly concentrations $> 3 \mu\text{g}(\text{S})/\text{m}^3$) were measured in Rautionkylä during 347 hours, in Pelkola 581 hours and in Mansikkala 106 hours.

The outdoor TRS concentrations were a bit higher in 2019 than in previous year. The level of TRS concentrations has declined during the 2000s due the process changes in local pulp industry.

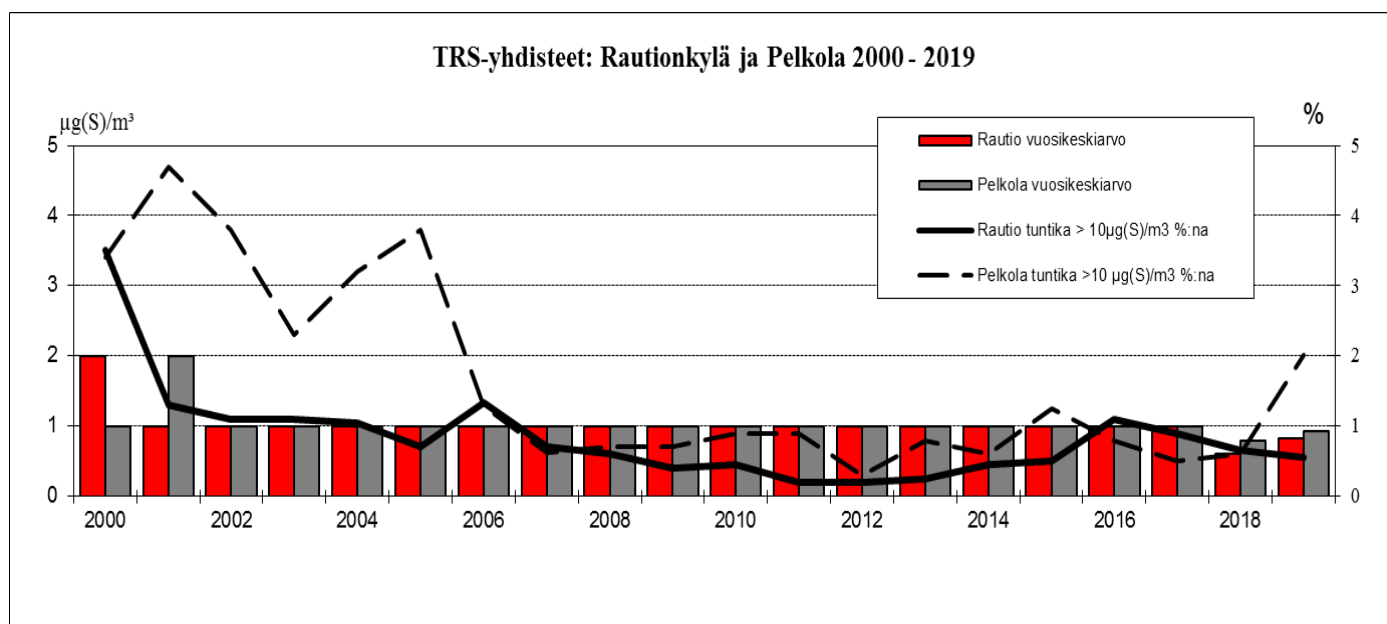


Figure 3: The annual averages of TRS and exceedings of TRS concentration $10 \mu\text{g}(\text{S})/\text{m}^3$ in Rautionkylä and in Pelkola during years 2000 - 2019

4.2 Sulphur dioxide in Imatra (SO₂)

Concentrations of sulphur dioxide (SO₂) were below the Finnish guidelines and limit values in Imatra in 2019. The SO₂ - concentrations in Rautionkylä and in Pelkola were about at the same level.

Emissions of Stora Enso Imatra mills affected the most on sulphur dioxide level in Rautionkylä, and Svetogorsk mill affected the most on sulphur dioxide level in Pelkola. Occasionally long distance emissions increased the sulphur dioxide level in all stations. In Imatra sulphur dioxide levels have been below guidelines and limit values during the years 2000 - 2003 and 2005 - 2019.

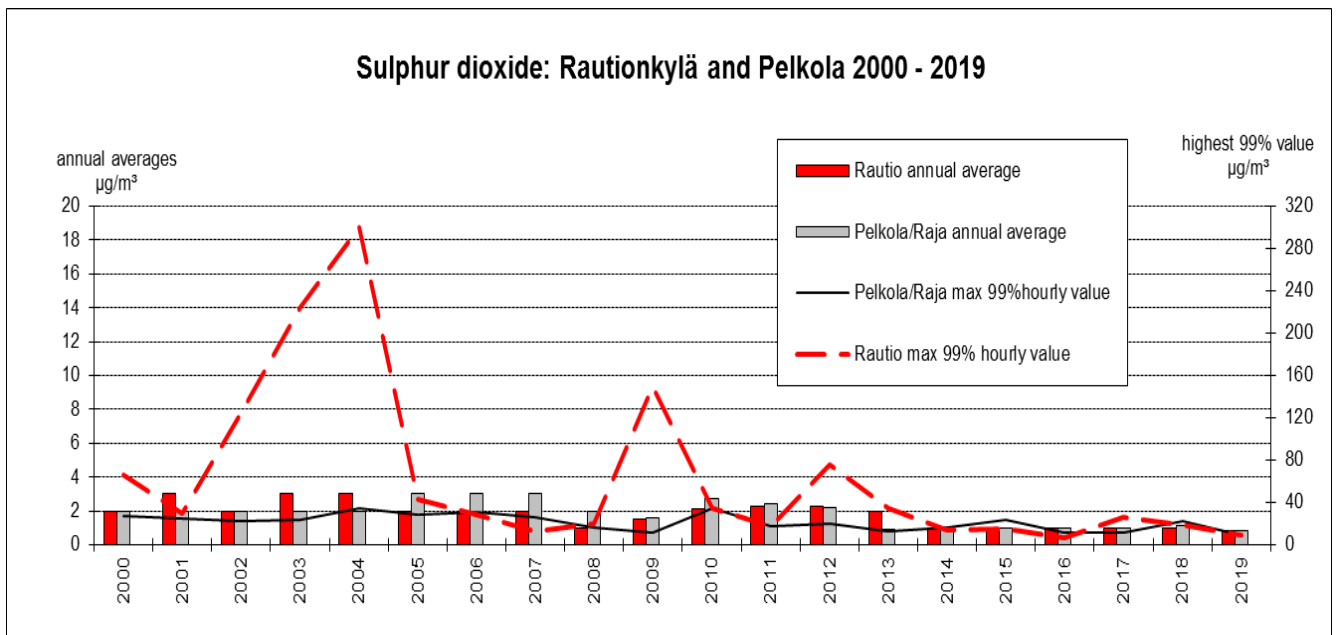


Figure 4: The annual sulphur dioxide averages and the highest 99 % - hourly averages in Rautionkylä and in Pelkola in 2000 - 2019

4.3 Nitrogen dioxide in Imatra (NO₂)

In 2019 the highest NO₂- concentrations in Imatra were measured in Mansikkala and in Pelkola. NO₂ - concentrations were at highest in April. NO₂- concentrations vary in Pelkola as a result of changes in border traffic. In 2019 NO₂- concentrations in Imatra were 29 - 49 % of guidelines. Traffic affects the nitrogen dioxide levels especially in city centers and along the busy roads. Industrial NO_x - emissions have not as clear affect as traffic emissions have.

4.4 Particles in Imatra (PM10 and PM2.5)

In Imatra the level of particles (PM10) raised during road dust period from March to April. In 2019 in April the guideline of PM10 was exceeded in Mansikkala.

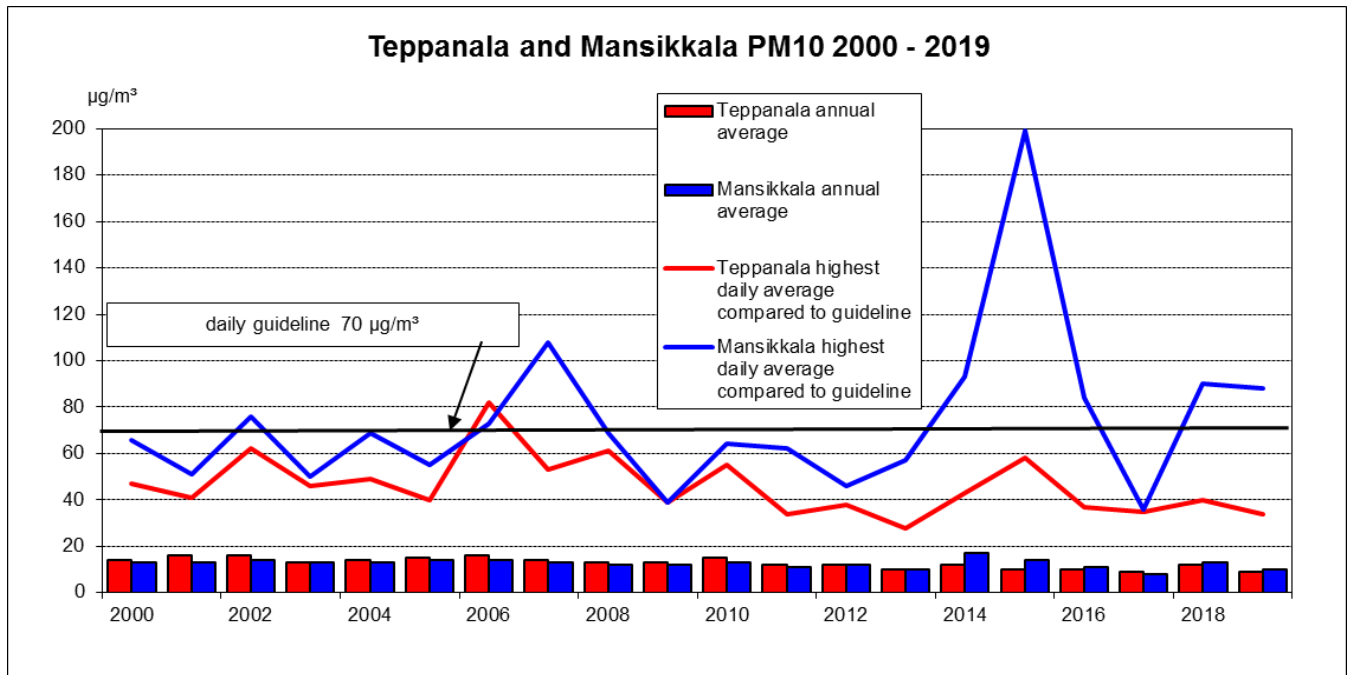


Figure 5: PM10 annual averages and the values compared with PM10 guideline in Mansikkala and in Teppanala in 2000 - 2019

In Imatra particulate matter $< 2.5 \mu\text{m}$ (PM2.5) was measured in Teppanala. The daily guideline of WHO wasn't exceeded in 2019. Concentrations level of PM2.5 rose during very low temperatures and due to the long distance emissions.

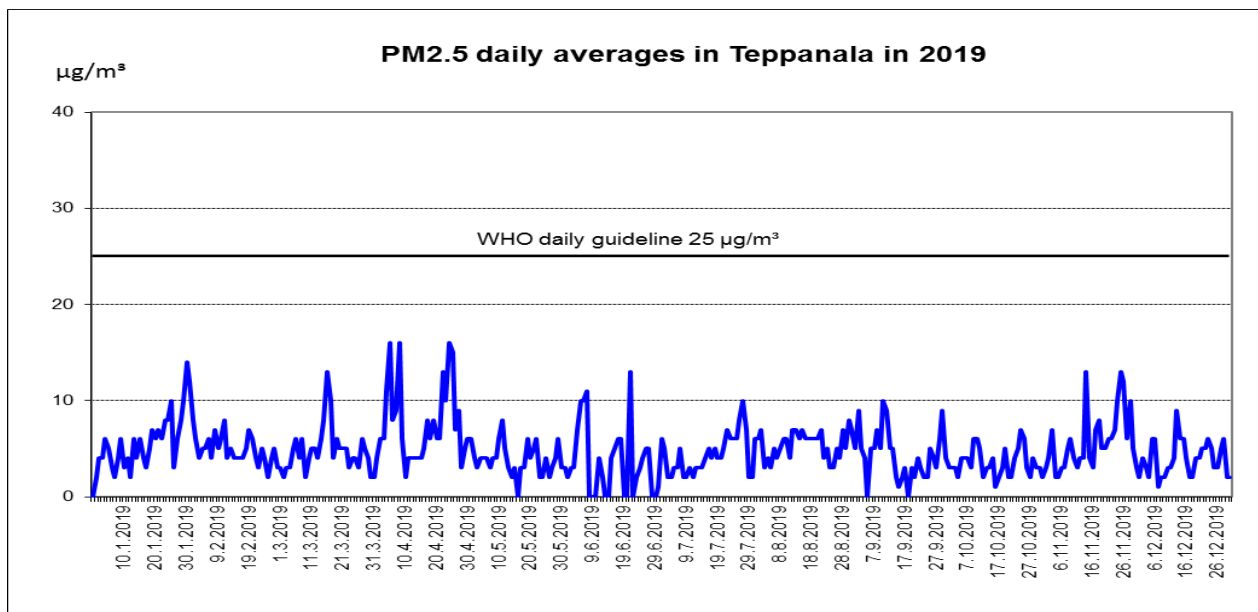


Figure 6: PM2.5 daily averages in 2019 and WHO's daily guideline 25 $\mu\text{g}/\text{m}^3$

4.5 Sulphur deposition in Imatra

The total sulphur deposition in Imatra has varied during the 2000s. The deposition level in Pelkola exceeded the target value in 2019.

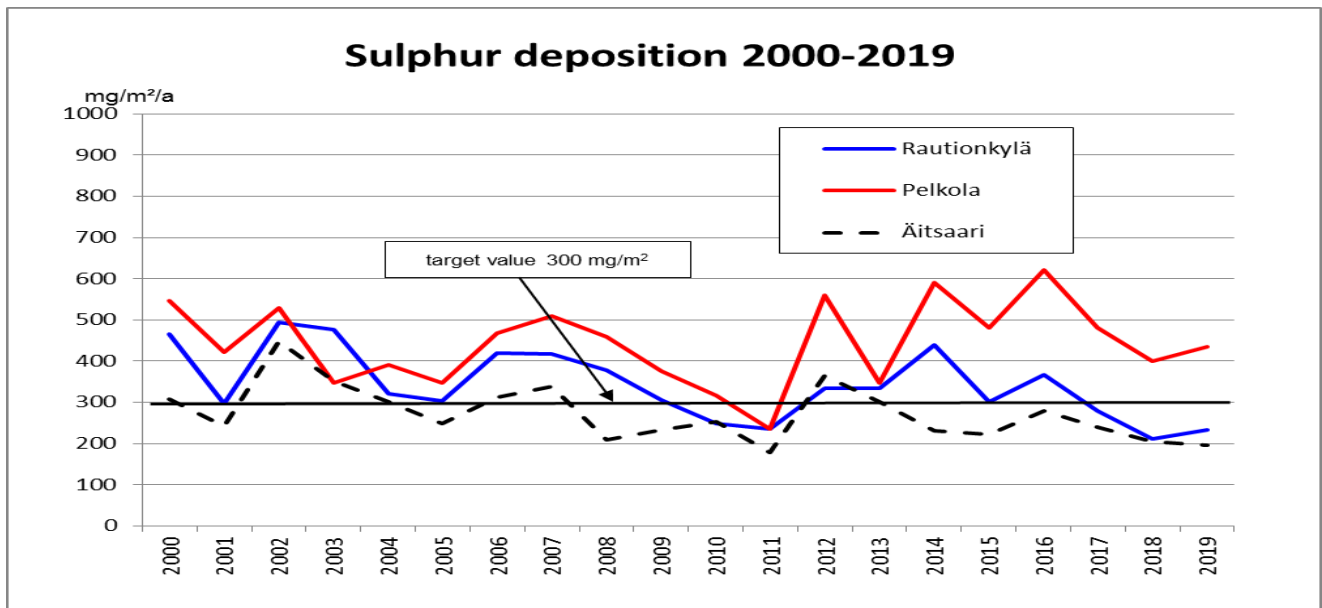


Figure 7: The sulphur deposition levels in Imatra in years 2000 - 2019

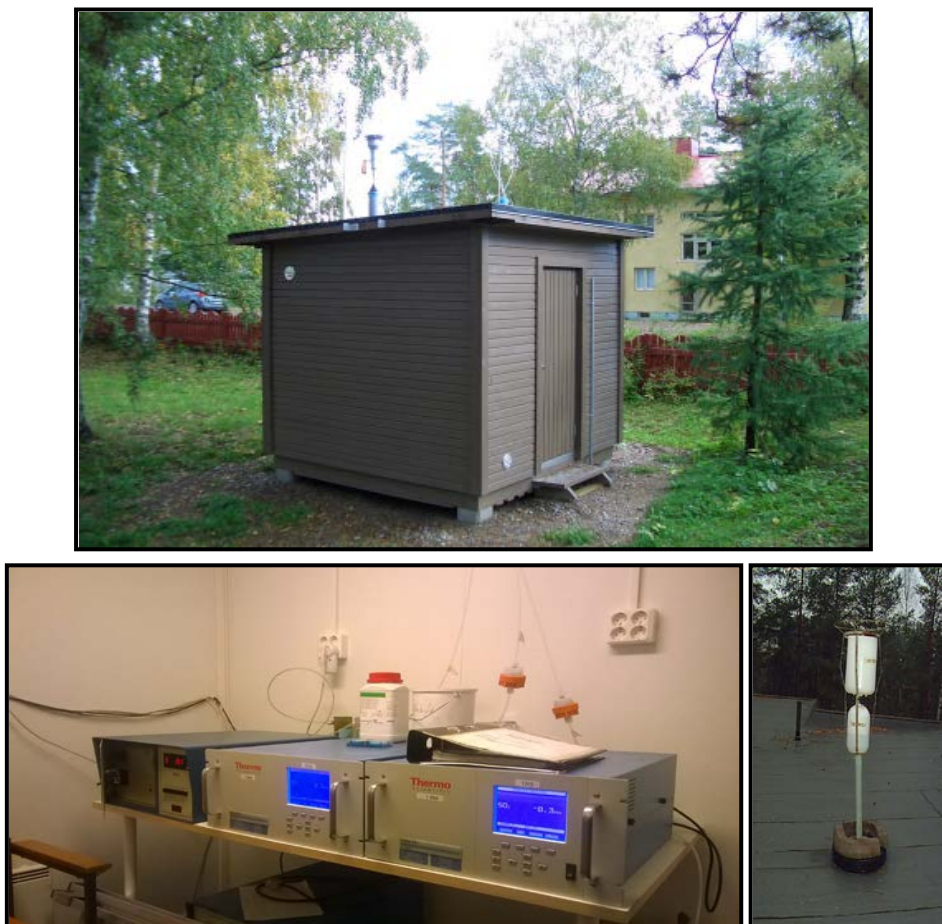


Figure 8: Measuring station in Rautionkylä, deposition collector and air quality measuring devices

5. Air quality in Lappeenranta 2019

According to the air quality index the air in Lappeenranta was mostly good in 2019. Very poor air quality wasn't measured in any measuring station in Lappeenranta. The raised particles levels during road dust period in spring and malfunctions in industry weakened the most the air quality in Lappeenranta.

5.1 Odor sulphur compounds in Lappeenranta (TRS)

Odor sulphur compounds (TRS) were measured at 5 stations in Lappeenranta in 2019: In Lappeenranta center (Lappeenrannan keskusta), in Tirilä, in Lauritsala, in Pulp and in center of Joutseno (Joutsenon keskusta).

The guideline of TRS wasn't exceeded in Lappeenranta in 2019. Odor hours (hourly concentrations $> 3 \mu\text{g}(\text{S})/\text{m}^3$) were measured during 20 hours in Lappeenranta center, 154 hours in Tirilä, 157 hours in Lauritsala, 168 hours in Pulp and 89 hours in center of Joutseno. Annual average level of odor sulphur compounds (TRS) hasn't varied very much in the 2000s.

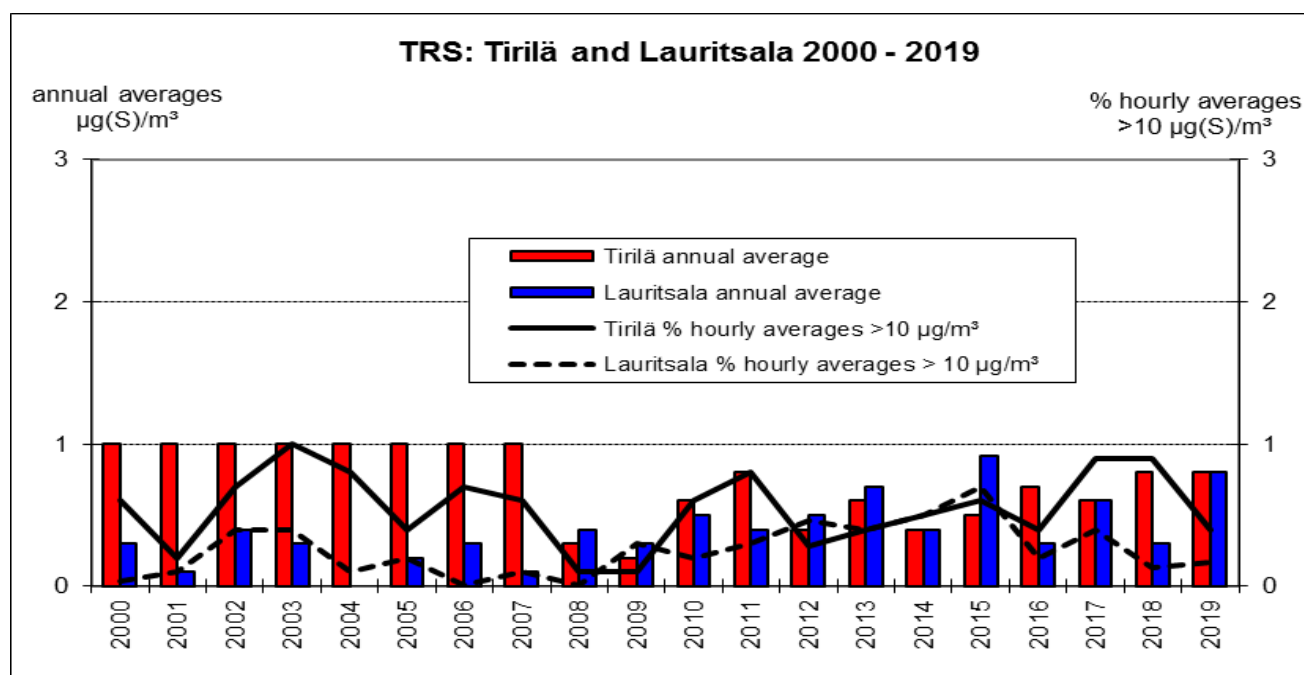


Figure 9: The annual averages of TRS and exceedings (%) of TRS concentration $10 \mu\text{g}(\text{S})/\text{m}^3$ in Tirilä and in Lauritsala in 2000 - 2019

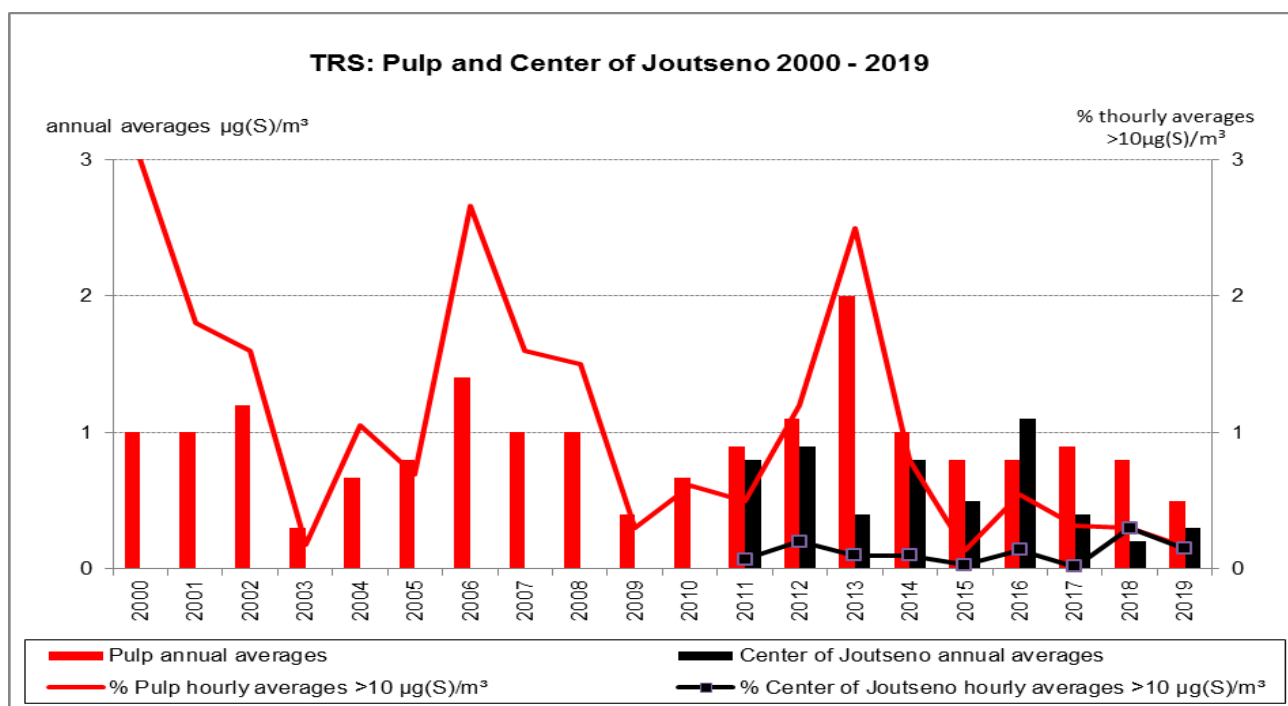


Figure 10: The annual averages of TRS and exceedings of TRS concentration $10 \mu\text{g}(\text{S})/\text{m}^3$ in Pulp and in center of Joutseno in 2000 - 2019

5.2 Sulphur dioxide in Lappeenranta (SO_2)

In Lappeenranta sulphur dioxide was measured in Tirilä, in Ihalainen and in Pulp. During 2000s concentrations have declined. SO_2 - concentrations in Lappeenranta have always been below guidelines and limit values. SO_2 -concentrations rise during very low temperature, during malfunctions in industry and during long distance emissions.

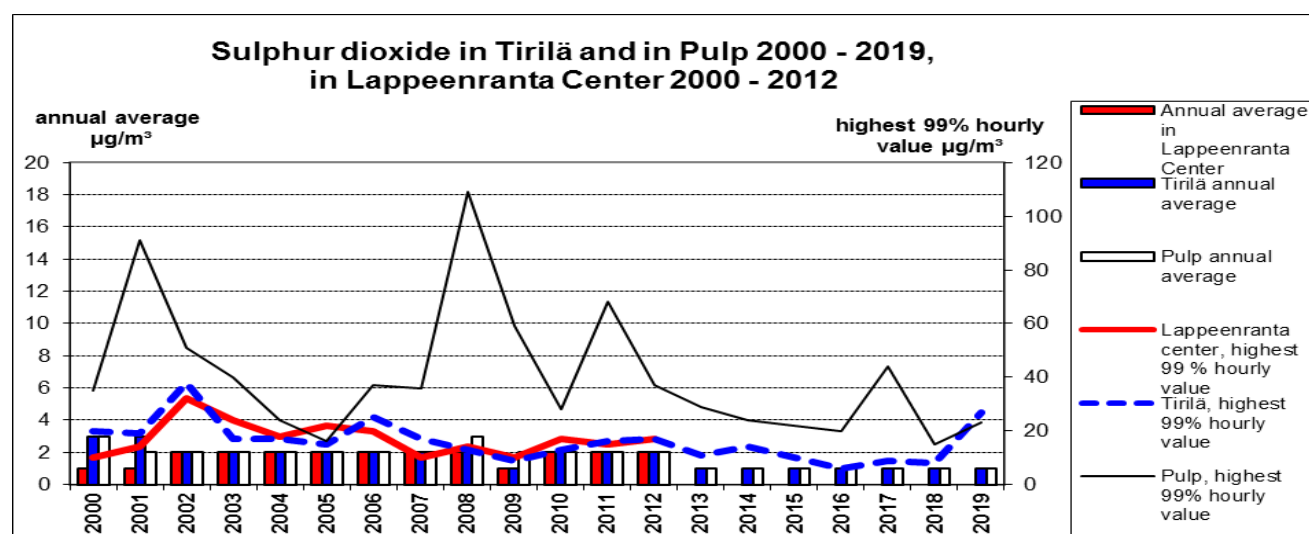


Figure 11: The annual sulphur dioxide averages and the highest 99 % - hourly averages in Tirilä and in Pulp in years 2000 - 2019 and in Lappeenranta center in 2000 - 2012

5.3 Nitrogen dioxide in Lappeenranta (NO₂)

Nitrogen dioxide was measured in Lappeenranta center and in Ihalainen in 2019. The level of nitrogen dioxide hasn't change a very much during years. In Ihalainen the level of nitrogen dioxide is higher than in Lappeenranta Center. NO₂ - concentrations were at their highest in April. The main nitrogen dioxide source in Lappeenranta is traffic. Concentrations of nitrogen dioxide rise during heavy traffic in city centers, and due the hard frost and low wind speed in winter time. The concentrations in Lappeenranta center were 40 - 42 % of guidelines and in Ihalainen 56 - 65 % of guidelines.

5.4 Particles in Lappeenranta (PM₁₀ ja PM_{2,5})

In 2019 particulate matter < 10 µm (PM₁₀) was measured in Lappeenranta at 4 stations: In Lappeenranta center, in Lauritsala, in Ihalainen and in center of Joutseno. Particulate matter < 2.5 µm (PM_{2.5}) was measured in Tirilä and in Pulp.

In 2019 the springtime road dust period rose the dust levels mainly in April. The guide line of particles matter < 10 µm (PM₁₀) was exceeded in Ihalainen and in Lauritsala. The limit value of PM₁₀ wasn't exceeded in any stations of Lappeenranta.

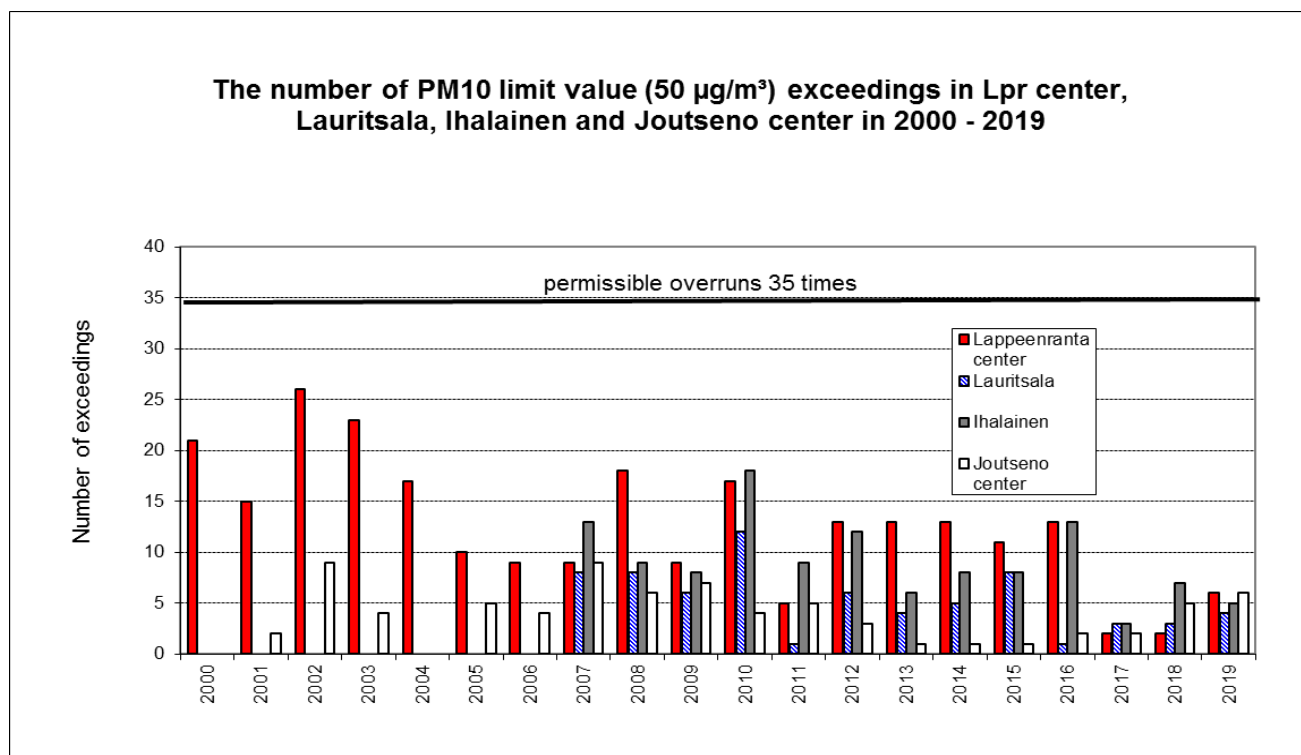


Figure 12: The number of PM₁₀ limit value (50 µg/m³) exceedings in Lappeenranta center, in Lauritsala, in Ihalainen and in center of Joutseno in 2000 - 2019

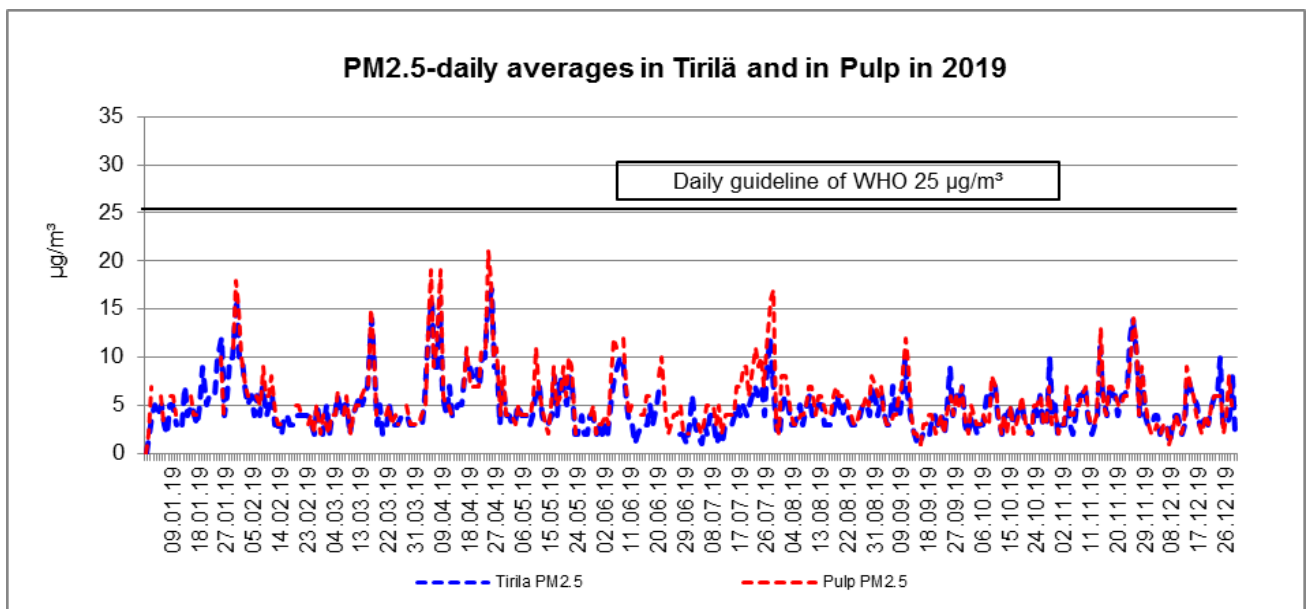


Figure 13: Daily averages of particulate matter < 2.5 μm (PM2.5) in Tirilä and in Pulp in 2019

WHO's daily guideline of PM2.5 wasn't exceeded in Pulp nor in Tirilä in 2019. PM2.5 concentrations rose during hard frost, and when wind speed was weak. Also long distance emissions raised PM2.5 levels. In 2019 the annual limit value 25 $\mu\text{g}/\text{m}^3$ wasn't exceeded.



Figure 14: The measuring station of Lappeenranta center is located in the Kauppahalli building along Snellmankatu

5.5 Sulphur deposition in Lappeenranta

In Lappeenranta depositions were measured in Ihalainen, Tirilä and in Pulp. The Finnish target value of sulphur deposition wasn't exceeded in any deposition stations in Lappeenranta in 2019. The reference point of depositions was located in Äitsaari in Ruokolahti. The amount of deposition in Lappeenranta has decreased in 2000s.

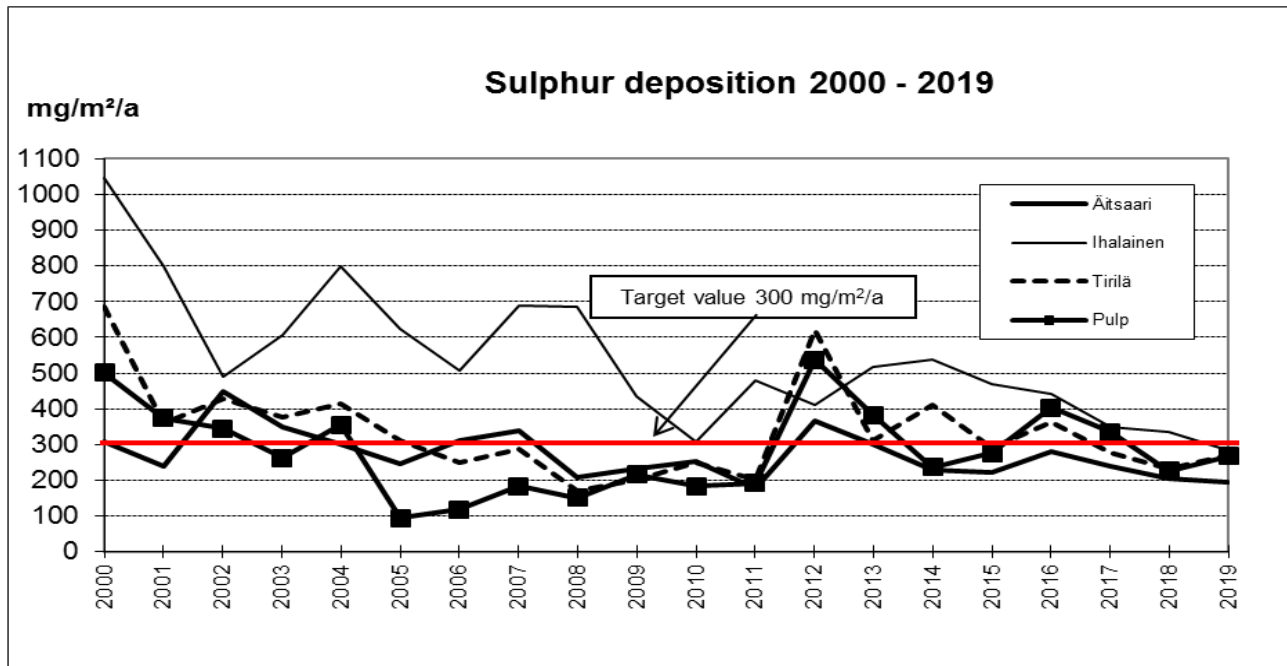


Figure 15: The sulphur depositions in Lappeenranta in years 2000 - 2019

6. Air quality in Svetogorsk in 2019

In Svetogorsk the air quality was measured at one station, which was located in parking lot of local hotel. Air quality in Svetogorsk has improved during 2000s. Odorous sulphur components (TRS) and nitrogen dioxides (NO_2) were measured in Svetogorsk in 2019.

6.1 Odorous sulphur compounds in Svetogorsk (TRS)

The elevated odorous sulphur compounds (TRS) were measured many times in Svetogorsk in 2019. Concentrations were at higher level than in previous year. During 2000s the process changes in Svetogorsk's industry have decreased the TRS emissions into the air. In 2019 the Finnish TRS daily guideline was exceeded in 4 months. So called odor hours, hourly averages more than $3 \mu\text{g}(\text{S})/\text{m}^3$, were measured during 1076 hours in Svetogorsk.

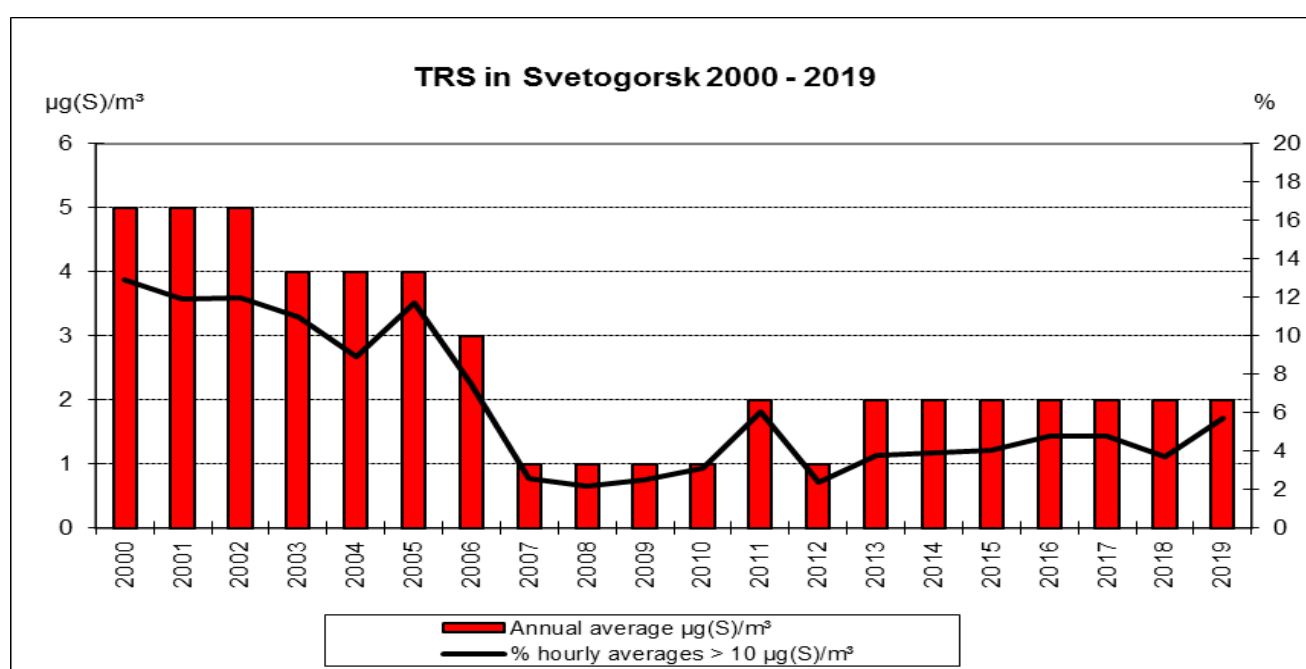


Figure 16: The annual averages of TRS and exceedings of TRS concentration $10 \mu\text{g}(\text{S})/\text{m}^3$ in Svetogorsk in years 2000 - 2019

6.2 Nitrogen dioxide in Svetogorsk (NO_2)

In 2019 the concentrations of nitrogen dioxide were below Finnish guidelines and limit values. The amount of border crossing traffic affects the Svetogorsk's nitrogen dioxide level.

7. Summary

Air quality in South Karelia was mostly good in 2019. However the spring road dust period weakened air quality everywhere in South Karelia mostly in April. Also the emissions from the local forest industry and long distance emissions had negative impact on air quality every now and then. Local industry has made process changes during last 20 years, so air quality has improved in South Karelia.

The Finnish Meteorological Institute maintains a nationwide network service called 'air quality portal'. From 'portal' it is possible to monitor the air quality data of South Karelia's and of the other 49 Finnish municipalities' air quality in real time (www.ilmatieteenlaitos.fi/ilmanlaatu). Imatra Environmental department access a new website <http://www.imatranseudunymparistotoimi.fi/palvelut/ilmanlaadun-valvonta/ilmanlaatu-etela-karjalassa/>. In new website it's possible to monitor the Index of the air quality and read notifications regarding local air quality. The local newspaper "Uutisvuoksi" publishes air quality index every Tuesday and Saturday. In every weekday morning at 8.30am Finnish TV program 'Yle aamu tv' is shown the air quality index of Center of Lappeenranta.

South Karelia air quality annual reports of years 2004 to 2019 and the summary reports of the annual reports from the years 2005 to 2019 are readable on Imatra regional environmental department's website (<http://www.imatranseudunymparistotoimi.fi/julkaisut/tutkimusraportit>)

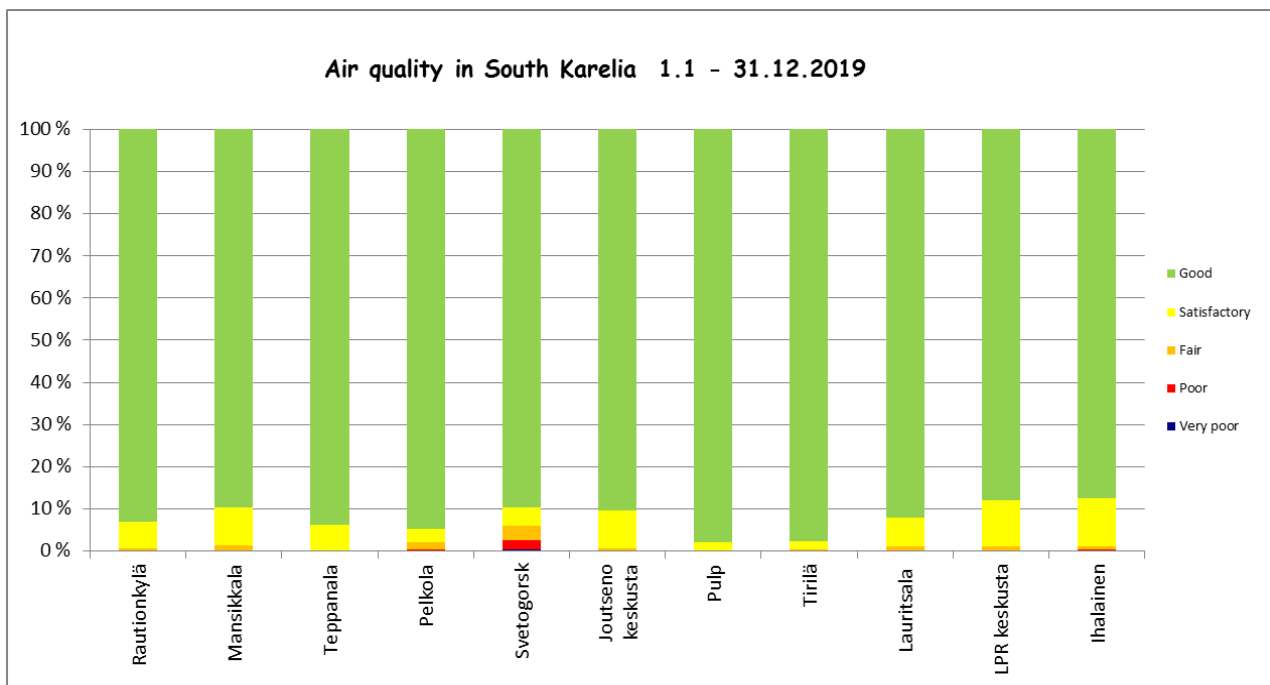


Figure 17: Air quality according to the hourly index in South Karelia in 2019

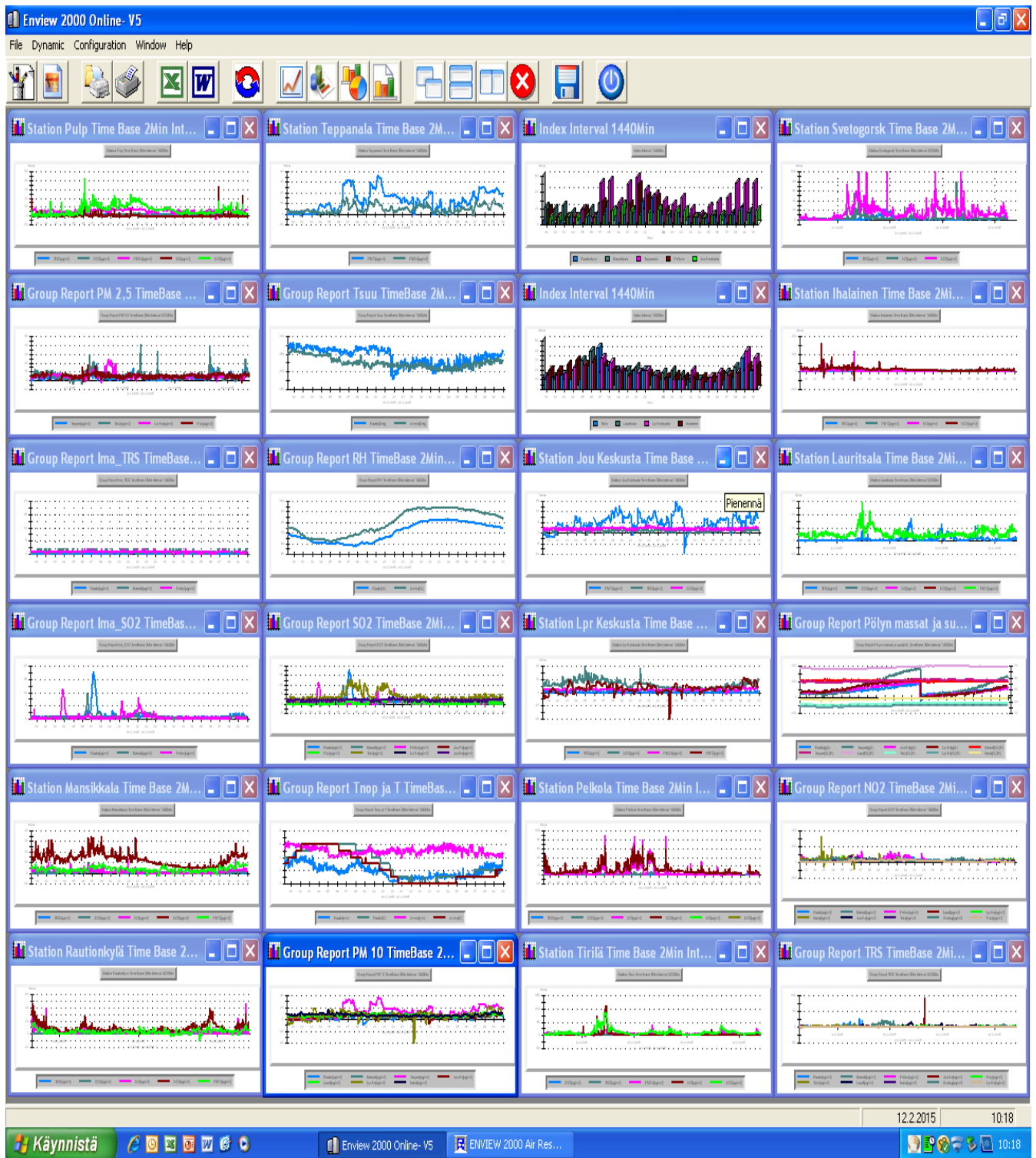


Figure 18: The picture of South Karelia air quality network's data collection software called 'Enview'

Contact information :
Imatran seudun ympäristövalvonta
Virastokatu 2
55 100 IMATRA
tel: +358 20 61 74301, +358 20 61 74319
e-mail: ymparistotoimi@imatra.fi

Report in Finnish online: <http://www.imatranseudunymparistotoimi.fi/julkaisut/tutkimusraportit/>