IMATRAN SEUDUN
ympäristötoimi

Air quality in South Karelia 2018

Imatra town 2019

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1. In general

Imatra's, Lappeenranta's and Svetogorsk's measuring stations form an air quality **network in South Karelia**. 2018 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 industrials 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 2018. 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 53 Finnish cities is updated hourly in internet.

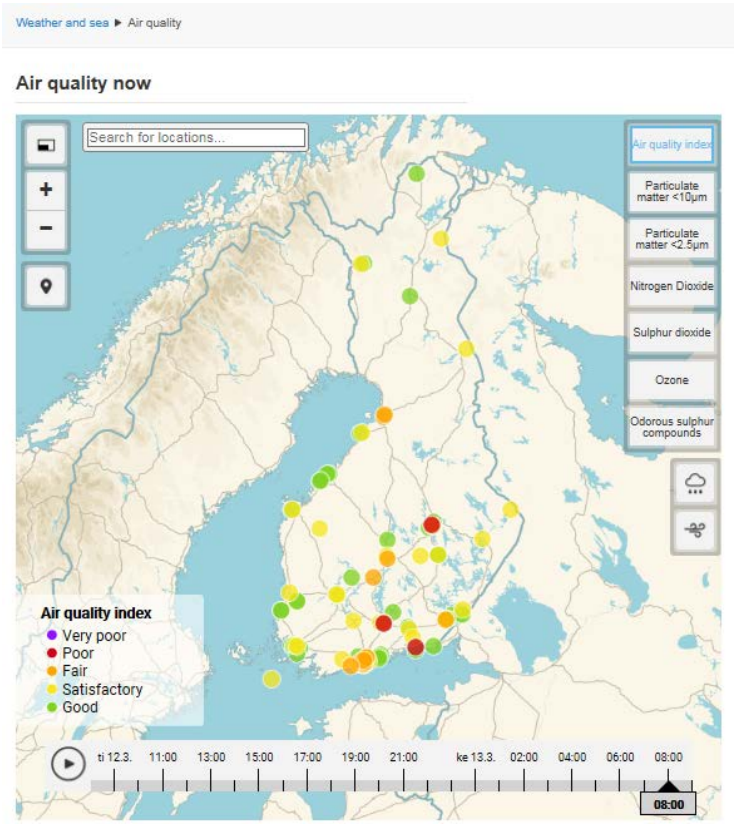

Figure 1: *Finnish Meteorological Institute published air quality online data from 53 Finnish cities and from 101 air quality measuring stations in 2018*

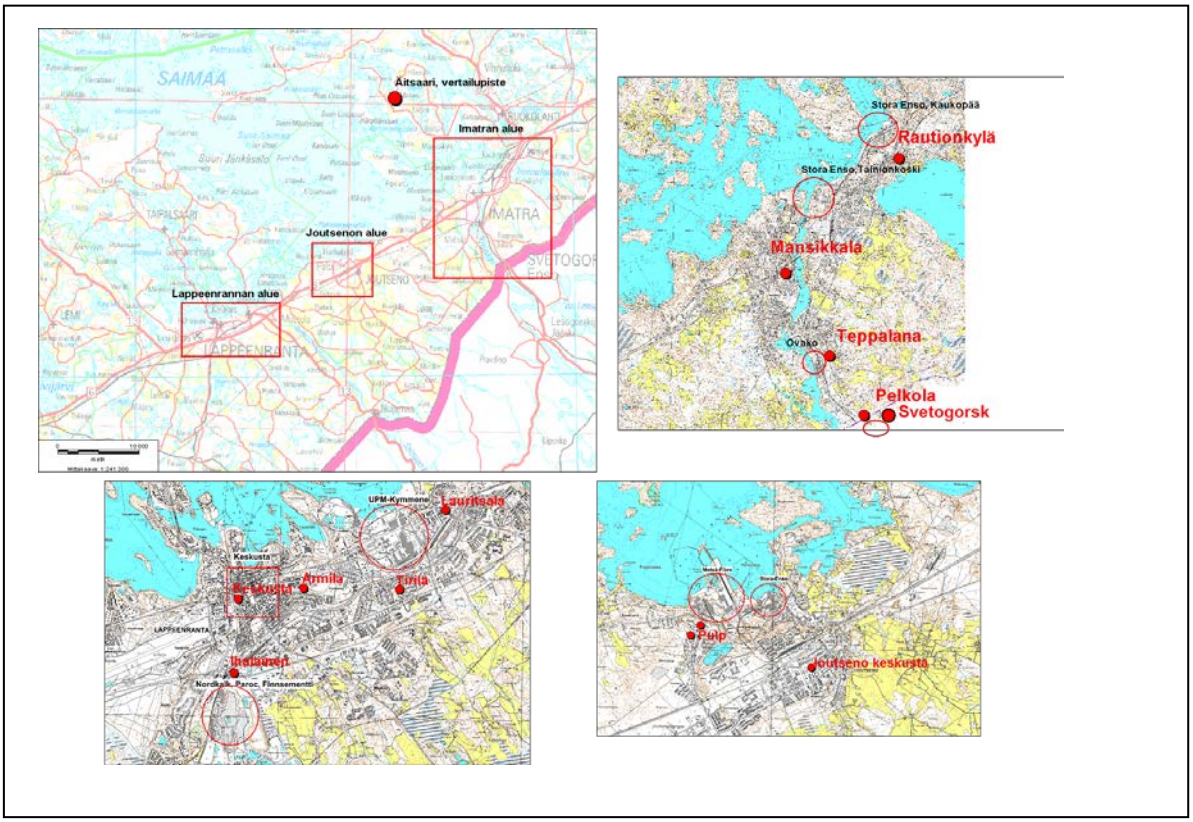

Figure 2: Air quality measuring stations of South Karelia in 2018. The red circles perform local industrial plants.

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 (NO_2) 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 (PM2.5) 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 polutation. World's Healthy Organization (WHO) has set a daily guideline 25 µg/m³ for particals diameter less than 2.5 µm (PM2.5).

*Table 1: (Vnp 480/96) Finnish **guidelines***

Component	**Interval**	**The maximum level, (µg/m³)**
Nitrogen dioxide *(NO_2),* ***$NO+NO_2$***	- daily (2.highest value/month) - hourly (99 %-value/month) -yearly guideline, based on vegetation effects ($NO+NO_2$ in unit µg(NO_2)/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 µg(S)/m³	10 (*

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

Component	**Interval**	**Maximum level (µg/m³)**	**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 2018

In 2018 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 2018. 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. The Finnish guideline wasn't exceeded in 2018. Odor hours (hourly concentrations > 3 µg(S)/m ^{3}) were measured in Rautionkylä during 169 hours, in Pelkola 409 hours and in Mansikkala 29 hours.

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

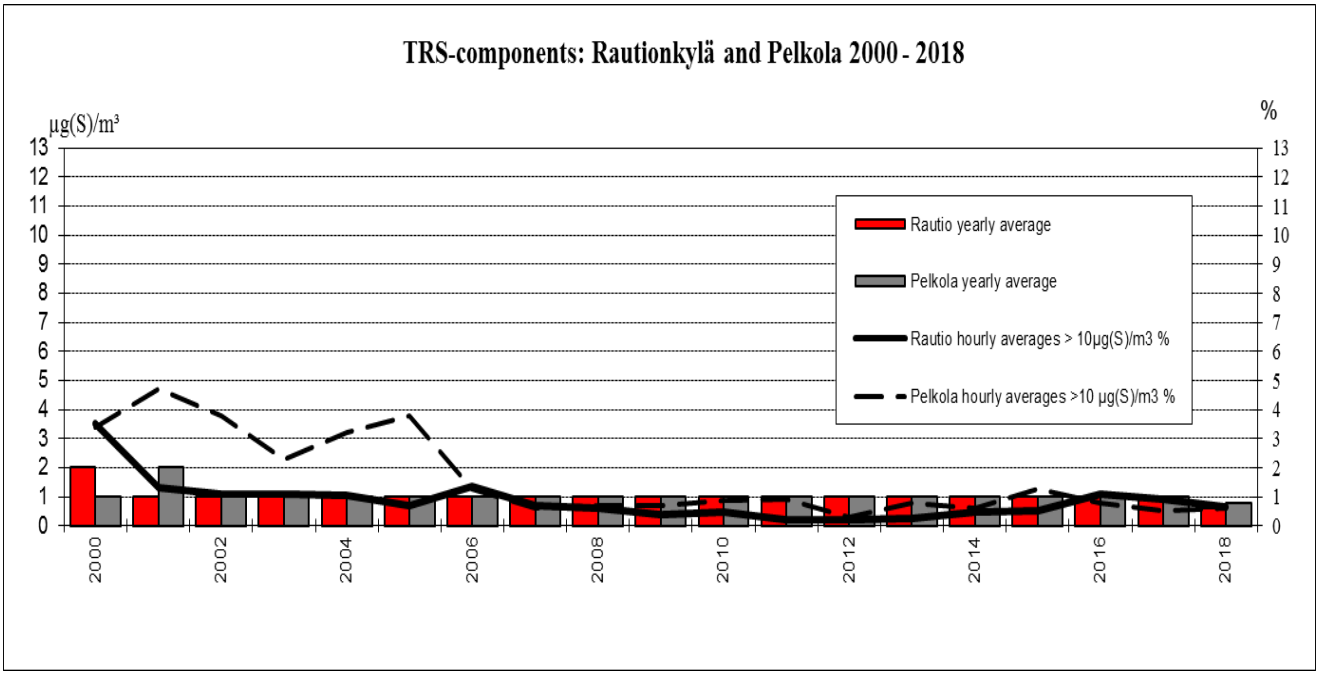

Figure 3: The annual averages of TRS and exceedings of TRS concentration 10 µg(S)/m ^{3} in Rautionkylä and in Pelkola during years 2000 – 2018

4.2 Sulphur dioxide in Imatra (SO_2)

Concentrations of sulphur dioxide (SO_2) were below the Finnish guidelines and limit values in Imatra in 2018. The SO_2 - 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 – 2018.

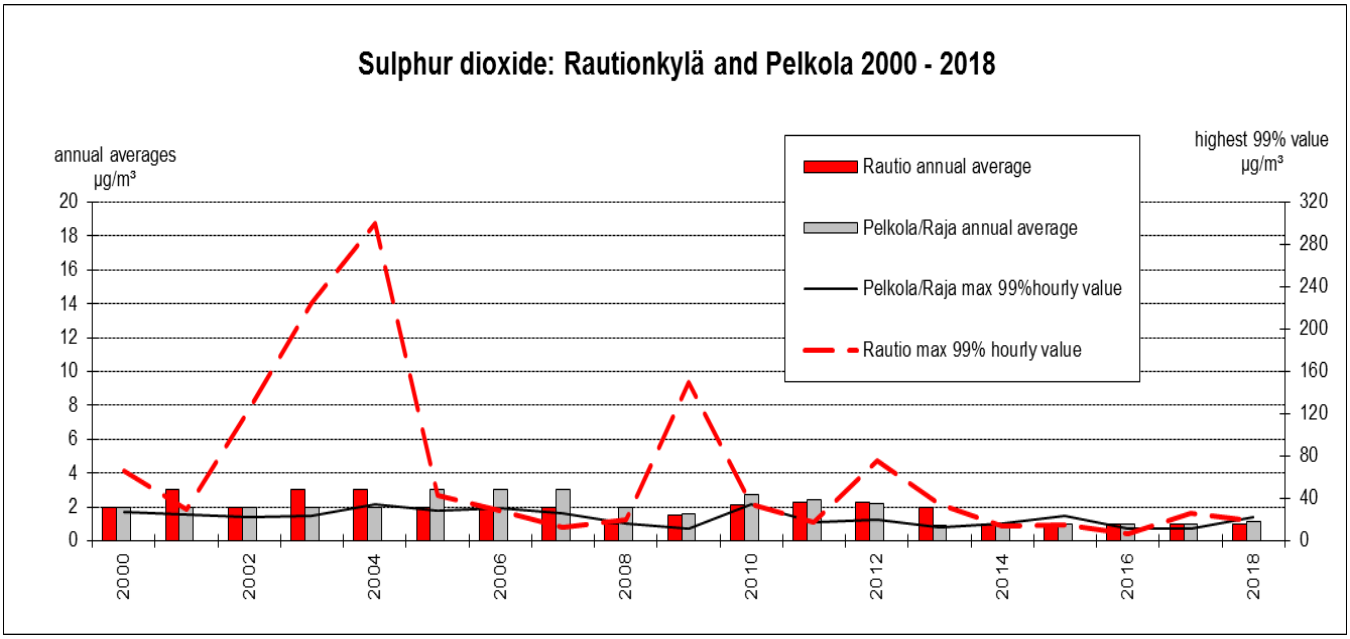

Figure 4: The annual sulphur dioxide averages and the highest 99 % - hourly averages in Rautionkylä and in Pelkola in 2000 – 2018

4.3 Nitrogen dioxide in Imatra (NO_2)

In 2018 the highest NO_2- concentrations in Imatra were measured in Mansikkala and in Pelkola. NO_2 - concentrations were at highest in March. NO_2- concentrations vary in Pelkola as a result of changes in border traffic. In 2018 NO_2- concentrations in Imatra were 38 - 53 % of guidelines. Traffic affects the nitrogen dioxide levels especially in city centers and along the busy roads. Industrial NOx - 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 May. In 2018 in April the guideline of PM10 was exceeded in Mansikkala.

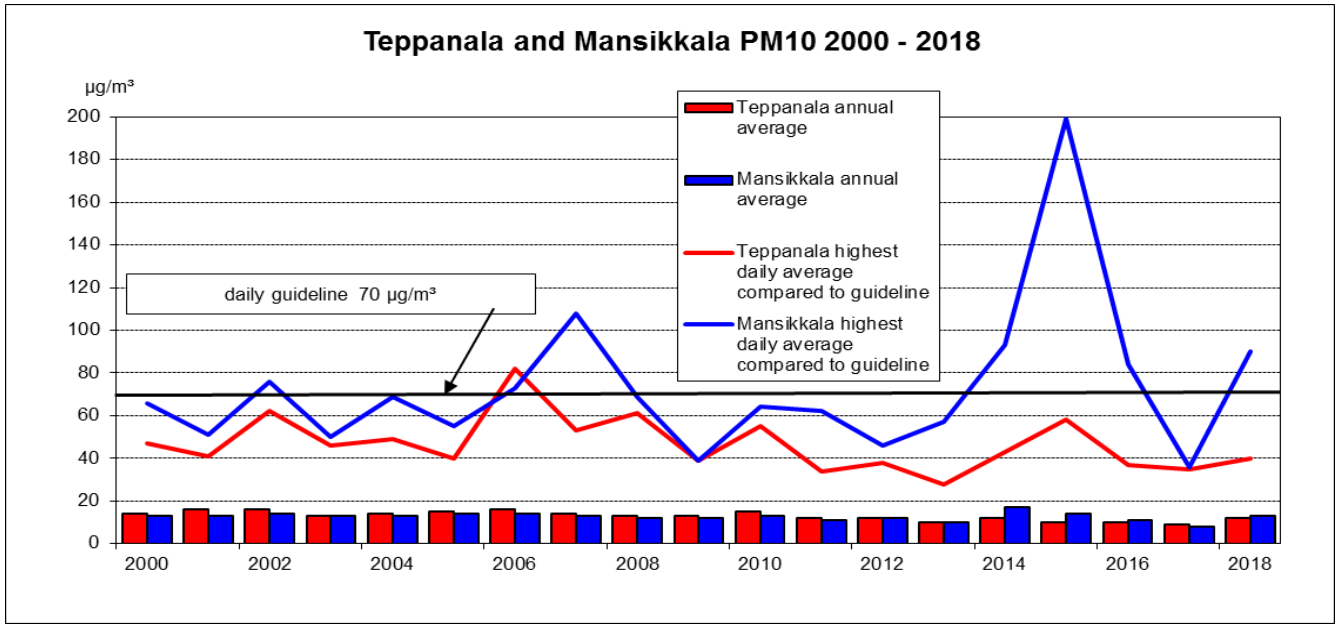

Figure 5: PM10 annual averages and the values compared with PM10 guideline in Mansikkala and in Teppanala in 2000 - 2018

In Imatra particulate matter < 2.5 µm (PM2.5) was measured in Teppanala. The daily guideline of WHO wasn't exceeded in 2018. Concentrations level of PM2.5 rose during very low temperatures and due to the long distance emissions.

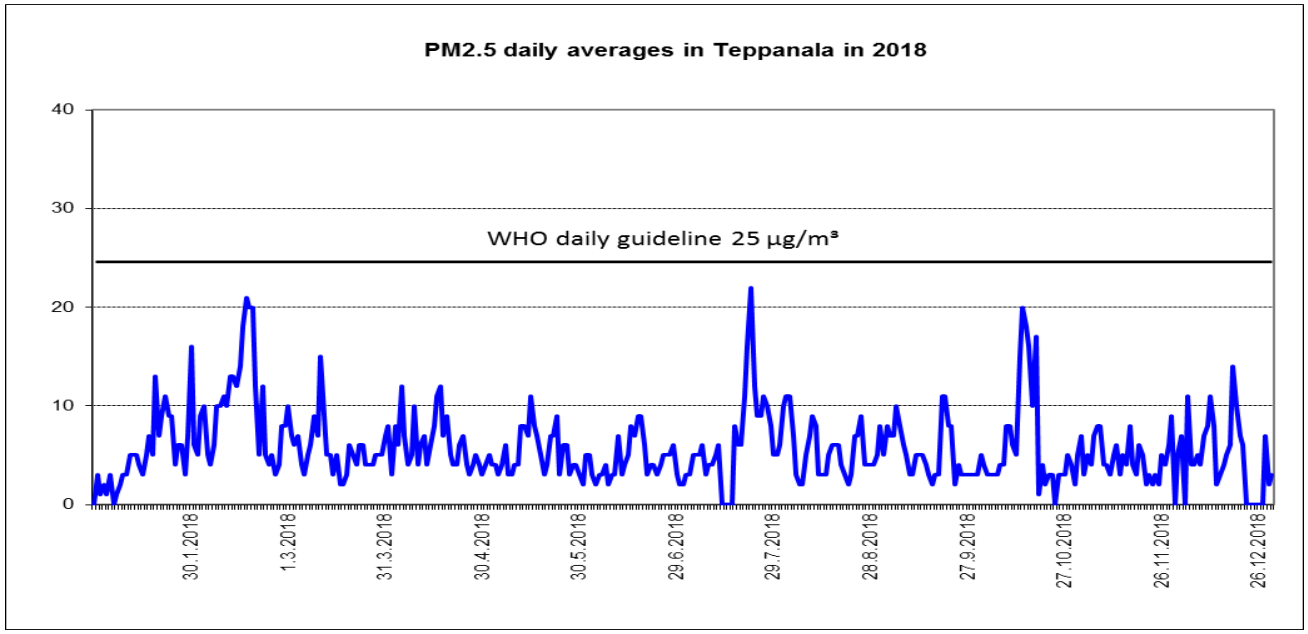

Figure 6: PM2.5 daily averages in 2018 and WHO's daily guideline 25 µg/m³

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 2018.

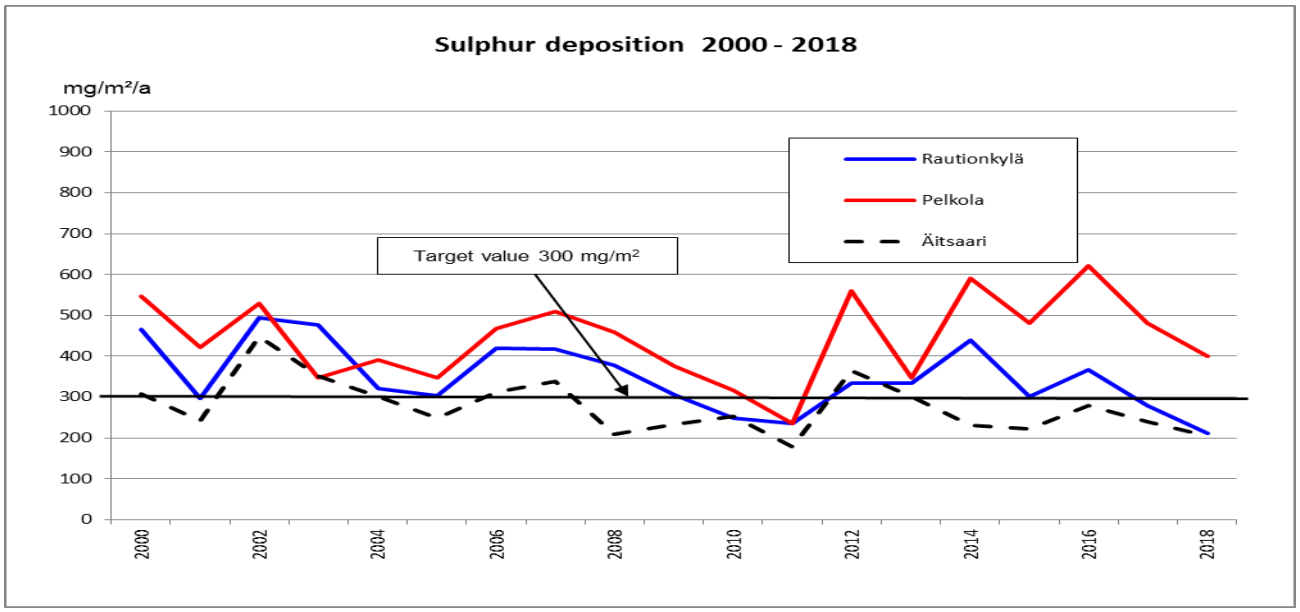

Figure 7: The sulphur deposition levels in Imatra in years 2000 – 2018

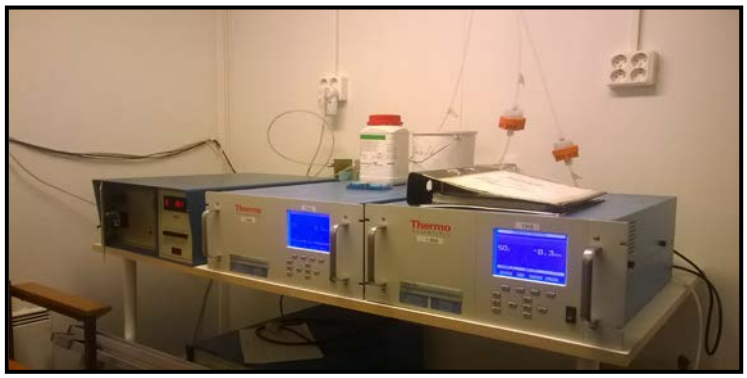

Figure 8: Measuring station in Rautionkylä, deposition collector and air quality measuring devices

5. Air quality in Lappeenranta 2018

According to the air quality index the air in Lappeenranta was mostly good in 2018. Poor nor 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 2018: In Lappeenranta center (Lappeenrannan keskusta), in Tirilä, in Lauritsala, in Pulp and in center of Joutseno (Joutsenon keskusta).

The guideline of TRS was exceeded in Tirilä in March in 2018. The guideline wasn't exceeded in other measuring stations in Lappeenranta. Odor hours (hourly concentrations > 3 µg(S)/m³) were measured during 91 hours in Lappeenranta center, 260 hours in Tirilä, 144 hours in Lauritsala, 150 hours in Pulp and 148 times in center of Joutseno. Annual average level of odor sulphur compounds (TRS) hasn't varied very much in the 2000s.

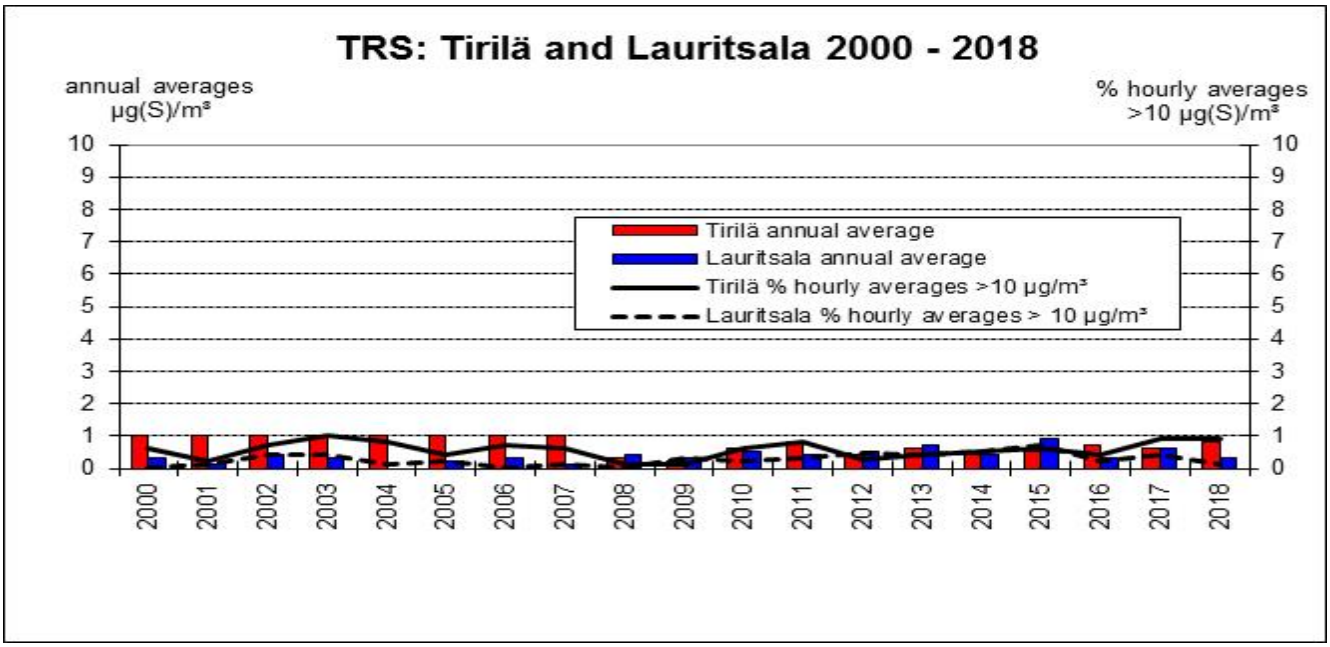

Figure 9: *The annual averages of TRS and exceedings (%) of TRS concentration 10 µg(S)/m³ in Tirilä and in Lauritsala in 2000 - 2018*

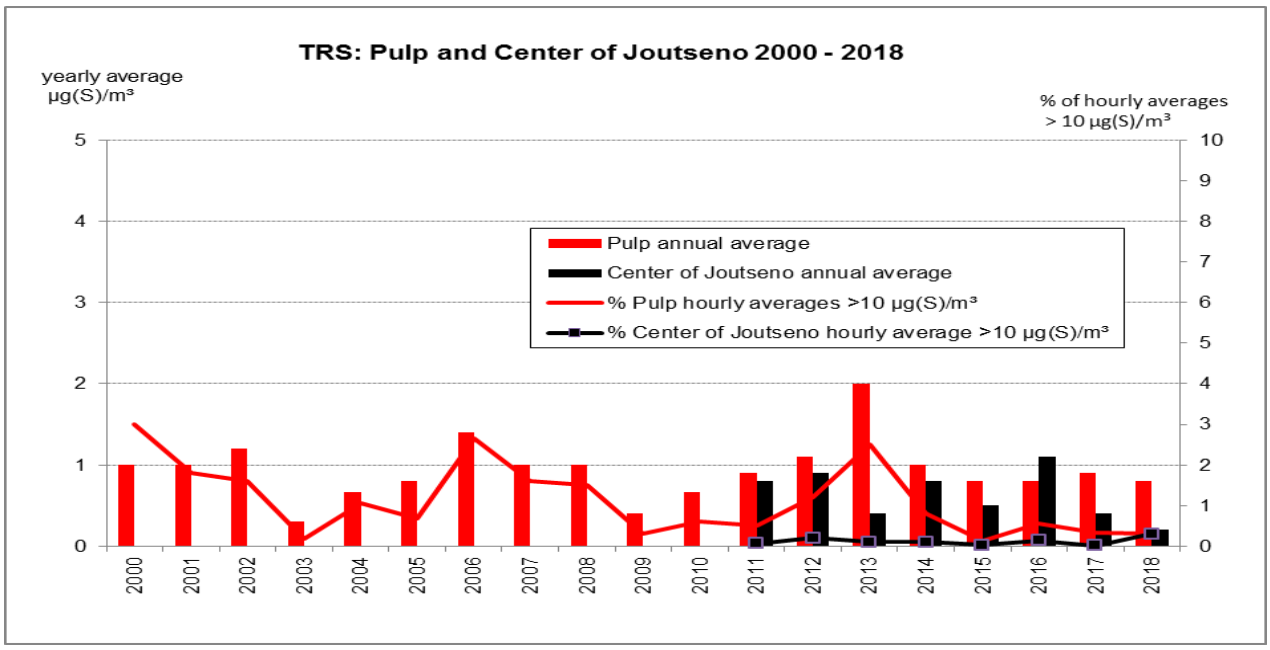

Figure 10: The annual averages of TRS and exceedings of TRS concentration 10 µg(S)/m³ in Pulp and in center of Joutseno in 2000 - 2018

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.

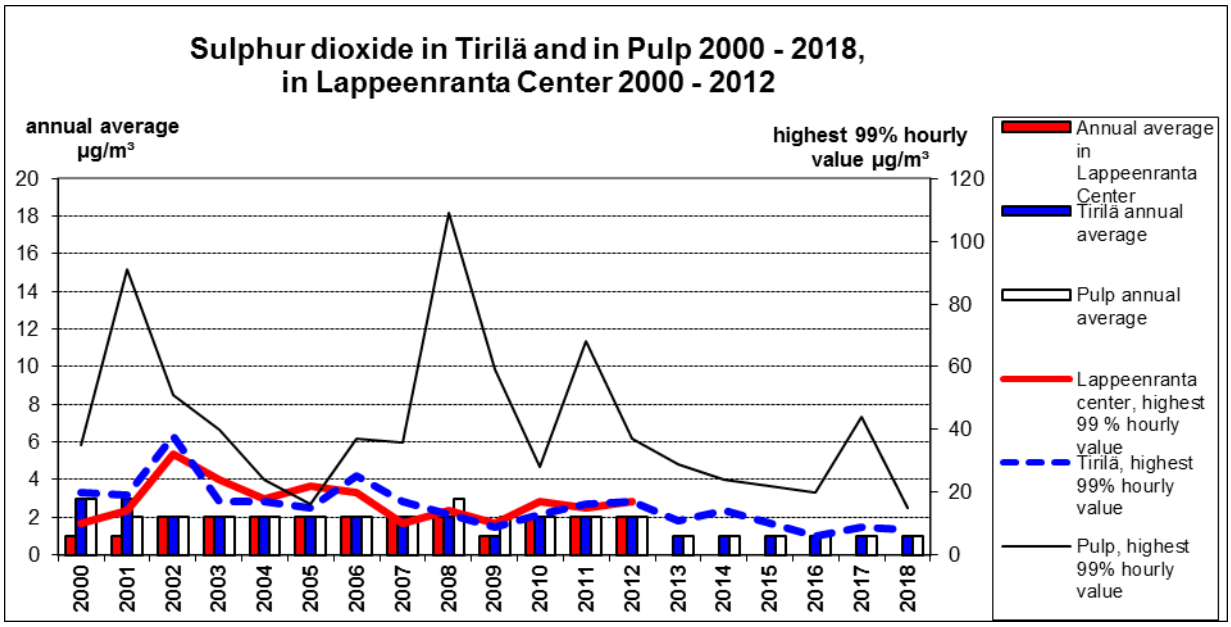

Figure 11: The annual sulphur dioxide averages and the highest 99 % - hourly averages in Tirilä and in Pulp in years 2000 – 2018 and in Lappeenranta center in 2000 - 2012

5.3 Nitrogen dioxide in Lappeenranta (NO_2)

Nitrogen dioxide was measured in Lappeenranta center and in Ihalainen in 2018. 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. NO_2 - concentrations were at their highest in March and 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 25 – 56 % of guidelines and limit values, and in Ihalainen 33 – 71 % of guidelines and limit values.

5.4 Particles in Lappeenranta (PM10 ja PM2,5)

In 2018 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 (PM2.5) was measured in Tirilä and in Pulp.

In 2018 the springtime road dust period rose the dust levels from March to May. The guide line of particles matter < 10 µm (PM10) was exceeded only in Ihalainen. The limit value of PM10 wasn't exceeded in any stations of Lappeenranta. In 2018 there were few more exceedings of limit value's numerical value than in previous year. Limit value is allowed to exceed 35 times before the limit value will be exceeded.

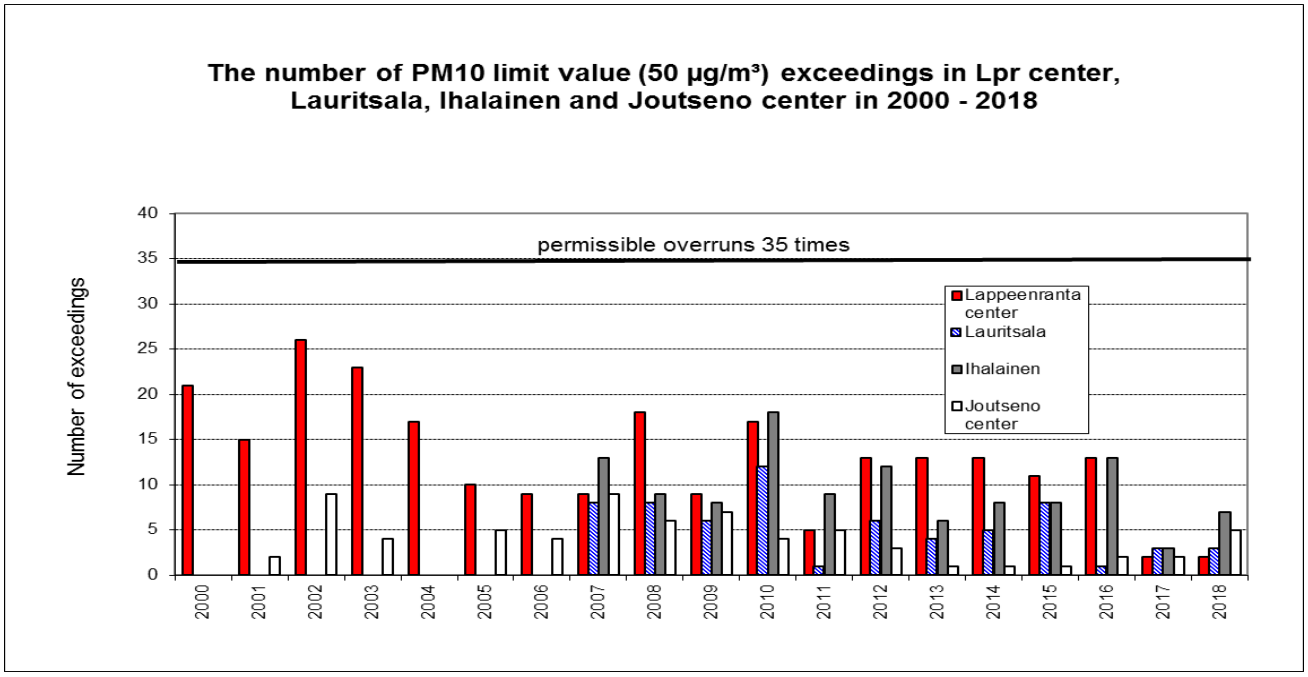

Figure 12: *The number of PM10 limit value (50 µg/m³) exceedings in Lappeenranta center, in Lauritsala, in Ihalainen and in center of Joutseno in 2000 - 2018*

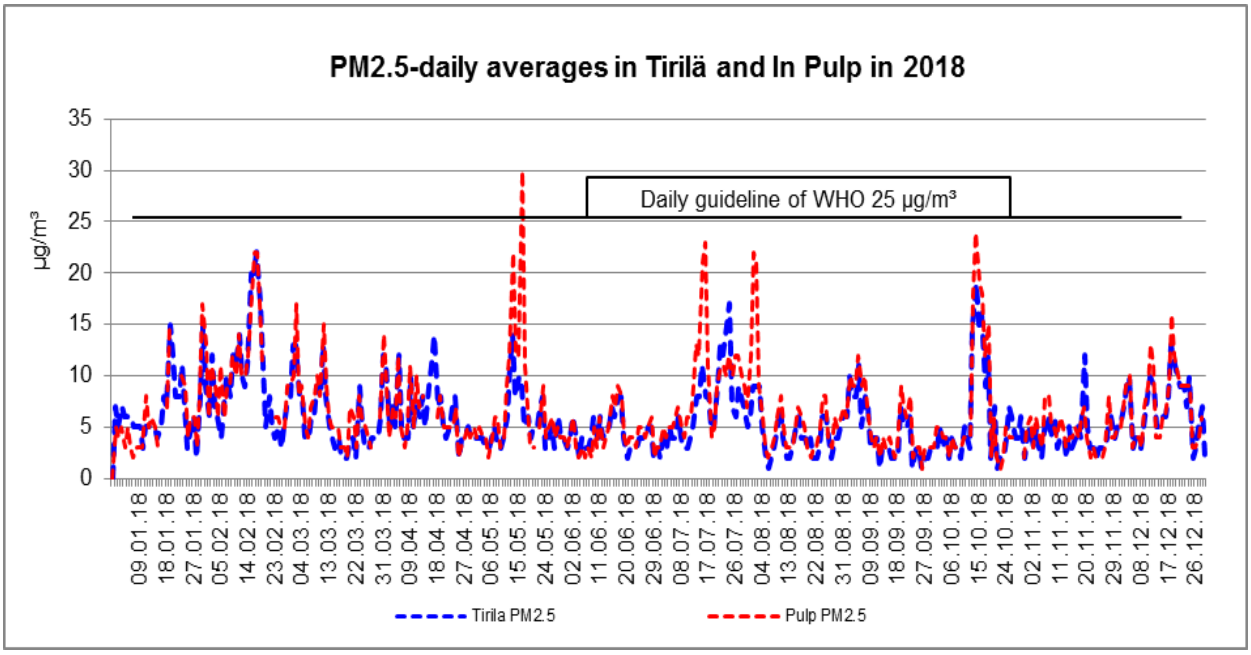

Figure 13: *Daily averages of particulate matter < 2.5 µm (PM2.5) in Tirilä and in Pulp in 2018*

WHO's daily guideline of PM2.5 was exceeded in Pulp in 2018. PM2.5 concentrations rose during hard frost, and when wind speed was weak. Also long distance emissions raised PM2.5 levels. In 2018 the annual limit value 25 µg/m³ 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 was exceeded in Ihalainen in 2018. The reference point of depositions was located in Äitsaari in Ruokolahti. The amount of deposition in Lappeenranta has decreased in 2000s.

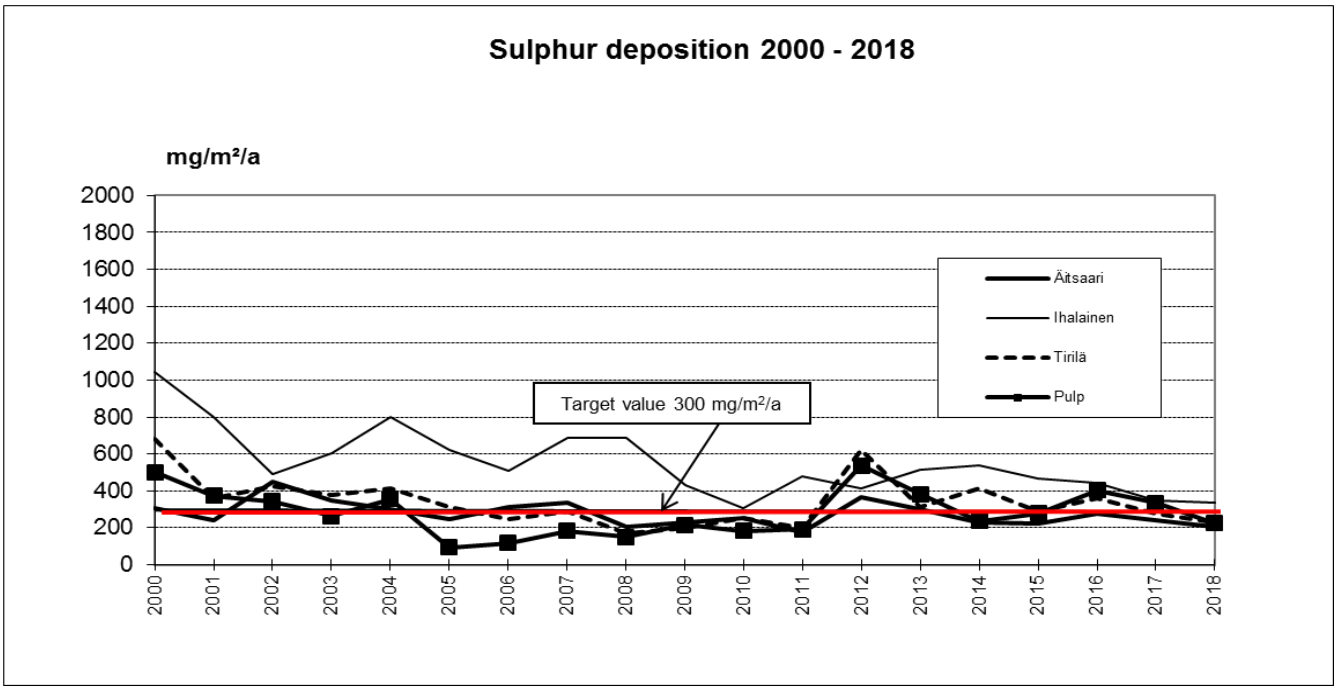

Figure 15: The sulphur depositions in Lappeenranta in years 2000 - 2018

6. Air quality in Svetogorsk in 2018

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) were measured in Svetogorsk in 2018, and nitrogen dioxides (NO_2) were measured only 3 months due to the analyzer problem.

6.1 Odorous sulphur compounds in Svetogorsk (TRS)

The elevated odorous sulphur compounds (TRS) were measured many times in Svetogorsk in 2018. Concentrations were at the same level as last year. During 2000s the process changes in Svetogorsk's industry have decreased the TRS emissions into the air. In 2018 the Finnish TRS daily guideline was exceeded in January and in September. So called odor hours, hourly averages more than 3 µg(S)/m³, were measured during 1125 hours in Svetogorsk.

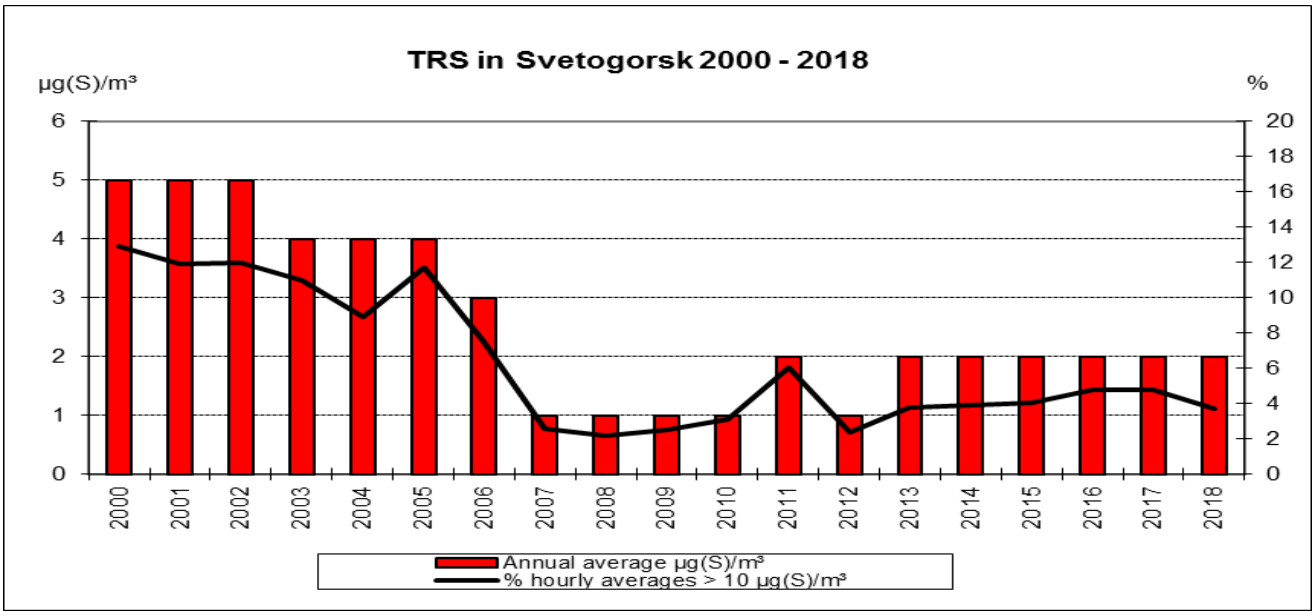

Figure 16: The annual averages of TRS and exceedings of TRS concentration 10 µg(S)/m³ in Svetogorsk in years 2000 – 2018

6.2 Nitrogen dioxide in Svetogorsk (NO_2)

In 2018 the concentrations of nitrogen dioxide were measured only 3 months from September to December due the analyzer problem. The measured concentrations were below Finnish guidelines and limit values. The amount of border crossing traffic affects the Svetogorsk's nitrogen dioxide level.

7. Summary

In 2018 air quality in South Karelia was mostly good. However the spring road dust period weakened air quality everywhere in South Karelia from March to 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 53 Finnish municipalities' air quality in real time (www.ilmatieteenlaitos.fi/ilmanlaatu). The local newspaper "Uutisvuoksi" publishes air quality index every Tuesday and Saturday. South Karelia air quality annual reports of years 2004 to 2018 and the summary reports of the annual reports from the years 2005 to 2018 are readable on Imatra regional environmental department's website (http://www.imatranseudunymparistotoimi.fi/julkaisut/tutkimusraportit)

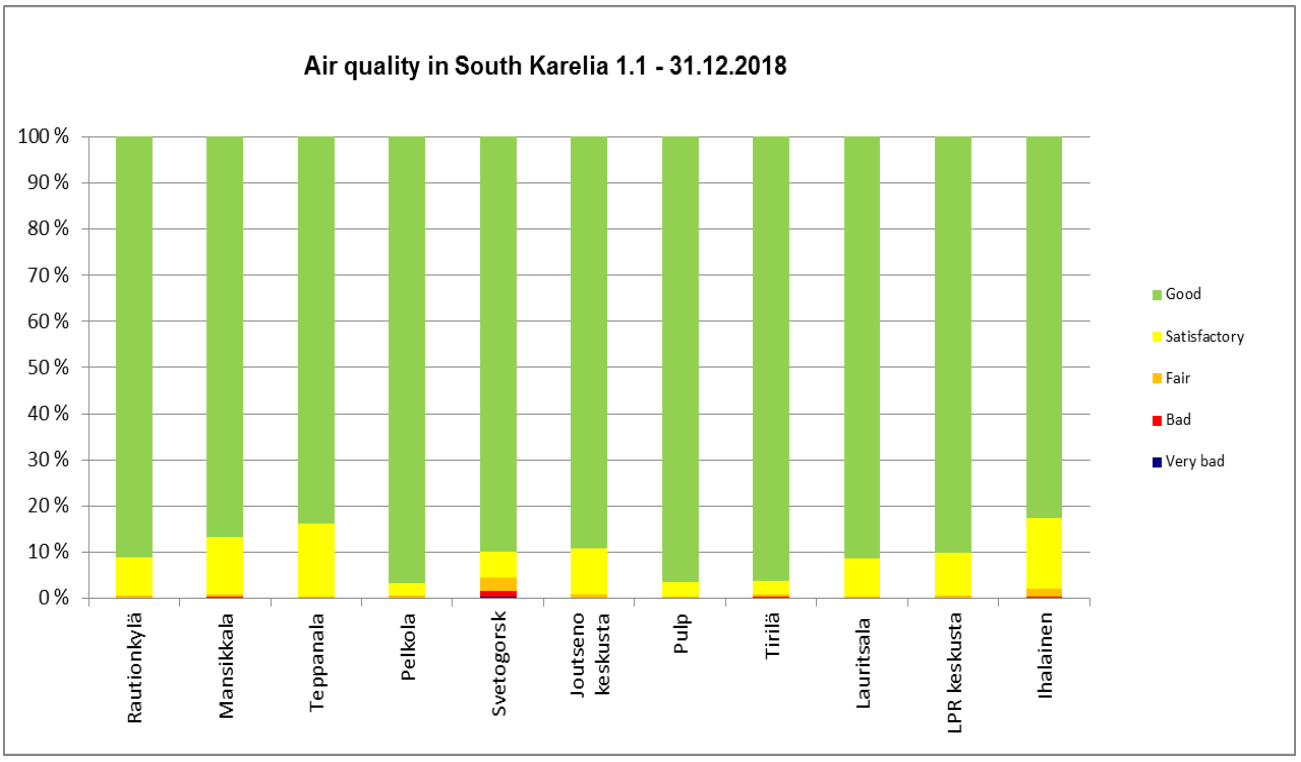

Figure 17: Air quality according to the hourly index in South Karelia in 2018

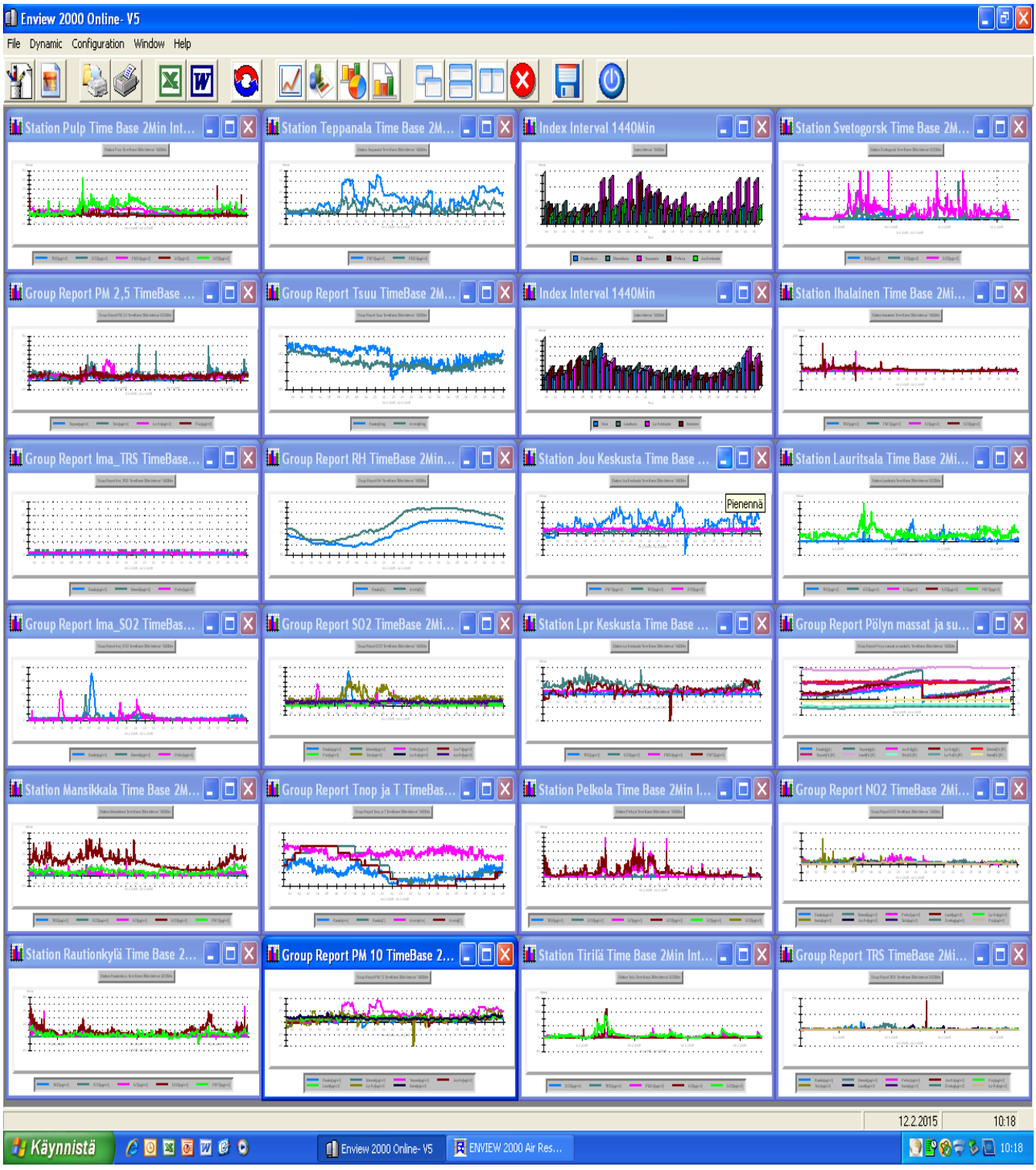

Figure 18: *The picture of South Karelia air quality network's data collection software called 'Enview'*

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