

# ENVIRONMENT MANAGEMENT, TECHNOLOGIES AND TECHNIQUES

EURONICKEL INDUSTRIES,  
KAVADARCI - RN MACEDONIA

euo  
**Nickel**  
INDUSTRIES





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# THE ENVIRONMENT

is part of Euronickel's chief priorities, and thus one of the company's main commitments is identification, monitoring, and reduction of any possible environmental impact that may result from its operation. The company operates in line with A – Integrated Environmental Permit, simultaneously applying environment management system, which is certified according to ISO 14001:2015.

Environment protection is a component of all Euronickel Industries' processes and is conducted by simultaneous conduct of various measures such as:



Direct treatment of all air emissions by using different types of end-of-pipe technologies;



Continual monitoring of air emissions and ambient air;



Waste water treatment, water conservation, and water monitoring;



Noise reduction and monitoring;



Waste selection and reduction;



Slag landfill re-cultivation;



Energy efficiency and renewable energy sources investments;



Use of alternative fuels;



Seeking sustainable solutions (Applying circular economy)

## A - INTEGRATED ENVIRONMENTAL PERMIT

Euronickel Industries operates according to A – Integrated Environmental Permit, issued by the Ministry of Environment and Physical Planning. This permit is confirmation of our commitment to protect the environment, and it was obtained after the completion of the Operational Plan, which was part of the A – Permit for compliance with operational plan, obtained by the company in 2008. All planned activities from the operational plan of the Permit were fully realized within the planned deadline in 2014, which resulted in obtaining an A-Integrated Environmental Permit or A-IPPC Permit.

The A – Integrated Environmental Permit is the only pollution and environmental impact control permit that has integrated approach to protection of the environment. This means that waste waters, air and soil emissions, waste management, noise, and other matters related to the plant will be treated as a whole and completely. The Ministry of Environment sets out conditions in the permit that must be observed and provide a high level of environment protection as a whole. These conditions must be based on the use of BAT – Best Available Techniques which are a balance of the operator's costs compared to the environmental benefits. In compliance to the A – Integrated Environmental Permit, Euronickel Industries prepares an Annual Environmental Report and submits it to the Ministry of Environment and Physical Planning.



## ISO 14001:2015

Euronickel Industries' environment protection objectives are achieved by diligent implementation of the Environment Management System, which is in compliance with the requirements of the ISO 14001:2015 standard and was implemented and certified in December 2009. Each year, the system is audited by an accredited body, and every third year the system is recertified. The system is an adequate environment management framework, which identifies all environment aspects.

Based on the PDCA (Plan-Do-Check-Act) model, ISO 14001 helps the organization establish environmental policy, policy realization objectives and processes, and take steps to improve performance and show system compliance with the standard requirements.

### ISO 14001:

- defines the requirements for establishing environment protection procedures;
- defines the product impact factors on the environment;
- anticipates ecological systems that are negatively affected;
- measures the negative impacts and gives instructions to prevent undesirable consequences;
- provides actions and procedures for prevention of environmental disasters;
- identifies potential weaknesses and helps define environmental safety procedures.







# DIRECT AIR EMISSION TREATMENT BY VARIOUS TYPES OF END-OF-PIPE TECHNOLOGIES

The following activities and technological operations that present the process flow are performed in the ferronickel production plant Euronickel Industries Kavadarci:

- Ore crushing;
- Ore drying;
- Milling of ore and other components;
- Pelletizing and pre-reduction in Rotary Kilns;
- Smelting in Electric Furnaces;
- Metal refining in converters and final product granulation.

In Working Unit 'Ore preparation', where the activities crushing, drying, and milling take place and we have low flows and low exhaust temperatures, according to BAT, bag filters are used.

In Working Unit 'Pelletizing and pre-reduction', where in the Rotary kilns the pellets and ore are pre-reduced and we have very high gas flows and not very high exhaust temperatures, according to BAT, electrostatic precipitators must be used.

In Working Unit 'Smelting', where the material is smelted in the Electric Furnaces and in Working Unit 'Refining', where the material is refined in the converters, and we have very high exhaust gas temperatures, according to BAT, water de-dusting must be used, that is the so-called Quencher-scrubber filters.

**ALL ACTIVITIES AND TECHNOLOGICAL OPERATIONS IN EURONICKEL INDUSTRIES' PRODUCTION PROCESS ARE TREATED BY SOME SORT OF END-OF-PIPE FILTERS, WHICH IS ADEQUATE FOR THE SUBJECT ACTIVITY ACCORDING TO BAT – BEST AVAILABLE TECHNIQUES.**



## AIR

### Bag Filters

- 1:** Ore reception silo
- 2-3:** Crushers
- 4-5-6:** Driers
- 7:** Dried ore silo
- 8-9:** Ball mills
- 10:** Pellet mixer bin

### Electrostatic precipitators

- 11-12:** ESP 1 and ESP 4
- 13-14:** ESP 2 and ESP 3

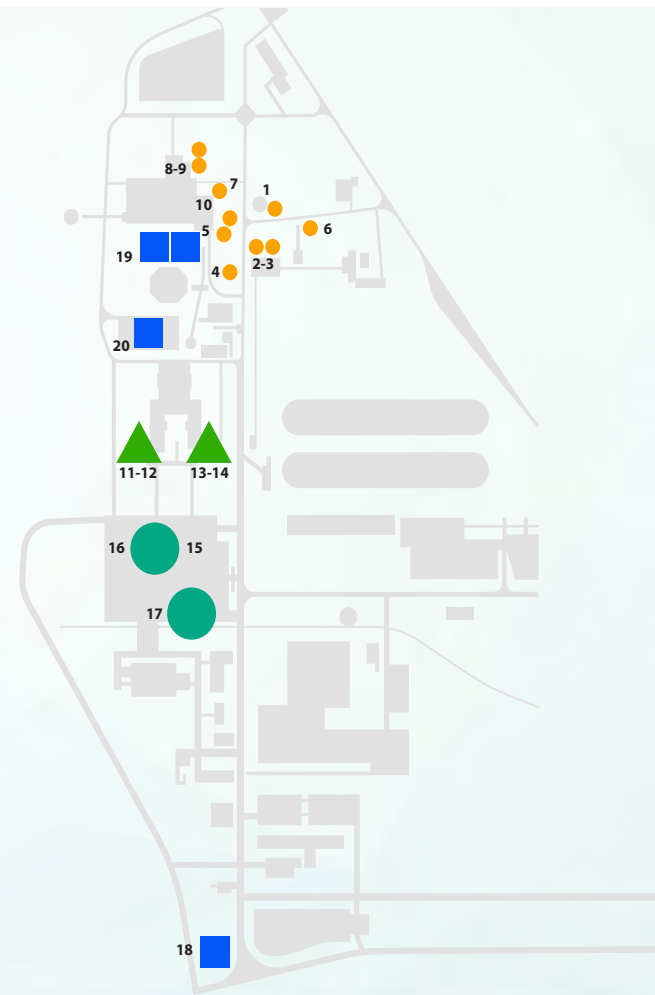
### Quencher-scrubber

- 15:** Electric furnace 1
- 16:** Electric furnace 2
- 17:** Converter

## WATER

### Water systems

- 18:** Pump station
- 19:** Thickeners
- 20:** Sedimentation pools
- 21:** North sedimentation pool





# BAG FILTERS

The technological process in Euronickel Industries starts with ore reception and handling, which generates ore dust. In this initial stage of the production process where there are no high temperatures and gas flow, the facilities are equipped with bag filters (all crushers, driers, and mills are equipped with bag filters).



Bag filter in Ore preparation – Crushing



Sample of bags (textile) inside the bag filter

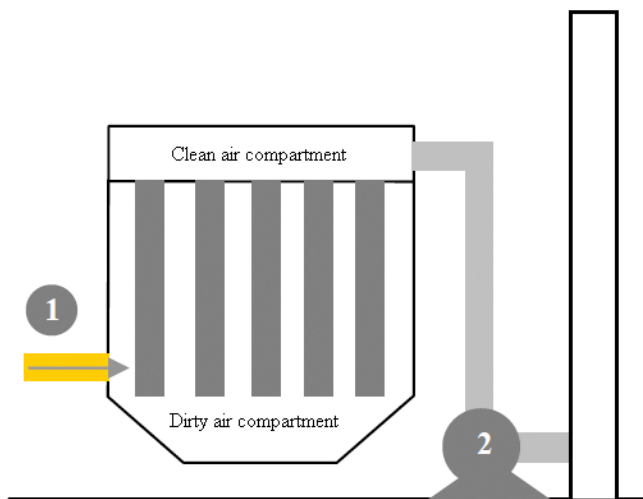


Bag filter in Ore preparation - Milling

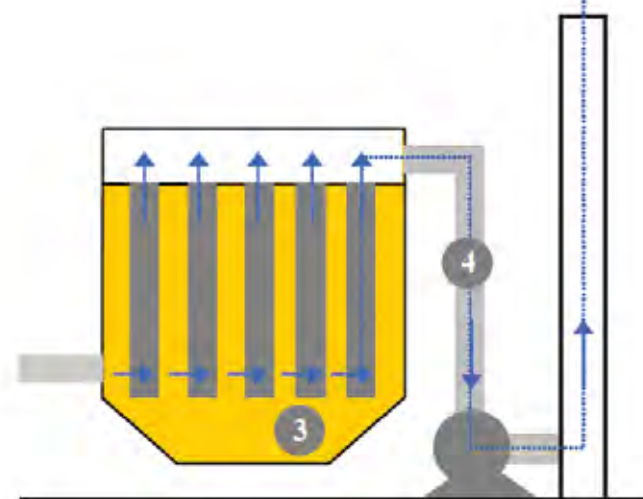


Inside the bag filter



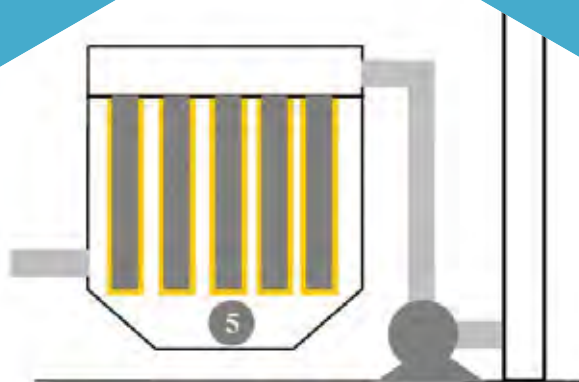


The bag filter is split in 2 isolated compartments (unclean and clean). The dusty air enters the unclean air compartment (1). Then the air is drawn with a fan (2).

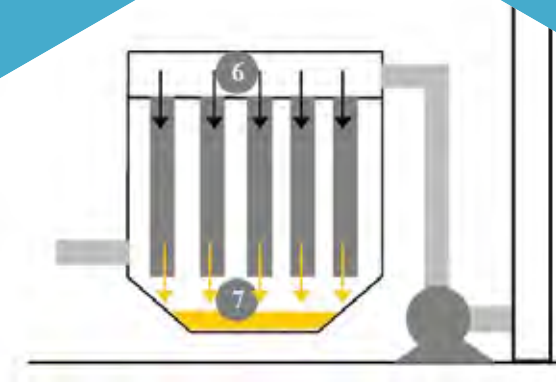


The air passes through the textile of the bag-filter (3) and enters the clean air compartment. Clean air is then taken away (4) by the fan and emitted through the stack.

## BAG-FILTERS - PRINCIPLE OF OPERATION



Dust precipitates to the external surface of the textile bag-filter (5), while the air passes through it.

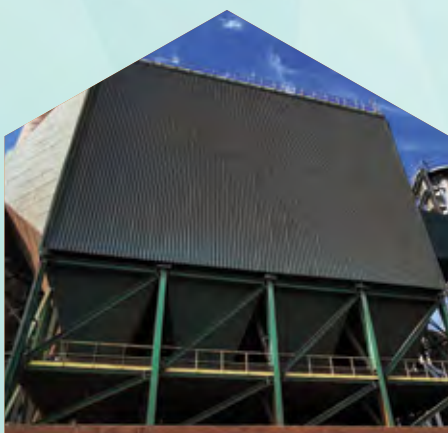


Compressed air is blown inside bag-filters, from the top (6). This flow separates the dust accumulated on the bags (7), which is then returned to the production process.

# ELECTROSTATIC PRECIPITATORS (ESP)

After receipt and preparation, the ore is pelletized on 6 balling discs. The pelletizing is done with wet material, so there is no dust and there is no de-dusting at this stage of the production. Once the pellets are formed, they enter the hot process in 2 technological lines equipped with Lepol grate - Rotary kiln. Inside the rotary kilns, temperatures are above 800°C and a lot of dust is generated. De-dusting in this largest production phase is done by filters called electrostatic precipitators (ESP). In addition to the existing two electrostatic precipitators, in 2008 and 2012 respectively, two new electrostatic precipitators were installed on each production line: ESP 3 on Line 2 and ESP 4 on Line 1.

These precipitators, purchased from the Swiss company ELEX, are very large and expensive equipment (a total of 7 million euros). Also, these new electrostatic precipitators are installed in parallel with the old ones. The European Commission recommends electrostatic precipitators as BAT (Best Available Techniques). These precipitators are huge installations where only the metal construction of each precipitator weighs more than 400t.



*Electrostatic precipitator no.1*



*Electrostatic precipitator no.2*

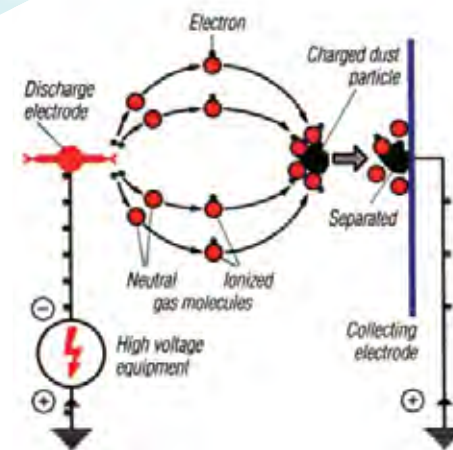
# ELECTROSTATIC PRECIPITATORS (ESP) - PRINCIPLE OF OPERATION

The electrostatic precipitator is quite suitable for capturing the solid particles. The emitting electrodes emit electrons. As electrons accumulate on solid dust particles, the dust becomes negatively charged.

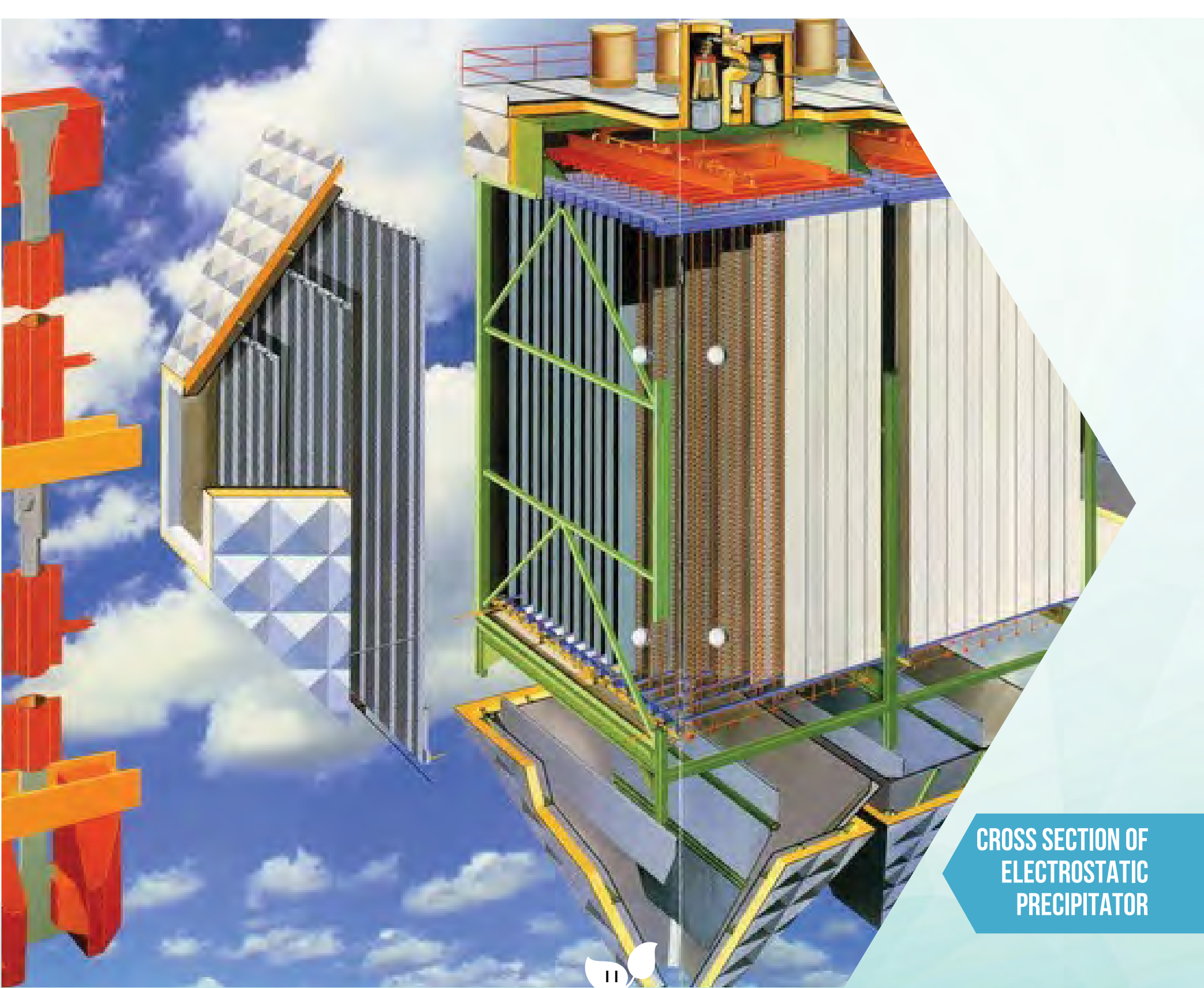
These negatively charged solid particles are attracted by the electric field of the collecting electrodes, where they accumulate. Periodically, hammers strike the collecting electrodes. Then, the dust, that is actually ore, falls into bunkers located at the bottom of the precipitators, and from there it is transported back into the process, which is a typical example of circular economy.



*The precipitators are computer operated*



*Electrostatic precipitators  
-principle of operation*



CROSS SECTION OF  
ELECTROSTATIC  
PRECIPITATOR

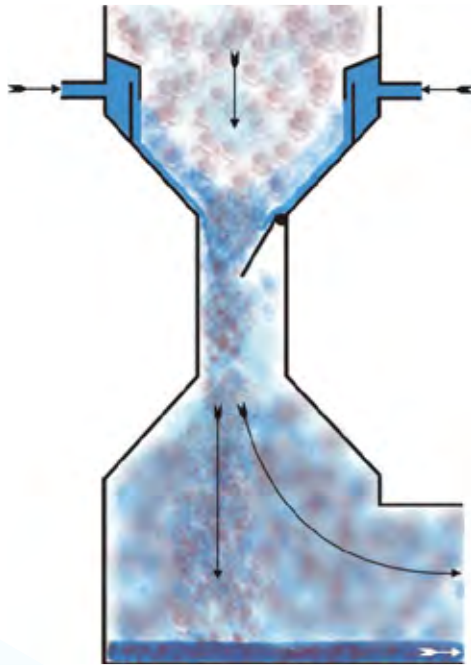


# QUENCHER - SCRUBBER

Once the pre-reduced pellets leave the Lepol grate – Rotary kiln system, they are fed into the Electric Furnaces. There are two Electric furnaces in Euronickel, which require temperatures of over 1600 °C to melt the ore fed inside. The ore becomes akin to “volcanic lava” and the heavier metals such as nickel and iron (ferronickel) sink to the bottom of the furnace, while lighter elements (mainly oxides of silicon, magnesium, calcium and iron) float at the surface (slag). At these high temperatures, direct de-dusting using bag filters or electrostatic precipitators is impossible, so water de-dusting takes place with the so called quencher – scrubber system, where the dusty air passes through water. This system is used both in Working Unit ‘Smelting’ and Working Unit ‘Refining’. When working with high temperatures, the European Commission recommends this type of de-dusting as BAT (Best Available Techniques).

## QUENCHER - SCRUBBER PRINCIPLE OF OPERATION

- ❶ Hot gases from electric furnaces enter the quencher,
- ❷ Evaporation of the injected water causes the gas temperature to drop (1100 °C -> 75 °C),
- ❸ Water also removes some of the dust (water + dust = slurry): 1st de-dusting,
- ❹ The cooled gas goes into a ‘venturi scrubber’. The injected water and the narrowed diameter of the pipe perform the 2nd de-dusting,
- ❺ The fine dust is moisturised,
- ❻ The gas speed increases,
- ❼ Wet fine dust falls to the bottom where it is removed from,
- ❽ The clean gas moves to the expansion vessel. This sudden increase in the size of the pipe causes the gas velocity to decrease, causing the remaining dust (gravitationally) to fall: 3rd and final de-dusting. The wet fine dust with a special pipeline is taken directly to the so-called Thickeners and then in the Sedimentation Pools for purification, from where it is returned to the production process,
- ❾ The clean gas is then emitted into the atmosphere. The white smoke seen in winter is water vapour that is created when water evaporates.

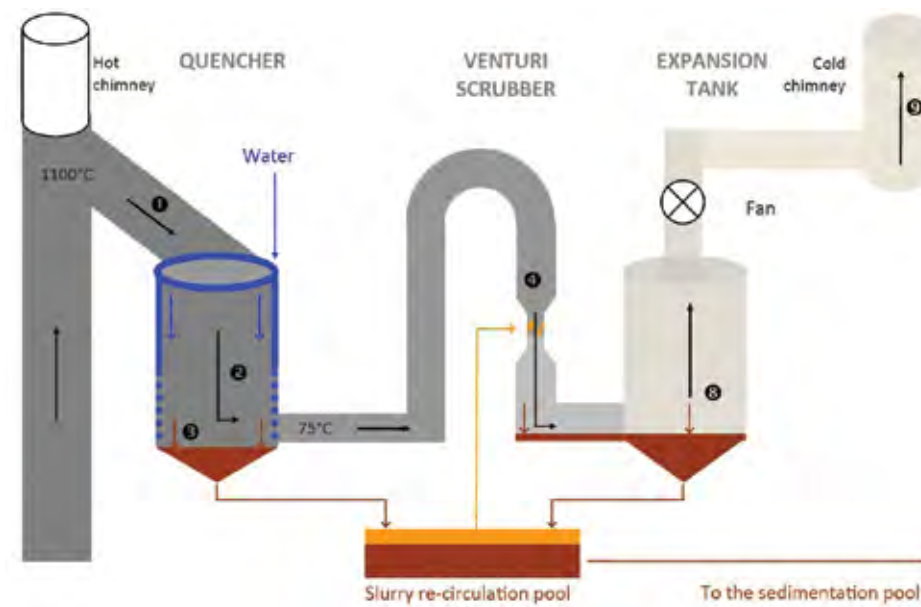


Quencher Scrubber  
Principle of Operation



Quencher Scrubber  
Water vapour is emitted  
using water de-dusting

Principle of operation  
schematic



# AIR MONITORING

## Ambient air monitoring

Euronickel Industries conducts continual ambient air quality (PM10) monitoring, in the village of Shivec, the nearest settlement to the plant. This monitoring is performed with an automatic system for continuous monitoring of the ambient air quality (Airpointer).

**The results of this monitoring show that the ambient air around Euronickel Industries throughout the year is in line with national legislation.**

## Comparison of ambient air in Shivec and Kavadarci

The graph compares the ambient air quality, namely the PM10 particles in Kavadarci with the ambient air quality in the village of Shivec for the period 2019-2021. The graph shows that the values for PM10 particles are much higher in Kavadarci than in the vicinity of Euronickel Industries. It is obvious that high values of PM10 in Kavadarci occur in the winter period during the heating season, whilst during the rest of the year the values of PM10 particles are within the limit values.

# AIR EMISSION MONITORING

In accordance with the A-Integrated Permit, Euronickel Industries is obliged to arrange periodic monitoring of the emissions of all stationary emission sources, performed an accredited laboratory. In addition to this periodic monitoring, in 2014, the company installed a Continuous Emission Monitoring System on the two process lines in 'Pelletizing', which are the main sources of air emissions. The installation of the Continuous Emission Monitoring System was one of the activities of the operational plan, which was completed on time in April 2014.

Euronickel Industries is one of the few companies in N. Macedonia that continuously monitors emissions. Emissions of SO<sub>2</sub>, NO<sub>x</sub>, CO, and dust from both lines in Pelletization are significantly below the emission limit values prescribed by applicable national and European legislation.

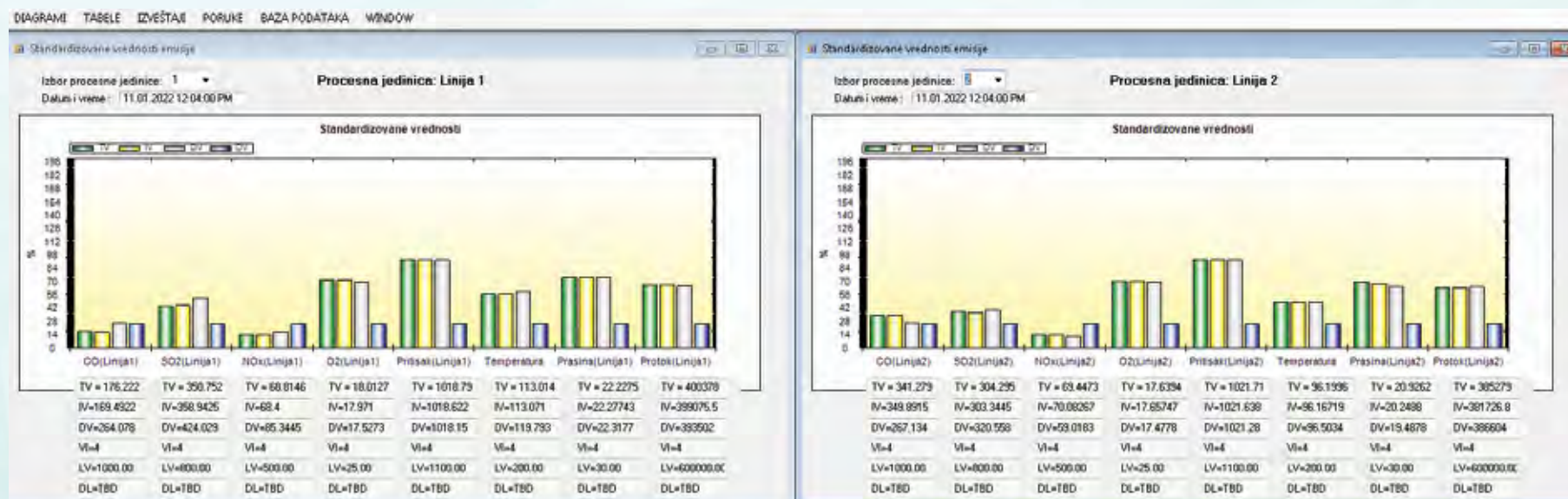




Ambient air monitoring station in v. Shivec (Airpointer)

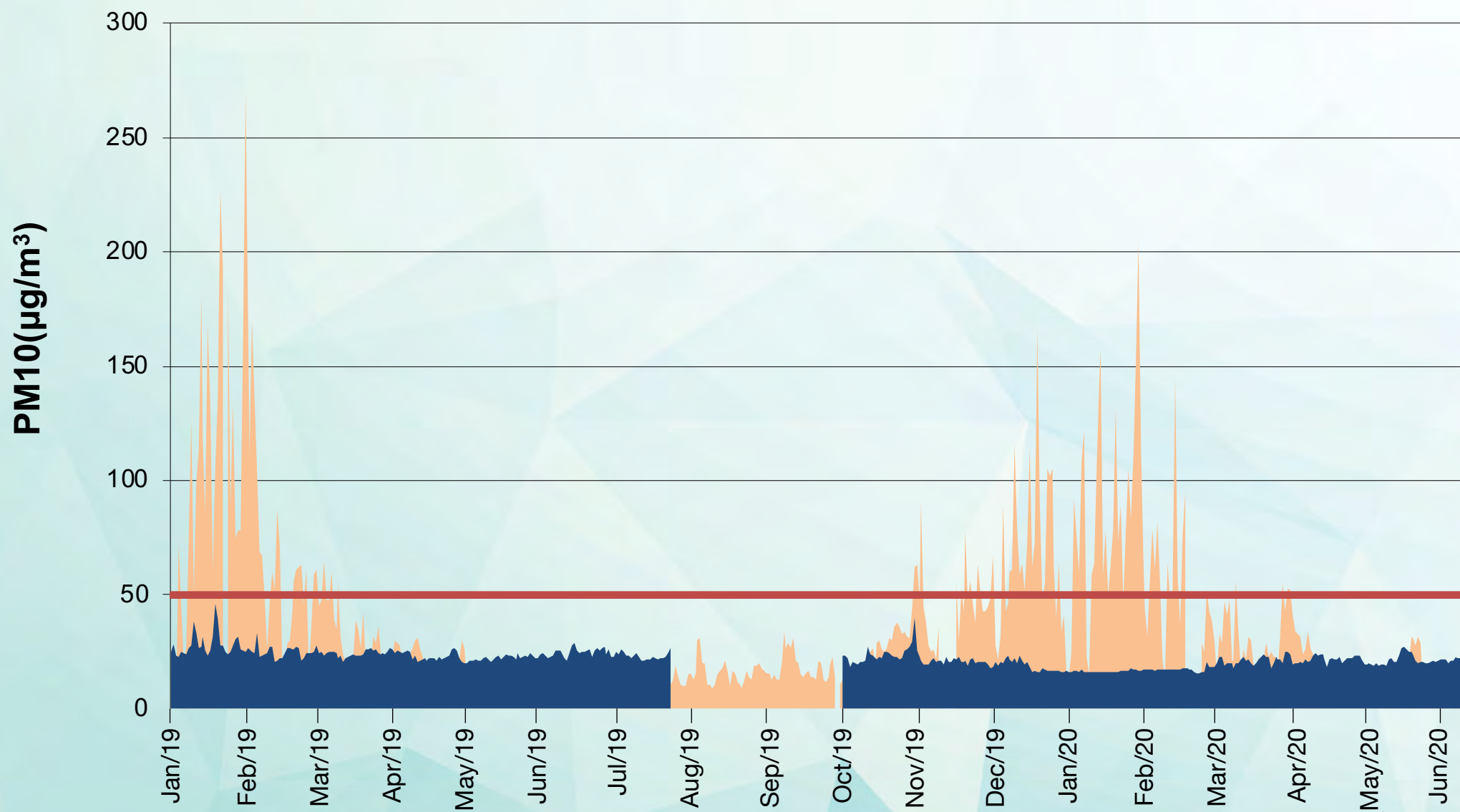


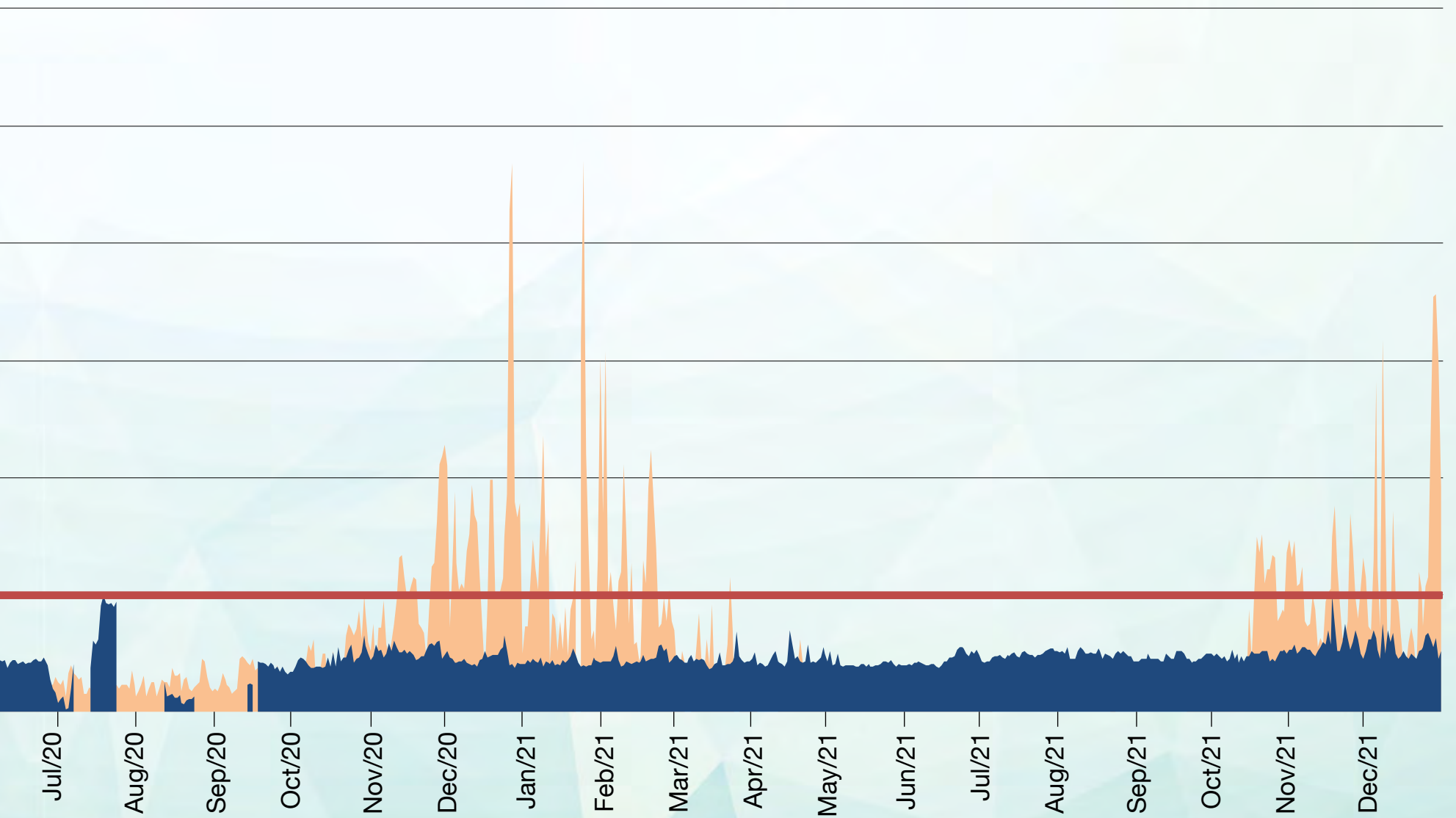
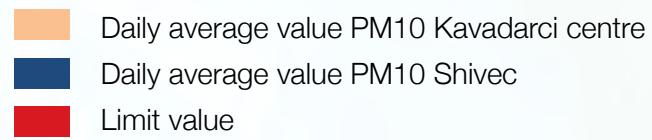
Part of the installed equipment for Continuous Emission Monitoring



Screenshot of values follow up from the Continuous Emission Monitoring System

# AMBIENT AIR QUALITY IN SHIVEC AND KAVADARCI CENTRE FOR 2019, 2020 AND 2021



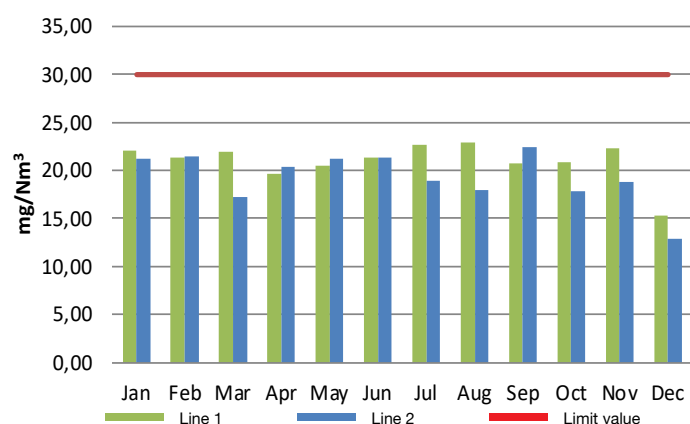




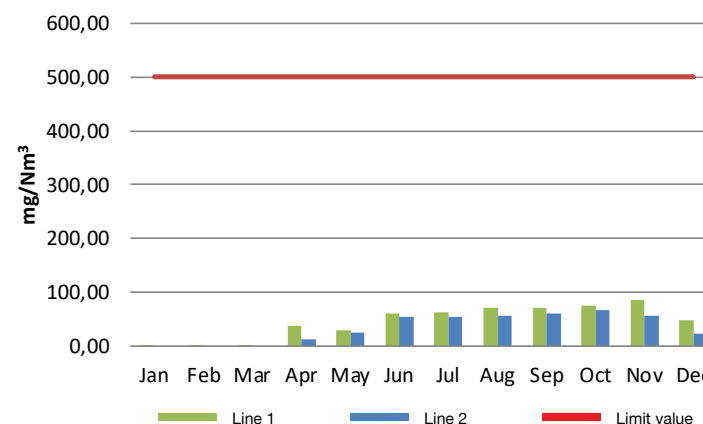


# 2021 MONTHLY OVERVIEW OF THE CONTINUOUS EMISSIONS MONITORING SYSTEM

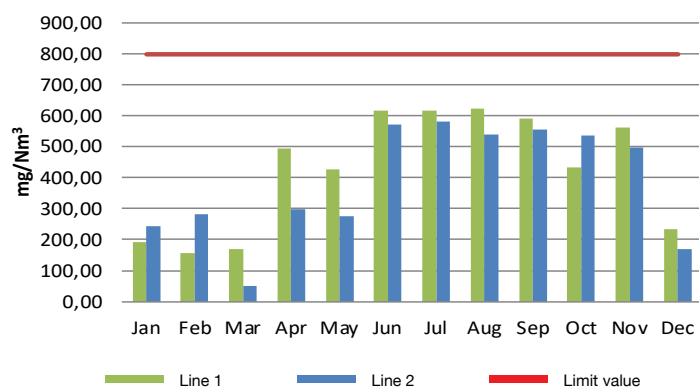
## Dust (mg/Nm<sup>3</sup>)



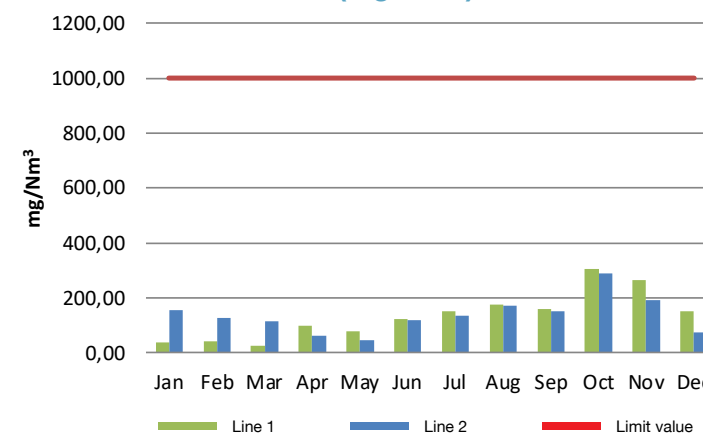
## NOx (mg/Nm<sup>3</sup>)



## SO<sub>2</sub> (mg/Nm<sup>3</sup>)



## CO (mg/Nm<sup>3</sup>)



# WASTE WATER TREATMENT AND WATER RESOURCES CONSERVATION



Euronickel Industries is a pyro-metallurgical plant that does not use water in its production process. Water is used as a coolant, and it is reused in the so-called closed system. Apart from cooling, the water is also used for water dusting, washing of mechanization, washing of platforms and streets, spraying of ore and lignite to reduce fugitive emissions as well as irrigation of green areas.

Euronickel Industries treats its water emissions by installing a state-of-the-art wastewater recycling system, which collects all the water that is to exit the plant at a pumping station located next to the main gate, wherefrom through a pipeline it is returned to the existing thickener located near the Milling Plant, for initial sedimentation. Then, it is taken to sedimentation pools for additional sedimentation. The solid particles (mostly the smallest ore fraction) fall to the bottom, and the purified water from the sediment pools with a pipeline comes out of the plant, in the recipient Crna Reka. By using this system, there are 4 great advantages:

- Euronickel wastewater is filtered before being discharged into the recipient, which is a legal obligation;
- The ore is returned to the production process and has economic value, and the finest ore is usually with the highest nickel content. This is another example of “circular economy”;
- Water consumption is reduced because the same water is kept in circulation;
- Fugitive emissions are reduced because all surfaces in Euronickel Industries can be water sprayed.



*Pipeline that returns the water to sediment*



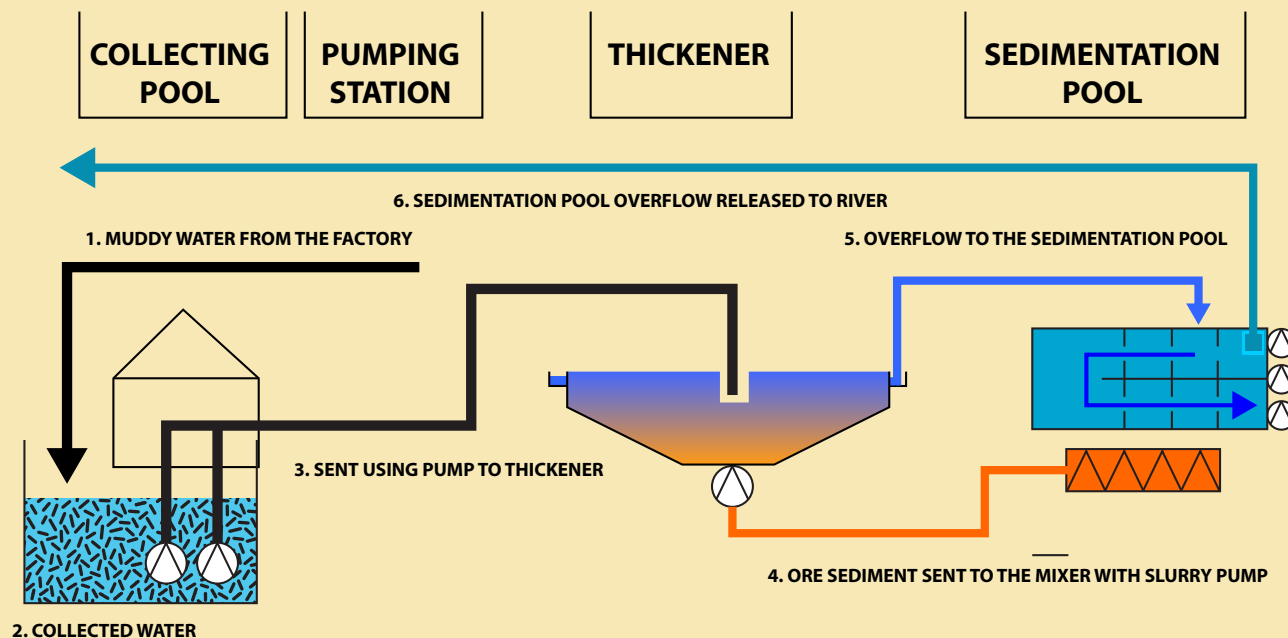
*The West Side thickener*



*Sedimentation pools*

# WASTE WATER RECIRCULATION SYSTEM SCHEME

ADDITIONAL  
SEDIMENTATION  
POOLS WITH OIL  
SEPARATORS ARE  
BUILT AT EACH EXIT  
TO PREVENT OIL  
AND HEAVY FUEL  
OIL SPILLAGE.







*Pumping station with oil separator*



*Lignite area sedimentation pool*



*North side sedimentation pool*



*Water collecting from washing platforms and mechanization in the Pumping station*



*Return of the water to sediment in the Thickener and Sedimentation Pools*



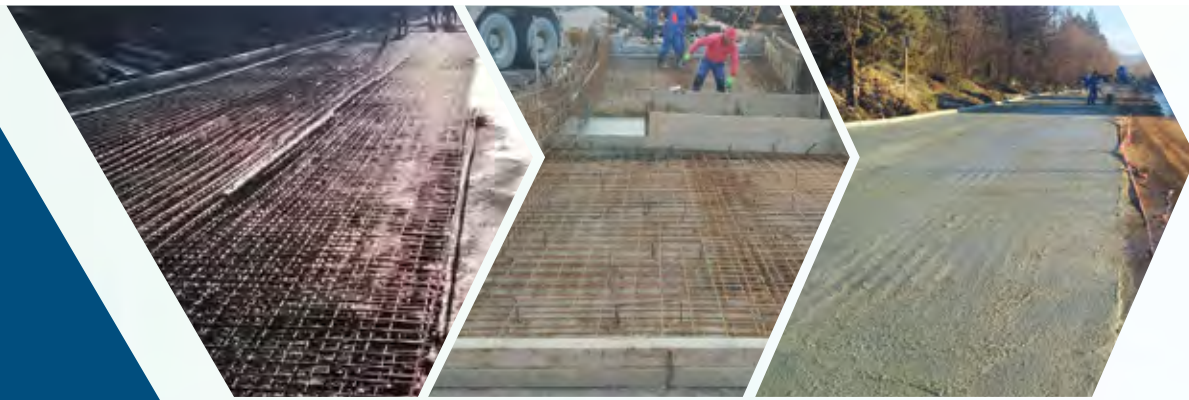
*Purified water drainage, as overflow from sediment pools*



# TRUCK WASHING STATION

At the exit for trucks from the plant, a special truck washing station is installed. All trucks leaving the plant must go through this automatic system that uses pressurized water. This water also goes to the pumping station for purification.

Additionally, the main street from the Truck Washing Station to the Main Gate was recently reconstructed. Frequent washing of this road is envisaged in order to reduce mud transfer from the plant to the regional roads.



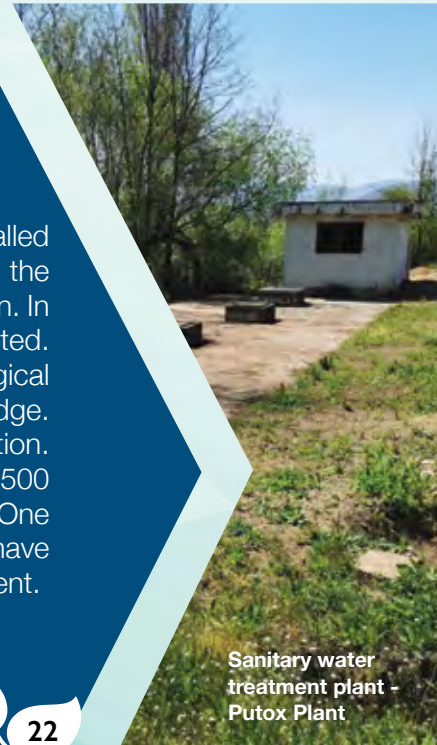
*Main street reconstruction from the Truck washing station to the Main Gate*



*Washing truck before leaving plant*

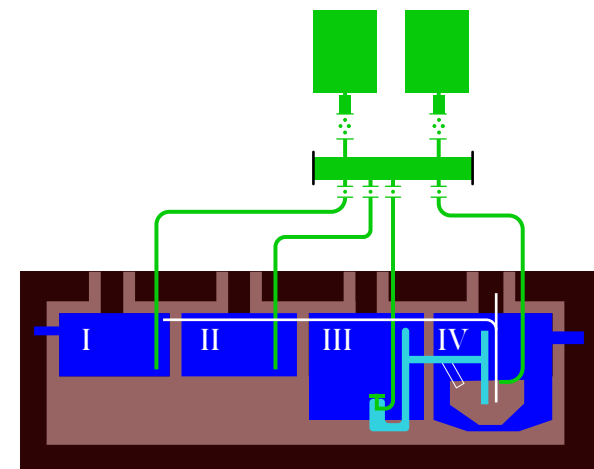
# SANITARY WATER

The plant also operates a Sanitary Wastewater Treatment Plant, called Putox Plant. The sewage water is completely separated from the atmospheric water and it is treated in this mechanical-biological station. In the first two chambers, solid particles from the wastewater are deposited. Wastewater then passes without solid particles into the biological chamber, where the purification process continues with active sludge. Eventually, the cleaning process ends with secondary sedimentation. The purified water goes to the recipient. This station is planned for 2500 workers, and the company currently employees about 1000 people. One may freely state that the surrounding villages and even cities do not have such a system and discharge their sewage directly into the environment.



**Sanitary water  
treatment plant -  
Putox Plant**

**Waste water treatment plan  
Putox (Put Oxygen)**



# WATER EMISSIONS MONITORING

Euronickel Industries continuously monitors the surface water quality, i.e. each month surface water samples from 9 measuring places around the plant are taken and analysis of TSS, Fe, Ni, Co, and Cr are performed. Thus, the impact of the smelter on the surface waters is monitored and controlled.

Beside this internal monitoring, the surface water quality is periodically monitored by an independent authorized laboratory, and twice a year, the Public Health Institute takes samples and monitors the waste water.

Based on the performed analyses results by the Public Health Institute, the conclusion is that there is no exceeding of limit values.

The surface water monitoring results are submitted to the Ministry of Environment and Physical Planning, as part of the Annual Environmental Report.

Surface water - Sampling Points



	RIV_0	RIV_1	RIV_2	RIV_3	RIV_4	RIV_5	RIV_6	RIV_7	RIV_8	Outlet RIV_9	Emission Limit Values
TSS (mg/L)	12	22	24	27	15	25	21	14	18	23	35
Ni (mg/L)	0.07	0.08	0.32	0.22	0.09	0.22	0.15	0.07	0.18	0.25	0.50
Fe (mg/L)	0.32	0.75	1.17	1.28	0.28	1.02	0.84	0.55	0.70	0.97	2.00
Cr (mg/L)	0.23	0.23	0.26	0.22	0.21	0.19	0.26	0.18	0.20	0.22	0.50

*Internal monitoring of surface water - average annual values for 2021*



# NOISE MANAGEMENT AND MONITORING

The activities that take place in Euronickel Industries create a constant and stable noise. There is no impulsive and high frequency noise that could cause an detrimental impact to the environment.

Ambient measurements inside Euronickel Industries show that noise levels decrease rapidly as one moves away from the production facilities. At the border of the plant (west side, which overlooks the nearest village Shivec) the noise level is below 60 dB (A), which is below the prescribed limit value for industrial zones and that is 70 dB (A).

According to the A-Integrated Permit, Euronickel Industries is obliged to perform noise measurements every year in the plant, as well as in the nearest villages Shivec and Vozarci.

All measurements show that the noise level at the monitoring points does not exceed the permissible limits prescribed in the respective regulations.



*Plant premises*



*Closest house in Shivec village*



*Closest house in Vozarci village*



# WASTE MANAGEMENT

The main type of waste generated in Euronickel Industries is the slag, which accounts for about 99% of the total generated waste with a production of about 1 million tons per year. There are 2 types of slag in Euronickel Industries: electric furnace slag and converter slag. After numerous tests, the converter slag with a special Declaration from the Ministry of Environment ceased to be treated as waste and was declared a by-product in August 2014, when commercialization and sales begun.

Waste reduction, reuse, and recycling are key elements in Euronickel Industries' efforts to effectively manage the environment protection. For this purpose, a slag crushing plant has been installed at plant's premises, where the converter slag is crushed and then exported around worldwide.

Since the start of operation of the converter slag crushing plant up till now, around 1 million tons of slag have been crushed and exported.

Electric furnace slag is generated in the production facility as a result of ore smelting in the electric furnaces. This slag is still treated as waste in our country, although in many places around the world, and especially in Europe, electric furnace slag is treated as a by-product and not waste. Euronickel Industries is making efforts to find market for this type of slag, which is suitable to use as an embankment for road construction, as a ballast on railways or for sandblasting. According to the A-Integrated Permit, every year the company is testing this slag, and the results repeatedly show that it is an inert material, which has no impact on the environment.

In addition to the slag generated during the production process, in Euronickel Industries there are several types of waste that are generated from daily operation and maintenance of the plant such as: utility waste, various types of metal, rubber conveyor belts, hydraulic oil, big bags, plastic cisterns, then vehicle maintenance waste, such as tires and engine oil.



*Disposal of slag at the Landfill*



*Slag crushing plant*



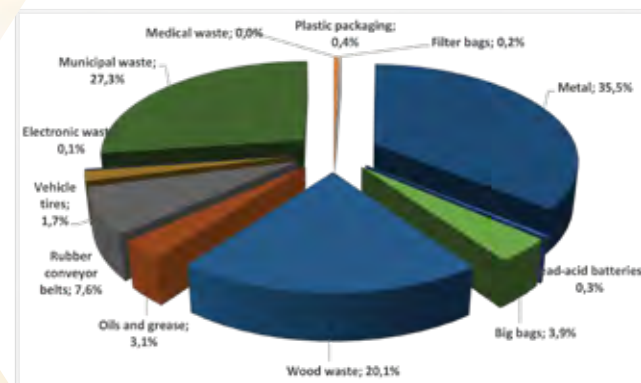
*Using slag as a road base*



If these listed types of waste are analysed, selected, and stored at a special location for temporary storage, and then handed over to authorized companies that have appropriate licenses and reported in accordance with the Law on Waste.



Hazardous waste storage location



Waste types and percentage participation

## SLAG LANDFILL RE-CULTIVATION

In line with the efforts to reduce the impact on the environment, in 2014 the company re-cultivated the completed part of the old slag landfill, where slag from electric furnaces is disposed, which was also an activity that was part of the IPPC Operational Plan. The re-cultivation was performed in accordance with the prepared Study for re-cultivation, prepared by the Faculty of Forestry in Skopje. As part of the re-cultivation, the slope of the landfill was cascaded, and then a layer of fertile soil was applied and acacia seedlings were planted.

In 2021, the upper part of the Slag Landfill was levelled up and it is ready for photovoltaics installation as part of the planned Photovoltaic project, with a total capacity of 35MW.



Re-cultivated slag landfill



Levelling of the upper part of the Landfill



# ENERGY EFFICIENCY AND CLIMATE CHANGE

Energy efficiency and energy conservation are vital to environmental protection. They are the most effective way to achieve an energy sustainable future. There is no doubt that the climate crisis is a challenge that is specific to the times we live in. That is why, in line with the ambitions of the European Union to reduce greenhouse gases by 55% by 2030, and given that electricity is the largest and most common type of energy in our production process, Euronickel is resolutely committed to gradual shift to electricity from renewable sources, **by investing in a 35MW photovoltaic project, which will drastically reduce our greenhouse gas emissions.** These photovoltaics will be installed at the Slag Landfill in the village Vozarci with a set date for realization and commissioning by the end of 2022.

Initially, in January 2022, a mini photovoltaic plant was put into operation in the Work Unit 'Refining', with a production capacity of 153kWh at peak capacity, which will fully power the ferronickel granules drying system.

In the meantime, in order to protect the environment, our efforts to act proactively, not just reactively, continue, as in the case of replacing conventional fossil fuels with biofuels. That is, the company continues to use biomass (olive seeds) as a biofuel, which began to be used in 2013.

One of the measures for direct reduction of CO<sub>2</sub> emissions is the implementation of the project for gasification of the plant and connection to the Main gas pipeline Negotino-Kavadarci-Bitola, with the construction of the Chief Metering and Regulation Station (CMRS) in the plant. With the realization of this project, the use of fuel oil will be replaced by gas, which will lead to a further reduction of total greenhouse gas emissions into the atmosphere.

In accordance with the policies and procedures of the integrated quality, environment, and OHS Management System, as well as the advanced ecological system, Euronickel Industries regularly calculates and reports CO<sub>2</sub> emissions and energy used in the company, although this is not a legal obligation.



*Photovoltaics in WU Refining*

*CMRS construction – Gasification project*





# USE OF ALTERNATIVE FUELS



*Rubber chips sample*

*Biomass – olive seeds*



Euronickel Industries has a unique production process in the country, which enables safe combustion of different types of fuels. This is due to the fact that the gases from the rotary kilns, where the fuels are added, are not released directly into the atmosphere, but pass through the After burner chamber. Here, the temperature is above 1100°C, and all potential organic elements are destroyed. Therefore, the company in 2011 obtained permit and started using alternative fuel i.e. waste rubber chips as a lignite substitute.

In 2013, the company started using biomass as an alternative fuel, namely olive seeds and sunflower cakes. This biomass, which is a residue from oil production, is a green product, which is a renewable resource and has a very low sulphur content. Since 2014, the amount of biomass used has increased, so that in recent years more than 25% of lignite has been replaced by biomass as an alternative fuel.

By using alternative fuels to replace the classic fossil non-renewable fuels, we preserve the fossil fuels for future generations. Even more importantly, the greenhouse gases in the atmosphere are also reduced, and this helps solving the local environmental challenges related to waste depositing.

**Actually, use of alternative fuels is categorised as proactive environment protection action because in essence this provides lesser impact on the environment compared to the classic reactive methods.**



# CIRCULAR ECONOMY

In a world where natural resources are scarce, every product from one industry type is a raw material for another. These are the basics of circular economy. Modern societies today seek sustainable solutions to conserve natural resources and replace them with waste materials from other industries that could be raw materials or energy sources, while minimizing the impact on the environment.

Worldwide, ferronickel production is an industry that provides sustainable solutions for the conservation of natural resources and the use of waste as a resource. In this regard, Euronickel Industries, as a ferronickel producer, has the opportunity and permit to use waste rubber chips and biomass, which are waste from some other industries, which is in line with the principles of circular economy.

On the other hand, Euronickel Industries product – nickel is an element that can be completely recycled, without quality reduction. Nickel recycling is an important contributor to global sustainability. Nickel-containing products, such as stainless steel, can be used over and over again. Nickel and nickel-containing alloys can be returned to their original state or converted into a different but still valuable form. For example, nickel-containing stainless steel scrap is converted to new stainless steel, or recycled nickel from recycled batteries can be used to make nickel-containing stainless steel.







# REUSE OF NICKEL FUN FACTS



Nickel is one of the most valuable non-ferrous metals, and at the same time the most recycled substance in the world!

57% of all mined nickel is in use today, thanks to the long lifetime and recyclability. Furthermore, about 68% of all nickel is recycled and begins a new life cycle.

As a metal that can be recycled, nickel can be repurposed in many different ways. In most cases, recycled nickel does not return in nickel form, but as part of nickel alloys, such as stainless steel which is composed of 60% recycled material.

Recycling nickel products guarantees that it re-enters the economy, once its lifetime expires i.e. it goes into reuse and that is what makes nickel economically attractive.

All this makes nickel a school example of how primary materials contribute to the circular economy!







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2022 edition